American Academy of Osteopathy

The Principles of Palpatory Diagnosis and Manipulative Technique

Edited by

Myron C. Beal, DO, FAAO

Published by the
American Academy of Osteopathy
Affiliated with the **American Osteopathic Association**

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Published by:

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Newark, Ohio 43058-0750

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Acknowledgements

My thanks to A. Richard Dyson for his able assistance, to David Patriquin for aid and encouragement, to William Johnston for his critique and to the members of the Academy publication committee.

I should also like to acknowledge the permission granted for publication of articles from the Journal of the American Osteopathic Association which appear in this yearbook.

Foreword

This Academy publication is devoted to materials dealing with the training of manipulative skills. It is designed to be a resource for students, teachers, and physicians in practice.

Included in this volume are the glossary of terminology, objectives for a core curriculum from the document by the Educational Council on Osteopathic Principles, the principles of psychomotor skills teaching, a discussion of practical examinations in osteopathic skills, osteopathic diagnosis and manipulative treatment, articles on osteopathic research, and a listing of textbooks on manipulation and other educational items.

In selecting materials for this volume, I have tried to include those which are basic to the teaching of osteopathic skills. They represent a personal judgement based upon my experience as a teacher of osteopathic palpatory and treatment skills.

The contents of this yearbook have been reviewed by several other osteopathic educators to try and obtain a broad consensus on the materials to be included. However, after reviewing the educational syllabi of several colleges, I am aware that each college employs and orders materials for their curriculum in an individual manner. Thus, I am sure that I have inadvertently left out items which other osteopathic educators would have included. The intent of this book is to be selective of the large amount of resource material available. The reader shall judge whether I have succeeded in presenting the pertinent materials dealing with manipulative skills training.

Myron C. Beal, D.O., F.A.A.O.

I

Glossary of Osteopathic Terminology

The glossary of osteopathic terminology was first published in the JAOA in April of 1981. The project was initiated by the members of the Educational Council on Osteopathic Principles and was directed by Robert Ward who obtained funding for the project from the colleges of osteopathic medicine.

It was recognized by the members of ECOP that it was essential that there should be agreement among the colleges of the definition of commonly used words and phrases employed by the osteopathic profession. The glossary was developed to standardize osteopathic terminology used in teaching and publications. It has achieved a general level of acceptance and is published annually in the American Osteopathic Association Yearbook. The latest revision in the glossary was presented in July 1989 by a committee of ECOP.

Previous attempts had been made by members of the osteopathic profession to standardize terminology. An AOA committee on nomenclature was appointed in 1907 and headed by M.C. Hardin of Atlanta, Georgia. The final report which was submitted eight years later, was translated into Latin to conform with the anatomical terminology which was then gaining in use.

Meanwhile teachers of technic in the various colleges were called together to formulate a list of acceptable terms and definitions. They met in June of 1915 and presented a report to the AOA in August of 1915 which was approved. Two days later Dr. Hardin's report with the Latin terminology was submitted and was turned down. The approved report was published in the JAOA and the Journal of Osteopathy in August 1915. Dr. Hardin's report was published in the Osteopathic Physician of April and May 1916. H.V. Halladay offered a terminology in 1922 which was published in the Osteopathic Physician, but it did not receive a great deal of interest.

The matter of nomenclature was discussed at AOA conventions for several years and finally culminated in the appointment of an AOA committee consisting of representatives of the six colleges. A report was published in the JAOA of October 1933. Subsequent work on the report was published in the JAOA of September 1934. The committee for the study of nomenclature and terminology of osteopathic technic consisted of W.W. Pritchard, chairman, H.V. Hallady, C. Haldon Soden, George Rothmeyer, H.E. Litton, C.A. Tedrick, Russell R. Peckham, and James A. Stinson.

In 1956 Dr. Fraser Strachan was appointed chairman of an AOA committee on standard nomenclature whose assignment was to review and revise the standard nomenclature as published in the January 1936 issue of the JAOA. The committee consisted of Drs. Edgar O. Holden, J.S. Denslow, Myron C. Beal, Charles C. Dieudonne, R.P. Keesecker, and Robert B. Thomas. Suggestions for the revision of the terminology were solicited from the colleges and other members of the profession. An interim report in 1959 consisted of definitions of the osteopathic lesion, tone, and movements characteristic of a typical intervertebral articulation, and copies of letters of response to the committee questionnaire.

The subject of nomenclature was not formally addressed again until ECOP assumed the task which resulted in the publication of the Glossary of Osteopathic Terminology.

Glossary of osteopathic terminology

Prepared by The Glossary Review Committee

Sponsored *by The Educational Council on Osteo-- pathic Principles of the AACOM*

Revised July 1989

This glossary revision is a continuing function of the Glossary Review Committee of the Educational Council on Osteopathic Principles of the AACOM, carried on during the past two years. The committee is grateful to Doris Brown for typing of the revised document, which first appeared in JAOA [80:552-67, Apr 81].

The present chairman of the Glossary Review Committee is John H. Harakal, DO, FAAO, Texas College of Osteopathic Medicine, 3500 Camp Bowie Blvd., Fort Worth, TX 76107-2690. The participating committee has included Lorane M. Dick, DO, Walter C. Ehrenfeuchter, DO, FAAO, William A. Kuchera, DO, FAAO and ex-officio Robert E. Kappler, DO, FAAO. Paul Kimberly, DO (retired) served as consultant to the revision project. Any comments or suggestions can be addressed to Dr. Harakal at the above address.

The purpose of this osteopathic glossary is to present important and often used words, terms and phrases of the osteopathic profession. It is not meant to replace a dictionary. This glossary offers the consensus of a large segment of the osteopathic profession and is to serve to standardize terminology. We also expect this glossary to be useful to the student of osteopathic medicine and to be helpful to authors and other professionals in understanding and making proper use of osteopathic vocabulary.

Dictionary definitions included are from:

Dorland's Medical Dictionary, 27th edition, W.B. Saunders Company, Philadelphia, PA, 1982.

Stedman's Medical Dictionary, 24th edition, The William & Wilkins Company, Baltimore, MD, 1982.

acceleration: the instantaneous change in rate of motion (also applies to deceleration).

accessory movements: movements used to potentiate, accentuate, or compensate for an impairment in a physiologic motion (e.g., the accessory activities in an asthmatic's breathing or compensatory movements needed to move a paralyzed limb).

active motion: *see motion: active motion.*

acute somatic dysfunction: see somatic *dysfunction.*

anatomical barrier: see *barrier (motion barrier).*

angle, lumbosacral: the inclination of the superior surface of the first sacral vertebra to the horizontal: usually measured from standing lateral x-ray films. (Fig. I)

angle of Ferguson: see angle, lumbosacral.

anterior component: a positional descriptor used to identify the side of reference when rotation of a vertebra has occurred: in a condition of right rotation, the left side is the anterior component; usually refers to the less prominent transverse process: see also *posterior component.*

anterior iliac rotation: see under *ilium, somatic dysfunctions of.*

anteroposterior axis of a rib: an imaginary straight line between the costosternal articulation and the costotransverse articulation of the rib.

antexion: an archaic term that was used to describe a position of a joint in which 1: the spinal column is fixed in a forward bent position, or 2: a vertebral unit is flexed.

A.R.T.: stands for asymmetry (qv). restriction of motion (qv), and tissue texture abnormality (qv); a mnemonic used to define the three essential dimensions of somatic dysfunction (qv); subjective tenderness associated with somatic dysfunction is sometimes added (T.A.R.T.).

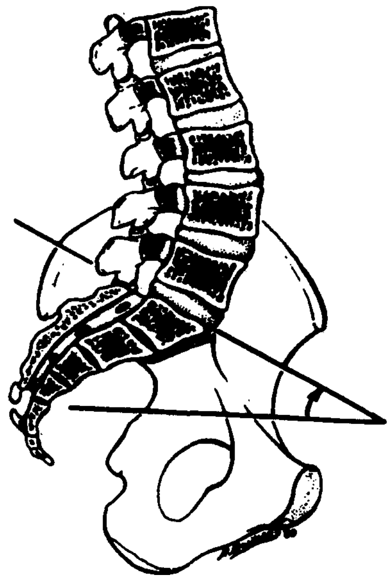
articular strain: see *strain.*

articulation: 1. the place of union or junction between two or more bones of the skeleton: 2. the active or passive progress of moving a joint through its permitted anatomic range of motion: see also osteopathic *manipulative treatment: articulatoy treatment.*

articulatory pop: refers to a characteristic popping sound made by a joint.

articulatory technique: see *technique: see* also *osteopathic manipulative treatment: articulatory treatment.*

asymmetry: absence of symmetry of position or motion: dissimilarity in corresponding parts or organs on opposite sides of the body which are normally alike: of particular use when describing position or motion alteration resulting from somatic dysfunction.



**Lumbosacral angle
(Fig. I)**

axis: 1: an imaginary line about which motion occurs 2: the second cervical vertebra 3: one component of an axis system.

axis of rib motion: 1: pump handle axis is through the neck of the rib 2: bucket handle axis is from the costotransverse joint to the costosternal junction of the rib. (Fig. 2)

axis of sacral motion: see *sacral motion, axis of.*

axoplasmic flow: see axoplasmic transport.

axoplasmic transport: the anterograde (cellulifugal) movement of substances from the nerve cell along the axon toward the terminals, and the retrograde (cellulipetal) movement from the terminals toward the nerve cell.

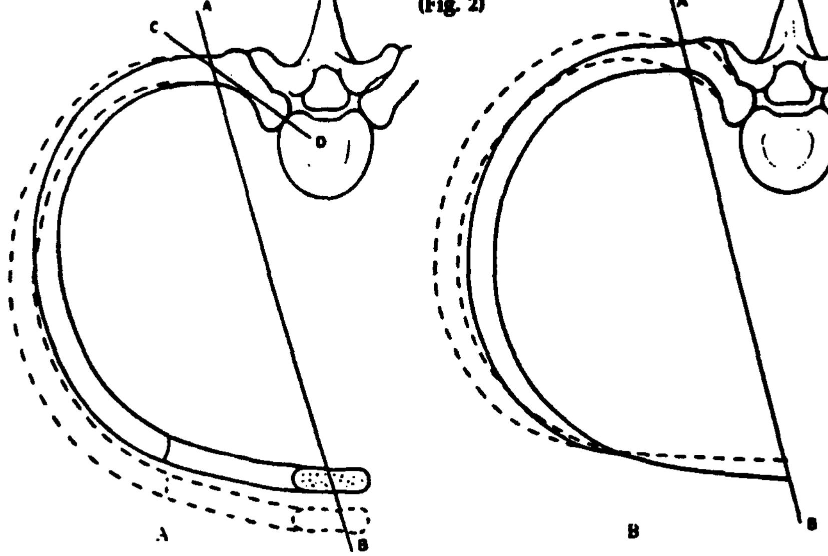
backward bending: see extension. (Fig. 3)

barrier (motion barrier): the limit to motion.

anatomic barrier: the limit of motion imposed by anatomic structure.

physiologic barrier: functional limits within the anatomic range of motion; soft tissue tension accumulation which limits the voluntary motion of an articulation: further

Axes of rib motion
(Fig. 2)



4-356 A diagram showing the axes of movement (AB and CD) of a vertebrosternal rib. The interrupted lines indicate the position of the rib in inspiration.
4-35B A diagram showing the axes of movement (AB) of a vertebrochondral rib. The interrupted lines indicate the position of the rib in inspiration.

(Reprinted, by permission, from *Gray's Anatomy*, 35th edition, p. 421. © 1973 by Churchill Livingstone)

motion toward the anatomic barrier is still able to be induced passively.

restrictive barrier: a functional limit within the anatomic range of motion, which abnormally diminishes the normal physiologic range.

pathologic barrier: see restrictive barrier.

batwing sacrum: see *transitional segment: lumbarization*

biomechanics: mechanical principles applied to the study of biological functions: the application of mechanical laws to living structures: the study and knowledge of *biological function from an application of mechanical principles;* distinguished from somatology (qv).

bogginess: a tissue texture abnormality [qv] characterized principally by a palpable sense of sponginess in the tissue, interpreted as resulting from congestion due to increased fluid content.

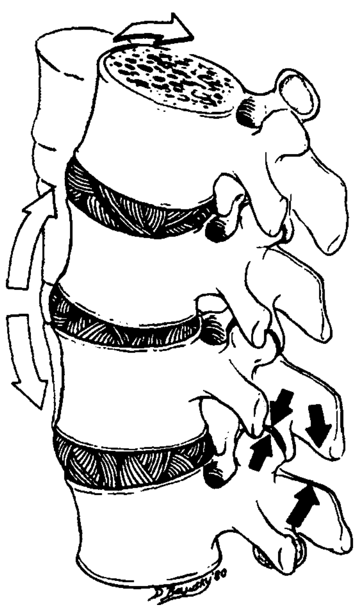
bucket handle rib motion: movement of the lower ribs during respiration such that with inhalation the lateral aspect of the rib elevates, resulting in an increase of transverse diameter of the thorax: see also *pump handle rib motion.*

caudad: toward the tail or inferiorly.

caught in inhalation (inhalation rib lesion (inhalation strain) (inhaled rib lesion): a somatic dysfunction (qv) usually characterized by a rib being held in a position of inhalation such that motion toward inhalation is freer and motion toward exhalation is restricted: caught in exhalation is the reciprocal of caught in inhalation.

cephalad: toward the head.

cephalad pubes: see *pubes, somatic dysfunctions of.*



Backward bending
(Fig. 3)

cerebrospinal fluid, fluctuation of: a description of the hypothesized action of cerebrospinal fluid with regard to the craniosacral mechanism.

Chapman's reflex: Chapman's reflexes present as predictable anterior and posterior fascial tissue texture abnormalities (qv) assumed to be reflections of visceral pathology; a given reflex is consistently associated with the same viscus; Chapman's reflexes are manifested by palpatory tidings of plaque-like changes of stringiness (qv) of the involved tissues.

chronic somatic dysfunction: see somatic *dysfunction*

circumduction: the active or passive circular movement of a limb; the rotary movement by which a structure or part is made to describe a cone, the apex of the *cone* being a fixed point (e.g., the circular movement of a ball and socket joint).

clapotage: the act of producing the splashing sound heard on succussion.

combined technique: see *osteopathic manipulative treatment: combined treatment.*

conditioned reflex: see *reflex.*

contraction: shortening and/or development of tension in muscle.

isolytic contraction: contraction of a muscle against resistance while forcing the muscle to lengthen.

isometric contraction: change in the tension of a muscle without approximation of muscle origin and insertion.

isotonic contraction: approximation of the muscle origin and insertion without change in its tension.

contractured muscle: as contrasted to contracted muscle: contracted muscle is regarded as the physiologic function of neuromuscular excitation-response, whereas contractured muscle is due to histologic change substituting non-contractile tissue for muscle tissue which prevents the muscle *from* reaching normal relaxed length.

contracture: a condition of fixed high resistance to passive stretch of a muscle, resulting from fibrosis of the tissues supporting the muscles or the joints, or from disorders of the muscle fibers.

Dupuytren's contracture: shortening, thickening and fibrosis of the palmar fascia, producing a flexion deformity of a finger (Dorland).

coronal plane: see *plane.*

cranial concept: a term used by William G. Sutherland, DO, DSc (hon) in reference to his conception of the nature of certain anatomical and physiologic mechanisms in the living human *bead,* as perceived *in his* experience as a physician and osteopath: he often said that his cranial concept in the science of osteopathy was implied in the teaching of Dr. Andrew Taylor Still.

cranial **rhythmic impulse:** 1: a term coined by Drs. John and Rachel Woods during their year of research at Still Hildreth Sanatorium in Macon, MO in 1958: they coined the term to use for counting the rhythmic cycles of expansion and contraction that they felt while palpating the head 2: the term denotes a palpable, rhythmic fluctuation believed to be synchronous with the primary respiratory mechanism.

craniosacral mechanism: a term loosely used to refer to the connection between the occiput and the sacrum by the spinal dura mater as used by William G. Sutherland DO; it was not used by Dr. Sutherland in any other sense.

diagnostic palpation: see *palpatory diag nosis.*

diagonal axis: see sacral motion, axis of, diagonal (oblique].

direct method technique: see osteopathic manipulative *treatment: direct treatment.*

easy *normal: see neutral.*

-ed: a suffix describing status, position, or condition (e.g. extended flexed rotated restricted).

effleurage: stroking movement in massage; frottage (Dorland).

elastic deformation: any recoverable deformation: *see also plastic deformation.*

elasticity: ability of a strained body or tissue to recover its shape after deformation: see plasticity: *viscosity.*

end feel: perceived quality of motion as an anatomic or physiologic restrictive barrier is approached.

enthesitis: traumatic disease occurring at the insertion of muscles where recurring concentration of muscle stress provokes inflammation with a strong tendency toward fibrosis and calcification (Stedman); inflammation of the muscular or tendinous attachment to bone (Dorland).

ERS: a descriptor of spinal somatic dysfunction used to denote a combination extended (E), rotated (R), and sidebent (S) vertebral position: similar descriptors may involve flexed (F) and neutral (N) position: examples of combinations are FSR and NRS.

exhalation rib: inhalation restriction of rib(s) exhalation strain, depressed rib; (an anterior tender point in strain-counterstrain).

extension: 1: backward motion in a sagittal plane about a transverse axis (in a vertebral unit when the superior part moves backward) 2: straightening of a curve or angle (biomechanics).

extension craniosacral: anterior movement of the sacral base around a transverse axis in relation to the ilia occurring during sphenobasilar extension and craniosacral mechanism: see also flexion, craniosacral. **(Fig 5)**

extension sacral: posterior movement of the base of the sacrum in relation to the ilia. (Fig. 6)

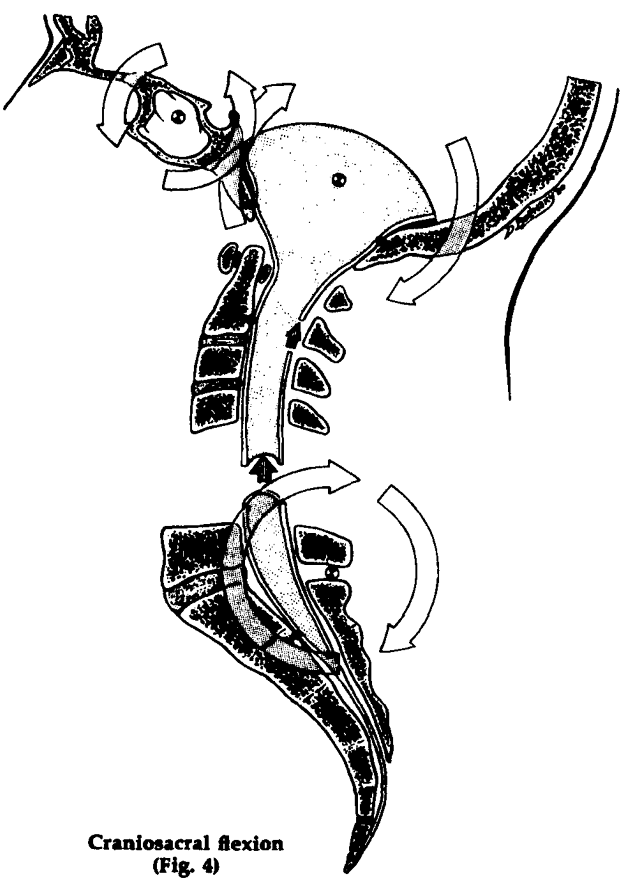
extension lesion of the sacrum: see *sacrum somatic dysfunctions of.*

extrinsic corrective forces: treatment forces, the sources of which are external to the patient: they may include operator effort, effect of gravity mechanical tables, etc; *see also intrinsic corrective forces.*

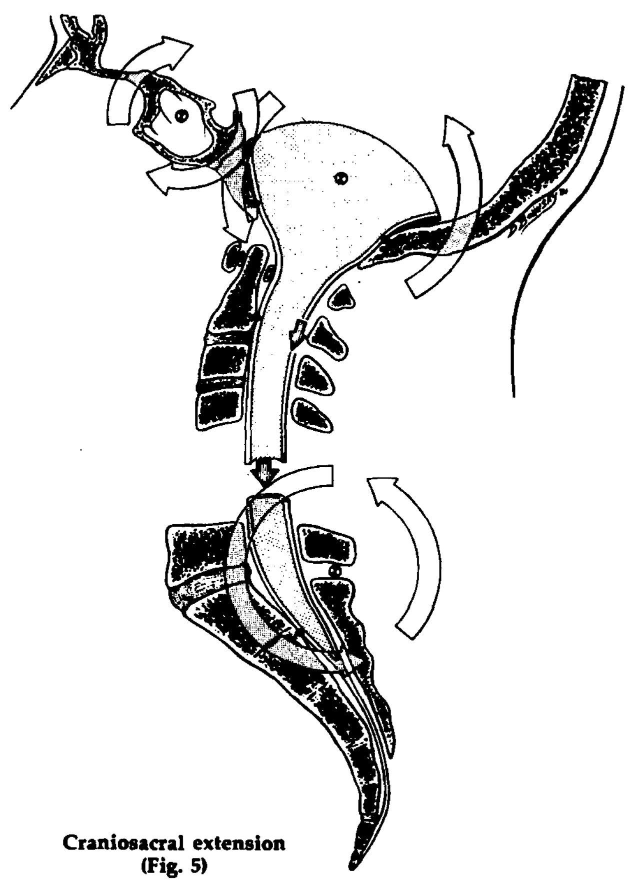
facet asymmetry: vertebra) structure in which the orientation of the facets is not anatomically bilaterally comparable: see facet *symmetry asymmetry; tropism, facet.*

facet symmetry: describes the structure of a vertebra in which the facets are anatomically bilaterally comparable: see **facet** *asymmetry; symmetry.*

facilitation: 1: the maintenance of a pool of

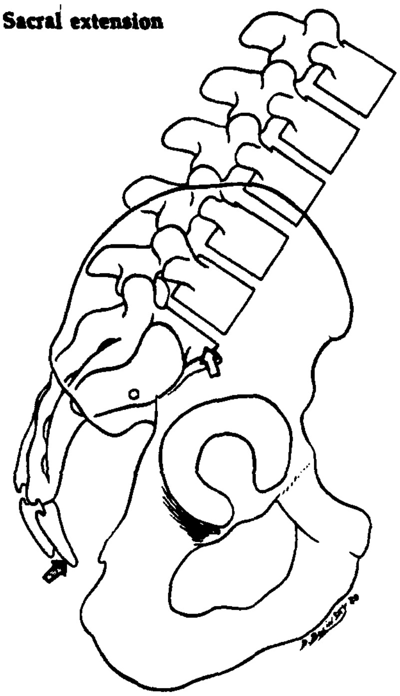


Craniosacral flexion (Fig. 4)



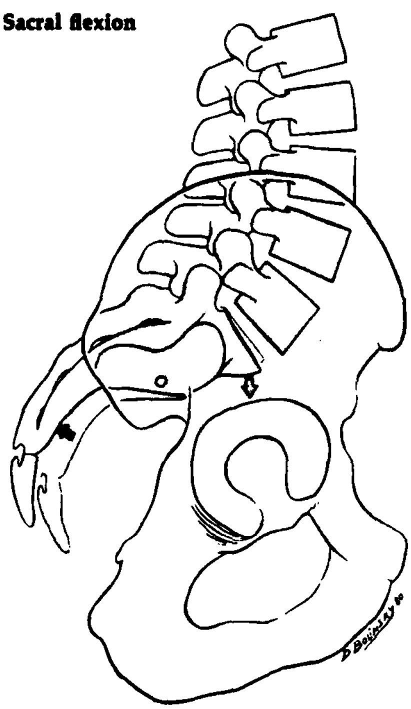
Craniosacral extension (Fig. 5)

Sacral extension



(Fig. 6)

Sacral flexion



(Fig. 7)

neurons (e.g. motoneurons or preganglionic sympathetic neurons in one or more segments of the spinal cord) in a state of partial or subthreshold excitation: in this state, less afferent or other presynaptic stimulation is required to trigger the discharge of impulses 2: a theory regarding the neurophysiological mechanisms underlying the exaggerated neuronal activity or hyperreflexia associated with somatic dysfunction 3: facilitation may be due to sustained increase in afferent Input (e.g., from certain proprioceptors), aberrant patterns of afferent input, or changes within the affected neurons themselves or their chemical environment.

flexion: bending to approximate: a bending movement that decreases a curve or internal *angle; see also forward bending.*

flexion, craniosacral: posterior movement of the sacral base around a transverse axis in relation to the ilia, occurring during sphenobasilar flexion; *see also extension craniosacral.* (Fig. 4)

flexion, sacral: anterior movement of base of the sacrum in relation to the ilia: see also *extension sacral.* (Fig. 7)

flexion somatic dysfunction of the sacrum: *see sacrum, somatic dysfunctions of.*

forward bending: reciprocal of backward bending, flexion. (Fig. 8)

functional technique: *see osteopathic manipulative treatment: functional treatment.*

gravitational line: viewing the patient from the side, an imaginary line in a coronal plane which, in the theoretical ideal posture, starts slightly anterior to the lateral malleolus, passes across the lateral condyle of the knee, the greater trochanter, through the lateral head of the humerus at the tip of the shoulder to the external auditory meatus; if this were a plane through the body, it would intersect the middle of the third lumbar vertebra and the anterior one third of the sacrum; it is used to evaluate the AP curves of the spine: see also *mid-malleolar line.* (Fig. 9)

guiding: gentle movement by the operator following the path of least resistance in the movement of a body part within its normal range.

habituation: decreased response to repeated stimulation: hypothetically, a short-term (minutes *or* hours) decremental central nervous system (CNS) process; it interacts with the incremental CNS process of sensitization (qv) and yields a final behavioral outcome.

health: adaptive and optimal attainment of physical, mental, emotional, spiritual, and environmental well-being.

homeostasis: 1: maintenance of static or constant conditions in the internal environment 2: the level of well-being of an individual maintained by internal physiological harmony; it is the result of a relatively stable state or equilibrium among the interdependent body functions.

hypertonia: a condition of excessive tone of the skeletal muscles: increased resistance of muscle to passive stretching.

iliosacral motion: motion of the ilia on a transverse axis through the sacrum, as occurs in walking; considered to be primarily influenced by the attachments and movements of the pelvis, hips, and lower extremities.

ilium, somatic dysfunctions of:

anterior (forward) iliac rotation: a somatic dysfunction (qv) in which the anterior superior iliac spines (ASIS) are anterior and inferior to the contralateral landmarks: the ilium moves more freely in an anterior inferior direction, and is restricted in posterior superior motion.

inferior ilium a somatic dysfunction (qv) in which the anterior superior iliac spines (ASIS) and posterior superior iliac spines (PSIS) are inferior to the contralateral landmarks: the ilium (innominate pelvic bone) moves more freely in an inferior direction and is restricted in superior motion.

posterior (backward) iliac rotation: a somatic dysfunction (qv) in which the anterior superior iliac spines (ASIS) are posterior and superior to the contralateral landmarks: the ilium moves more fully in a posterior superior direction and is restricted in an anterior Inferior motion.

superior ilium a somatic dysfunction (qv) in which the anterior superior iliac spines (ASIS) and posterior superior iliac spines (PSIS) are superior to the contralateral landmarks: the ilium (innominate pelvic bone) moves more freely in a superior direction and is restricted in inferior motion.

inferior ilium: see under *ilium, somatic dysfunctions of.*

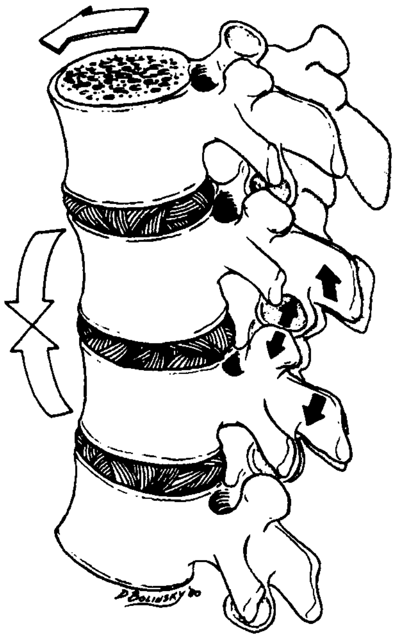
inferior pubes: see under *pubes,* somatic *dysfunctions of:*

Inhalation rib: reciprocal of exhalation rib.

inhibition, reflex: 1: in osteopathic usage, a term that describes the application of steady pressure to soft tissues to effect relaxation and normalize reflex activity 2: effect on antagonist muscles due to reciprocal innervation when the agonist is stimulated; *see laws, Sherrington's: osteopathic manipulative treatment: inhibitory pressure treatment.*

innominate bone: the large flaring bone that comprises the lateral part of the pelvis, and is composed of the ilium, ischium, and pubis; the pelvis is made up of the right and left innominate bones and the sacrum.

intersegmental motion: designates relative motion taking place between two adjacent vertebral segments or within a vertebral unit (qv): described as the upper



Forward bending
(Fig. 8)

vertebral segment moving on the lower.

intrinsic corrective forces: voluntary or involuntary forces that assist in the manipulative treatment process.

-ion: a suffix describing a process or movement (e.g., extension, flexion, rotation, restriction).

isokinetic exercise: exercise using a constant speed of movement of the body part.

isolytic contraction: see contraction, isolytic.

isometric contraction: see contraction, *isometric.*

isotonic contraction: *see contraction, isotonic.*

-itis: a word termination denoting inflammation of the part indicated by the word stem to which it is attached (Dorland).

kinesthesia: the sense by which muscular motion, weight, position, etc. are perceived.

kinesthetic: pertaining to kinesthesia.

kinetics: the body of knowledge that deals with the effects of forces that produce or modify body motion.

klapping: striking the skin with cupped palms to produce vibrations with the intention of loosening material in the lumen of hollow tubes or sacs within the body, particularly the lungs.

kneading: a soft tissue technique (qv) which utilizes an intermittent force applied transversely to the long axis of the muscle.

kyphoscoliosis: an abnormal kyphosis plus scoliosis: see also *kyphosis: scoliosis.*

kyphosis: 1: the exaggerated (pathologic) AP curve of the thoracic spine with concavity anteriorly 2: abnormally increased convexity in the curvature of the thoracic spine as viewed from the side (Dorland).

kyphotic: pertaining to or characterized by kyphosis.

lateral flexed: a term used to describe a position of a vertebral body; defined as the movement of a point on the anterior superior aspect of the vertebral body about an anterior-posterior axis in a coronal plane.

lateral flexion: also called lateroflexion: see *sidebending* for definition and illustration.

latexion: an archaic term that was used to describe a position of a joint in which the spinal column or vertebral unit is fured in a sidebent position.

law, Head's: when a painful stimulus is applied to a body part of low sensitivity (e.g., viscus) that is in close central connection with a point of higher sensitivity (e.g., soma), the pain is felt at the point of higher sensitivity rather than at the point where the stimulus was applied.

laws of motion, Fryette's: *see physiologic Motion* of *the spine.*

laws, Sherrington's: 1: every posterior spinal nerve root supplies a specific region of the skin, although fibers from adjacent spinal segments may invade such a region 2: when a muscle receives a nerve impulse to contract, its antagonist receives, simultaneously, an impulse to relax. (These are only two of Sherrington's contributions to neurophysiology: these are the ones most relevant to osteopathic principles.)

lesioned components: *see osteopathic lesion; somatic dysfunction.*

lesion (osteopathic): *see osteopathic lesion.*

line of gravity: *see gravitational line.*

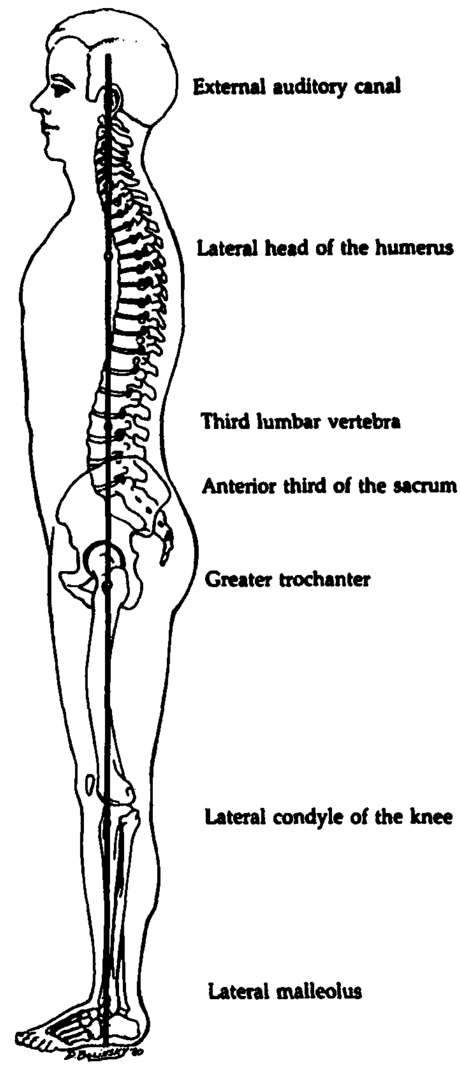
localization: 1: in manipulative technique, the precise positioning of the patient and vector application of forces required to produce a desired result 2: the reference of a sense impression to a particular locality in the body.

lordosis: 1: the anterior concavity in the curvature of the lumbar and cervical spine as viewed from the side: the term is used to refer to abnormally increased curvature (hollow back, saddle back, sway back) and to the normal curvature (normal lordosis). Kf. kyphosis and scoliosis (Dorland) 2: hollow or saddle back; an abnormal extension deformity: anteroposterior curvature of the spine, generally lumbar with the convexity looking anteriorly (Stedman).

lordotic: pertaining to or characterized by lordosis.

Lumbosacral angle: See angle, Lumbosa-*cral.*

Gravitationl line



(Fig. 9)

manipulation: therapeutic application of manual force: see also *technique.*

manual medicine: the use of mechanical forces applied through the hands to diagnose and treat functional disorders of the mechanical and soft tissue system.

massage: systematic therapeutic friction, stroking, and kneading of soft tissues without monitoring of tissue and motion changes: *see also osteopathic manipulative treatment: soft tissue treatment.*

middle transverse ***axis: see sacral*** *motion axis* of *middle (postural)* ***transverse.***

mid-heel line: a vertical line used as a reference in standing anteroposterior (AP) x-rays and postural evaluation, passing equidistant between the heels.

mid-malleolar line: a vertical line passing through the lateral malleolus. used as a point of reference in standing lateral x-rays and postural evaluation.

motion: 1: a change of position (rotation, and/or translation) with respect to a fixed system 2: an act or process of a body changing position in terms of direction, course and velocity.

active motion: movement produced voluntarily by the patient.

inherent motion: that spontaneous motion of every cell. organ, system, and their component units within the body.

passive motion: motion induced by the operator while the patient remains passive or relaxed.

physiologic motion: normal changes in the position of articulating surfaces taking place within a joint or region.

translatory motion: *see translation.*

motion barrier: *see barrier (motion barrier).*

muscle energy technique: *see osteopathic manipulative treatment: muscle energy treatment.*

myofascial trigger point: *see triggerpoint.*

neurotrophicity: *see neurotrophy.*

neurotrophy: the nutrition and maintenance of tissues as regulated by direct nervous influence.

neutral: the point of balance of an articular surface from which all the motions physiologic to that articulation may take place.

oblique axes of the sacrum: *see sacral motion axis of, diagonal (oblique).*

-osis: word element [GR.], disease: morbid state; abnormal increase.

Osteopathic concept: osteopathic medicine is a philosophy of health care and a distinctive art, supported by expanding scientific knowledge; its philosophy embraces the concept of the unity of the living organism's structure (anatomy) and function (physiology). Its art is the application of the philosophy in the practice of medicine and surgery in all its branches and specialties. Its science includes the behavioral, chemical, physical, spiritual and biological knowledge related to the establishment and maintenance of health as well as the prevention and alleviation of disease. Osteopathic concepts emphasize the following principles: 1: the human person is a unit in which structure, function, mind and spirit are mutually and reciprocally interdependent 2: the body, through a complex equilibrial system, tends to be self-regulatory and self-healing in the face of disease processes 3: adequate function of body systems depends upon the unimpeded circulatory mechanisms, nerve impulses and neurotrophic influences 4: a rational treatment regimen is based on this philosophy and these principles.

osteopathic lesion (osteopathic lesion com-plex): term previously used to identify what is currently defined as somatic dysfunction, which is in common usage today; *see also somatic dysfunction.*

osteopathic manipulative treatment: the therapeutic application of manually guided forces by an osteopathic physician to alleviate somatic dysfunction: this is accomplished by a variety of techniques:

articulatory technique: a low velocity/ moderate amplitude technique where a joint is carried through its full range of motion with the therapeutic goal of increased freedom range of movement.

combined treatment: 1: a term coined by Paul Kimberly, DO, to describe a technique where the initial movements are indirect; as the technique is completed the movements change to direct forces 2: a manipulative sequence involving two or more different techniques (e.g. Spencer technique combined with muscle energy technique).

counterstrain: considers the dysfunction to be a continuing, inappropriate strain reflex, which is inhibited by applying a position of mild strain in the direction exactly opposite to that of the false strain reflex: this is accomplished by use of the specific point of tenderness related to this dysfunction followed by specific directed positioning to therapeutic response.

cranial treatment: a description suggested by W.G. Sutherland, DO, that refers to the diagnosis and treatment skills using the primary respiratory mechanism (qv).

Dalrymple treatment: a venous and lymphatic drainage technique applied through the lower extremities: also called the pedal fascial or pedal lymphatic pump.

direct treatment: any technique engaging the restrictive barrier and then carrying the dysfunctional component in the direction of restrictive barrier.

exaggeration treatment: 1: an indirect procedure that involves carrying the dysfunction part away from the restrictive barrier then applying a high velocity/low amplitude force in the same direction 2: operator movement of the dysfunctional component away from the restrictive barrier through and beyond the range ofvoluntary motion to a point of palpably increased tension.

fascial *release treatment: see myofascial* **re-***lease treatment*

functional treatment: an indirect treatment method (qv) in which the physician guides the manipulative procedure while the dysfunctional area is being palpated in order to obtain a continuous feedback of the physiologic response to induced motion: the physician guides the dysfunctional part so as to create a decreasing sense of tissue resistance (increased compliance).

Galbraith treatment: see mandibular drainage.

indirect treatment: a manipulative technique where the restrictive barrier is disengaged; the dysfunctional body part is moved away from the restrictive barrler until tissue tension is equal in all planes and directions.

inhibitory pressure treatment: the application of steady pressure to soft tissues to reduce reflex activity and produce relaxation.

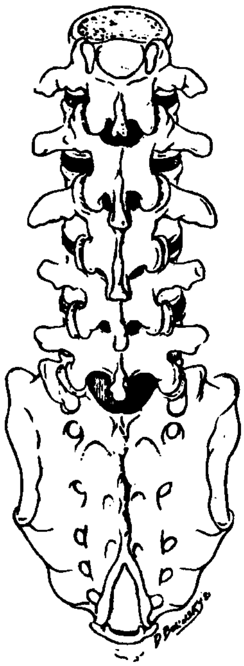
lymphatic pump: a term coined by C. Earl Miller, DO, to describe the impact of intrathoracic pressure *changes* on lymphatic flow: this was the name originally given to the thoracic pump technique (qv) before the more extensive physiologic effects of the technique were recognized.

mandibular drainage: a technique used to effect increased drainage of middle ear structures via the eustachian tube and lymphatics.

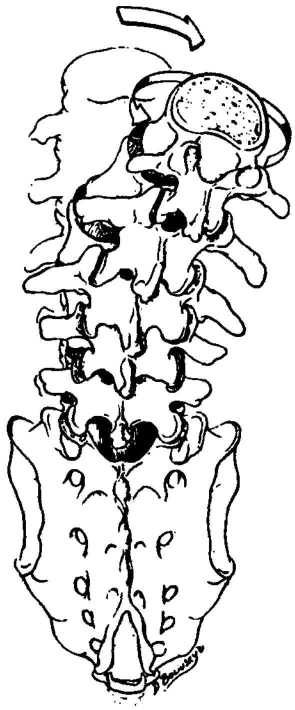
muscle energy treatment: a term first used by Fred L. Mitchell, Sr., DO, to describe the form of osteopathic manipulative treatment in which the patient voluntarily moves the body as specifically directed by the physician: this directed patient action is from a precisely controlled position, against an isometric resistance of the physician.

myofascial treatment: any technique directed at the muscles and fascia; see also soft *tissue treatment.*

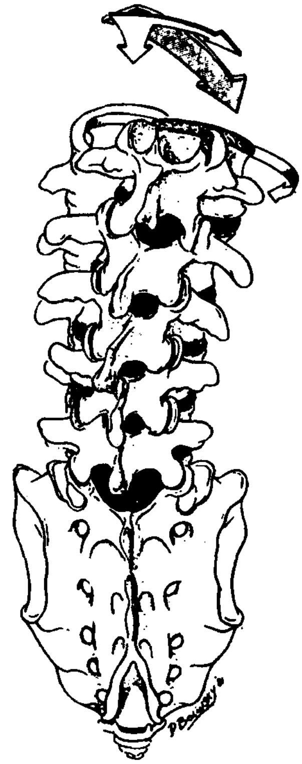
myofascial release treatment *(MR7):* 1: direct MRT: a restrictive barrier is engaged for the myofascial tissues: the tissue is loaded with a constant force until tissue release occurs. 2: indirect MRT: the dysfunctional tissues are guided along a path 'of least resistance until free movement is achieved.



Physiologic motion of the spine, Neutral (Fig. 10)



Physiologic motion of the spine (I) Sidebending from Neutral (Fig. 11)



Physiologic motion of the spine (II) Forward bending and sidebending (Fig. 12)

positional treatment: a direct segmental technique in which a combination of leverage, patient ventilatory movements and a fulcrum are used to achieve mobilization of The dysfunctional segment: may be combined with springing or thrust technique.

range ofmotion: movement of a body part to its physiologic or anatomic limit in any or all planes of motion.

active: the person voluntarily effects and carries out the motion.

passive: the examiner (after securing the person's cooperation) effects and carries out the motion.

Note: various methods are used to enhance a more normal range of motion: e.g., 1: cooperative muscle energy 2: multiple/repeated efforts gradually increasing the range of motion with each effort to the limit ofpermitted motion physiologically or anatomically.)

soft tissue treatment: procedure directed toward tissues other than skeletal or arthrodial elements; a direct technique which usually involves lateral stretching, linear stretching, deep pressure, traction and/or separation of muscle origin and insertion while monitoring tissue response and motion changes by palpation; also called myofascial treatment.

Spencer treatment: a series of seven direct manipulative procedures to decrease soft tissue restrictions about the shoulder.

springing treatment: a low velocity/moderate amplitude technique where the restrictive barrier is engaged repeatedly to produce an increased freedom of motion.

thoracic pump: a technique developed by C. Earl Miller, DO, which consists of intermittent compression of the thoracic cage.

thrust treatment: a direct technique which uses high velocity/low amplitude forces also called mobilization with impulse treatment.

traction treatment: a procedure of high or low amplitude in which the parts are stretched or separated along a longitudinal axis with continuous or intermittent force.

osteopathy (osteopathic medicine): a system of health care founded by Andrew Taylor Still (1828- 1917) and based upon the osteopathic concept.

osteopathy in **the cranial field:** 1: refers to the work of William G. Sutherland, DO, in expanding the philosophy and principles of osteopathy as developed by A.T. Still to include the whole body 2: title of reference work by H.I. Magoun, Sr, DO.

palpation: the application of variable manual pressure to the surface of the body for the purpose of determining the shape, size, consistency, position, inherent motility, and health of the tissues beneath.

palpatory diagnosis: a term used by osteopathic physicians to denote the process of palpating the patient to evaluate the neuromusculoskeletal and visceral systems.

palpatory skills: sensory skills used in performing palpatory diagnosis and osteopathic manipulative treatment.

passive motion: see *motion: passive motion.*

patient cooperation: voluntary movement by the patient (on instruction from the operator) to assist in the palpatory diagnosis (qv) and treatment process.

pelvic declination (pelvic unleveling): pelvic rotation about an A-P axis.

pelvic rotation: movement of the entire pelvis in a relatively horizontal plane about a vertical (longitudinal) axis.

pelvic sideshift: deviation of the pelvis to the right or left of the central vertical axis as translation along the horizontal (2) axis, usually observed in the standing position.

pelvic tilt: pelvic rotation about a transverse (horizontal) axis (forward or backward tilt) or about an anterior-posterior axis (right or left side tilt).

petrissage: deep kneading or squeezing action to express swelling: also called foulage.

physiologic barrier: see *barrier: physiologic barrier.*

physiologic motion: *see motion: physiologic barrier.*

physiologic motion of the spine: descriptors of spinal motion proposed by Harrison H. Fryette, DO. The three major principles are:

I. when the spine is in a neutral position (easy normal) and sidebending is introduced. the bodies of the vertebrae will rotate toward the convexity: see *rotation, rotation of a vertebra.* (Fig. 10)

II. when the spine is either forward or backward bent and sidebending is introduced, a singular vertebra will rotate toward the intended concavity. (Fig 11)

III. initiating motion of a vertebral segment in any plane of motion will modify the movement of that segment in other planes of motion. (Fig. 12)

plagiocephaly: a deformity marked by an obliquity of the skull, one side being more developed anteriorly, the other side posteriorly (Stedman).

plane: a flat surface determined by the position of three points in space: any of a number of imaginary surfaces passing through the body and dividing it into segments. (Fig. *13)*

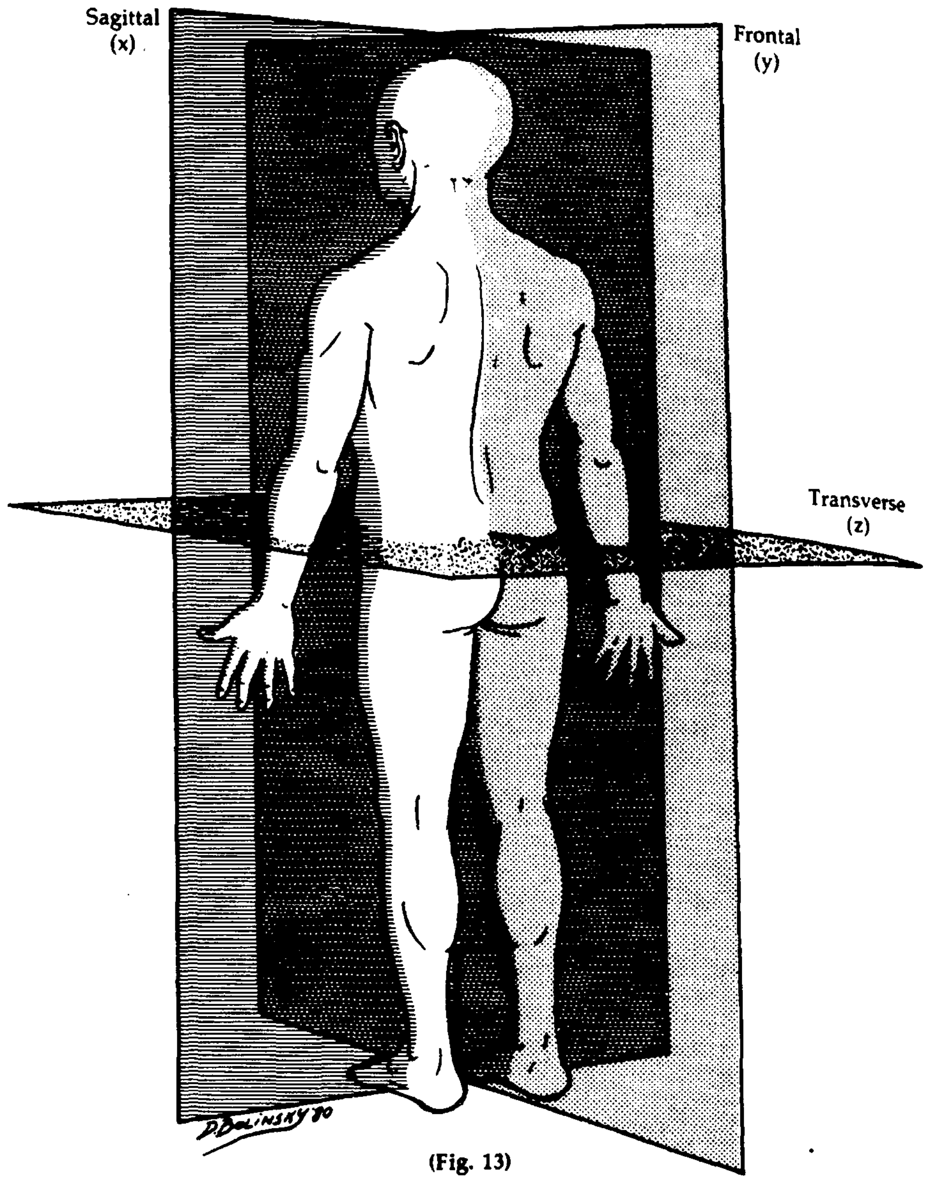
coronal plane: frontal plane.

frontal plane: a plane passing longitudinally through the body from one side to the other, and dividing the body into anterior and posterior portions.

sagittal plane: a plane passing longitudinally through the body from front to back and dividing it into right and left portions; the median or midsagittal plane divides the body into approximately equal right and left portions.

transverse plane: a plane passing horizontally through the body perpendicular to the sagittal and frontal planes, dividing the body into upper and lower portions.

Planes of the body



(Fig. 13)

plastic deformation: a non-recoverable deformation; see also elastic deformation.

plasticity: ability to retain a shape attained by deformation; see also *elasticity; viscosity.*

posterior component: a positional descriptor used to identify the side of reference when rotation of avertebral segment has occurred; in a condition of right rotation, the right side is the posterior component: usually refers to a prominent transverse process: *see also anterior component.*

posterior ilium: see under ilium, somatic *dysfunctions of*

postexion: an archaic term that was used to describe a position of a joint in which 1: the spinal column is fixed in a backward bent position, or 2: a vertebral unit is extended.

postural balance: a condition of optimal distribution of body mass in relation to gravity.

posture: position of the body; the distribution of body mass in relation to gravity.

primary machinery of life: the neuromusculoskeletal system; a term used by I.M. Korr, PhD, to denote that body parts "act together to transmit and modify force and motion through which man acts out his life"'; this integration is achieved via the central nervous system acting in response to continued sensory input from the internal and external environment.

primary respiratory mechanism: an anatomic physiologic concept proposed by William G. Sutherland, DO, to describe the interdependent functions among five body components as follows: 1: the inherent motility of the central nervous system 2: the reciprocal tension of the dural membranes 3: the fluctuation of the cerebrospinal fluid 4: the articular mechanism of the cranial bones 5: the involuntary motion of the sacrum between the ilia (pelvic bones).

primary: refers to the internal tissue respiratory process.

respiratory: refers to the process of internal respiration, i.e., the exchange of respiratory gases between tissue cells and their internal environment constituted of the fluids bathing the cells.

mechanism: refers to the interdependent movement of tissue, bones, and fluid with a specific purpose.

prime mover: a muscle primarily responsible for causing a specific joint action.

pronation: in relation to the anatomical position, as applied to the hand, the act of turning the hand palmar surface backward (medial rotation); applied to the foot. A *combination of eversion* and abduction movements taking place in the tarsal and metatarsal joints, resulting in lowering of *the* medial *margin* of the foot: see also *supination.*

prone: lying face downward (Dorland).

proprioception: the sensing of motion and position of the body.

proprioceptor: sensory nerve terminals that give information concerning movements and position of the body; they occur chiefly in the muscles, tendons, joints, and the labyrinth (Dorland).

pubes, somatic dysfunctions of:

inferior-pubis: a somatic dysfunction (qv) in which one side of the pubic symphysis is inferior to the contralateral side as the result of a shearing in the sagittal plane.

superior *pubis:* reciprocal of inferior pubis.

pubic symphysis, somatic dysfunctions of: see pubes *somatic dysfunctions of.*

pump handle rib motion: movement of the upper ribs during respiration such that with inhalation the anterior aspect of the rib elevates and causes an increase in the anteroposterior diameter of the thorax: see *also bucket handle rib motion.*

reciprocal inhibition: the inhibition of antagonist muscles when the agonist is stimulated: *see also laws, Sherrington's.*

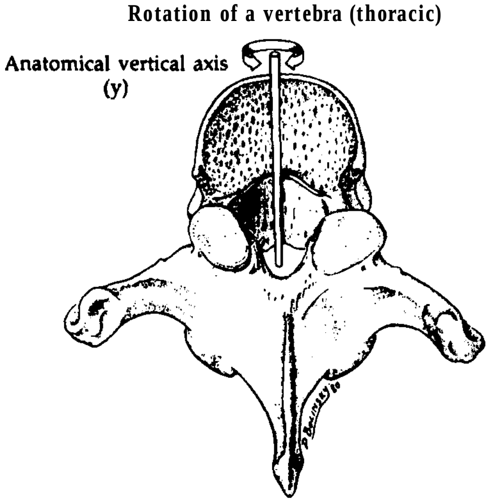
reciprocal tension membrane: the intracranial and spinal dural membrane including the falx cerebri, falx cerebelli, tentorium and spinal dura.

reflex: an involuntary nervous system response to a sensory input: the sum total of any particular involuntary activity.

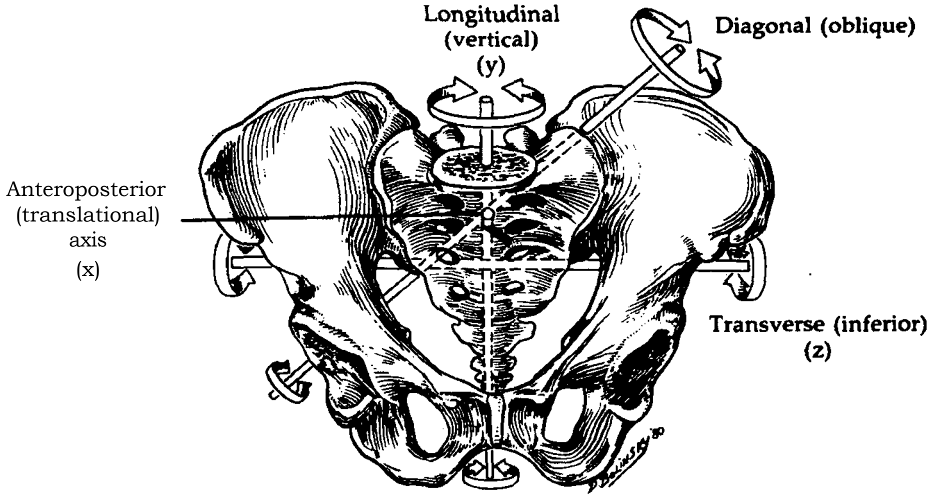
conditioned reflex: one that does not occur naturally in the organism or system but that is developed by regular association of some physiological function with an unrelated outside event: soon the physiological function starts whenever the outside event occurs; *see also somatic dysfunction: facilitation.*

red reflex: 1: the erythematous reaction of the skin in an area that has been stimulated mechanically by friction: the reflex is

Rotation of a vertebra (thoracic)



(Fig. 14)



Axes of sacral motion
(Fig. 15)

greater in degree and duration in an area of acute somatic dysfunction as compared to an area of chronic somatic dysfunction: it is a reflection of the segmentally related sympathetonia commonly observed in the paraspinal area 2: a red glow reflected from the fundus of the eye when a light is cast upon the retina.

somato-somatic reflex: localized somatic stimuli producing patterns of reflex response in segmentally related somatic structures.

somato-visceral reflex: localized somatic stimulation producing patterns of reflex response in segmentally related visceral structures.

viscera-somatic reflex: localized visceral stimuli producing patterns of reflex response in segmentally related somatic structures.

viscero-visceral reflex: localized visceral stimuli producing patterns of reflex response in segmentally related visceral structures.

residual tension: any involuntary muscle contraction above the level of normal tonus persisting after a treatment sequence.

resilience: the property of returning to the former shape or size after distortion: see *also elasticity: plasticity.*

respiratory axis of the sacrum: see sacral *motion axis of superior (respiratoy).*

respiratory cooperation: a physician-directed inhalation and/or exhalation by the patient to assist the manipulative treatment process.

restriction: a resistance or impediment to movement: for joint restriction see **barrier** *(motion barrier).*

rib dysfunction (rib lesion): a somatic dysfunction (qv) in which movement or position of one or several ribs is altered or disrupted; for example, an elevated rib is one held in a position of inhalation such that motion toward inhalation is freer, and motion toward exhalation is restricted: a depressed rib is one held in a position of exhalation such that motion toward exhalation is freer, and there is a restriction in inhalation: see also *inhalation rib; exhalation rib.*

rib motion: see *axis* **of** *rib motion: bucket handle rib motion; pump handle rib motion.*

ropiness: a tissue texture abnormality (qv) characterized by a cord feeling.

rotation: motion about an axis.

rotation dysfunction of the sacrum: see under sacrum, *somatic dysfunctions of.*

rotation of sacrum: movement of the sacrum about a vertical (y) axis (usually in relation to the pelvic (innominate) bones).

rotation of vertebra: movement about the anatomical vertical axis (y axis) of a vertebra: named by the motion of a midpoint on the anterior superior surface of the vertebral body. (Fig 14)

rotexion: an archaic descriptor of spinal motion that involves flexion or extension followed by rotation and sidebending to the same side, in accordance with the second principle of physiologic motion of the spine proposed by Harrison H. Fryette, DO: see *physiologic motion of the spine.*

sacral base declination: with the patient in a standing or seated position, any deviation of the sacral base from the horizontal in a corona) plane; generally, the rotation of the sacral base around an anterior-posterior axis.

sacral motion, axis of: motion of the sacrum about any of its hypothetical axes. (Fig. 15)

anterior-posterior (x) axis: axis formed at the line of intersection of a sagittal and transverse plane.

diagonal (oblique): a hypothetical functional axis proposed by Fred Mitchell, Sr., DO, that is from the superior area of a sacro-iliac articulation to the contralateral inferior sacro-iliac articulation: it is designated as right or left relevant to its superior point of origin.

inferior transverse axis: the hypothetical functional axis of sacral motion proposed by Fred Mitchell, Sr., DO, that passes from side to side on a line through the inferior auricular surface of the sacrum, and represents the axis for movement of the ilia on the sacrum.

longitudinal: the hypothetical axis formed at the line of intersection of the midsagittal plane and a corona) plane.

middle *[postural) transverse axis:* the hypothetical functional axis of sacral flexion/extension in the standing position proposed by Fred Mitchell. Sr., DO, passing from side to side through the anterior aspect of the sacrum at the level of the second sacral segment.

postural: see middle (postural) axis.

superior (respiratory) axis: the hypothetical transverse axis about which the sacrum moves during the respiratory cycle proposed by Fred Mitchell, Sr., DO: it passes from side to side through the articular processes posterior to the point of attachment of the dura at the level of the second sacral segment: also called the superior transverse axis.

superior transverse: see superior (respiratory) axis.

transverse (z) axis: an axis formed by intersection of the coronal and transverse planes about which flexion/extension occurs.

vertical (y) axis: the axis formed by the sagittal and coronal planes.

sacral somatic dysfunction: see sacrum, *somatic dysfunctions of*

sacral torsions: a set of positional terms first proposed by Fred L. Mitchell, Sr., DO, to describe normal and abnormal combinations of sacral motion involving forward or backward bending (sacral flexion or extension, rotation around transverse sacral axes), sidebending (rotation about AP axes of the sacrum), and rotation about oblique (diagonal) axes of the sacrum: for examples, see under sacrum, somatic dysfunc*tions of.*

sacrum, somatic dysfunctions of (sacral somatic dysfunction): any of a group of somatic dysfunctions involving primarily the sacrum.

anterior sacrum: a positional term referring to sacral somatic dysfunction in which one side of the sacral base relative to the pelvic bones has rotated forward and sidebent to the side opposite the rotation about a diagonal axis: the dysfunction is named for the *side* on which **the forward rotation occurs:** anterior sacrum right describes a condition in which the sacrum is rotated left and sidebent to the right, such that rotation left and sidebending right are freer motions and rotation right and sidebending left are restricted: the use of the term anterior (or posterior) **to** describe dysfunctions of the sacrum uses the pelvic bones for reference.

anterior translated sacrum: a sacral somatic dysfunction in which the entire sacrum has moved forward between the ilia; anterior motion is freer, and there is a restriction to posterior motion; (Fig. 16) ***see also posterior*** *translated sacrum.*

extension dysfunction ***of*** *the sacrum (sacrai base* ***posterior):*** a sacral somatic dysfunction that involves rotation of the sacrum about a transverse axis such that the sacral base has moved posteriorly relative to the pelvic bones: backward movement of the sacral base is freer and forward movement is restricted: this is the reciprocal of flexion sacrum.

flexion dysfunction of the sacrum [sacral base ***anterior):*** 1: **a** sacral somatic dysfunction that involves rotation of the sacrum about a transverse axis such that the sacral base has moved anteriorly between the pelvic bones; forward movement of the sacral base is freer and backward movement is restricted 2: reciprocal of an extension sacrum.

left *on* ***left (or*** **right on right) forward** ***sacral*** *torsion:* see under ***sacral torsions.***

left on right (or right on left) (backward) torsion: see under *sacral torsions.*

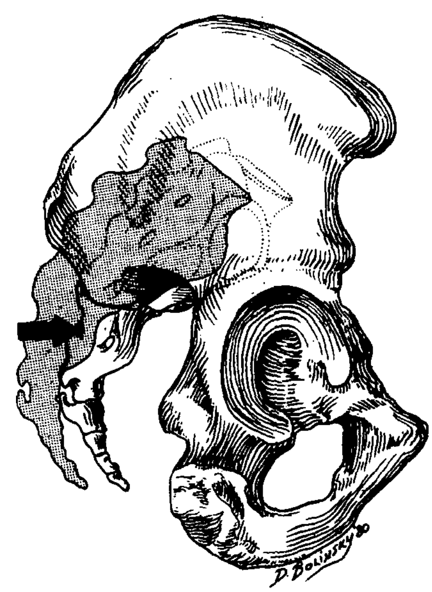
posterior sacrum: a positional term referring to a sacral somatic dysfunction in which the sacral base has rotated backward and sidebent to the side opposite the rotation; the dysfunction is named for the side on which the backward rotation occurs: for example, a posterior sacrum left describes a condition in which the sacrum is rotated left and sidebent to the right, such that rotation left and sidebending right are freer motions and rotation right and sidebending left are restricted.

posterior translated sacrum: a sacral somatic dysfunction in which the entire sacrum has moved backward between the ilia; posterior motion is freer, and there is a restriction to anterior motion. (Fig. 17)

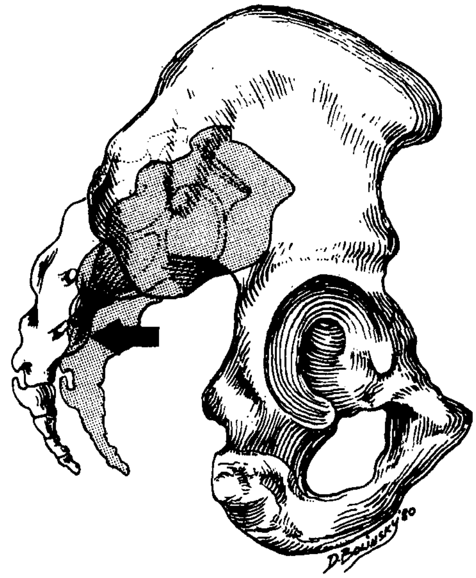
right on right (or left on left) forward torsion: see under *sacral torsions.*

rotated dysfunction of the sacrum: **a sacral** somatic dysfunction in which the sacrum has rotated about an axis approximating the longitudinal (y) axis: motion is freer in the direction that rotation has occurred, and is restricted in the opposite direction.

sacral torsions: rotational motion about an oblique or diagonal sacral axis; primarily a term used to designate somatic dysfunction that results in torsion at the L/S junction. One of the dysfunctions described by



Anterior translated sacrum
(Fig. 16)



Posterior translated sacrum
(Fig. 17)

Fred Mitchell, Sr., DO, based on the motion cycle of walking in which *forward torsions* (neutral torsions) occur when the lumbar spine is in neutral and sidebending, for example, to the left engages the left oblique axis. The sacrum then rotates left about the left oblique axis. The lumbar spine in neutral rotates right with left sidebending. The term torsion originates from the fact that the sacrum has rotated in a direction opposite to the supported vertebra (sacrum rotates left, the lumbar spine rotates right). A left rotation about a left oblique axis produces a right anterior sacral base with a deep right sacral sulcus, a more posterior inferior lateral angle than the opposite side and a decrease in the tensity of the sacrotuberous ligament. For convenience, the forward or neutral torsions are designated as "left on left" or "right on right." A backward torsion (non-neutral) occurswhen the lumbar spine *is* in *non-neutral* and the sacral base then rotates posteriorly about an oblique axis. Backward or non-neutral torsions are identified for convenience by "right on left" or "left on tight." The use *of the term torsions to describe sacral dysfunctions uses the axial spine as reference.*

translated sacrum a sacral somatic dysfunction in which the entire sacrum has moved forward between the pelvic bones (an anterior translated sacrum). or backward between the pelvic bones (posterior translated sacrum).

scan: an intermediate detailed examination of specific body regions which have been identified by findings emerging from the initial screen (qv): the scan focuses *on* segmental areas for further definition or diagnosis.

scoliosis: 1: pathological or functional lateral curvature of the spine 2: an appreciable lateral deviation in the normally straight vertical line of the spine (Dorland). (Fig. 18)

screen: the initial general somatic examination to determine signs of somatic dysfunction in various regions of the body: see also *scan.*

secondary joint motion: involuntary or passive motion of a joint; also called accessory joint motion.

segment: a portion of a larger body or structure set off by natural or arbitrarily established boundaries: often equated with spinal segment, i.e., 1: to describe a single vertebrae, viz, a vertebral segment 2: a portion of the spinal cord corresponding to the sites of origin of rootlets of individual spinal nerves.

segmental definition: the final stage of the spinal somatic examination in which the nature of the somatic problem is detailed: also called segmental diagnosis: see also *scan: screen.*

segmental motion: movement within a vertebral unit described by displacement of a point at the anterior-superior aspect of the superior vertebral body.

sensitization: hypothetically, a short-lived (minutes or hours) increase in central nervous system (CNS) response to repeated sensory stimulation that generally follows habituation (qv).

shear: an action or force causing or tending to cause two contiguous parts of an articulation to slide relative to each other in a direction parallel to their plane of contact [e.g., symphyseal shear (qv); sacro-iliac shear].

Sherrington's laws: *see laws, Sherrington's.*

sidebending: movement in a coronal (frontal) plane about an anterior-posterior (x) axis: also called lateral flexion, lateroflexion or flexion right (or left).

sidebent: the position of any one or several vertebral bodies after sidebending has occurred. (Fig. 19)

somatic dysfunction: impaired or altered function of related components of the somatic (body framework) system: skeletal, arthrodial, and myofascial structures, and related vascular, lymphatic, and neural elements; the positional and motion aspects of somatic dysfunction are best described using two parameters: 1: the position of a body part as determined by palpation and referenced to its adjacent defined structure 2: the directions in which motion is freer and the directions in which motion is restricted: in either instance, the Cartesian, orthogonal or Euler coordinates are used as the reference axes of motion: see also *osteopathic lesion (osteopathic lesion complex).*

acute somatic dysfunction: immediate or short-term impairment or altered function of related components of the somatic (body framework) system: characterized in early stages by vasodilation, edema, tenderness, pain and contraction, identified by A.R.T. (qv): palpatorily diagnosed by assessment of tenderness, asymmetry of motion and relative position, restriction of motion and tissue texture change -T.A.R.T.

chronic somatic dysfunction: impairment or altered function of related components of the somatic (body framework) system present at least several weeks; characterized by tenderness. itching, fibrosis, paresthesias, contracture; identified by A.R.T. (qv)

secondary somatic dysfunction: somatic dysfunction (qv) arising subsequent to or as a consequence of other etiologies.

somatogenic: that which is produced by activity, reaction, and change originating in the musculoskeletal system.

somatology: the study of the anatomy and physiology of the body with emphasis on the musculoskeletal system.

somato-somatic reflex: see *reflex, somato-somatic.*

somato-visceral reflex: see *reflex, somto-visceral.*

spasm: (compare with hypertonic@) a sudden, violent, involuntary contraction of a muscle or group of muscles, attended by pain and interference with function, producing involuntary movement and distortion (Dorland).

spondyl, spondylo: combining form denoting relationship to a vertebra, or to the spinal column (Dorland).

spondylitis: inflammation of the vertebrae.

spondylolisthesis: anterior displacement of one vertebra relative to one immediately below (usually L-5 over the body of the sacrum or L-4 over L-5).

spondylolysis: dissolution of a vertebra. aplasia of the vertebral arch, and separation at the pars interarticularis: platyspondylia.

spondylosis: 1: ankylosis of adjacent vertebral bodies 2: degeneration of the intervertebral disk.

sprain: stretching injuries of ligamentous tissue (compare with strain).

springing technique: see *osteopathic manipulative treatment: springing treatment*

static contraction: see *contraction, isometric.*

still point: a term used by William G. Sutherland, DO, to identify and describe the brief cessation of rhythm attributed to the fluctuation of cerebra-spinal fluid (a component of the primary respiratory mechanism (qv) observed by palpation during osteopathic manipulative treatment when a point of balanced membranous tension (or balanced ligamentous tension) is achieved.

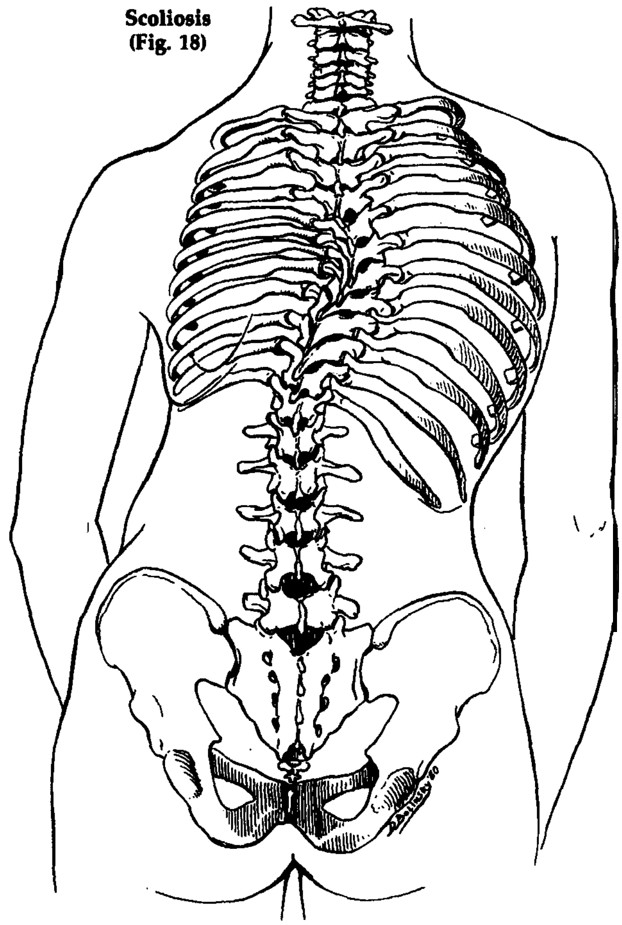
strain: 1: stretching injuries of muscle tissue 2: displacement without tissue disruption of the sphenobasilar symphysis (synchondrosis) 3: deformation of solid tissue (compare with sprain).

stretching: separation of the origin and insertion of a muscle and/or attachments of fascia and ligaments.

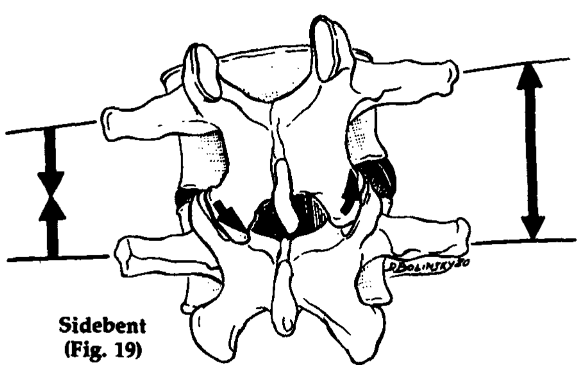
stringiness: a palpable tissue texture abnormality characterized by fine or stringlike myofascial structures.

structural evaluation: *see musculaskeletal evaluation.*

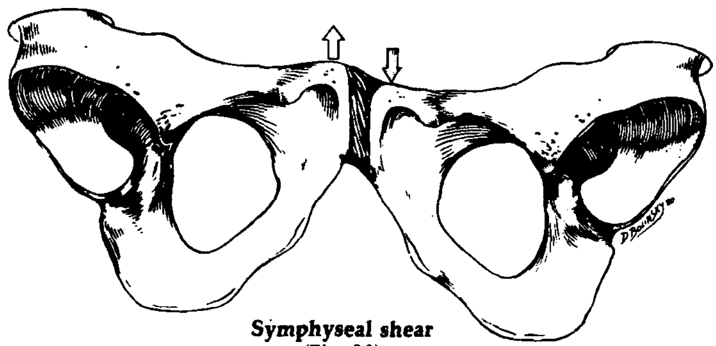
subluxation: 1: a partial or incomplete dislocation 2: a term describing an abnormal anatomical position of a joint which exceeds the normal physiologic limit but does not exceed the joint's anatomical limit.



Scoliosis
(Fig. 18)



Sidebent
(Fig. 19)



Symphyseal shear
(Fig. 20)

superior ilium (innominate pelvic bone): see under ilium, somatic *dysfunctions* of.

superior pubes: see under *pubes. somatic dysfunctions of.*

superior transverse axis: see *sacral motion* superior (respiratory) axis and **transverse (2)** axis.

supination: 1: beginning in anatomical position, applied to the hand, the act of turning the palm forward (anteriorly) or upward. performed by lateral external rotation of the forearm 2: applied to the foot, it generally applies to movements (adduction and inversion) resulting in raising of the medial margin of the foot, hence of the longitudinal arch; a compound motion of plantar flexion, adduction and inversion; see also pronation.

supine: lying with the face upward (Dorland).

symmetry: the similar arrangement in form and relationships of parts around a common axis, or on each side of a plane of the body (Dorland).

symphyseal shear: the resultant of an action or force causing or tending to cause the two parts of the symphysis to slide relative to each other in a direction parallel to their plane of contact; it is usually found in an inferior/superior direction (see illustration) but is occasionally found *to be in an anterior/* posterior direction. (Fig. 20)

tapotement: striking the belly of a muscle with the hypothenar edge of the open hand in rapid succession in an attempt to increase its tone and arterial perfusion.

technic: see *technique.*

technique: the method of procedure and the details of any mechanical process or surgical operation. [. . .method, treatment, maneuver. . .] (Dorland): *see also osteopathic manipulative treatment.*

terminal barrier: see *barrier: physiologic barrier.*

thrust: *see osteopathic manipulative treatment: thrust treatment.*

tissue texture abnormality (TTA): a palpable change in tissues from skin to periarticular structures that represents any combination of the following signs: vasodilation, edema, flaccidity, contraction, contracture, fibrosis; and the following symptoms: itching, pain, tenderness, paresthesias: types of TTAs include: bogginess (qv), thickening, stringiness (qv), ropiness (qv), firmness (hardening), increased/decreased temperature, increased/decreased moisture.

tonus: the slight continuous contraction of *muscle* which, *in skeletal muscles, aids in* the maintenance of posture and in the return of blood to the heart (Dorland).

myogenic tonus: tonic contraction of muscle dependent on some property of the muscle itself or of its intrinsic nerve cells.

torsion: 1: a motion or state where one end of a part is turned about a longitudinal axis while the opposite end is held fast or turned in the opposite direction 2: a specific sacral motion 3: an unphysiologic motion pattern about an anteroposterior axis of the sphenobasilar symphysis/synchodrosis; see sacrum, somatic dysfunctions of: *sacral torsions.*

traction: a force acting along a longitudinal axis to draw structures apart.

transitional segment (transitional vertebral segment): a congenital anomaly of a vertebra in which it develops characteristic(s) of the adjoining structure or region; e.g., lumbosacral, cervico-thoracic; the clinical significance of this lies in its aberrant motion characteristics: gross postural effects on the superincumbent spinal column, or pseudoarthrosis between the enlarged transverse processes and either the sacrum or ilia.

lumbarization: transitional segment (qv); when transverse process(es) of the fifth lumbar (L5) are atypically large commonly causing pseudoarthrosis with the sacrum and/ or ilia(um); referred to as a batwing or butterfly deformity when it is bilateral.

sacraization: incomplete separation and differentiation of the fifth lumbar vertebra (L5) such that it takes on characteristics of a sacral vertebra.

translation: motion along an axis.

translatory motion: see motion: translatory motion.

transverse axis of sacrum: see sacral motion, axis of transverse (z) axis.

trigger point (myofascial trigger point): a small hypersensitive site that, when stimulated, consistently produces a reflex mechanism that gives rise to referred pain or other manifestations: the response is specific, in a constant reference zone, and consistent from person to person.

trophic: of or pertaining to nutrition, especially in the cellular environment: example: trophic function-a nutritional function.

trophicity: 1: a nutritional function or relation 2: the natural tendency to replenish the body stores that have been depleted under sympathetic direction.

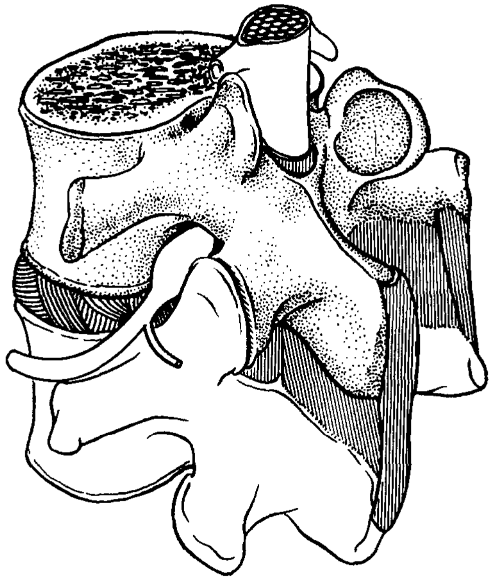
trophotropic: concerned with or pertaining to the natural tendency for maintenance and/or restoration of nutritional stores.-

- tropic: a word termination denoting turning toward, changing, or tendency to change (e.g., trophotropic-a tendency for nutrition to produce change).

tropism, facet: unequal size and facing of the zygapophyseal joints of a vertebra: see also facet asymmetry.

velocity: the instantaneous rate of motion in a given direction.

vertebral unit: twovertebral segments with their spinal and extraspinal articulations, sensory and motor units. (Fig. 21)



Vertebral unit
(Fig. 21)

viscera-somatic reflex: see reflex, viscero-somatic.

viscosity: 1: a measurement of the rate of deformation of any material under load 2: the capability possessed by a solid of yielding continually under stress: see also elasticity; plasticity.

II

Core Curriculum

The consultants to the Biochemistry section of the National Osteopathic Board of Examiners had been discussing steps to be taken to improve their examination. At their instigation I contacted J. Warren Anderson at Michigan State University. He met with the Biochemistry section and discussed some fundamental changes in the Boards method of examination preparation. One suggestion he made was the development of a core curriculum to be used as the basis for examination question development and selection. The Board had been using a subject outline for some time, but he suggested that a more detailed outline would be more appropriate which he called a core curriculum.

The National Board, as a whole, became interested in this proposed change and Dr. Anderson became a consultant to the Board to oversee the development and implementation of a core curriculum for each subject. The Osteopathic Principles section had recently been added to the National Board. I served as a consultant to that section as well as being the examiner in Biochemistry. I presented a challenge to ECOP. I told them that they could develop a core curriculum for the National Board or the Board would develop its own core curriculum. This proved to be the initial stimulus for the development of a core curriculum by ECOP.

An outline of the core curriculum entitled “General Objectives for an Osteopathic Principles and Practice Curriculum” has been included in this yearbook. The more detailed subject matter of the core curriculum may be obtained from members of ECOP.

The original purpose for the development of a core curriculum was to provide an outline of the content of educational subject matter that all the osteopathic colleges could agree should be included in an osteopathic principles and practice curriculum. Basic content objectives were to be taught in all the colleges. The National Board Osteopathic Principles and Practice examination questions would be based on the core curriculum.

GENERAL OBJECTIVES FOR AN OSTEOPATHIC PRINCIPLES AND PRACTICE CURRICULUM

BASIC KNOWLEDGE

I. History and Philosophy

1. Medical history
2. Osteopathic history, including its evolution with the context of medicine
3. Philosophy of A.T. Still
4. Philosophy of osteopathic medicine and its distinguishing feature from other medical philosophies
5. Contributions of basic and clinical research to the understanding of osteopathic philosophy

II. Basic Sciences

1. Anatomy
   - 1.1 Surface landmarks
   - 1.2 Joint anatomy, static/functional
   - 1.3 Musculoskeletal, static/functional
   - 1.4 Autonomic nervous system
   - 1.5 Peripheral nervous system
   - 1.6 Pertinent central nervous system

2. Physiology
   - 2.1 Adaptive roles during normal function
   - 2.2 Autonomic reflexes
   - 2.3 Cord reflexes
   - 2.4 Central control mechanisms
   - 2.5 Concepts of facilitation, habituation, and sensitization
   - 2.6 Viscerosomatic, somatosomatic, somatovisceral, viscerovisceral reflexes
   - 2.7 Stress and immunity
   - 2.8 Pain mechanisms
   - 2.9 Biological rhythms, e.g. circadian, ultradian, craniosacral, catecholamine, thermoregulation, digestion, respiratory, cardiac

3. Mechanics
   - 3.1 Joint biomechanics
   - 3.2 Reflex influences
   - 3.3 Soft tissue biomechanics
   - 3.4 Kinesiology: Motion, posture, strength
   - 3.5 Locomotion and gait
   - 3.6 Interactive relationships among musculoskeletal, nervous and circulatory systems

4. Epidemiology
   - 4.1 Population studies and occurrences of neuromusculoskeletal problems
   - 4.2 Natural history of neuromusculoskeletal and related problems

5. Behavioral
   5.1 Stress
   5.2 Depression
   5.3 Anxiety
   5.4 Pain

III. Manipulative Skills Development

Detailed musculoskeletal examination skills should identify areas of somatic dysfunction including craniosacral and myofascial components

1, General principles of biomechanics as they relate to soft tissues, spinal mechanics and muscle function

2. Visual assessment for gross and subtle changes

3. Palpatory skills
   3.1 Soft tissues, ligaments, tendons, bones
   3.2 General skeletal responses to active motion
   3.3 General skeletal responses to passively induced motions
   3.4 Static and motion asymmetries
      3.4.1 vertebral position and effects of active motion
      3.4.2 accurate diagnosis of restricted motions
   3.5 Tissue texture abnormalities as reflections of
   3.6 Craniosacral and myofascial rhythms

4. Manipulative treatment skills

   4.1 Application of basic principles of direct, indirect and combined techniques that include:
   --high velocity/low amplitude techniques
   --muscle energy techniques
   --counterstrain
   --craniosacral
   --functional
   --myofasical release

Note: Commendable skill implies understanding of concepts and mechanisms of the techniques as well as general indications for applications.

5. Problem solving

Use of clinical reasoning that arises from a thorough history a physical that incorporates structural exam in the context of total patient care.

   5.1 History taking should elicit a data base sufficient to evaluate significant musculoskeletal factors
   5.2 History and physical should lead to assessment of need for appropriate laboratory and imaging procedures

5.3 Visual assessment and structural exam should lead to formulation of a reasonable treatment and health maintenance program that acknowledges any musculoskeletal components and their effects

IV. Clinical Knowledge/Skills

Clinical applications of structural examination and manipulative treatment should demonstrate ability to create positive changes in areas of somatic dysfunctions including craniosacral and myofascial components.

1. Perform a quick and accurate structural exam
2. Know reasons for performing structural exam
   - 2.1 Role of neuromusculoskeletal system in health and disease
   - 2.2 Role of stress in health and disease including neuromusculoskeletal manifestations
   - 2.3 Assessment of autonomic influences
   - 2.4 Neuromusculoskeletal manifestations of inflammation, injury and repair: reflex, circulatory and mechanical
   - 2.5 Patterns reflecting somatic manifestations of visceral problems
   - 2.6 Pain and its many manifestations
   - 2.7 Depression, anxiety and somatization as sources of complaints/findings
3. Accurate interpretation of structural findings, including relative importance of somatic dysfunction in presenting complaints
4. Perform appropriate manipulative treatment
5. Understanding disease processes and management in order to determine prognosis
6. Problem solving classroom experiences with clinical case presentations
7. Experience with skilled role models in clinical settings
8. Experience with record keeping

III

Psychomotor Skills Training

A psychomotor skill is one in which voluntary motor action is directly related to mental activity. Palpatory and manipulative technique skills are psychomotor skills. The teaching of these technical skills in recent years has been referred to as psychomotor skills training.

Traditionally osteopathic technique procedures have been taught in our colleges by a method of demonstration and imitation with little attention given to the physical skills employed. Allen and Stinson were the first to draw attention to the importance of the physical and mental components of a technique skill. However, outside of instruction given in tactile skill training, little else of the principles of psychomotor skills training has been incorporated into osteopathic skills education.

The articles by Allen and Stinson, "The Subjective Factors of Skillful Technic," are still timely in their critical analysis of technique procedures. They are the first members of the osteopathic profession to speak of the importance of what is now called psychomotor skills training. These articles are included in this volume because of their classical importance.

In addition I have included the elements of psychomotor skills training which was derived from a Michigan State University workshop presented by Stephen Yelon from the College of Education. Dr. Yelon responded to the question posed by the committee in charge of osteopathic skills teaching at the osteopathic college as to how people learn psychomotor skills and how do you teach them. The basic principles presented by Dr. Yelon have been modified for osteopathic skills teaching.

The last article in this section deals with the examination and grading of psychomotor skills. It includes a list of do's and don'ts for examiners to serve as a guide for the conduct of practical examinations in osteopathic skills training.

THE SUBJECTIVE FACTORS OF SKILLFUL TECHNIC

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INTRODUCTION
By Dr. Stinson

After some thought, correspondence, and conference, we have decided to use Dr Allen's lecture to the Senior Class at the Chicago College of Osteopathy last spring for the first part of this presentation. We offer no apologies for some of the ideas expressed. You may not like them, but if they stir up thought, perhaps some favorable action may result.

Too often we are forced to listen to someone shout "Hurrah for osteopathy!" During our student days we called this oratorical flag-waving stunt "handing out a dose of consecrated ignorance". We do need some renewal of our faith and meetings of this kind serve to stimulate enthusiasm. But we need most of all a very highly critical review of some of our problems. We hope that this may start some analysis.

PART I
By Dr. Allen

During the first few years after I left C.C.O., I composed many talks to the seniors of my Alma Mater. Some of them were pretty passionate words of advice and of warning, but all of them died adorning, Thank God for that ! You'll do the same, no doubt, and then find as I did, that the urge dies away; and one comes to feel a great responsibility when such an opportunity as this presents itself, and finds himself very much less certain that he knows what will do these seniors the most good. Especially, one comes to the realization that one's own experience, yours and mine, is what counts the most for each one of us. I always have thought that the old adage, 'Experience keeps a dear school, but fools will learn in no other," should be revised to read, "but none of us can learn by any other! Even then it depends upon whether we meet experience blindly and thoughtlessly, or whether we examine and utilize it with intelligent awareness.

So it occurred to me that many things I might discuss with you are better left to your own experience; but that it might be worth while to think about the problem of examining and utilizing experience with intelligent awareness. I thought of the first five years of your experience in general practice (for that is where most of you will be)- years of getting dry behind the ears; not very busy years much of the time; plenty of time to read and study and think-and to waste time, unless we read and study with some intelligent plan, some goal in view.

So since we're supposed to be here to discuss technic, we will consider these five years ahead of us in terms of experience in technic. The plan and the goal are embodied in what we may as well call the subject of today's lecture: Critical Thinking and Fine Craftsmanship in Technic.

*Delivered by Dr. Stinson before the annual convention of the Middle Atlantic States Osteopathic Association, Washington. D.C., October 4 1940. The program was sponsored by the Osteopathic Manipulative Therapeutic and Clinical Research Association.

First, let me list some of the problems and controversies in my experience that have disturbed me and that are partly responsible for this approach to technic. They probably will not be wholly unfamiliar to you, and I think you will see, without my comment as we go along, how they point up our subject.

(1.) The "old-timers" and their claims. Did they do what they claim? Can you and I do likewise? If so, How? If not, why?

(2.) The Manipulative Orthopedic, and Technic Sections of the National Convention-a three-ring circus of some wheat and a lot of chaff. How shall we separate them and preserve the wheat? To do so is most important. What is the result of a critical evaluation of the work of the doctors appearing on these programs and of their reports of their work? These are two very different things by the way. The rosy aura of self-esteem that surrounds our memory of a case treated twenty, no, even one year ago, is not conducive to critical analysis. Is there any clue in this critical evaluation as to how we may duplicate their success?

For instance, as you observe a demonstration of technic, is it not necessary to remember that similar mechanical relations may not mean similar soft tissue states? A method may be highly effective mechanically, and we see it used with impunity on an old chronic quiescent lesion, but if the malposition is maintained by acute inflammatory tensions it would be utterly inappropriate. How many times this point is overlooked in our enthusiasm for what seemed to be and was for its purpose, and with appropriate tissue states, a marvelously skillful procedure.

(3.)The short treatment vs. the long. The specific, corrective treatment vs. the general or a combination of both. Pearson' in an article some months ago in The Journal of Osteopathy states the case very well, but didn't go far enough. He pointed out that advocates of each method are successful, so you take your choice as to what seems best to you. The point to emphasize is that each time you see each patient there is a best method, and it's our business to find out what it is and to use it skillfully. By critical thought we must, out of our training and experience, evolve criteria for determining the best way in each instance. How many of us here, or among those in the field, can say in a majority of instances: "In this case, these two corrections are precisely indicated, and that is all that should be done, because: 1-, 2-, 3; while in that case no specific correction is indicated; but the treatment should be confined to soft tissue work alone, because ; 1-,2-,3. Surely lots of folks say it, up to the word "because," but from there on critical analysis leaves us cold, for their reasons why are too often based upon too few cases, cases poorly studied, examination incomplete, its findings poorly recorded, descriptions vague and carrying little meaning in terms understandable to us all in common.

(4.) The fact that some technicians have an inherent knack and others have not, and little really is done about the latter.

(5.) The usual technic "demonstration" at meetings and conventions. As I see the crowd pressing to get close to some master technician, I am impressed with the futility of it, because there is such a lack of critical analysis of his work ; an emphasis on the end gained and not on the means whereby it is reached, except in terms of imitation of the grosser elements of the procedure. There is a lack even of a common descriptive language adequate to convey from one to the other precisely what is felt and what is done.

But that is enough of the negative side of our field of discussion. The last experience cited leads us directly back to our subject, "critical thinking." Remembering that we are trying to keep our feet on the ground by thinking about these first five years of your practice, let us attack this subject positively and ask why I believe such a technic demonstration to be largely futile. My answer, I repeat, lies in the conviction that there has been too little critical analysis of his own work on the part of the demonstrator; and equally little, or less, on the part of the observers; so that they have no common language, no common concept of the simpler basic elements of technic which are necessary to the exchange of ideas in any field. The very attitude of the observers usually indicates a desire to learn how to press some all-powerful button in some magic way so that cure comes without the effort of a single thought on their part. So both need to exhibit some "critical thinking."

What do we mean by "critical thinking"? Vaguely I feel that I owe this next thought to someone--to whom, or where it is recorded eludes me--but it is these three words: observation, analysis, classification. One of the finest examples of critical thinking has come down to us in the form of Koch's postulates. It has occurred to me that we might draw up an analogous series of postulates to epitomize what we mean by "critical thinking" in technic. Our postulates would run something like this:

"In order that a procedure of technic shall be acceptable, the following criteria must be met:

"1. The osteopathic lesion to which the technic is applied must be observed and described accurately and precisely in all its aspects.

"2. It must be related by definite anatomical or reflex pathways or by definite physiologic principles to the pathological condition it is presumed to cause or to influence, and these pathways or principles must be described accurately and precisely.

"3. The contemplated correction must be described in detail in relation to:

(a.) The method by which it is to be applied to the lesion involved, i.e. its mechanics in relation to the lesion.

(b.) The manner of application, i.e., its mechanics in relation to the operator and to his use of the mechanics of his own body.

"4. The clinical result must be evaluated and described precisely, especially to determine to what extent that result is produced by the correction applied or, on the other hand, by other factors possibly entering into its accomplishment.

"5. Many instances of this osteopathic lesion must be carefully carried through the analysis outlined in points 1 to 4, and the observations and descriptions accurately recorded, and such records must be in terms subject to common, uniform understanding, so that many other workers can produce the same results in the same way when the same conditions pertain."

Now obviously, the perfect attainment of such an ideal is beyond us, because, first, all of us put together are not clever enough to reach it completely; second, it is inherently impossible of absolutely complete accomplishment due to the infinite variety of lesions and tissue conditions and of individual ways of attacking them. Furthermore, absolute attainment of that ideal, if it were possible, would not be desirable because it would be almost sure to be accompanied by a loss of common-sense "seeing of the patient whole," in an effort to reach mathematical precision. Yet, as a practical goal, a practical ideal of "critical thinking," this series of postulates or a similar and better one, if you will evolve such a one for yourself, should become a vital part of our very being every day we practice osteopathy. There is a Tahitian legend of "The Laughing Woman," whose tantalizing laughter leads one from the slothful ease of the sunny beach into the hardships and dangers of the dark jungles that cover the mountain sides and ravines to search for her--whom one never finds. To them she symbolizes man's urge toward the ideal. So such an ideal should lead us away from routine, deadening, uncritical back-punching. But we must not follow "The Laughing Woman" until she lifts our feet too far off the solid ground of practical reality; so back to our subject.

The first basic demand of our postulates is observation; and need I remind you that in technic, observation is largely by the sense of touch? Of course that is a trite saying and we have all heard it almost ad nauseam. But what have we done about it by and large? Nothing! We have assumed that tactual perception, facility in palpation, was something with which we are endowed to a certain variable extent at birth, and which just grows like Topsy if it grows at all, with no particular attention on our part. If our sense of touch becomes keener, it does so merely as a by-product of other activities. But this should not be so; we must go farther than that. And we can: as we hope to point out.

One of the first items in this "five year plan" is to pay direct attention to training the sense of touch. The first step in the training is to begin consciously to be aware of everything around us in terms of *how it feels.* Normally, we pay little attention to the feel of things; we think more of sight, sound, taste and smell. If Toscanini can detect the slightest dissonance in one note played by one man away in the back of a full orchestra, don't you think he would likely be aware of a thousand sounds that you and I never hear, if he were sitting in this room now? We see a white bank of snow. A painter sees a dozen shades of red and orange and blue in the same snow. Each is exquisitely aware of the details of the whole world about him in a way that is peculiar to terms of how its elements feel to us? Very little, and how amazing that that is so. But we must. It is natural for me to note that A has on a brown suit and B a blue dress. It must become just as natural to note that A's brown suit would convey the sensation of a tweed, of a certain weight, woven with a certain looseness of texture, etc., while B's dress feels like satin, of a certain weight and with a certain figure woven into it of heavier thread. So we must become habitually aware of our world in terms of touch.

We also must become habitually curious in terms of touch. I don't mean by that of course that we must openly paw everything or everybody we see; by everything we can touch must be savored, as we try to determine its tactual quality. In that respect we must become more sensual, "tactual gourmands" as it were.

Then we also can devise many exercises in touch training: Dr. James A. Stinson[2] has suggested some. Pottenger,[3] with whose book you are familiar, has also done marvels in what he calls light touch palpation. [Exercises suggested by Drs. Stinson and Pottenger were described in the February Journal.] Once you have seen this point, many similar exercises will come to mind. Practice them daily.

Remember, too, in this becoming aware of the sense of touch, that in our field it means more than tactual sensation. It means also deep muscle sense, kinestheses: the means whereby we sense weight and movement, and this, too, can and must be trained. This deep muscle sense takes part in observations ranging from Pottenger's light touch palpation,[3] or the sensing of the minutest increase of rectus tone over a disturbed appendix to the sensing of the force required to correct the stubbornest lesion. This kinesthetic sense can be trained also. Just as we noted above, with respect to the tactile sense, we first must become aware of the muscles we use in certain movements, and of the leverages utilized--become muscle and movement conscious. Many times if we study this we will find that we are using too much of our body for a given purpose; or that we are using impractical leverages.

But, you say, "What has all this to do with 'critical thinking'?" Simply that critical thinking in science depends on precise measurement, and we are simply developing the accuracy of our measuring tools to the utmost.

Observation is followed by analysis and classification. The tissue states, the tensions, thus become the guides in determining what procedure in technic is appropriate. So our postulates next insist that we work on reflex pathways, the anatomical relationships, the physiologic principles that relate the existing pathological condition, to the symptoms, to your findings, to the technic you propose to use and to the result you expect to bring about. Dare to make the attempt to do that in every case every time you treat the patient! What awful gaps you will find, but if you don't dare to face them squarely you'll never fill them up, As you analyze your findings in this way, you will run to books like Grant's "Method of Anatomy,"[4] and Pottenger,[3] and you'll be drawing crude diagrams as R.C. Hart, D.O., of Chattanooga, Tenn., does, tracing out reflex pathways in case after case as a daily routine. If you don't develop habits of critical thinking in this phase of technic; if you don't compel yourself to work out these analyses, you'll be just another "engine wiper."

Next, with postulate number 3, we turn to technic proper--the application of force to correct this lesion we have been observing and analyzing. Here we seek methods of critical thinking about the corrective technic itself. As far as it concerns the lesion it is simply applied force, and the observations we already have made determine the quantity, the direction, and other characteristics of the force that are indicated. Our analysis of these conditions, and of the indicated correction which they call for, has given us a clear, detailed picture of each factor in that correction; angles and direction of application of force, quantity of force, position of patient, etc. Most of this we pass over and depend on your work here in school to fill the gaps we leave. But what are the factors which determine the technician's ability to apply that force precisely is indicated by the status of the tissues in lesion?

In the simplest terms, an osteopathic correction is a movement by which a force applied to a resistance. The force has three characteristics:

1. Direction.
2. Distance.
3. Speed.

The degree of the resistance, and the nature of the lesion determine the quantitative value and nature of these characteristics. It may be noted that from the beginning to the end of a corrective movement, this resistance may change and thus require a change, perhaps very minute, in the nature of the force. It is necessary that we be able to alter the force and its character to meet such changes. These alterations in quantity, direction, or speed of force must be made with smooth, easy, fluid precision.

Let me suggest a few factors involved in the operator's use of his own bodily mechanisms which determine his skill and precision in the application of force.

(1.) Obviously the first would be the keenness of his tactile sense, and we need not discuss that further here.

(2.) A well-developed kinesthetic sense is even more important here than in diagnosis, because it is the basic guide which tells us how we are applying the force. I leave it to you to enlarge upon that thought.

(3.) Leverages and fulcra. Most of the levers of the body are of the third class, with fulcrum at one end. The use of a lever requires a fixed fulcrum, and every movement requires the complete or relative fixation of one or more fulcra. We may lay down three general principles:
   (a.) Greater force or greater distance of move ment requires longer leverages.
   (b.) Greater control and finesse is possible with shorter leverages.
   (c.) Sometimes the two can be combined in a series of levers so that great force can be applied with finesse.

Every procedure of corrective technic must be analyzed from this standpoint. The appropriate fixed and relatively fixed fulcra, and their associated levers must be utilized. Perhaps a movement is begun from a basic fixed fulcrum and other subsidiary fulcra and levers are later brought into play. This must be done in a smooth, fluid, continuous movement, always under perfect control.

(4.) Muscular action upon levers is most efficient and under best control, and therefore smoothest, when the levers upon which they operate are in about the middle third of their complete range of motion; i.e., close to half-way between complete extension and complete flexion.

(5.) The follow-through is a principle which, in these days of golf, needs little discussion. Let me quote from a writer[5] on the physics of piano technic: "It is the consistent maintenance of the intention to follow through, throughout the movement from its mental conception and nervous initiation to its physical culmination which constitutes true freedom and suppleness in any act of touch." Again "the intention to get past the point of contact connotes very different physical conditions from those which aim only at the point of contact." It is the follow-through that enables us to bring the force to its peak at the point where it is most effective; not before, so that it is dissipated against the flexible resistance of impeding muscles and ligaments; not after, so that muscles and ligaments are traumatized.

(6.) The greater fluidity and smoothness of movement if lines of force flow through curves as much as possible and not by angles.

(7.) Rhythm:

(a.) Rate or tempo at which in soft tissue treatment each movement succeeds the last. A slow tempo produces results different from a rapid one. Use the one indicated by conditions. Too long a continuation of any rhythm is apt to be irritating.

(b.) Relative time value of effective phase of movement as compared to return phase: 3/4 time, two counts to the effective phase and one to the return.

These are but a few of the basic factors in skillful technic. I hope you will work out others. Analyze your own technic in this manner, until in so doing you have familiarized yourself thoroughly with this basic method of analysis. You will thus master your own practices or procedures in technic as you cannot do otherwise. May I urge at this point that, until you have mastered the methods and principles you have been taught here in C.C.O. in the carefully coordinated way which your faculty has perfected, do not bother with facile, spellbinding demonstrators however skillful they may actually be. After you have mastered your own technic, and have become thoroughly familiar with such a method of technic analysis as I have suggested, then you can analyze their technic in such a way as to enable you really to utilize it and make its superior elements an integral part of your own armamentarium. Perhaps you would find then that the super-technicians' technic is not so superior to yours after all.

One more return to our postulates and we note in every one the demand for description. That seems to be essential both because it constitutes a compelling necessity that you clarify your own thinking and because only through description can we widen our contact with, and usefulness to, each other in our efforts to develop skill and understanding. Vagueness and ability to describe too often reflects sloppy observation. Try to describe as accurately and vividly as possible just what you feel in a certain case, so that your classmate can identify a tissue status in another patient as being very closely similar to the condition you describe. It is very difficult, but if you persist you will find whatever success you may attain reflected in a keener appreciation of the finer variations of tissue conditions. Both now and later in practice try such an exercise as this for example: take some time to write out a thoroughgoing differential description of the tensions in cervical muscles in five patients:

(1.) A businessman in good health, with no foci of infection but under a great mental strain;

(2.) A man under no unusual mental tension, with no infection but with badly impacted and unerupted third molars;

(3.) A man with no unusual mental tension, no impacted molars, but with several apical infections;

(4.) A man with none of the above, but having much eyestrain;

(5.) A man with none of the above but having acute tonsillitis and running a temperature of 102 F.

It was also mentioned that results are to be evaluated and described. That implies records of past findings and of findings at every session with the patient; case histories, in other words, and progress notes. Before you get too busy, try to work out a method of recording osteopathic findings that isn't too cumbersome so that you're tempted to neglect records, but that is as fully and as vividly descriptive of osteopathic findings, of tissue states, as possible. I have thought of using a diagram of Pearson's' as a basis and working out a system of descriptive symbols for quick recording. So far as I know nobody as evolved a system of recording these findings that is very satisfactory. If you work at it you may succeed in finding a way to do it adequately and that would be a great benefit to the profession. That, plus a much more comprehensive and complete language of description for osteopathic findings as to tissue conditions, etc., would facilitate tremendously the progress of our profession toward a firmer scientific basis. It is absolutely essential to the accomplishment of our last postulate, namely: that the lesion and its correction can be so accurately described that others of us can repeat what each of us may be able to do.

Finally, let me place before you the concept *"fine craftsmanship"* in technic. Time was when no finer compliment could be paid a man than to say of him: "He is a fine craftsman." It is a pity that so little is thought of fine craftsmanship in these days of mass production. We see little, any more, of the exquisite workmanship of the fine craftsman, but I think we still each see enough of it here and there to appreciate its quality. That quality reflects the ability of the workman to visualize the finished product, to analyze critically the materials with which he works and the methods of utilizing them; to keep his tools sharp and keen, capable of accurate, precise work; and finally, the ability to use those tools with superlative skill. Can we not apply that statement exactly to osteopathic technic? And in so doing do you not see that what I have been suggesting is simply a method of self-development to the end that we in our field can become "fine craftsmen"? Someone has suggested application of the old guild system to osteopathy. In some ways this plan is better than hospital training, because many of the methods I have discussed could be worked out more easily. The tradition of "fine craftsmanship" is one that well can challenge the best that is in us and I believe that you will find that the men who most consistently find osteopathic methods effective are the fine craftsmen in our profession. I believe, too, that the final depth of the imprint which osteopathy will make upon medicine as a whole will depend upon the degree to which the philosophy and the principles of osteopathy have been implemented by fine craftsmanship. If that be true, what will your contribution be?

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The Subjective Factors of Skillful Technic*

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PART II

INTRODUCTION
by Dr. Stinson

Almost any speaker may be pardoned for relating personal experiences. The things that we live through are the most vivid for us. Thus my early life led me into considerations regarding certain needs in osteopathy.

After the usual amateur days, continued study led me to a degree in physical education, and some years as a professional athlete. During all this time I weighed less than one hundred and forty pounds. Inheritance gave me a reasonable amount of muscular coordination plus a certain amount of speed. The skills necessary for success were developed the long hard way of following the rigorous programs for training in correct "form." For only thus can the mediocre athlete compete with those who have greater size and strength, or a more abundant native ability.

From the moment of my beginning studies of osteopathy it was startling to find so little attention paid to the physical development of the prospective osteopathic physician. Frankly, it seemed foolish to impart required book knowledge, some imitation of certain technicians, and then expect the individual to become an accomplished practitioner.

Professional baseball presents an example of the extreme care used in selection of those upon whom large sums are to be expended for correct education in "form." The mental qualities are considered, but weight, speed and coordination are requisite. It is extremely difficult for a young man weighing under one hundred and seventy-five pounds to get a tryout as a major league pitcher or catcher. It has become a recognized fact that few small men can stand the "pounding" of a baseball season.

After long years of training, I had spent some time in coaching such technical events as the track start, tumbling, gymnastics and football fundamentals. Imagine the shock of finding so little attention paid to the development of correct "form" in the teaching of the muscular skills requisite for osteopathic technic.

At the Dallas convention of the A.O.A. we heard a learned discussion on "Aptitude for Osteopathic Training." It was brought out that there is in process a study of some psychological tests for the determination of such aptitudes, yet not one word was said as to the physical skills necessary for success in osteopathy.

Dr. Allen followed somewhat the same thought processes. However, he approached the subject from the artistic rather than the boisterous athletic side. He found in the training of the musician, the dancer, and the artist, much of the same insistence on correct" form.

There is something to be said for the combination of the able theoretical thinker, and the more blunt and less refined practical worker. Such a collaboration means many hours spent in argument, in conference, and in a long range correspondence. Dr. Allen thinks I am too brutally practical. I think he sometimes becomes a little too theoretical. We agree that there are certain lacks in osteopathic education and that much can be learned from other fields. We have tried to work some of it into a contribution to osteopathy. Several papers under the announced topic have been prepared, delivered and published by both Dr. Allen and myself. I am frank to admit that his contribution is far greater than mine. I join with him in hoping that some of it may prove of value.

SUBJECTIVE FACTORS OF SKILLFUL TECHNIC

The subjective basis of skill in technic is "form." It is difficult to, teach, or to learn, anything that cannot be broken down into step-by-step processes that are analyzed, explained, and then repeatedly practiced. Osteopathic technic, like the skills of the accomplished musician and the athlete, falls into this general class in the educational field. It begins with the acquisition of correct form.

How much of the requisite mechanical ability can be taught? We do not know, for the teaching of much of it never has been tried. There was a time when a course in physical education was taught to juniors at the Chicago College of Osteopathy. But even that was too late in the course, for habits of technic were being established before correct muscular coordination was developed.

When should we start? One of us, Dr. Allen, is working on an idea for a measuremental device that will help determine just how much skill in kinesthetic sense may be developed. This certainly is a much needed apparatus for it is significant that many of those who rate the highest in book learning show the least adaptability in developing a mechanical skill.

It has been said that the world's's first lazy man invented the wheelbarrow. Even if there is not a lazy person in this room, it is worth time and thought to consider methods of technic that save energy for the operator.[10] There is much to be said here, for the more skillful technicians seem to "do it so easily." If we make a game of it, and learn just how to do it easily, we will find that we have developed greater skill.

It used to be said that technic was acquired by imitation. Those who had a natural aptitude picked it up very easily, while those lacking it never were able to master even the rudiments of skill in technic, and therefore, perhaps, failed in practice. It is well known in athletics that star performers are not "born."

* Delivered by Dr. Stinson before the annual convention of the Middle Atlantic States Osteopathic Association, Washington, D.C., October 4, 1940.

It is true that we all have some natural abilities, but the world's championship performers, in all events, have been individuals who worked hard and long to develop their skills by acquiring correct form.

Speaking of form, how about golf? Remember the countless volumes that are written about golf "form" -the stance, correct grip, trial swing, follow through, etc.? If we follow this line of thought and apply it to manipulative technic, it is easy to see that even in the absence of a certain knack, a skillful technic may be acquired by careful analysis, separation of all component parts, constant study, and repeated practice. In fact, when it comes to working out an entirely new problem in the mechanics of manipulation such a slow hard-working technician, who had to struggle for his skill, will go much further than the one depending on a natural aptitude and imitation. And we are facing new problems almost daily.

We think that technic now has been better analyzed, and therefore can be better taught than formerly. For one thing we know more of the applied anatomy, particularly of supporting structures,"" and of the mechanics of joint movement. Especially is this true of the spine.

In my files are over forty articles, published in various osteopathic publications, on these important subjects-most of them produced by faculty members in our colleges and by our distinctly osteopathically minded x-ray men. Not only spinal mechanics but also the physiology of the nervous system as it applies to body mechanics, and of all joints, have been studied much more exhaustively in our profession, especially during the last fifteen years, than in the M.D. profession. If you doubt this, compare our own literature with the rather extensive M.D. literature on the subject of manipulation. It is easy to get impatient with some of our profession who write articles and give a long nonosteopathic bibliography, ignoring our own literature or betraying an ignorance of its value.

This increased knowledge has aided in visualizing the problems and consequently in solving them. We cannot ignore these advances, but we want to confine our attention to those factors which have most to do with the physical equipment of the operator.

Now as to our findings: First of all, what is movement? In physics a simple movement is said to be caused by a force acting on a mass. Is a manipulation a simple movement? No, for while we apply force to a mass (or a resistance) to cause movement, it must be a controlled movement carefully limited as to direction, distance, and speed. Again, in a simple movement, the mass remains the same, while in manipulation the resistance is a constant variable. Therefore, *force, speed,* and *distance* must vary.

What does this require of the operator? If we go back to our golf stance, grip, trial swing, stroke, and follow through, we can pick the following requirements of good manipulation: a firm base of support, perfectly centered weight, correct leverage and correct anchorage, exactness of timing, minutely coordinated smooth flowing muscular action, and the mental and nervous direction of the whole process or series of processes. It requires an adequate organization from a mental, a nervous and a muscular standpoint.

Mentally there must be a confidence, for a lack of it may be transmitted to the patient and complicate proceedings considerably. Confidence comes in part from understanding just what there is to do and how to do it.

Nervously there must be perfect coordination of muscles under control of the will, already prepared by the mental predetermination of exact movements. Also, nervously, we derive considerable help from our sense of touch, both light touch and deep pressure, and from the proprioceptive impulse which enables us to gauge the amount of force necessary for accomplishment. Perhaps this is another reason for our trial swing or preliminary thrust.

Now, muscularly, we cannot hope for easy, flowing motion, nor speed of action, if we are tense. We must be in a state of readiness, of poised flexibility and resilience, in that state aptly described by one of us, Dr. Allen, as "dynamic relaxation." The best example of this is the crouch of the cat family, as they are about to spring. It is more than relaxation, for this may be loose and flabby: and it certainly is not stiff and tense. This state of dynamic relaxation is used in many positions and in almost all forms of athletics, as for example, the crouch start of the sprinters.

If time permitted, we might analyze this much further, for there are some interesting sidelights on this important subject, since we must constantly seek relaxation in our patients.

Granted that we have an awareness of just this state of readiness to perform, which we have designated as "dynamic relaxation," we shall pass on to consideration of how we are to execute it, now that we are ready. There is axiom in physical education to the effect that "the body tends at rest to assume the posture it held during activity." This directs our attention to stance, and to a brief consideration of body mechanics. We know that there arc two main groups of muscles, antagonists in actions-the flexors and the extensors. We know that the ones most involved in maintaining the upright position are the extensors and these muscles are constantly engaged in a battle against gravity. They are also subject to much abuse through overuse of the flexors. Hence, we will make progress in warding off "old-age stoop" if we give careful attention to posture, and avoid overuse of the flexors, thus planning definitely to shield the extensors.

Let us now consider some of the factors involved in attaining this coordinated state of dynamic relaxation. We shall discuss the following factors:

1. Leverage or anchorage
2. Muscular action
3. Follow-through
4. Curvilinear vs. rectilinear motion
5. Rhythm
6. The psychologic element

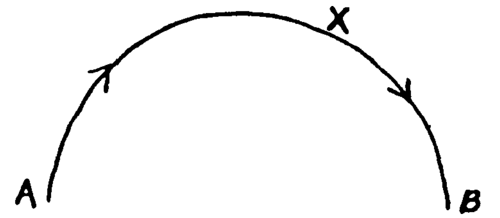
In discussing the first factor, we recall that the bones, joints, ligaments and muscles constitute a system of levers, some of which are levers of the third class, the fulcrum being at one end. We may use the term anchorage here, signifying the fixation of the fulcrum. To accomplish a given movement of the tips of the fingers through a given distance, we may move the fingers alone, using the knuckle joints as anchorage or fixed fulcra. Or we may keep the entire hand rigid and use the wrist as a fulcrum, or again the elbow, the shoulder, or the pelvis.

It is evident that a complete fixation of any single fulcrum is not what we want, but rather we seek the ability to begin a movement from the proper anchorage, and then, as it progresses, to bring smoothly into play subsidiary movement at any other fulcrum as indicated. Motion at any point may be increased or decreased or the member may be shifted en masse to give a new leverage at another joint. We learn, too, to determine from which anchorage a given movement should start, depending upon the force which it will require and the distance through which it must be carried. For instance: with the patient sitting astride the table, we wish to rotate his entire trunk forward and sidewise. We do not attempt to do this with the shoulders or even with the pelvis as our anchorage, but our whole body swings from the feet, bringing subsidiary fulcra into play as the movement progresses. This is an obvious example in which we rarely see our principle violated. Less apparent is the application of the principle to cervical technic. Here we have less weight and usually less resistance and hence less force requirement, and a movement through a shorter distance. Therefore, we fix our anchorage higher up, perhaps at the shoulder, the elbow or the wrist. Thus we use levers of a length better adapted to a shorter and finer movement. Yet how many times do we see some one attempt a cervical correction with wrist, elbow and shoulder relatively fixed, swinging his body from the hips into a too forcible and too little controlled thrust. Again in soft tissue work where the movement is a rhythmic swing, but calls for no fine adjust-ment of force, it is easier to swing the whole weight from the hips or feet thus making for energy, economy, and smoothness of swing. It is obvious that we can here lay down the general principle that the shorter the leverage the greater the control over the finer elements of the movement, and vice versa.

Our second factor is that of muscular action. We recall that there are extensors and flexors, and that these operate as balanced units. It is evident that if the forearm is being flexed, the extensors must relax at just the proper rate. If they relax too rapidly we have a loose, uncontrolled, jerky movement; while if they relax too slowly we have a stiff, uneven movement and one that involves unnecessary expenditure of energy. The development of muscle sense is requisite to proper control of this balanced action. We must learn to sense the action of our individual muscle groups, at first consciously, and later automatically, but with conscious control. Next we are concerned with the fact that muscles work to better advantage in the middle of their range of action. This seems fairly obvious so we will illustrate it simply by noting that the elbow flexors are at the height of their power and adaptability when the forearm is close to halfway between complete extension and complete flexion. Hence any technic in which the levers involved are working near the limits of their range can not be so smooth, powerful, or well-controlled as one in which those levers work near the middle of their range.

The third factor is the "follow-through.'' In a sense this is a part of the psychological approach but we shall deal with it separately. It is to a large degree theoretical, but as we describe it, the principle involved will be worth thinking about and analyzing. It is at least a useful working theory.

We begin, by recalling that in tennis or golf, every movement which is aimed at applying force at a given point



includes a follow-through. Let us analyze it, thus:
A tennis racket describes the arc AXB in striking a ball-starting at A, striking the ball at X and ending the stroke at B. It is obvious that the force of the racket increases progressively to X, the point of contact and the point of greatest force. When X is reached and contact with the ball made, the force begins to diminish to a relaxed state at B. The effective stroke, therefore, involves:

1. An even acceleration of force from A to X
2. Maximum force at X, the point of contact
3. An even diminution of force beginning at X and ending in relaxation at B or rather in dynamic relaxation at B, ready to swing into the next phase of the movement

It is possible to meet these three requirements by maintaining an intention to follow-through; that is, a determination to carry the force up to X and equal determination to relax gradually. Thus the muscles do not begin their preparation to relax until X is reached. Conversely, if the intention should be to stop at X, then they would begin to relax before X was reached and the point of maximum force would be previous to the point of contact, which is obviously undesirable. The result of this intention to carry through, constitutes accurate and effective timing and is a supreme requisite of true suppleness and resiliency as well as of effective use of muscular strength. It is this which enables a skilled boxer who has no more muscular strength than we have to hit us much harder than we can hit him; or a girl who plays tennis well, to serve a much harderball than can a much stronger man, who has not learned the follow-through.

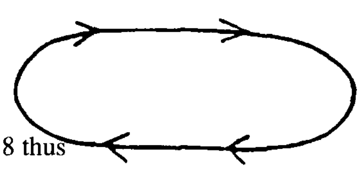
Let me quote a worker in another field: "It is the consistent maintenance of the intention to follow through, throughout the movement from its mental conception and nervous initiation to its physical culmination, which constitutes true freedom and suppleness in any act of touch."[5] Again, "the intention to get past the point of contact connotes very different physical conditions from these which aim only at the point of contact."

Practically, what do we accomplish by this ? First we apply the greatest force at the point of thrust where it is most effective, and not dissipated against the flexible resistance of impending muscles and ligaments. Second, we begin to relax at the point of contact, and accomplish complete dynamic relaxation before we reach the end, rather than carrying the force beyond the contact point, bringing up with a painful thud against the ligaments of the joints involved.

Quoting again: "All action, once the point of contact has been achieved, passes through that point, in the direction of (though not entirely achieving) *complete relaxation,* and this condition can be achieved properly only when this departure from the point of contact has beenpredetermined in the original initiating impulse."

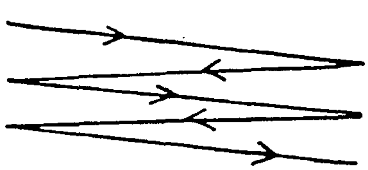
In order that it shall be predetermined, there should be a preparatory "trial correction," so to speak, in which the articulation and the quality and quantity of its mobility are carefully sensed; a mental picture obtained of the degree of force probably necessary, of the direction of application, and of the location of the point of thrust in the arc of the movement; then with this mental picture vividly in mind, a smooth return swing is carried through to the starting point from which, without interruption and with a curviform swing, the actual corrective movement is initiated-always with the intention to follow through. Sometimes it is necessary to carry through this trial swing repeatedly, in order to sense the situation completely and also in order to obtain complete voluntary relaxation of the patient before making the correction. If one cultivates such inward physical sensitiveness, he often will detect in this preliminary "trial correction" a state of tension which he estimates will require too much force to overcome. When he does so he either proceeds to relax the tissues, or, if that be impossible, waits for another day to attempt complete correction; for in such a situation the attempt to make the correction is not only useless but also meddlesome because it is inexcusably traumatizing. Here it might well be noted that in the case of many corrections it is possible to make the corrective thrust a part of a rhythmic articulatory movement which does not end at the completion of the thrust but which reverts to the former rhythm, the correction being simply a marked acceleration of speed and force in an otherwise smoothly rhythmic series of similar repeated movements.

Our fourth factor concerns curvilinear motion vs. rectilinear motion. We have mentioned already that an abrupt or angular change in direction necessitates the expenditure of more energy than does a curviform shift. Clearly, an angular shift connotes unevenness of motion in contradistinction to fluidity of movement in the curvilinear type. In a series of similar movements, as for instance in soft tissue relaxation, we should shift from a forward or effective movement to the return movement and vice versa in an elliptical path, thus



or in a figure 8 thus

rather than in an angular path:



In so doing we have conserved our own energy and accomplished a smooth, fluid manipulation. There are few, if any, manipulations to which this principle should not be applied.

The fifth factor concerns the principle of rhythm, this applies especially to a series of similar movements such as occur in working to relax soft tissues. It is concerned with, first, the rate at which each movement succeeds the last-a consideration often neglected. Many times, especially if we are in a hurry or if we are nervous, we attack a patient at much too rapid a tempo. Proper ease of relaxation requires an even rhythm at a comparatively slow tempo. Too rapid a tempo initiates muscle spasm in the first place. In the second place, tense muscles, or the muscles and interstitial tissues in acute myositis, are edematous; and too quick a tempo does not give the requisite time for the movement of fluids from the edematous tissues. On the other hand, when stimulation is required, as of the upper thoracic, a staccato movement at quick tempo is necessary. A manipulation at a given rhythm ordinarily should be maintained steadily but for a comparatively short time. Several procedures may be used to accomplish the same thing and they should be varied, none being used for too long a time. If the rhythm be shifted every other movement or so, the patient cannot relax, but if a steady rhythm be kept up too long he becomes restive. One must he alert to change as indicated.

The second consideration in rhythm is the relative time value of the effective phase of a movement as compared with the return phase. Experience shows that ordinarily the forward or working phase of the movement should take about twice as long as the return, because it must slowly move against resistance; whereas the return has little or no resistance. The return, however, should not be too quick, else the patient feels that he has lost his support and must tense his muscles to support himself. We find, then, to borrow musical phraseology, that a movement is best executed in approximately three-fourths time, rather than two-fourths, giving the forward motion two counts and the return one, thus: forward on one, two and back on three; rather than forward on one and back on two; or forward on one, two, and back on three, four. This point will be visualized more vividly if one contrasts the smooth, fluid motion of a waltz, with the sharp emphatic motion of a two-step or of a march.

Sixth, finally, there is the psychologic factor. We have seen that it really goes back to the mental adequacy of the technician's organism. In other words, its foundation is a thorough understanding of pathology and physiology and particularly of the sensations which the various pathologic states convey to the palpating fingers. We have seen, too, this factor evidenced in the almost instinctive shifting of leverages, in the sensing of the balanced action of muscles and in the intention to follow through. A carefully studied preliminary "trial correction" gives a mental certainty that, having formulated his conception of the correction, the operator knows that he will secure the effect he desires, and this makes for sureness, precision, and smoothness of technic.

The accomplishment of these various factors of skill also rightfully belongs to the psychologic field. In order to attain dynamic relaxation, the mind must be able to analyze a manipulative movement, as we have tried to do, breaking it up into its component phases and studying each singly. More than that, it means practicing each action in turn until it is perfected, and becomes almost an automatism, but yet under control; and then combining them all into a more perfect whole. With the student just beginning this is simple. With those of us who already have relegated the elements of these movements to the level of automatism, it involves the bringing of them back to conscious control; there to examine them, to practice them introspectively under control, and to perfect them, and rehearse their coordination, before permitting them to revert to the reflex and subconscious level. Even at that they should be hauled up for re-examination every now and then. And this, of course, in a matter of constant mental application, in the work of every day.

What has been gained if all these principles are effectively applied ?

First, what has the patient gained? An opportunity to relax, for one thing, and therefore a much more comfortable and effective treatment. He does not feel that corrections are forced, or that they are carried too far, to be brought up with a painful jerk in the other direction, or that the return movement is so relaxed that he must tense in order to keep from being dropped. Neither is he at any time held in a vise, against which he feels that he must struggle; for the operator brings his stresses into play flexibly. Did you ever notice the fear displayed by an animal when snubbed up short with an inflexible tierope; and its consequent struggles ? That is about the way the patient feels when the operator's muscles are stiff and tense and not dynamically relaxed. There will beless tendency to tenderness after treatment because there is no unnecessary trauma, and for that reason and many others, treat-ment will be more effective. Because of all these considerations the patient will have that satisfactory feeling that he has been in the hands of a physician who is a skillful artisan.

On the other hand, what has the physician gained? We hope he will have acquired greater skill and precision. We hope, too, that he has learned to analyze his own technic so that he will be growing constantly more skillful, not alone in those par-ticular manipulations for which he seemed to have a natural aptitude, but throughout the entire array of his manipulative procedures. We feel sure that the dual requirement before mentioned will be met. His palpating fingers will be more keenly appreciative of tissue changes, because they palpate lightly but firmly, with resilience and not with tension and stiffness. His muscle coordination will permit precise, accurate, definite, even, and polished manipulation, economical both as to motion and as to energy, satisfaction and interest derived from sense of skilled artisanship.

SUMMARY

1. Skill in technic depends upon correct form. Acquisition of form is the basis for learning and for teaching technic.

2. In analyzing the factors involved in skillful technic we find that a manipulation is a movement, which consists of a force acting against a resistance, in a certain direction, through a given distance, and at a given speed.

3. Since the resistance constantly varies, all the other factors must be capable of infinite gradation.

4. These gradations or nuances of force and of its speed, direction and distance, can be made smoothly by the use of dynamic relaxation.

5. Dynamic relaxation depends upon the proper and automatic use of leverage, anchorage, muscular activity, the "follow-through," curviform motion, and rhythm. All these are made effectively useful through efficient psychologic coordination.

6. These various component elements must be analyzed consciously, isolated and rehearsed introspectively and when perfected, relegated to the subconscious again, a process which deserves frequent repetition, and which can be done all in the day's work.

7. The effective use of these principles makes for relaxation in both patient and operator, a more gratifying and effective result for the patient, economy of energy, added interest and a longer life for the physician.

Finally, let us borrow again from Dalcroze:[13] "Durable work is not created out of mere intuition: it demands a complete mastery of the art of technic." And again: "The most profound thought may be distorted by deficiencies in the vehicle of its externalization. That is why one should never obsess himself with any particular method, but should be constantly experimenting with those which have not come instinctively to him." Our effort in this discussion has been toward the elimination of technical deficiencies in the externalization of osteopathic philosophy to the end that its application in everyday practice may become effective.

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RECAPITULATION

(Following the presentation of Part I of this paper, which was published in the March** Journal, **the meeting was thrown open to discussion. Many points were brought up seemingly with the idea of bridging the gap between the so-called 'old timers" and the younger graduates, so that both could be doing something toward a better osteopathic technic. Dr. Stinson condensed these remarks and ideas that were expressed and presents them in the following paragraphs.---Editor)

1. Concerning the so-called "old timers" and their claims:

Without a doubt, much of the history of the earlier osteopathic practitioners and especially of Dr. Still, has become legendary. This may give rise to some exaggerations and some lack of exact detail, and particularly of the painful part of the story. However, many of us have witnessed some of the near miraculous things that happened. It is puzzling to know how much to expect in the present day and age.

SILHOUETTES ILLUSTRATING SOME OF THE PRINCIPLES OF CORRECT USE OF THE OPERATOR'S BODY IN OSTEOPATHIC TECHNIC

In an effort to afford practical application of ideas expressed in the foregoing article, the following illustrations are offered. Considering certain important requirements of good manipulation-a firm base of support, perfectly centered weight, correct leverage, correct anchorage, minutely coordinated, smooth flowing, muscular action--the illustrations are intended to portray the principles of correct use of the operator's body. Drawn in slight exaggeration in order to be more easily understood, they picture fundamentals adapted to *osteopathic* manipulation, but do *not* illustrate specific technics.

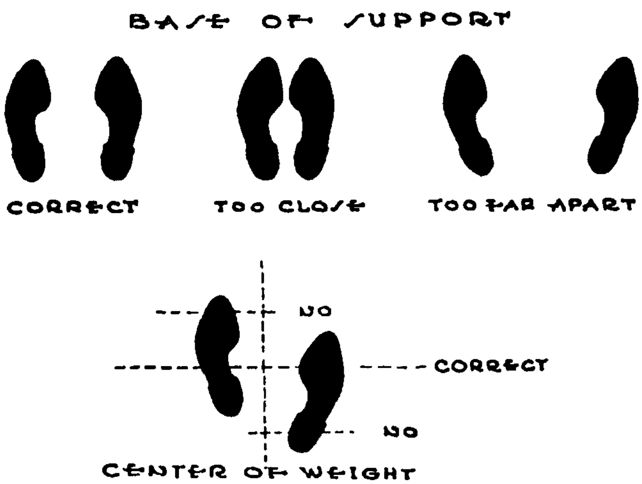


Fig. 1 .--The base of support of the body is, roughly, an area bounded laterally by the outer margins of the feet, anteriorly by a line connecting the toes, posteriorly by a line connecting the heels. (Remember that the lateral unit of the foot is the part used for stability, balance, standing posture.)

Feet placed from six to ten inches apart (varying according to the size of the individual) afford greater stability and require less energy than when placed close together. (Notice how hard it is to stand with heels and toes together for any length of time.)

Check you usual posture while working over a treatment table to see if you are using the right base of support. The difference of an inch or two between you feet may mean less fatigue.

The center of weight (and of mass) in most individuals is near the pelvis, at or just below the second lumbar vertebra. Therefore, the best position is that which maintains this center directly above the middle of the base of support.

Weight supported forward, backward or to either side is not correct. The illustration shows correctly placed feet; incorrect when one foot is forward or back.

Illustrations by Dale Boarman. Sr. Petersburg. FL.

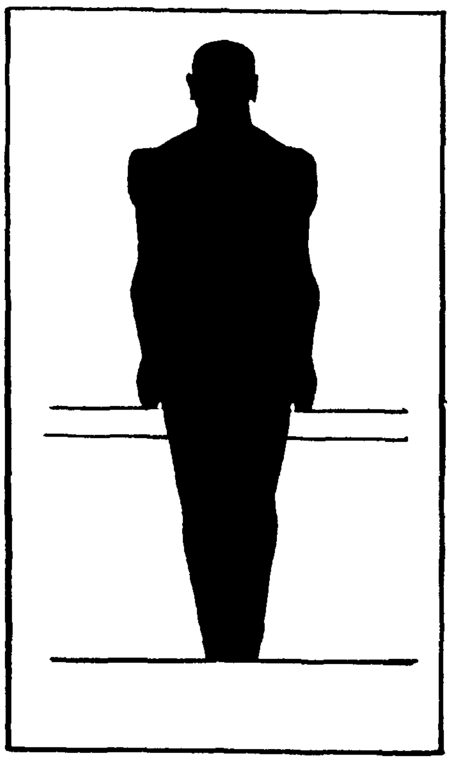


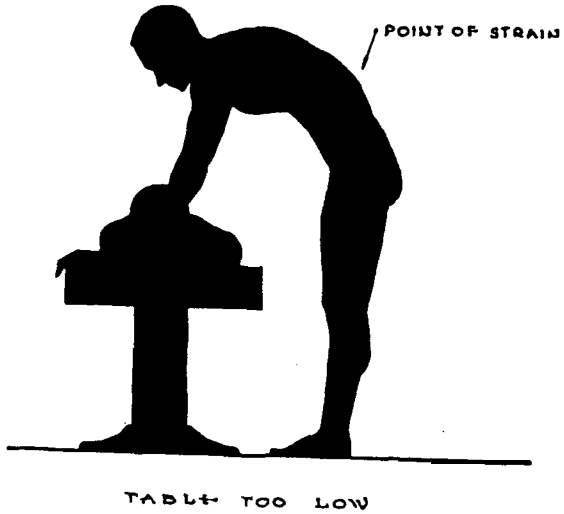
Fig. 3

Fig 2.--Height of Table: Repeated tests, experience, and much conference among the members of the technic group of the Chicago College of Osteopathy led to the suggestion that the correct height for a treatment table is that which enables the operator, standing in easy posture, just to touch the table top with his fingertips.

When the table is too high, a strain is thrown on the upper thoracic region (See Fig. 3), because there is little chance to use the body weight of the operator, all the work being placed on the shoulder girdle and arms.

Conversely, bending over a table that is too low places the lumbar region on a strain (See Fig. 4).

Obviously, no table height is right for all technics, for example, those with patient sitting would not call for the same as those used with patient



reclining. Again, there is a variance for different sized patients.

Many technicians have found that the hydraulic base table, easily raised or lowered a few inches, affords a great saving of the body strength and energy. One way to acquire such a table without great expense is to buy an old barber chair base, then have a table top made and bolted onto the frame which held the chair.

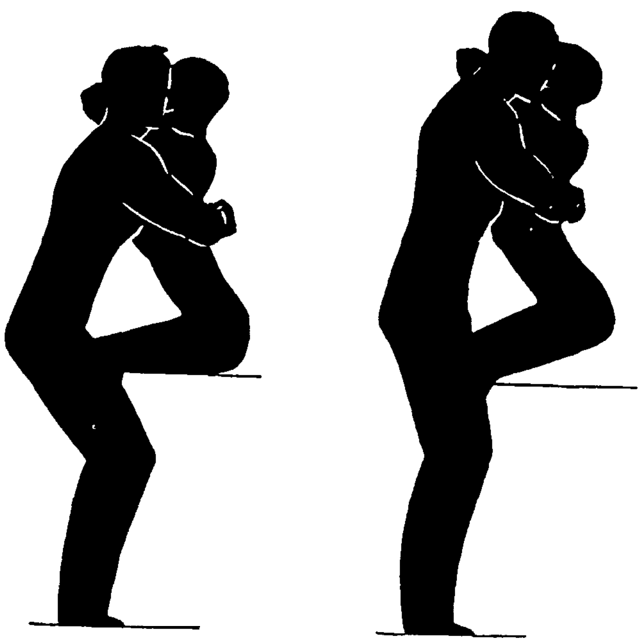


Fig. 5--The advantage of utilizing the most powerful muscles in the body, those in the thighs, and thus saving the operator's spinal muscles, is often overlooked. Weight lifters learn to make the heavy thigh muscles do most of the work by bending the knees and keeping the spine erect. Note the bent knees of the operator on the left and the "lift" of the patient in the illustration on the right, also the straightening of the operator's knees.

We should learn to make "thrusts" from the floor. Boxers are said to "hit from the floor" by straightening the arm (elbow, wrist and shoulder) and then the knees. On defense, many boxers watch their opponents feet for a weight shift.

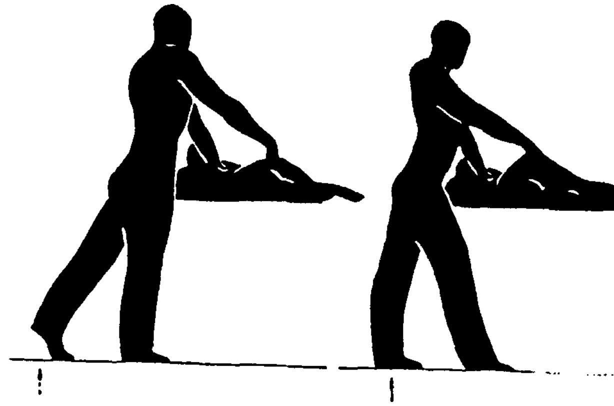


Fig. 6.--Illustrating further the use of the weight shift. On the left the operator has his body weight on the forward foot, arm straight. On the right the operator has shifted to the rear foot, affording a powerful pull on the patient, with but little pull on the operator's shoulder girdle.

There are several adaptations of this weight shift which are almost impossible to picture. One example is the use of a "straight arm" thrust against the prone patient, the operator dropping his weight through the arm as he thrusts. This is probably what takes place in the so-called "scissors" sacroiliac technic.

Fig. 7.--These two silhouettes are intended to illustrate another weight-shift effect. The picture on the left shows the hard work involved when the operator stands a short distance from his patient and attempts to manipulate him. Practically all of the operator's body is on strain.

The picture on the right shows the effect of holding the patient tight against the operator's body (feet slightly apart) and then shifting weight to the adjacent hip, thus moving the patient with very little effort. This is a movement adapted from the athlete's "throwing the hip"--a much used defense movement in personal contact games.

On the next page (Fig.8) is another example of weight-shift thrust. On the left are shown operator's feet slightly apart, elbow resting against crest of ilium, and hand on patient's spine.

On the right the operator's weight has shifted to the right hip while an almost effortless but powerful thrust is applied by the straight arm to the patient's spine. This picture had to be drawn in exaggeration and does not show the control of the patient by use of the left arm. There are many adaptations of this idea, which are surprisingly easy on the patient as well as on the operator.

One of the most difficult things to teach the beginning technician is how to hold a joint in the correct position for the application of a corrective technic, "take out all the slack," and then apply additional

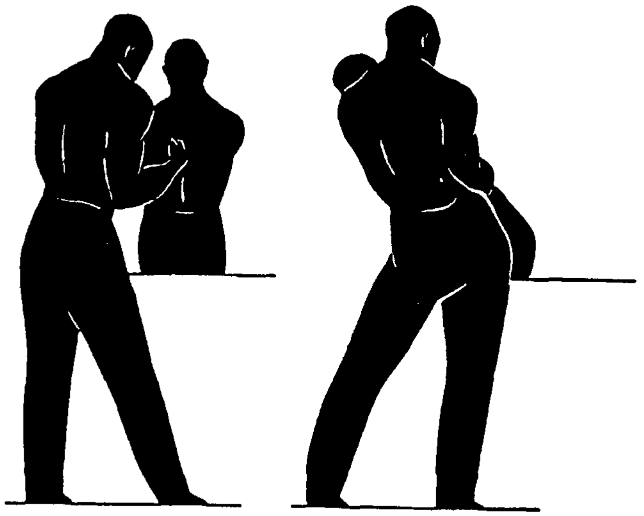


Fig. 8

force, without loosening his first firm grip. The effort of this loosening is to destroy the specific application of force, many time resulting in a failure of adjustment, and always disseminating force through to, and around, other regions, needlessly traumatizing adjacent soft tissues.

Athletes call this "taking a run and jump at it" types of movement, which aptly describes the difference between an easy specific correction and one that "pops everything from the sacrum to the occiput."

Here is a practice tip: Grasp any soft object, such as a sponge rubber ball, squeeze it slightly then compress it completely without relaxing the muscles used in the original squeeze. This requires adequate control of muscles by the mental and nervous processes. These simple movements should be analyzed, isolated and rehearsed introspectively, and when perfected, relegated to the subconscious. In other words, an easy smooth-flowing technic should become second nature.

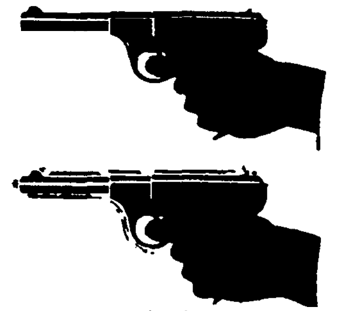


Fig. 9

Examples from other fields include the aviator's stem necessity for feeding gas slowly and steadily into a motor to afford quick acceleration with the danger of "stalling" it. Another example is the locomotive engineer who can start a heavy train by the application of the right amount of steam without "jerking" it.

Perhaps the easiest to illustrate is the effect of a slow, steady "squeeze" of the trigger necessary for accurate use of firearms, in contrast to the jerky "pull" which deflects all aim (Fig. 9).

RECAPITULATION

Those of us who graduated within the last score of years and are struggling along trying to do our bit will soon reach the stage of being "old timers." How much better are we?

We can take cheer from some of the facts. The "old timers" faced an entirely different situation from that which we do. Their competition was largely from old-school physicians who relied upon a laxative, a sedative and bed rest to do the work. These M.D.'s were described characteristically as "C.C. pill and iodine" doctors. Aspirin was an important discovery for them.

Contrast them with the modem M.D.'s who use a variety of drugs, some manipulation, intramuscular injection of procaine, short-wave diathermy, corrective diet, vitamin feeding--in all a much better rationale then the M.D's of an earlier day used for the type of ailments that were handled so spectacularly by the "old time" D.O.'s. The older M.D.'s knew little, and cared less, for the many functional disorders that bother mankind.

2. Concerning the three-ring circus of uninhibited "old timers" which is seen at national convention:

When it is realized that technic cannot be taught in a short time and to large groups, perhaps this type of meeting will be changed. The answer is better state and sectional programs. Postgraduate courses in the colleges are designed for this purpose. All of us need brushing up periodically by such "refresher" courses.

Some very real progress has been made in teaching spinal mechanics, with more understanding than in the past of the structural pathology that underlies the lesion. With a more exact knowledge of technic, the recent graduate does not have to do more than see a technic to understand it, analyze its usefulness, and then adopt or reject it accordingly.

It is true that we see too many case histories giving in detail all the laboratory and x-ray findings and omitting all reference to spinal joint lesions. It must be realized that we can have the benefit of every laboratory facility available to the M.D. profession and can add to that our examination for spinal conditions. It is this latter big factor that gives us an edge on our competitors, and the younger doctors must learn to use this one distinctive advantage. Spinal examination and diagnosis constitute the key to treatment. Unless he possesses and uses this, the young osteopathic physician is "just another doctor."

3. Concerning type of treatment--short vs. long, specific vs. general, or combinations of these:

It is extremely doubtful if there ever will be entire agreement on the best type of treatment. The fact that the various types are being discussed is hopeful. One thing that must be remembered is that all pathological conditions, although subject to general classifications, differ in some essential detail, such as the age of the patient, sex, duration of the lesion, etc. On the whole, there seems to be a tendency to separate the types of treatment to fit classes of cases. What kind of osteopathic treatment? How much? How often? and Why? Study of the four articles in the series, "Thoughts on the Autonomic Nervous System," by Dr. Leonard V. Strong, Jr., and published in THE JOURNAL OF THE AMERICAN OSTEOPATHIC ASSOCIATION (Aug., Sept., Oct., Nov., 1940) should stimulate the development of an osteopathic therapy which is both scientific and specific.

The old saying "an osteopathic treatment," the same kind and amount for smallpox and for baldness, no longer applies today. The folks who give such "a treatment," and "sell" it as they would market a package of cigarettes over the counter are not doing so well today! (In general, D.O.'s addicted to such practices were not those who consistently had good results.--Editor)

4. Concerning aptitude for osteopathic technic, and its lack:

Part II of the article, published in this issue, deals with aptitude.

5. Concerning the lack *of* a common descriptive language adequate to convey ideas:

Perhaps the paper on "The Development of Palpation," published in the January and February JOURNALS, served to definitize some ideas. Maybe all of us are guilty of using inexact terms. But the uniform osteopathic nomenclature 1 adopted as "standard" can and must be used. It can be improved if there is need that it be. The "old timers" may have to study a little, and the youngsters try a little harder to understand.

The history cards used in the college clinics, in the New York Osteopathic Clinic and in other clinics call for plus and minus signs adjacent to "tension, tenderness and mobility," affording a numerical rating up to 3 or 4 for rotation, lateroflexion, extension, and other types of lesion. While this method may not be entirely adequate, it is a quick and easy way of recording lesions. Sooner or later we will accumulate thousands of case histories from which many valuable studies can be made.

Finally it is agreed that much of the experience, the skill, and the knowledge of the "old timers" is badly needed. There is much to be said for a study of this, as a sort of apprenticeship in osteopathy. Perhaps the Osteopathic Manipulative Therapeutics Section can fit in and help bridge the gap.

About all that is needed to silence the criticism of skeptics would be substantiating laboratory findings. Dr. E. G. Hombeck of Rocky Mount, N. C., for some 18 years has checked osteopathic spinal findings with the work of a trained laboratory technician. He can furnish a long list of cases, checked with x-ray and other findings. For instance, he can say to a patient who has 35 per cent kidney function that osteopathic manipulative treatment will increase this to 50 per cent in a month, and in most cases to 65 to 75 per cent in six weeks. Analyses of stomach secretions checked over a long period lead him to the conclusion that 7 out of 10 so-called "dyspeptics" are suffering from hypoacidity. Again he assures his patient that this can be corrected in about six weeks by osteopathic manipulative treatment and proves it by subsequent laboratory tests.

He has a long record of blood sugar determinations in relation to diabetes and to treatment with and without insulin. He has another long record of blood analyses for the anemias. He uses a Rehfuss tube to prove to himself, as well as to the patient, that he actually has drained a gall-bladder manually.

Dr. Perrin T. Wilson has prepared slides of the charts showing blood counts, temperature, respiratio and pulse rate, made daily of patients suffering with various types ofpneumonia.

It would seem that there can be little question raised of substantiation for presentations of this kind.

There are osteopathic ways of raising and lowering body temperature and blood pressure, for increasing or decreasing respiration and pulse rate, for changing the amount and chemical constituents of the urine, for increasing or decreasing the number of white blood cells, and for raising the red cell content-all subject to proof by accepted laboratory procedures. There is no reason why enough of us cannot do this to substantiate any claims we want to make. No one needs to appear on any program without them unless he so chooses. And for the doubter, the same checking is his privilege. Anyone who desires can do so, if only he will apply himself, and stay in one place long enough to observe results.

It will require more work to prepare papers, but it can be done. Maybe all of us can help preserve all of the "old timers' " work, and blend it with the new things that we are learning constantly.

Dr. Ralph W. Rice has been working for years to secure motion pictures of technic. While the criticism has been made that there are too many ideas portrayed on one film, this can be overcome by re-running the film several times until we see and understand it. This procedure was adopted by our St. Petersburg society, and we have used every technic film available.

It is to be hoped that Dr. Rice's work will succeed in getting motion pictures of many of the "old timers' "technic. What a wonderful thing it would be if we had motion pictures of the Old Doctor's work.

There is, and has been, much research going on in our colleges. This work needs support. Some of us have advocated increased national dues for this purpose. It may be years before some of the benefits of this work will be apparent. The bare fact that it is going on is hopeful.

It is probable that we have just scratched the surface of the infinite possibilities of osteopathic therapy. The future will show much advancement. There is at present no greater breach between young and old osteopathic physicians than between youth and old age in any profession or vocation. There is no reason why the Osteopathic Manipulative Therapeutics and other sections cannot solve most of the problems of today. We all want the same thing-a better osteopathy. We repeat: "What will be your contribution?"

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1. Halladay, H. V.: The New Nomenclature. Jour. Am. Osteop. Assn., 1936 (Jan.) 35:238-243.

A Psychomotor skill is a physical skill, it involves the use of sense organs and and muscles in the execution of a smooth, precise, well-timed performance. The skill is organized to relate to the space around the individual, and the skill is timed so that each muscle's performance comes into play at a certain moment. Examples: writing, drawing, operating machinery or laboratory equipment, swimming, sewing, driving.

Simplified Model in Teaching Psychomotor Skills

I. INTRODUCTORY PHASE

A	prepare student for learning the skill
B	provide information about the skill
C	require analysis of the skill

⇨

II. PRACTICE PHASE

A	require practice of the skill
B	observe student practice and prompt when needed
C	provide feedback when needed

⇨

III. PERFECTING PHASE

A	require precision performance
B	observe and prompt on details
C	provide feedback on fine points

Teaching Complex Psychomotor Skills

Psychomotor skills teaching and learning is an integral part of the curriculum of a college of osteopathic medicine. It is critical that those skills and their associated principles which are unique to the practice of osteopathic medicine be taught effectively in the early phases of an osteopathic curriculum. The acquisition of these skills requires time and practice. It is important that students be motivated to incorporate these procedures into the health care of their own patients once they are in practice.

Psychomotor skills teaching can be discussed in three phases as illustrated in the accompanying diagram: an introductory phase, a practice phase, and a perfecting phase.

I Introductory Phase

A. Preparing the student for learning the skill

1. State the objective. What is the whole skill?
2. Check the student's prerequisite knowledge and skills. If they are not adequate, remediation may be necessary. Anatomical knowledge may be essential for the procedure. Basic tactile and proprioceptive skills are of critical importance.

B. Providing information about the skill

1. Define the principle of the technic. Tell the student what to attend to in the demonstration of the skill.
2. Note that the application of the procedure may vary from physician to physician based upon the physician's body type. That is why learning the principle of the procedure is important. The principle is the objective of the procedure or what you wish to accomplish.
3. Factors to be considered: proper positioning of physician and patient. foot position, the base of support, is the patient able to relax? height of the table, the optimum height to reduce fatigue, ascertaining tissue resistance, taking out the slack, localization of forces, smooth controlled application of force
4. Advanced organizers are helpful- A task description of the procedure.
5. Demonstrate the whole skill
    a. describe the skill
    b. describe what to look at, what to look for, and what to do.
    c. attend to difficult parts of the procedure
    d. show possible errors
    e. keep the demonstration short and include only essential detail
    f. describe what to look for to check results, and what to do to remediate

C. Require analysis of the skill

1. Require the student to analyze the skill in words.
2. The student should develop a mental template by analyzing the skill or describing it to a fellow student. This reinforces memory of the details of the procedure. This is a significant part of skills learning.

II Practice Phase

A. Require practice of the skill

1. The student should practice the total unsimplified skill.
2. He should concentrate on how it feels.
3. The student should be told the quality of the performance that the instructor is looking for.
4. Provide mass practice, a number of trials in a row, watch for fatigue.

B. Observe the student practice the skill and give prompts when needed.

1. Watch for the general form of the procedure.
2. Watch for gross errors.
3. Provide verbal or physical cues where appropriate.
    a. the instructor may place his hands over the students to guide him
    b. verbal prompts may be helpful
    c. do not demand fine accuracy

C. Provide feedback on the student's performance
1. Provide feedback on student's knowledge of the performance and results.
2. Give immediate feedback, what was right, wrong, and what should have been done.

III Perfecting Phase

A. Require precision performance
1. Observe details, work on fine points, fluency, timing
2. Require practice beyond an adequate level
3. Add stress - such as requiring the use of the procedure in a clinical situation
4. Encourage the use of mental practice, visualizing or describing the procedure. It can be helpful if a practice situation is unavailable
5. Encourage practice of the procedure outside of class.

B. Observe and prompt on detail
1. Look for fine details.
2. Encourage fluency and attention to timing
3. Give minimal cues as appropriate.

C. Provide feedback on fine points.
1. What was right and what was wrong.

Precepts & practice

Practical examinations in osteopathic skills

Myron C. Beal, DO and Sarah A. Spraflka, PhD

Abstract. Practical examinations are used to evaluate student achievement in the acquisition of osteopathic diagnostic and manipulative skills. The subjective judgment of the examiner and his interpretation of the criteria of performance form the basis for grading the student. A study was undertaken to ensure uniform evaluation of student performance in the practical examination.

The direct observation of behavior has long been a method for assessing the quality and performance of psychomotor skills. This approach to evaluation involves the establishment of a set of criteria for performance, the observation of an individual's or group's performance, and the comparison of the observed performance with the criteria. The comparison usually results in a judgment such as a rating or a grade. This type of evaluation is fraught with a number of difficulties, a major one of which is the influence that subjectivity has on the observer's judgment. Subjectivity can enter in at the point of criterion establishment as well as at the point of rendering a judgment. When it affects criterion establishment, the consequence may be that each individual judge or observer uses a different (subjective) criterion as a basis of judgment, rather than a uniform criterion. Similarly, when subjectivity has its effect at the point of rendering judgment, the consequence may be that each observer reaches a different conclusion when comparing an individual's performance to the criterion. At MSU-COM, these issues of subjectivity have recently been observed and studied in an attempt to find some solutions to differences in judgments which are influenced by subjectivity.

Our attention has been directed to the practical examinations which are used to evaluate student achievement in the acquisition of osteopathic diagnostic andmanipulative skills throughout a seven course sequence conducted during the first two years of our curriculum. The seven course sequence progresses from relatively simplistic skills for osteopathic diagnosis and manipulative treatment, to more complex and sophisticated procedures, culminating in the integration of these skills within the context of examining and treating a patient. Instruction in each course in the sequence usually is designed to take place partly in a large group lecture format and partly in a small group laboratory/practical format. The laboratory groups are taught by instructors who range in background from second year medical students (who teach first year students) to practicing physicians with many years of experience. Each instructor usually teaches once or twice a week. Attempts have been made to permit new instructors (particularly clinicians) to teach in one of the early courses and then progress through the sequence each term. This would enable them to become acquainted with the structure of the course sequence, and the progressing level of skill expected of students. Since laboratory instructors usually serve as practical examiners as well, it is very important that they be aware of the level of skills expected of a student at any stage in the seven course sequence.

In each course in the sequence, student performance is assessed by at least one practical examination. In the initial courses, students take both a mid-quarter examination given by their own laboratory instructor, and a final examination given by a laboratory instructor other than their own. In the more advanced courses, students take one final practical examination given by someone other than their own instructor. At the conclusion of each examination, the student receives a grade of P (pass) or N (no grade).

Before closer scrutiny of the examination process was undertaken, both students and faculty/examiners were prepared for the examination in a general manner. Students were given instructions which included details regarding the time and place of the examination, setting, dress, examination format, grading (including the minimum needed to pass), and general areas to be evaluated. They were informed that they would be scored on a point scale of 1 to 100 and were given general guidelines on which areas of the examination would be weighted more or less heavily. Examiners were given guidelines on what specific areas of skill were to be covered by the examination; how each area of performance (e.g. knowledge of procedure, skill of performance, and handling of patient) was to be weighed; and how scores were to be obtained (including the minimum score needed to pass).

Use of these general guidelines by students and examiners revealed some concerns regarding student performance as well as examiner performance. With regard to student performance, it was noted that:

1. Students lacked knowledge of the procedures they were expected to perform, as well as knowledge of what level of performance was expected of them.
2. Students had difficulty following examiners' instructions at times..
3. Students, in the examiners' estimation, lacked ability to demonstrate skill in certain details associated with procedures, such as positioning of patient; localization of forces while treating; ability to complete a technique procedure; awareness of the need to evaluate the patient following treatment; and accuracy and reliability in identification of diagnostic findings.
4. Students, at times, lacked confidence in their skills, as demonstrated by slowness or uncertainty in their performance.
5. Students sometimes displayed

a negative attitude toward the examinations.

6. Students, at times, displayed a lack of professionalism in relating to patients.

With regard to the examiners, the following questions arose:

1. Were students being evaluated in the same manner by all examiners?

2. Were the same criteria being used by all examiners to judge performance ?

3. Were all examiners weighing the components of the examination similarly when judging student performance?

It was clear from these observations that one central area of concern was at the foundation of these questions and perceived student deficiencies: the problem of subjectivity. The reports of deficiencies in student performance strongly suggested that at least some examiners were expecting more of students than perhaps was realistic. The questions raised regarding the examiners suggested that, in fact, some examiners used different criteria for their judgments than others. A second area of concern that was revealed was that of information. It appeared that, on occasion, students and examiners had different information about what was expected, as well as what should be the criteria for judgment.

To alleviate these problems, an effort was launched to increase the amount and quality of information given to examiners and students about the conduct and expectations for practical examinations, and to decrease the influence that subjectivity has on the judgments made by examiners. To begin to address these goals, two workshops were designed aimed at clarifying examiners concerns and achieving more uniformity in the way examinations were conducted, as well as in how judgments were made about student performance. Videotapes were made of several practical examinations with the consent of both student and instructor. These taped segments were edited into a single tape which showed contrasting examples of examiner behavior such as giving instructions, observing student behavior, prompting, and giving feedback to the student. This edited tape then served as the stimulus for a mini-workshop where desirable and undesirable examiner behaviors were discussed in an open forum. The comments from participants in the mini-workshop were then compiled into a set of "Do's and Don't's for Examiners" which now serves as a guideline for the conduct of subsequent practical examinations. When the list of do's and don't's was completed, videotapes of three simulated examinations were prepared which showed examples of appropriate and inappropriate examiner behavior.

The second examiner workshop focuses on the do's and don't's. This workshop is held before every final practical examination. Examiners in attendance are asked to review the list of do's and don't's and ask any questions or make any comments they may have about them. They are then asked to apply the do's and don't's by viewing the videotape and discussing the appropriate and inappropriate examiner behaviors being exhibited in each simulated examination.

The first time this workshop was offered, participants were asked to give a grade to the student in each simulated exercise, and an attempt was made to get participants to agree on the grade. In almost all instances, agreement was reached on whether the student passed or failed, but the discrepancies in scores were high enough to suggest that similar discrepancies among examiners might exist in the real examination setting. This was the subject of a study discussed later in this paper. The grading exercise also stimulated a lengthy discussion of acceptable student performance and testing procedures. Disagreement was noted in the following areas:

1. The advisability of completing a detailed checklist of items for grading versus that of making a global judgment;

2. The meaning of "skill of performance," and the amount of skill to be expected from more or less advanced students;

3. The acceptability of the student deviating from the standard protocol for performing a technique procedure (some examiners accepted deviations from the standard as long as the desired outcome was achieved; others were highly critical of such deviations);

4. Reasons for giving or subtracting points for a student's performance (although there would often be agreement on whether the student passed or failed, the actual score given varied, the scores in the various examination categories differed, and points were given or subtracted for different reasons).

It was concluded from this discussion that clearer directions for examiners are needed, as well as clearer definitions of the criteria to be used in judging performance in the categories of handling the patient, knowledge of procedure, and skill of performance.

Following this first offering of the workshop, it was clear that subsequent workshops should focus on the do's and don't's for actual conduct of the examination, and a separate exercise was needed to address the issue of grading. It was agreed that development of an exercise focused on grading must await the development of clearer instructions for examiners and clearer criteria for judging student performance.

Since this fast workshop strongly suggested that different criteria were being applied by examiners and that students were not being evaluated similarly by all examiners, a study was designed to look more closely at these potential problems. The major goal of the study was to determine the amount of agreement among examiners. A secondary goal of the study was to assess whether examiners were applying the do's and don't's in their conduct of the examination.

To study inter-rater reliability of the practical examination, seven associate examiners were employed along with the regular faculty to grade a final practical examination. The associate examiners were faculty who had had some experience in teaching in the osteopathic sequence. A workshop was held to instruct the examiners and associate examiners in the procedures. The do's and don't's were reviewed and two television tapes of simulated examinations (the same used in the previously described workshop) were viewed and critiqued.

Faculty were paired with associate examiners in 35 of the 89 examinations. The associate examiner was asked to make his own independent evaluation of student performance, as well as to record the examiner's behavior in terms of the do's and don't's for examiners.

The associate examiners reported that the examiners carefully observed the do's and don't's during the examination, and in only a few instances omitted desirable behavior. In 7 of the 35 paired examinations, the examiner and associate examiner disagreed on the level of student performance. In six instances, the associate examiner gave a failing grade (score of 75 out of 100 being a passing grade). In six instances, the examiner's and associate examiner's scores were more than 10 points apart. In each case, there was disagreement between examiner and associate examineron whether the student passed or failed. In five of the six instances, the associate examiner gave the lower score.

The median scores for the various examiners demonstrated a uniform approach to judging the quality of student performance. No one examiner appeared to be stricter or more lenient than another. In general, the study showed that there tends to be a reasonably high level of agreement regarding the quality of student performance on practical examinations.

The results of both components of this study are encouraging. Despite suspicions that different criteria and different approaches were being used in evaluating students, the agreement among examiners seems to be quite high, although it could be improved. Furthermore, reports that the do's and don't's were generally followed by examiners were encouraging. It has not been determined whether the do's and don't's themselves are directly responsible for this outcome, or whether these ideas were being applied before the do's and don't's list was developed, and have continued.

Conclusions and discussion. We may draw a number of conclusions from the outcome of the examiner workshops, as well as from the reliability study. First, there is an obvious need for improved instructions for both students and examiners. Students should be given instructions at the beginning of the examination about the scoring of the examination, including whether one part is worth more credit than another. The faculty should have a clear understanding of what a student must do to pass the examination. Procedural details should be clarified for the examiners prior to the examination. They should know what are acceptable minor and major variations in procedures.

Secondly, there is a need to establish criteria of acceptable student performance for each course in the sequence. Since the teaching sequence progresses from relatively simple skills to the more complex integration of findings into the development and execution of a patient treatment plan, it is clear that different levels of skills should be expected of students at different stages in the course sequence. Examiners should be fully aware of the progression of skills taught in the course so that they will be able to know just what level of expertise to expect of a student at any level of the sequence.

Both faculty and the course organizers feel that the examiner workshops have been helpful in decreasing the influence of subjectivity on the conduct of the examination. More work is needed to decrease this influence as it affects criteria for grading students and specific reasons for awarding or subtracting points when judging student performance. Despite our efforts thus far, the examination process is still more subjective than is desirable. There will always be an element of subjectivity in any judgment made from the direct observation of performance. It is hoped that future efforts at examiner orientation, particularly with regard to grading, will help decrease the influence of this subjectivity, and ensure that students are examined and graded fairly in the practical examination.

Do's and don't's for examiners Do's for examiners:

1. Take a positive attitude toward the examination process, and convey to each examinee that you are interested and confident that he/she will do a good job.

2. Try to place the student at ease. One way to accomplish this is to take a neutral task-oriented approach, focusing the student's attention on the examination itself. This will help draw attention away from any feelings of apprehension the student may be experiencing.

3. A. Give clear instructions about what the student is to do and make sure he/she understands what is expected of him/her. This includes advising the student of the time limit on each segment of the examination.

B. If the student has any questions about the instructions, be sure to answer them at the outset. If for any reason you do not think the student understands the instructions, *ask him/her to relate them to* you. This is much more effective than, for example, asking "Are you sure you understand?"

4. (Optional) Ask the student to explain the principles behind any procedures you ask him/her to perform. This should be done (a) if it is an integral part of the examination question, and (b) as a justification for any modifications the student might want to make in a procedure you have asked him/her to perform

5. A. (Optional) Ask the student toverbally describe-"talk through" -a procedure as he/she is doing it.

B. Ask the student to describe any findings.

6. As the examination proceeds, be sure to watch the student's behavior carefully, moving about if necessary so you can see all aspects of the procedure. Observe the student's performance in the areas of: handling of the patient, knowledge and sequencing of diagnostic and treatment procedures, andvalidity of findings and results.

7. If necessary, prompt the student if he/she hesitates, if he/she seems to be approaching a procedure incorrectly, or if he/she indicates that he/she is finished with a procedure before all steps have, in fact, been performed.

8. Verify all findings the student reports.

9. When the examination is complete, grade the student, based on your honest, objective assessment of his/her performance. Remember that as an examiner your primary role is to observe and judge.

10. Give detailed feedback, being sure to (a) tell the student what grade you gave him/her (i.e., whether he passed or failed); (b) tell him/her what he did right; (c) tell him/her where he made errors and what those errors were; (d) explain or demonstrate to the student the correct answer or procedure in those areas where he/she made errors.

Don't's for examiners:

Generally, DON'T do the opposite of any of the do's given above. For example, don't be brisk, show a negative attitude, give vague instructions, stand where you cannot see what the student is doing, et cetera.

The following don't's deserve particular attention:

1. As the examination begins, **DON'T** give the student the impression he/she cannot fail by, for example, telling him/her you will prompt him/her, or telling him/her you will not mark him/her down if he/she does a poor job.

2. During the examination, **DON'T** lecture to the student or engage in any other type of teaching which may interfere with your ability to evaluate the student's knowledge and skills. An examination should be a learning experience; however, the primary goal of giving the student an opportunity to demonstrate his/her skills and knowledge should not be lost.

3. Allow the student to proceed on his/her own after he/she has received a question. **DON'T** interrupt or distract him/her.

4. At the conclusion of the examination, **DON'T** give vague, uninstructive, or personally critical feedback.

5. **DON'T** worry about hurting the student's feelings by giving him/her a poor grade if he/she did a poor job.

IV

Diagnosis

The diagnosis of somatic dysfunction is based upon a history, a physical examination including a structural examination, and appropriate laboratory tests as required. The structural examination may be classified in three parts; a screening examination, an examination to survey the patient to determine whether a musculoskeletal problem is present; a scanning examination, to identify the segments within the involved area; and segmental definition, to define local response to motion demand.

Tests used in the structural examination have been classified by Dinnar from a study of the examination decision making process used by five osteopathic physicians. Five classes of tests were identified: 1. general impression tests 2. regional motion tests 3. positional landmark tests 4. tests of superficial and deep tissue evaluation 5. tests of the local response to motion demand. Fifty separate tests have been identified and categorized. This is the first time that an attempt has been made to define the osteopathic structural examination process. The first two papers in this section report the details of the Dinnar study.

"A clinical investigation of the osteopathic examination", the third article by Kelso presents the results of the visual and palpatory examination of over 6000 hospital patients by both experienced and inexperienced examiners. The findings support the concept of viscerosomatic reflex relationships.

The osteopathic structural examination can be incorporated into the general physical examination as illustrated by the examination method presented by Dr. Sara Sutton, or it maybe conducted as a separate examination using the method of the screen, scan, and segmental definition which follows.

Classification of diagnostic tests used with osteopathic manipulation

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In an effort to characterize methods and decision-making used in osteopathic manipulative diagnosis, videotapes were made of a group of osteopathic physicians individually examining patients who complained of pain considered to be related to musculoskeletal problems. The diagnostic tests used fell into five classes: I-General impression; II-Regional motion testing; III-Position of landmarks; IV-Superficial and deep tissue evaluation; and V-Local response to motion demand. The first three classes are not unique to osteopathic diagnosis. Tests in classes IV and V, however, require high levels of sensory skill and precise anatomic knowledge and are subject to considerable individuality in their application by different physicians. Such differences are consistent with low levels of interexaminer agreement on findings unless special care is taken to adopt detailed criteria for use of a test and for interpretation and recording of findings. The differences may also explain why osteopathic physicians when communicating with other medical professionals rely mainly upon findings obtained with the first three classes of tests.

Diagnosis of musculoskeletal problems is obtained in various forms and is usually documented with very general descriptors. For the most part, the severe problems are obvious by simple observation of posture and gait. However, diagnosis is much more complex and controversial in cases that exhibit only slight deviation from normal, yet involve complaints of chronic pain. The phenomena which link the mechanical and structural integrity of the human body to its physiologic functioning are highly ordered and complex. This linkage involves muscles, bones and joints, ligaments, tendons, nervous activity, and fluid exchange in the tissue. Different methods of musculoskeletal diagnosis are utilized by various disciplines in the health sciences. Diagnostic techniques range from those used in the fields of physiotherapy, chiropractic, and other paramedical professions, to those used in osteopathic and allopathic disciplines within the medical profession, including general practice, orthopedics, physical medicine and rehabilitation, and rheumatology. Although there is a basic protocol for documentation of traumatic injury to bony structures and joints, the evaluation of aspects of dysfunction in the rest of the musculoskeletal system by palpatory and manipulative diagnosis has tended to be less ordered and more dependent on the examiner's individual style of approach and his interpretation of what he feels. In osteopathic medicine, because of the absence of a generally accepted protocol, each physician develops during practice his own basic criteria for diagnosis and evaluation leading to treatment of different problems. However, these criteria are applied to findings which arise from the use of various test procedures, selected and interpreted differently by individual physicians prior to final decision on diagnosis and treatment. This has led to a communications gap between physicians who use manipulative diagnosis and those who do not; consequently, there has been a very limited use of these procedures in clinical practice.

This report describes the results of a research project undertaken to characterize the methods and underlying rules of decision-making currently employed by osteopathic physicians who regularly practice manipulative diagnosis. These are compared with methods, techniques and ideas already documented in the medical literature. Although history-taking is also an essential part of osteopathic diagnosis in which selection and sequence of questions may vary significantly from one physician to another, investigation of this aspect was omitted from the study.

Methods

Five osteopathic physicians were observed while examining three different patients, for a total of fifteen patients. Patients were selected by an independent party on the basis of complaints of pain which were considered to be related to a musculoskeleta1 problem. Most of the patients selected complained of low back pain. Additional requirements were that (1) the patient had never had osteopathic manipulative therapy (OMT), and (2) that the pain had persisted for more than a week before the examination. After the history was taken, the patient was examined by the physician. Videotaping from two angles was used to record the examination sessions for subsequent analysis. Physicians also made their customary written records of findings at appropriate stages of the examination. After a tentative diagnosis was reached, the patient was treated, which, in some instances, led to a revision of the diagnosis. Treatment procedures are not considered in the present report.

Videotapes were analyzed test by test to determine the following: (1) the type of test used at each stage of the examination; (2) the way in which each physician used the test; (3) the kind of information or finding that resulted from the test; (4) whether the finding, or lack of findings, was sufficient to reach a decision or whether another test was required for confirmation; and (5) how the specific findings were recorded for future reference.

Fifty different tests were identified during the analysis of videotapes. (A full description of these will be published later.) Tests were grouped into five classifications according to the underlying principle of each test. Some tests were used in different ways at different points in the examination, or by different physicians. Therefore, some tests belonged to more than one classification. In most instances, the underlying principle (classification) of the test was more clearly appreciated from the findings revealed by discussion with the individual examiner than from observation of the videotape.

Results

Data from one of the examiners were excluded from the study because the tests used in his examinations were based primarily on principles of craniosacral manipulation[1] rather than on the musculoskeletal manipulation which has historically characterized OMT. Although the other four examiners used tests in different sequences and with different emphases or interpretations, their approaches were sufficiently similar to obtain the following classifications.

Class I. General impression. A quick screening, visual and/or palpatory, of the whole body or parts thereof for general impression of asymmetries and abnormalities in structure and function. This class of tests is used to various extents by all practicing physicians, consciously or unconsciously. However, it is employed for different purposes. In contrast to other disciplines, osteopathic manipulators rely heavily on their palpatory skills for general impressions. For the most part, these tests are used to identify signs of possible problems, but not to detail specific characteristics. Some physicians make important diagnostic leaps with this class of tests. In such instances attention begins to focus on specific regions of the body, and other regions are eliminated from consideration, thus narrowing the examination procedure. If a subsequent localized finding fails to confirm the first impression, the diagnostic leap may be corrected by a return to other general impression tests. In many cases, whenever the history is sufficient to focus attention on a problem, the general impression test may further narrow the attention to a particular region of the patient's complaint. However, permitting the patient thus to focus the examiner's attention often is resisted by osteopathic physicians because it risks diverting the examiner from more fundamental problems which may be antecedent or causal to the patient's complaint. Thus the essential aim of class I tests is a quick, general screening of the entire musculoskeletal system, taking precautions not to ignore significant findings in apparently asymptomatic regions.

Class ll. Regional motion testing. Evaluating regional responses to gross motion demand by one or both of the following methods. (1) Visual-observe (a) continuity and (b) range of motion; and (2)palpatory-determine (a) continuity and (b) ease of motion. Motion for this test may be active, orpassive; i.e., introduced by the examiner. If the motion is passive, the patient is as relaxed as possible during the test. The various positions where discontinuity occurs may subsequently be recorded geometrical in distance or degrees.* This class of tests also is used by the majority of practicing physicians, both osteopathic and allopathic, with a variety of test procedures. Although the tests have different terms, the principle is the same. However, the determination of normal and abnormal responses, or the recorded findings by individual physicians, are likely to vary considerably, and performance of these tests by different practitioners may confuse the observer in regard to what is being measured. Some passive test protocols call for motion "as far as possible,"[2] until "pain is produced,"[3] "to a point just short of producing pain,"[4] or "until the pain is no longer present."[5] In the typical osteopathic use of this class of test, the end points of the applied motion are determined by the palpatory sense of the examiner. Two examiners who use the same end points and put the patient through apparently similar maneuvers may actually be paying attention to quite different cues. In the case of manipulative diagnosis, the cues are characteristically those which the examiner feels while the maneuver is in process. Differences among patients, or in findings by different examiners of the same patient, can sometimes be reconciled by attention to the protocols and recorded findings.

For example, consider a simple test procedure of passive straight leg raising while the patient is supine on the examination table. The force required to move the leg versus its angular displacement is recorded. In Figure 1 the straight line (R) represents the force required to raise one leg, while the curve (L) is the force required to raise the other. In both cases the end points are the same; however, in case R the force is the same throughout the displacement, while L requires more force, applied non-uniformly and increasingly throughout displacement. Palpatory evaluation of these differences may be tuned to the force required to initiate motion at each point of the displacement; to the motion achieved by application of a specific, fixed increment of force; to the velocity (first derivative of displacement) or acceleration (second derivative) or other perceived properties of the moving dynamics of the leg.

During the study it was found that the examiners may employ one or several such perceptions, either consciously or unconsciously, while simultaneously tuning to superficial or deep tissue response in a localized region of the leg undergoing displacement. (Among the possible perceptions is that of a sequence of small discontinuities in force requirement, such as that described for a sequence of spinal segments in motion, by Kapandji[6] This type of perception is more appropriate to class V tests described below.) Since the osteopathic curriculum stresses that each examiner build up a vocabulary best suited

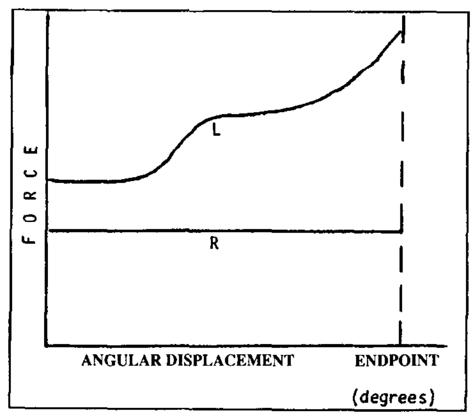

Fig. 1. ***Recording** of force **versus displacement angle obtained during straight leg raising test for right (R) and left (L) legs. End points are predefined by a given displacement angle.***

to his own sensory perceptions, a variety of descriptors has emerged for verbalizing findings. Such descriptors include: "give" (noun), "meet resistance," "hard," "tense, " "stuck," "fibrotic," "hyperbolic,"

*Some prefer the complementary description: resistance to motion.

"parabolic," "increasing resistance," "barrier," and many others. These terms are all applied, in one way or another, to the process in Figure 1. However, a lack of attention to establishing the correspondence between the subjective impressions of different examiners, or between objective measurements and subjective impressions, has led to diversity in test findings. This diversity inevitably generates inferences that either the tests used by different physicians are not the same, or that interexaminer agreement using the same test is poor[7] In this study, not all of the examiners used class II tests as separate entities because elements of these tests are present in other regional soft-tissue evaluation tests. Thus, similar findings may emerge from use of tests in other classes, or even from the treatment procedure.

Class III. Position of landmarks. Either (I) palpatory definition of bony landmarks and uisual measurement of their relative static positions, or (2) measurement of predefined landmarks at two positions, the-beginning and end of a prescribed, actiue motion by the patient. The landmarks in most cases occur in pairs, one on each side of the midsagittal plane, and their relative positions are compared. In certain instances, landmarks are determined at the end points of a *passive* motion introduced by the physician. However, in these instances the end points are determined as geometric landmarks at predefined positions. When response to motion demand is appraised in addition to measurement of landmarks, the test belongs to more than one class and merges with class II and/or class V tests of regional or local responses to motion demand. The motion introduced can be either total body motion or movements of a specific part of the body. This test class is used more intensively by European manipulators than by American osteopathic physicians. It is comparable to x-ray evaluation because of its reliance upon predominantly bony landmarks. In fact, when only class III tests are employed, complementary x-ray evaluation is frequently used.

Class IV. *Superficial and deep tissue evaluation. Localized palpatory evaluation, at superficial and/or deep levels, of tissue characteristics which depart from normal expectations.* The main emphasis in these tests was the localization of findings by palpation carried out more thoroughly and in more detail than in previous test classes. These tests are dependent on the development of a high level of sensory skill. By varying the amount of pressure, the type of finger contact, and the probing action of the fingers on the tissues, characteristics of the skin surface, the subcutaneous layer, and the superficial and deep muscle layers and fascia are evaluated. Features of the acute and chronic stages of tissue inflammation are often interpreted using tests of this class.

Class V. Local response to motion demand. Monitoring the response at a localizedarea, or a point with its immediate environnment, to motion demand. The motion can be introduced by a force applied directly to the specific area, or indirectly by a gross motion. Special attention is given to continuity of motion, resistance to motion, tension, and tissue response of the immediate area. The test is also used to map the area of involvement, and, in some instances, to determine the center of this area. (Geometric description of end point or point of discontinuity may also be used with this test, using the localizedresponse todetermine when that point is reached.) The comments that follow the definition of class IV are also appropriate to class V tests. They appear to be primarily palpatory tests, but some investigators appear to use visual cues as well during the tests. In most instances observed in the present study, class V tests were used after a preliminary working diagnosis had been adopted, and then mainly for the determination of more precise tissue response characteristics required for devising and monitoring manipulative procedures used in treatment.

Discussion and conclusions

The sequence in which tests from the five test classes described are employed in practice is sometimes confusing to the observer. The order presented above reconstructs some of the logic of the decision-making process entailed in the use of the tests. In reality, however, they are often not used in this sequence because of the different positions they require of the patient. To save time and spare the patient discomfort, the examiner usually follows a positional sequence for each patient-standing, sitting, supine, and then prone. Within each position the test sequence usually follows the order given above, with minor repetitions of some tests for confirmation of findings.

The five test classes observed in the study- general impression, regional motion testing, position of landmarks, superficial and deep tissue evaluation, and local response to motion demand- are named to describe the underlying principle of the test. Presumably, these principles relate to biomechanical events ultimately amenable to objective measurement. Occasional tests were also used by some physicians which did not easily fit within these classes, and which did not appear to be easily related to biomechanical principles. These few tests might be based on bioreflexes, but further attention to them was not considered appropriate to this study.

The first three test classes include tests which are used, for the most part, in arriving at a preliminary diagnosis as to the location and extent of the problem, that is, what musculoskeletal region is involved and how large is the complex of disturbed structure, tissue, and motion. Comparison of osteopathic and allopathic procedures reveals large overlap in the use of these three test classes. Neither pharmacologic nor surgical intervention in a musculoskeletal disorder necessarily requires a further diagnosis than the one reached by the use of these three test classes. Manipulative treatment, on the other hand, requires additional refinement of the local tissue response, which is derived from classes IV and V. This is consistent with the observation that this particular group of osteopathic physicians gathered a large proportion of their musculoskeletal findings from palpatory diagnosis utilizing tests in Class IV and class V, for detailed corroboration of the preliminary diagnosis.

The methods, descriptors and assumptions underlying use of tests in classes I through III appear to be similar in the allopathic and osteopathic literature, and generally accepted by both.[8-10] However, the method of treatment and especially the evaluation of treatment effectiveness in osteopathic manipulation require detailed corroboration of the preliminary diagnosis and gross motion characteristics. This has impelled individual examiners to develop their own procedures, terminology, and interpretations on the basis of personal experience in practice. Thus, different examiners may rely more heavily on one class of test than another. For example, one examiner might depend primarily on interpretation of tissue characteristics (class IV), while another might use motion characteristics (class V). Although both use position, tissue characteristics, and motion, the relative emphasis in selection and application of tests is individual.

These individualities are consistent with reported low levels of agreement of findings in the same patient, unless the examiners took special care to adopt detailed criteria for use of a test and for the interpretation and recording of findings:[7-12]

The same considerations also may explain why osteopathic physicians rely mainly upon findings obtained with the first three classes of tests when communicating with other health professionals.

The requirement for a high level of sensory skill and precise anatomic knowledge makes class IV and class V tests relatively more difficult to teach and to analyze. Perhaps more than in other areas of physical examination skills, attaining expertise requires regular application of the palpatory skills, together with frequent opportunities to compare findings with other trained examiners. Modem osteopathic colleges, for a variety of reasons, have not achieved this kind of interaction, which may be the major reason why reliance on this class of test is confined for the most part to the osteopathic profession and within the profession to a relatively small number.[11] It may also help explain why interexaminer reproducibility of findings is not yet as good as should be.[7,12]

It appears appropriate to conclude that a major effort be directed toward understanding the biomechanic principles underlying the use of class IV and class V tests-superficial and deep tissue evaluation, and local response to motion demand. These tests appear to undergird much of the effectiveness of modem manipulative therapy as practiced by osteopathic physicians and, therefore, to be almost unique to the profession. Among the goals of systematic investigations of these tests should be the development of instrumentation and procedures for objective measurement of the biomechanical phenomena perceived by the physician's palpatory sense. Although such measurements undoubtedly will complicate the diagnostic techniques currently used by osteopathic physicians, they also afford the promise of making the techniques amenable to use by many other practitioners who presently cannot, or do not, place heavy reliance on palpatory findings.

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Accepted for publication in December 1979. Updating, as necessary, has been done by the authors.

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Description of fifty diagnostic tests used with osteopathic manipulation

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Fifty diagnostic tests used during videotaped examination and treatment of patients with low back complaint by five osteopathic physicians are described. The tests have been assigned to five classes: general impression, regional motion testing, position of landmarks, superficial and deep tissue evaluation, and local response to motion demand. Considerable variation was encountered among the physicians in choice of test and use of a single test in one or more modes or test class. Test selection and sequence were influenced by the conceptual orientation of the physician, patient position, outcome of previous tests, the status of developing hypotheses about the patient's problem(s), and the accessibility of the problem to treatment and to monitoring of its progress. Distinctions among the fifty tests and differentiation between treatment and diagnostic tests were often obscured. Nevertheless, each physician appeared to follow an orderly process of diagnostic inference leading to treatment. The tests and classification system provide a useful descriptive and analytical tool for research into osteopathic manipulation

Clinical research into osteopathic manipulation inevitably encounters a broad diversity among practitioners, not merely in treatment methods, but in diagnostic methods as well. In practical terms, this diversity has important consequences. No two osteopathic physicians are likely to examine or treat a given patient in precisely the same way. Because of this variation, thereconstruction of underlying principles of diagnosis or treatment that can be demonstrated to apply to the majority of practitioners is very difficult.

Previously, we reported the levels of agreement found among several physicians examining the same patients, with and without constraints upon the diagnostic tests used.1,2 We have also reported the results of an effort to classify the kinds of diagnostic tests used in videotaped examinations by several physicians of different patients.3

The fifty tests used were assigned to five classes, which can be abbreviated as follows: I-general impression; II-regional motion testing; III-position of landmarks; IV-superficial and deep tissue evaluation; and V-local response to motion demand. Only class IV and class V tests appeared to be unique to osteopathic practice,3 but it was specifically these tests that were subject to the greatest individual variability in their application. The present report provides the detailed description of all fifty tests.

Several considerations should be kept in mind by the reader as these tests are examined:

(1) Not all the tests were used by any one physician.

(2) The same test was not necessarily used in the same way by two or more physicians. For example, a test might be used strictly as a regional motion test (class II) by one physician, or as a test of specific, localized tissue response to motion demand (class V) by another. Even when two physicians agreed that they used a test in the same class, especially in class IV and class V, individual variances-) were likely to emerge in the following:

(a) performance of the test;
(b) the findings observed; or
(c)the interpretation.

(3) Two different physicians might derive essentially the same information from the use of different tests.

(4) A single test was often used by a physician as more than one class of test. For example, straight leg raising with the patient supine could be used to evaluate regional responses to gross passive motion demand (class II); to define the end point of leg motion (class III); and to monitor localized tissue response in a particular area to the leg motion (class V). The assignment of a test to a particular class was facilitated by asking the physician what information he was seeking.

(5) In the present study, preselection of patients eliminated the necessity for other routine physical examination procedures at the time of the videotaping.

Synopsis of methods

A detailed description of methods was given in the previous report.3 Each of five osteopathic physicians was videotaped while he examined and treated three different patients (for a total of fifteen patients). Subsequently, each videotape was analyzed test by test in consultation with the physician, to determine kind of test used, the way it was used, the information derived from it, and its relationship to other tests and to the diagnostic process. The fifty tests identified by videotape analysis are described in the following section.

The fifty tests

Test 1. Gait. (Class I.)

Description: Monitoring of the whole body, to answer the following questions:

(a) Is length of stride within normal range?
(b) Is length of stride of each leg equal?
(c) Is weight transferred in a continuous manner from heel to toe for pushoff?

(d) Is either leg internally or externally rotated?
(e) Is flexion/extension of either leg re stricted?
(f) Is motion (hips, shoulders, arms) totally symmetrical?
(g) Is the position of the head normal during the walk?
(h) Is there an abnormality in spinal motion at the level of the hips or shoulders?

Comments: This test appeared to be used only selectively; that is, when gait appeared abnormal or whenever there was a symptom related to gait.

Test 2. Visual screen-patient standing. (Class I.)

Description: Visual screen of the wholebody from each of three views. The following questions were addressed:

I. Posterior view

(a) Are levels of shoulders and scapulae un equal (asymmetric)?
(b) Is there a lateral curvature (asymmetry) of midspinal line?
(c) Is head held to one side?
(d) Is pelvic position asymmetric (are iliac crests level)?
(e) Is there special flatness or fullness of paravertebral tissue mass?
(f) Is placement of feet asymmetric or irregu lar?
(g) Are positions of the knees asymmetric or irregular?
(h) Is the whole body position rotated?
(i) Are Achilles tendons asymmetric or medi ally deviated?
(j) Are positions of mealleoli irregular or asymmetric in relation to calcanea?
(k) Is there asymmetry of arm postion?
(1) Is there asymmetry of fat folds at the waist (crease)?
(m) Are there special morphologic asymmetries of the posterior skin surface such as scars, bruises, et cetera?

2. Lateral view

(a) Is there exaggeration or reversal of the normal spinal curvature?
(b) Is there displacement of the body relative to the line of gravity? For example, is the anterior posterior postion of the head nor mal?
(c) Are there special morphologic asymmetries of the lateral skin surface such as scars, bruises, et cetera

3. Anteriorview

(a) Are shoulder levels asymmetric at midsternalline?
(b) Is head held to one side?
(c) Is there some deviation from the normal horizontal clavicular line?
(d) Is pelvic position asymmetric (are iliac crests level)?
(e) Are patellae deviated laterally or medially?
(f) Are there special morphologic asymmetries of the anterior skin surface such as scars, bruises, et cetera?

Comments: The test was performed to determine morphologic asymmetries and marked anomalies. It did not include finite measurement and as such was not specific. The findings were used for an initial impression of a patient's structural problem. Not all parts of this test were used by all physicians or on all patients.

Test 3. Palpatory screen of arch offoot-patient standing. (Class I.)

Description: Palpation of arches for deviation or asymmetry in (a) arch height or (b) tissue tone.

Comments: Although this test could be extended to a geometrical landmark test, it was used primarily as a general impression test, especially with respect to weight bearing.

Test 4. Palpatory screen of legs--patient standing. (Class I.)

Description: Palpatory screen for asymmetry between left and right leg in:

(a) surface tension
(b) masses-size, shape, and consistency
(c) texture-muscle size and tone
(d) tenderness

Comments: In performing this test the examiner also looked for possible edema in the tissue.

Test 5. Palpation of *back-patient standing. (Class I.)*

Description: Palpatory screen for asymmetries, regional differences and other departures from normal expectations in:

(a) skin temperature
(b) skin surface texture, moisture, and skin drag
(c) structure and contour (surface elevations, depressions or masses)
(d) muscle size, mass, firmness, and tone
(e) soft tissue response or resistance to palpation (includes firmness, tension, and tone)
(f) red response to skin stroking

Comments: Usually this test was performed as a quick screening test and hence classified as genera1 impression. However, part (e) of the test was sometimes extended to include class III (landmarks), class IV (tissue evaluation), or class V (response to motion demand; for example in connection with respiration) tests.

Test 6. Levels of landmarks-patient standing. (Class III.)

Description: Palpatory definition of bony landmarks followed by comparison of levels for asymmetry, at the following locations:

(a) trochanters
(b) iliac crests
(c) posterior superior iliac spines (PSIS)
(d) inferior angles of scapulae
(e) shoulders

Comments: This test sometimes was part of a battery of tests used for a general impression (class I) of bony landmarks.

Test 7. Response to lateral motion at the hips-patient standing. (Class II.)

Description: Determination of asymmetry in side-toside motion induced by the examiner at the trochanters, moving the whole body away from the midline with feet in place.

Comments: Some examiners may determine and compare only the initial forces required to move the patient from the balanced position. Others may determine end points of motion.

Test 8. Response to rotation at the hips--patient standing. (Class II.)

Description: Observation of response to whole body rotation to the left and to the right, introduced by the examiner at the level of the hips, to look for reduced, exaggerated, or painful mobility, unilateral or bilateral.

Test 9. Standing flexion (forward bending). (Class I, II or III.)

Description: The test has two main components: (1) examination of the active forward-bending motion and (2) comparative examination in the forward-bent and standing positions.

I. Motion test(class I, II, III):

(a) visual observation of the continuity of motion.
(b) visual observation of the range of motion.
(c) palpatory monitoring of the resistance to motion at the
(d) visual comparison of the amounts of anterior superior movement of one

PSIS relative to the other, with the points defined by palpation.

2. Comparative examination inforward-bent and standing positions, addressing the following questions (classes I, III);

(a) Does the geometric relationship of the two PSISs in the forward-bent position differ from that in the standing erect position?
(b) Are there paravertebral areas of special flatness or special tissue mass as determined visually or by palpation?
(c) Is there some special lumbar or thoracic midline curvature as evaluated visually or by palpation?
(d) If so, where is its apex?
(e) Is there asymmetry at the knees?

Comments: Test T(c) was performed as a class II test; however, this is easily extended to class V.

Test IO. Visual screen--patient sitting. (Class I.)

Description: The following questions are addressed:

(a) Are shoulder levels unequal?
(b) Is there some special curvature in the relaxed (sitting slouched) position?
(c) Is there some special curvature in the erect (sitting tall) position?
(d) Is the head held to one side?
(e) Is the cervical region asymmetric?
(f) Is the thoracic region asymmetric?
(g) Is the lumbar region asymmetric?

Comments: The same comments that follow the description of test 2 are applicable here. If performed after test 2, findings with test 10 may be used to confirm findings with test 2, but new findings may also emerge.

Test II. Seated flexion (forward bending). (Class III, or III.)

Description: The test has two main components: (1) the active forward-bending motion and (2) comparative examination in the forward-bent and seated erect positions.

1. Motion test (I,II, or III);

(a) visual observation of the continuity of motion
(b) visual observation of the range of motion
(c) palpatory monitoring of the resistance to motion at the PSIS
(d) visual comparison of the amount of anteriorsuperior movement of one

PSIS relative to the other, with the points defined by palpation.

2. Comparative examination inforward -bent andseated erectpositions, addressing thefollowing questions (classes I,III);

(a) Does the geometric relationship of the two posterior superior iliac spines in the forwardbent position differ from that in the seated erect position?
(b) Are there paravertebral areas of special flatness or special tissue mass as deter mined visually or by palpation?
(c) Is there some special lumbar or thoracic mid-line curvature as evaluated visually or by palpation?
(d) If so, where is the apex?

Comments: Same comments about I (c) that follow test 9 description are applicable here.

Test 12. Palpation of the back--patient sitting. (Class I.)

Description: The examiner looks for asymmetries, regional differences, and other departures from normal expectations

(a) skin temperature

(b) skin surface texture and moisture, skin drag
(c) structure and contour (surface elevations, depressions or masses)
(d) muscle size, mass, firmness, and tone
(e) soft tissue response or resistance to palpation (includes firmness tension, and tone).
(f) red response to skin stroking

Comments: Same as test 5, except that the use of test 12 as class IV or V test ordinarily implied a previous finding in a particular location, with this or another test.

Test 13. Segmental palpatory scan--patient sitting. (Class IIII or IV.)

Description: Palpatory scanning of deep tissues, often with alternating local pressure (springing) of the spinal column, segment by segment, for asymmetry and/or geometrical evaluation of transverse processes.

Comments: The emphasis in this test was on muscle and tissue reaction, although segmental mobility can also be explored (class V).

Test 14. Sitting tall and slouched. (Class II, III, or V.)

Description: The patient is alternately instructed to sit tall (erect) and slouched (relaxed). The lumbar and lower thoracic regions are palpated for contour muscle mass and other properties, both in transition between the two postures and at the end points.

Comments: The instructions to the patient were the same as in tests 10 b and c. This test may seem like a class I test, but monitoring was primarily and either regional (11) or local (V) in focus. Certain landmarks may also be monitored (V).

Test 15. levels of landmarks--patient sitting. (Class III.)

Description: Palpatory definition of bony landmarks followed by comparison of levels for symmetry, at the following locations:

(a) iliac crests
(b) inferior angles of scapulae
(c) shoulders

Comments: The geometrical evaluation was done by identifying the landmarks by palpation, and then comparing levels visually. This test may be used with tests 6, 23, and 46 as a battery of general impression tests (class I).

Test 16(a). Response to sidebending-patient sitting. (Class II or V.)

Description: Class II-Introducing alternate' sidebending of the trunk by pressure on shoulders. With both hands on shoulders, any asymmetry in resistance to gross motion demand is estimated. *Class* V-Monitoring by palpation the segmental response to (usually passive) sidebending. One hand introduces the motion while the other monitors the response at thoracic or lumbar segments. Both tests involve looking for reduced, exaggerated, or painful mobility, unilateral or bilateral, in response to sidebending.

Test 16(b). Response to translation in the coronal plane. (Class V.)

Description: Monitoring by palpation the segmental response to (usually passive) side-to-side motion induced without sidebending. (See test 16(a), class V.) *Comments: The* class procedure in both (a) and (b) was used either as a scanning device where each local segment was evaluated in turn, or for a more careful localization of findings at one segment.

Test 17. Response to rotation-patient sitting. (Class II or V.)

Description: Class II---Rotation of trunk in alternate directions by pressure at shoulders. With both hands on shoulders, asymmetry in resistance to gross motion demand is estimated. Class V-Palpatory monitoring of the segmental response to rotation. One hand introduces the motion while the other monitors the response at thoracic or lumbar segments. Both tests involve looking for reduced, exaggerated, or painful mobility, unilateral or bilateral, in response to rotation. *Comments: Same* as for test 16.

Test 18. Response to respiration-patient sitting. (Class I or II.)

Description: Visual and palpatory evaluation of the continuity of motion of the entire rib cage during exhalation and inhalation, to determine restrictions or departures from expected symmetry and mobility.

Comments: This test was used as a class I test, to provide a quick impression of total breathing function: for example, was the patient dyspneic? However, the test also served as a regional motion test (class II) and can be focused to determine localized restrictions in mobility (class V). The test is also used in supine position.

Test 19. Rib evaluation--patient sitting. (Class V.)

Description Palpatory scan of the entire rib cage to assess rib mobility during respiration.

Comments: The test calls for a separate evaluation on of each rib throughout inhalation-exhalation range. Local responses were monitored to define the exact part of the respiratory cycle where a rib showed resistance to motion.

Test 20. Response to rotation of head and neck--patient sitting. (Class II, III, or V.)

Description: Class II-Evaluation of asymmetry in resistance to motion in (usually passive) rotation of the head and/or neck. *Class* III-Measurement of the end points (in degrees) of active and/or passive rotation of the head and neck. *Class V*-Monitoring of the response to (usually passive) rotation of head and neck, as in tests 16 and 17, at predefined locations anywhere along the spinal column.

Test 21. Response to sidebending of head and neck--patient sitting. (Class II, III or V.)

Description: Same as test 20, with sidebending replacing rotation.

Test 22. Response to forward and backward bending of head and neck--patient sitting. (Class II, III or V.)

Description: Class II-Evaluation of restriction to motion in (usually passive) forward and backward bending of the head and neck, and definition of limitations. *Class* III-Measurement of the end points (in degrees) of active and passive forward and backward bending of the head and neck. *Class* V-Monitoring of the response to (usually passive) forward and backward bending of the head and neck at predefined segments anywhere along the spinal column.

Test 23. Levels of malleoli-patient supine. (Class III.)

Description: Standardization of patient position, followed by measurement of the relative levels of the malleoli. *Comments:* This test is often called the apparent leg length test, but a discrepancy in malleolar levels in supine position does not necessarily indicate difference in actual leg length.

Test 24. Pelvic landmarks--patient supine. (Class III.)

Description: Palpatory definition of bony landmarks followed by comparison of levels for symmetry at the following locations: iliac crests, anterior superior iliac spines (ASIS), pubic tubercles.

Test 25. Visual screen of thoracic cage--patient supine. (Class l.)

Description: Visual evaluation of rib cage during respiration, for symmetry of contour and excursion. Is the patient a costal or abdominal breather?

Test 26. Arms over head-patient supine. (Class I, II)

Description: The patient is instructed to raise arms over head (parallel to the body). The examiner looks for exaggerated, or painful mobility, unilateral or bilateral. *Comments* This test was used as a class I test to get a quick impression of upper extremity motion. When it was used as a class II test, specific asymmetric regional response to motion was evaluated. Measurement can include determination of specific degrees of restricted motion (class III).

Test 27. Straight leg raising (active or passive-patient supine. (Class II, III or V.)

Description: Straight leg raising one after the other. The examiner looks for reduced, exaggerated, or painful mobility, unilateral or bilateral.

Comments: If this was used as a class II test, motion was introduced passively to test regional response to motion. In some cases class III end points were measured. (Since there were various criteria for end points, they must be carefully defined.) In other instances a local area was predefined for monitoring response to the leg raising (class V).

Test 28. Chest and abdominal wall---patient supine. (Class II or III.)

Description: Palpatory and visual examination, using the palmar surface of the whole hand, is made to monitor regional responses to inhalation and exhalation throughout the chest and abdominal wall. Departures from normal expectations, including asymmetries, regional differences in tension and response to respiratory movement are noted. If a positive finding is made, localization of the finding usually follows by class IV or V tests at individual ribs.

Comments: The examination of the abdominal wall often precedes palpation of abdominal organs during the physical examination.

Test 29. Lower extremity palpation-patient supine. (Class I, IV, or V.)

Description: Palpatory evaluation of muscle tension and muscle tone of the lower extremity.

Comments: This test may be used for general impression (class I); for localization of areas with tissue texture abnormalities, pain, or tightness of ligaments (class IV), or for determination of local response to motion (class V).

Test 30. Motion testing of knee-patient supine. (Class II or V.)

Description ClassII- Evaluation of the continuity of movement and the resistance to motion demand introducedthrough the legs by active or passive flexion and extension. *Class V-* Local monitoring of the response at the knee to (usually passive) motion demand introduced through the leg. A variety of motions can be used and monitored at a number of specific locations at the knee; for example, cartilage, ligaments, muscles, and patella.

Comments: If positive findings result, orthopedic tests for joint damage may be appropriate, such as the McMurray test, drawer sign, Apley's test and others.

Test31. Motion testing of ankle and foot patient supine. (Class II or V)

Description: Class II-Evaluation of the continuity of movement and the resistance to motion demand introduced passivly through the ankle (dorsal and plantar flexion, inversion and version of ankle and foot). *Class* V-Local monitoring of the response at the ankle and foot to passive motion demand introduced through the ankle. A wide variety of motions can be used and monitored at a number of plantar or dorsal locations on the ankle or foot; for example, bony prominences, ligaments, and tendons.

Test 32. Motion testing of hips--patient supine. (Class II.)

Description. Testing of hip motion in flexion, internal and external rotation, in response to motion demand introduced by examiner through the lower extremities, one at a time or both together. The examiner looks for reduced, exaggerated, or painful mobility, unilateral or bilateral.

Comments: This test is sometimes used as a class V test to monitor local response to motion demand.

Test 33. Motion testing of pelvis and lower spine-patient supine. (Class V.)

Description: Local monitoring of the response throughout the pelvis and lower spine to various motion demands introduced by the examiner through the lower extremities, one at a time or both together.

Test 34. Lateral swing of legs---patient supine. (Class II.)

Description: Examiner introduces lateral swings of both legs together, looking forreduced, exaggerated, orpainful mobility.

Test 35. Motion test for effect on apparent leg length-patient supine. (Class III.)

Description: Measurement of lengthening or shortening of apparent leg length as the examiner induces internal or external rotation of the hip with flexed hip and knee.

Conunents: Some physicians draw inferences about sacroiliac mobility from this test. However, the measurements are all made at the malleoli, which may change in their relative positions following rotation of the hip. Absence of expected change is basis for finding of restricted mobility.

Test 36. Response of sternoclavicular joint to abduction of the arm patient supine. (Class III or V.)

Description. Class III-Measurement of the response of the sternoclavicular joint to abduction of the arm by comparing initial and final positions of the medial end of the clavicle. *Class* V-Monitoring of the response of the sternoclavicular joint to motion demand.

Test 37. Response to rotation of head and neck--patient supine. (Class II, III or V.)

Discription: Class II Introduction of rotation of head and neck in alternate directions by hand contacts on the head. Estimation of resistance to gross motion demand and comparison of directions for asymmetry. *Class* III-Measurement of the end points (in degrees) of rotation (active and/or passive) of head and neck. *Class* V-Monitoring, by palpation, the segmental response to rotation. One hand introduces the motion while the other monitors the response at cervical segments. In each test examination is made for reduced, exaggerated or painful mobility, unilateral or bilateral, in response to rotation.

Comments: Same as for test 16.

Test 38. Response to sidebending of head and neck-patient supine. (Class II, III or V.)

Description: Same as Test 37, with sidebending replacing rotation.

Test 39. Paraspinal palpation--patient supine. (Class I or IV.)

Description: Class l -The examiner looks for departure from normal expectations or predictions, including asymmetries and regional differences in (a) tissue texture; (b) structure and contour (masses, surface elevations, and depressions); (c) soft tissue response to palpation (firmness and tension). *Class* IV-Palpation of all spinal regions or costotransverse articulations for tissue characteristics which depart from normal expectations. *Comments:* This test can also be used to determine position of the bony landmarks (class III).

Test 40. Gluteal palpation--patient prone. (Class I or IV.)

Description: Class&Palpation of the gluteal muscles for a general impression of muscle tension and tone. *Class IV-*Palpation, superficial and deep, of the entire gluteal area.

Test 41. Low back palpation--patient prone. (Class I or IV.)

Description: Class I (a) Tapping the back throughout the thoracic and lumbar regions, checking for general impression of differences in tissue firmness; (b) palpating for general impression of tissue differences along the sacroiliac junctions. Class IV-Superficial and/or deep palpation of the thoracic, lumbar, and sacroiliac regions. *Comments:* This test can also be used to determine bony landmarks (class III).

Test 42. Segmental palpatory scan - patient prone. (Class III or V.)

Description: Class III Geometrical evaluation of the transverse processes, segment by segment. *Class* V (a) Local motion testing by palpation of the spinal column, segment by segment, through superficial and deep paraspinal tissues, looking for asymmetry of transverse processes; (b) springing test of the spinal column, segment by segment, for asymmetry of response of transverse processes.

Comments: This test can be repeated in the hyperextended position by positioning patient on elbows.

Test 43. Local response to respiration-patient prone. (Class V.)

Description: Monitoring of the motion of ribs and/or overlying tissues in response to the demand of respiration.

Test 44. Pelvic landmarks--patient prone (Class III)

Description: Palpatory definition followed by positional measurement of the following bony landmarks:

(a) PSIS
(b) depth of sacral sulcus
(c) inferior lateral angle of sacrum (ILA)
(d) ischial tuberosities
(e) sacrotuberous ligaments

Test 45. Sacroiliac evaluation---patient prone (Class V.)

Description: Palpation is used at four locations along the sacroiliac articular junction (that is, cephalad and caudad to the PSIS bilaterally) to evaluate local response to a variety of (passive) motion demands; for example, pelvic rocking, sacral springing, or to active respiration.

Comments: This test can also be used to define bony landmarks, either static or in motion (class III). It can also be used as a class V test with patient supine.

Test 46. Levels of malleoli-patient prone (Class III.)

Description: Standardization of patient position followed by visual and palpatory determination of relative positions of heel pads or malleoli.

Test 47. Hip rotators-patient prone (Class II.)

Description: Evaluation of hip rotator muscles is made by introduction of passive motion through the lower extremities with internal and external rotation of thigh with knee flexed 90 degrees, looking for reduced, exaggerated, or painful mobility

Test 48. Sidebending--patient on the side (Class V.)

Description: Palpatory monitoring of spinal segmental response to motion demand of sidebending, introduced passively by raising or lowering of both legs while they are moderately flexed (about 90 degrees) at hip and knee.

Comments: This test can also be used as a regional motion test (class II).

Test 49. Paraspinal palpation-patient on the side. (Class IV.)

Description: Palpation of spinal areas and/or costotransverse articulations for tissue characteristics that depart from normal expectations.

Comments: This test also can be used to determine local response to motion demands (class V) or bony landmarks (class III).

Test 50. Movement in the sagittal plane-patient seated.(ClassV.)

Description: The patient is moved passively in the sagittal plane, by flexion or extension of the back, or by anteroposterior translation of the straight back, while seated erect. Local response to motion is monitored by palpation, segment by segment.

Discussion

Selection of tests and test sequences

At the start of the typical examination, test sequences tended to follow the order of the five test classes. However, as diagnosis proceeded, considerable departure from this sequence was often evinced. Each physician exhibited a preference for his own selection of tests; no physician used all fifty, Test selection and sequence were guided by several elements, including, though not limited to, the following:

(1) the patient's position (for example, standing examination tests were usually followed by seated tests, then by supine, prone, or on-the-side tests, the latter three positions often in different orders, or repeatedly interspersed as diagnosis proceeded;

(2) the outcome of previous tests (that is, one or more of them might direct the examiner logically to perform a potentially related or confirmatory test)

(3) the status of one or more developing hypotheses about the locus and nature of the patient's problems;

(4) the accessibility of the problem to treatment and to monitoring of the progress of treatment; and

(5) conceptual orientation of the physician-more will be said of this in a later paragraph.

Flagging

As analysis of the videotapes progressed, we, by mutual agreement, adopted the term "flagging" to describe the underscoring by an examiner of findings with a particular test. Thus, a flag was initially "raised" at a region, or with a test, when preliminary findings suggested a hypothesis as to the origin, location, or accessibility to treatment or to monitoring of a problem. The initial raising of the flag was subject to further confirmation or elaboration by subsequent tests. When an asterisk was added (flag*) it meant that the importance of the region or the finding to the patient's problem(s) had been *established.* Flags usually represented clusters of findings combined into a unit, and associated with a particular region. *Established* flags(*) represented major problems or points of departure. To illustrate, with patient 1 physician C erected flag 1 in the lumbar region, as a result of the apparent convergence of several predominantly class I (general impression) findings in this region. Each of these had previously been isolated in character, but now appeared confluent in test 9-standing flexion (forward bending), used as a class II and III test. Flag 2 was erected for a scoliosis, including in this instance the lumbar region. It was detected by visual screen-sitting (test 10, class I) and palpation of the back-sitting (test 12, class I). Flag 3 was erected for an aberrant thoracic anteroposterior curve detected by the same tests; flag 4 for a somatic dysfunction of the cervical spine detected in tests 20-22 used in class II and III modes; flag 5 for arthritis in the spinal segments, apparently inferred from previous tests but still to be confirmed by x-rays.

Next, flag 1* was *established* at L4 by respiratory and other localized motion (class V) tests. Flag 6 was erected as a presumption of lower extremity and/or pelvic dysfunction, to which previous tests had pointed, but the hypothesis was strengthened by local (class V) and regional (class II) information from test 17, response to rotation-sitting. Finally, flag 6* was *estab-*

lished by anteroposterior motion testing at the hips (test 50) with the patient once again seated while the examiner monitored the local response (class V) at the level of S3, and by palpatory findings in the gluteal muscles with the patient prone (test 40, class IV). The S3 monitoring point was carried over into later evaluation of the effectiveness of treatment.

Test selection and treatment

During videotape analysis, it was learned that physicians were sometimes reluctant to *establish* a flag until at least preliminary treatment procedures had been initiated. Initiating a trial of manipulative treatment will often help to evaluate an initial hypothesis and test tentative findings. On these occasions, treatment procedures may be considered an essential part of the test battery.

Choice of tests and conceptual orientation

Significant diversity was observed among the five physicians with respect to the kinds of tests selected. This diversity was expressed in the kinds of findings that determined their flagging decisions. For example, physician A apparently relied principally on general impression (class I) palpation in his diagnosis, believing that distinctions between procedures of general impression tests and of tests involving specific, localized palpation (class IV) were often difficult to make. In addition, A thought that class I palpation alone gave him most, if not all, the information he might have secured from class II motion testing.

By contrast, B used about the same number of tests in all classes, whereas C used many more tests than did A or B, in all classes except landmarks (class III). Both B and C reported that they monitored motion restrictions by what they palpated in local tissues (class V), but B visualized motion of bone on bone, whereas C denied using such images. Correspondingly, B's written findings typically included notations such as "T12 restricted in left rotation," while C was uncomfortable with notations implying a concept of localized joint restriction. So was A, although both A and C admitted to use of such terms under certain constraints. C preferred to define segmental findings in terms of issue compliance with motion demands.

D characterized himself as being "a bone man," whose typical findings were almost always phrased in terms of altered bony positions. Yet while he relied on class III landmark tests more than any of the other physicians, he also employed a great many soft tissue tests of class IV and class V, almost always with reference to particular joints. E, whose use of tests from the five classes was decidedly eclectic, expressed discomfiture with definition of problems in terms of eitherjoints or soft tissue, preferring to characterize them relative to his cranial concepts.4

From these considerations, it seems quite plain that test selection was influenced to a significant degree by the conceptual model(s) applied by the particular physician to the process examined. The use of different testing procedures and/or different concepts might still lead to agreement on location of patients' problems, but our previous observations 1, 2 argue that one cannot in general assume such a favorable outcome.

Blurred distinctions among tests

To observers of the videotapes, distinctions among tests were sometimes obscured. For example, one observer commented that physician A's "gross motion testing of the knee and hip" (A's description) with his second patient was apparently eversion, inversion, and flexion of the hip, together with similar tests for the knee, blended into one test. Sometimes it was only after careful step-by-step analysis of the videotape procedures, in the presence of the examining physicians and their recorded findings, that individual tests could be clearly identified. The analysis led to five distinct classes of tests based on agreement regarding underlying principles. Although the classification scheme for musculoskeletal tests may appear somewhat arbitrary, we believe it provides a useful descriptive and analytical tool. If, in fact, the physician blends tests, the scheme enables us at least to describe and perhaps to analyze the elements of the blend, whereas without some such scheme, to do either is difficult.

Conclusions

The fifty tests described allow characterization of the musculoskeletal diagnostic process observed among five osteopathic physicians, each examining and treating three different patients. The classification scheme devised for comparing and differentiating the fifty tests cannot be construed as exhaustive, nor even necessarily representative of osteopathic practice in its entirety. Nonetheless, the tests and classification scheme provide a unifying probe for exploring the underlying methodological and conceptual differences and similarities among physicians who practice osteopathic manipulation. Employment of this probe has enabled us to visualize quite different diagnostic styles, as approaches that measure different attributes of a common underlying process within the patient. Forthright recognition and detailed characterization of the considerable differences among diagnostic styles is a prerequisite, in our judgment, for ultimate understanding of the process.

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Accepted for publication in January 1981. Updating, as necessary, has been done by the authors.

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A clinical investigation of the osteopathic examination

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Between 1969 and 1972, over 6,000 patients admitted to Chicago Osteopathic Hospital were examined by a modified osteopathic examination. Visual and palpatory observations of somatic tissues were made by a method which identified each finding as a separate component. The analysis of the somatic findings on a regional and segmental basis and relative to conditions affecting the health of patients were used to study viscerosomatic relationships. An **increased frequency of findings** in **somatic tissues segmentally related to diseased viscera was found. Although the viscerosomatic relationship is not precise, there is a significant increase in somatic findings within a region which can be rationally associated with the visceral afferent input. Generalized disease states and surgical removal of visceral organs were identified as additional conditions which modify the frequency of somatic findings. This clinical, double-blind controlled study lends support to osteopathic concepts of facilitation of spinal cord synaptic transmission and viscerosomatic relationships.**

An osteopathic examination is similar to a physical examination in the use of visual and palpatory examination of somatic tissues. In addition, the osteopathic physician notes findings during motion testing.[1] As clinical investigation tools, osteopathic and physical examinations are characterized by variability in the patient and variability among examiners. Although signs are not as variable as symptoms, they are affected by functional and psychic states, as well as the presence of a pathologic condition. It is not known to what extent any of these factors affect osteopathic examination findings in somatic tissues. It is generally accepted that training, experience, and focus of attention influence a physician's observations and decisions. The relative influence of these personal characteristics of the examiner on findings needs to be evaluated.

An osteopathic examination has two purposes- to identify somatic dysfunction and to identify visceral disease through viscerosomatic relationships.[2,3] The terms used to describe osteopathic findings have not been universally accepted, and terminology is a subject for debate even within the osteopathic profession. Two terms, osteopathic lesion[4] and somatic component of disease,[5] have been used for general classification of osteopathic findings. Until recently, there were no general descriptors for a more detailed examination of the somatic system (the musculoskeletal system and related tissues, such as skin, blood vessels, fascia and nerves). Asymmetry, tissue change, and motion change have been proposed as general descriptors for somatic findings.[6] If they become widely used, they will serve to identify the need for detailed examination of the somatic system in the same manner that arrhythmia and murmur serve to identify the need for detailed examination of the cardiovascular system. The value of general descriptors is exemplified by their application to the classification of detailed descriptors and their effect in organizing examination procedures and records of findings.

Three clinical research studies have been conducted to provide information on the osteopathic examination. Two studies (a previously reported study' and the present one) by inexperienced osteopathic examiners (third- and fourth-year osteopathic medical students were trained to examine and record their findings as described under "Methods") dealt with the question of frequency of osteopathic findings. The third study involved both experienced and inexperienced examiners andevaluated the influence of examiner experience on judgments related to findings.[8] Examiners used in these studies were trained by an experienced osteopathic physician to conduct the examination and record their findings in a manner which would increase reliability of the examinations. Student examiners met weekly for reinforcement of their training. Experienced examiners were trained through discussion and demonstration by the principal investigator. Concurrence on examination procedures was sought to minimize interference with the experienced physicians' examinations as they used them in practice. The methods of both the student and experienced physician were uniform, and special attention was made to obtain agreement for the definition of each term in the examination. The research record forms or computer display of the recorded data reinforced the examination techniques by providing step-by-step data entry or check-off which matched the instructions for examination procedure. Examinations were reviewed by the technician completing the data and entering the reports in the research files. Questions were raised on procedures or records with the examiners either at the time of the examination or within a week of it. The inexperienced examiner's technique of examination and method of recording were developed to eliminate the influence that concomitant findings could have on objective decisions concerning the identification of each component osteopathic finding. *(A number of components* relating to (1) structural asymmetry, (2) superficial, subcutaneous, and deep tissue change, and (3) change in motions about a joint can be identified. Experienced osteopathic physicians generally use detection of one or several of these components to focus their attention on the complex of components present in a region or segment of the body.)

The emphasis of all three studies was on developing a definition of examination technique and defining characteristics of findings. The conditions present in the body systems of the patient were subsequently studied for possible general influence on osteopathic findings. The diagnosis used for computed tabulations were the discharge diagnosis validated from the medical records such as surgeon reports, pathologist reports, cardiologist reports, or evidence of ischemia and reports on endoscopy. The internist's, surgeon's, and pathologist's reports confirmed the presence of acute and chronic conditions and ischemia or inflammation.

Methods

Data collected for this study consisted of osteopathic examination findings and information obtained from the patient's medical record. The patients were obtained from the general admissions to Chicago Osteopathic Hospital (COH) Medicine and Surgery Services during the period 1969 to 1972. Patients admitted through the emergency room or outside of regular admitting hours were not included in the study. Also, patients who refused examination and those whose physician specifically ordered no research-oriented examination were excluded. COH patients represent a heterogeneous population, including Caucasians, blacks, and several racial minorities, persons from low- and middle-income groups, and both thirdparty-paid and self-paying patients.

Patients were examined either prior to or shortly after bed assignment. Examiners were directed to the patient and were given only patient identification. Access to patient medical data was restricted in order to establish a blind control. Medical data was obtained from the medical record after the patient's discharge in order to complete the double-blind control.

The osteopathic examination was made by trained osteopathic junior and senior student physicians who comprised the inexperienced osteopathic examiner group. Weekly sessions were used to reinforce examination techniques and recording procedures. The participation of inexperienced examiners and the use of an examination which emphasized identification of individual findings reduced the influence of one finding being used to focus attention in a body region or segment for detecting other findings. The patient was first examined in a standing position by visual and palpatory inspection for active posture and thoracolumbar motion. Next, in the prone position, the patient's subjective response of tenderness to digital pressure over the interspinal space, lateral spinous lamina, and costovertebral junctions was noted. Superficial and deep tissue changes and muscle tension (tone) of paravertebral muscles were then determined by inspection and palpation in the thoracolumbar segments with the patient prone and, finally, in the cervical region with the patient supine. Following cervical tissue examination, passive cervical motion was tested.

The record of osteopathic examination (Fig. 1) was dictated as each component was observed. The patient's identification and osteopathic findings were stored on computer tape as copies of original records. Patient identification data consisted of name, birth date, sex, color, height and weight, and specific identification numbers-hospital chart number, social security number, and computer file number. The specific numbers provided a cross reference for the records used in the study. The computer record of medical data and osteopathic findings was identified only by the computer file number. Regional findings included postural asymmetry (levels of the mastoid processes, shoulder tips, inferior scapula angles, ischial tuberosities, lumbosacral dimples, and trochanter heads), and spinal motion during rotation, forward and backward bending, and side bending. Segmental findings (osteopathic findings) included the following: (1) presence of tenderness at 4 or 6 locations for each segment (intervertebral, over lateral processes, and over costovertebral junctions); (2) presence of increased muscle tension in paravertebral muscles; (3) presence of change in sweating, circulation, skin temperature, pigmentation, fibrosis or edema; and (4) presence of change in motion.

In addition to height and weight, the data from the medical record (Fig. 1) included blood pressure; the H-ICDA coded diagnosis; history of trauma, surgery, or chronic disease; evidence of "acute" or chronic illness; and evidence of primary somatic problems. The H-ICDA codes obtained from the medical librarian's notes were verified before entry in the computer record. Histories of specific trauma and previous surgery, identified in the medical record, were entered in the record by a modified H-ICDA code. "Acute" (defined in this study as recent trauma, inflammation, or ischemia, as determined by the specialist, or segmental findings that represent dermatomal or sclerotomal changes referred to vertebral levels and named for that level, except for motion changes which are referred to the lower vertebrae of the segmental motion) or chronic illness was verified from the surgeon's, pathologist's, or consultant's reports. Chronic illness criteria included evidence of long-term circulatory, endocrine, or metabolic disease.

Data from the study was stored on computer tape as individual records, using a PDP-12 computer. (The program-"MedRec," Instructions for Computer Coding, a dictionary for the program and operation instructions are available upon request.) Data was entered from either IBM punched cards or a peripheral terminal located in the Research Office. Records were verified before storage on magnetic tape.

Tabulations were completed by a computer program. (A search program, "Search," which uses specified data at designated addresses, lists the cases containing the specified data. A tabulation program, "Tabulation," completes the tabulation of somatic findings for each list.) Listings were made of the H-ICDA-coded diseases present, including the frequency of the diseases studied. From this list of diseases, a list of cases was made for each HICDA-coded disease in which more than 100 cases had occurred. Additional lists of cases were made for all "acute" cases, including "acute" cases for the above diseases, and for chronic diseases of the cardiovascular, renal, endocrine and metabolic systems. Tabulations of somatic findings from the cases in each list gave the frequency of somatic findings by regional or segmental location.

Comparisons of data within tables and some comparisons of summed data between tables were made. The data within tables were analyzed for frequency of component findings and for the tendency of components to group at segmental locations. (Accuracy of segmental identification is assumed to be plus or minus one. In 1940, Arthur H. Steinhaus, Ph.D., and Seaver A. Tarulis, D.O., studied five examiners' ability to agree on segmental identification and found that disagreement between examiners, and between examiners and a posteroanterior x-ray with radio-opaque skin markings, did not vary by more than one segment in over 99 percent of the series of trials. In that study, the first osteopathic examiner used a radioopaque skin pencil to mark the vertebral levels with the patient in the prone position. The marks were used by subsequent examiners and for radiographic examination. Each of the two to five subsequent examinations was made on the same patient on the same day within a two-hour period to identify osteopathic lesions which were present. The osteopathic lesion was identified as to the vertebral level(s), the side to which the lesion was attributed, and each examiner's estimate of level and the corresponding coded skin marker(s). A subsequent radiologic examination of the patient was used to identify the vertebral segment below each skin marking. The identification of osteopathic lesions by two or more examiners was considered to be in acceptable agreement if the identification of segments was allowed to vary by plus or minus one segment. The purpose of this study was to identify correlation between an experimental instrumental examination and the individual examiners. However, the invalidation of the instrumental examination technique resulted in discarding the material without publication. Because of the present interest in reliability of examinations, this personal experience is reported.[9]

Results

The data obtained in the study have been tabulated as regional or segmental somatic findings for either general patient conditions or for diseases involving specific visceral organs. These tables for all cases-all female cases, all "acute" conditions, all non-acute conditions, diseases affecting the body in general, and specific visceral disease-appear in the appendix. Six thousand, three hundred and fifty-eight (6,358) cases were included, with no racial or other selectivity. The average patient's age was 47 years, and 67 percent were female patients. The patients represented elective admissions to the Medicine and Surgery Services at COH. The diagnoses included 1,961 H-ICDA categories of disease, with 12,139 diagnoses. Most cases were coded for more than one diagnosis, but there may have been more conditions present than were indicated on the record. The coded conditions were verified by cross-reference to the source data in the medical record. The specific diseases that were tabulated included only those conditions for which more than 100 cases occurred. Conditions were classified as "acute" if there was direct evidence of visceral inflammation or ischemia. The list represents the expected conditions for elective admissions to Medicine and Surgery Services.

The results have been tabulated as frequency of somatic findings separated into regional and segmental groupings. This tabulation was then summarized in two ways. For general analysis of the data, the total somatic findings present in the table were used. The total findings for all cases were used as a reference for comparison. Most comparisons involved less than 5 percent of the total cases, and no corrections were applied to the reference base. In the analysis of specific visceral diseases, the data for segments in a specific region were totaled for comparison with totals for the same region on all cases. The data calculated from the summarized analysis is presented in Tables 1 through 4.

Discussion

It is evident from the results that the frequency of any one somatic finding in a region or segment does not predict the health status of the patient. It is also evident that there is no specific segmental relationship that will signal probable presence of a visceral disease. However, when the tabulated results are subjected to analysis which reflects consideration of visceral sensory input to the nervous system and possible influences of concomitant states of health, the results support the conclusion that somatic findings reflect the presence of visceral pain and related conditions.

Visceral pain is most commonly caused by inflammation or ischemia[10] Cases in this study were classified as "acute" when evidence of inflammation or ischemia was identified in vivo by the surgeon or internist, by the pathologist through tissue study, or the cardiologist from analysis of the ECG. The data on "acute" cases appears in line two, Table 1. In about 15 percent of the total tabulated cases, an "acute" condition was present. There was a 7-percent increase of total somatic findings in the "acute" cases when compared to the total somatic findings on all hospital patients. The 7-percent change would occur less than one time in a thousand as a result of a sampling error. Consequently, the increased findings in "acute" cases support the hypothesis of visceral pain being one cause for increased frequency of osteopathic findings.

Osteopathic physicians state that the chronically ill patient is less reactive during examination. Although chronic illness may cause either anxiety or depression,[11] it is possible that depression is more common in the hospitalized patient. It is also possible that the somatic tissue changes and responses to motion testing are less pronounced in non-"acutely" ill hospitalized patients. The tabulated data for all non"acutely" ill patients, about 85 percent of the cases in the study, had 1 percent fewer total findings than when all patients were considered. The data on chronic cases appear in line 3, Table 1. In patients with diabetes mellitus (line 4, Table l), there were 7 percent fewer total findings; in hypertensive patients (line 5, Table l), 9 percent fewer total findings than occurred in the totals for the whole study. The statistical significance of the three instances, representing the probability of the difference not being real, was between one chance per hundred and one chance per thousand. This analysis indicates that the influence of generalized disease is to reduce reactivity of the hospitalized patient's somatic system.

There are sufficient numbers of cases in our study with visceral pathologic condition in various body regions to answer the question," Do visceral organ pathologic conditions increase the frequency of somatic findings in segmentally related somatic tissue?"

The vagal visceral afferents are assumed by osteopathic physicians to affect synaptic transmission in the cervical spinal cord. The results in cases of sinusitis and tonsillitis (Table 2)

OSTEOPATHIC RESEARCH RECORD
CHICAGO OSTEOPATHIC CENTER

PROJECT ______
SOURCE ______
CASE NO. ______
DATE OF RECORD ______

PATIENT NAME ______
ADDRESS ______
SOCIAL SEC. NO. ______
OTHER INFORMATION: ______

PATIENT DATA

1	SOURCE 1	CASE NO. 2–7	SOCIAL SECURITY NO. 8–16	◀ IDENTIFIER	
17	EXAM NO. 18–20	DR.CHGE. 21–23	SER. 24	ADMIT DATE 25–30	RELEASE DATE 31–36; SEX 37; RACE 38; REL. 39; BIRTH DATE 40–46
	DIAGNOSIS 51–56	DIAGNOSIS 57–62	DIAGNOSIS 63–68	DIAGNOSIS 69–74	DIAGNOSIS 75–80
2 / 17	HISTORY 18–23	HISTORY 24–29	HISTORY 30–35	HEIGHT 36–37; WEIGHT 38–40	BLOOD PRESSURE 41–46

OSTEOPATHIC EXAMINATION

EXAM.DATE 47–52	EXAMINER 53–55	TYPE 56	MAS. 57	SHOUL. 58	SCAP. 59	ILIAC. 60	TROCH. 61	SACR. 62	POSTURE

FLEX. EXTEND C / T / L	LAT. FLEX. C / T / L	ROTATION C / T / L	
63 / 64 / 65	66 / 67 / 68	69 / 70 / 71	LIMITATION OF ACTIVE MOTION
72 / 73 / 74	75 / 76 / 77	78 / 79 / 80	LIMITATION OF PASSIVE MOTION

Card	CERVICAL 1234567	THORACIC 123456789101112	LUMBAR 12345	S	COMMENTS
3 / 17	SCOLIOSIS 18–24	STANDING 25–36	37–41	42	43–49
	SCOLIOSIS 50–56	FLEXION 57–68	69–73	74	75–80
4 / 17	18–24	A–P CURVES 25–36	37–41	42	43–49
	50–56	SWEATING 57–68	69–73	74	75–80
5 / 17	18–24	PIGMENTATION 25–36	37–41	42	43–49
	50–56	TEMPERATURE 57–68	69–73	74	75–80
6 / 17	18–24	VASOMOTION 25–36	37–41	42	43–49
	TISSUE 50–56	CHANGE 57–68	69–73	74	75–80
7 / 17	MUSCLE 18–24	TENSION 25–36	37–41	42	43–49
	INTERVERT 50–56	EBRAL TENDERNESS 57–68	69–73	74	75–80
8 / 17	LATERAL 18–24	PROCESS TENDERNESS 25–36	37–41	42	43–49

COSTOVERTEBRAL TENDERNESS	RECENT PAIN S F N C B A L AR FA H T L F	SOM. INVOL.	TYPE
50–61	62 63 64 65 66 67 68 69 70 71 72 73 74	75–77	78–80

Fig. 1. *Example of medical record used to obtain data for this study.*

support this concept of cervical involvement in the somatic tissues innervated from the third to the sixth cervical segments. compared to the somatic findings in all hospital patients, there was a 9½ percent increase in the findings in sinusitis and an 181/2 percent increase in tonsillitis. Both increase are highly significant, with praactically no chance of the differences being related to sampling. Disease in visceral tissues of the head, the liver, and the esophagus are accompanied by increased somatic findings in the cervical region.

The visceral afferents from thoracic viscera not found in the vagus reach the spinal cord via sympathetic nerves T1 to T4. Data on visceral organs related to the spinal segments appear in Table 3. In the reported cases of bronchitis there is a loo-percent increase in frequency of somatic findings, T1 to T4, compared to the frequency reported for all cases. Chronic coronary disease and chronic heart disease were observed to have a similar increased frequency of findings in the upper thoracic region, although not as dramatic as the increase that was seen in bronchitis. There is a major difference between the bronchitis and heart conditions in that bronchitis was a diagnosed condition during the hospital stay, whereas the cardiac conditions did not always represent the presence of an acute episode during hospitalization.

Visceral afferent fibers from most abdominal viscera enter the spinal cord from the splanchnic nerves. The data for increased frequency of findings related to disease of abdominal viscera appear in Table 4. Data from acute appendicitis and gastric ulcer cases do not fit with the general pattern of an increased frequency of somatic findings associated with visceral pathologic condition, Acute appendicitis, representing cases scheduled for surgery and observed by the surgeon and/or pathologist to have an inflammatory involvement, had fewer findings in the somatic tissues related to spinal cord segments T5 to T12 than were present in the same segments of all patients studied. Similarly, gastric ulcer, representing cases in which radiologic evidence confirmed the internist's diagnosis, had a decreased frequency of findings in the segmentally related somatic tissues. Other conditions in abdominal viscera (gastritis, duodenal ulcer, pyelonephritis, chronic appendicitis and cholecystitis) has significantly higher frequencies of total somatic findings in areas segmentally related to visceral afferent inputs, T5 to T12. It was also noted that in the original data on chronic appendicitis, the findings reflected increased left-side frequencies, while cholecystitis findings reflected increased right-sided frequencies of somatic findings. although the evidence is not as clear-cut because the acute appendicitis and gastric ulcer cases do not fit the general pattern, the increased frequency of findings for somatic tissues related to spinal segments T5 to T12 supports the theory of visceral afferents influencing facilitation of spinal cord synaptic transmission. There is also strong supporting evidence for visceral afferent influence on facilitation from the increased right-sided frequency in cholecystectomy and increased left-sided in chronic appendicitis.

The visceral afferent fibers which originate in pelvic visceral organs and in caudal portions of the gastrointestinal tract reach the spinal cord segments from T10 to S3 via parasympathetic rami and somatic nerves. In patients with salpingitis, an increased frequency of somatic findings was noted in segments T9 to L3. The patients with cervicitis had increased frequency of muscle tension in the same areas, T9 to L3. These increased frequencies of somatic findings represent less than one chance in five hundred of increase being related to sampling error. As in the previous visceral disease conditions, the segmental relation of pelvic organs is shown to relate to a specific segment of the spinal cord.

The analysis of data from the 10,000 cases for selected conditions in which more than 100 cases were available support the theory that stimuli arising from visceral organs resulted in facilitation of synaptic transmission in segmentally related spinal cord segments and that the presence of facilitation is reflected in somatic tissue changes. The lack of highly specific segmental relationship between viscera and somatic tissue could be attributed to many factors. The accuracy of locating findings by the examiners may cause some dispersion in the data. More experienced examiners might have been more specific in selecting the segmental location of findings or in localizing the origin of findings which extend over several segments. Also, there is more variability in visceral neuroanatomy than in somatic neuroanatomy, and this variability in the termination of visceral afferents in different individuals over several segments could

TABLE 1. COMPARISON OF FREQUENCY OF OSTEOPATHIC FINDINGS IN "ACUTE" AND IN CHRONIC CASES WITH FREQUENCY OF OSTEOPATHIC FINDINGS IN *ALL* CASES.

	Total (percent)	Average frequency (percent)	Confidence level (percent)
All cases	100	22.9	—
"Acute" cases	13	24.3	Above
Chronic	85	22.7	Less than 5
D.M.	2.9	21.5	Less than 1
Hypertension	5.4	20.8	Less than 0.1

TABLE 2. COMPARISON OF FREQUENCY OF OSTEOPATHIC FINDINGS IN CERVICAL SEGMENTS C3 THROUGH C6 BETWEEN *ALL* CASES AND CASES OF TONSILLITIS AND SINUSITIS.

	Total (percent)	Average frequency (percent)	Confidence level (percent)
All cases	100	30.6	—
Tonsillitis	2.7	33.5	Less than 0.1
Sinusitis	2.1	36.3	Less than 0.1

TABLE 3. COMPARISON OF FREQUENCY OF OSTEOPATHIC FINDINGS IN THORACIC SEGMENTS T1 THROUGH T4 BETWEEN *ALL* CASES AND CASES OF BRONCHITIS AND OF CARDIAC ISCHEMIA.

	Total (percent)	Average frequency (percent)	Confidence level (percent)
All cases	100	9.6	—
Bronchitis	1.18	20.7	Much less than 0.1
Cardiac ischemia	3	14.3	Less than 0.1

TABLE 4. COMPARISON OF FREQUENCY OF OSTEOPATHIC FINDINGS IN THORACOLUMBAR SEGMENTS IN *ALL* CASES VERSUS VISCERAL DISEASE IN ABDOMINAL VISCERA.

	Total (percent)	Average frequency (percent)	Confidence level (percent)
All cases	100	25.2	—
Gastric ulcer	1.3	23.6	Less than 5
Appendicitis			
acute	1.0	23.7	Less than 5
chronic	.65	26.9	About 1
Gastritis	1.1	33.1	Less than 0.1
Pyelonephritis	1.6	26.8	About 1
Duodenal ulcer	1.2	28.4	Less than 0.1
Cholycystitis	3.4	29.4	Less than 0.1

result in different viscerosomatic relations among patients.[13] Recruitment which occurs when continued stimulation of spinal neurons is present would also account for spread of facilitation of synaptic transmission to both the ipsilateral and contralateral spinal segments. There is no conclusive evidence in the present study to support any or all of these factors contributing to multisegmental relationships between somatic findings and visceral pathologic conditions. However, the interpretation is consistent with present knowledge of anatomy and physiology.

The reduced frequency of findings in chronic disease supports the concept of a reduction in general reactivity in such conditions, although these effects need further study. There are increased somatic findings present after surgical removal of the appendix or the gallbladder. These are unexpected results which may deserve further study by persons interested in the role of afferent impulses or their absence in nervous system function, or in the role of spinal cord learned engrams as causes of physical signs. The data suggest that more information concerning somatic findings-on temporal relationships and on the specific qualities of the somatic findings-will provide further tests of the osteopathic concept on viscerosomatic relationships.

The results provide evidence that there are many influences which modify somatic findings. There is an increase in the occurrence of somatic findings in segmentally related tissues in the presence of a visceral pathologic condition. Also, findings are present even when there is no evidence of a visceral pathologic condition. Conditions which affect the entire body, such as metabolic or generalized circulatory conditions, decrease the frequency of somatic findings. The multiple influences related to the presence of somatic findings suggest that, in addition to facilitation, recruitment, variability of visceral-afferent innervation, and learning of physical signs should be included in osteopathic theories of disease. Osteopathic physicians should recognize that in osteopathic diagnosis, like all other diagnoses, multiple factors related to a finding and the occurrence of false-positive findings prevent unequivocal interpretation of somatic findings.

In this paper, the method used to present the results of this study and to organize the discussion relied on an extension of the basic concept of facilitation, and considered additional influences mediated within the nervous system and via circulation. The segmental motor nerves exert both a trophic influence and control skeletal muscle function, circulation, sweating, and piloerection in somatic tissues.[14] Facilitation of the motor control will be apparent in at least three functional states of the controlled tissues.[15] The most obvious influence of facilitated motor control is apparent in the tonic activity when there is continuously activated function present. During continuous activity, facilitation would increase muscle tone and increase vasomotor tone. A second state related to facilitation would be evident when motor responses are initiated. In this state, facilitation is apparent as an increased responsiveness. This increased responsiveness would appear as hyperreflexia in skeletal muscle and increased reaction in pilomotion, sudomotion, and vasomotion. Because both inhibitory and excitory controls are exerted by autonomic motor fibers, facilitation can be expected to cause more pronounced visceromotor action or decreased visceromotor action, dependent upon the type of control. In a third and more complex situation, facilitation should be apparent during integrated motor activity. Synapses of feedback control loops lie within spinal cord segments, and errors in motion would be predicted on the basis of increased impulse traffic in the feedback control loops. Effector controls and effecters are modified by several states of health. Psychosomatic influences are well known, and the possible anxiety or depression which may accompany generalized disease or be present in other conditions, probably act on somatic motor controls. The reaction of the somatic motor system and the somatic motor control system to general states of health are to be expected. This discussion does not purport to provide definitive support for the foregoing statements; however, it does reflect on the question, "What is the influence of visceral and general disease states on the frequency of findings obtained during an osteopathic examination?"

Conclusion

The somatic findings present in over six thousand cases of hospital patients support the osteopathic theory of viscerosomatic relationships. The mechanism of facilitated transmission within the spinal cord is a rational basis for the theory, particularly when other factors are also assumed to modify synaptic transmission.

Addendum

In 1974 one of the authors (AFK) collaborated with an ad hoc Committee of the American Academy of Osteopathy to standardize osteopathic examination and records for the purpose of developing clinical research. The component method of examination as reported (AFK, this paper) (M. Hoag, personal communication) is not usable because it increases the frequency of false-positive diagnosis of somatic dysfunction. It is also a very lengthy examination, requiring 20 or more minutes for the detailed examination and extensive recording. The Committee agreed to using general descriptors, restricted motion, structural asymmetry and tissue change (op. cit.) rather than the specific findings, and agreed to develop a screening examination and concise method of recording. Although several screening examination procedures were tried and several recording systems were proposed, it was impossible to reach aconsensus or agreement on a procedure for examination or a method of recording.

The experienced physician zeroes in on an area and/or segment of somatic dysfunction and validates his initial decision by the presence of concentration and severity of individual findings which persist even though posture is changed and extensive examination procedures are used which might alter findings. The experienced examiner also utilizes the response to manipulative treatment to verify his diagnosis. Each examiner utilizes different signals to zero in on somatic dysfunction, and there is wide variation in their subsequent effort to validate their initial decision. It would appear that for research purposes a trained cadre of examiners will be required and that reliance on usual osteopathic physicians' records will not be suitable. The record of somatic dysfunction should reflect location, side(s), presence or absence of major descriptors of somatic dysfunction, and possibly acute or chronic nature and severity.

Research on diagnosis and treatment of somatic dys-

function may lead to adopting a research procedure as the standard procedure for examination and recording as an alternative to efforts by groups within the osteopathic profession and by the profession adopting a standard procedure **and record. Stan**dardization has few disadvantages which neither individually nor collectively outweigh the rapid progress which is possible professionally and in research once a standard is established.

Thefollowing individuals are recognizedfor their assistance in the project: research assistant, Ms. Alice M. Townsend; computer programmers, Messrs. Lawrence Anderson, Mark Lovik, and Roger Grant; computer operators, Ms. Rochelle Katz and Mr. Richard Jablonski; and the student-physician examiners and osteopathic physicians who participated.

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Supported by grant no. T6257 through the AOA Bureau of Research.

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An osteopathic method of history taking and physical examination: Part II

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A method of collecting data by history taking and physical examination that lends itself to holistic evaluation of the patient is organized around neurologic, nutritional-digestive, endocrine, psychologic, circulatory-respiratory, genitourinary-psychosexual, and musculoskeletal models. To conserve the physician's time, all the examinations that can be done with the patient in a single position are grouped, and observations are dictated at once to an assistant to acquaint the patient with normal and abnormal results. Although the procedures seem lengthy as described, they can be carried out in a visit of reasonable length.

Physical examination

A routine for examining the patient should offer the examiner an efficient method of obtaining information about the patient with as few position changes by the patient as possible. The examiner may choose to record findings by anatomic regions or in the order of examination.

Evaluation of the musculoskeletal system is incorporated into the traditional physical examination for various anatomic areas in each patient position. The methods and sequences offered are not the only possibilities available to the physician. However, a few comments regarding principles of spinal mechanics, of motion testing, and of strength testing may clarify some of the examination procedures to be described in this paper.

Spinal mechanics

The major spinal motions to be examined are forward and backward bending, side bending (lateral flexion) right and left, and rotation right and left. Motion of a superior vertebral segment is described in terms of the segment below it.

These motions combine physiologically in a logical and predictable manner. When the spine is in neutral, as in standing or sitting, the ventral surface of the body of each vertebra will rotate to the side opposite the side bending. The vertebral bodies tend to crawl out from under the load, and this pattern of function usually occurs in multiple segments or groups.

When the spine is backward bent, the facetjoints should close, and the individual segment will rotate and side bend to the same side. When the spine is forward bent, the facetjoints should open, and the individual segment will rotate and side bend to the same side.

Physiologically, the joints should return to their "normal" position when a neutral posture is resumed. However, dysfunction may occur when ligaments and muscles attached to and affecting vertebral articulations are shortened or lengthened, restricting motion of one or more segments.

In order to determine the behavior of individual vertebral segments to introduced motions, the spinal examination may be done with the patient in neutral, forward bending, and backward bending. In each case the examiner will determine the direction of vertebral rotation by inspecting and palpating the transverse processes. The transverse process will be more posterior on the side toward which the vertebra is rotated. Knowing the principles of spinal motion as just described, the examiner can determine the side toward which the vertebra is side bent.

If the patient is examined in neutral position and one or more segments are rotated to one side, side bending will be to the side opposite the rotation. If the patient is examined in forward bending, the segment which is rotated will be side bent to the same side and that segment will have lost its side and that segment will have lost its ability to bend forward and is described as backward bent or extended.

Similarly, if the patient is examined in backward bending, the segment which is rotated is unable to bend backward, is described as forward bent or flexed, and is rotated to the same side.

A positional description of the three vertebral joint motions implies restriction of motion in the opposite direction.

Motion and strength testing

Ranges of motion for a given articulation may be recorded in degrees, and the comparable measurement for the opposite side is noted. An understanding of the barrier concept is helpful at this point. When the examiner passively tests a joint for range of motion, he will note increasing resistance to motion, often called a bind. This initial resistance to motion is described as the physiologic motion barrier. It is possible to carry the joint beyond that point, but the added motion usually is uncomfortable to the patient. This is called the anatomic motion barrier. In evaluating passive range of motion, the examiner should be interested in the degrees of motion up to, but not through, this motion barrier.

When asymmetry of range of motion is noted, it must be determined whether the side with greater motion is weak or the side with less motion is short.

Length testing. Length testing of a muscle or muscle group is accomplished by passively carrying the joint through a range of motion until the motion barrier is encountered and noting the degrees of permitted motion.

Strength testing. Strength testing of a muscle or group is accomplished by first carrying the joint to the extreme of motion permitted by the antagonist muscles, and then the examiner resists an active maximum effort by the patient to contract the muscles. The examiner notes the side of weakness. (Strength testing procedures are not included here because individualized instruction in these procedures is desirable. They are recommended for almost all the joints of the larger extremities except the sternoclavicular.)

The examiner may use many of his senses in evaluating the patient. Auscultation requires acute hearing on the part of the examiner. The patient's voice, as mentioned earlier, offers many clues to dysfunction or disease. Olfactory functions assist in making diagnoses. Palpation involves feeling tissues with the hands to detect changes of temperature, moisture, texture, tension, vibration, and position. The pads of the fingers are most sensitive for fine tactile discrimination, and require a light touch. The dorsal surfaces of the hands are more sensitive to temperature changes, while the palmar surfaces of the metacarpophalangeal joints are more sensitive to vibratory changes. The center of the palm is sensitive for gross shape recognition.

The examiner's peripheral vision is used for evaluating both sides of the body simultaneously, as in assessing bilateral motion of the rib cage. The examiner should know if he has a dominant eye, and if so, should always examine the reclining patient with his dominant eye over the midline of the patient's body. Eye dominance may be determined by the following steps:

(1) Hold the index finger of the right hand at arm's length directly in front of the nose at the level of the eyes.

(2) Approximate the tips of the left index finger and thumb as if to form a circle.

(3) Place this circle directly in front of the nose about elbow distance away.

(4) Sight in the tip of the right index finger in the middle of the circle, using both eyes.

(5) Close the left eye to see if the right index finger stays in the middle of the circle. If so, the right eye is dominant.

(6) Close the right eye and see if the right index finger stays in the middle of the circle. If so, the left eye is dominant.

No attempt has been made to design a physical examination form upon which to record findings. The reader may easily adapt the principles of the examination to be described to his present methods of recording.

Mechanics of patient evaluation

Lest the length of this paper imply that patient evaluation is equally lengthy, the method of evaluating patients in my office will be described. As with any new method or technique, the physician must determine how he can adapt it best to his present way of conducting practice.

In my practice all patients who are to receive a complete physical examination are scheduled to appear a minimum of 30 minutes prior to the time they are placed on my schedule. During this time, one of my nurses interviews the patient and compiles vital statistics. a history of chief complaints and habits, dietary history, past history of surgery, illnesses, immunizations, drug therapy (past and present), accidents, and allergies, the family history, and a review of systems in the traditional manner.

A total of 45 minutes is allotted on my schedule for seeing a new adult patient, and 30 minutes for a recall physical examination or seeing a new child or adolescent patient. Often I have an opportunity to review the written history or receive an oral synopsis from the nurse prior to meeting the patient, but the written record is reviewed in the presence of the patient, and at this time additional questions, many of them relating to the various models discussed in this paper, are asked. All models do not apply to all patient histories, but a flow of questions and answers will lead the examiner in and out of several systems or models. Opportunity is given the patient to add to information given to the nurse, especially in terms of confidential information which may not have been shared with a paraprofessional. This method of history taking has met with little resistance from my patients. The reader has or will develop his own method of gathering historical data. The important point is to take the time to integrate the answers in relation to osteopathic principles. After the history is reviewed the patient is escorted to the examination room, where the physical examination is performed in a routine designed to evaluate most efficiently all parts of the body with the fewest possible changes of position by the patient. This requires evaluating some of the anatomic areas out of sequence, but assures thoroughness.

My findings are dictated to my assistant in the presence of the patient, with a few exceptions. This serves two purposes: (1) it is an efficient and accurate method of recording findings in more detail than the examiner might write or dictate later; and (2) it affords an opportunity openly to acquaint the patient with normal or abnormal findings. My assistant will have underlined in red pencil those findings which vary from normal, thus facilitating identification of problems when I review the record. There is time to explain to the patient what I am doing and answer questions about abnormal findings or what those long words mean! If it is likely that the discussion will be too lengthy, I do not evade questions, but reply that there will be opportunity later to discuss physical findings in detail as they relate to history, laboratory tests, and other diagnostic findings.

All adult patients scheduled for the morning are instructed to come after a 14-hour fast, so that blood specimens may be drawn for the indicated chemical studies at the time of the initial visit. Recall patients are advised in advance whether they need to come fasting. Those scheduled for the afternoon are advised that it may be necessary to return fasting at a later date. In addition to laboratory studies, indicated x-ray and other diagnostic studies are scheduled for the patient. My assistant will have completed checking off the procedures on the "pink slip" (Fig. 1), which will assist my secretary in being sure that the results of all tests are returned before the patient is advised of findings.

Prior to dismissing the patient at the time of examination, a problem list or tentative diagnoses are dictated by me and recorded by my assistant in the patient's presence. These problems are discussed briefly with the patient, and this opens the way to a summary of the plan for diagnostic procedures and advice on the treatment indicated, if any. The patient is given an opportunity to ask questions or offer additional information. He is told when and if a return visit should be scheduled, or whether he will be advised of test results by telephone or mail. If no return visit

Chart # ______	X-rays:	Consultation
Date ______	C spine ______	Dr. ______
ESR ______	L spine ______	
CBC ______	T spine ______	Time ______
Medscreen ______	LS and Pelvis ______	
Pap ______	erect ______	Place ______
UA ______	recumb ______	
T4 ______	Chest ______	
Triglycerides ______	Up GI ______	
Cholesterol ______	GB ______	
Other ______	Ba enema ______	
	Skull ______	
Cultures	IVP ______	
vag ______	Mammogram ______	
throat ______	Other ______	
urine ______		
stool ______		
sensitivities ______		
Nickerson's ______	EKG ______	
vag ______	EEG ______	
throat ______	Isotopes ______	
Advise by mail Phone NA		

Fig. 1. *"Pink slip" for checking off procedures during examination.*

is anticipated, an effort is made to discuss fully the information gained from the history and physical examination. The patient is asked if he wishes to be placed on recall for his next examination. If so, I have a method of accomplishing this.

If a return visit for discussion of problems is scheduled, the information already gained is reviewed at that time, along with significant historical and physical information, a detailed discussion of laboratory and x-ray reports, which the patient usually is permitted to see, and an outline of the plan for management of his problems. The patient is given an opportunity to share in the decision as to the recommendations he is willing to follow.

A large proportion of the mechanical work relating to the aforementioned procedures is performed by my assistants, who also share in the responsibility of advising patients of results and recalls and in patient education. I encourage my staff to share their valued observations and opinions with me.

Sequence of physical examination

I. With patient seated

A. *General appearance.*

1. Nourishment: average weight, underweight, mild or marked obesity
2. Emotional state: depressed, anxious, apparently normal, with bizarre reactions, tense, other
3. Attitude: belligerent, cooperative, frank, friendly, unfriendly, evasive, sulky, other
4. Level of consciousness: attentive, alert, stuporous, drowsy, out of contact
5. Thought content: preoccupation, fixed ideas, illusions, delusions, hallucinations
6. Intellectual performance: memory of past event immediate memory, orientation, abstract reasoning.

B. *Skin.*

During the course of examination, skin of all areas of the body will be observed or palpated for the presence of dryness, oiliness, scaliness, hyperhidrosis, tenderness, petechiae, purpura, ecchymosis, rash, papular eruptions, telangiectasis, herpes, seborrheic dermatitis, eczema, urticaria, cyanosis, eruptions, pustules, carbuncles, furuncles, tumors, crepitus, texture, erythema, and coldness.

C. Head.

1. Skull: exostoses, masses, swelling, ridging of sutures, state of fontanelles
   a. Normal: brachycephalic, mesocephalic, dolichocephalic
   b. Lesioned: flexion, extension, torsionside-bending rotation, intraosseous, traumatically induced asymmetry
2. Scalp: inflammation, dermatitis, alopecia, distribution of balding
3. Facies: adenoidal hepatica, hippocratica, masklike, myxedematous, myopathic, abdominalis, aortic, mitral, acromegalic, agitated
4. Facial muscles (Table 3 outlines this examination, to be carried out if indicated).

D. *Ears.*

1. Tympanic membranes, external canals
2. Auricles: tophi, skin lesions
3. Hearing: spoken voice, watch ticking (audiogram if indicated).

TABLE 3. EVALUATION OF FACIAL MUSCLES.

Instruction to patient	Muscle involved	Nerve involved
Close eyes tightly	Orbicularis oculi	VII
Raise eyebrows	Occipitofrontalis	VII
Draw eyebrows medially and downward	Corrugator supercilii	VII
Lift upper eyelids as eyes look upward	Levator palpebrae superioris	III
Look up and to right	Obliquus oculi inferior, right	III
	Rectus oculi superior, left	III
Look up and to left	Obliquus oculi inferior, left	III
	Rectus oculi superior, right	III
Look down and to left	Obliquus oculi superior, left	IV
	Rectus oculi inferior, right	III
Look down and to right	Obliquus oculi superior, right	IV
	Rectus oculi inferior, left	III
Look to right	Rectus oculi lateralis, right	VI
	Rectus oculi medialis, left	III
Look to left	Rectus oculi lateralis, left	VI
	Rectus oculi medialis, right	III
Lift lateral borders of nostrils (distaste)	Procerus	VII
Flare nostrils	Dilatator naris posterior, anterior	VII
Compress nostrils	Nasalis	VII
Approximate and compress lips	Orbicularis oris	VII
Protrude upper lip	Levator labii superioris	VII
Lift upper border of lip on one side without raising lateral angle of mouth	Levator anguli oris	VII
Smile	Zygomaticus major	VII
Grimace	Risorius	VII
Approximate lips and blow	Buccinator	VII
Protrude lower lip (pout)	Depressor labii inferioris	VII
Draw corners of mouth down strongly	Depressor anguli oris, platysma	VII
Draw tip of chin upward	Mentalis	VII
Close jaws tightly	Temporalis, masseter, pterygoideus medialis	V
Move mandible laterally forward and right	Pterygoideus lateralis, medialis, left	V
Move mandible laterally forward and left	Pterygoideus lateralis, medialis, right	V
Depress mandible	Digastricus, suprahyoid muscles	V, VII, CI

E. *Eyes.*

1. Orbit: variation in size of right and left
2. Eyelids: edema, inflammation, retraction, elevation, xanthoma
3. Pupils: size, reaction to light, accommodation
4. Eyeballs: exophthalmos (unilateral or bilateral), analgesia
5. Lenses: cloudiness, opacity
6. Sclera and conjunctiva: inflammation, foreign bodies, pterygium
7. Peripheral vision
8. Visual acuity: Snellen chart with and without glasses, reading ordinary newsprint
9. Color vision
10. External ocular muscles (if not previously examined with facial muscles)
11. Ophthalmoscopic study: optic disks, vessels, perphery of retina, hemorrhage, edema
12. Tonometry of patients aged 39 years and more (may be done with patient reclining)

F. Nose.

1. Nares: fissures, ulcers, tumors, inflammation
2. Septum: deviation (traumatic or developmental), perforation, ulcers
3. Mucosa: inflammation, edema, polyps, secretions (clear, yellow, bloody, crusted)
4. Ventilation: with one of nostrils closed, the patient is asked to blow through the other nostril. Repeat on opposite side and the examiner compares air flow on the two sides.

G. *Mouth.*

1. Lips: herpes, cheilosis, cyanosis, tumors, pallor
2. Teeth: location and number of restorations extractions, bridges, partial plates, dentures, development and eruptions, tartar deposits, stain, discoloration, caries, bite, overbite, underbite deviation from midline
3. Gingiva: retraction, inflammation, infection, edema hypertrophy, bleeding, ulceration
4. Mucosa: leukoplakia, vestibules from parotid ducts
5. Cheeks: palpation of parotid glands
6. Sublingual area: palpation of floor of mouth (nodes, sublingual and submandibular salivary glands), freulum
7. Tongue: inflammation, trauma, taste buds, geographic markings, coating, tumors
8. Hard palate: posterior contour, inclination of alveolar process flare, exostoses, ulceration from dentures
9. Soft palate: deviation of uvula with phonation, inflammation, absence

H. *Throat.*

1. Tonsils: enucleation, inflammation, enlarge ment, injection, crypts, pus, caseous plugs
2. Tonsillar fossae: scar tissue, tags, imbeded tags
3. Pillars: inflammation, injection
4. Pharynx: granulation, inflammation, injec-

tion, edema, or purulent postnasal discharge
5. Larynx: epiglottis, vocal cords

I. Speech (refer to history).

J. *Neck.*

Cyanosis of neck and head, engorgement of neck veins unilaterally or bilaterally, enlargement of anterior and posterior cervical and supreclavicular nodes, supraclaviclar fat pads

1. Thyroid: enlargement, nodules, tenderness, mobility, texture
2. Cartilages: mobility
3. Thoracic outlet: crowding and tenderness
4. Carotid arteries: pulse quality, tenderness, bruit
5. Cervical spine: palpation posterior and anterior to transverse processes to localize tenderness of segmental nerve roots, gross ranges of motion of cervical spine (rotation right and left, side bending right and left, forward bend ing and backward bending).

While facet motion, or restriction of motion, is often evaluated in the supine position, it may be easier for the examiner to palpate facets opening and closing if passive motion of C2-7 vertebral segments is tested in the seated position. The pads of the thumb and third finger of one hand are placed posteriorly on the neck over the articular pillars. With the other hand, the examiner passively introduces lateral flexion right and left successively in forward bending neutral and backward bending positions. If side bending restriction is palpated, rotation will be restricted in the same direction at the C2-7 levels.

Atlantoaxial motion may also be tested in the seated position by standing in front of the patient, forward bending the patient's head until motion is felt at the atlantoaxial segment, and then rotating the head right and left. Degrees of rotation from midline should be recorded.

K. Thorax.

1. Heart rate and pulse rate: arrhythmias, pulse deficit, pulse quality
2. Heart: auscultation of valves and apex, intensity of sounds, murmurs, split sounds, accentuated sounds, point of maxi mum intensity, apex beat, percussion for cardiac dullness
3. Blood pressure: bilateral readings
4. Lungs: auscultation for normal, abnormal, or absent sounds, increased or decreased vo cal fremitus, friction rub percussion for areas of increased density and hyperresonance, res piratory rate, abnormal types of respiration
5. Posterior thorax: Murphy punch or Lloyd's sign, kyphosis

L. *Reflexes.*

1. Triceps: C6, 7, and 8
2. Biceps: C5 and 6
3. Brachioradialis: C5 and 6
4. Patellar: L2, 3, and 4
5. Achilles: S1 and 2
6. Babinski: pyramidal tract disease

M. Lower extremities.

1. Knees: For evaluation of the proximal fibular head the patient is seated on the examining table with legs hanging loosely. The examiner is seated in front of the patient, this approximation between his own knees. The examiner grasps the fibular heads bilaterally between his thumbs and index fingers and alternately pulls the fibular heads anteriorly and posteriorly, comparing motions bilaterally. The examiner then places the pads of his thumbs on the anterior aspect of the fibular heads and ascer tains whether the restricted fibular head is anterior or posterior to the other.

N. Upper extremities.

Joint enlargement, tremors (type), tenderness, deformity, measurements of circumference (if indicated), distension of bursae, stiffness, tophi, nodules, hypermobility, edema, masses or tumors, scars, temperature changes, cyanosis, pallor, gangrene

1. Sensory changes: pin prick, brush stroke, temperature, sensitivity to hot and cold
2. Fingernails: texture, thickness, ridges, clubbing, capillary blanching, filling
3. Ranges of motion, recorded in degrees of permitted motion. When asymmetry of joint motion exists, strength testing also should be performed for all joints except the sternoclavicular.
   a. Acromioclavicular: abduction, external and internal rotation of clavicle
   b. Glenohumeral (with humerus in anatomic position): flexion, extension, external and internal rotation of clavicle
   c. Glenohumeral (with humerus in horizontal position): horizontal abduction and abduction of humerus and scapula, external and internal rotation, and adduction
   d. Elbow: flexion, extension, pronation, supination
   e. Wrist: flexion, extension, abduction, adduction
   f. Hand: flexion and extension of interphalangeal joints

II. With patient standing

A. *General observations.* Tilt of head, level of ear lobes, heights of shoulders, scapular tips, iliac crests, gluteal folds (record caudad side): If iliac crests are unlevel the examiner may determine the amount of lift (or shim) required under the apparent short leg to produce leveling. The patient is directed to put his arms straight out in front (90-degree shoulder flexion) to detect winging of scapulae. Lateral spinal curves in neutral position: The direction of convexities, apices, and number of segments involved in each convexity should be noted. Anterior-posterior curves: Increase or decrease of cervical and lumbar llordosis and thoracic kyphosis are noted.

1. Body type: mesomorphic, endomorphic, ectomorphic
2. Weight distribution: comparison of width of thorax and lower part of trunk, andricity suggested by wider shoulders and gynicity if hips are wider than chest

B. *Standingforward bending (flexion) test.* Patient stands with knees extended, and with feet acetabular distance apart. Examiner places thumbs on inferior slopes of posterior-superior iliac spines. Patient is asked to bend forward slowly without bending knees, as if to touch toes. Examiner observes anterior-superior excursion of his thumbs, which are on patient's posterior-superior iliac spines, and notes if one side moves further in anterior-superior direction than the other. While the patient is in the forward bent position, the examiner should note degrees of trunk flexion, the posterior transverse processes of the lumbar and thoracic spine (viewing patient's back from a position at the patient's head), the relative posterior position of rib angles, and any change in lumbar lordosis, whether fixed, reversed, or minimal (see Seated forward bending test for interpretation).

C. Hip drop test. This test is a screening examination for the lumbosacral junction and is performed with the patient standing erect with the feet acetabular distance apart, toes pointing straight ahead, and the weight evenly distributed on the two feet. The examiner sits or squats behind the patient and palpates the highest point on the iliac crests. Then the examiner asks the patient to bend one knee and support his full weight on the opposite straight leg while maintaining erect posture of the rest of the body. The examiner observes the height of the skin fold on the convex side and the degrees of "hip drop" produced from the slope of the iliac crest as it drops from horizontal on the side that does not bear weight. This is repeated on the opposite side and a comparison made. In the absence of rotoscoliosis, there should be equality of side bending of the lumbar spine and the height of the skin folds when the hip drop tests of the two sides are compared. If there is rotoscoliosis, side bending will be restricted on the side of convexity, and the skin fold will be at a lower level on the side of concavity.

D. *Lower extremities.* Genu varum, genu valgum, distension of bursae, popliteal cysts, edema, cyanosis, varicosities, asymmetry of development, tophi, pallor, gangrene, hallux valgus, talipes cavus, and pes planus are observed.

E. *Romberg's sign.* Patient stands with feet close together and closes his eyes. If he is unable to maintain body balance the test is positive, and other cerebellar tests are indicated.

F. *Gait.* The patient is asked to walk in his usual manner, walk on heels, walk on toes, and walk tandem fashion, and obvious limping or dragging of a leg is noted, as well as whether knee flexion and extension are equal bilaterally and whether the patient has the ability to climb stairs. Limping, spastic, steppage, scissor, ataxic, staggering, and hemiplegic gaits may be observed.

III. With patient seated on a low stool

A. *General observations.* Lateral spinal curves in the neutral seated position are noted for convexities, apices, and the number of segments involved in each convexity. These observations are compared with those made with the patient in the erect neutral position.

B. *Seated forward bending (flexion) test.* The patient sits on a low stool with feet and knees shoulder width apart, knees flexed 90 degrees, and feet flat on the floor directly beneath the knees. The examiner places his thumbs on the inferior slopes of the posterior-superior iliac spines and asks the patient to bend forward and put his flexed elbows between his knees. The examiner observes the anterior-superior excursion of his thumbs on the patient's posterior-superior iliac spines and notes if one side moves more in an anterior-superior direction than the other.

1. Interpretation of standing and seated flexion tests: There should be minimal, but equal, anterior-superior excursion of the ilia as the sacrum moves cephalad with the spine during forward bending. If the ilium moves more in an anterior-superior direction on one side than the other during either the standing or the seated test, restriction of motion between the sacrum and the ilium is indicated, and theresult is called positive. The test is negative if excursion on the two sides is equal.
    a. If the test is positive only during standing, it points to iliosacral (lower extremity) dysfunction. If the test is positive in the seated position, sacro iliac dysfunction is suggested. If the test is positive both when the patient is standing and when he is seated, there may be dysfunction in both the lower extremity and the sacrum.

C. Otherfindings. While the patient is forward bent in the seated position, the examiner should note:

1. degrees of trunk flexion;
2. the posterior transverse processes of the lumbar and thoracic spine, observing location and degree of vertebral rotation, as the examiner looks down the spine from a position at the patient's head;
3. the relative posterior position of rib angles;
4. whether these findings are greater, less, or

unchanged when the patient is seated and standing in forward-bent position;

5. whether lumbar lordosis is fixed, reversed, or changed minimally with seated flexion, compared to standing flexion.

D. *Examination of upper thoracic vertebrae.* The examiner evaluates rotations of T1 to 3 vertebrae by placing his thumbs on the transverse processes of each of three upper thoracic vertebrae successively, while noting the relative posterior position of the transverse process on one side as the patient successively forward bends his head to the extreme, returns the head to upright neutral position, and backward bends the head to the extreme.

IV. With patient supine

A. *Cervical spine.* Gross ranges of passive rotation, side bending, and forward bending are determined. Individual segmental motion testing is performed as follows:

1. Occipitoatlanal: The examiner stands at the head of the table and asks the patient to bend his head backward. The examiner then asks the patient to tip his chin down toward his chest while the examiner observes whether the tip of the chin deviates frrom the midline. The chin will deviate to the side toward which the occiput.

2. Atlantoaxial: The examiner stands at the head of the table and bends the patient's head forward while palpating motion at the atlantoaxial joint bilaterally with fingertip, until locking occurs above and below that segment. The examiner then rotates the patient's head to one side and notes degrees of rotation from the midline and repeats the motion to the opposite side.

3. Cervical segments 2 to 7: The cervical spine may also be examined in the three postions of neutral and forward and backbending while the patient is supine. With the patient supine in each of these postions the examiner places the pads of his middle fingers lightly on the articular pillars of segment 2 to 7 successively, palpating for restriction of side- bending motion passively introduced by the examiner as he supports the patient's head in the palms of his hands.

B. *Temporomandibular joints.* The patient is asked to place the index, middle, and ring fingers of one hand between the upper and lower incisors, testing the ability to open the jaw widely. As the patient opens his jaw widely, the examiner notes any deviation of the chin from the midline. The examiner may also palpate the temporomandibular joints just anterior to the tragi, and while the patient opens the jaw widely, the examiner palpates for any asymmetry in the gliding movement of he mandibular condyles during opening and closing of the jaw.

C. Sternoclaviculur joints. The sternoclavicular joints have two major motions, abduction, in which the distal end of the clavicle moves superiorly and the proximal end slides inferiorly against the manubrium, and flexion, in which the distal end of the clavicle moves anteriorly and the proximal end glides posteriorly against the manubrium. To examine for dysfunction of these two motions, the examiner stands beside the patient, faces the patient's head, and performs the following:

1. The examiner places the pads of his index fingers lightly on the superior surface of the medial end of each clavicle and asks the patient to shrug his shoulders toward his ears. The examiner compares the inferior glide of the clavicular heads and notes the side which fails to move caudad.

2. The examiner places the pads of his index fingers over the anterior surface of the medial end of each clavicle and asks the patient to reach toward the ceiling. The examiner notes which clavicular head does not move posteriorly.

D. *Breasts and axillae.* The examiner looks for bilateral asymmetry, scars from incisions, dimpling, edema, inflammation, gross evidence of masses, and eversion, retraction, crusting, and discharge from the nipple. He palpates breasts and axillae for masses or enlarged nodes and tenderness (taking care to differentiate between tenderness of the breast and the rib cage) and teaches self-examination of the breast to female and male adults. While the examiner is carrying out the examination of the breasts, the assistant puts a topical anesthetic agent in the patient's eyes in patients 39 years of age and older in preparation for tonometry.

E. *Heart.* Auscultation is done with the patient supine and in left lateral position if indicated.

F. *Thoracic cage.* The examiner looks for depression of the sternum, depression or flaring of ribs, and developmental asymmetry. He compares excursion on the two sides and notes anteroposterior chest circumference during inhalation and exhalation.

1. Evaluation of excursion asymmetries during inhalation and exhalation of "bucket handle" and "pump handle" motions of the ribs is performed after asking the patient to inhale and exhale quickly and in an exaggerated manner. "Pump handle" motion is produced by the upward excursion of the ribs during inhalation and the downward excursion during exhalation. This increasing and decreasing of the anteroposterior diameter of the chest is the major motion of the upper six ribs and the minor motion of the lower six ribs. "Bucket handle" motion is produced by the outward flare of the ribs during inhalation, which increases the transverse diameter of the rib cage, and the reverse during exhalation. This is the major motion of the lower six ribs and the minor motion of the upper six ribs. To screen the rib cage for somatic dysfunction, the examiner places the palmar surfaces of his fingers lightly in the areas described in the

following paragraphs, observes excursion during inhalation and exhalation, and notes failure of the ribs to complete either phase of excursion.

2. For "pump handle" motion the examiner evaluates the first four ribs by placing the pads of his index fingers just lateral to the sternum with tips just touching the inferior surfaces of the clavicular heads. He studies the next three ribs by placing the palmar surfaces of his fingers on their sternal ends. To evaluate ribs six to ten he places the palmar surfaces of the fingers on their sternal ends just inferior to the xiphoid process.

3. For "bucket handle" motion he evaluates the first four ribs by placing the palmar surfaces of his hands over the pectoralis major muscle tendons, so that the lateral surfaces of the hands form 45-degree angles with the midclavicular line. For ribs five to seven he locates the sternal end of the fifth rib and follows that rib laterally with the index fingers. The palmar surfaces of his index, middle, and ring fingers are then spread along thelateral interspaces of the fifth, sixth, and seventh ribs. For ribs eight to ten, as for ribs five to seven, the examiner places the pads of his fingers in the intercostal spaces.

4. The sternum is evaluated during a threefold movement described as follows by Steindler[4]

a. a translatory perpendicular motion up and down;

b. a rotatory motion in the sagittal plane . . .which causes the end of the sternum to move forward and the lower to move backward;

c. another translatory movement in the sagittal plane which carries the whole sternum backward and forward.

The examiner may palpate these motions during inhalation and exhalation by locating the sternal angle, then placing the palmar surfaces of his fingers on the sternum so that the caudad fingers point toward the head and the cephalad fingers point toward the feet.

G. Tonometry. This examination is performed on all patients 39 years of age or older who have not had this examination in the previous year. As mentioned earlier, the assistant has placed a topical anesthetic agent in the patient's eyes while the examiner was doing the breast examination.

H. *Abdomen.*

1. Observation: Skin lesions, incision scars, masses, swelling, inflammation, adipose tissue, striae, and distribution and amount of pubic hair are noted.

2. Percussion: The size of the liver and spleen, flatulence, dullness, and the localization of pain which may be produced by percussion are observed.

3. Auscultation: The examiner notes either the absence or increase in peristalsis. He may ask the patient to hold the stethoscope head on the epigastric area while the examiner percusses the liver and spleen and listens for dullness.

4. Palpation: Tone and consistency of abdominal wall (rigidity, doughiness, softness, muscle tone, tenderness, and referral of pain with deep palpation), width of abdominal aorta, and femoral pulses are noted. Tenderness of the abdominal wall and abdominal visceral are differentiated by palpating the abdomen as the patient places his hands behind his head and attempts to do a partial sit up. Then the patient relaxes as the examiner palpates visceral structures and notes the location, size, and tenderness of palpable masses. Palpation for umbilical, ventral, inguinal, and femoral herniae is done as the patient places his hands behind his head and attempts to do a partial sit up.

5. Eliciting superficial reflexes: The skin of the abdomen is stroked with a moderately sharp object. In the upper part of the abdomen the seventh, eighth, and ninth thoracic segments are involved; in the lower part, the eleventh and twelfth.

I. *Pelvic landmarks. To evaluate* the anterior-superior iliac spines, the anterior and medial aspects as well as the inferior slopes are palpated, and the anterior-inferior and posterior-superior relations are compared bilaterally. Dysfunction is noted on the side of the positive standing forward bending (flexion) test. To study the pubic tubercles, their anterior and superior aspects are palpated lightly from 1/2 to 3/4 inch lateral to the symphysis pubis. If dysfunction is noted, it should be treated before other pelvic landmarks are examined. Dysfunction would also be on the side of the positive standing flexion test.

J. Mule *pelvis.* The scrotum is examined for skin lesions, incision scars, seminal vesicles, varicocele, and descent, size, tenderness and masses in the testicles. Transillumination is done for hydrocele and masses. The cremasteric superficial reflex is elicited to test involvement of T12 and L1. The penis is examined for chancre, ulcers, carcinoma, infection, urethral discharge, circumcision, and phimosis.

K. *Femal pelvis.* With the patient in lithotomy position, the external genitalia, labia, skin, and clitoris are studied for discharge, cysts, tumors, and congenital anomalies. After insertion of the vaginal speculum the appearance of the urethral orifice, the character of vaginal secretions, and the appearance of the vaginal mucosa and cervix are studied. The presence of cystocele, rectocele, or uterine prolapse is determined, and a Papanicolaou smear is taken. In the bimanual examination, the size, position, and tenderness of the uterus, the size and tenderness of the ovaries, the tenderness of the tubes, the presence of masses in the pelvis, and tenderness of the urinary bladder and urethra are determined. The lateral pelvic walls and diaphragm are palpated for tenderness and increased tension.

L. *Rectum. The lithotomy position is suitable for both female* and male patients. The left lateral Sims position is an alternative for males. Anoscopic examination is done for hemorrhoids, fissures, polyps, and inflammation. Digital examination determines sphincter tone, masses, tenderness, mobility and contour of the coccyx, and sacrococcygeal tenderness. The sacrotuberous ligaments and coccygeus muscles are compared bilaterally for tension and tenderness, and the size, consistency, tenderness, and presence of nodules in the prostate are determined.

M. Lower extremities.

1. Hips: Degrees of permitted motion are measured during abduction, adduction, flexion, internal rotation with hips and knees flexed 90 degrees (lateral movement of the foot from the midline is measured), externa! rotation with hips and knees flexed 90 degrees (medial movement of the foot from the midline is measured), internal rotation with hips and knees extended 180 degrees, and external rotation with hips and knees extended 180 degrees. To measure permitted extension, the patient is supine with his knees past the end of the table, and the examiner passively flexes both of the patient's knees and hips, and asks the patient to grasp and support one knee to maintain the flexed position. The examiner places one palm under the other thigh to support it as the hip is extended and looks for inability of the patient to let the leg lie flat on the table surface. This is repeated with the other leg. If both legs can lie flat on the table, the iliopsoas muscle is assumed to be of normal length. If either or both legs will not lie flat on the table, the iliopsoas muscle is shortened.

2. Knees: General observations are made of patellar mobility, distention of the prepatellar and suprapatellar bursae, swelling of the medial and lateral menisci, enlargement of the tibia1 tuberosity, and atrophy of muscles. The abduction test is made with the patient's knee flexed and the femur stabilized laterally. The examiner attempts to abduct the lower leg. If pain is produced laterally, the lateral meniscus is usually its origin. If pain is produced medially, there is usually strain of the medial collateral ligament. The adduction test is done with the knee flexed and the femur stabilized medially, while the examiner attempts to adduct the lower leg. If pain is produced laterally, the lateral collateral ligament is usually the origin. If pain is produced medially, the medial meniscus may be its origin. The drawer test is done with the knee flexed 90 degrees and the foot resting on the table while the examiner stabilizes the foot by sitting on it. The examiner attempts alternately to pull and push the tibia forward and backward. Increased forward excursion points to instability of the anterior cruciate ligament. If there is increased backward excursion, there is instability of the posterior cruciate ligament.

3. Ankles: Palpating the inferior slopes of the medial malleoli, the examiner determines whether one is more caudad than the other (this may be determined also with the patient prone). The medial, anterior, and lateral portions of ankle joint are palpated, and the distal portion of the fibula is studied with the patient supine on the table with his knees flexed and his feet flat on the table. The examiner places the heel of one hand anterior to the medial malleolus and the other thenar eminence behind the lateral malleolus. Simultaneously he brings the medial malleolus backward and the lateral malleolus forward, noting resistance and the positions of the malleoli. The examiner then reverses his hand positions to bring the medial malleolus forward and the lateral malleolus backward, noting resistance and positions of malleoli. This is repeated with the other ankle and the two sides compared.

V. With patient prone

A. *Rib* cage. The examiner places his index and middle fingers along the eleventh and twelfth ribs, asks the patient to inhale and exhale deeply, and observes whether the ribs complete inhalation and exhalation excursions. Then the patient is instructed to place his palms under his anteriorsuperior iliac spines to facilitate palpation of the rib angles, and the examiner palpates the superior borders of the fifth to tenth rib angles successively, asking the patient to inhale and exhale deeply as he observes the rib angles for incomplete inhalation or exhalation excursion.

B. *Pelvic landmarks.* The depths of the sacral grooves are palpated and compared bilaterally. The inferior lateral angles of the sacrum are palpated for relative inferior and posterior positioning.

C. Spine. The lumbar and thoracic paraspinal skin is stroked lightly to evaluate dryness or hyperhidrosis, and the lumbar and thoracic paraspinal muscles are stroked deeply two or three times to observe hyperemia or pallor. With the patient in neutral position he is examined for posterior positioning (rotation) of transverse processes T4 to L5. In the backward-bent position (hyperextended) he is examined for posterior positioning (rotation) of transverse processes. Segments T4 to 9 are evaluated with the patient prone with chin resting on the table and head resting in the midline., The examiner places his thumbs over the transverse processes of T4 and lightly compresses soft tissues. Then he applies firm ventral pressure with his thumbs, forcing the segment into hyperextension and notes resistance to hyperextension, which indicates rotation of the segment to the side of resistance. This is repeated for each segment through T9. To evaluate segments T7 and L5, the prone patient arches his back by placing his weight on his elbows and rests his chin on the heels of his hands. The examiner stands at the side of the table facing the patient's head, and successively palpates the tips of the transverse processes of T7 through L5 with the pads of his thumbs and notes whether the transverse process is more posterior (rotated) on one side than the other.

D. *Lower extremities.* General observations are made for swelling, atrophy, ulcers, deformities, bunions, calluses, hammer toes, nodules, edema, cutaneous changes, appearance of nails, cyanosis, pallor, and varicosities. Palpation is done to observe areas of warmth, coldness, tenderness, presence and quality of pulses, and pitting and nonpitting edema.

1. Hips: To test extension, the examiner stabilizes the pelvis with one hand and lifts the thigh just above the knee, measuring degrees of permitted motion. To test internal rotation with hips extended 180 degrees and knees flexed 90 degrees, the examiner stands at the foot of the table and places the patient's knees together in the midline, and then lets the feet fall apart, noting the degrees of permitted motion from the midline. To test external rotation with hips extended 180, degrees and knees flexed 90 degrees, the examiner stands at the foot of the table and places the patient's knees together, and then lets one foot drop medially cephalad to the other flexed knee, measuring the degrees of permitted motion from the midline. This is repeated with the other leg.
2. Supeficial reflexes: To test superficial reflexes of segments L4 to S3, the examiner strokes the gluteal muscles.
3. Knees: Popliteal swelling should be observed, and permitted degrees of motion for flexion, extension, and internal and external rotation with knee and ankle flexed 90 degrees should be noted.
4. Ankles: Permitted degrees of motion for plantar flexion, dorsiflexion, adduction, abduction, inversion (supination), and eversion (pronation) are noted. The relative caudad positions of the medial malleoli are determined by palpating their inferior slopes.
5. Feet: The insertion of the Achilles tendon, the calcaneus, and plantar fascia are palpated to note the presence of tenderness. The intertarsal joints are observed for tenderness, and the degrees of flexion and extension in the metatarsophalangeal and interphalangeal joints are measured.

To be realistic, it would be impossible for all the aforementioned procedures to be carried out on every patient consulting a busy practitioner. The history, age of the patient, and the experience and judgment of the physician will help in the selection of procedures.

The writer acknowledges the influence and the teaching of Drs. Paul Kimberly, C. D. Furrow, and Fred L. Mitchell, Sr. Part of the material contained in this paper is closely related to the curriculum developed by the Muscle Energy Tutorial Committee, appointed by the E:ducation Committee of the American Academy of Osteopathy. Appreciation is expressed to the members of that committee for their part in the formulation of the curriculum.

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Accepted for publication in July 1977. Updating, as necessary, has been done by the author.

This paper was prepared in partial fulfillment of the requirements for fellowship in the American Academy in Osteopathy.

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The Structural Examination

There are three stages in the musculoskeletal examination 1. the screen 2. the scan, and 3. segmental definition of specific joint motion descriptors. The screening examination consists of a selective group of tests which may focus the examiner's attention on one or more regions or areas showing evidence of asymmetry, soft tissue abnormality, or resistance to motion demand. The screening examination should consist of a few reliable, selective tests. Additional tests may be utilized for confirmation or additional information. The screening examination should include:

1. a postural screen - visual cues
2. active gross motion tests - standing flexion test, etc.
3. passive motion tests
4. a palpatory screen of structural symmetry and tissue texture
5. combinations of the above

The information derived from the screen should lead to the scan examination which is designed to elicit local segmental information to identify the dysfunction. The scanning examination may use a palpatory examination of the soft tissues and or an. articulatory type of motion testing procedure. The examiner scans from segment to segment for localized problems of dysfunction.

Once a local segment is identified by the scan as dysfunctional, the third stage of the examination, segmental definition, defines the nature of the segmental problem in terms of specific motion descriptors. The examiner places the fingers of one hand in contact with the joint to be tested and introduces passive motion of the subject's body with the other hand. Movements commonly test forward and backward bending (flexion and extension), sidebending right and left, and rotation right and left. Translatory movements of forward and backward and side to side motion may also be tested. The information derived from the structural examination should enable the examiner to develop a manipulative prescription.

An example of a screening examination follows:

1. Subject walking (active) note the following
    - a. feet - the pattern of action in weight bearing, ie. heel to lateral foot, to ball of the foot, pushing forward from the first metatarsal
    - b. hips and shoulders - symmetry
    - c. head - carriage
    - d. upper extremities - symmetrical swing
    - e. total body - are there interruptions in the smooth action of movement?
2. Subject standing
    - a. appearance -postural curves, A-P and lateral, head carriage
    - b. anterior alignment of chin, clavicles, sternal angle, ASIS
    - c. levels of iliac crests, trochanters and PSIS
    - d. symmetry of arms and angular space with the body-waist folds, gluteal folds
    - e. levels of iliac crests, trochanters, and PSIS
    - f. tissue tension, comparing right with left - arches, achilles tendons, lower extremities muscular and facial continuities to the hips, gluteals, paraspinal lumbar, thoracic and cervical
    - g.gross motion
        - 1) passive- side to side and rotatory movement at the hips
        - 2) active
            - a)asymmetry of PSIS before and after forward bending (standing flexion test), the quality of the movement and lateral deviation in the forward bent position
            - b) squat test for lower extremities (heels flat on the floor)
            - c) Upper extremities - arms overhead approximation dorsal surfaces of the hands, check at the ears, elbows, and hands

3.Subject seated

a. appearance - visual from cervical to chest to pelvis

b. level of iliac crests- recheck

c. tissue tension - comparing right with left, paraspinal, upper extremities

d. gross motion - passive

1) trunk (at the shoulders) rotatory and sidebending

2) Head and neck - rotatory, sidebending and forward and backward bending

4. Subject supine

a. appearance - visual for general symmetry

b. apparent leg length - at malleoli

c. lower extremity motion - passive

1) foot - inversion and eversion

2) ankle - plantar and dorsi flexion

3) knees - flexion and extension

4) hips in 90 * flexion - internal and external rotation

d. chest and abdomen - visual assessment of respiration, diaphragmatic or costal breathing pattern, symmetrical, smooth compliance, areas of relative inactivity

e. palpation - light contact to monitor motion assessment, any gross limitation or asymmetry?

V

Palpation

The development of skill in palpation is critical for osteopathic diagnosis and the use of manipulation. Drs. Allen and Stinson address some of the fundamental aspects of acquiring this skill in their articles on the "Development of Palpation " In "The Feel of the Tissues" Dr. George Webster discusses the art of tissue palpation, and Dr. Louisa Bums addresses the training of the sense of touch in " The Teaching of Osteopathic Skill".

There are a number of other excellent articles on the art of palpation in the osteopathic literature. Those by Drs. Rollin Becker and Viola Frymann are two that appear in Academy Yearbooks and should receive serious study by students of the art of palpation. These articles are listed under significant articles in the bibliographic section of this book.

I have chosen to include the articles by Drs. J.S. Denslow and William Walton in this section. They both were college teachers and skilled in the use of palpation in diagnosis and treatment. In the concluding article, "Osteopathic Basics", I have tried to analyze the steps that are fundamental to palpatory diagnosis.

The Development of Palpation*

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PART I

THE APPLIED PHYSIOLOGY OF PALPATION-THE NERVOUS MECHANISM OF LIGHT TOUCH, DEEP PRESSURE, PROPRIOCEPTION (MUSCLE, JOINT AND TENDON SENSE).

Two essentials of successful practice of osteopathy are: the palpatory ability to "find a lesion," and the mechanical skill to adjust or "fix it." To some of us it seems that these two fundamentals are not receiving proper attention. Not enough of either of them ever can be taught. Since our college education serves as a background for continued study, further attention certainly is needed among those of us in practice.

It has *been* stated that the worst to be said of osteopathy can be said of those practicing under osteopathic licenses. Certainly no one can encounter any large number of the osteopathic profession without some thoughts of this kind occurring to him. The fact that many of those in the profession could not find a lesion if they tried, nor do anything about it if they did find it, affects everyone of us. This is not intended as a criticism of our colleges. For after all, there is no problem that involves the status of osteopathy that does not include the entire profession. It is a sad thing for us when we hear a person say: "I tried osteopathic treatment, but it did not do any good." There is in this remark an utter lack of appreciation of the fact that there could be a "quality" **of osteopathic therapy. Many of us think that in this lies our** great danger, more than in smallness of numbers.

It is comparatively easy to follow a routine of instruction and develop a reasonable amount of skill in technic. Natural aptitudesand theirlacks will be dealt with in the third paper in this series discussing technic. However, if there has been no development of the *sense of touch,* then there is no way to determine that great primary of osteopathic therapy-the osteopathic lesion. Without this there is little use in attempting to practice an adjustive therapy. No amount of mechanical skill ever will overcome the failure to "find the lesion" for obviously *we cannot 'fix it," if we cannot "find it."*

In our first experience with osteopathy most of us wondered what it was that the examining physician felt with his fingers. No matter what our earliest impression of osteopathic therapy, this was probably one of our first questions. Many of us have seen some of the earlier practitioners examine a patient sitting on a table with his back bared, and after spending four or five minutes palpating the spine, tell the patient most of his history.

Performances of this kind are still marvelous to many of us. What is it that these doctors detect ? What tells them that one kind of fifth lumbar lesion causes pain in the lower extremities, while another type of lesion in the same segment is primary to urinary bladder trouble? What factors are included in their knowledge and skill, and why can't the rest of us learn it?

To start with the foundation of it all, let us review the characteristics of an osteopathic spinal joint lesion.

There is pretty general agreement that there are changes in the texture and temperature of the skin alterations in the subcutaneous tissues; variations of contraction and *contracture* of muscles; tension and alteration of pliability in ligament and fascia; changes in the amount of density of body fluids; modification of cartilage, disc, synovial membrane, periosteum and eventually of bone. Information relative to practically all of these conditions can be gained by palpatory findings.[1,2,3,4,5,6]

A classification of objective signs of the osteopathic spinal joint lesion based somewhat on that in McCole's book, "An Analysis of the Osteopathic Lesion,"[7] is given as follows:

Rigidity of vertebral joint tissues-muscular, ligamentous and fascial

Malposition of bony parts

Perversion of movement-deficient amount; in certain directions only; in certain positions only; too much motion (rare)

Contractions-muscle shortening of a voluntary nature, or involuntary as a result of pathological irritation

Contractures-A permanent muscular contraction due to tonic spasm or to loss of muscular equilibrium, the antagonists being paralyzed

Impaired resilience of joints

Postural stresses

Localized edema

Temperature and color changes in skin over joint - redness and warmth; pallor and coolness

It is understood easily that most of these diagnostic findings come through the trained fingers of the examiner. Some observations of vision are helpful, but the fundamental information comes from the sense of touch. This is not of necessity a special sense of touch, but an ordinary one developed to a high degree. It is with this development that we are concerned. If we are able to devise methods of study and a program of growth, we may find some important factors in the future of osteopathy.

First let us consider some of the anatomy and physiology involved. In this way we may understand better the mechanism of touch.

Perhaps the most satisfactory discussion of this subject will be found in Wright's "Applied Physiology"8 Briefly the more important sensory nerve endings are the *special cutaneous sense organs:* (1) Pacinian corpuscle, (2) tactile corpuscle, (3) end bulbs of temperature, (4) free terminal ramifications of pain, (5) organ of Golgi, and (6) the muscle spindle-additional end organ of proprioceptive (muscle, joint and tendon sense) or kinesthetic sensations.

Cutaneous Sense Organs.-The special cutaneous sense organs are built on a uniform plan. They consist of an outer lamellated connective tissue capsule and a core of soft material, chiefly protoplasmic cells. Within this core the axon ends simply, or by means of an arborescence. The different organs to be described vary chiefly in the complexity of their design.

Pacinian Corpuscles.- These are very large organs found in the subcutaneous tissues of the hands and feet. The capsule consists of a number of concentric fibrous coats arranged like the layers of an onion- the soft core is cylindrical in shape. The nerve fiber loses its sheath and passes down the middle of the core to its further end to form terminal aborization. (They *are more numerous in the pads of the fingers than elsewhere; most numerous in the pad of the forefinger.)*

Tactile Corpuscles.- These are found in the papillae of the skin. They are ellipsoidal in shape. The nerve fiber winds once or twice around the corpuscle to reach its distal part; it then enters, loses its medullary sheath, and ends in a complex ramification.

End Bulbs.- These occur in the conjunctiva, in the papillae of the lips and tongue, in *the sheaths of nerve trunks,* in the skin of the genital organs, and in the neighborhood of joints. They are spherical in shape, but otherwise resemble the tactile corpuscles.

Organs of Golgi.-- These are found in a tendon close to its point of attachment to the muscle, and also in the intramuscular connective tissue. The end of the muscle is enclosed by the sarcolemma, to the outside of which the tendon is joined. The tendon fibers separate into a number of small bundles; the nerve fibers penetrate between the fasciculi, and their medullary sheaths stop short; the axons end in terminal aborizations beset with irregular varicosities.

Free Nerve Terminations.- These are found in the cornea, larynx and other epithelia. The nerve fibers form a plexus under the epithelium, and filaments proceed to ramify between the epithelial cells.

To reiterate:

(1) There are *more* touch nerve endings in the pads of the fingers than anywhere else; *most* in the pad of the forefinger.

(2) There are at least seven, possibly more, types of nerve impulses which aid in touch appreciation.

(3) There are end bulbs in the sheaths of nerve trunks.

(4) Muscle, joint and tendon sense (proprioception) is very important.

Dr. Still is reported to have examined very carefully, by light touch, the skin of a very sick patient, first, to determine areas of increased temperature. This may be the first impression that we can gain regarding a patient. Temperature perception consists of two parts: an appreciation of heat and of cold. Variations either way should be picked up easily by the trained operator. Many of the older practitioners laughed at the importance attached by some to the clinical thermometer. They could detect fever to within half a degree with their fingertips and therefore had little use for a thermometer. Here is an opportunity for practice-just make a guess at a temperature before you read your thermometer.

Light touch enables us to pick out regions in the spine (or other parts of the body, for that matter) which are different, through changes in temperature and texture of the skin; slightly increased or decreased density- superficial dryness or moisture; minutest changes in pliability or resistance- increased or decreased amount of body fluids. The feeling of greater density informs us of first, superficial, then deep, muscular contractions and contractures.

One of the most important evidences of fracture is the rather heavy, hard feeling of muscle spasm, differing in density from other types of lesion. This is apparent to light touch, and serves to warn against any other kind of diagnostic procedure which may result in further injury.

Tension of the supraspinous ligament, best picked up by light touch, shows slight variations in tension, which are extremely valuable in determining the position of a lesioned spinal segment.

Light touch is easier to use, is useful in more ways, and affords more information, than any other type of touch.

Deep touch (between light touch and pressure) aids in differentiating types of lesion in the areas of vastly increased muscular and ligamentous tension. Perhaps deep touch is more valuable in mobility than in other tests.

There are distinct differences between light touch deep touch and pressure. It is difficult to be exact, but the impression among several of us studying the various sensations is that deep pressure may be partly a registration of mild pain, compounded with the proprioceptive sense. Many of us mix the impression of positional sense with the impressions gained from muscle, joint, and tendon sense. Perhaps we are in a hurry and in addition to feeling for a changed mobility in the joint, we use deep touch, pressure, and a certain gauge of the amount of slack in a joint, the last named being used in trying to apply just enough force for correction. Certain it is, however, that the proprioceptive sense must be highly developed in the technician in order that a proper amount of force will be applied in adjustment. It might be hard for many technicians to define just where diagnosis leaves off and adjustment begins. The thought we wish to leave is that proprioception has its place in diagnosis and should be developed and used. It is distinct from deep pressure, since the latter, as mentioned before, becomes pain when used to an extreme.

Practically all of these sensory impressions follow the same route to the brain. Impulses enter the cord through the posterior nerve root, encountering the first cell in the posterior root ganglion, the second in the posterior gray column and the third, after ascending the cord, in the lateral thalamic nucleus. From here they ascend to the posterior central gyrus by way of the internal capsule.

This part of the anatomy is interesting because we know that in all nerve pathways, involving two or more nerves and their junctions or synapses, habit tracts develop through usage. Just as some reflexes, notably that which results in the application of brakes to the automobile we may be driving at the sign of danger, become very rapid, so touch pathways may be developed by intensive practice and use until their speed of transmission is accelerated. We have sound anatomical and physiological basis then, for continued practice. There is nothing here to indicate that new touch impressions might not be developed by concerted effort, at any age, by use and repetition.

What stimulates the sense of touch? It often is said that the blind develop this sense in compensation for the loss of another special sense. Is it necessary to lose one special sense in order to develop another? And what degree of skill may be reached through working at development of special palpatory sense?

These and many other questions come to the mind of those who try to study out a program of education in touch. Lessons may be learned from the blind, but probably first of all, we should understand as much as possible of the mechanism. The nearest we can come to understanding and describing what is perceived by the palpating fingers is that there is a different vibratory rate for various substances. Just as the fingers distinguish the difference between wood and metal, also between wool, cotton, and silk, so trained fingers can detect different conditions of many of the soft as well as the hard tissues of the body. Muscular tissue in particular, since it is always in a vibratory state, can vary with the time of day, the ingestion of food, body temperature, weather conditions, the many constitutional factors such as fatigue, as well as the syndromes which characterize what we call disease. Obviously, the ability to detect these phenomena is primary to osteopathic skill.

Dr. H. H. Fryette in the course of a classroom lecture said that it is difficult to describe what was perceived with the fingers, and compared it to "describing the color red to an individual who had never had vision."

Dr. W. A. Schwab described the feel of toxemia from infected teeth as a "beefsteak feel" in the neck muscles. Schwab repeatedly demonstrated that he could detect unerupted molar teeth by the feel of the cervical tissues, his record being checked by dental x-ray films and clinical results. Dr. J. B. Littlejohn taught spinal diagnosis as a method of differentiating various acute abdominal conditions, and said that many surgeons use the spinal reflex as a guide. Dr. E. R. Proctor proved to many of us that he could differentiate the childhood diseases in the prodromal stage by palpation. Since most of these diseases start with about the same symptoms, and are only differentiated when the skin eruption or other classical symptoms develop, early diagnosis is valuable.

Dr. S. V. Robuck describes in detail the palpatory findings for the chest, including the "feel" of pulmonary tuberculosis and the outline of the heart and demonstrated his skill in locating a leaky valve with his fingertips. The late Russel R. Peckham had a reputation for diagnosis from his exceptional tactual acuity, combined with an extraordinary knowledge of anatomy. He described the peculiar feel of the spinal reflex of carcinoma. Dr. H. L. Riley of Boulder Colo., demonstrated his remarkable skill in spinal diagnosis in many ways, and on many occasions.

Dr. C. S. P. Ball of Eustis, Florida, won a bet of five dollars that he could locate a human hair placed under five or six sheets of flimsy (typewriter second sheets) on a glass-topped desk, while he was blindfolded. Just to make the test good, the betters placed the hair under thirteen sheets of flimsy.

Perhaps most of us have witnessed or staged demonstrations of this kind or are familiar with the possibilities. It is a further step, however, to make up a program of development for this exceptional sense of touch. How do we go about it?

Let us consider, briefly, some of the best methods of palpation, that is, the use of our fingers. Some operators find it better, when they begin this part of their examination, to shut out all other sensorv impressions. They close the eyes, mentally the ears also and concentrate on what is coming in over their fingers, interpreting the nuances of tissue states.

After first looking at the patient, they determine just what region or regions are of interest and proceed with the fingers. Palpation9 confirms findings by inspection, and additional information is obtained. In spinal examination, for instance, it may be divided into palpation of paravertebral structures, namely skin, muscles and ligaments, and bony palpation. The former is divided into light touch, or superficial palpation, and deep palpation. Before discussing these divisions it seems necessary to lay down a few common rules for palpation.

The pads of the fingers are used rather than the tips for two reasons: There are more sensory nerve endings in the pads than in the tips of the fingers and the use of the former causes less discomfort to the patient.

The type of palpation determines the amount of palpating surface to be used and the amount of force or pressure. For instance, in palpating the skin a light touch is necessary; in palpating for minute changes around a segment only one or two fingers are used, while in palpating for gross changes in muscle the whole hand may be used.

Palpate down to but not through the structure to be palpated. If deep muscles are to be examined, it is necessary to go through the more superficial tissue.

The elbow, wrist, and hand used in palpation must be relaxed because this procedure demands a delicate differentiation of sensations which is impossible if the muscles are held rigid and tense. It is said that an artist grasps his brush lightly. A surgeon holds his scalpel firmly but easily, not tensely.

It is important that the examiner does not try to receive too much information at one time in palpation. Let him first palpate for changes in the skin and superficial tissues and then retrace his steps to palpate the deeper structures. He should compare his findings upon successive examinations rather than attempt to cover the whole field with a single procedure.

He must bear in mind also that too hard, rough vigorous palpation will set up a reflex irritation in the muscle so treated.

The findings by palpation come from changes in tissue resistance which are recognized by the examining fingers. What is normal tissue resistance? It may be defined as the normal texture of skin, subcutaneous tissue and muscle. It is the discovery and evaluations of these changes in which we are interested in this discussion.

The skin, except for a few areas, such as the soles of the feet and the palms of the hands, has within it numerous hair follicles. For the most part these are rudimentary except on the scalp, axilla, etc.

The follicles, however, are supplied with minute muscles known as the arrectores pilorum, which are innervated by the sympathetic nervous system. Changes in the normal outflow of sympathetic impulses produce a change in the tension or tonus of these muscles. Possibly the best example of this condition is that known as "gooseflesh" following exposure to cold. Now, when any region of the spine is in lesion, the sympathetic impulses emanating from that segment are altered. In view of this, the presence of superficial tension over areas of lesion, as has been seen and demonstrated clinically, is explained logically in view of the present-day knowledge of skin physiology. However, postganglionic connector fibers of the sympathetics disseminate impulses to more than one segment. Therefore, the area of altered tension or tissue resistance will not be localized, but will extend both above and below the site of lesion. It will be seen that perception of this change is of value in testing areas of lesion as well as individual lesions.

The alteration of tissue resistance in the skin is elicited by light touch palpation. The technic is as follows:

The fingers of one hand are applied to the skin over and immediately lateral to the spinous processes. The technic is characterized by an extremely fine and light touch. The fingers are moved from segment to segment and the sensations received carefully noted. Concentration is most important in this type of palpation properly to evaluate the findings.

Normal tissue resistance of muscle is elicited by light palpation and may be described as characteristically soft, elastic and nonresistant. It is well exemplified by the biceps muscle when relaxed. No other tissue gives quite the same sensation to the examining fingers as does normal muscle. In acute lesions there is found a full, boggy nonresilient resistance (due to the swelling and edema of the muscle. In the chronic state the resistance is hard and inelastic, due to the infiltration of fibrous tissue.

May I repeat that especially in light touch palpation must the arm, hand, and wrist be well relaxed as the tactile sensations are impaired when the arm is kept tense.

The technic of deep palpation is characterized by firm, moderately heavy palpation with one or two fingers. It is directed to the structures lateral to the spinous process, over the lamina, articular facets, and transverse processes and should be slow and steady. The resistance offered to the examining hand will reveal the location of major tissue change and points of greatest stress and strain about an articulation.

By bony palpation we determine the position of the bony landmarks and the mobility of each segment. Briefly the landmarks are the spinous processes, the transverse processes, the articular facets in the cervical region and the mammillary processes in the lumbar. The spinous processes are easily palpable and may be examined by using two thumbs, one on either side of the line of spines, or the fingers of one hand. We must remember that there are many anomalies in the size, shape, and position of the spines.

Bony palpation must include also palpation for mobility. This is accomplished by placing the finger over adjoining segments and moving the joints involved, either by pressure, as in the prone position or by moving some adjoining portion of the body as the head, shoulder, or hip.

Much of this material is adapted from the routine used in instructing students at the Chicago College of Osteopathy. We have briefed the "Routine of Examination," retaining only that part needed for our study of palpation.

The findings to be elicited by these methods are:

1. Changes in paravertebral structures.
2. Changes in bony position of the individual segments.
3. Changes in the normal curve of the spine as a whole.

Changes in soft tissues are most important in locating osteopathic pathology. Light touch palpation is the most important of the methods to use. It is dependent upon the tactual acuity of the examiner.

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The Development of Palpation*

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PART II

In part one we dealt with the applied physiology of palpation. We now move into a different aspect of the field in considering just how far it is possible to go in diagnosis by palpation, and take up some of the methods of sharpening touch appreciation.

Many osteopathic writers[10] have mentioned the value of touch. One of these, Dr. Hedley V. Carter, describes the feel of the skin over the back in lung conditions. We take the liberty of quoting his entire article, "An Unique Diagnostic Aid":"

"The list of reflexes useful in diagnoses includes cutaneous, plantar extension, tendon--or deep colonic and tonic spasms, and electrical reactions.

"To the list of cutaneous reflexes I believe we may add, tentatively at least, another osteopathic discovery. While Head, Mackenzie, Pottenger and others have noted the frequent hyperalgesia of the skin in diseases of the viscera, sometimes exquisite in cases of pulmonary tuberculosis and pleurisy, I have been unable to find prior mention of a peculiar and constant skin phenomenon which outlines on the surface the extent of deeper situated pathology.

"This surface sign is quickly apparent to osteopathically trained fingers with their educated tactile sense. The technic consists in noting an increased resistance or drag and roughness of the skin as the examining fingers are lightly but not too delicately drawn over a morbid region. The extent of the involvement may be delineated by the smoother normal feel of the skin over contiguous healthy regions.

"A few experiments in your daily work will readily enable you to recognize this peculiar diagnostic evidence. For example: before deeper palpation of spinal lesions, draw the fingers of one hand down over the bared back of a patient and note any areas of increased resistance of the skin. This should be done with a light, even pressure. The feeling has been described as a 'moist rubber' sensation. Then check your findings by the usual methods of locating spinal lesions.

"You may test your ability to appreciate a 'positive' sign dissipating the sensation momentarily by touching the patient with the other hand. A positive reflex, reaction, or sign reappears over a morbid region when the 'short circuiting' influence, either of the examiner's other hand or that of an assistant is removed. There is no change over a healthy region.

"It is extraordinary how accurate this localization has been proven by orthodox diagnostic methods, including the roentgen ray. Due to their accessibility, diseased teeth and tonsils are good subjects for experimentation as the findings are quickly proved. Pathological regions in the lungs are also readily outlined and proved by percussion and auscultation.

"Many patients are able to feel a 'positive' sign, particularly on non-hairy areas. Without making an explanation, use the technic described and ask if the patient notices any difference in the 'drag' of the fingers before and while 'short circuiting.' Some sensitive people will declare the skin over a pathological region 'feels like very fine sandpaper' or 'emery dust.'

"Another peculiarity is that these 'positive' areas may be defined by the adhesiveness of non-metallic instruments such as a pencil shaft, stiffened rubber tubing, glass rod, etc., as they are drawn over the skin. 'Shorting' causes them to slide as over 'negative' areas. (I use the term 'short circuiting' for its descriptive qualities and for lack of a better one.)

"Permit me to add that this procedure has nothing to do with any system of diagnostic reactions. It is, I think, purely an osteopathic discovery. The patient may be in any position relative to the force of gravity or to the points of the compass.

"This method of localization has been used and tested for several years. It has been demonstrated and taught to a number of osteopathic physicians who have amply corroborated its practicability.

"The explanation of this peculiar objective symptom is mere conjecture. Some years ago an article entitled 'The Electropathology of Local Inflammation' was distributed by the manufactures of a well-known product widely used by the osteopathic profession. This short treatise presented the body as having in the brain a generator of neuro-electricity, in the nerves a series of conductors insulated by the nerve sheaths to maintain nerve energy at a certain pressure. The ganglia function as storage cells or condensers and the skin acts as an insulator, though a poor one.

"I believe it is Crile who suggests, in referring to electromagnetic phenomena of the body, that the liver might be considered as one pole and the brain as the opposite pole of a mass unit.

"It has been stated that the intimacy between electricity and the metabolism of a fully ionized cell is so delicate that it has been possible to start cell division in the ovum of a sea urchin by electrochemical stimulus. The groups of ions in the protoplasmic membrane surrounding the cell exert a selective power regulating absorption and excretion which can only take place when the material without the cell meets the electrical requirment, opposite polarity, to the material within the cell.

"If disease be considered as electropathology, it may be presumed that electrochemical 'losses' are manifest on the surface due to a lowered electrical resistance of the skin, which is at best an inefficient insulator. Wherein may lie the explanation that the 'Carter surface sign' is a practical diagnostic measure and is surprisingly definitive."

From nonosteopathic medical sources perhaps the most detailed literature is that of Dr. Pottenger, whom we all recognize for his work on visceral reflexes. We want to quote from his book, "Muscle Spasm and Degeneration in Intrathoracic Inflammations and Light Touch Palpation."'*

"LIGHT TOUCH PALPATION

"A discussion of the possibility and practicability of delimiting normal organs and of diagnosticating diseased conditions in organs, especially within the chest and abdomen, by very light palpation when such normal organs and diseased conditions exhibit a density of tissue differing from neighboring organs or parts of organs

"While making a clinical study of the muscle changes previously described, I noted that these changes were best detected by a very light touch. Further study showed that by this very light touch the examiner was not only able to determine differences in the superficial tissues, but, to my great surprise, he was also able to detect the differences in density of tissues which were situated within the great cavities of the body at a distance from the surface walls. The heart, liver, stomach (within two or three hours after a meal and even without food provided it contains some gas), abdominal tumors, mediastinal tumors, infiltrations of the lung (whether due to tuberculosis, pneumonia, actinomycosis, svphilis, or cancer), and effusions either pleural or peritoneal can be accurately outlined by light touch palpation, a touch so light that it scarcely causes an indentation of the superficial tissues.

"The boundaries of the heart were the ones that I detected first. I found that by simple touch I could distinguish the outline of this organ from the surrounding tissues. Inasmuch as I was studying the reflex contraction of the muscles at the time, I at first thought this must be a skin reflex, due to the contraction of the erectores pili, and so described it as a new physical sign, probably a skin reflex; but, before my paper was published, I had determined that it was not a reflex at all, consequently not a new physical sign, only a new method of applying palpation."

There are several pages in which experiences in using this method are described and the findings checked by post mortem and x-ray examinations. A long discussion of the relative merits of light touch and percussion and a listing of all the evidence leads to the conclusion that there is greater accuracy in light touch.

The methods of outlining the heart, instructions for differentiating heart and lung tissues, and for recognizing various types of pathology are described minutely. Several pages are devoted to the abdominal contents, with specific directions for detecting abdominal and pelvic tumors and peritoneal effusions.

In another part of the book the author pictures the changes that take place in the muscles of the spine and thorax in pulmonary tuberculosis.

We quote again to get another important idea, and to get the author's summary.

"In employing *light touch palpation* considerable care is necessary at first, until the examiner is fully aware of what he is attempting to feel. He should remember that he is attempting to recognize slight differences. In outlining organs or differences in density or tissues, I have found it better to examine the part which is presumably of lesser density first, and pass from it to the organ or part of greater density.

"One thing that surprised me very much was the fact that *light touch palpation* could be relied upon to give accurate results through bone as well as soft tissues. This fact led me to make further experiments. While studying percussion I practiced upon tables and chairs, locating the legs and reinforcing strips; so I tried to do the same by palpation and found that it is possible to note a difference in resistance on palpation also when palpating over the chair and table legs and those parts which are reinforced.

"Quoting from one of my former papers: 'I have found the best method of procedure in endeavoring to outline the deeper solid organs by *light touch palpation* to be as follows:

"'1. Always palpate wholly, either in the intercostal spaces or over the ribs. This can be applied to the liver and spleen, as well as the heart, because of the oblique direction of the ribs.

"'2. Begin palpating beyond the border of the organ and approach it slowly. When the border is reached an increasedresistance is at once noted, the degree varying in different chests.

"'3. The palpating fingers must not be moved too rapidly, or confusions will result. Sufficient time must be allowed to concentrate the mind on the sensation produced at each touch. Concentration is very important, especially when the change is slight, as would be noted in a heart or liver border covered by emphysematous lung in a patient with thick chest walls.' "

We all know that we could get more information from palpating a spine at the end of six months of practice than we did at first, and very much more at the end of five years. But we need some regular methodical things to do as a program of education. Here are a few practical ideas:

We have the general idea from Pottenger that we should be able to detect varying densities with our fingers. Many specialists in commercial lines are able to do this as part of their job. Wood workers detect the kind of wood by feel; most clothing buyers can detect the quality of wool and other cloth by feel. We can practice most of these things.

Can you put your hand in your pocket and pick out heads and tails on the coins ? Some gamblers depend on this skill for winning the toss of the coin. Can you pick the various coins-penny, nickel, dime, quarter? That should be an easy method of training the fingers, for it can be done while waiting for a car or idly chatting. How many of your keys can you pick out by touch? Do you have to have a light to find a keyhole at night? Here again we have some practice tricks which are usually readily at hand.

Some of the older doctors, among them Dr. Still, laughed at us as senior students with our stethoscopes and thermometers. They depended on a sense of touch for determining temperatures. Can you feel the skin of a patient and tell what his temperature is? One of us, Dr. Allen, practices locating a youngster in the dark by passing his hand just over the baby and picking up his position by the changed air temperature of body heat and the flow of air from breathing. That is something of a variation of the ability of the seaman who detects wind direction by moistening a finger and holding it up.

One anatomy professor was known to carry around a pocketful of carpal bones, mixed rights and lefts, male and female, and woe to the student who could not sort them out properly.

Along this line, Dr. Schwab used to require that each student in his technic classes do the actual work of putting together an "articulated spine." This required about twenty hours of patient labor in fitting sponge rubber for the intervertebral discs, hollow tubing for the cord and flat rubber for the anterior common ligament. In doing this work the students learned much of the "feel" of the size, shape and articulations of the spine.

There are a number of methods for acquiring a keen sense of touch. First let us discuss the matter of care of the hands. It is possible to improve touch reception by keeping the joints of the elbow wrist, hand and fingers very flexible. Sometimes we can get help by immersing the hands in fairly warm water for a few minutes. Most physicians have a favorite application for keeping the skin of the fingers soft, with the nails trimmed fairly short. Practically all of us have had to give up some of the things we like to do with hard tools because of the effect on our hands. Many have found that delicate proprioceptive feel diminished by such things as ball games, golf, whittling, and even long auto drives. Some of this can be overcome by the use of gloves, but probably not all of the muscle, joint, and tendon sense is protected thus.

Right here is a good place to discuss the need for osteopathic manipulative treatment ourselves. We who use our hands, arms, and shoulders need periodic care for the fatigue, the overuse, and the small injuries which we acquire day by day. The region of the spine giving origin to the nerves of the brachial plexus should receive constant attention and adjustment when necessary. Not only the muscular and the circulatory effects may be perceived; there is also a distinct growth in touch appreciation from this routine care.

Do you have days when your touch is better than other days? And is it easier on such days to make adjustments? That should point out to you the times when treatment is necessary. We should be able to "take our own medicine." One way to do it is to cultivate a friendship among our own group, and exchange treatment at least once a week.

Again, the matter of a vacation worries some of us. It is far better to make vacation a matter of a day or two a week for two or three months than to go away for thirty days and allow our hands to lose some of their trained cunning.

Safe breakers are said to use sandpaper on their finger tips to make them more sensitive. We may not get so far along as this, but certainly we do not want our hands to develop a hard, fibrous covering from the rough things we do.

We have already gone over Pottenger's suggestions. Let us try some of them one at a time.

Table top- or arm chair- feel for support from floor.

Coins-pick heads and tails; distinguish penny nickel, dime and quarter. Pick date lines.

Paper-feel for ruled lines as in an appointment book-printed lines of any book or paper. Outline of illustrations and figures.

Dr. Allen suggests the following test: Arrange two small bowls with small number of bird shot in each. Have someone add or take away a few shot and test your ability to recognize the change in weight. Note the smallest perceptible variation and keep practicing until you can detect the difference of one shot.

All common objects give us something on which to practice touch. Do you shave by sight or feel? Try shaving in the dark.

While driving your car, have you learned to pick up the vibrations of the motor? A little practice will enable you to tell whether or not the motor is running smoothly, and sometimes will help to determine a too rich or too lean gas mixture. Certainly you should be able to pick up a "missing cylinder."

Tire pressures should come to your touch very readily. Slight differences in the front tire pressures will be easy. Recently I told a filling station attendant that there was about three pounds difference in the pressure in my rear tires. He checked and found just two pounds.

Can you run a finger over the tops of a folder of safety matches and count them? You can with a little practice.

Professional dice throwers pick the numbers on the dice with their hands closed. Card sharks are said to "read" the cards with their finger tips while dealing. Some of us have been able to identify the characters in the cheaper grades of playing cards, but not accurately when dealing at the customary rate of speed.

Many of the simpler tricks of the prestidigitators afford not only practice in touch, but also skill in muscular coordination.

Musical talents afford opportunity for much that we need in our hands and fingers. Balance tricks require "muscle sense" as well as touch.

Try picking a hair under a sheet of paper. Then add a couple of sheets. Next note the length of the hair. If you get really expert try distinguishing between human and animal hair and between coarse and fine hair. If you get really good, try counting grains of sand.

Dr. Allen calls some of this "tactual gourmandizing."

Finally, two things: first, think of your world in terms of touch, and second, evolve and use exercises for both tactual acuity and kinesthetic sense.

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The Feel of the Tissues

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The osteopathic physician develops a specialized sense of touch which is as important to him in practice as is the trained sense of taste in the professional tea-taster, the sense of smell to the professional cheese buyer, the sense of color in the metallurgist or the sense of hearing to the leader of an orchestra. The osteopathic touch compares in a large measure with the same specialized sense developed by the blind. It is upon this specialized sense of touch that the osteopath by palpation depends for a diagnosis of tissue tone and anatomic relationships. Tissues may be classified in two ways: hard tissues, including cartilage and bone; and soft tissues, including skin, fascia, muscles and ligaments. Then they may be again classified as normal or abnormal. Each tissue has its peculiar feel under normal conditions and each tissue may have varying degrees of alterated feel depending upon the pathology. The feel of tissues in the normal is largely an individual matter. Normal tissues vary in their feel with the individual. That is, all normal tissues do not have the same feel. For instance, the feel of a normal muscle in an athlete and that of a society drone would not have the same resistance, resiliency or tone, yet each would be normal for the individual. Age as well as activity also present varying degrees of tone each normal for the individual. Normal tissues cannot well be described in terms of touch. It requires education of the tactile sense over a long period to be able to determine the normal under all conditions. Knowing the normal, the varying shades from the normal may be detected. The variations from the normal may be in either direction; toward tensed tissue on the one hand and relaxed tissue on the other. The palpating hand soon comes to recognize the most marked degrees of tension, while the lesser degrees are distinguishable only by the most carefully trained fingers. The same is true with reference to relaxations. On the whole, I believe, that relaxed tissue is far more apt to be overlooked than tensed.

Each tissue state has a meaning all its own. It is in the interpretation of these that the highest professional judgment is called into play. We will consider for a moment some of the possibilities in each class of variations from the normal.

First: Tense tissues. This refers particularly to interosseous tissue-ligament and muscle-occasionally fascia. Tense tissue may mean one of many things. Among the possibilities are to be considered subluxations, acute toxemias, deposits of fibrin or scar tissue, reflexes from an irritated nerve or viscus, primary lesion or compensatory lesion. Each case is largely a law unto itself and the findings must be correlated and deductions made from the general findings in the case.

Second: Relaxed tissue. This may refer either to interosseous tissue or to the supports of a viscus or a viscus itself. The interpretation may rest in carefully weighing the possibilities and evidences of strain, disuse, gravity, chronic toxic states, over-fatigue and faulty elimination.

Third: Altered feel due to the imbalance of the chemical equation in the tissue itself. This we observe in edema, local inflammation and retention of toxins In tissues from overuse.

Fourth: There is a class of cases each peculiar to itself which may depend upon an extraneous source for altered tone, as met in the spasm of strychnine poisoning, the relaxation of alcoholic stupor, etc.

Fifth: The alterations in tissue tone independent of the above-mentioned causes which are due to some alteration in the output from one or more of the endocrine glands in such disorders as hyperthyroidism, cretinism, certain types of obesity, etc.

Sixth: The altered feel of the tissues due to infections local or general, including such as the spasm states of tetanus or the glandular involvement of mumps, each giving a certain feel to certain tissues. The subject is so great that in the few minutes allotted I can no more than outline the field presented for study by the tactile sense and which I believe is appreciated more by the osteopathic profession than by any other group of physicians. We should feel with our brain as well as with our fingers, i.e., into our touch should go our concentrated attention and all the correlated knowledge that we can bring to bear upon the case before us. I cannot but feel that the profession wastes both time and energy by reason of the fact that palpation in the individual case or of a particular lesion is too often superficially or hurriedly accomplished so that a full evaluation of the condition of the tissues and tissue relationships is not made. The principle employed by Dr. Still in so carefully educating his tactile sense as he did with his Indian skeletons and living subjects, together with the knowledge to properly interpret the findings accounted for his success over such a wide field. We can very fittingly imitate him in his efforts to perfect the tactile sense. He had a way of letting his fingers sink slowly into the tissues, feeling his way from the superficial to the deep structures that gave him a comprehensive picture of local as well as general pathology.

In treatment, the same principle, I believe, applies as in diagnosis. The guide should be the feel of the tissues; abnormal reactions following attempts to correct lesions would seem to be due to not following the feel of the tissues with sufficient acumen. This has been my own observation in applying treatment in cases under my care. The Old Doctor's caution against the rough handling of tissue has been my constant guide when confronted with an obstinate lesion. Some experiments that I have tried on a series of cases presenting restricted movement in the great joints, such as the knee, elbow, shoulder and hip gave much evidence in confirmation of the above. Attempts to establish the normal range of motion by quick or jerky movements, were painful to the patient, met with resistance, produced shock and unfavorable reactions, while slow movements giving the tissues time to relax, carrying the limb slowly, but steadily beyond the apparent limit of motion produced little pain, no shock and little reaction and more rapidly increased the range of motion in the articulation. Applying the same principle to the lesser articulations, the spinal and rib, gave equally as pleasing results. I found as many other osteopaths have found that it was easier to err on the side of doing too much to a chronic lesion than on the side of doing too little. In re-establishing normal mobility in either the gross or minute articulations, the feel of the tissues must be the guide. When a certain ligamentous tension was reached, further attempts to force movement were discontinued, although two or more movements up to the tension limit might be made in succession.

Each tissue is composed of cells and each cell is a living thing. Living things prefer persuasion to force; consideration to trauma; intelligence to ill expended energy. It is better to work with the tissues rather than at the tissues. Nature has her regards and also her penalties for the manner in which lesions are treated. As osteopathic physicians, our highest duty is to cooperate with nature.

The Teaching of Osteopathic Skill

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Teaching the principles upon which osteopathic practice is based is pedagogically simple. It is quite a different matter to train osteopathic fingers. To be really skillful the hands of an osteopathic physician should act as though they had a part of the brain for their own control. Indeed, this is almost anatomically true.

The exact site of the cortical area concerned in touch is not definitely outlined, but appears to be located in the ascending parietal convolution, opposite a corresponding area in the ascending frontal convolution which governs the muscles of the hands and the fingers. These two areas, one which receives sensory impulses and the other which sends out motor impulses, are intimately connected by nerve fibers passing from each area to the other and running immediately below the gray matter of the fissure of Rolando and its adjacent convolutions. Frequent use of these cortical centers seems to increase their efficiency, both separately and in co-ordinated activity.

Like other cortical areas, these centers are connected with other parts of the nervous system by an extremely abundant and complicated system of association neurons. These, also, seem to develop increased efficiency with frequent use.

Cortical areas adjacent to those which primarily receive sensory impulses seem to be concerned in storing memories, and therefore in co-ordinating past with present experiences. The significance of sensory experiences becomes evident from the co-ordination of past and present experiences (a) within any given sensory system, (b) of any system with other sensory systems, and (c) with motor centers and association neurons. The structures concerned are complicated though the underlying relationships are very simple.

Nerve impulses reach the cortical centers which are receiving stations for sensory organs-in this case for the sense of touch. Nerve impulses initiated by the neurons of the receiving station stimulate association neurons and finally, the cortical areas which govern related muscles, in this case those of the hands and arms. As a result of these complicated and delicate co-ordinations, two activities are caused. First the nerve impulses which control the movements of the hands and the fingers are stimulated in such a manner as to increase, if possible, the efficiency of palpation of a particular object at a particular time. Second, the co-ordinated impulses form an image which is stored in the cells devoted to memories and thus to the co-ordination (the understanding) of things felt or palpated.

Establishment of association pathways of the touch centers with many other cortical areas is important, and of these perhaps the speech center has the greatest pedagogical value. For this reason practice in the art of palpation needs to be associated with description of the findings in accurate language, and comparisons need to be employed very freely.

During his earliest days of osteopathic education the student should be taught the importance of training his sense of touch and his control of his hands. He should be encouraged to practice touching and handling various articles as a musician practices scales. Some guidance may be helpful. He should be taught to palpate, first, barely above the surface of a selected article. His fingertips scarcely touch the surface as he attempts to determine slight temperature changes the existence of elevations or hair-like processes above the surface, and other qualities. He must put his discoveries into words. Next he touches the surface with the slightest possible contact. He must describe this surface accurately, using comparisons freely. With slightly greater pressure he determines the qualities of the substance of the palpated article. These qualities also he must describe in accurate words. If any motion is present, the sensations produced by his palpation of the articles also must be described. Comparisons should be used freely in describing motions.

Estimations of the weight of objects or the amount of pressure necessary to indent any surface or to shove an object along a surface, or to resist force exerted by another person or by any mechanical activity-all these experiences promote increasingly delicate appreciation of sensory impulses from skin muscles and other tissues. Attentive repetition of these experiences develops increasingly accurate appreciation of things felt, and of the significance of findings on palpation. Accuracy in diagnosis by trained osteopathic physicians is often amazing to persons whose training in touch has been neglected.

Almost every subject in the curriculum of an osteopathic college offers opportunities for training in the art of palpation and for the development of increased skill in performing delicate operations.

In anatomy it is generally expected that the student shall draw pictures of the tissues he studies. The touch-minded teacher has him draw pictures of tissues which he palpates. To draw the bones of the hands as he feels them may not produce a very pretty picture, but it helps to produce a very vivid appreciation of the palpable form of the bones. He should draw, also, any given contracted muscle or group of muscles.

Autopsy material may have its palpable quality modified by embalming processes as well as by change occuring during and after death. Even so, at autopsy the different tissues present different pictures on palpation. Abnormal tissues do not have the same feeling as do normal tissues.

In physiology other opportunities present themselves. The student should palpate the pulse and note the changing palpable quality due to rest, exercise and other physiological conditions. He should notice the difference in the palpable quality of a vein and a throbbing artery, of the carotid and the radial arteries, of the throb of the heart over different areas of the chest wall and of the thrill which is given the chest wall by the beating of the heart. He should palpate the thorax during quiet and forced respiration, noting the different palpable qualities.

As he watches varying activities of tissues during physiological experiments he should palpate the changing tissues as well as watch the results of experimentation. The touch-minded physiologist finds abundant opportunity for illustrating palpable changes. Probably his study of laboratory diagnosis is begun at about the time when he is engaged in some clinic activities. He should examine the tissues of each patient by palpation. If he examines sputum he should palpate also the chest of the patient from whom the specimen has been taken. He should associate palpation of the chest with his use of the stethoscope. By palpation he may appreciate the varying palpable qualities of the chest which show the rales of a tuberculous cavity or the rough breathing during bronchial inflammation. If he can associate the findings on palpation of the chest wall with the sounds as heard through the stethoscope he will develop a much clearer picture of the condition of the lungs of that patient than he could possibly attain by any number of separate examinations of sputum, rales and fremitus.

If the patient suffers from hypertension or hypotension the student should palpate the pulse. He should learn to estimate the blood pressure by palpation. He should palpate the fibrous quality or the lack of it in superficial tissues, in the muscles generally, and locally around vertebral lesions. The coordination of these examinations at one time on the same patient is much more efficient pedagogically than is the repetition of many examinations on many patients. However, repeated determinations of certain entities, such as blood pressure, make for greater efficiency in determining those things. Both groupings should be used: all the systems of a given patient, and a series of patients in whom a given system is examined.

When the student begins his work in an osteopathic clinic he should make his physical examinations under conditions which emphasize their importance. Under all ordinary circumstances his findings on palpation should be emphasized as of chief importance. The recognition of vertebral lesions and of changing palpable qualities of the deep muscles in spinal segments is known to be a most accurate method of determining the viscera affected by disease. He should be able to distinguish by palpation those muscles which are relaxed, those which are voluntarily contracted, those which are tense as a result of visceral disease, those which are contractured, and those which are peculiarly solid, as they are in rigor or in the presence of vertebral lesions.

Not only for the spinal tissues but also for subcutaneous connective tissues in general and for accessible viscera, he should be able to determine by palpation those which are hyperemic, feverish, edematous, fibrous, dehydrated or tumorous. He should be able by palpation to determine the probable relative time during which any given pathological state has existed. That is, he should be able to determine which of two pathological states has been present a greater length of time, and thus to differentiate between primary and secondary tissue changes.

The technic of palpation is important. The student should develop delicacy in the application of pressure. For example, in a spinal examination of a patient he should palpate first the quality of the clothing (unless the examination is made upon the bare skin). When he has a clear picture of the quality of the cloth which covers the skin he can distinguish more delicately the quality of the skin itself. He should notice then the temperature, the moisture or lack of moisture, the softness or roughness of the superficial epithelium, then certain other qualities of the skin itself; that is, whether it is elastic and firm or loose and flabby and whether it has that indescribable sense of “aliveness,” or seems inert. These qualities should be expressed in words, and comparisons used freely.

Next he should study the subcutaneous tissues. These may seem harsh or soft, elastic or fibrous, uniform, uneven or edematous or may present any of several other palpable conditions. Then he feels the fascia of each of the superficial spinal muscles, then their mass. He should note whether these are uneven or fairly uniform, whether local areas of tension, edema, contraction or any other quality exists and, if so at what spinal segments these conditions appear. Then he palpates more deeply and notices the deep spinal muscles in the same manner. Working still deeper he palpates the various processes and surfaces of the posterior aspect of the vertebrae and ribs, and notes whether or not these are symmetrical. After this he should move the vertebrae and the ribs and note any limitation of motion, the speed of return to the normal relations after the release of pressure and the bilateral symmetry of the spinal tissues and the vertebrae.

By so palpating, layer by layer, and by devoting constant attention to the information which is derived from palpation, a student can gain a very exact picture of the lesion and its surrounding tissues. His findings should be carefully recorded because accurate description increases his skill in palpation. It is true also that case records are of value only when they are complete and that the habit of making accurate records is of great value during his entire professional life.

The same procedure is essential to accurate palpation of viscera. Attention first devoted to the superficial tissues, then to the visceral outlines, enables the development of a clear picture of even quite deeply placed tissues. With continuing practice the skillful osteopathic student becomes able to visualize visceral pathology from the information gained by palpation.

After he has been shown a few of the commonly accepted methods for the correction of lesions, his hands become so skillful that it seems as if they performed their proper duties without attention. That is, of course, far from true. It is not desirable for any person to perform delicate and important duties in a perfectly automatic manner, or completely without thought.

These suggestions are intended to be just that. They cover only a very small fraction of the field indicated by the title. Every osteopathic teacher of every subject in the curriculum of our colleges can find many opportunities for training his students in technical skill and delicate palpation as he teaches his subject, provided only that he realizes the importance of the art of palpation, and has some understanding of pedagogical principles.

ing against them; even here they may not be entirely eliminated. Hence they provide the examiner with a means of checking the degree of discomfort which the patient might profess to have against the degree of reflex activity which he actually exhibits. (Figs. 1 and 2).

In searching for and evaluating hyperalgesic areas the examiner must be careful to start with a very light pressure which can be increased gradually. Such a procedure, in most normal areas, is painless. When the hyperalgesia of osteopathic lesion is present, care should be used to avoid causing the patient undue discomfort; in addition, hyperalgesic tissues are more susceptible to bruising than normal tissues, and soreness, which may last for days, may result from using too much force during the palpatory examination.6

Since hyperalgesic areas are frequently not spontaneously painful, as is usually the case with such overt pathologic states as a fracture, or in rheumatic fever, the patient is often surprised when tender areas are found. This is particularly dramatic when the hyperalgesia is largely unilateral, as is usually found, for example, when a patient has recurrent "muscular tension" headaches which predominantly involve only one side of the posterior portion of the head and the suboccipital area.

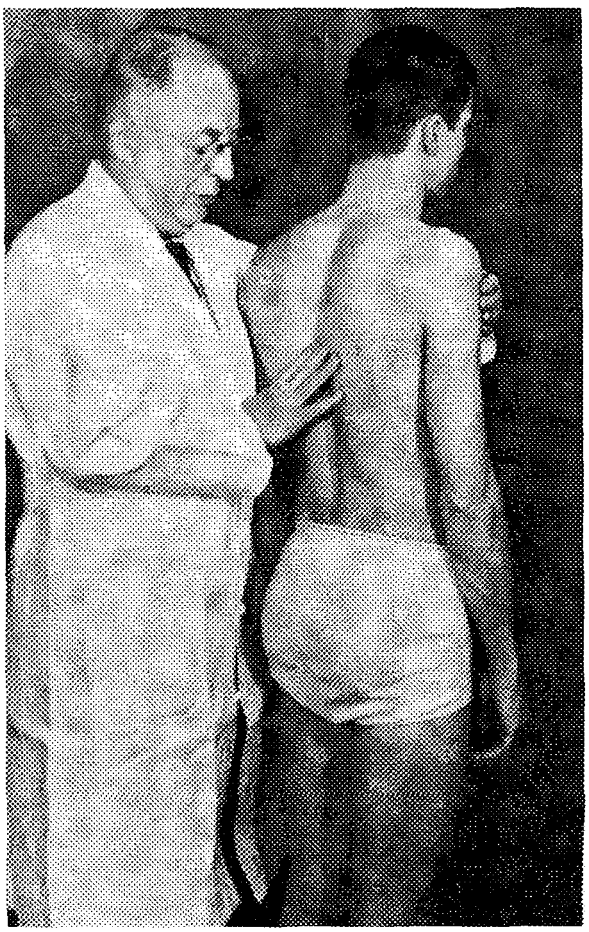

Fig. 1A. The patient is standing comfortably and at ease (he may also be examined while prone or lying on his side) and is supported by the physician's left hand, arm and shoulder. The tip of one finger of the physician's right hand presses moderately against the area to be examined. If hyperalgesia is present the patient experiences discomfort.

Fig. 1B. If hyperalgesia is found by moderate digital pressure, and if the physician twists or moves the examining finger slightly (while maintaining moderate pressure), the patient will experience additional discomfort. If the twisting pressure is further increased the patient will wince involuntarily, arch the entire vertebral column, and attempt to withdraw further by flexing the knees.

Examination for tissue tone or tension

Normal tissue is resilient and has a tension or "tone" which is readily recognized by the experienced examiner. In osteopathic lesion this tone is disturbed. The abnormalities in tone, which have been variously called "doughy" or "boggy" (as in an area of edema), or "rigid" (as in an area of contracture or contraction), are quite similar to the changes in tone that may be palpated over a hairline fracture of an underlying bone, adjacent to a chronically "sprained" joint, or in the part of the abdominal wall which overlies an intraperitoneal inflammation.**

The procedure used in palpation for tissue tone in the supporting tissues is quite similar to the procedure used in searching for and evaluating hyperalgesia. The patient is placed comfortably at rest, frequently sitting or reclining, and is asked to relax as completely as possible. The tip(s) or pad(s) of one or more of the examiner's fingers are lightly placed, or drawn over, the area involved, and the texture (resiliency, scaliness, dryness, wetness, and so forth) of the skin is noted. The pressure of the

**It seems probable that different degrees of acuteness, or of chronicity, of the osteopathic lesion, together with the probability that different tissues in the lesion may be involved in different pathologic processes (trauma, reflex disturbances, and so forth), may account for the different kinds of "tone" abnormality that may be found, and for the different descriptive terms that have been used to describe it. However, further studies of these changes will have to be done before more definitive terms can be used.

Palpation of the musculoskeletal system

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A major purpose of the examination of the neuromusculoskeletal system by palpation is to search for and to evaluate evidences of dysfunction or derangement in the body framework which have come to be recognized by a substantial number of physicians (and by patients who have benefited from treatment of these problems) as representing areas of osteopathic lesion.

The term "osteopathic lesion" has been used, since the early years of the profession, to describe discrete, hitherto unrecognized evidences of disturbances in the body framework which could be palpated, which appear to be due to the many different stresses that may have an influence on the neuromusculoskeletal system, which frequently seem related to signs or symptoms of illness, and which respond favorably to appropriate therapy. This brief description is still valid, although in the intervening years Goldthwait,[1] Travell,[2] Judovich and Bates,[3] Davis,[4] and a number of others have used other names ("faulty mechanics, the potential of disease," "trigger zones," "segmental neuralgia," and so forth) to describe disturbances that are similar to, if indeed they are not identical with, the osteopathic lesion.

The pathologic processes involved in the osteopathic lesion, the relationship it has to other systems and organs of the body, and the mechanisms by which manipulation, and other therapy, produce favorable clinical results, are still only partially understood. There are a variety of reasons for this; these reasons will, be discussed elsewhere when evidence is presented which deals with abnormality in the several components of the body framework (skin, connective tissue, muscle, cartilage, bone, vascular beds, neural networks, and so forth).

However, experience has shown that the student is much better prepared to gain understanding and insight concerning the pathologic processes and mechanisms involved in the osteopathic lesion after he has started to actually palpate for, and to recognize, the various signs of abnormality of osteopathic lesion. While the experienced examiner uses a single palpatory procedure to secure, more or less simultaneously, information concerning tenderness, tissue tone, motion, and alignment, the student will study each element in the palpatory examination as though it were a separate procedure in itself; ultimately, of course, these elements will be blended into a single procedure. While this is obviously an empirical approach, it has proved to be useful for most students.*

*As will be discussed elsewhere, there is a very high incidence of osteopathic lesions (comparable to the high incidence of dental abnormalities) in so-called healthy adults who are free from overt clinical problems. Kendall, Kendall, and Boynton,5 in the monograph *Posture and Pain,* have emphasized this point by stating that they have never seen an adult with "ideal" posture. Hence, there are few, if any, adults that are completely free from some postural stress and from some evidences of osteopathic lesion. In view of this, students have ample opportunity to study this disturbance by examining each other.

The primary signs or characteristics of osteopathic lesion, as they are observed clinically (by palpation), are as follows: (1) abnormal tenderness or hyperalgesia, (2) abnormal tension or "tone" in the covering and supporting tissue, (3) disturbance in the ease and range of motion (particularly motion involving the "play," in articular structures, which is not under voluntary control), and (4) disturbances in anatomic relationships. Each of the elements will be discussed separately.

Examination for abnormal tenderness or hyperalgesia

Theoretically, the finding of hyperalgesia, which in this instance involves a subjective response to digital pressure, might be open to question; however, it is, in fact, a clinically valid observation. This is because, with few exceptions (such as at the lateral side of the neck, where the cervical nerves emerge), the tissues of the body framework are nontender to moderate, nontraumatic forces, because abnormal tenderness is associated with an abnormality in the tension or "tone" in the involved tissues and because, as will be discussed shortly, irritation of hyperalgesic areas initiates certain patterns of neuromuscular reflex activity.

Palpation for tenderness or hyperalgesia is carried out with the patient in a comfortable position, and involves the use of a highly localized pressure' applied by the tip of the examining finger. The palm of the hand and the other fingers are used to steady both the examining finger and the part being examined. The examiner's other hand and arm are also used to steady the patient. The effectiveness of the pressure is greatly increased when the finger, which is being pressed against the tissue being examined, is moved slightly, preferably by a slight twist of the examining hand, which accentuates any discomfort that might be present. If the discomfort caused by the moving pressure is continued, certain reflexes also appear: the patient's eyelids are narrowed, as in a wince; there are frequently involuntary and purposeless movements of the extremities; and, if the discomfort is marked, a withdrawal reflex is initiated. For example, when a patient has abnormally tender midthoracic spinous processes (a common finding in most adults and in many children) a twisting digital pressure applied over the spinous process will elicit discomfort; the patient will involuntarily blink, or wince, *move* his hands or feet or both, and finally, will arch his back into extension. If the patient is standing, the knees will break from extension into flexion. These reflexes are involuntary and are not under control of the will unless the patient is deliberately guard-

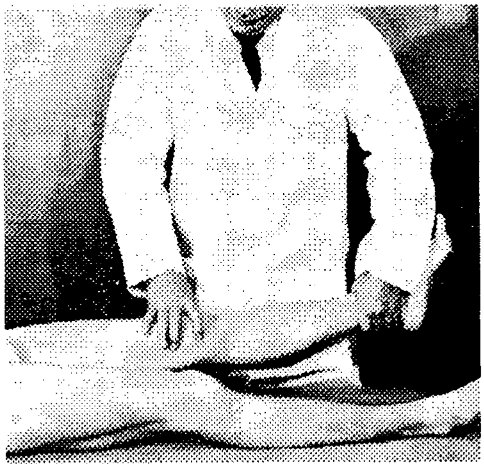

Fig. 2A. The physician places his right index finger in the groove between the femur and tibia on the medial side of the patient's left knee. The physician's left hand elevates the foot and ankle slightly to carry the knee joint into full extension. The degree of extension and the configuration of the groove are noted.

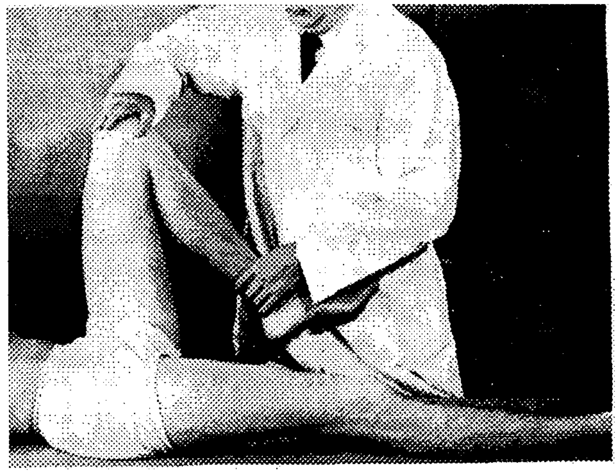

Fig. 2B. The physician flexes the patient's knee, maintaining the right index finger in the groove between the femur and the tibia. The motion is carried out slowly to permit the physician to note, carefully, the changes that take place in the configuration of the groove, and the ease and range of the total motion.

finger tips is increased to palpate through the skin to the subcutaneous tissues and, ultimately, to the underlying muscles, ligaments, fascial bands, tendons, and so forth, to determine the presence of abnormal tension (Fig. 1A).

The observation of abnormal tension in covering and supporting tissue indicates the segmental location, the extent, and the severity of osteopathic lesion. When the examination is repeated from time to time (hours or days) the observation of an increase or decrease in the severity of the disturbance reflects the progression, or the regression, of the underlying pathologic process with which it is associated, and may indicate such factors as progressing fatigue through the day, abnormal exercise, accidental trauma, or an episode of another disease which may alter the status quo.

Changes in the severity of osteopathic lesion occur regardless of whether the process is general, as in the so-called infectious diseases, or local, as in diseases which predominantly involve a single visceral structure, such as the appendix, or if it involves a mechanical stress commonly associated with joint articulations and their muscular and fascial supports. This element of osteopathic lesion (abnormal tissue tension) is readily recognized, and can be roughly quantitated, by any physician who has developed a reasonable degree of skill in the palpation of tissues.7

Possibly the best way to discuss the information to be secured by examining the texture or tone of different types of tissues will be by means of an illustration. Forexample, one of the commonest sites of chronic osteopathic lesion is the midthoracic area. When a patient with such a problem is in a period of relatively good health, the most marked palpatory findings appear to be (1) in the skin, where the examining finger appears to "drag" as it is drawn over the area, (2) at the spinous processes, where there is a thickening which appears to involve the supraspinous ligaments, and presumably tissues such as the periosteum which closely invest the bone (in normal areas the bony prominences feel hard and clean-cut), and (3) in the paravertebral musculature, where there is a minor to moderate abnormality in tension or tone. However, when this patient develops a segmentally related visceral disturbance-- lobar pneumonia, for example-the skin and the tissues investing the spinous processes continue to have about the same abnormality in tissue texture as was present originally, but the rigidity of the related paravertebral musculature, particularly on the side of major lung involvement, is much more abnormal than it has been previously. Also, as the pneumonic problem improves, or regresses, there is a concurrent improvement or regression of the abnormality in the paravertebral musculature, still without too much change either in the skin or at the spinous processes.***

Disturbance in the ease and range of motion

There are two basic types of movement in every joint; that is, motion which can be produced voluntarily by the patient, or passively by the examiner, and motion which can only be produced passively by the examiner (through externally applied traction and compression). The range and the direction of both types of joint movement are governed by the shape and the plane of the articular surfaces, and by the location and condition of ligaments, tendons, muscles, and so forth. Hence, in even the simplest joints, the number of different movements or combinations of movements that may be restricted, or increased, is virtually infinite. In addition, many articulations, particularly those of the vertebral column, are so deeply placed as to make precise evaluation of the particular motion involved extremely difficult, and at times impossible.

Hence, while the experienced examiner can detect motion disturbances, can develop a mental image of the disturbance

***The importance of carefully evaluating (and ultimately of treating) the paravertebral rigidity that is palpated in such as lobar pneumonia problems is seen in Korr's[8] comments about the work of Speransky[9] and of Ginsberg.[10] The Russian investigators observed that intense stimulation of sensory nerve endings in muscle and skin, in areas innervated from the medulla oblongata and upper segments of the cord, could produce profound pulmonary changes, very similar to pneumonia. These observations led to the development of "somatic blockade" therapy in the clinical management of lobar pneumonia. When the segmentally related rigidity of the paravertehral musculature was reduced by procaine infiltration there was a concurrent resolution of the pneumonic process; the temperature dropped, and the patient's general condition improved.

involved, and can describe gross and obvious disturbances, such as extreme flexion or extension, the difficulties in fitting each and every abnormality in motion into a few relatively simple categories, for the purpose of clear-cut description, practically insurmountable. This situation has been described very graphically by Sir James Mennell[11] who discussed the difficulties inherent in categorizing motion disturbances; equally important, Mennell pointed out how much we still have to learn about both the normal and abnormal joint motion characteristics of the many joints of the body.

While it would be desirable, especially for the charting of motion disturbances, to be able to record all such problems with a high degree of accuracy, the primary purpose of the examination is to permit the examiner to secure information about disturbances in both the ease and range of motion that will, in turn, permit him to design, and ultimately to carry out, appropriate manipulative and other procedures that will aid in overcoming any restrictions that might be present. Mennell[12] states as follows: "Thus the technique for examination and for treatment is identical, with the one exception, that examination omits the administration of the final impressed force, which is calculated to aid the restoration of normality with regard to any function that is found to be imperfect."

The procedures that are used to test for motion from joint to joint. Yet there are certain basic fundamentals as regards motion testing that are applicable to all joints. These will be discussed in two categories: motion under voluntary control, and motion not under voluntary control. In each, of course, both the patient and the examiner must be relaxed and comfortable. Also in both, the examiner secures information by watching the part being moved, by the sense of touch in the examining hand, and by his own proprioceptive sense. As regards the latter, when the examiner is palpating for motion he literally fixes himself to the patient; thus, when he moves a part of the patient, he moves apart of himself, and his own muscle, joint, and tendon sense provides him with information concerning the ease and range of motion that is being produced.

Motion that may be produced voluntarily or passively

The examiner usually moves the joint with one hand while the other is placed so that the thumb and on more fingers can determine changes in the "groove" that is formed by the apposition of the rounded edges of adjacent bones. For example, in examining the left knee for flexion-extension, the patient lies supine on the examining table. The examiner grasps the leg, close to the ankle, with his left hand, while the index finger of the right hand is bridged in the groove between the femur and tibia at the medial side of the joint. The examiner flexes and extends the leg on the thigh with his left hand (with an assist by the right hand). Throughout this procedure both hands palpate for the ease and range of the total motion. In addition, the index finger evaluates the ease and smoothness of the motion by carefully noting changes in the depth and configuration of the groove between the femur and tibia as the joint is put through its range of motion (Figs. 2A and 2B).

Testing the more complex, and deeply placed, joints of the vertebral column is somewhat more difficult. Here the examiner places the thumb and/ or one or more fingers in the groove between the spinous processes, or on the tissues overlying the more deeply placed articular and transverse processes where, of course, a clearly defined groove cannot be palpated. The other hand is used to move the trunk down to, or up to, the segments being examined; this is done in the direction of the particular motion for which the test is designed. While the parts of the trunk to be moved (head, shoulder girdle, pelvis, lower extremities, and so forth) vary from area to area and will be discussed in detail later, the basic procedures involved in testing the more complex joints are essentially the same as those for the more simple joints; that is, one of the examiner's hands palpates at the joint for

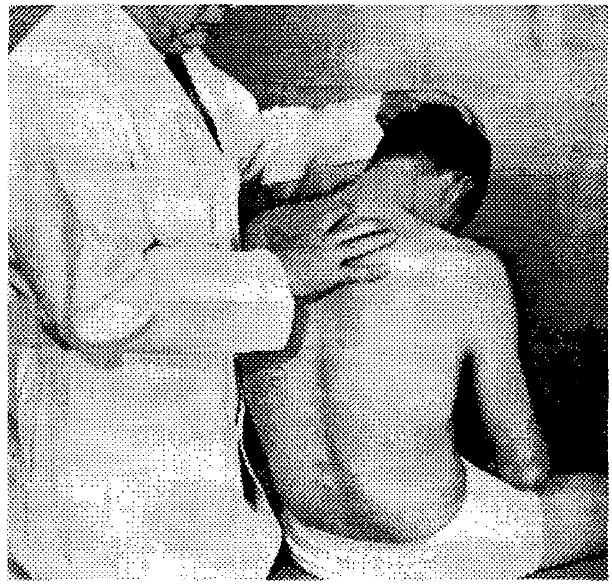

Fig. 3A. The physician places the index finger of his right hand in the groove between the spinous processes of the seventh cervical and first thoracic vertebrae; with his left hand he flexes the neck. In this position the groove between the spinous processes is quite wide and deep.

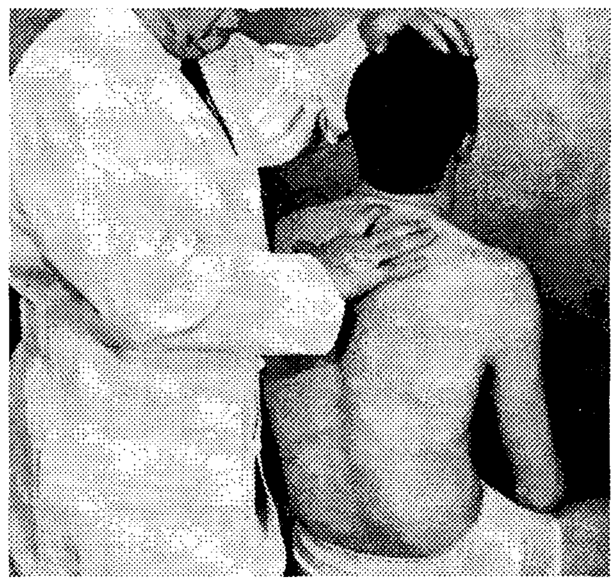

Fig. 3B. The physician extends the patient's neck, maintaining the right index finger in the groove between the seventh cervical and the first thoracic vertebrae. As this movement is being carried out the examiner feels the groove become more narrow; the tip of the seventh cervical spine actually recedes. Such a recession of the tip of the first thoracic vertebrae is not found when the groove between the first and second thoracic vertebrae is examined.

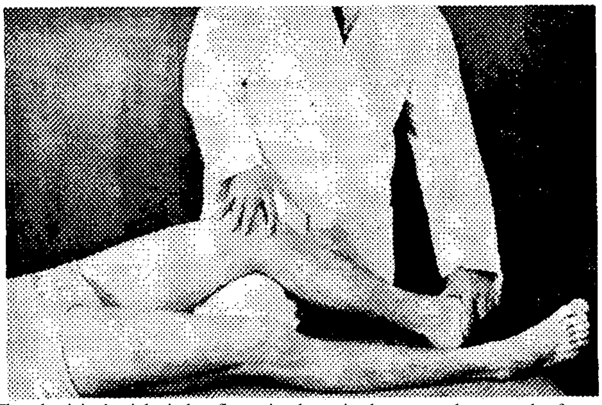

Fig. 4. The physician's right index finger is places in the groove between the femur and tibia while his left hand holds the foot and ankle. Lateral and medial forces with the left and right hands, respectively, slightly side bend the knee; this permits the physician to note the ease and range of the externally induced movement.

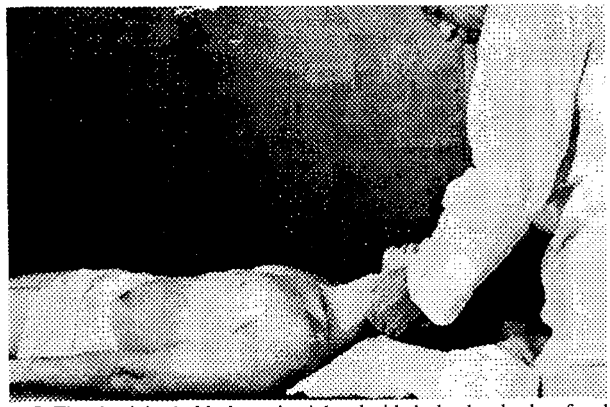

Fig. 5. The physician holds the patient's head with the heel and palm of each hand; the hands are either anterior to, or cupped over, the patient's ears. The physician's finger tips palpate the articular joints bilaterally. When traction is applied to the head the physician palpates the straightening of the anterior cervical curvature which occurs as individual joints are separated.

motion while the other uses various leverages to move the joint through its range of motion.

The joints between the seventh cervical and first thoracic vertebrae and between the first and second thoracic vertebrae will be used for illustration, since one motion (flexion-extension) has such different characteristics at the two joints that the difference is evident to even the most inexperienced beginner. Here the patient is seated comfortably on the examining table. The examiner stands behind, and slightly to one side, of the patient. The tip of the index finger of the right hand is placed, at the midline, in the groove between the spinous processes of the seventh cervical and first thoracic vertebrae. The examiner's left hand is placed on top of the patient's head and flexes the neck until separation. between the seventh cervical and first thoracic spinous processes is maximal (the groove is wide). The neck is then extended until the spinous processes are closest together (the groove is narrow). Actually, at this point the seventh cervical spinous process moves forward, or recedes, under the examining finger, as the neck is extended. This procedure is repeated with the examiner's finger between the spines of the first and second thoracic vertebrae. Here, because both vertebrae are restricted in motion by the attachment of the first and second ribs, the change of the relationships of the two spines (and of the width and depth of the groove between them) is much less marked, in flexion-extension, than it was between the seventh, cervical and first thoracic vertebrae. (Figs. 3A and 3B).

Motion not under voluntary control

Motion which can only be produced passively (by external forces) is made possible by the "play," or the "slack motion" which is found in a joint (1) when external forces are used to secure a slight increment in movement after the patient has carried the joint as far as it will go with voluntary effort, and (2) when external forces are used to secure a motion which cannot be secured by voluntary effort. An example of the former is the slight increase in flexion at the knee that can be secured by the examiner after the patient has reached the end of voluntary movement, and of the latter, the "gapping" of the knee joint when the examiner applies force to side bend the knee slightly, a motion that cannot be produced voluntarily by the patient.

The palpation procedures for motion not under voluntary control, as regards the joints of the extremities, are similar to those used to test the voluntary range of motion. Here, however, when the limit of voluntary motion is reached (or when no voluntary motion is present normally) the examiner gently "springs" the joint to determine how easily a slight increment in motion may be secured. For example, in testing for the joint play that is normally present at the end of the flexion in the knee joint the examiner places his hands as described earlier and, when the extreme of voluntary force is reached gently increases the force being used to determine how much, and how easily, additional gapping may be secured. To test the knee joint for the play that occurs in the direction of side bending, a motion that is not normally produced by voluntary effort, the examiner holds the foot and ankle with his left hand and, with the index finger of the right hand, palpates the groove between the femur and the tibia on the medial side of the joint. With both hands gently exerting forces in opposite directions (the left hand moving laterally and the right medially), sidebending is produced with a gapping of the joint on the medial side(Fig.4)

The same general principles are used in testing the multiple joints of the vertebral column. For example, in testing for joint play, which involves flexion of the cerivcothoracic junction, the examiner places his hands as decribes earlier; when the patient flexes the neck as far as possible with voluntary effort, the examiner gently forces downward on the head with his right hand while palpating for the slight additional movement, that should occur, with his left. An example of testing for motion not under voluntary control is seen in the application of traction to the head and cervical area. With the patient supine on the examining table, the examiner cups the head between the palms of both hands while the tips of the fingers are placed over the articular processes. The examiner exerts a tractional force and palpates for the motion that is thus produced.(Fig.5).

Disturbances in anatomic relationships

Theoretically, in the median plane the bilateral structures of the body framework, the bones, muscles, ligaments, cartilages, and

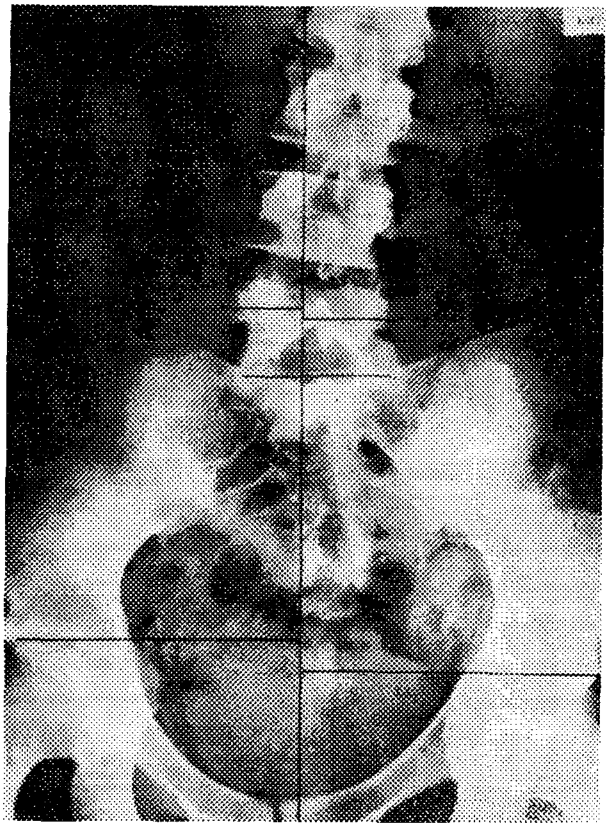

Fig. 6A. The trunk of this patient (standing) was rotated toward the right, the spinous processes being closer to the left edge of the vertebral bodies and the symphysis deviated to the right of the median sacral crest. Although the sacral base is nearly level there was lumbar lateral flexion toward the left, most marked at the fourth lumbar level. The left femoral head was approximately l/2-inch lower than the right.

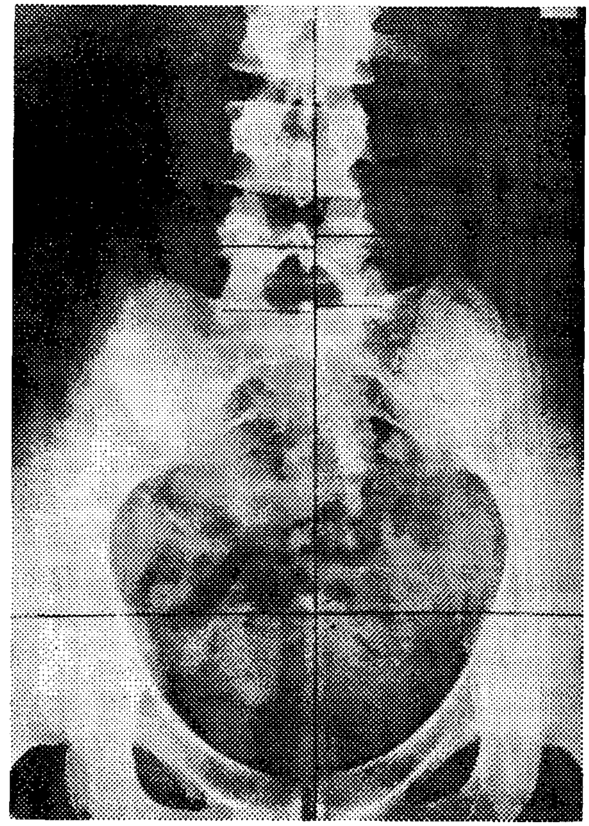

Fig. 6B. This is the same patient as shown in Fig. 6A. This roentgenogram was taken after a period of therapy (bed rest, heat, analgesics, and stretching manipluation) which was followed by inserting a 3/8-inch prosthesis under the left heel. The femoral heads have been leveled, the trunk derotated toward the left, and the lateral flexion, particularly at the fourth lumbar level, considerably decreased.

so forth, are morphologically symmetrical on the two sides and have bilaterally equal functions, including motion and weight bearing. In the frontal plane the situation is somewhat more complicated since when the body is bisected, in this plane, the anterior and posterior halves have quite different characteristics which include, of course, the anatomic curvatures of the vertebral column. Even here however, there is some symmetry since in the ideally constructed individual, the total body mass on the two sides of the line of gravity, that is, the anterior and the posterior portions, are equal in weight and thus balance each other.

Thus it would be logical to assume that the bilateral symmetry of morphology, motion, and weight bearing in the median plane and the symmetry of weight bearing in the frontal plane represent a structural arrangement that would provide for maximum functional efficiency. Conversely, it might be assumed that deviations from this structural arrangement would disrupt symmetry and impair function. Clinical experience has shown that these assumptions, with some qualifications, are in fact, valid. An illustrative case will be cited. A 20year-old female was nearly bedfast because of lowback pain which was greatly exaggerated during menstrual periods. The condition was first experienced, to a mild degree, at age 16 and had gradually increased in severity. There was marked hyperalgesia and rigidity over the lumbosacral area the sacroiliac and the hip joints. The trunk was rotated toward the right and laterally flexed toward the left. Weight-bearing roentgenograms revealed a marked asymmetry of the femoral head heights, the left being l/2 inch lower than the right. Therapy (bed rest, heat, analgesics, and stretching manipulation) was used to reduce the hyperalgesia and rigidity. A prosthesis (heel lift) which was gradually increased from l/8 inch to 3/8 inch was placed in the left shoe (the side of the low femoral head). Under this management the trunk asymmetry decreased with a concurrent (and permanent) decrease in symptoms, hyperalgesia, and rigidity (Figs. 6A and 6B).

Less obvious disturbances in osseous relationships are seen when joints, at rest, do not have their normal anatomic relationships. Such disalignments are usually within the normal range of motion of the joint or joints involved. Steindler[13] describes this situation, as regards vertebral joints, quite aptly. He states:

> In the ability of the spine to revert to symmetry at will from all asymmetrical positions with promptness and precision lies the characteristic hallmark of the normal spine. The inability to do so makes the spine abnormal. The normal spine can, at any point within its range of motion, establish an active equilibrium, can maintain this position at will as long as necessary, and can return to the position of perfect symmetry again, whenever it is desired.

In other words, when a joint cannot return to symmetry from, for example, a position of rotation, this constitutes abnormal alignment, with some of the supporting tissues of the joint being more or less constantly compressed or shortened while others are being stretched.

Anatomic relationships are assessed by palpation of accessible bony prominences and by the evaluation of postural and other roentgenograms. For instance, the vertebral joint is in proper alignment if the interspinous spaces are neither too wide (as in flexion) nor too narrow (as in extension).

Unfortunately, attempts to identify disalignment (short of frank luxation) are complicated by the facts that many prominences are misshapen, and many are too deeply placed to be located precisely by palpation. In addition, there is some question concerning the relative importance of anatomic relationships of osseous structures since in a number of situations a favorable clinical result, at least on a palliative basis, may be obtained by decreasing skeletal tension and improving the ease and range of motion, without making an overt change in anatomic relationships.

In palpating for alignment (or disalignment) the patient should be comfortable and relaxed, usually sitting or reclining. The examiner places himself so that his eyes are at least close to the same level as the part being evaluated, and places one or both hands on, or over, the bony prominences to be examined. Thus the examiner can locate the position of the prominences being palpated and, from his knowledge of the relationships of these prominences to the other parts of the joint, can mentally project the positional relationships of the total joint. For example, we will consider a patient with a convex side rotation curvature to the right at the thoracolumbar junction. This means that the vertebrae are rotated to the right and laterally flexed to the left. Hence, palpation over each transverse process (in a reasonably thin patient) will reveal that those on the right side will be posteriorly placed and separated, while those on the left will be anteriorly placed and approximated. At the same time, palpation of the spinous processes will reveal a curvature that is convex toward the right side. In cases where the bony prominences are too well covered with muscle or adipose tissue, or where there are misshapen prominences, the palpatory findings must be checked by means of radiologic studies which, when properly interpreted, can frequently be used to assist in determining the relationships of the two or more osseous components of the joint (Figs. 6A and 6B).

Laboratory Procedures to be Performed by Students

(Each procedure to be carried out on at least three other students)

Examinationfor hyperalgesia (subject standing or sitting): Palpate spinous processes of Tl, T6, and T12, requesting patient to indicate if and when tenderness is found. When tenderness is found, exceed previously applied pressure and watch for reflex activity.

Examination for tissue texture or tone (subject sitting): Palpate spinous processes of Tl, T6, T12. Note whether or not bony prominences appear to be hard and clean-cut (as would be felt if a similarly shaped piece of metal with rounded edges were palpated through velvet cloth) or if the tissues over, and investing, the spinous processes appear to be thickened, or "boggy." Draw the palpating finger lightly over the skin overlying the spinous processes to determine if it is smooth, or if the finger appears to "drag" on a slightly roughened area.

1. Examination for motion under voluntary control (subject sitting). Place the tip of the middle finger of one hand between two spinous processes at the cervicothoracic area. With the other hand flex and extend subject's neck. Move finger from interspace to interspace until the spines of C7 and Tl are identified. Check for ease and range of motion.

2. Examination for motion not under voluntary control. Repeat procedure described above. At the end of motion under voluntary control, spring joint to produce further flexion and extension and check for "give" in the restraining tissues of the joint.

3. Examination for motion not under voluntary control (subject reclining). Cup hands under back of subject's head with the fingers under the articular processes. Apply traction gently and check for "give" in the cervical vertebral segments.

4. Examination for motion under voluntary control (subject reclining). Place thumb and middle finger in groove between femur and tibia of subject's right knee. Grasp subject's right ankle with right hand. Have subject flex and extend knee (with your assistance). Check for ease and range of motion, and for changes in the width and depth of grooves between femur and tibia. Repeat, using left knee, and compare motion on the two sides.

5. Examination for motion not under voluntary control. Repeat above and add slight springing force at the extreme of motion in flexion and extension. Check "give" in restraining tissues; compare findings at right and left knees.

6. Examination for motion not under voluntary control (subject reclining). Place the heel of the left hand against the lateral side of the subject's extended right knee with the middle finger in the groove between the femur and tibia on the medial side. Place the right hand on the subject's right ankle. Spring the knee medially by exerting force in opposite directions with the two hands. Check for "give" in the restraining tissues and for changes in the groove between the femur and tibia.

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Palpatory diagnosis of the osteopathic lesion

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Although x-ray study and gross visual inspection of the patient are important aspects of osteopathic diagnosis, skillful palpation can detect relatively minute structural changes affecting tissues neurologically related to the disturbance. This article describes an efficient method of developing a workable palpatory diagnostic technique for each of the various areas of the spinal column and extremities. The types of change noted by superficial and deep palpation in both acute and chronic lesions are discussed. The techniques employed to detect lesions affecting the sacroiliac joint are considered in greater detail because of the unique aspects of this joint.

The osteopathic physician uses all available methods of diagnosis, such as laboratory tests and x-ray studies, but there is a method used to a much greater extent and in different ways in the osteopathic profession (compared to the allopathic profession), namely, palpatory diagnosis.

It is by this method that the osteopathic physician seeks out and evaluates all of the evidence afforded him in a suspected disease process-by thoroughly examining each area and taking into account all of the following conditions:

(1) changes in mobility between vertebral segments (these are the most important findings in osteopathic diagnosis);

(2) pathologic changes in skeletal tissues surrounding an area in which a lesion is suspected;

(3) changes in interosseous relations between vertebral segments (these may be misleading owing to inconstancy of form and anomalous changes in shape);

(4) effects of visceral afferent reflexes;

(5) effects of visceral efferent reflexes.

There are, however, two other methods of diagnosis that the physician should utilize to substantiate his palpatory findings: These are, of course, x-ray study and gross visual inspection of the patient. X-ray study especially can be helpful in determining the gross skeletal changes that possibly are related to given disease processes that have occurred. These include scolioses, vertebral anomalies, anatomic short-leg problems, intrinsic bone disease, and discernible soft tissue changes that can be detected in a gastrointestinal series, flat plates of the chest, and retrograde pyelograms.

Gross inspection may reveal some pertinent changes in posture and gait, as well as trophic changes in skin or superficial musculature.

It always must be remembered that there is no valid substitute for skillful palpatory diagnosis in detecting the relatively minute structural changes-reflex or primary-that have drastic and widespread effects on the function of the tissues neurologically related to the disturbance.

Detailed consideration will be given here, therefore, to an efficient method of developing a workable palpatory diagnostic technique. The types of palpatory procedures, the information to be gained by each, and what the author considers to be the best technique for each type of palpation in the various areas will be discussed.

It might be well first to consider the portion of the hand that is most effective to use in palpating. Most authorities agree on two points. One is that the pads of the fingers are the most sensitive portions of the hands available in diagnosis: that part of the pad of each finger just distal to the last interphalangeal articulation is most sensitive. The second point is that the thumb and first two fingers are the best to use. Which of these fingers or what combinations of them to use vary with the area under consideration and the operator's own personal preference.

The process of palpatory diagnosis can be considered under two major headings, namely, superficial and deep palpation. This is a natural division, according to the amount of pressure applied on the operator's palpating fingers as he endeavors to gain information regarding a suspected lesioned area.

The best way to localize a lesioned area is to begin palpation lightly over the area to check on changes in the skin and tissues immediately beneath it and then, after localization in this manner, additional pressure can be applied to ascertain the conditions in the deeper periaxial structures.

In superficial palpation, the operator, using the pads of his fingers, strokes the skin gently, but firmly enough to allow perception, over the area to be examined.

There are five types of change to be noted by superficial palpation in both acute and chronic lesions: skin changes, temperature changes, superficial muscle tension, tenderness, and edema.

In the acute lesion, an actual increase in temperature may be felt in the skin overlying it, but the evidence is vague and extremely fleeting, and not much reliance should be placed on it.

The skin overlying the lesion will feel tense and relatively immobile, owing to the congestive effect of the pathologic processes below it. Detection of superficial muscle tension will require a slight increase in palpatory pressure, but this will show a definite doughiness of the superficial muscular fasciculi.

Tenderness, like temperature change, may be misleading and should be considered with caution. However, it is usually found in the skin and deeper periaxial tissues directly overlying the acute lesion.

Edema is most pronounced in the deeper tissues of the acute lesion, but a definite impression of fullness can be perceived in the superficial tissues.

In the chronic lesion, temperature changes may or may not be present because acute inflammatory tissue changes are minor. The temperature of the skin overlying a chronic lesion may be either normal or even reduced as a result of ischemia of the underlying tissues. This is characteristic, for example, of chronic fibrotic changes.

The skin usually will show immobility and tension as a result of reduced elasticity when chronic fibrotic changes are present beneath the skin. Also as a result of fibrotic changes, the muscular fasciculi will be harder and more ropy in chronic than in acute lesions.

Tenderness is of even less importance in chronic than in acute lesions because the tissue irritation characteristic of acute inflammation is not present.

Edema usually is absent. In its place will be fibrotic tissue changes.

Performing deep palpation, the operator increases the pressure on his palpating fingers sufficiently to make contact with the tissues deep in the skin, known as the periaxial (paravertebral) soft tissues of the spinal column. Six types of change may be noted: mobility, tenderness, edema, deep muscle tension, fibrosis, and interosseous changes. All but fibrosis can be perceived in both chronic and acute lesions.

In the acute lesion, restriction of freedom of movement of the vertebral segments may be perceived. A joint may be put through the full range of movement in any position, including flexion, extension, rotation, and lateral flexion, but more than the normal effort is required to do so.

Perception of increased tenderness will be unreliable, but considerable tenderness over a lesioned segment-particularly in an acute traumatic lesion produced by severe force may be observed by deep palpation.

There is always marked edematous swelling of tissues in the deep periarticular regions in the acute lesion. To the palpating fingers, this feels like a soggy, swollen area in the region of the lesion.

A characteristic doughy spasticity may be perceived in the fasciculi of the muscles directly concerned with the mobility of the individual vertebral segments, such as the intertransversarii, rotatores, or multifidi, or in the more superficial periaxial spinal muscles concerned with the gross movements of the vertebral column.

In the chronic lesion, the periaxial soft tissues will have lost much of their normal elasticity and pliancy, so that range of motion will be decreased between the segments in any combination or all of the physiologic movements. (The check for mobility changes and that for interosseous changes always should be done together and one used to check on the other.)

Tenderness will be much less in the chronic than in the acute lesion and may be absent.

Edema may have given place to fibrotic changes characteristic of chronicity.

Alteration in muscular tone will have changed from the doughy type found in the acute lesion to the ropy, bonelike change characteristic of chronic inflammation.

At an advanced stage, the chronic lesion will show fibrotic changes resulting in dysfunction of the periaxial musculature and ligamentous supports to all degrees, even to the extent of actual ankylosis of the joint.

Changes in interosseous relations perceptible on deep palpation will be the same for both chronic and acute lesions. Osteopathic lesions are designated principally by their interosseous abnormalities. However, the evaluation of these positional derangements is best accomplished through observation of mobility changes between vertebrae rather than of abnormalities of bony relations. Anatomic anomalies in each vertebral segment (for example, malformed or crooked spinous processes or transverse processes) are common enough to be misleading if they are used as the sole criteria of derangement.

Types of lesions

The principal types of lesions can be classified as either primary or secondary, and in each of these categories there are single lesions and group complexes.

Single lesions are of four types: flexion lesions (straight or simple), extension lesions (straight or simple), flexion-rotation-lateral flexion lesions, and extension-rotation-lateral flexion lesions.

With simple flexion lesions, extension is restricted, but additional flexion usually is possible. The converse is true for simple extension lesions. For both, superficial and deep tissue tension are equal bilaterally, and there is increased tension in the supraspinous ligament with the former. In structural relations, the two types show contrasting pictures. Flexion lesions show separation of spinous processes, bilateral separation of transverse processes and facets, and anterior approximation of the bodies of the vertebrae. Extension lesions show approximation of spinous processes, bilateral approximation of transverse processes and facets, and anterior separation of the bodies of the vertebrae.

In the single straight flexion lesion, when the vertebral segment flexes on the one below it, it also moves directly forward. This has been verified in cineradiographic studies. In the single straight extension lesion, when the vertebral segment extends on the one below it, it also moves directly backward.

Flexion-rotation-lateral flexion lesions and extension-rotation-lateral flexion lesions may be primary, secondary, or compensatory to imbalance factors. In both, lateral flexion is restricted toward the convexity, but in the former the segment will not extend, and in the latter it will not flex. Rotation toward the concavity can be increased by pressure on the transverse processes on the side of the convexity, but passive rotation toward the convexity is markedly restricted to pressure over the transverse process on the side of the concavity.

In both, there are superficial tissue tension on the side of the convexity and deep tissue tension on the side of the concavity.

In structural relations the two types differ. In the flexion-rotation-lateral flexion lesion, the spinous process is separated from the one below, and, in following the arc of the vertebral body's rotation toward the produced concavity, the spinous process has deviated laterally toward the produced convexity. The transverse process is posterior to and approximated to the one below in the concavity.

On the concavity, the intervertebral disk has been compressed and narrowed, and the inferior facet of the vertebra above has moved downward and posteriorly in relation to the superior facet of the vertebra below. The vertebral body has rotated into the concavity.

In the extension-rotation-lateral flexion lesion, the spinous process is approximated to the one below, and in following the arc of the vertebral body's rotation into the produced concavity, the spinous process has deviated laterally toward the produced convexity. The transverse process is posterior to and approximated to the one below in the concavity and anterior to and separated from the one below on the side of the convexity.

On the concavity, the inferior facet of the vertebra above has moved downward and posteriorly in relation to the superior facet of the vertebra below.

On the convexity, the intervertebral disk is on tension because of the separation of the vertebral bodies, and the inferior facet of the vertebra above has moved upward and anteriorly in relation to the superior facet of the vertebra below. The vertebral body has rotated into the concavity.

Among group complexes, the first to be considered is the easy normal-lateral flexion rotation type, with scoliosis. To understand the mechanisms involved in production of such a group curve in the vertebral column, one must view the factors responsible for production of the phenomenon, the manner in which the whole spinal column reacts as a unit to these factors, and the way the individual vertebral segments react one with the other as the curve is produced.

In considering the interactions of the vertebral segments, it is well to recall the law of physiologic movement of the spinal column, which states that when the spinal column is in the easy-normal position, that is, when no element of flexion or extension has been introduced, if lateral flexion occurs, the spinal column acts as a semiflexible shaft that swings outward and away from a force applied directly downward on it. (This phenomenon is in contrast to the behavior of the vertebrae concerned in a single lesion, in which they are in either flexion or extension. Then when lateral flexion is introduced, the vertebral bodies rotate into the produced concavity.)

The manner in which the spinal column behaves when a lateral flexion group curve is introduced may be explained in terms of differences in behavior between the bodies of the vertebrae and the neural arches and facets.

Because there has been no element of flexion or extension introduced between the vertebral segments in the group curve, there is no specific localization of the lateral flexion force applied to produce the curve. The entire area becomes involved, and the lateral flexion force is centered mainly on the bodies of all the vertebrae concerned in the group curve. As a result, the vertebral bodies move outward and away from the midline (center) much more quickly than do the corresponding neural arches and articular facets of these vertebrae. This phenomenon creates the situation wherein the vertebral bodies rotate as a group into the produced convexity. The vertebral body or bodies at the apex of the curve produced move furthest away from the midline, and each successive vertebral body in the curve moves a shorter distance from the midline as the curve progresses above and below the apex.

The remaining portions of the vertebrae in the curve behave as follows: The transverse processes of the vertebrae at the apex of the curve are most widely separated, and the spinous processes of the vertebrae at the apex have deviated farthest from the midline. Successive processes deviate less as the distance from the apex to either end increases. This creates a situation wherein palpation of a group curve shows the transverse processes of the vertebrae at the apex of the curve farthest back. As the curve is traced above the apex and below it, the transverse process of each succeeding vertebra is farther forward than the next one below in the region above the apex and farther forward than the one above in the region below the apex.

The structural pattern thus created can give the examiner the impression that he is dealing with a series of single lesions without any necessary element of flexion or extension between each two segments. However, there are varying degrees of rotation and lateral flexion between each two segments, depending on their proximity to or distance from the apex of the curve. The direction of rotation of these individual segments in relation to each other differs above and below the apex of the curve. The segments above the apex rotate toward the produced concavity in relation to the midline, and those below the apex rotate toward the produced convexity in relation to the midline. All this is, in fact, physiologically true, and some manipulative procedures are designed to correct group lesions as if they were just a series of rotation-lateral flexion lesions stacked one upon the other.

It is possible and not at all uncommon to find, within the elements of a group curve complex, pure single lesions of the flexion-extension-rotation-lateral flexion type. Such single lesions usually were in existence before the advent of the clinical conditions that produced the group curve.

The whole process just described applies to any lateral deviation from the midline of the body, and either functional or organic scoliosis may result.

Functional scoliosis is the more commonly encountered type. It is a purely compensatory mechanism and promptly disappears when the cause is relieved.

Organic scoliosis is a condition that has existed for a considerable length of time. Extensive fibrotic changes are present in the soft tissues around the scoliotic area, and at times there is even actual molding of the vertebral bodies themselves to fit the curvature produced by the scoliosis.

In either type, the salient palpatory diagnostic signs include restriction of lateral flexion toward the convexity and of passive rotation toward the concavity when pressure is applied on transverse processes on the convexity. Passive rotation toward the convexity by pressure on transverse processes on the concavity remains unrestricted. There is superficial and deep tissue tension on the side of the convexity.

Among structural relations, the spinous process has deviated laterally toward the convexity. Each transverse process is posterior to and separated from the one below on the convexity and anterior to and approximated to the one below on the concavity. Facets are separated on the convexity and approximated on the concavity. The vertebral body is rotated into the convexity or the side to which the spinous process deviates.

Other types of group lesions concerned with increases or decreases from the normal in the anteroposterior curve of the spinal column are the kyphotic, flat thoracic, and lordotic.

Kyphosis represents an exaggeration of the normal anteroposterior curve in the thoracic area and usually is considered to be a group of single straight flexion lesions.

The flat thoracic lesion is the opposite of the kyphotic thoracic lesion and is considered to be a group of single straight extension lesions.

Lordosis, according to the new classification, means the exaggeration of the spinal curvatures that are normally concave posteriorly, as in the cervical and lumbar areas. Group curves of this type may be considered as a series of straight flexion lesions in both areas.

The factors that cause the various group lesions are, in order of their frequency, short leg (anatomic), occupational stress, bad posture, congenital deformity (hemivertebra), incipient poliomyelitis, injury to spine or extremities, rickets, and ptosis.

Methods of palpatory diagnosis

In a consideration of the most efficient methods of palpatory diagnosis for each of the various areas of the spinal column and the extremities, the correct positions for the operator and the patient are important.

Cervical area

In palpation of the cervical area, the patient lies on his back on the table, and the operator stands at the end of the table above the patient's head.

The patient's head may lie flat on the table, or the operator may place one of his knees on the table and rest the patient's head against the anterior surface of his thigh.

The posterior aspect of the patient's occiput is then cradled in the operator's two palms. This allows the operator the free use of the pads of the first three fingers to check the entire cervical area both superficially and deeply.

In superficial palpation, the operator passes the pads of his fingers lightly up and down over the skin overlying the facets and transverse processes of the entire cervical area until a suspected area is reached, and then increases the depth of his palpating pressure until he can investigate the area further through deep palpation. In this he checks for edema, deep muscle tension, interosseous changes, and mobility changes.

He checks flexion by placing the pads of the fingers between the spinous processes of the vertebral segments. He checks for separation by comparing the intervals between relatively normal segments above and below with that of the questionable one. If the segments are actually separated, the operator may use a double check by gently extending the cervical portion of the vertebral column at the suspected vertebra. If movement is more restricted here than between the relatively normal segments, the vertebra may be said to be definitely in flexion.

Extension is checked by exact reversal of the procedure just described for flexion.

Lateral flexion is checked by placement of the pads of the operator's fingers in the interval between transverse processes and laterally flexing the cervical portion of the vertebral column down to and including the segment in question.

If palpation reveals that the transverse processes are approximated on the left side, the vertebral column should be laterally flexed to the right until the segment in question is included. If lateral flexion of that segment is restricted to the right side, the segment may be said to be definitely lesioned in lateral flexion to the left side. (The converse also is true.)

Rotation is checked by deep palpation with the pads of the fingers over the articular facets of the cervical vertebrae until one is felt to be posterior in relation to the next one below. When such a condition is palpated, the operator rotates the spinal column to the side opposite the posterior transverse process. If the segment in question shows resistance to this rotatory movement to the opposite side with or without decrease in the range of mobility (depending on the degree of acuteness or chronicity), the segment may be said to be lesioned with rotation to the side of the palpated posterior articular facet. This rotation is to the same side as the approximated transverse processes in the single lesion or to the side of the separated transverse processes in a group lesion.

Rotation is almost negligible in the occipitoatlantal area per se because of the peculiar facing of the articular facets on the occiput and superior surface of the atlas and the limiting effect of the alar ligaments. Most of the pure rotatory action in the cervical area is found between the atlas and the axis and the accumulated rotatory action of the balance of the cervical area. The sternomastoid muscle, acting unilaterally along with the suboccipital muscles, produces whatever slight movement is found.

Thoracic area

In palpation of the thoracic area, the patient sits on the side of the table facing away from the operator, and the operator stands behind the patient.

The pads of the first two fingers usually are used in all phases of palpatory diagnosis except the checking of mobility restriction, for which the thumb is used.

In superficial palpation, the operator gently but firmly palpates the skin and superficial subcutaneous structures overlying the vertebral column by a stroking action over the area. This is done to check the salient points that superficial palpation can uncover, such as muscle tension, tenderness, and edema. When a suspicious area is located by this method, the operator increases his palpatory pressure until his fingers can detect the deeper periaxial tissue changes.

For deep palpation, the operator may develop a particular preference for which fingers to use in the thoracic area, but the pad of the thumb usually is best. The anatomic structure of the thoracic area, with its rather limiting appendage-the chest cage-makes it necessary for the operator to have a much firmer hold on the patient than he needs in other areas if he is to produce the necessary movements of the thoracic portion of the vertebral column to check interosseous changes and restrictions of mobility.

The articular facets and the transverse processes in the thoracic area should be examined one side at a time. (The intervals between spinous processes can be examined during examination of either side.) The operator stands behind the patient and to the side that he wishes to check. For example, if he wishes to check the right side of the thoracic area, he stands behind the patient and slightly to the patient's right side. He then grasps the upper surface of the patient's left shoulder with his right hand and allows his right arm to fall across the back of the patient's neck and shoulders in such a way that the operator's right elbow falls on the upper anterior surface of the patient's right shoulder.

With his arms and hands in this position, the operator is free to move the thoracic portion of the vertebral column through flexion, extension, rotation, and lateral flexion at will. He can check all phases of interosseous change and mobility restriction by simply moving his thumb from one diagnostic point to the other (intervals between spinous and transverse processes and facet prominences).

To check the other side of the thoracic portion of the column, the operator simply steps to the patient's other side, changes hands, and repeats the procedure.

Flexion is checked by first examining the intervals between spinous processes. If there is greater separation at some point than above and below it and the interspinous ligament is tense, the operator should change the position of the arm he has placed across the back of the patient's shoulders to a position across the front of the upper part of the chest and grasp the patient's opposite armpit with his hand. By doing this, the operator is able to put the thoracic portion of the patient's vertebral column into forcible extension by applying upward traction and backward bending through the arm across the front of the patient's chest. If the segment being examined is found to be restricted in its movement of extension, it may be said safely that the vertebra is lesioned in a position of flexion.

For testing extension, the operator remains in the position used for flexion, except that he keeps his upper arm across the back of the patient's neck and shoulders and puts the thoracic portion of the vertebral column into forcible flexion by applying downward pressure and forward bending with that arm.

To check lateral flexion, the operator bends the thoracic portion of the vertebral column to the right or left of the midline by pressure through the hand or elbow of the arm placed behind the patient's neck and shoulders. The pad of the thumb is placed in the interval between transverse processes, and the spinal column is laterally flexed until the segment being examined is included in the movement. If lateral flexion is limited to the side opposite that where deep palpation has shown the transverse processes to be approximated, the vertebra may be said to be lesioned in lateral flexion to the same side as the approximated transverse processes.

To check rotation, the operator forms a firm, fixed point by pressure from the pad of his lower thumb against the transverse process and articular facet of the vertebra below the one in question, and then uses his upper arm (the one over the patient's shoulder) to rotate the thoracic portion of the vertebral column down to and including the vertebra being checked.

If the segment is found to be restricted in rotation to the left, it may be said to be lesioned in a position of rotation to the right, and vice versa. This finding usually is confirmed by the subsequent finding that the articular facet of that vertebra is posterior on the right side also.

It is important to remember that, in diagnosing the condition of any area, the operator should make a detailed evaluation of which phase or phases of mobility restriction are most severely involved. This can and does vary in primary lesions with the nature and degree of force applied by trauma to the joint and the position of the joint at the time of the lesioning. The degree of severity of the visceral abnormality causing the reflex spasms in the periaxial spinal musculature, and the length of time it has been in force, will greatly influence the degree of change in mobility in any phase. This is important because it exemplifies the close relation between correct, thorough palpatory diagnosis and the subsequent application of specific corrective osteopathic techniques.

Lumbar area

In palpation of the lumbar area, the patient lies prone on the table (except for diagnosis of mobility restriction), and the operator stands to either side of the patient at about the level of the hip joint.

For superficial palpation, the pads of the first two fingers are the best to use, and some operators use these also for deep palpation. In that procedure, however, I believe the pads of the thumbs are best to use, except in checking for mobility changes. A gentle but firm upward and downward springing motion with the thumbs is most helpful.

During checking of changes in mobility, the patient should sit on the side of the table or astride the end and face away from the operator, with his hands clasped behind his neck. The operator then slides one of his arms through the loop of the patient's arms on one side and grasps the upper arm of the patient on the opposite side just below the shoulder. With the patient and operator in this position, the operator has complete control of the upper portion of the patient's torso and is able to rotate, laterally flex, flex, or extend the lumbar portion of the vertebral column to any position. The operator then places the pad of the thumb of his other hand as a fixed point over the portion of the lumbar vertebral segments to be checked (intervals between spinous and transverse processes and articular facets), and moves the lumbar portion of the vertebral column through all the phases of motion to be checked, down to and including the vertebra above the one at which the thumb rests as a fixed point.

Sacioiliac area

Because the sacroiliac joint is a singular structure, different from all intervertebral joints, and has its own peculiar differences of mobility reactions, the various types of lesions possible here and the technique for their diagnosis will be considered in detail.

It must be recalled that, in this region, the relations between rotation and lateral flexion as the sacrum moves between the innominate bones are not the same as in the other vertebral joints. That is, when the sacrum rotates to one side, it flexes laterally to the opposite side. (The occiput follows the same rule as it moves on the atlas.)

There are two types of sacroiliac lesions: anterior sacral and posterior sacral. In the former, the sacrum has moved anteriorly, for example, on the left side at the superior pole of the joint between the innominate bones. When this occurs, the sacrum rotates to the right and laterally flexes-r tilts-to the left side.

In the posterior sacral lesion, the sacrum has moved posteriorly, for example, on the right side between the innominate bones at the inferior pole of the joint. When this occurs, the sacrum rotates to the right side and laterally flexes to the left side.

From these descriptions of anterior and posterior sacral lesions, it can be seen why there is some controversy as to whether it is possible for the sacrum to be lesioned anteriorly at the superior pole on one side without a coexistent movement of the sacrum posteriorly at the lower pole on the opposite side, and vice versa.

The general consensus at the present is that it is possible. However, experience has taught me that the best policy is to check both aspects of possible lesioning in each patient and adjust subsequent application of corrective technique accordingly. In other words, often both anterior and posterior lesioning exist simultaneously. The extent of such lesioning probably is directly proportional to the degree of traumatic force applied to the sacroiliac joint at the time of application of that force.

In diagnosis of sacroiliac lesions, the patient is placed prone on the table, and the operator stands to the side of the patient at the level of his hips.

When a typical anterior sacral lesion on the left is present, superficial palpation with the pads of the first two fingers or the thumbs will show marked tenderness in the superficial structures overlying and immediately lateral to the superior pole of the joint on the left side, and tension in superficial fibers of the gluteus maximus in the region of the superior pole.

Deep palpation with either the pads of the first two fingers or the thumb will show various deep tissue changes. To detect changes in the gluteal muscle, the pads of the thumbs may be used to palpate deeply over the area radiating laterally from the superior pole of the joint. Marked tension and tenderness in the deep fibers of the gluteal muscles on the left side will be felt. For changes in the adductor magnus and sartorius muscles, the pads of the first two fingers may be used to apply deep pressure over the lower insertions of these muscles and the medial aspect of the left thigh just above the knee. Marked rigidity and tenderness will be observed. The rectus femoris muscle will be in marked tension over the left side as a result of posterior rotation of the innominate bone.

Various interosseous changes also will be observed. To detect changes in the posterior superior iliac spine, the operator uses the pads of both thumbs, placing one thumb immediately beneath the posterior superior iliac spine on each side. In the presence of an anterior sacral lesion on the left side, the posterior spine on the left side will appear lower than the corresponding one on the opposite side. (The converse will be true when an anterior sacral lesion is present on the right. The anterior superior iliac spines will appear in exactly the reverse relation.)

Changes in the interval between the posterior spine of the ilium and the posterior surface of the sacrum may be detected by using the pads of the first two fingers to palpate deeply in the groove formed between the posterior superior iliac spine and the sacrum in the region of the superior pole. This groove will be markedly deeper than normal as a result of rotation of the sacrum (to the right with an anterior sacral lesion on the left).

The spinous process of the first sacral segment may be palpated with the pads of one or both of the first two fingers, and will be found to be closer to the left posterior superior iliac spine than to the right one (again, as a result of the direction of rotation of the sacral body to the right).

For diagnosis of a posterior sacral lesion between the innominate bones on the left side, the techniques of palpation are the same as for an anterior sacral lesion, as just described. Superficial tenderness and tension will be marked over the lower pole of the sacroiliac joint on the left side (opposite the posterior inferior iliac spine on the left side). This tenderness and rigidity will radiate laterally outward to the left, over the surface of the gluteus maximus muscle.

Deep palpation will show the deep fibers of the gluteus maximus to be rigid and tender opposite the lower pole of the joint on the left side. Tension in the fibers of the piriform muscle will run laterally from the region of the lower pole of the joint on the left to the femur. There will be tenderness and tension in the adductor magnus muscle on the upper medial aspect of the left thigh also. The whole left aspect of the sacrum will appear to be posterior to the right side, with the sulci between both the posterior superior and inferior spines and the dorsal aspect of the sacrum considerably decreased in depth.

Interosseous changes will include apparent elevation of the left posterior superior iliac spine above the corresponding one on the right. The left anterior superior iliac spine, on the other hand, will appear lower than the corresponding one. The spinous process of the first sacral segment will be farther from the left than from the right posterior inferior iliac spine, again as a result of rotation of the sacral body to the left.

Restrictions of mobility are most important and are checked by a rather special technique. The patient remains prone on the table. The operator first places the pads of the first two fingers of one hand in the sulcus between the posterior superior iliac spine and the dorsum of the sacrum in case of an anterior sacral lesion, or between the posterior inferior iliac spine and the sacrum in case of a posterior sacral lesion. He then places the heel of the other hand directly over the dorsum of the sacrum.

To check for mobility changes, the operator simply springs the sacrum between the innominate bones by alternate pressure and release through the heel of his hand; he checks for restrictions in movement by the palpatory sensations he perceives beneath the fingers held in the sulcus.

In the presence of true anterior sacral lesions, the mobility restriction will be found to be greatest in the region of the superior pole of the sacroiliac joint. With true posterior sacral lesions, the mobility restriction will be found greatest in the region of the inferior pole of the joint.

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Discussion

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The evaluation of a paper of this nature will be influenced by the circumstances of its preparation and delivery. If such a subject were studied and presented by an undergraduate student, the material presented here might be accepted as indicating a reasonable understanding of spinal mechanics and the local eflects of disturbances therein. But when such a subject is prepared by a Fellow of the American Academy of Osteopathy for the Conclave of Fellows, I submit that it should provide evidence of an acquaintance with the literature already available on the subject, which should then be evaluated through the author's own personal experience. A postfellowship article could reasonably be expected to present original thought and personal experience supported by or even refuting previously reported work.

The title of this paper needed definition. What does the author mean by "palpatory diagnosis"? What is his definition of the "osteopathic lesion"? First, considering the subject of palpatory diagnosis, he distinguishes it as a method used primarily in the osteopathic profession. Thus it is clearly differentiated from the forms of palpatory diagnosis used in other branches of the healing arts. It is further defined as the medium through which "the osteopathic physician seeks out and evaluates all of the evidence afforded him in a suspected disease process- by thoroughly examining each area" . . . . This is an excellent comprehensive definition which, may I emphasize, applies to all of the evidence afforded by examining each area. A series of conditions is then enumerated in which such changes may be detected, namely: active and passive mobility changes between vertebral segments; changes in skeletal tissues surrounding an area of suspected lesion (is the listener to assume that this lesion, mentioned here for the first time, and without definition, is the area of mobility change referred to in No. 1); changes in anatomic relations in vertebral segments; reflex changes mediated by the autonomic nervous system.

But are these all of the palpatory evidence afforded him by thoroughly examining each area ?

Perhaps this question will be answered if the listener can discover the author's working definition of the osteopathic lesion. He speaks of detecting "the relatively minute structural changes-reflex or primary-that have drastic and widespread effects on the function of the tissues neurologically related to the disturbance." However, those "relatively minute structural changes" are not anatomically located except by inference from what follows. It is implied that the term "osteopathic lesion" is a universal term for a precise clinical entity, or perhaps an anatomic or pathologic entity, whereas such is far from the truth even within the American Academy of Osteopathy. Korr[1] wrote:

> The human organism . . . is highly subject to anatomic and functional derangements of joints and their supports, especially the vertebral, pelvic, and other weightbearing articulations. These "errors" in weightbearing unfavorably affect the structure and function of neighboring and distant parts of the body, thus initiating and contributing to pathological influences and processes. *This complex of the articular disturbance and its associated phenomena has been designated as the OSTEOPATHIC* LESION (italics supplied).

Hoag[2] provided a masterly analysis of osteopathic lesions. He stated that the term is applied to the following:

> disturbances in structure which interfere with any function of an individual, . . .disturbances in structure or to disorders of the mechanisms which normally maintain the physiological structure-function interrelationship or reciprocal interdependence.

He then classified osteopathic lesions and pointed out:

> Considering that structural disturbances, i.e., osteopathic lesions, can affect a tissue's function, one must realize that each type of structure of the body can originate or accentuate such a disturbance.

He named nine anatomic areas included as the basic sites of the osteopathic lesion and described in considerable detail the articular disturbances in structure, adding:

> It should be emphasized that disorders in articular mobility are only one type of structural disturbances that frequently become osteopathic lesions . . . The non-articular types of osteopathic lesions are none the less important.

He cited the various criteria by which the osteopathic lesion may be recognized, the first of which is "irritation in the tissue," and the second, "a disorder in the normal mobility, movability, or motion of the structure." I have selected only a few points from this excellent study of the true meaning of the osteopathic lesion, but I recommend it for the enlightenment of every member of the profession.

In the past 75 years, there have been numerous articles on the osteopathic lesion. Only a superficial perusal of these indicates that different authors employ the term to describe different anatomic and physiologic conditions. It is perhaps significant that this term was rarely, if ever, used by Dr. Still. He referred his students to the healthy alignment of articulations, the healthy function of fascia, the adequate arterial supply and venous drainage of all parts of the organism, irrigation of the central nervous system with abundant cerebrospinal fluid, free diaphragmatic function and so forth, but he did not refer to an osteopathic lesion by that name. In Paragraph 265 of *Osteopathy: Research and Practice,*[3] he referred to a bony lesion, which he defined simply as "a sufficient strain or dislocation to produce pressure and obstruct the normal discharge of nerve and blood supply." In Paragraph 74 he epitomized the duty of the osteopathic physician in his treatment of disease in these vivid words:

> If a mechanic is so particular to inspect every part and principle belonging to a steam engine for the purpose of getting good results, can you as an engineer omit any bone in the body and claim to be a trustworthy engineer? Can you say that any part has no importance physiologically, in this the greatest engine every produced-the engine of human life?

Dr. Walton implied a definition of the osteopathic lesion, I believe, as a condition of restricted mobility in a vertebral or sacral articulation, and he meticulously described the palpable findings related to the various lesions. He included a remarkable description of the minutiae of joint motion that may be studied by the use of trained fingers. I commend the author on his precise analysis of the changes in active and passive motion of vertebral and sacral articulations and his careful observation of variations of temperature, edema, muscular tension, and tenderness in the vicinity of such articular changes. This paper, obviously prepared with diligent attention to detail, might be compared to a detailed description of Colorado Springs, its buildings, its water and lighting systems, and its climate when the real subject of the discourse was to be the state of Colorado.

I have suggested extensive study of the term osteopathic lesion. As the concept of the lesion expands, as Hoag, for example, has indicated it inevitably must, the concept of palpatory diagnosis also must be expanded. Becker[4] provided the profession with a learned series of articles on diagnostic touch, and I reported on a series of workshops on palpation.[5]

The physician should not rely solely on the writings of others for his authority, however. His patients can be his finest teachers if he will “listen” to what their anatomic-physiologic mechanism can teach him. Dr. Walton spoke of range of joint motion-active or passive. But in two places he referred to the skin feeling immobile. Is this a reference to resistance to passive motion, or to lack of customary motion from within?

Palpatory diagnosis in the osteopathic sense is like an iceberg. Active and passive articular motion is the visible eighth of the iceberg, but the inherent motions within the body are the hidden seven eighths of the iceberg. These are the motions to which Still referred when he defined osteopathic medicine as the law of mind, matter, and motion. These are the motions that are fundamental to health and in which aberrations precede and accompany outward manifestations of disease. The inherent motility is manifested in bone, in fascia or dural membrane, in fluid, and in the central nervous system. While all are inseparably interrelated and interdependent, the educated diagnostic touch can study them individually, diagnose pathologic conditions within them, and follow corrective activities as they occur.

This is an exciting realm of exploration, and its study reveals to the earnest student the remarkable intelligence within the organism that directs, protects, and corrects its mechanism to maintain the maximum efficiency known as health. If the author applies to this realm the careful, meticulous methods that he has applied to the study of active and passive articular motion, his second chapter on palpatory diagnosis will be awaited eagerly.

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Discussion

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Dr. Walton has presented a splendid paper on palpatory diagnosis of the osteopathic lesion. It is precise, descriptive, and indicative of thoughtful and thorough preparation.

The suggestion that the osteopathic profession may lay a claim to priority in utilizing palpatory diagnosis may be debatable. A competent surgeon or a physician in general family practice, in specialty practice, or almost any other area, of necessity is involved with palpatory findings on frequent occasions to establish the validity of his diagnosis. The use of palpatory diagnosis by the average osteopathic physician and the correlation with subsequent treatment procedures is distinctive, however.

The statement that mobility changes between vertebral segments are the most important finding in osteopathic diagnosis is undoubtedly true in the majority of cases.

Of necessity, there are various degrees of restrictions of mobility involving the spinal joints, skin, and subcutaneous structures. Included are ligamentous, muscular, myofascial, lymphatic, venous, and arterial circulation as well as pain patterns.

Radiographic studies are a substantial aid in understanding disturbances in mobility of the spinal articulations, rib cage, and appendicular structures. Such studies provide for the inclusion or elimination of abnormalities of viscera and other soft tissues.

The fact that the osteopathic profession embraces the holistic philosophy, recognizing the connection between the primary somatic dysfunction and ancillary or interrelated body tissues and viscera, must enter the mind of the palpating physician.

We assume that the periaxial structures include the paravertebral, intercostal, costochondral, and interosseous tissues as well as the joint structures of the appendages. There would also be included in this framework of reference the viscera and the reflex patterns initiating viscerosomatic, somaticovisceral, somaticosomatic, and possibly viscerovisceral influences. Temperature changes within the patient as a whole may need to be differentiated from those found in the lesioned area.

The importance of attention to the patient’s history in addition to the palpatory findings should be emphasized, and any radiographic studies that have been made are of utmost importance. After the physician learns of the chief complaint, he should elicit the story of how it was produced or review possibly connected incidents or illnesses.

If an injury occurred during working hours, the compensation or insurance aspect should be considered. If there was no connection with employment, any relation to accidental origin should be sought. The patient should be questioned also as to when discomfort is most noticeable, the time of day and the associated activity-arising, going to or from work, working, looking at television at home, or working in the household. Searching questions should be asked about the type of chairs, mattress, and bedsprings he has; and about driving a car, athletic activities, and clothing with relation to temperature or kind of work.

History of previous surgery of any type, illnesses, allergies, electrocardiograms, and laboratory studies also should be determined.

Other possible considerations of palpatory diagnostic studies are evaluations of the patient in the standing and sitting positions for scoliosis, determination of the shoulder and pelvic crest levels while the patient is standing, and leg length studies with the patient lying down. Palpatory examination of the myofascial tissues of the thoracic inlet may best be made in the sitting position. Other examinations would include observations of appendicular structures, abdomen, thorax, skin texture, swellings, pulsations, temperature, fluid retention, atrophy, hypertrophy, dermatoses, dryness or moisture, and scar tissue.

Further diagnostic information is found during each of the patients subsequent visits to the office in the course of administrating osteopathic manipulative procedures.

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Osteopathic basics

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Basic osteopathic skills include the development of the tactile sense and the ability to detect tissue texture abnormalities, asymmetry of position, and changes in range of joint motion, to sense position in space, and to detect improvement in palpatory findings. These skills are fundamental to the diagnosis and treatment of problems affecting the neuromusculoskeletal system and are basic for the evaluation of treatment and the patient's prognosis.

Basics are defined as fundamental skills. When one speaks of returning to the basics in education, he is referring to training in reading, writing, and arithmetic. In tennis, the basics are the serve, the forehand and backhand strokes, the volley, and the overhead. Basics for playing a woodwind instrument include rhythm, ornamentation, breathing, intonation, tonguing, and fingering.

Osteopathic basics are those skills that are fundamental to the development of a diagnosis or that are used in the treatment of the neuromusculoskeletal system. Basic skills are employed in the diagnostic triad used to determine somatic dysfunction. The skills enable the physician to detect changes in tissue texture, changes in the asymmetry of bony landmarks, and changes in the quality and range of joint movement.

Fundamental to the basic skills is the development of a tactile sense. The degree of tactile sensitivity of the physician is often the decisive factor in his development of diagnostic and treatment skills. One mark of a skilled physician is his ability to palpate subtle changes in tissue texture and joint motion. The ability to detect abnormal tissue texture is basic to skillful diagnosis. The experienced clinician can detect changes in texture, contour, temperature, and moisture of the skin surface. He can palpate through the subcutaneous tissue to detect changes in tension and fluid content. He can distinguish differences in the quality of the superficial and deep muscle layers.

Another basic skill is the ability to detect asymmetry of position by both visual and tactile means. The identification of gross postural changes manifested by changes in levels and asymmetry of the body is important in the assessment of somatic dysfunctions. Positional asymmetry is assessed not only for areas of the body but also for individual segments.

The skilled physician can detect subtle changes in the range of joint motion as well as differences in the quality of movement. This skill is basic to accurate diagnosis. In some instances the only detectable sign of joint dysfunction is a slight change in movement.

I am reminded of a ballet instructor who complained of foot discomfort. Examination of the foot disclosed only a subtle disturbance in the movement of one joint in the lateral arch of the foot. The only diagnostic finding was a dysfunction in joint motion.

The ability to sense position in space is a basic skill and is an important part of tactile perception. The physician is dependent on proprioceptive sensitivity for information about his position in relation to his patient. The patient's compliance or resistance to passive movement may be an important element of diagnosis. A moment-to-moment proprioceptive control is essential in the use of manipulative treatment. A skillful manipulator has a sensory awareness of his physical relationship to his patient and the variations in resistance that are related to changes in position and movement'

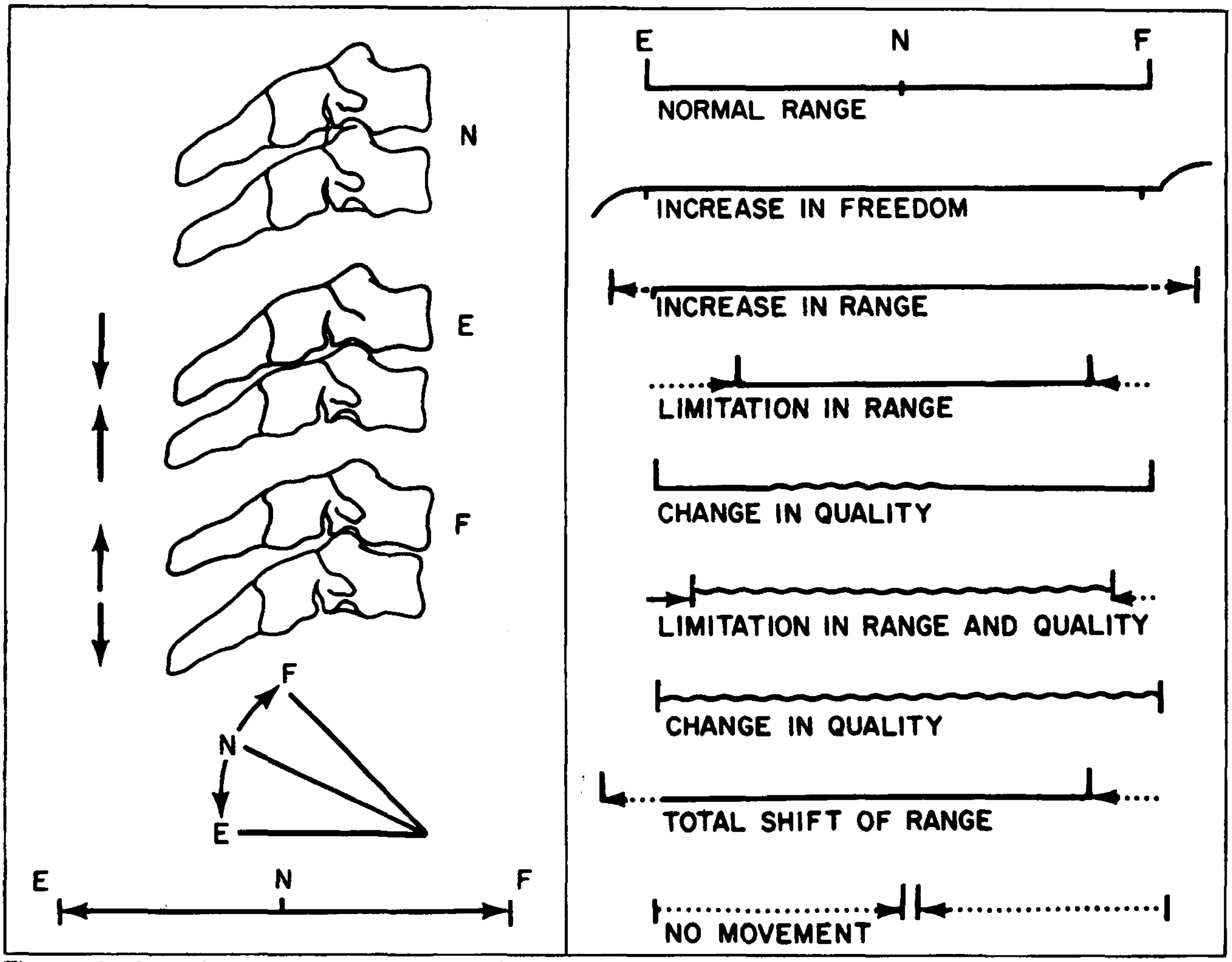
Lastly, the ability to detect improvement in palpatory findings is basic to determining the effectiveness of treatment and its eventual outcome. The diagnostic criteria of tissue texture abnormality, asymmetry of position, and changes in joint motions are reevaluated. The skill to assess subtle palpatory changes is not only basic to establishing a diagnosis but also is important in the reassessment of the patient and his response to treatment. Objective criteria of improvement that correlate with the patient's symptomatic response are essential to establishing the efficacy of treatment.

The development of palpatory skill requires directed effort and practice. Palpation consists of three steps: reception or sensing, transmission of sensory impulses, and interpretation[2]

Reception is the process whereby stimuli are perceived by the tactile receptors of the fingers and the proprioceptors of the deep muscles and tendons. Reception is qualified by the experience of the examiner, the conditions of the examiner's hands (calluses interfere with tactile sensing), and the state of relaxation of the examiner. Tension results in contracted musculature, which produces excessive stimulation from the examiner's own muscle and tendon proprioceptors and causes interference with reception.

Transmission of the sensory impulses is the next step in palpation. Interference with transmission may be caused by excessive proprioceptive stimulation on the examiner's part, created by awkward positions, excessive movement, or an inability to relax. There may be a dysfunction in the examiner's nervous system, which could interfere with sensory transmission.

Interpretation is the final step in the palpatory experience. It consists of the perception and analysis of the impulses sent to the brain. Attention and awareness are prime requisites for



Figs. 1 and 2. ***Cervical spine, flexion-extension range of motion.*** **Fig. 1** ***shows normal joint motion.*** **Fig. 2** ***shows pathologic joint motion.***

the best reception. Interpretation is a process that is unique to each individual. It is based on experience and previous associations. It may be qualified by the reception of other sensory stimulation such as sight, sound, or smell. Excessive tension on the examiner's part, loss of attention, preconceptions of what should be experienced, and lack of experience in palpation may all contribute to interference with the interpretative step of palpation.

It should be apparent that attention to the steps of reception, transmission, and interpretation is essential to skillful palpation.

Tissue palpation

The examination of tissue texture is carried out by both light-touch and deep-touch palpation[3] Light-touch palpation may be further divided into passive touch and active touch[4] In passive touch, the fingers rest lightly on the skin surface, discerning the changes taking place in the skin and subcutaneous tissue under them. This is contrasted with active touch, in which the fingers move from site to site to explore the skin and subcutaneous tissues. Active-touch palpation also has been called tactile scanning.

In deep-touch palpation, the fingers compress the skin surface, palpating through skin and subcutaneous tissues to the superficial muscle layer. Further compression leads to palpation of deeper muscles, fascia, and bone. Deep palpation utilizes forces of compression and shear. Compression is a force applied perpendicularly to the skin surface. Shear is a force applied parallel to the skin surface. In some instances, deep palpation combines both compression and shear in the exploration of deep tissue texture.

Descriptors

The response of deep tissue to palpation may be characterized by terms of consistency, compliance, or resistance. Many descriptors have been used by physicians to give meaning to their palpatory observations. However, the descriptors lack consistency or universal agreement as to their definition. Some of the descriptors that are commonly used in both superficial and deep palpation are as follows: fixed-non-fixed, superficialdeep, soft-hard, hot-cold, painful-nonpainful, thick-thin, red-white, moist-dry, rough-smooth, circumscribed-diffuse, compressible-rigid, flaccid- firm, pliable-tight, acute-chronic.

The need for a definitive language to aid in communication is essential for teaching and research.

Joint motion

The ability to detect differences in the quality and range of joint movement represents the acme of palpatory skill.[5] Joint motion testing may be either active or passive.[6] In active testing, the examiner's hands rest quietly over the joint while the patient carries out active movement of the joint. In passive testing, one of the examiner's hands is placed in contact with the joint while the other hand introduces motion into the joint by moving the patient. A controlled movement is used to explore the characteristic motions of the articulation, the range of movement, the end points, and the quality of the movement. The element of control should be emphasized, for it is important that moment-tomoment control of movement should be attained. Subtle nuances in joint motion can only be detected with a slow exploratory movement guided by critical attention. Additional information about the patient's response to passive motion testing is obtained from the physician's proprioceptive system as he introduces motion and observes the amount of force required and his relative position in space.

Examination of normal joint motion reveals a sense of smooth freedom in the middle of the range of movement. As the end points are reached, there is a build-up of resistant tension as the end point barrier is reached. The barrier may consist of a physiologic barrier identified as a point of increased tension which may be transversed with increased force to the unyielding anatomic barrier, giving a sense of "joint play."

Pathologic motion

Pathologic motion may differ from normal joint motion by showing a disturbance in the range, a change in the barrier sense, or a change in the quality of movement. For example, if we observe the flexion-extension range of spinal motion (Figs. 1 and 2), we may see:

(1) a greater freedom or range in movement than normal. (A recent injury may demonstrate a certain laxity or looseness of movement, which gives a sense of greater freedom of range. The total range of movement may be increased.)

(2) a disturbance in the total range of movement, a sense of limitation, or a disturbance of quality.

(3) a limitation in the extremes of movement.

(4) a disturbance in the quality of movement without a disturbance in range. (This may occur in the total range of movement, in one extremity of the range, or in some phase of the range of movement. Early arthritic changes may give this impression. Changes in quality are usually associated with a limitation in the range of movement, but sometimes they may be subtle and found alone.)

(5) a total shift of the range of movement-a compensatory increase. (The range of movement may appear to have shifted into the flexion or extension phase of the range.)

(6) no detectable movement. (This may be associated with fibrosis or ankylosis.)

Restrictions in joint movement may be caused by trauma to the joint, resulting in some mechanical disorder. They may be caused by a disturbance in the tissues surrounding the joint. Pain, disease of the joints, fractures, and neurologic disease may all limit or change the movement in a joint.

Prognosis

There appears to be a direct relationship between disorders in joint motion and symptomatology. In many cases, there is a direct association with the return of function and the relief of symptoms. Thus, tests of joint motion are used in determining the prognosis. Occasionally, joint motion may be restored before there is symptomatic relief. This symptomatic lag may be caused by weakness in the tissues surrounding the joint or in a delay in soft tissue recovery. Sometimes, symptoms persist despite the restoration of joint motion. In these cases there must be some other causative or aggravating factor. Posture, occupation, or personal habits often will prevent complete symptomatic recovery. Occasionally, the symptoms disappear before joint motion is completely restored. When the patient's functional movement has been restored, his movement for ordinary tasks is adequate. It is evident that the ability to sense joint movement is basic in diagnosis, treatment, and prognosis.

Diagnosis

The diagnosis of somatic dysfunctions is based on the use of basic skills as they are applied in the examination of the patient. A study of the examination process used by five osteopathic physicians has led to a classification of tests according to the skills involved.' The first category is that of general impression tests, in which the patient is screened by either visual or palpatory means to elicit general impressions or either asymmetry or regional departures from normal. The next category is tests of gross motion, in which the patient's response to the introduction of passive motion demand is assessed by visual or palpatory means. Tests of geometric landmarks compose the third category. Anatomic landmarks are measured in respect to specific axes and planes or the relative position of landmarks are evaluated at the beginning and at the end of a prescribed motion. In the fourth category, the local response to motion demand is tested; here, a specific segment is monitored for its response to a motion demand. The last category consists of tests to evaluate superficial and deep tissues. Tissue texture is assessed by palpation to determine characteristics that differ from normal expectations.

As the physician conducts his examination, he will be utilizing tests from the categories described. However, he may not use tests from all categories and he may not use them in the order described. Also, he may use a variety of tests that may be more heavily weighted in certain categories than in others. In essence, the clinician selects tests that he has found reliable and that will serve as the basis of his examination process. He evaluates the information obtained in terms of significance or reliability. Test data that are deemed strongly positive are used as the foundation for diagnosis; test data that are equivocal or at variance to the strong data are discarded. Some test data are held in abeyance for further evaluation or use.

Not all tests provide equally significant or reliable data. Clinicians select data that are significant to them. The clinician's confidence in the use of his basic skills may determine his assessment of the reliability of the test data. In some cases, other tests are used to confirm or deny the working diagnosis. Thus, information that is derived from basic-skill testing procedures is summarized in the patient's diagnosis.

Summary

Basic osteopathic skills which are fundamental to the diagnosis and treatment of problems affecting the neuromusculoskeletal system have been identified. These skills have been analyzed because they are used to gather diagnostic data and to formulate a prescription for the manipulative management of the patient.

These basic skills are of importance not only in the diagnosis of disorders but also in the evaluation of the effects of treatment and the patient's prognosis.

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Accepted for publication in October 1980. Updating, as necessary, has been done by the author.

This paper was presented at the International Congress of Manual Medicine, Baden-Baden, West Germany, April 18-22, 1979.

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VI

Joint Motion Testing

Skill in joint motion testing represents the acme of palpatory skill. Of the three criteria for somatic dysfunction - asymmetry of position, tissue texture abnormality, and joint motion dysfunction; joint motion dysfunction is the only criteria which may alone establish a diagnosis of somatic dysfunction.

In the first article in this section Dr. Strachan discusses in detail the factors which are essential for passive joint motion testing. He emphasizes the importance of observing the range and quality of the movement In the second article Dr. Ho explores the testing of intervertebral joint movement, its characteristics and the implications of intervertebral joint motion for health and disease. The last article "The role of Static and Motion Palpation in Structural Diagnosis, by Dr. Johnston, discusses the examination of the somatic tissues in the static state and their response to a demand for movement. He emphasizes the importance of the critical evaluation of the dynamics of demand for both position and movement and the bodys' response.

Joint motion-testing and forces involved in passive motion

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This article undertakes to guide the osteopathic physician in the testing of passive joint motion. The characteristics of the various kinds of passive motion are described. It is emphasized that it is necessary to study motion both quantitatively and qualitatively in appraisal of the functional capacity of a joint. Various procedures are suggested for producing and evaluating passive motions in examining the musculoskeletal system. Each type of passive motion in a joint should he tested in those combinations normally characteristic of the joint. In **testing passive motion of a particular joint or series of joints the physical contact of the examiner with the subject has two purposes: one, to apply sufficient force in the proper direction to move the joint under study through its essentially maximum range at the time, and second, to evaluate the amount and quality of the motion so produced. The various ways in which this physical contact is made are described, and the principles used in the application of force are outlined. The posture and position of examiner and subject are discussed, as well as the sensory mechanisms by which the examiner receives impressions of passive motion.**

The testing of passive joint motion is an important objective part of the examination of the musculoskeletal system of the body. "When the active and passive ranges of motion are not equal, the passive range is usually greater and is thus the more reliable indication of the actual range of motion."[1] The findings are evaluated and interpreted throughout the procedure. Success depends upon the diligence and skill of the examiner and the cooperation of the subject, particularly in remaining relaxed. Some people find it difficult to relax voluntarily, either because of the acuteness of the local process involving the muscles, hyperactive reflex activity, or an apprehensive or emotional state. At the other extreme, some individuals in trying to co-operate may unknowingly add voluntary motion to each passive movement being tested. When the examiner recognizes this tendency he can usually either make allowances or modify his procedure to accomplish an accurate evaluation of the passive motion.

Passive motion characteristics

The direction of passive (and active) motion in a joint is determined principally by the contour of its articular surfaces. The examiner should direct his force accordingly as he attempts to produce and evaluate this motion; otherwise, he will waste energy and his findings will be inaccurate (Fig. 1). Developmental variations in the plane of joint surfaces can frequently be determined by the experienced examiner as he finds it necessary to apply force in an unusual direction to produce the motion.

Some types of motion can be produced passively but not actively at a given joint. Denslow[2] makes a clear distinction between "motion not under voluntary control" and "motion that may be produced voluntarily or passively," and describes how each may be detected and evaluated.

Mennell,[3] in speaking of the entirely passive type of movement uses the term "joint play," pointing out that, although it may be small in range, it is essential for the easy, painless performance of movements in the voluntary range. An example of strictly passive motion is the rotation at the sternoclavicular, at the metacarpophalangeal, and at the extended knee joints. At these joints the capsule is loose enough to permit rotation, but rotator muscles are either absent or, as at the knee, incapable of producing rotation when the joint is extended.[4] Other examples are the abduction-adduction play and the joint separation from the application of a traction type of force at an interphalangeal joint.

Motion at a joint may be simple or complex, whether the movement is active or passive. A simple motion involves only one plane or one axis of movement. Opposite phases of this simple motion may require different terms. Examples are flexion and extension around a single transverse axis at the ulnohumeral joint or at a typical intervertebral joint. The spinal joint differs from the ulnohumeral in that it is capable of other motions and combinations of them.

Complex motions utilize two or more axes simultaneously. For example, the shoulder joint can be moved to an extreme position by a combination of abduction, lateral rotation, and extension. The same position can be reached by a succession of the same three simple motions, each performed separately and to the limit in any given sequence.

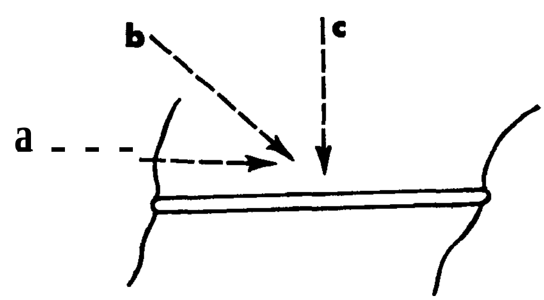

Fig. 1. ***Force parallel to the joint surface produces motion with the least waste of energy. a., b., and c. indicate directions of force of decreasing efficiency in producing passive gliding motion at a normal plane joint.***

Spinal joints differ from the shoulder joint in that the final position after a succession of simple superimposed motions (active or passive) may vary according to the sequence of the motions. This is illustrated by the attempted maximum successive motions of lateral bending and extension in the thoracic area. When the motion is lateral bending followed by extension, the final position will be one of greater lateral bending than when the sequence is reversed.[5,6] When the spine, especially in the thoracic area, is maintained in complete extension, all of the other motions, except flexion, are limited. Fortunately, the common pattern of active spinal motion consists of harmonious combinations of basic motions, none of which is forcibly carried to an extreme.

The amount of passive motion is determined principally by the muscular, ligamentous, and fascial tissues which bridge the joint. Variations from the average amount of motion found in comparable normal joints suggest abnormal tone in these restraining tissues. The deviation from the normal range of joint motion is usually a decrease, but hypermobility is occasionally found. This latter may be a compensation for restricted mobility at a joint which is functionally related. The experienced examiner, in deciding the range of joint motion which is normal, considers the age, sex, occupation, and habitus of the person being examined.

The repeated passive stretching of restraining tissues while testing joint motion may produce increased freedom of the joint. This indicates that the pathologic state of the tissues can be favorably altered by manipulative treatment. Difficulty may arise, however, when two or more examiners attempt to compare their findings on successive testing of the same joint. The first examiner has the advantage of finding the most clear-cut evidence of impaired joint function.

The examiner may derive as much useful information from noting the quality of passive joint motion as from testing the amount. He can evaluate the resistance encountered not only at the termination, but through the entire range of motion.

When the examiner's force, in attempting to test the motion, is met almost immediately by an abrupt counterforce (somewhat like the recoil of a spring), an inflammatory change or muscle spasm is indicated. A rather free motion terminating prematurely and rather abruptly is characteristic of a chronic pathologic state with deposit of increased fibrous tissue. As would be expected, any shade of variation may be found between the two extremes mentioned.'

Procedure for testing passive joint motion

Each type of passive motion in a joint should be tested, not necessarily alone, but in those combinations which are normally characteristic of the joint. The information thus obtained can form the basis of planning a most effective manipulative procedure. The treatment may be nothing more than an accentuation of the passive motion which meets the most resistance at the joint.

Both the subject and the examiner should be in a position of good postural balance. This facilitates proper relaxation of the subject and promotes efficiency of the examiner by minimizing fatigue and avoiding strain.

The subject may be placed in an upright or a recumbent position at the discretion of the examiner. Spinal joints, for example, are frequently tested for passive motion with the subject in more than one position. The recumbent position allows greater relaxation but less freedom in most areas, as compared to the upright position. With increasing experience, the examiner may ascertain for each spinal area the position of the subject which yields the most reliable findings.

The surface on which the subject sits or lies for this examination should not be so smooth and firm as to allow unwanted sliding. A slippery table will promote involuntary tensing of the patient with proportionate difficulty in the examiner's task of accurate evaluation of the passive motion. On the other hand, if the surface is very soft and springy, too much of the force applied by the examiner is dissipated in motion of the subject in relation to his yielding support. This makes it difficult to evaluate separately whatever passive motion occurs at the joint being tested.

The examiner's equilibrium must be stable for efficiency in applying force to produce motion and in the coincident analysis of the passive motion. Whether standing or sitting he should avoid the discomfort and strain that result from moving his own joints to their limit. Such distraction would greatly interfere with his sensory reception from-variations encountered in the tissues of the subject.' Additionally, the surface which supports the weight of the examiner should provide enough

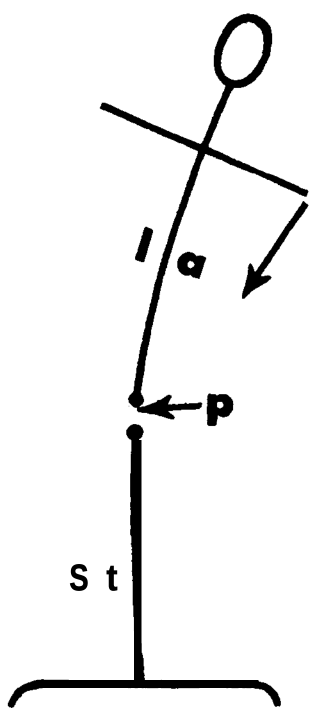

Fig. 2. *f, force applied by one hand of the operator moving the point of the shoulder downward and backward; la, lever arm through which the force is transmitted; p, location between adjacent spinous processes where joint motion is palpated; st, relatively stationary area of the spine.*

friction to avoid slipping, which would result in inefficiency and possibly danger in applying force. Another important factor from the standpoint of the examiner is the height of the surface which supports the subject as he sits or lies. Ideally the height should be adjustable in accord with the size and position of the person being examined, the physique of the operator, and his manner of applying force at a particular time.

In testing the passive motion of a particular joint or series of joints, the examiner's physical contact with the subject has a double intent. One purpose is to apply enough force in the proper direction to move the joint being examined through its essentially maximum range at the time. The other objective is to evaluate the amount and quality of the motion so produced.

The manner in which this contact is made may vary considerably. Certainly the examiner's hand should not inadvertently slip on the skin of the subject or produce unwanted motion between the skin and deeper structures. It would be unwise in contacting a bone to palpate through a thickness of soft tissue when another area of the bone might be close to the skin surface and equally suitable otherwise.

The margins of many of the joints of the extremities are accessible for palpation of passive motion. The fingers of the palpating hand remain passive for the most efficient use of the tactile sense. This direct method, however, is not always preferable, even when the joint margins are readily accessible. The examiner may prefer to use a less direct method in testing some of the motions at this type of joint. He may judge the resistance to certain motions by the amount of force necessary to produce them.

The margins of the sacroiliac joint and of most of the spinal joints are inaccessible to direct palpation. This situation is not entirely disadvantageous because, in most instances, the motion can be palpated between superficial portions of the bones adjacent to the joint being tested. In fact, the farther the palpable **bony parts are from the center of joint motion, the greater will be** the arc of motion between them. Palpation of motion between the tips of adjacent vertebral spinous processes is a convenient method of evaluating function at the corresponding intervertebral joint.

The force may be applied by one hand placed far enough from the joint being tested to gain the advantage of long leverage. The operator's other hand is used for palpation at the joint margins or between palpable parts of the adjacent bones. When this principle is used in the spine it is necessary that the total motion produced be sufficient to remove in succession the play in each joint in the spinal "lever arm." Some authors use the term "take up the slack" in stressing the importance of this procedure of removing the joint play.[8,9] Only when this is accomplished does the final additional motion meet resistance at the joint being palpated (Fig. 2).

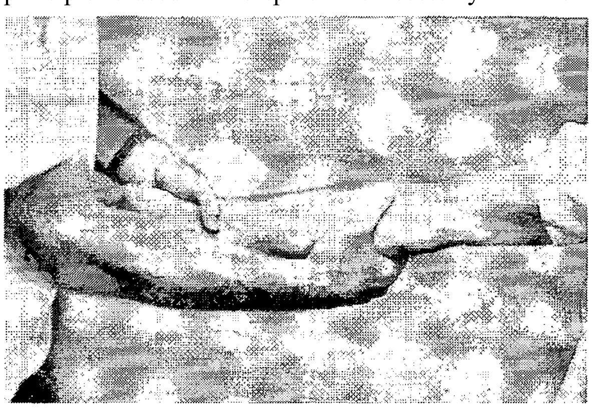

Fig. 3 A method of testing passive abduction-adduction motion at the elbow joint.

If the application of force is continued after the excursion of passive motion is completed in the joint being examined, the next bone in the series begins to move unless it is held by a resisting force (counterforce). To elicit the maximum available passive motion, an adequate force properly directed must meet an equal counter-force at the joint. Both forces may be applied using the advantage of leverage. The long bones of the extremities may be used effectively as levers in testing passive motion at such joints as the elbow or the knee.

The necessary resistance may be afforded by the stationary inertia of the heavier portion of the body when leverage is used in applying force to produce passive motion in certain spinal or appendicular joints. In this instance the operator may use one hand to apply force through the length of the lever arm and the other hand close to the joint, but on the bony lever. This second hand aids in localizing the force and in evaluating the resistance encountered. In fact, both hands take part, not only in producing the motion, but also in evaluating how difficult it is to produce the motion. The passive motion of abduction-adduction (side play) may be tested by this method at the ulnohumeral or at the knee joint. The proximal bone (humerus or femur) is sufficiently stabilized by its attachments to the trunk (Fig. 3). The same principle may be used in testing combined rotation-lateral bending at or near the cervicodorsal junction. In this instance the upper spinal area acts as a rigid lever in transmitting force downward after joint play has been removed, successively, from each joint of the area. The weight of the trunk provides the stationary inertia for the vertebra below the joint being tested.

Some joints (for example, the tarsal joints) do not lend themselves to the use of leverage in testing their passive motion. A direct application of force is made to one of the bones adjacent to the joint while the opposite bone is held stationary. With one hand grasping each bone, the operator may move them in opposite directions along the plane of the joint surface. Each hand produces motion and each is used to sense the resistance to passive motion (Fig. 4). The use of such directness may be advantageous, at least as a supplementary method, in locations where other methods are commonly used in testing passive joint motion. In the spine, where exact localization is especially important after an injury, the operator may test each joint in the suspected area by grasping adjacent spinous processes and moving them in opposite directions.

Another method in which force may be applied in producing at least some types of passive motion in selected joints is to direct it precisely at the joint interval. If the point of contact extends to the adjacent bones it should do so with equal force on each bone. Usually with this method, the examiner evaluates the resistance to passive joint motion by the same hand or digit which produces the motion. It may be feasible at times to use the other hand passively for palpation of motion.

Application of force to the joint space can be used effectively in producing and testing extension or combined

Fig.4. A method of testing talocalcaneal joint motion. One hand grasps the calcaneus while the other hand holds firmly the anterior portion of the talus.

motions in the thoracic and lumbar spinal areas with the patient prone on a suitable surface. When the force is directed anteriorly by a thumb or finger placed between the adjacent spinous processes, extension is produced. If the force is directed anterolaterally from the same point of contact, less extension will be produced but a combination of lateral bending and rotation is added (Fig. 5). These combined passive motions should be compared on opposite sides of each joint tested, using the same amount and direction of force on each side.

It is a good general rule to apply and release gradually the force used in producing passive motion in a joint. This allows the examiner time to appraise the type and amount or resistance encountered without danger of provoking a painful reactionary spasm in the presence of an acute pathologic state in the restraining tissues.

Perception and evaluation of passive motion

It has been pointed out that a quantitative and qualitative study of motion not under voluntary control is essential in the appraisal of the functional capacity of a joint. The examiner may receive his impressions of this motion by the use of no less than three sensory mechanisms.

The exteroceptive tactile sense is receptive when the relaxed hand or digits can be placed at the joint interval close to the articular margins or between palpable portions of the bones adjacent to the joint. This is illustrated at the sacroiliac joint when the other hand of the examiner produces motion of the sacrum between the ilia.

It is possible, in areas such as the elbow or knee joint, to observe the positional changes produced when the range of passive motion is completed.

The examiner receives proprioceptive sensations as he activates his muscles to produce passive motion in the joint being examined. The resistance to the motion is directly proportional to the amount of muscular energy required to produce the motion, provided that the force is properly applied, The information gained in this manner is quite important in ascertaining the pathologic state of the tissues which act as restraints to joint motion. The examiner using the procedure of examination illustrated in Figure 5 receives both exteroceptive tactile and proprioceptive sensations.

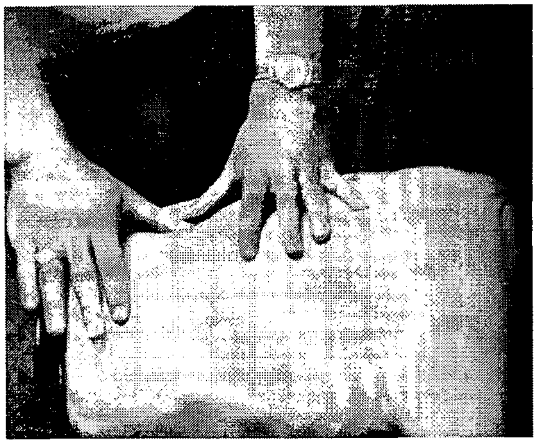

Fig.5. A method of testing the combined passive spinal motions of extension, rotation, and lateral bending.

Usually, a combination of these sensory impressions is used in evaluation of passive joint motion. Each supplements the other. When the functional impairment of the joint becomes obvious to the examiner, the planning of treatment is greatly facilitated.

Summary

This paper is concerned with passive joint motions. The notable characteristics of the various types of passive motion are described. It is emphasized that both quantitative and qualitative study of motion not under voluntary control is essential in appraising the functional capacity of a joint. The principles and suggested procedures for producing and evaluating passive motions in examination of the musculoskeletal system are outlined.

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This paper was written as part of the Editorial Conference program.

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Testing intervertebral joint movement

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The osteopathic physician is traditionally concernedwith spinal function in the evaluation and care of the human organism. An important part of this concern centers around the study of intervertebral joint movements. Where spinal dysfunction is due to restriction in joint movement, excessive joint movement, or painful joint movement, it is important that these defects be detected.

Principles of spinal testing procedure

The clinical evaluation of intervertebral joint movement (abbreviated IJM in this paper) is performed primarily by passive movements of the patient's spine. In such tests, the physician positions the patient so that certain requirements are met:

1. The position is appropriate for the joint movement being studied. For instance, the supine position would be appropriate for studying forward bending of the cervical spine, but it would have limited usefulness in studying backward bending of the cervical spine if the patient's head rested on the table.

2. The patient is comfortable and secure. Any position eliciting unconscious or deliberate muscular contraction in the patient will distort the data which are supposed to be based on passive motion testing.

The examiner must satisfy certain criteria to assure a satisfactory examination:

1. He must be so positioned that a minimum of effort is required by him to maintain or change his posture from moment to moment, and to induce movement in the patient.

2. His hands must be appropriately placed on whatever anatomic indicators of movement he is using; for example, the tips of the spinous processes, or the transverse processes.

3. His psychologic set must be fixed upon the palpatory and proprioceptive sensations mediated through his hands, fingers, and bodily movement during testing procedures.

Quantitative analysis of IJM

Commonly the tips of the spinous processes of the vertebrae are used as landmarks in identifying the specific vertebrae between which IJM is being studied. The movement between any two adjacent spinous processes serves to indicate indirectly the associated IJM. How much the spinous processes actually move in a given patient is an important question.

The measurements reported in this paper were made during Dr. Ho's clinical research fellowship at the Kirksville College of Osteopathy and Surgery, in the Biomechanics Laboratory, of which Dr. J. S. Denslow is head; writing of the paper was completed during a Wyeth fellowship at Philadelphia College of Osteopathy, in the Department Orthopedic Surgery, of which the late Dr. James M. Eaton was chairman. Dr. Ho is now a resident in orthopedic surgery at Detroit Orthopedic Hospital.

Figure 1 illustrates the situation from which the approximate magnitude of movement of a point on a spinous process of a vertebra undergoing forward and backward bending can be calculated.

For purposes of simplification, let it be assumed that forward and backward bending occur around an axis in the frontal plane running through the nucleus pulposus of the intervertebral disk. Vertebra A, in broken line, is seen in amaximally backward bent position on vertebra B. A, in solid line, is in a maximally forward bent position on B. O represents the position of a point on the spinous process of A in the maximally backward bent position. P represents the position of the same point in a maximally forward bent position. D is the curvilinear path between O and P followed by the given point on the spinous process of A when A's angular excursion is f. R. is the distance between the given point and N. Therefore, D is an arc of the circle the radius of which is R and the center of which is N. Therefore:

$$D = \pi\, 2RX\ f/360$$
$$= 0.017\ R\ f.$$

Table I presents approximate average values of D in the forward and backward bending range for all intervertebral joints except the occipitoatlantal and atlantoaxial. Also included are the angular excursions in side bending about which comment will be made later.

The values for R are based on measurements from each vertebra of thirteen preserved adult spines in the Biomechanics Laboratory of the Kirksville College of Osteopathy and Surgery. Each measurement was taken from the approximate center of the inferior surface of the given vertebra to a point on the tip of the spinous process which seemed most distant from the first point.

Values for f were taken from a table presented by Stoddard.'

It should be realized that the calculated values for D in the table represent approximate averages based on a simplified scheme. N may actually shift forward in forward bending, and backward in backward bending, the two positions being separated by 3 to 8 mm.[2] 'Furthermore, it is thought that the spine may become unstable because of disk degeneration in such a way that the usual rolling movement of one vertebral body upon the nucleus pulposus of the disk below is modified into a sliding movement.[3] Also, other work has been done in which it was shown that the quantitative data for Ovary somewhat from study to study and subject to subject.[4]

Palpability of IJM

Figure 2 is a full-scale graph depicting the linear relationships of D for the different joint levels. It is evident that the palpability of spinous process movement for forward and backward bending is greatest in the lumbar and cervical areas and minimal in the middorsal area. Of course overlying ligamentous, myofascial, and

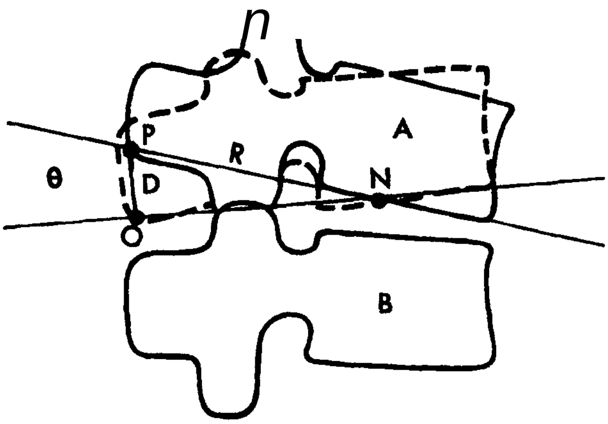


Fig. I. Diagram depicting vertebra A, solid line, in maximally forward bent position on vertebra B; and A, broken line, in maximally backward bent position.

integumentary tissue tend to diminish this palpability.

Side bending, insofar as it occurs as a pure movement of the intervertebral joints, may be considered to occur around an axis (possibly shifting from side to side) in the sagittal plane running through the intervertebral disk. The anatomy of the spinous processes is such that their tips or ends lie on the axis of side bending as in the lumbar area (Fig. 1) and upper cervical spine, or below the axis of side bending as in much of the dorsal spine (Fig.3).

Where the tips of the spinous processes lie below the axis of side bending, magnification of IJM in the frontal plane results. The tips of the dorsal spinous processes lie farthest below their respective axes of side bending. However, palpable movement is minimal because of limited movement due to the presence of ribs and other anatomic factors.

At this writing no measurements have been taken for the equivalent of R in the frontal plane. Therefore no calculations are offered for D, the theoretic distance through which the tips of the spinous processes move in side bending. Nevertheless, angular excursions in side bending (see Table I) have been determined roentgenographically; these measurements provide insight into the relative degree of side bending at the different spinal levels.

The determination of the angular excursions for rotation by roentgenographic means presents technical problems yet to be solved. Most estimates are based on the degree of deviation of the spinous processes from the midline as seen on anteroposterior roentgenograms of the spine in rotation. For anatomic and projectional reasons this approach is fraught with unreliability. Gross observation and clinical testing procedures plus observation on skeletons and Halladay spines* probably provide the best insights presently available on rotational IJM.

TABLE I--AVERAGE VALUES OF D IN FORWARD AND BACKWARD BENDING

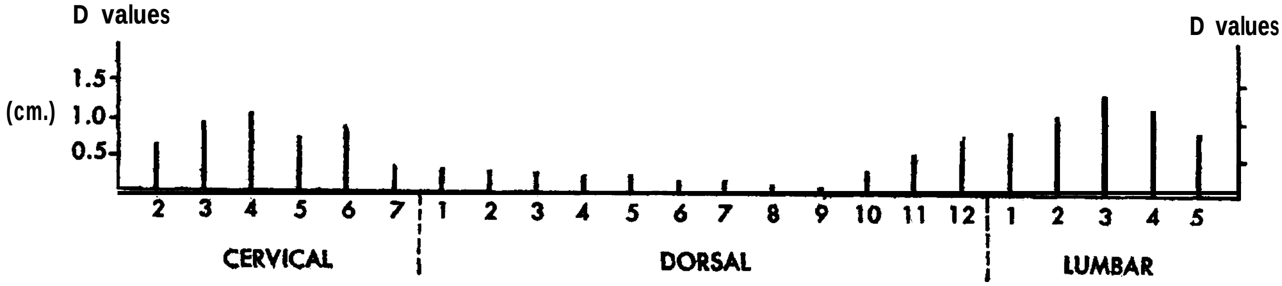
Vertebra	R (length of spinous process in cm.) Range	Average	θ in forward and backward bending (10° for OA joints)	D (cm.)	θ (side bending)
C1	—	—	15°	—	—
2	3.4 - 4.6	4.0	10°	0.68	—
3	3.1 - 4.0	3.5	15°	0.99	9°
4	2.8 - 4.0	3.5	17°	1.01	8°
5	3.0 - 4.5	3.6	12°	0.73	5°
6	3.5 - 4.9	4.3	12°	0.88	8°
7	4.2 - 5.7	4.8	4°	0.33	8°
T1	4.5 - 5.5	5.0	3°	0.26	3°
2	4.5 - 5.7	5.0	3°	0.26	3°
3	4.4 - 6.0	5.1	3°	0.26	2°
4	4.4 - 5.9	5.1	2.5°	0.22	2°
5	4.5 - 5.8	5.0	2.5°	0.21	1°
6	4.5 - 5.7	5.2	2°	0.18	2°
7	4.6 - 6.1	5.2	2°	0.18	4°
8	4.6 - 6.0	5.2	1°	0.09	5°
9	4.4 - 5.9	5.1	1°	0.09	5°
10	4.3 - 5.6	4.9	4°	0.33	5°
11	4.4 - 5.7	4.7	7°	0.56	6°
12	4.6 - 5.8	5.2	9°	0.80	6°
L1	4.8 - 6.0	5.5	9°	0.84	6°
2	4.8 - 6.3	5.7	11°	1.07	8°
3	4.9 - 6.7	6.6	12°	1.35	10°
4	4.9 - 6.9	5.7	12°	1.16	8°
5	4.6 - 5.8	5.2	10°	0.88	2°

Clinical application

The clinical practice, testing IJM generates questions concerning the relative mobility of given joints. Criteria for judging IJM to be restricted, excessive, or salubrious are demanded. Presently roentgenography seems the only quantitative approach for evaluating IJM. There is a certain inconvenience as well as radiation hazard in any heavy dependence upon this approach, however.

*Halladay spines are specially prepared[5] anatomic specimens in which the intraspinal ligaments are retained. These ligaments have enough resiliency to allow the simulation of normal spinal movements.

Fig. 2. Full-scale graphic depiction of the calculated lengths (distances) through which given points on spinous processes move in forward and backward bending.



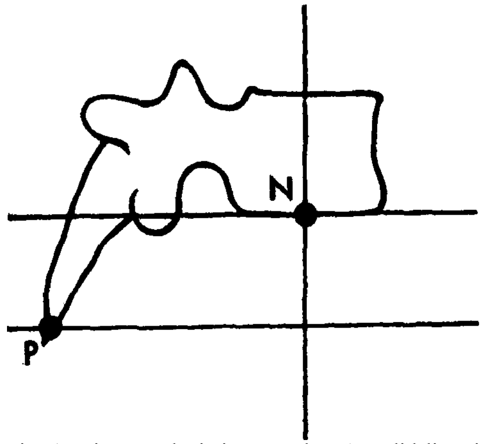


Fig. 1. Diagram depicting vertebra A, solid line, in maximally forward bent position on vertebra B;and A, broken line, in maximally backward bent position.

It should be well understood that IJM testing procedures commonly employed by osteopathic physicians require diligent and concentrated practice if they are to serve as useful avenues of information. Palpation and proprioception remain clinically valuable. From Table I a graphic correlate (Fig. 4) of what may be appreciated by palpation and proprioception of IJM is presented. It is an attempt at somewhat systematic expression of a most important art.

In Figure 4 the representation of side bending from the occipitoatlantal joints to the second and third cervical vertebrae is based on extrapolation from Table I, assuming side bending to decrease from the midcervical spine cephalward.

Individual variations in IJM

Constitutional differences are suggested in the musculoligamentous and cartilaginous determinants of IJM on a genetic-biochemical basis. These differences may account for those persons whose spinal function is salutary but whose IJM falls above (hypermobility) or below (hypomobility) the average illustrated in Figure 4.

It is postulated that the relative magnitudes of IJM for the different spinal levels would be more or less the same for the average as for the constitutional deviants. However, the absolute magnitudes would be greater for the hypermobile and the opposite would be true for the hypomobile.

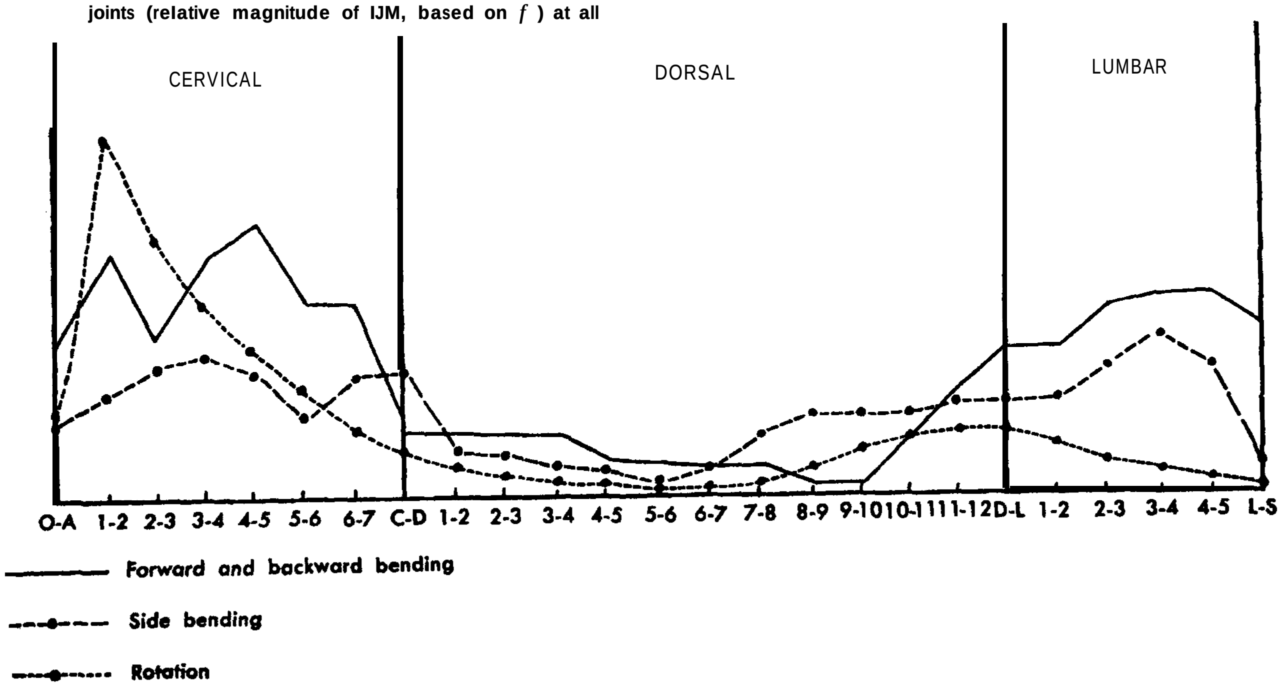
Ease of IJM

Besides range of IJM, the osteopathic physician is concerned with ease of IJM. Besides tactile sensations of changes in interspinous intervals, he receives proprioceptive data through the movements of his own body while inducing passive movement in the patient. Various degrees of resistance or yielding to the forces imposed upon the patient are noted.

Conclusions

1. IJM presents a characteristic pattern of relative magnitudes at the various spinal levels.
2. In general, dorsal IJM is less than that in the cervical and lumbar areas respectively.
3. The cervical spine exhibits the greatest versatility in IJM; the lumbar spine is second in this regard.
4. Except for rotation the cervical spine is most mobile in the middle.
5. Rotation is maximal in the cervical spine at the atlantoaxial joints.
6. IJM is minimal at either end of the cervical spine.

4, **Graphic expression of the relative movement of inter- joints (relative magnitude of IJM, based on *f*) at all spinal levels in all planes of movement.**



7. The lower half of the dorsal spine exhibits significantly more IJM than the upper half.
8. Rotation is minimal in the lumbar area but the other movements are liberal.
9. Palpable IJM tends to parallel roentgenographic quantification of IJM.

Discussion

The osteopathic movement in medicine has been traditionally concerned with the anthropologic significance of the orthograde stance and bipedal locmotion relative to the health problems of man. Relationships between soma, psyche, and viscera especially on a neurovascular basis, are important problems. The role of spinal integrity and IJM in these problems has been thought to be unique. The ways in which IJM may play a part in human wellbeing require further investigation.

In cases of acute spinal injury with symptom of pain, exquisite tenderness, and marked muscle spasm, the general area of pathologically altered IJM can usually be detected with facility. In traumatic orthopedics the need for a scaling of IJM from segment to segment may seem small.

In cases of visceral diseases (such as acute appendicitis or chronic cholecystitis), it is generally appreciated that there may be prominent reflex muscle spasm of the rectus abdominis, iliopsoas, or dorsolumbar paravertebral musculature. However because of the dramatic syndromes that may present themselves, the importance of assessing IJM may seem negligible.

The previous examples of acute trauma and acute and advanced visceral diseases, because of the extremity of their conditions, are recognizable by the distinct syndromes they commonly produce. However, the very diagnosis of a disease entity by abstraction of some characteristic syndrome from the gestalt presented by the patient implies a kind of inadequacy in medicine. The presence of a disease as such only indicates that a pathologic process has already been in action and has finally reached that stage (often irreversible) where it is productive of symptomatology.

Medicine needs more sensitive approaches to the patient wherein the earliest deviations from some level of wellness may be detected-before well defined disease processes are recognizable as such.

Because of the neural reflex continuity of somatic and visceral tissues, it has long been held in osteopathic circles that early disruptions in the integrity of somatic tissues may be reflected in viscera, and vice versa. Somatic expressions of viscera dysfunction are thought to be "quietly" expressed changes in the palpable characteristics of paravertebral tissues and thus in IJM, perhaps long before clinically recognizable syndromes of specific diseases ring their alarms.

Aberrations in palpable somatic tissue characteristics and IJM may be due primarily to problems of an orthopedic nature in the soma itself. Even psychologic problems may be manifested via muscle tension or altered posture.

Assuming that evaluation of IJM is as important as suggested, it is apparent that modem medical education at present does little to encourage the thinking and skills necessary to exploit what could be a technique for health maintenance and early detection of deviations from wellness in the person.

To say that IJM analysis is of little moment in the diagnosis of acute pancreatitis or that manipulative therapy is of little value in bronchogenic carcinoma is to miss the point completely. Examination and evaluation of individual humans before they have recognizable diseases require a way of thinking and implementation which the tools of "disease medicine" either cannot fulfill or for which they are irrelevant.

What are needed are nonspecific (with regard to disease) functional approaches to the whole man as distinguished from specific treatments for specific diseases in which, in a sense, the man is incidental.

Summary

A quasi-objective frame of reference for analyzing IJM both quantitatively and clinically has been presented.

The role that IJM may play in medicine has been discussed. The difference in importance of IJM in medicine preoccupied with disease and in approaches more concerned with health maintenance have been examined.

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The role of static and motion palpation in structural diagnosis

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Palpation offers the clinician the opportunity for a personal and directed, on-the-spot evaluation of the neuromusculoskeletal system. Fingertip cues derived from palpation provide significant diagnostic information about the patient and guide the physician in his therapeutic approach.

The purpose of this paper is to review the simplest overriding principles, with the broadest application, in the palpatory diagnosis of somatic dysfunction. This paper will not include an analysis of any single type of anatomic structure such as muscle, bony structure, ligament, or fascia alone; nor will it include a discussion on intervertebral discs, which are not palpable. Slackening of ligaments, pinched nerves, facet-joint processes, joint surfaces, and the axes of intervertebral movements' all have been dealt with elsewhere. Terms such as "minor intervertebral derangements of discal herniations"[2] and "posterior intervertebral articulations of interspinal ligaments" will not be necessary.

Discussion will focus on somatic tissues in toto-tissues in movement, tissues in action, the perception of what it is the tissues reflect when they apparently are static, and the perception of tissues in their response to a demand for movement and what they reflect during that movement- specifically, what they reflect to the palpating hand.

In communicating his palpatory findings, the clinician's first obligation is to locate accurately *where* his palpating hand is sensing.[3,4] Is it overlying a particular spinal segmental level? Is it located centrally, laterally, or bilaterally? In this manner, the site of contact is localized accurately. Does the size of the finding involve the contact of just the fingertips, fingerpads, or the whole hand? Such careful designations may seem simplistic, but they are primary in recording the facts and my initial premise is that careful observation is scientific. It is scientific whether carried out in a laboratory looking through a microscope, at the bedside auscultating on the surface of a chest, or in the office palpating on the surface of the back. Palpation has not been recognized widely yet as a careful form of observation with scientific validity. Scientific observation is the factual reporting of what is *actually* observed, and *how* it is observed.

A second premise, closely allied to the first, is that the context of the observation-the situation of the observer and the observed-bears heavily on the implications of what is to be recorded as fact. This point cannot be emphasized too strongly because repeatedly throughout the history of our profession physicians, observing the same neuromusculoskeletal phenomenon with their fingertips, have espoused numerous, varying interpretive frameworks. There is a need to delineate carefully what is perceived at the hand of the observer and what is conceived in the mind of the observer. Often the relation between the two is tenuous.

In separately listing items of theory and items of fact, what can the palpating physician (observer) report under items of fact as a first level record of careful observation? To discuss the rigors of static palpation, imagine that a patient is seated and the operator runs two fingers lightly down the paraspinal area overlying the thoracic spine. The physician can report encountering differences at different levels. He can report that one area differs from another (experience with Braille can verify this fact). Under items of fact we can list differences at different levels of the thoracic spine, areas of tissue texture that are changed from their immediate surroundings.[3, 4] These are reportable palpatory facts that should be able to be confirmed by a second observer If findings are described as "congestive," "tense," "ischemic," or "fibrotic," the statement expresses an interpretation that may or may not be confirmable.

The physician also can report factually the location of his finding. An example would be T2-T4 on the right or even bilaterally at the level of T6. The size and extent of the difference can be observed carefully and measured. For example, he might describe a unilateral patch on the right extending vertically 4 cm. and horizontally 1.5 cm., or a bilateral strip extending vertically 1 cm. and horizontally 7 cm. Even with approximate measurements, the basic picture emerges reasonably factual.

By an appreciation of the amount of pressure employed in palpation, the approximate depth of the finding may be gauged and the palpated tissue interpreted. The gradation of pressure can be recorded as factual, the interpretation as theoretical.

Pain and sensitivity[1,5,6] represent significant criteria and are recordable as fact. However, they rely specifically on the subjective nature of the patient's response. As such, they are of a lesser reliability than the objective palpatory cues of a skilled observer.

Perceptions in palpation of deeper tissue, irregularities of the underlying soft and bony tissue, prominences, depressions and asymmetries, are recordable as fact (location, size, and distribution). Interpretation of the finding, such as bony malposition[7] subluxation, sprain, et cetera, is recorded as a theoretical concept.

Where deep pressure palpation ends and joint probing begins is a point of controversy. The situation is still one of static palpation with the subject resting. The technique of pressure probing may involve just one thumb or one reinforced by the other.[8] The actual demonstration of this kind of palpation might involve the subject in a prone position with pressure probing by the operator downward over the paraspinal musculature at a

TABLE 1. SOMATIC DYSFUNCTION.*

Fact	Theory (caused by)
STATIC PALPATION	
Subject seated	
Tissue texture abnormality (t.t.a)—paraspinal	
Level T2 bilateral	
1 cm. vertical, 7 cm. horizontal	Sprain
(subjective pain)	Subluxation
Irregularity, asymmetry, bony prominences	Bony malposition, zygopophyseal lock
Subject prone	
Resistance to pressure probe at right	T2 on T3, transverse process posterior on right
Resistance to pressure in a medial direction from right	T2 on T3, sidebent to left
Resistance to pressure bilaterally in an anterior direction	T2 on T3, restricted in extension, positioned in flexion
	T2 joint lock on T3 (roughened articular cartilages, irregular joint surfaces, adhesions)
Tissue texture abnormality (t.t.a.) at T6—increased compliance to pressure probe bilaterally in an anterior direction	T6-hypermobile joint Stretched ligaments

*Three kinds of palpatory facts about somatic dysfunction: asymmetry, tissue change, and motion change.

given segmental level, comparing one side with the opposite. Encountering a sense of resistance at one side (as compared to a sense of yield at the other side), the local point of resistance to pressure probe could be recorded as factual data. As theory there might be the interpretation of a zygopophyseal lock,[9] or of the vertebra positioned with the transverse process posterior on the side expressing resistance.

One variation of this kind of joint probing involves pressure with one thumb over a bony prominence at a joint area (spinous or transverse process), often with the second thumb creating a counter pressure on an adjacent bone.[10] Resistance to the pressure probe is recorded as fact. If a resistance is elicited by pressure against the side of the vertebral spinous process, it often is interpreted as restricted rotation. If it is elicited by pressure in a medial direction against the articular process, it often is interpreted as restricted sidebending; if bilaterally, in an anterior direction (patient still prone), it may be interpreted as restricted extension. These interpretations are all recordable as theory. Other terms such as "hypermobility," "joint lock," "stretched ligaments," "roughened articular cartilages," "irregular joint surfaces," and "adhesions"" are also recorded under theoretical data. Numerous concepts such as these in the past have given rise to much controversial discussion. Rather, it is the items of skilled perception that deserve attention-their careful recognition and recording as observable fact (see Table 1).

Thus far this discussion has focused on local asymmetry and tissue change. These represent two cues of a triad that is equally as reflective of problems in the neuromusculoskeletal system as the triad of rate, rhythm, and murmur in the cardiovascular system. The third cue is motion change. The methodology of motion palpation is not necessarily a familiar one.

Most procedures for joint motion testing have separated the joint as an isolate from the rest of the body.[2,6,12] Usually with the body static and resting, a joint structure has been evaluated with some type of pressure probe or testing procedure for the joint itself and its motion range. Such methods have led to a concept and a terminology that relate the position of one bone to another, and imply a restriction of motion as a locking of a joint in a given position. The findings have emerged as a snapshot photograph. Consider for a moment the commonly used movement patterns of the subject's musculoskeletal system. These are not movements of one bone alone, nor just at a single joint. They are movement patterns involving many segments, with each segmental part organized and contributing to the total patterned performance, whether the pattern involves primarily segments of a spine or segments of a limb.

With a subject seated, the operator can introduce a gross movement passively, palpating first of all for the sense of total range and extent of the total performance, and recording its limitation and any asymmetry as factual data. Rotational, lateral, and forward and backward bending elements are all appropriate for gross motion testing. Motion testing involves the dynamics of total body movement, or at least the movement of a region of the body. It is a segmented pattern that involves the summation of many parts. Does each part easily go along with and contribute to the gross movement pattern? Or does it express resistance to the particular demand for movement?

Motion palpation deals with the behavior of these segmental parts during motion.[13] After identifying a local segmental area of tissue texture change, the operator palpates for the motion of that segmental part by monitoring it individually while introducing a variety of gross movement patterns (gross rotation of the shoulders, gross forward bending of the head and neck, et cetera).

It is alight palpation, during motion, with the fingerpads overlying the defined segmental level as it participates in the particular gross movement being introduced. The procedure utilizes the same sensations for cues at the fingertips with the operator registering either compliance or resistance, but this time during movement. These are picked up by a light palpatory technique[14] that has been described as nonperturbational. It does not intrude in the action and therefore offers an increased validity in a scientific setting.

Findings during motion palpation add further specific descriptors to the phenomenon included under perceived facts. Until now, during static palpation, an area of tissue texture was localized, for example, overlying T2 bilaterally (changed from its surrounding areas above and below). Subjective sensitivity

TABLE 2. SOMATIC DYSFUNCTION.*

Fact	Theory (caused by)
MOTION PALPATION** Subject seated: t.t.a. at T2	Binding in relation to postural demands (of the seated position)
Head rotation to right ←→ t.t.a. increases Head rotation to left ←→ t.t.a. decreases Head sidebending right ←→ t.t.a. increases Head sidebending left ←→ t.t.a. decreases Head forward bending ←→ t.t.a. increases Head backward bending ←→ t.t.a. decreases	Active binding accelerating or decelerating in relation to demand for movement

*Three kinds of palpatory facts about somatic dysfunction: asymmetry, tissue change, and motion change.
**The tissues about a moving part constantly reflect its compliance or resistance (behavior) in response to specific movement patterns (position and changing position).

was noted and the asymmetry of its relationships and the resistances to the pressure probe. But in motion palpation, an immediate increasing resistance (active binding) can be recorded at T2 during the initiation of gross rotation of the head to the left, as compared to its increasing compliance (active easing) when the head is rotated to the right. Range is not measured here. This is not a resistance to *all* movements. Rather, it is a constantly changing response of local segmental tissues during movement-bind accelerating during some movement, bind decelerating during others.

The conceptual framework is behavioral. The relationship is of a segmental part, not to the one below but to the whole movement of which its behavior is being evaluated. The phenomenon is conceived of as one of lesioned segmental behavior within the dynamics of movement; this time the findings are analogous to a motion picture, not a photograph. We do not ask the question: "A lesion of what?", which indicates a conceptual answer of bone, joint, ligament, muscle, et cetera. Rather, the question is asked: "Lesioned in response to what?" Such questioning demands a factual answer, such as: "In response to the particular gross demand for movement that initiates the action." This is a definable, reportable fact (see Table 2). It is a careful, scientific observation that can be confirmed by a second observer.

Regarding motion and position, Sherrington said that position follows motion like a shadow.[15] The corollary to this statement is that motion is position on the run. The fact to be pondered here is that motion and position are integral stages of the same process. Once identifying a lesioned phenomenon of tissue texture abnormality during a so-called static palpation in the resting position, now consider asking this same question in the static situation: "Lesioned in response to what?" A plausible answer might be that it may be lesioned in response to the demand to assume a position. Actually, this is a particular *postural* positioning, one that the subject has been asked to take during the examination. Each segment is asked to contribute to that positioning so that each segment is in the right place in the sequence. This assumption can be easily probed by monitoring the already tense tissue texture at T2 as we alter the subject's position. The tissue texture immediately changes and becomes either more resistant or more compliant depending on the new position demanded. From one position to another position is considered movement, bearing out the direct relationship of the phenomenon to position and/or motion. Binding has existence only as a *response* to the demand currently placed on it, whether motion or position.

There is an impact to this kind of observation, attentive to the methodology of palpation and the facts perceived in palpation. It enables the physician to integrate all of the diagnostic findings in both static and motion palpation as factual data (Tables 1 and 2). Once distinguished from the theories (grouped in the columns on the right), the opportunity is provided for the factual data to be organized under a single common conceptual framework (theory) that will begin to deal with all descriptors of the phenomenon of somatic dysfunction. All palpatory procedures will be viewed in direct relation to the dynamics of demand and response The commonality of demands for both position and movement-their existence together- should be dealt with as a single continuum of demand rather than the diversity of the two separate entities that the terms have long implied. With proper attention to the methodology of palpation (how the facts are observed) and the clinical diagnostic findings of palpation *(what is* observed factually), procedures can be reproduced and findings can serve as specific descriptors within a laboratory setting.

Palpation is a careful form of observation that can be scientific. I have tried to address a verbal *logic,* and suggest a kind of physiologic, as the basis for a theoretical model which will be an appropriate guide for clinical research.

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VII

Somatic Dysfunction

Dr. MacBain in a classic article explores the functional and dynamic aspects of the somatic components of disease. He traces the evolution of the concept of the osteopathic lesion and suggests that the somatic tissues act as perpetuators and accelerators of the response to stress organized by the nervous system and manifest as somatic pain.

In two articles Dr. Denslow explores the role of soft tissue in joint dysfunction. He emphasizes the importance of the use of soft tissue palpation in diagnosis and prognosis. In a third article entitled "Pathophysiologic Evidence for the Osteopathic Lesion: the Known, Unknown, and Controversial" Dr. Denslow delineates the clinical evidence for the osteopathic lesion. He points out that objective evidence as to the etiology of the osteopathic lesion is almost totally lacking as well as the interrelation of somatic and visceral reflexes in health and disease, and the effectiveness of manipulative therapy directed at the osteopathic lesion. Dr. Denslow concludes that controversies about the lesion can only be resolved through appropriate research.

The last article reviews the incidence of spinal palpatory findings in nine research studies.

The SOMATIC components of DISEASE*

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THE FREQUENT STUDY and re-evaluation of osteopathic principles, practices, and concepts have been recognized needs and practices in our profession throughout its history. As a separate, independent profession in a numerical minority in the field of medicine, it has faced a continuing challenge to its existence. The challenge today, though somewhat different, is as great as it was in the 1890's or early 1900's. In its infancy, the threat to osteopathic survival came from its radical departure from the theories and practices of late nineteenth century medicine.

Today, in the mid-twentieth century, we see conformity as a danger to osteopathic independence and to its existence as a separate school. In the opinion of some observers, the two recognized branches of medicine have eliminated many of their differences, and the significance of those that remain is in question. The medical world of 1956 is vastly different from that of 1900 or even 1925. Does a school of practice whose claim to independence is based on its emphasis of the neuromusculoskeletal system make as great a contribution to the public health today, relatively, as it did 50 or 25 years ago?

The American Medical Association Committee[1] for the Study of Relations between Osteopathy and Medicine, on the basis of a survey made in 1955, said in its report:

> The sole fundamental difference in principle in the teaching of medicine in colleges of osteopathy and schools of medicine lies in the degree of emphasis placed upon the study of the musculoskeletal system and the application of manipulative therapy.

This is an understandable oversimplification, but we must agree it is fairly accurate, though limited, reporting. This paper proposes to review some of our knowledge and theories regarding this fundamental point of divergence between osteopathy and old-school medicine.

That our understanding of the nature and relation of the nervous, muscular, ligamentous, and other skeletal tissues to the disease process has been modified and broadened in recent years is obvious. The history of medical thought is one of continuous reorientation during that period of great medical discoveries which began in the late nineteenth century and has gone on without interruption since that time. Osteopathy has not stood still. There have been modifications and adaptations required of osteopathic thought, but they have been minor rather than basic.

In 1874, Dr. Still announced his observation that the skeletal tissues were subject to a variety of hitherto unrecognized stresses and strains from traumatic and other influences. He advanced the theory that these stresses and strains were either primary or secondary parts of the disease process and were significant etiologically, diagnostically, and therapeutically. In 1955, as quoted above, a group of medical observers noted that Still's followers were continuing to give what seemed to the observers particular emphasis and importance to these same stresses and strains. Recognizing the basic consistency of osteopathy through 82 years of its history, we must also realize that some clarification and illumination of the earlier observations and experiences of our profession have taken place. Both relative emphasis and terminology have progressed and developed.

The term "somatic components of disease" in its present reference was first used by Korr[2] in 1948, and it has recurred in the titles and text of several papers from the Kirksville group since that time.[3,4] It is used as the title of this paper because it expresses the integral and ever-present nature of neuromusculoskeletal stresses and strains. The more familiar and more commonly applied terms "osteopathic lesion" and "osteopathic pathology" are synonymous, yet not so inclusive. The word "component" implies that these stresses and strains are a part of the disease process in all its phases. The older terminology in which common medical terms are qualified by the word "osteopathic" as in "osteopathic lesions," "osteopathic pathology," and "osteopathic diagnosis and treatment" requires orientation and explanation for those not accustomed to thinking osteopathically. The "osteopathic" terms have served us well in focusing our own thought but have added to the difficulties of communication with other scientific groups. They may, in a minor way, have delayed a broader understanding and acceptance of our contribution to medicine.

The third component

There are three components of disease: the visceral, the psychic, and the somatic. The processes through which they have come to be identified are of interest.

The science of pathology began with the study of the morphologic cellular tissue changes associated with disease. These changes are the terminal stages of the morbid process and are observed at surgical removal or postmortem. The studies are confined almost exclusively to viscera so that the consideration of the changes occurring in vital organs in degenerative and in terminal diseases have dominated medicine. Organic visceral disease has been considered of primary importance in diagnosis and therapy. Medical thought is and has been "organ oriented" with two results:

1. Functional disorders tend either to be unrecognized or considered of no importance to the true scientist who is absorbed in making his clinical opinion coincide with findings at

*Keynote Address delivered at the Sixtieth Annual Convention of The American Osteopathic Association, New York City, July 16, 1956.

surgery and autopsy.

2. Concentration on the study of visceral disease caused the neglect of those studies dealing with the relative importance of the psychic of the somatic functions and tissues. Emotional and psychic problems together with symptomatology referable to the skeletal tissues, have been considered only when they have been major, easily recognizable, and of such intensity that they could not be ignored. Wherever possible, they have been classified as secondary to visceral disease.

Although psychic and somatic problems have been assigned a secondary role by medicine, their frequency has stimulated interest in the phenomena of referral of symptoms and referral of functional disturbances from points of primary involvement *to* other areas and systems of the body.

Studies of referred pain and reflex contracture were begun by Ross,[5] Head,[6] and Mackenzie,[7] who originated the concept of viscerosomatic reflexes. The subject has attracted the interest of a growing number of investigators, particularly those concerned with understanding the mechanism of pain. The data and the theories resulting from these studies on symptoms referred to the somatic structures have made an important contribution to our understanding of the integrating functions through which body unity is maintained.

The development of modem psychiatry and the recognition of psychosomatic and other psychogenic symptomatology have further stimulated interest in the mechanisms of referral and the organ systems through which they are effected. Modem psychiatry represents the first major break in medicine away from the arbitrary confines of the idea of the sole primacy of visceral-organic disease. As a result, general medicine has largely accepted the interdependence, the interreaction, and the interrelationship of the visceral and the psychic components of disease. Each or either is considered capable of a dominant role but some element of both is usually accepted as present in most clinical problems.[8] Thus has one part of the concept of body unity, mediated through the nervous system, come to be adopted by clinical medicine.

That both the visceral and psychic components are integrated with the skeletal somatic tissues has been recognized by all schools of practice, but in general medicine the skeletal tissues have been assigned a secondary and passive role *in* relation to the other two. That the skeletal tissues have been studied as secondary reactors is indicated by current medical terminology: "viscero-somatic reflexes," "referred pain," "reflex contractions," and "psychosomatic" and "psychogenic pain." Reference to somatovisceral reflexes is rare in nonosteopathic literature. The possibility that the skeletal tissues might at times play a dominant role is seldom recognized in medical writing or clinical study.

Historically, the growth of osteopathy as a profession has roughly paralleled in time the gradual reorientation in medical thought which recognizes functional disease as clinically important and which assigns to the skeletal tissues a part, although a passive and limited one, in the disease process. Thus modem medicine accepts body unity and its clinical application to a limited extent.

Osteopathy has always recognized the clinical importance of the concept of body unity and has applied it specifically and with emphasis to the relation of the somatic skeletal tissues to viscera. It assigned to the skeletal tissues a place of active and dynamic influence in the disease process-a place which makes them of equal relative importance with the visceral and psychic components in pathogenesis and morbidity, if not in mortality.

Livingston[9] has said that in many clinical syndromes there undoubtedly may be a combination of somatic, visceral, and psychic irritants, with each contributing to the central process, regardless of whether they represent primary or secondary factors.

As the sole proponent of a completely unified response of the body to disease, including an active and positive role for the skeletal tissues, the osteopathic physician has shown a surprisingly modest degree of the tendency toward overemphasis of his viewpoint that has characterized many pioneers in new fields of medical development.

To the osteopathic physician belongs the distinction of recognizing and seeking a proper evaluation of the role of "the third component," the somatic component, which is interactive with the other two, visceral and psychic, and like them capable of dominance in circumstances frequently encountered in clinical medicine. The somatic component completes the triad of components mentioned previously.

Functional nature of somatic components

I suggest that many of the difficulties in understanding the somatic components of disease have come from a tendency to describe them structurally and morphologically rather than functionally. A review of osteopathic literature fails to reveal any great uniformity in diagnosis, in the recording of findings, and in the relation of the somatic components to various types and groups of disease. What we term the "osteopathic lesion" has not yet been described in a way to permit such uniformity. It is possible that what we have tried to describe as characteristics of the lesion have been incidental to it, rather than of its essence.

In 1917 a group of definitions of the osteopathic lesion by such authors as Hulett, Tasker, McConnell, Clark, and Ashmore was presented in an introductory chapter to Bulletin No. 4 of the A. T. Still Research Institute.[10] 'The definitions showed the divergent ideas of these early writers.

Also in this bulletin it is stated:

> Very few records are to be found which give the results of a study of the essential tissue changes occurring in those slight structural perversions called variously "bony lesions," "osteopathic lesion," or "vertebral lesion." Much has been written concerning the supposed nature of these changes, but, so far as now appears from a study of the literature, little study has been made of the pathology. Even the tissue changes occurring in ordinary dislocations and sprains have failed to receive proper study anywhere, and the changes occurring in subluxations and in the other classes of structural perversion have received practically nothing in the way of systematic study.

Denslow has stated:

> The term "osteopathic lesion" has been placed in quotation marks since, although the recognition and treatment of this entity has been at the very core of the work and development of the osteopathic profession, general agreement as to its exact nature and its anatomical, physiological, and pathological characteristics has not yet emerged.

A preoccupation with the search for tissue changes and positional changes in areas of lesion was characteristic of our profession in its formative years. The early osteopathic physicians began their experience with and studies of the lesion at a time when the cellular pathology of Virchow occupied much of the attention of medicine. There was a consistent search for objective changes, gross and microscopic, that could be identified with disease processes. Medical contemporaries of the early osteopathic physicians were impressed by and concentrated on "organic disease."

It was only natural then that a structural description of the newly recognized neuromusculoskeletal factors should be sought. Since these factors so frequently involved joints and their supporting tissues, the positional changes of the bones entering into the joint appeared, to early students, to be of prime importance, and to supply an objective frame of reference for identification and description. The terms "structural maladjustments," "subluxation," "malrelationship," and the like came to be indicative of osteopathic thinking.

It was thought that some trauma of varying degrees of severity and duration forced these structures into maladjustment where they remained until suitably treated. They were "put back in place," "corrected," "realigned," et cetera. Again the terms used in therapy indicated the concept of pathologic structural relationships rather than functional change. The words used described something tangible, objective, and understandable and in terms familiar at that time.

The result was that the altered anatomic relationships (usually minor in nature) frequently found on palpation of joints which give other evidence of the stresses and strains described by Dr. Still became established as criteria of the lesion and considered of its essence. Much thought has been given to efforts to indentify and classify the somatic components of disease in terms of altered anatomic relationships, expressed as alterations of, or fixations in, one or more of the normal movements of the joint concerned.

It soon became evident that the functional disturbances and effects of the Still lesion bore little if any relationship to the degree of altered anatomic position. In fact, there was almost an inverse ratio, since gross and long-established anatomic deformities could be symptom free while what were apparently the most minor alterations, anatomically, produced marked clinical reactions. This disparity between structural malrelationship and functional effects did not discourage, until recently, persistent efforts to study and record osteopathic findings in terms of positional change. The result has been many samples of structural examination sheets, none of which has been used for very long.

While these altered relationships are not the essence of the lesion, an ability to recognize them and evaluate them still remains one of the basic skills required of the osteopathic physician. It is indispensable in the diagnosis and treatment of many of the functional disorders in the musculoskeletal system in which positional changes help to indicate the nature and degree of the functional change. These findings are indicative, however, rather than determining, and they rest on individual interpretations which do not permit objectivity from independent observers.

The search for objectivity in the lesion had another influence on osteopathic development. That second influence was the search for morphologic tissue changes, identifiable microscopically, in areas of lesion. This led to a series of tissue studies of traumatically injured vertebral joints in laboratory animals, usually rats, guinea pigs, and rabbits.[10] These traumatized tissues showed simple, noninfective inflammatory changes in the immediate post-traumatic period. The findings were generally consistent.

Observations made some time after injury of laboratory animals (weeks and months) showed less characteristic findings. Some injured joints had fibrositic degeneration of muscles, thickening of ligaments, and degeneration of cartilage. In others with negative findings, the observers presumed that recovery had occurred through "spontaneous correction."

The similarity of the tissue changes observed in traumatized laboratory animals and in humans rests on reasonably sound conjecture. Palpation of these animal spines at the point of injury showed minor positional changes of the bones of the joint, restrictions of mobility, and some edema and swelling of tissues. These palpatory findings were similar to those found in humans in vertebral joints diagnosed as being "in lesion." In the immediate post-traumatic acute stage the edema and swelling were more marked than in the chronic stage when tissues tended to be contracted and firmer (fibrositic) in both animals and humans. Because of these similarities the findings seen in traumatized laboratory animals were accepted by osteopathic physicians as probably the same as those occurring in humans at points of lesion.

So, today as in 1917 we are still writing and talking about the "supposed" tissue changes in humans. Tissue studies of simple traumatic injuries to joints and other human skeletal tissues are no more abundant today than in 1917, in either osteopathic or medical literature. A few efforts to observe cellular changes in cases diagnosed as fibrositis have been made under medical auspices.

Bonica[11] has reported confusion as to what constitutes fibrositis and records also a recommendation that the term "fibropathic syndrome" be substituted. The existence of fibrositis is doubted by many because "usually there is a lack of histologic evidence." (The concept of organic disease must be served.)

Other writers do find some inflammation of the muscles and their attachments with infiltration of inflammatory cells, some hyperplasia of white fibrous tissue, fibroblastic nodules, interfascial adhesions, and localized muscle spasm.

Practically, no consistent pattern of morphologic change has been established for the somatic components of disease. In trauma, an acute inflammatory change is probably present, but this would be self-limiting and would heal spontaneously without the presence of some other factor. Korr[4] has suggested that a certain pattern is organized by the nervous system to produce what is termed "the osteopathic lesion." Since chronic tissue changes follow injury to skeletal tissues in some instances and are absent in others in both laboratory animals and humans, some explanation other than the simple reaction of inflammation must be found.

These considerations lead to the suggestion that the somatic components of disease represent a functional disturbance of the normal activities of the supporting the contractile, and the pressure-bearing tissues of the neuromusculoskeletal system. They are the functional response of these tissues to stress of any kind, whether that stress is traumatic psychogenic or reflexly transmitted from other primary factors in the viscera. The sequelae of these functional changes may include a variety of manifestations which come from the functional change but do not cause it-positional changes, restricted mobility, edema, later fibrositis, et cetera. These are all incidental to the response to stress as it is organized by the nervous system. They are determined not only by the force and duration of the stress but by preceding influences on the involved tissues and neural pathways.

A definition of the osteopathic lesion given by W. A. Schwab to his classes 25 years ago was “a maladjustment of structure which perverts physiology.” Could that not now be rephrased, with a change of emphasis, to “a maladjustment of structure caused by perverted physiology”? Even trauma must first pervert the physiology in order to prevent spontaneous recovery. Actually, of course, structure and function cannot be separated. The functional nature of the somatic components of disease has been considered at length because its recognition will:

1. Lead to clarification of osteopathic diagnostic records with principal emphasis on the identification of functional changes in tissue rather than positional change.

2. Make for more effective manipulative treatment when it is realized that corrective measures must reach function primarily and structure secondarily.

3. Promote realism in osteopathy by recognizing that many supposed characteristics of the lesion, particularly morphologic tissue changes, which we have failed to demonstrate over many years, may frequently be nonexistent or are end-results rather than causes when they are present.

4. Give a more dynamic conception of the somatic components and their ability to dominate the response of the organism to stress.

5. Direct research along productive lines similar to those which are being followed at Kirksville and Kansas City, and are being begun at Los Angeles, in studying functional changes in areas of osteopathic stress and strain.

6. Lead to a more careful evaluation and interpretation of current literature and its contribution to a better understanding of osteopathic principles.

Somatic components and pathogenesis

Osteopathy has at times been challenged to “prove” that disease is caused by the functional pathologic disorders under discussion in this paper. Many observers with only a superficial knowledge of our science reason that if appropriate treatment to the somatic components of disease produces a favorable clinical response then, per se, these components must have caused the disability and the relationships should be capable of proof. That this is an oversimplified approach to the study of pathogenesis is apparent. It is characteristic of the etiologic concept.

Galdston[12] has said that we live in the age of etiological medicine which had its origin in bacteriology and has evolved with it.

The etiologic era has been characterized by a consistent search for as many specific causes for as many diseases as possible. The purpose of this etiologic approach has been to find means of prevention and to develop a therapeutic attack on the causative agent when its presence has been identified clinically. In other words, eliminating the cause will cure the disease. Etiological medicine has many successes to its credit, particularly in some of the infectious diseases. It has only limited usefulness in others, and even less in degenerative and neoplastic fields.

Osteopathic thought was influenced by this etiological trend, and a number of theories were advanced in our profession as to the presence of a causative relationship between certain areas and types of skeletal stresses and strains and systemic and organic disease or diseases. Once again observations on the viscera of laboratory animals whose vertebral articulations had been traumatized were undertaken and some interesting observations made.[13-15] At present there has been no general acceptance of the relationship established between mechanically injured vertebral joints of laboratory animals and functional and morphologic changes in the animals’ viscera. Some additional effort was made to collect clinical statistics on humans which might establish an etiologic relationship between areas and types of skeletal strain and certain clinical entities. It has also been difficult to find consistency in this approach up to the present, possibly because it may rest on a doubtful premise as well as being handicapped by lack of uniform terminology.

All osteopathic physicians with experience in somatic tissue diagnosis and treatment recognize the presence of skeletal changes in a wide range of disorders. I suggest that the sustaining and amplifying roles of these skeletal changes, together with their tendency to exaggerate the impact of other factors, may outweigh in importance their etiologic significance.

The specific etiological concept is giving way, in general medicine, to an appreciation of what may be termed “stress factors.“ The change will be gradual, not abrupt. Old concepts are not given up nor new ones adopted quickly. From the transition, a practical meeting ground for the two ideas will be found.

Beyond a minority of diseases with markedly specific etiologies, attention is more and more directed toward the manner in which an individual responds to noxious factors in the environment. The particular nature of the individual response to stress is at times an equal, or at other times a greater, determinant of the clinical entity that develops than the stress itself. The individual in all the complexities of heredity, social, and physical environment, past injuries, and experiences becomes the key to pathogenesis rather than does the stress factor which happened to be most recently operating on him.

This means that etiology is multiple and combined, many times the accumulation of a number of factors appearing in sequence over some period of time. The clinician is not always able to weigh the relative significance of trauma, infection, psychogenic strain, and the like, so the important element becomes the individual’s own adaptability and resistance. In many common diseases of the circulatory, digestive, nervous, and glandular systems, the texts list so many possible etiologies or combinations of etiologies as to throw doubt on the importance of any of them.

In the midst of such complexity of possible causes it is unreasonable to expect to define for the somatic components a specificity and an exactness that we expect of very few of the other noxious influences known to produce physiologic stress. Even in the field of trauma and posture, where pathologic skeletal changes could most readily be expected to be specific and localized, we are confronted with such a variety of individual responses that, in all but severe and major injuries the simple reaction of skeletal tissues to direct force immediately becomes complicated by the total reaction of the individual.

It is not without reason, then, that our efforts to establish a selective and specific role for the lesion have not been successful. The somatic components are but one of a number of conditioning factors influencing the response to stress. No osteopathic physician will question their importance. That they are clinically frequent and often dominant in determining the direction and nature of the response to stress is apparent to those who recognize them and treat them.

However, too little emphasis has been placed on a possibly more significant role of the somatic components in pathogenesis and in therapy-that is, their tendency to set up, through the intricate segmental and higher reflex mechanisms which they activate and which activate them a sustained, self-perpetuating, and often self-accelerating cycle. If an opinion based on clinical experience may be permitted, I venture to state that the somatic tissues have the ability to maintain a state of untreated or uncorrected functional imbalance for a long time and with considerable dynamism. Trends in the literature support this view.

Livingston[9] has suggested that the concept which he proposed for the pain mechanism in causalgia may be applicable to pain associated with various disorders, including visceral, somatic, and psychic conditions. He has stated that an organic lesion at the periphery, involving sensory nerve filaments, may become a source of chronic irritation. From this trigger point afferent impulses eventually create an abnormal state of activity in the internuncial neuron centers of the spinal cord gray matter. In turn, the internuncial disturbance is reflected in an abnormal motor response from both the lateral and anterior horn neurons of one or more segments of the cord. The muscle spasm, vasomotor changes, and other effects which this central perturbation of function bring about in the peripheral tissues may furnish new sources of pain and new reflexes, thus creating a vicious cycle of activity.

Long after an immediate or precipitating factor in viscera may have been overcome or have been compensated for, the associated response of the skeletal tissues, particularly the vertebral joints, may be self-perpetuating and continued. From its role as a secondary or incidental component of the body's reaction to stress, the somatic component often progresses to a place of dominance in the clinical picture, a place toward which treatment must be directed.

Recognition of the role of skeletal stress and strain in perpetuating and amplifying the response to all stress contributes to all appreciation of its clinical importance. Recognition of the limitations of the specific etiological concept, both as it applies to a variety of stress factors and to the osteopathic lesion itself, will contribute to a more fundamental appreciation and understanding of our science.

The spectrum of diseases in which a favorable response to osteopathic treatment has been and may yet be achieved is broad. Understanding and acceptance by objective observers of these favorable results of treatment cannot be conditional on the finding of a simple etiologic connection between the skeletal components and the disease in question. The importance of these skeletal components of disease increases as their wider influence, particularly in treatment and recovery, is understood through what Livingston[9] calls "the vicious circle concept."

Somatic pain

Pain in the skeletal tissues is a major clinical problem and is recognized as such. Its exact clinical frequency is not easily established because it does not lend itself to statistical treatment. It has its origins principally in functional rather than organic disturbances, and classification by objective methods is difficult. Also many physicians have a limited knowledge of and interest in this phase of practice, chiefly because they are not equipped by training to deal with it. It is discussed here as one indication of the clinical frequency of the somatic components.

A recent article in a lay magazine said of backache that in all probability this ailment causes more general discomfort than any other medical problem except the common cold.[16]

Bonica[11] has grouped pain along the distribution of spinal nerves, myofascial pain, and arthralgia or joint pain as among the most common problems confronting the clinician. Other writers join in giving pain in the skeletal tissues a high priority of clinical incidence. This is done in spite of a wide diversity of views regarding pain and differentiation of its various types.[17]

A few trends in the consideration of skeletal pain are of interest. Pain in the musculoskeletal system may have its origin in three areas, the viscera, the psyche. and the somatic tissues themselves. Medical opinion has shifted from the viscerogenic to the psychogenic as the most frequent and important source of somatic pain, until recently there has appeared to be a realization that the somatic tissues themselves are responsible for much of the pain felt in them.

Following the work of Ross,[5] Head,[6] Mackenzie,[7] and later investigators, referred pain of visceral origin was widely thought to be the explanation for most somatic pain where the skeletal tissues themselves showed no infectious, traumatic, degenerative, or neoplastic lesions demonstrable on objective examination. There was a period when much abdominal surgery was undertaken primarily for the relief of back pain. The study and analysis of the back itself was neglected while the search for visceral disease was pursued with vigor, because in the minds of most clinicians and surgeons functional pain from the back itself was nonexistent.

Unsatisfactory therapeutic results from surgery, together with more investigation of somatic pain by other investigators, have changed the perspectives. Judovitch and Bates[18] have said:

> In the chest and abdomen segmental pain and tenderness may simulate the pain of visceral disease, and many patients who have submitted to medical treatment and surgical procedures are not relieved of pain until treatment is directed to the somatic origin and its cause. Following surgery, the pain may persist or become even worse.

McHenry[19] has pointed out that chronic pain, apparently related to viscera, often disappears with proper orthopedic treatment of body mechanics. Chapman[20] has questioned the validity of several hypotheses relating to referred pain and has emphasized the frequent somatic source of skeletal pain.

While the frequency of pain diagnosed as referred has diminished substantially, and much more care is exercised in its identification than was the case 20 years ago, the majority still recognize visecral pain referred to somatic structures as a clinical fact. The subject is confused and confusing because of the number of different views advanced to explain its mechanism. Again the majority appear to favor the existence of a central excitatory state (area of facilitation) either at the segmental level, in the internuncial pool, or in the cerebrum itself.

Somatic pain of psychogenic origin is the province of the school of psychosomatic medicine. The overemphasis that accompanies new conceptions in medicine appears to have had free rein here. When the visceral explanation of somatic pain came into question, pain for which no explanation could be found in organic and objectively demonstrable disease of the skeletal tissues or viscera was then often termed "psychogenic in origin" and treated as such in general medicine.

That there is some influence of psychogenic factors on the skeletal tissues is generally accepted. But its usual effect is to exaggerate or exacerbate an already established functional or organic change rather than to initiate it. Here again statistics are not satisfactory but Weiss and English[8] reported on a combined clinic in which a psychiatrist participated, for the handling of low back cases. Of 300 cases of low-back complaint, only twenty-seven were classified as neuropsychiatric in origin. Bonica[11] reported a number of opinions ranging from those which attribute all cases of "fibrositis" to psychosomatic factors to those which place the syndrome on a purely physical basis. In the face of this great diversity of opinion, the osteopathic physician can only advance his experience to support his impression that somatic pain is usually classified as psychogenic in origin predominantly by those whose training has not included an understanding and a recognition of the effects of fatigue, of tensions, and of other strains to which the back, with its upright posture, is subjected. The diagnosis of psychosomatic pain is usually made by default and by those who have limited understanding of the musculoskeleta1 system and its weaknesses.

The predominantly somatic origin of somatic pain has long been recognized by the osteopathic physician, and his record (again statistics are not available) in therapy attests to the soundness of his concept. Havemann[16] reports the conclusion that practically all backache is functional, the fault of muscles and ligaments that are working badly. Of 1,000 cases of the difficult and persistent type, 60 percent were attributed to muscular strain or ligamentous sprain and 30 per cent to chronic fatigue.

Weiss and English's[8] statistics mentioned above attributed 262 of 300 cases of low-back pain to causes as follows: posture, osteoarthritis, acute low-back disturbances, myositis, undiagnosed or deferred diagnosis, and miscellaneous causes.

Bonica,[11] in addition to labeling problems of neuralgia, myofascial disease, and joint pains as among the most common confronting clinicians, has listed as their principal causes influences which affect the skeletal tissues directly, such as trauma, postural strain, over-exertion of muscles, chilling, and fatigue, while at the same time recognizing their functional nature and the usual absence of histologic change.

These few illustrations show the primacy given to purely somatic functional disorders by these authors in contrast to the former referred pain and psychogenic concepts which have not stood the test of clinical experience. Referred pain and psychogenic pain are still important in clinical medicine, but their relative importance and frequency have been minimized as somatic causes have become understood.

Somatic pain is one phase of the study of the somatic components of disease that has gained some understanding outside of osteopathic circles, but there are as yet only scattered indications in the literature of any appreciation of the integration of these components with visceral and psychic diseases in an active and, at times, a commanding role.[21] That still remains the unique and distinct province of osteopathy. Osteopathy will probably ultimately share that distinction with general medicine as it now shares its more advanced concepts of somatic pain.

Summary and conclusions

Andrew Taylor Still[22] said in his autobiography, "Its [osteopathy's] applications may be more thoroughly understood, but the philosophy is eternally the same." I have discussed some of the applications of that philosophy as it has applied to the supporting, protective, and motor and sensory skeletal tissues and given to them an important and significant role in health and disease,

The somatic tissues are one of three components of disease whose inclusion in the triad of visceral, somatic, and psychic factors makes the clinical application of the concept of body unity a reality. They are functional and dynamic, not static, degenerative, and passive. Their part in pathogenesis is active, particularly as perpetuators and accelerators of the response to stress organized in them by the nervous system. Their most commonly understood manifestation to date is in the realm of somatic pain. The search for their true place in medicine is just beginning. It will involve a challenging volume of laboratory and clinical study with a type of organized direction that our profession has not yet developed.

The laboratory should, first, provide methods of measuring and recording the functional changes which are the osteopathic lesion and, second, contribute something to the study of the integrating mechanisms which coordinate visceral, psychic, and somatic functions. Two osteopathic laboratories, at Kirksville and Kansas City, are working in these fields, and work is being started at Los Angeles. There should be at least three more groups with essentially the same interest and much greater support.

The clinic must provide simple methods of identifying and recording the functional changes in the muscles, skin, and fascia, which are the somatic components in disease. Controlled and comparative studies in diagnosis and therapy will follow.

Osteopathy is the school of medical practice which recognizes and emphasizes the role of the somatic components of disease. That is the reason for its existence. It began and was sustained in its trying early days by a sense of mission, the conviction of a great contribution to medicine. Part of that contribution has been made, but only a small part. The sense of mission needs to be preserved. The challenge that remains is bigger than ever, so big in fact that other groups with more resources than we have may be the ones to meet it first. If they do, our purpose is accomplished. But until that purpose is accomplished, we must grow in strength, in independence, and in pride in our special and distinctive philosophy, training, and skills.

To be practical about it, let us see that we recognize and emphasize the role of the somatic components in individual practice, in our service institutions, and in our teaching clinics and hospitals. That we can all do. That has been the basis of osteopathic strength, and it remains the principal means by which the resources to meet our challenge will be provided. Let us capitalize on our distinctive and unique place in therapy, and our conformity will take care of itself

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Soft tissue in areas of osteopatic lesion

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The discovery and development of osteopathy, like many useful clinical methods, required first, the logical assumption that under certain circumstances certain biological characteristics should exist (in this case a realization that mechanical structure is related to function) and, second, the observation that characteristic palpable changes in mechanical structures apparently accompany and influence functional and organic disease.

This paper deals with the examination and analysis of the palpable changes, in areas of osteopathic lesion, which occur in the overlying and supporting tissues of joints, which affect the positional and motion characteristics of joints, and which are used for the purpose of reaching a diagnosis and an outline of therapy.

In approaching this subject it is wise to recognize, at the outset, certain facts which have a direct bearing on these changes. Most important of these is that the joint changes which Still' described originally are recognized and used daily by osteopathic physicians and, to a limited degree. by a few nonosteopathic physicians. Next is the fact that the joint changes under discussion are exceedingly complex and to date have largely defied classification and precise measurement; and finally, that although there has been considerable speculation, the actual mechanics of the relationship between these joint changes and clinical symptoms and disease are not known.

The reason that tissue changes are of great importance is because they indicate the location, extent, severity, and progress of malfunctions which involve not only the joints to which they are attached but other organs and tissues as well. These changes apparently involve the skin, subcutaneous tissues, fascia, muscle, and the attachment of muscle and fibrous elements to periosteum and to bone. They may be either functional or organic, or both in lesion areas of some duration.

The evidence that these changes are functional lies in the fact that they may be altered within short periods, it is secured subjectively by patients' comments and objectively by palpation findings. When these changes are alleviated by therapy patients report decreases in pain or discomfort, greater ease of movement, increase in the sense of well-being, etc. While technics and methods for quantitating such observations are still not satisfactory this lack does not invalidate the fact that patients report improvement concurrent with decreases in soft tissue abnormality.

Objectively, careful palpation reveals marked changes in tissue texture in either the direction of improvement or of regression to greater abnormality. The latter is dramatically illustrated by the increase in extent and degree of tissue abnormality which occurs in unsuccessful attempts to use the heel lift therapy. In a matter of a few hours after a change in weight-bearing stresses has been produced by a lift the tissue abnormality may become more severe and may extend over a greater area, at the same time the patient reports an exacerbation of symptoms. Although such palpation findings are, of course, subject to the interpretation and evaluation of the examining physician and although this method does not permit precise quantitation, they are valid and establish the point that alterations in tissue texture are not organized to the point of being static.

Organic changes occur not only in the soft tissues mentioned above but in bone as well. The latter occurs in the form of stress deformities and is typified by the wedging of vertebral bodies which is a part of many long-standing spinal curvatures. Since bone changes must be evaluated by x-ray they will not be discussed in this paper. As regards the organic changes in soft tissues, there is much speculation as to their exact nature and to the degree to which they are reversible. Certainly fibrous adhesions and bands may be stretched and probably tom. In contrast to functional changes, organic changes are altered more slowly. However, except for the time differential, the improvement or regression of the latter is somewhat similar and may be detected by palpation.

Classification of Tissue Change.- The fact that there are almost as many descriptions of tissue abnormalities in lesion areas as there are osteopathic physicians is evidence that the abnormalities do not fall into sharp and easily differentiated classifications. In addition, to date only one phase of changes in the muscle component of the lesion[2,3] has been objectively studied.* However, certain generalizations, based on physical findings alone, can be made. One of the fairly common classifications is one which divides lesions into three groups, acute, subacute, and chronic. In gathering material for this paper the writer has reexamined his experiences with this classification in view. In reevaluating the palpable changes and the response to palpation pressure it seems that acute lesions feel as though moderate amounts of air had been injected into the tissues; they are characterized by a doughy, boggy texture, with considerable hyperesthesia evidenced, and by a decrease in ease and freedom of joint movement. Chronic lesions present an abnormal hardness and rigidity, a comparative absence of hyperesthesia, and a decrease in total motion rather than a loss of ease and freedom of movement. The subacute division seems to fall in between the acute and chronic. Actually it seems that long-standing subacute lesions, at different times, are first in one group and then in the other. Henceforth in this paper lesion areas will be referred to as acute, subacute, and chronic.

Significance of Soft Tissue Changes.- As has been stated, changes in the texture of the supporting tissues of joints are of great importance. This is because changes in the condition of these tissues are controlled not only by the state of the joints to which they are attached but by all the various motor elements in the vegetative and central nervous systems and because the latter have physiologic connections with, and are influenced by, both the external and internal environments of the organism.

From the practical standpoint this means that, in osteopathic diagnosis, the texture of the paravertebral tissues provides an index, not only of the joints themselves but of distant influences as well; that the presence of abnormal tissue texture must be evaluated in view of all factors which might account for it.

This is somewhat in contrast to earlier views held by many of us, which placed a major emphasis on positional and weight-bearing stresses. The latter continue to be significant, of course, but results of tissue study indicates that now they are at least equalled in importance by evaluation of the supporting tissues.

Lesion Patterns.- As we stated under classification, osteopathic lesions are not easily set apart into groups. However, there are certain types of conditions in which definite patterns may be identified.

Acute Infections, In all acute bacterial or virus invasions there are pathologic changes in the spinal tissues and, at times, also in those of the appendages. The changes are widespread and acute in character. The skin and superficial tissues seem tense-almost spongy, the muscles are hard and rigid and there is a generalized hyperesthesia. Beyond the palpation findings of osteopathic physicians there have been almost no objective studies of these changes.

While the fact that the skeletal components of acute infections can be decreased by osteopathic manipulative treatment is of great importance, it is of equal significance that the severity of the condition can be estimated by the time required for the tissue changes to recur after improvement under treatment. This makes possible more accurate estimates of the extent and intensity with which supplemental treatment programs must be instituted. Modern therapy, with the sulfa drugs, penicillin, oxygen, parenteral fluids etc., is complex and expensive, and the ability to judge when and to what extent these measures should be employed is of great importance.

Since the early days of osteopathy, when almost all chemical and biologic therapeutic agents were hazardous and of questionable value, great advances have been made in these fields. Now supplemental therapy is used in every osteopathic institution known to the writer. The task of the osteopathic profession is to determine, on the basis of the findings presented by each patient, when and to what degree, measures other than manipulative therapeutics should be employed. The point in including such a discussion in this paper is that the soft tissue changes which are being considered represent one of the most effective criteria which may be used to estimate the patient's progress and to determine what therapeutic program is indicated. This point is particularly apropos here in the state of New York which has recently joined the ranks of the states which do not limit the practice of osteopathy. Our task is to use the osteopathic examination, particularly the evaluation of soft tissue changes to determine what the indication is for specific osteopathic therapy and when and to what extent it should be supplemented.

A young osteopathic physician recently said that he used the sulfa drugs and penicillin for cases that responded well and only treated osteopathically those cases which didn't progress well on that management. Since the sulfa drugs are not without hazard and since a patient should not be made penicillin-fast except in extremely serious conditions it would seem that the young graduate's program should be reversed and that chemotherapy should be withheld until the persistence or rapid recurrence of lesion pathology indicates a bacterial invasion too great to permit its controls by the body's natural defense mechanisms.

Psychoneurosis.- In neurasthenia, psychasthenia and hysteria there are widespread acute and subacute changes in the paravertebral tissues which are out of all proportion to mechanical and weight-bearing imbalances. It would be foolish to attempt, at the present level of our knowledge, to establish lesion pathology alone as the etiological factor in these conditions since we see many patients with widespread effects of lesions who are not neurotics. At the same time, it would be equally foolish to ignore the objectively demonstrated causative factor of the lesion in analysis of these cases.

As a result of osteopathic manipulative treatment some patients show permanent improvement in tissue abnormalities (and in symptoms), some temporary, and some no improvement. The very demonstration, however, of recurring or persistent soft tissue changes indicates that there are actual etiological factors (despite their obscurity) and that these patients are not simply imagining their complaints.

As will be indicated in the next section, the observation of widespread subacute and chronic tissue changes, out of all proportion to any demonstrable mechanical difficulty, indicates the presence of factors which are constitutional and of long standing.

Thyrotoxicosis.- As might be expected in a disease which is characterized by a heightened irritability of the nervous system there are widespread acute and subacute lesion manifestations in the paravertebral and, at times, in the appendicular tissues. There is considerable hyperesthesia and reflex thresholds are greatly lowered. In this condition the decision of whether to employ conservative or surgical management is difficult to make except, of course, in those cases where the patient's general condition demands surgery as soon as proper preparatory measures can be taken. The decision concerning management is greatly facilitated by the careful evaluation of soft tissues following manipulative treatment plus supporting measures such as bed rest, high caloric diet, etc.

Three cases will illustrate this point. Two adult patients in their thirties had basal metabolic rates, at various tests, of between +30 and +40. Both had pulse rates which did not get below 110 at rest. Both had good nutrition despite small weight losses. In each the most pronounced lesion pathology involved the lower cervical and upper thoracic segments although the entire vertebral column was involved to some degree. They were placed at bed rest and given daily manipulative treatment designed to articulate, with slowly applied and released forces, the entire vertebral column. Within a few days there was symptom-

* Studies of skin resistance and temperature, and of the latter in deeper tissues, are planned at Kriksville College of Osteopathy and Surgery for the near future. Also tissue specimens from autopsies will be taken to contrast normal and lesion areas by histologic methods.

atic improvement and a decrease in the intensity of the lesion pathology. As improvement in the soft tissues occurred manipulative treatment was increased in extent and decreased in frequency. The gradual soft tissue improvement was the finding on which the extent of bed rest and the ultimate decision not to use surgical treatment was based. These patients were seen for occasional treatment after the basal metabolic and pulse rates returned to normal.

The third case was one in which the patient would not stop work until, despite great determination, he simply could not push himself through a day's work. Clinical findings were exophthalmos, rapid pulse, loss of weight, tremor, ravenous appetite, insomnia, and profound exhaustion. (Exact data on pulse, the basal metabolic rate, etc., are not available but the patient is a physician and there is no question as to the diagnosis of advanced thyrotoxicosis.) He also had a deep and intense ache centering in the region of the angles of the second and third ribs on the left side. This ache was in direct proportion to fatigue and to the rapid pulse, being great when the latter factors were marked. A thyroidectomy was performed and an excellent clinical result secured with the patient returning to his former robust state. About 5 years after the throidectomy) my three of his symptoms began to return (without the basal metabolic rate going above +14). They were the ache at the second and third ribs, the insomnia, and the tachycardia in a mild form. The writer saw the patient at this time. There was an almost complete absence of lesion pathology except in the upper thoracic vertebral and rib joints on the left side. In these areas, however, there was marked acute lesion pathology. Osteopathic manipulative therapy was followed by marked alleviation of the soft tissue abnormality and complete elimination of symptoms. The patient was seen periodically by the writer for a 6-year period during which time there were probably twenty such flare-ups. The relationship of tissue change to symptoms was the same in each one.

Focal *Infection.-* Although the mechanism which accounts for it is obscure, focal infection, particularly (in the writer's experience) when it involves the teeth, is associated with widespread changes in soft tissues. This change is characterized by the fact that osteopathic manipulative treatment has little or, at best, temporary effect on the symptoms about which the patient complains or on the palpatory findings in the paravertebral tissues. Since focal infection (such as alveolar abscesses which are not demonstrated by x-ray) may escape direct detection, persistence of soft tissue changes is strong supporting evidence that regions in which the normality of tissues is questionable should be definitely included in any plan for therapy.

Other Constitutional States.- There are a number of diseases, with widespread effects, such as the malignancies, cardiorenal disease, chronic pulmonary disease, menopausal syndromes, various types of arthritis, diabetes, etc., which reflect certain changes in the paravertebral tissues. However, they are not sufficiently distinct, or well enough understood, at least by the writer, to warrant discussion at this time.

Localized Lesion Pathology.- At the outset of this section it must be recognized that human beings, from "teen agers" on up, who are completely free from at least minor lesions are as rare as those who are free from dental caries. This observation is paralleled by the studies reported at the White House Child Health Conference of 1931,[4] where, with methods which completely missed all weight-bearing stresses except those sufficiently gross to be reflected in body contours, poor body mechanics was noted in over 80 percent of the children and young adults examined.

Fortunately, the adaptive and protective mechanisms, which are fundamental biological traits, permit normal function despite a certain amount of pathologic influence. This statement has great significance in the evaluation of the paravertebral tissues since it permits an understanding of the reason for certain clinical observations. They are: (a) That lesions exist without causing clinical abnormality; (b) that when lesion pathology exceeds the limits of adaptation, it is not necessary to return the joint to an absolute normal, but merely to return it to within those limits ;** (c) in a given case, the location and alleviation of the essential etiological factor will be adequate to secure a satisfactory clinical result even though a certain degree of lesion persists.

The Etiology of Localized Pathology.- Localized lesion pathology is invariably found in connection with a segmentally related etiological factor which may or may not coexist with some distant abnormalities. This is a point of great importance because often the distant factor is so obvious that it is considered to be the basic cause of a given condition by the patient and, too frequently, by the physician as well. This point will be illustrated.

The first case is one in which the patient "self-diagnosed" her problem, a disabling facial neuralgia, as being due to a disturbance in her neck and jaw. One osteopathic physician relieved the neuralgia to a minor degree by manipulative treatment. She went to a second D.O. who, in addition to finding cervical and temporomandibular pathology discovered that the woman's home life was, at times, intolerable, and that her severe attacks of neuralgia coincided with flareups in her home environment. His counsel aided in eliminating her difficulties at home and this, together with attention to the skeletal lesions, secured a satisfactory clinical result. The environmental distress was embarrassing to the patient and she did not volunteer information about it in the history. It was discovered when the physician failed to secure an adequate degree of improvement in the tissue abnormality of the involved joints and consequently hunted out the other etiological factor.

A second case is that of a woman who complained of persistent pain in the upper right quadrant which radiated to the back. Her appendix and later her gallbladder were removed. Both operations provided temporary relief. The only positive findings at physical and osteopathic examination was an area of acute lesion pathology in the upper lumbar area on the right side. Typical of many patients she refused x-ray examination stating that she had already spent thousands of dollars on hospitalization,

** This paper deals with the practical and everyday use of osteopathic diagnosis in the treatment of sick patients. This requires a realization that the patients will not make the effort to attain perfect health, but simply want to recover from their present illness. The task of securing people who are relatively free from abnormal body mechanics is one which must be started in early childhood. This task represents work which we are obligated to do if we are to develop osteopathy to the maximum of its potential. However, this is a huge field in itself and cannot be explored in this paper.

examinations, operations, etc. Manipulative treatment was applied on a therapeutic test basis with the understanding that if it was not effective further studies would be made. Treatment was applied twice, both times without producing an alleviation in the soft tissue abnormality. X-rays were then taken and a small and ununited fracture of the anterosuperior edge of the body of the second lumbar vertebra was discovered. The patient was immobilized in a brace, which was removed twice weekly for careful stretching of the involved joints, and made an uneventful recovery.

A third case is one in which a male in his early thirties was incapacitated due to "numbness" and fatigue of his lower extremities and persistent lowback pain. He had been treated off and on by several different osteopathic physicians with temporary relief. Osteopathic examination revealed a very marked rotation of the pelvis but with no lateral curve in the lumbar area and with apparently, at physical examination, no leg length discrepancy (despite an atrophied lower left leg due to infantile paralysis in childhood). There was widespread subacute lesion pathology in the sacroiliac and gluteal regions. X-ray examination in the standing position revealed a deformity of the right hip joint and an anatomical shortness, on the left side, of 2 inches. Manipulative therapy was directed at eliminating the soft tissue changes and at derotating the pelvis. This treatment together with a gradual decrease in the leg length discrepancy with heels lifts produced a permanent improvement in the tissues of the pelvis and a complete relief of symptoms.

In each of these three cases there were two important etiological factors. In two of them an articular lesion, identified positively by local abnormalities in the texture of the tissues, coexisted with a distant abnormality. In each of the latter the effect of manipulative therapy was temporary due to the failure to eliminate all the articular pathology and to the persistence and severity of the distant etiological factor. The obvious conclusions to be drawn from these observations are: (a) That such articular disturbances are of sufficient standing to require considerable therapy; (b) that the improvement is gradual and not the result of a complete elimination or "correction" of the pathological findings at each treatment, with arecurrence after each treatment; and (c) that the lesion apparently exerts a localizing effect in cases where there is a pathologic influence affecting the whole organism. In the latter two cases this is quite apparent. The importance of psychic trauma and of a major weight-bearing abnormality is obviously great and significant of the fact that local lesion changes coincident with the patient's symptoms must be recognized.

Progress of Tissue Changes.- We have demonstrated in the laboratory[2,3] that such almost insignificant procedures as lightly tapping a patient on his shoulder may reduce the spinal cord irritability to a great degree in a fraction of a second and that flatulence from an excessively large meal causes reflex muscle contraction which is promptly relieved by a substantial decrease in the size of the gastric air bubble. Consequently, it is obvious that tissue abnormalities may change, in extent and degree, at a very rapid rate. These facts indicate that the treatment of such joint changes must be subject to constant and instantaneous control. From the standpoint of osteopathic technic this means: (a) That a structure under treatment must be re-evaluated by palpation every few moments to determine the effectiveness of the forces being applied, and (b) that the use of routine manipulation without an understanding of the functional and organic pathologies involved is not only of questionable value but may result in actual harm to the patient.

SUMMARY

1. Analysis of the soft tissue coverings and supports of joints is an important factor in osteopathic diagnosis.
2. Location, extent and severity of soft tissue abnormalities may be identified by palpation.
3. Soft tissue changes in an area of lesion reflect the level of irritability of certain spinal reflex arcs.
4. Soft tissue pathology reflects the influence not only of the joint to which the tissue is attached but of distant organs and tissues as well.
5. Improvement or regression in the patient's clinical condition frequently may be predicted by an analysis of the texture of the tissues overlying and supporting the joints.
6. Manipulative treatment should be controlled by a constant evaluation of the texture of the tissues being treated.

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The Supporting Tissues in Normal and Abnormal Joints*,**

A Preliminary Report

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A long range program to gain factual evidence concerning the incidence, characteristics, and relationships of the osteopathic lesion has been started. The program is being conducted in cooperation with the Student-Health Service of the Kirksville College of Osteopathy and Surgery and includes examinations of each member of the class which matriculated in the College in the fall of 1948. The examinations are as follows: History and Physical Examination by Max Gutensohn, Director of the Student Health Service; x-ray studies of the pelvis and the lumbar and thoracic vertebrae by George Rea, Head of the Department of Roentgenology of the College; certain tests of the activity of the vegetative nervous system by I. M. Korr, Head of the Department of Physiology; and an analysis (by palpation) of the texture of the soft tissue covering and supporting pelvic, vertebral and costal joints by Jean Pearson, Research Associate, and J. S. Denslow, Professor of Osteopathic Technic in the College.***

This paper is a preliminary report of the findings of the examination of the soft tissues of the first group of students to be examined.

METHOD

The investigators recognized at the outset of the study that although the detection and evaluation of osteopathic lesion pathology by palpation is at the very core of osteopathic theory and practice a universally acceptable method of analyzing and classifying lesions has not emerged from the work of the profession. There appears to be an important reason why this is true. It is that the complexities of skeletal tissues and their mechanical, neurological, and vascular relations to other tissues and systems are so great that they have defied rigid classification. This was aptly described last year by R. C. McCaughan[1] when he stated,

> The structures of the various parts of the body are so constituted that every part-every part-is directly or indirectly structurally related to every other part and the relation which, while it may be comparatively remote and minimal between some of the parts, is nevertheless in every instance of some degree of importance. The various parts supplement each other as part of the whole. The body can function without some of those parts but it cannot function normally without all of them. The functioning of the body is planned for a coordinating activity of all these parts. If the structure of these parts is normal, the resulting activities of these parts constitute functional or physiologic activity. If the structure is abnormal, the whole body is to some degree unable to act in a physiologic manner.

There are so many possibilities and combinations of abnormality that it is impossible, with the facts now available, to do more than seek additional information and to expect that as facts accumulate, additional correlations and groupings will emerge naturally. Hence, it was decided to limit this study to one phase of the examination that is made by palpation.

An analysis of the supporting and covering tissues was selected because (1) such an analysis is widely used by osteopathic physicians to determine the presence and degree of lesion pathology, (2) a correlation between certain tissue texture abnormalities and the irritability level of parts of the spinal reflex arc have been demonstrated, and (3) it appears that two physicians can establish a common understanding and recognition of tissue states more easily and with greater uniformity than is possible in making similar determinations of joint mobility and position.

Previous work was reviewed and it was decided to evaluate tissues on the basis of the texture characteristic of various levels of spinal cord irritability with the following arbitrary classifications:

1. High reflex threshold-Normal texture
2. Slight lowering of threshold-Slight texture abnormality
3. Moderate lowering of threshold-Moderate texture abnormality
4. Marked lowering of threshold-Marked texture abnormality
5. Severe lowering of threshold-Severe texture abnormality.

To compensate, at least in part, for the subjective nature of examination by palpation, which involves interpretation and judgment, it was decided to have two physicians examine each subject and record their findings independently.

A uniform examination procedure was adopted. The cervical area was examined with the patient supine and the tissues across the posterior portion of the neck from the lower part of the skull to the seventh cervical evaluated. The area from the first to the third thoracic vertebrae and related ribs to the vertebral border of the scapulae were examined with the patient sitting. The balance of the thoracic spine, the lumbar segments, the sacrum, sacroiliac joints, and the posterior portions of the gluteal masses were examined with the patient prone. The two physicians worked in different rooms and each made a chart, with colored pencils, of his opinions. When each physician had completed his

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*Presented at the General Sessions, Fifty-Third Annual Convention of the American Osteopathic Association, St. Louis, July 12, 1949.

**This study has received financial support from the Research Fund of the American Osteopathic Association.

***A full report of findings will be given by this group at a later date.

examination the charts were compared, points of difference discussed, and the patient re-examined.

RESULTS

Comparison of Findings.-- Although an entirely satisfactory method of comparing the findings has not been developed, it was found that the observations of the two examiners coincided to a remarkably high degree.

It was planned, originally, to compare the findings of the two examiners on a segmental basis, i.e., the right and left sides of each spinal, rib, and sacroiliac joint. This proved to be impractical for a very simple reason, one with which every osteopathic physician is familiar. It is that soft tissue abnormality may be much more evident in one part of a joint than in others or it often does not have precise segmental distribution. After considering a number of possibilities it was decided to use a grid, with numbered squares drawn on transparent paper which might be superimposed on each chart. By this means a determination could be made of the tissue texture at each part of the grid on each patient. The limitation of this device is that often a given square may contain more than one degree of texture abnormality. However, even with this limitation it was found that there was a high degree of correlation between the findings of each examiner. It was considered, that where the findings of the examiners were within one grade at a given location they were in essential agreement for that location. In 4 cases the examiners were in agreement more than 95 per cent, in 9 cases between 90 and 94 per cent, in 5 cases between 85 and 89 per cent, in 2 cases between 80 and 84 per cent, and in 3 cases between 50 and 79 per cent. In 20 of the 23 cases there was essential agreement in at least 80 per cent of the areas examined. It is expected that as further work is done additional refinements in method will be developed.

Incidence of Lesion Pathology.- As might have been predicted, for reasons which will be discussed later, there was some degree of tissue texture abnormality in every case that was examined. This ranged from a comparatively small amount of abnormality as seen in certain cases to major amounts in others. Both examiners were in essential agreement on the incidence and location of (1) areas showing no tissue abnormality which are predominately in the lumbodorsal area and (2) the areas showing marked abnormality which are fairly small and evenly distributed except at the lumbosacral area where they are, comparatively, quite numerous.

There is a considerable discrepancy between the two opinions of areas showing slight and moderate abnormality but if these two grades are considered together the agreement is good. In such an analysis it is found that the upper cervical region, in the opinion of both examiners, showed abnormality of these grades in a high percentage of the cases examined. This is true to almost the same degree in the upper thoracic areas. In contrast the lumbodorsal junction shows the least number of these grades. The lumbosacral region shows about the same number of these grades as does the lumbodorsal area but in the lumbosacral area the incidence of marked disturbance is much greater, bringing the total incidence to a high figure.

These observations may be recapitulated by stating: (1) the cervical and upper dorsal areas show the highest incidence of abnormality with most of it being slight or moderate, (2) the lumbodorsal area shows the smallest incidence of total abnormality with a preponderance being of the moderate grade, and (3) the lumbosacral area shows a high incidence of abnormal with the highest incidence being in the moderate and marked grades.

Relation of Soft Tissues to Other Systems.-- Sufficient work to justify conclusions concerning the relationship between history and physical examination, x-ray findings, physiological tests, and soft tissue states has not been completed. However, it has already become apparent that the "structure-function relationship" with which this study is concerned is extremely complex. Three cases will be cited.

Case 28. Male, aged 23. Both examiners found widespread abnormality in the texture of the tissues which was particularly marked at the lumbar and lumbosacral areas.

The anterior posterior standing pelvis x-ray revealed a severe weight-bearing stress which is associated with a discrepancy in the heights of the two femur heads.

The history indicates that at the present time the patient is essentially free from complaints except for occasional headaches which are associated with an "upset stomach."

The studies of the activity of the vegetative nervous system as measured by sweat gland activity indicate a small imbalance of the vegetative system except for a small area at the cervicothoracic junction where irritation is marked.

Case 39. Male, aged 28. In this case there was the least amount of tissue texture abnormality of any of the cases in the series. Both examiners found moderate or severe pathology in the upper cervical region and moderate pathology at the mid thoracic region; one examiner found moderate irritation in a small area at the lumbothoracic junction.

The lateral standing pelvis x-ray revealed a severely hyperextended lumbosacral junction.

The history in this case, with the exception of an operation for bilateral cervical ribs to eliminate a progressive atrophy of both thenar eminences, is entirely negative. The patient stated that he had never experienced a sick day in his life and except for the atrophy of his hands had never visited a physician. Close questioning concerning the cervical rib disturbance revealed that the patient did not experience the extreme pain which usually accompanies this disturbance.

The study of the activity of the vegetative nervous system revealed an extremely marked irritation involving the entire lumbar region and the skin overlying the right sacroiliac joint. There was moderate activity throughout the lower thoracic region on the right side and across the neck at the level of the second to the seventh cervical segments.

Case 41. Male, aged 24. This case had marked and widespread abnormalities in the texture of the tissues. The most severe areas being at the lumbosacral junction, the mid thoracic region, and the upper cervical region.

The anteroposterior x-ray report states: "No apparent short leg mechanism noted. The lumbar spine is straight, no rotation. The lumbosacral facets are stable. The weight bearing angle is good. Dorsal: No apparent scoliosis or rotation."

The history indicates that the patient is essentially free from complaints.

Studies of the activity of the vegetative nervous system as measured by sweat gland activity indicate a small imbalance of the vegetative nervous system which is localized to the right side of the mid lumbar region.

Relation of Tissue Texture to Pain Threshold.- There was a marked and unmistakable correlation between the texture of the soft tissues and the reflex and the pain thresholds. Without exception, digital pressure over an area considered to have marked tissue texture abnormality produced considerable pain and an attempt at withdrawal from the pressure. The opposite was true in areas of normal tissue texture where much greater pressures elicited neither pain nor a withdrawal response. However, in most instances, the patient was not aware of the hyperesthetic areas prior to the examination.

CONCLUSION

From the data it is apparent that:

1. Each case in the series examined had some degree of tissue texture abnormality.

2. In a substantial number of the cases the tissue texture abnormality was "subclinical."

3. There was a similar correlation between tissue texture and pain and reflex threshold previously reported.[2]

4. The greatest incidence of tissue texture abnormality was in the cervical and upper thoracic areas although the most marked changes were at the lumbosacral regions.

5. Given types of weight bearing characteristics do not have a similar degree of spinal reflex arc irritability in different patients.

6. Two physicians, examining the same patient independently, recorded findings that were in essential agreement.

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Pathophysiologic evidence for the osteopathic lesion: The known, unknown, and controversial

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"Osteopathic lesion" is a generic term which requires clarification. This term, of obscure origin, has been used for many years. Apparently it came into usage to represent a palpatory experience shared by those who worked with it. Manipulative therapy often has proved beneficial to patients with osteopathic lesions.

"Somatic dysfunction" recently has been offered as a substitute term for osteopathic lesion for use in the Hospital International Classification of Disease, Adapted (H-ICDA). This term is defined as "impaired or altered function of related components of the somatic (body framework) system: musculoskeletal, arthrodial, and myofascial structures, and related vascular, lymphatic, and neural elements."[1]

There is persuasive evidence that the osteopathic lesion is similar to, or possibly identical with, such disturbances as trigger points in the body wall and upper extremities in myocardial disease, splinting and tension of the abdominal wall, flank and paravertebral tissues in intraabdominal disease, the muscular aches and pains accompanying systemic infections such as influenza, et cetera.

Despite the fact that osteopathic lesions have been diagnosed and treated by thousands of health professionals and that millions of patients have benefited from such diagnosis and treatment, the proof that such disturbances exist and can be managed effectively continues on a subjective basis for both the health professional and the patient. However, it is clear and generally acknowledged that much of contemporary therapeutics is judged efficacious on subjective evidence alone.

A few examples of data on what is known, what is not known, and what is controversial regarding the osteopathic lesion will provide background for a much broader review of the subject.

Clinical evidence for osteopathic lesion

The clinical evidence for existence of the osteopathic lesion, which leads to a discussion of the pathophysiologic evidence, usually is obtained by methods of physical examination, including inspection and palpation, supplemented at times with procedures such as x-rays, electromyography, and thermography. This clinical evidence includes hyperalgesia (with or without pain); abnormality in the texture or tone of soft tissues; anatomic asymmetry*; and disturbance in range and ease of joint motion.

Hyperalgesia is identified clinically by the presence of tenderness to digital palpation in the area of the osteopathic lesion, in contrast to the absence of tenderness in response to similar palpation in a normal area.

Abnormality in the texture or tone of soft tissues is identified by light to moderate digital palpation. The area of the osteopathic lesion may be described as boggy, with thickened non-muscle tissue and rigid muscle. It can be identified by palpation methods similar to those described by Maigne[2] to identify disturbances in tissue texture and in the ease and range of joint motion.

Hyperalgesia and abnormal tissue texture will be discussed together. Hyperalgesia and abnormal tissue texture probably involve all nonosseous tissues, including the skin and the periosteum, and various tissues between, namely, muscle, fat, various collagenous tissues (for example, cartilage, fascia, ligaments, and tendons), and the vascular, neural, and lymphatic networks that are embedded in all of these tissues. The heterogeneity of these tissues is probably the most important single factor accounting for the current lack of objective diagnostic methods for differentiating normal from abnormal somatic tissues (in the way that the electrocardiogram does for cardiac muscle, the x-ray for bone, and the electroencephalogram for the brain). Hence, while normal and abnormal somatic tissues can be differentiated by physical examination, the precise nature of the abnormality still is unknown.

Hyperalgesia and abnormal tissue texture are of overriding importance as characteristics of the osteopathic lesion. They represent a disturbance in local homeostasis that might be attributed to pathophysiology within these tissues resulting perhaps from trauma, or to changes induced by visceral, emotional, and other disturbances via the controlling and communicating systems (for example, the neural, vascular, lymphatic, and hormonal) which govern, sustain, and determine the state of the somatic tissues involved.

The presence of hyperalgesia and abnormal tissue texture provide direct information concerning the location and severity of the osteopathic lesion. The cause of this disturbance must be determined from the history and other diagnostic procedures.

Anatomic asymmetry and range and ease of joint motion also will be considered together. Kendall and associates[3] have pointed out that in the human erect stance, ideally the center of gravity in the sagittal plane bisects the trunk, including the pelvis and the vertebrae. Thus, there would be a symmetrical distribution of body weight, one-half on one side and one-half on

*It is recognized, of course, as Maigne[2] has pointed out, that misshapen bony prominences and the remote location of such prominences must raise questions as to the validity of palpation in determining the presence or absence of segmental asymmetry.

the other side of the center line of gravity. In the coronal plane, the anatomic curves would not permit a true bisection but would provide for symmetry, with half the body weight anterior to and half posterior to the center line of gravity. Balance in the upright position would depend heavily on weight distribution with a minimum of stress, and subsequent wear and tear, on articulating processes and on nonosseous supporting tissues.

Similarly, where there is symmetry in the sagittal plane, and normal anatomic curves in the coronal plane, normalcy in both the ease and range of joint motion would be expected. Conversely, asymmetry in the sagittal plane, and/or a diminution or exaggeration of the anatomic curves in the coronal plane would produce abnormal stresses and strains on the cushioning and supporting tissues, and problems regarding the ease and range of joint motion.

Asymmetry in alignment and ranges of joint motion are detected by inspection and palpation, supplemented at times with radiography, particularly when done in the weight-bearing position. Methods for taking and interpreting such films have been described[4]

The discussion of pathophysiologic evidence will start with our own work. It had been postulated that the abnormal tissue texture in the osteopathic lesion was caused, at least in part, by muscle contraction. Following the early work of Adrian and Bronk[5] using electromyography to identify the single motor unit, and the work of Jacobson[6] showing that resting skeletal muscle is electrically silent, it was reasoned that, in normal areas, resting muscle would be relaxed and no muscle action potentials would be seen. Conversely, in areas of osteopathic lesions the finding of action potentials would show the presence of muscle contraction. The early work did bear out this hypothesis, and the first publication concerning this work reported no muscle contraction in normal areas (as identified by palpation) and the presence of muscle contraction in many areas of osteopathic lesions (also identified by palpation).'

However, following further experience with these methods and additional studies by other researchers, it was recognized that if sufficient care was used in bolstering the subject with pillows and sandbags, the electromyographic evidence of muscle contraction in some of the abnormal areas disappeared" In other words, undercertain conditions, palpable abnormal tissuetexture could not be caused by muscle contraction.

However, another differentiating characteristic between normal areas and areas of the osteopathic lesion was found. In normal areas the irritation produced by placing needle electrodes through fascia and into muscle frequently results in a burst of action potentials called insertion potentials. This burst lasts for a brief period and subsides spontaneously; minor movements of the electrodes do not reinitiate it, and the muscle remains electrically silent. In contrast, in areas of osteopathic lesions, the insertion potentials persisted for longer periods of time; and, when they did subside, they could be reinitiated by minor electrode movement. Further studies revealed that a wide variety of stimuli, whether applied to the area of the osteopathic lesion or remotely, would initiate action potentials in that area, unlike the normal area.

This observation suggested that the motoneurons supplying the areas of the osteopathic lesion were in a state of enduring subliminal excitation, as was confirmed by the low reflex thresholds demonstrated in such areas.[9]

Later, methods were developed to quantitate levels of reflex activity and to correlate reflex thresholds with various other segmental phenomena.[10] Briefly, the following was found:

Normal areas (by palpation)	*Areas of osteopathic lesion (by palpation)*
High reflex threshold	Low reflex threshold (facilitation)
Paravertebral tissues	Paravertebral tissues
Normal texture	Abnormal texture
No hyperalgesia	Hyperalgesia
No lasting soreness following minor trauma	Lasting soreness following minor trauma

Probably the most important points to be made here are that there is a direct correlation between the palpable tissue texture abnormality in the osteopathic lesion and a state of chronic facilitation in the motoneuron pools in the spinal cord that are segmentally related to the osteopathic lesion, and, since the abnormal tissue texture may not be caused by muscle contraction, some other phenomena must be sought to account for it.

The correlation between palpable tissue texture abnormality and other disturbances is comparable to a similar correlation made by Brendstrup and associates." These investigators examined patients prior to surgery for herniated intervertebral discs. Normal areas and areas of fibrositis were identified by palpation. At the time of surgery, tissues from normal and fibrositic areas were taken for microscopic examination and chemical analyses. Although the series of cases was small (12), the findings from the control areas were normal; in contrast, there were positive findings in 10 of the 12 specimens from fibrositic areas. The positive findings included a decrease in potassium and an increase in chloride and hexosamine content, the latter indicated by an excess of acid mucopolysaccharides. Microscopic examination of the fibrositic tissues showed a widening of the interstices, indicating edema, an increased number of mast cells in the connective tissue, and an increased number of nuclei in muscle fibers.

As regards fibrositis, in discussing pain thresholds, Procacci and coworkers[12] commented, "In the pathological field: in subjects with fibrositis of the upper limb the cutaneous pain threshold is significantly lower in the limb itself ...."

Another possibility that might account for abnormal tissue texture which is not caused by muscle contraction involves the observation that patients suffering from migraine (and so-called "tension") headaches show evidence of osteopathic lesions at the atlanto-occipital and upper cervical areas; the osteopathic lesion is severe during acute episodes and less severe during interim periods.

In discussing vascular permeability and vasoactive substances and theirrelationship to migraine, Dalessio[13] suggested ". . . that migraine is a clinical syndrome of selflimited neurogenic inflammation." He points out:

. . . present evidence implicates at least five groups of vasoactive substances associated with inflammation: (a) catecholamines, (b) other bioactive amines (histamine and serotonin), (c) the peptide kinins, (d) the prostaglandins, which are fatty acids, and (e) SRS-A, an acidic lipid. These vasoactive substances all have potent biologic properties which differ with their structure and include, among others, contraction or relaxation of smooth muscle, constriction or dilation of arteries and veins, induction of water and sodium diuresis, fever, wheal and flare reactions, and induction of pain, including headaches.

It seems possible, even probable, that this inflammatory process might account for the abnormal tissue texture that is seen in the absence of muscle contraction. The selflimited neurogenic inflammation very well could be involved in clinical syndromes other than migraine headache, including osteopathic lesions.

Still another possibility that might account for abnormal tissue texture in the absence of muscle contraction involves the trophic functions of the neuron.[14] Regarding muscle, it is known that maintenance of axonal and junctional integrity between neuron and muscle cell is essential for "normal" trophicity. Axoplasmic flow, rather than impulse traffic, clearly is implicated in a variety of neurotrophic influences, such as those operating in morphogenesis, regeneration, control of genic expression, and the maintenance of structural, functional, and biochemical integrity of the innervated tissue.[15]

Chamberlain and coworkers[16] have shown that ". . . a postural asymmetry in the hind limbs, induced by a unilateral cerebeller or vestibular lesion, will persist after midthoracic spinal cord transection, providing sufficient time is allowed for this asymmetry to 'fixate' in the cord before transection." Patterson" has discussed mechanisms involved in conditioning and in the fixation of functional patterns in spinal mammals. Surely such patterns of functional activity have some bearing on integrity, or lack of it, of the axonal transport mechanisms.

Related to the demonstration of facilitation in motoneuron pools of the voluntary side of the nervous system, Korr[18] has shown that similar phenomena occur in the sympathetic system. He studied regional and segmental variations of sympathetic activity by determining sudomotor and vasomotor activity. He found that in certain spinal cord segments

. . . at least some of the neurons mediating sensory, motor, and autonomic function are maintained in a state of hyperexcitability, which they manifest in their easier, augmented, and prolonged responses to impulses reaching them from many sources. They are therefore susceptible to sustained and exaggerated activity under conditions of daily life. These segmental disturbances appear to be physiologic lesions related, by nature and location, to the clinical phenomena designated as osteopathic lesions.

This will be discussed further in connection with experimentally produced neuromusculoskeletal disturbances.

Over the years there have been a substantial number of reports of disturbances, or syndromes, in which somatic and visceral problems concur. The somatic problems, often show strong resemblance to osteopathic lesions. Hence, these disturbances should be discussed as part of the pathophysiologic evidence for existence of the osteopathic lesion. A few of these reports will be cited as examples. Ruch and co-workers[19] comment:

Sustained contractions of skeletal muscle likely to cause pain may arise from higher centers or from reflexes of somatic or visceral afferents. Such reflexes are important (i) as diagnostic signs (Kernig's sign, stiff neck of meningeal irritation, abdominal rigidity of appendicitis), and (ii) as secondary sources of pain and discomfort.

They comment further:

The muscle contraction may be due to a vicious circle: deep pain-sustained reflex contraction-deep pain-reflex contraction-&c. The success of such single procedures as osteopathic treatments, ethyl chloride sprays and procaine hydrochloride injection of trigger zones may depend on the breaking of the circle.

It is well known by those who have studied the neuromusculoskeletal system carefully in patients with acute infectious diseases, for example, various types of pneumonia, that osteopathic lesions are present in the spinal area that is segmentally related to the affected organ or viscus; for example, there is hyperalgesia, abnormality in tissue texture, and limitations in the ease of joint motion. In addition to relieving the hyperalgesia, tissue texture abnormality, and joint movement restrictions, spinal manipulation often has been followed by concurrent improvement in the remote infection.

Speranski and associates[20] carried out well-controlled experiments in patients with pneumonia by reducing the related abnormality in the neuromusculoskeletal system with a different form of therapy (somatic blockade by local anesthesia). Following a long series of studies on experimental animals, they suggested that treatment of pneumonia in man be directed at the cord segments involved. In patients suffering from lobar pneumonia, they injected the rhomboid area with procaine. They observed that this treatment, when given early, usually is followed by a drop in body temperature, resolution of the pneumonic consolidation, and improvement in the patient's general condition. One might speculate that the muscular disturbance was the result of spinal cord hyperirritability initiated and sustained by afferents from the affected viscera, and that when the feedback from the rigid musculature was moderated, the patient's ability to combat the original infection was improved, presumably by a breaking of the positive feedback circle suggested by Ruch and co-workers." Speranski suggests, "The rationale of this treatment is based on the presumed changes in the lung following restoration of normal nerve function."[20]

Many years ago, MacKenzie[21] called attention to a relationship between cardiac disease and somatic tissues via what he termed an "irritable focus" in the spinal cord. Since then numerous reports concerning this relationship have been published. Lindgren[22] studied patients with angina pectoris and other cardiac problems by inducing precordial pain with hypoxemia or exercise. She mapped the areas of referred pain and infiltrated them with local anesthetic. It was observed that this procedure lessened both the pain and the accompanying electrocardiographic abnormalities.

Rinzler and Travell[23] used somatic blockade in the management of angina pectoris, related cardiac problems, and hyperalgesia in the chest wall; the latter may simulate cardiac problems, but may be caused by somatic factors. They studied cardiac and somatic chest pain through the presence of what they called a trigger mechanism in the somatic structures. The trigger area is an abnormal zone of hypersensitivity, which, when stimulated by digital pressure or needling, gives rise to a brief reference pattern of pain. They suggested that the essential part of the examination for trigger areas was the discovery, by careful palpation, of topographically discrete areas of exquisite somatic tenderness. At times the spot of hyperalgesia was so acute that when it was palpated a motor response followed, such as wincing or withdrawal. The trigger area was treated by infiltration of procaine or by spraying the overlying skin with ethyl chloride, with the result that in a large majority of cases the pain and disability occasioned by the disease were eliminated or greatly lessened.

In their monograph on pain syndromes Judovich and Bates[24] direct attention to the large number of patients who suffer pain and disability because of unrecognized disturbances in the somatic system. They comment:

... segmental pain and tenderness may simulate the pain of visceral disease, and many patients who have submitted to medical treatment for visceral disease are not relieved of pain until treatment is directed to the somatic origin of pain and its cause.

The diagnostic methods they describe have much in common with the diagnostic methods used in the search for, and evaluation of, osteopathic lesions. They place considerable stress on structural asymmetry and imbalance (and related soft tissue stresses and strains) that are caused by an inequality of leg length and are responsive to the appropriate use of a heel lift. For example, they state:

A slight shortening of one lower extremity will produce a lateral tilt of the pelvis. The lumbar spine swings to the short side and develops a compensatory scoliosis with strain at the dorsolumbar spine. This may be mild and is many times ignored, yet we have observed and corrected these mild postural changes by using a heel lift, and have often seen chronic pain disappear without using any other form of therapy.

Siehl and coworkers[25] studied a series of patients who had sciatic pain. All of these patients had lumbar and lumbosacral osteopathic lesions and were suspected of having a herniated intervertebral disc. All were studied with electromyography for evidence of nerve root pressure. All received spinal manipulation. Subsequently, it was found that a high percentage of patients with normal electromyograms responded favorably to manipulation, while those with positive electromyographic evidence of nerve root pressure did not respond favorably, and required surgical intervention.

Another aspect of pathophysiologic evidence of osteopathic lesions is seen in disturbances that have been produced experimentally. Lewis and Kellgren[26] point out that stimulation of an interspinous ligament produces segmentally related pain, superficial and deep hyperalgesia, and muscle contraction; stimulating appropriate somatic structures produces pain similar to that of angina of effort or intestinal colic; stimulating either spinal muscles or a viscus, such as the pancreas, produces contraction of the muscles of the abdominal wall; and visceral disease and the stimulation of deep somatic structures both produce segmentally related cutaneous hyperalgesia.

Korr, Wright, and Thomas[27] also clearly demonstrated that certain characteristics of osteopathic lesions can be produced experimentally. These investigators irritated musculoskeletal tissues by hypertonic saline injections and produced postural stresses by the use of heel lifts and tilt chairs. They found that when saline injection produced referred pain, there was the appearance of segmentally related areas of lowered electrical skin resistance, and that experimentally induced postural changes produced both an exaggeration of existing patterns and additional areas of lowered electrical skin resistance. They concluded that their observations suggest a relationship between patterned differences in sympathetic activity, as shown by lowered electrical skin resistance, and painful myofascial and visceral conditions.

Unknowns and the osteopathic lesion

Identification of what is not known regarding pathophysiologic evidence of the osteopathic lesion represents a very extensive work in itself. However, three of the most critical areas will be identified.

Objective evidence

Objective evidence concerning such things as the etiology, type (acute or chronic), location, severity, et cetera, of the osteopathic lesion is almost totally lacking. At this point it is appropriate to recognize that the heterogeneity of the tissues involved, skin, muscle, fat, many kinds of collagens, and the vascular, neural, lymphatic, hormonal systems that are embedded in the tissues make objective determinations extraordinarily difficult.

Interrelation of reflexes

It is known that there are such phenomena as somatic and visceral reflexes and reflexes initiated by impulses from the higher centers. It is also generally accepted that there are combinations of these, which are involved in psychosomatic, viscerosomatic, and somaticovisceral problems. But how these reflexes interrelate in matters of health and disease is not known. For example, a patient might be ill from a disturbance involving a psychosomatic reflex.

Currently it is not known how to evaluate either the higher center or the somatic element; hence, it is impossible to determine on the basis of objective evidence which, in any given case, should receive major attention, or if both should be addressed simultaneously.

It is not known whether one disturbance precedes the other, or, if two or more occur as primary pathophysiologic disturbances, what influence each exerts on the other, if any. This is not to say that the experienced clinician with competence in the evaluation of psychiatric and somatic problems, for example, cannot successfully treat patients who present such a combination of problems; he certainly can do so, on an empirical basis. However, objective evidence to support his empirical obserations is not available.

Assessment of therapy

Finally, it is not known how to assess objectively the usefulness and effectiveness of therapy, particularly manipulative therapy, directed at the osteopathic lesion.

Controversy and the osteopathic lesion

There are two major and one minor controversial issues regarding the osteopathic lesion. First, there is the question of whether the osteopathic lesion contributes to pathophysiologic disturbances in organs and systems outside of the somatic system itself. Strong evidence has been presented above that a pathophysiologic disturbance in the neuromusculoskeletal system (osteopathic lesion) at least contributes to the total clinical picture that the patient presents. Since emotional, visceral, and other disturbances generally are acknowledged to cause certain somatic disturbances, it is reasonable to assume that the reverse might also occur (for example, that somatic disturbances might have comparable deleterious influences on higher center, visceral, and other functions). The fact that the latter possibility is ignored almost totally in texts and treatises on medicine and surgery has given rise to major controversy. It might be said here that it is the lack of appropriate research, particularly involving experimental animal research, rather than negative results of research, that has given rise to this controversy.

Second, controversy exists as to whether or not the manipulative and other management of the osteopathic lesion contributes to the amelioration or elimination of emotional, visceral, and other disturbances. Here again, this controversy is not caused by negative observations from carefully controlled studies, but rather by a lack of appropriate research.

A third controversy of lesser significance, particularly among health professionals who use, and are skilled in, manipulation involves the breaking of the synovial seal in arthrodial joints, which sometimes occurs in the course of manipulation. This procedure frequently is accompanied by a noise often referred to as a "pop" or a "snap." Roston and Haines[28] and later Unsworth and coworkers[29] showed conclusively that the breaking of the joint seal permits an increase in motion, particularly motion not under voluntary control, reportedly for a period of 15-20 minutes. Some hold that this is an unimportant phenomenon and is not involved in the beneficial effects of properly applied joint manipulation. On the basis of personal experiences with attacks of low-back pain, Livingston[30] disagrees:

> An unsuccessful manipulation of the back seems to aggravate the pain, but a successful one causes a snap that may be audible. When this occurs, there is an immediate sense of relief, even though much of the pain and the muscle spasm are still present. The residual muscle stiffness and soreness gradually disappear once the underlying source of irritation has been corrected, and within three or four days I am back playing badminton without the slightest back disability.

This author, like many of his colleagues, agrees with Livingston, since in many situations breaking the joint seal in the course of manipulation of the osteopathic lesion is followed by an immediate sense of relief on the part of the patient, an immediate reduction in the palpable abnormality in the texture of the tissue, and an improvement in joint motion that is evident to the individual administering the manipulation.

Again, such controversies can be resolved only through appropriate and well-controlled research.

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Incidence of spinal palpatory findings: A review

MYRON C. BEAL, DO

Epidemiologic studies of the incidence of somatic dysfunction in a normal or asymptomatic population are needed to evaluate somatic dysfunction as an etiologic factor or as a reflection of disease. Nine studies of the incidence of spinal palpatory findings are reviewed to see if there are commonalities in the patterns of somatic dysfunction, and whether insights into the nature of spinal dysfunction can be gained by an overview of these studies.

Interrater reliability studies account for data reported by Denslow,[1] McConnell,[2] Kappler,[3] and Beal.[4] Heilig[5] recorded the spinal findings in 200 cases selected from his family practice. Cox[6] and Beal[7] reported on the incidence of spinal palpatory findings in subjects examined for coronary artery disease, and Miller[8] and Beal[9] plotted the incidence of spinal palpatory findings in patients with pulmonary disease. These investigators examined the subjects either in the hospital or an ambulatory clinical setting.

Denslow[1] reported on the results of an interexaminer study of two observers who examined 61 subjects independently without knowledge of the history or clinical findings, and recorded the incidence of tissue texture abnormality at the spinous processes. The areas of highest incidence of lesion were the upper cervical region, the midthoracic area, and the lumbosacral area (Fig 1).

McConnell and associates[2] reported on an interrater reliability study by six osteopathic physicians. Three physicians examined 21 patients independently. Only the primary examiner knew each patient's history. Each physician conducted a neuromusculoskeletal examination using his own customary examination method. Spinal segments were rated on a scale of 0 to 3 for the clinical significance of the presence of somatic dysfunction. A composite chart of the six examiners' findings for the 21 patients weighted by the scaled subjective evaluation for significance shows peak incidence of findings at the occipital area, the cervicothoracic junction, the thoracolumbar junction, and the lumbosacral spine (Fig 2).

Kappler[3] reported on the results of a doubleblind study of the incidence of spinal palpatory findings in 837 examinations performed by experienced examiners and students. The students and experienced examiners conducted their examinations independently without knowledge of the history or physical findings. In addition, the attending physician was blinded as to the results of the structural examination. Findings were based on inspection, motion testing, and palpation. A composite chart of the incidence of spinal findings was plotted for both right and left sides. However, if the graph is altered to show only the greater incidence of either right- or left-sided findings, then peak incidents are observed at the upper cervical spine, the upper thoracic spine, the thoracolumbar spine, and the lumbosacral spine. There is a higher incidence of findings throughout the thoracic spine area (Fig 3).

Another interexaminer study reported by Beal and Dvorak[4] was conducted by two physicians-one an osteopathic physician and the other a physician who is a teacher in the Swiss School of Manual Medicine. The physicians each examined 50 patients independently without knowledge of the history or physical findings. The patients were selected on the basis of a diagnosis of cardiovascular disease, pulmonary disease, gastrointestinal disease, or musculoskeletal injury or disease. Spinal findings were rated from 0 to 3 for significance. A plotted composite graph shows peak incidences of spinal findings for the osteopathic physician (solid line) at the upper cervical spine cervicothoracic area, thoracolumbar area, and lumbosacral spine (Fig 4).

Heilig[5] examined 200 patients in his practice who had a low back complaint or a postural alteration affecting the low back. Lesion sites were selected on the basis of altered vertebral mechanics, restricted motion, and point tenderness. The data were presented as a percentage of the total observed incidence at each spinal segment. He noted an increased incidence of palpatory findings at the transitional areas of the spine, the occipital area, cervicothoracic spine, thoracolumbar spine, and lumbosacral spine (Fig 5).

Cox and associates[6] reported on the incidence of somatic dysfunction in patients examined for coronary artery disease. Palpatory findings were based on range of motion, pain, soft tissue texture, and red reflex activity. A three-point scale was used by the examiners to grade the subjective impression of the degree of cornpliability of the paraspinal and intercostal tissue. A peak incidence was observed in the upper thoracic area and one in the upper cervical area (Fig 6).

Beal and Kleiber[7] examined patients prior to cardiac catheterization and correlated palpatory findings with the objective evidence of coronary artery disease. Palpatory findings of somatic dysfunction were based on palpation of tissue texture changes, asymmetry of bony landmarks, and restriction in segmental spinal motion. A graph of the findings of 76 patients with diagnosed coronary artery disease shows peak incidence of spinal findings in the upper cervical area, the upper thoracic area, the lower thoracic area, and the lumbosacral area (Fig 7).

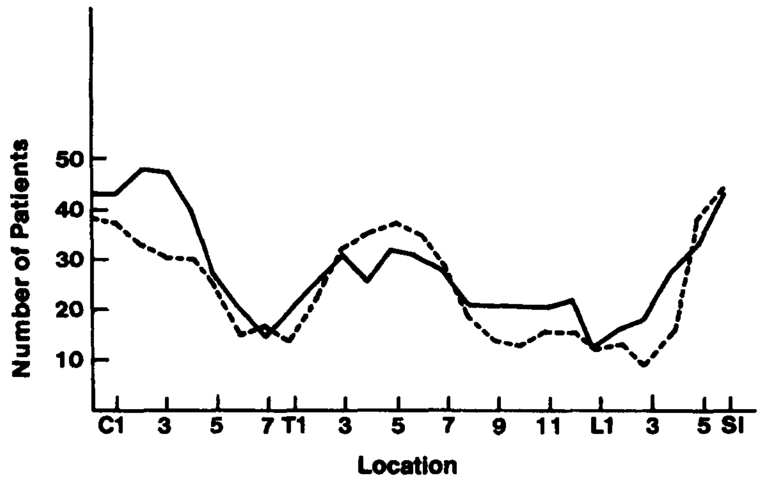

Fig 1. *Incidence of palpatory findings in blind ambulatory study in 61 subjects by Denslow[1], using tissue texture at the spinous process.*

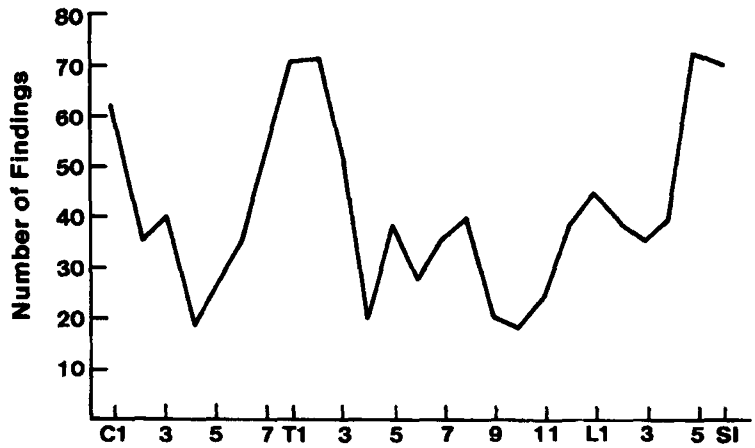

Fig 2. *Incidence of palpatory findings in blind ambulatory study in 21 patients by McConnell and associates,[2] using tissue texture, position, and joint motion (scaled for significance from 0 to 3).*

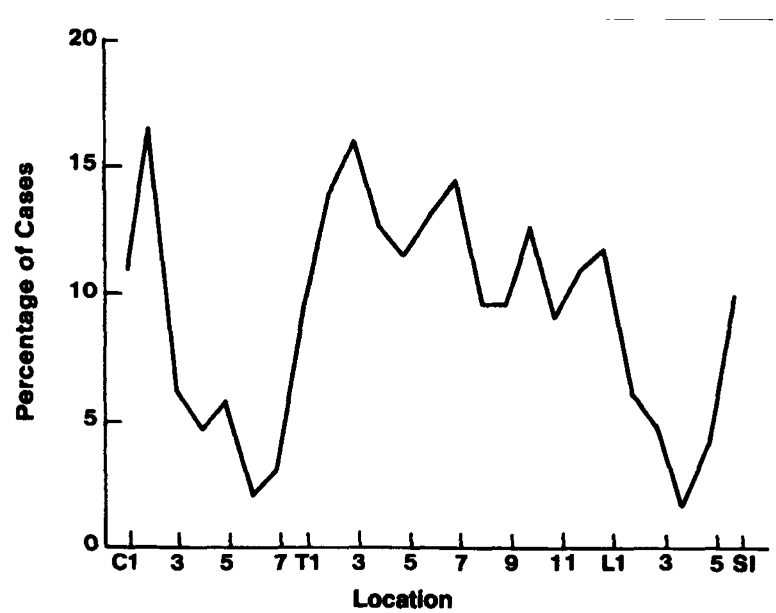

Fig 3. *Incidence of palpatory findings in double-blind hospital study (837 examinations) by Kappler,[3] using* ***inspection, motion testing, and palpation.***

Miller[8] plotted the incidence of palpatory findings in.44 patients with chronic obstructive pulmonary disease. Palpatory examination included tissue texture and joint motion tests. There was an increased incidence of spinal findings in the upper thoracic area (Fig 8).

Beal and Morlock[9] reported on the incidence of spinal findings in 40 patients with diagnosed pulmonary disease. The palpatory findings were based on observations of tissue texture, symmetry of position of transverse processes and ribs, and segmental spinal mobility as determined by acompression springing test applied to the transverse process. A graph of the findings shows peak incidences in the upper cervical area, the upper thoracic and midthoracic area, and the lumbosacral area (Fig 9).

Discussion

An examination of the graphs (Figs l-9) from the studies that have been reviewed shows that the incidence of somatic dysfunction is not uniform throughout the spine. There are peaks and valleys. The peaks occur at the transitional areas of the spine, that is, the occipital area, the cervicothoracic area, the thoracolumbar area, and the lumbosacral area. The predominant areas of incidence are the upper thoracic area and the lumbosacral area.

Variations in the reported findings may be attributed to observer influence, differences in testing procedures and their interpretation, and different subject populations. At the present time, we do not have a broadly accepted protocol of tests for the evaluation of spinal somatic dysfunction other than the general categories of tissue texture, asymmetry of bony landmarks, and segmental joint motion. Tests are individually selected by each examiner and interpreted according to his or her own criteria. Interexaminer reliability studies for assessment of tissue texture and segmental joint motion have shown poor results except in instances in which the testing procedures were prescribed and the examiners were trained in the procedures and the method of reporting results.

Hypotheses have been advanced to explain the patterns of spinal findings. However, it is evident that a single concept will not encompass the data presented or the possible etiologic factors. Chamberlin's[10] concept of multiple working hypotheses provides an opportunity to view all rational explanations of the observed phenomena and to propose several causes for the data rather than selecting a single determinant.

An example requiring multiple variant analysis would be a 50-year-old left-handed man who has upper thoracic and left-sided chest pain and is found to have a short left leg with a left convex scoliotic pattern and somatic findings in the upper left thoracic spine. Consideration must be given to multiple factors either acting singularly or in consort. They include a viscerosomatic reflex, left-handedness, a compensation pattern to a short left leg, and the transitional spinal area between the cervical and thoracic spine.

Several authors have emphasized the importance of the lumbosacral area and pelvis in determining musculoskeletal patterns. Dunnington[11] discussed a musculoskeletal stress pattern that he attributes to the body's adaptation to gravity stress. Heilig[5] concluded that the lumbosacral area was a basic factor in altered vertebral patterns, and Magoun[12] stated that the mechanics of the sacrum makes it a key area in which other lesions show compensatory changes to sacral malalignment. The increased incidence of spinal findings at the lumbosacral area is noteworthy and may be taken as evidence to affirm the importance of the lumbosacral area.

Adaptive musculoskeletal patterns have been associated with asymmetries of the lower extremities. Schwab[13] discussed the short-leg problem in detail. The effect of a difference in leg length on body mechanics has received considerable study.[14] A pattern of short leg, low iliac crest, and lumbar spinal curve convex to the short-leg side occurs in about a third of the cases that are examined.

Cathie[15] noted a compensatory pattern associated with the pronation syndrome which involved the tarsal bones, internal rotation of the lower extremity, increased pelvic inclination, increased lumbar lordosis, and a compensatory thoracic kyphosis.

An increased incidence of spinal segmental change in the upper thoracic spine has been attributed to head carriage and the action of the upper extremities. A convexity in the upper thoracic spine has been associated with the dominant hand.[16]

Heilig[5] found an increased incidence of spinal findings at the junctional areas of the spine. A change in facet mechanics and a change in the spinal curves, which tend to occur at the junctional spinal areas, has been associated with an increased incidence of palpatory findings, as seen in Figures 1 through 9. Of special interest are the peaks of increased incidence at the cervicothoracic and lumbosacral areas.

The increased incidence of palpatory findings in the thoracic spine in the patients examined for coronary artery disease and pulmonary disease supports the concept of a viscerosomatic effect. The higher incidence of palpatory findings in the thoracic spine in the study reported by Kappler[3] may also reflect a viscerosomatic component in the hospital patients examined. Of the studies reviewed, only three were not identified with subjects having visceral disease; namely, those by Denslow,[1] Heilig,[5] and McConnell.[2] Although there appears to be graphic evidence of spinal findings associated withvisceral disease, there does not appear to be a clear distinction between the hospital subjects examined and the patients who were selected from an ambulatory setting.

Conclusion

The factors that have been identified as influencing the incidence of somatic dysfunction are posture, short leg, pronation syndrome, handedness, transitional areas of the spine and visceral reflexes. We need to know the natural history of somatic dysfunction, the stimuli that initiate it, how it is maintained, its stability, what influences exacerbations; and what are the effects of somatic dysfunction locally and on general body function.

The peak incidence of findings in the lumbosacral areas has been associated with complaints of low back pain. The peak incidence in the upper thoracic spine is generally attributed to the use of the upper extremities. One can only speculate as to their potential for reflecting somatovisceral and viscerosomatic effects.

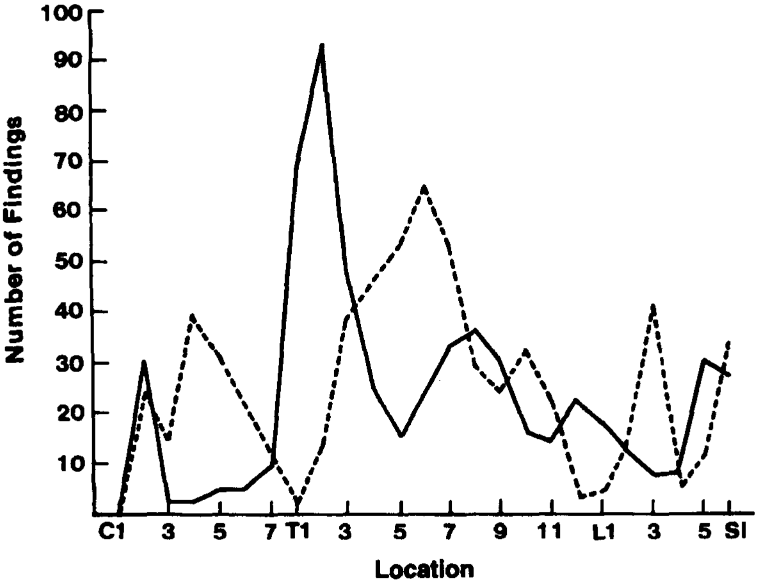

Fig 4. *Incidence of palpatory findings in blind hospital study in 50 patients by Beal and Dvorak,[4] using tissue texture, position, and joint motion (scaled for significance from 0 to 3). Solid line represents osteopathic physician's findings; broken line, those of physician-teacher in Swiss School of Manual Medicine. (Reprinted with permission.)*

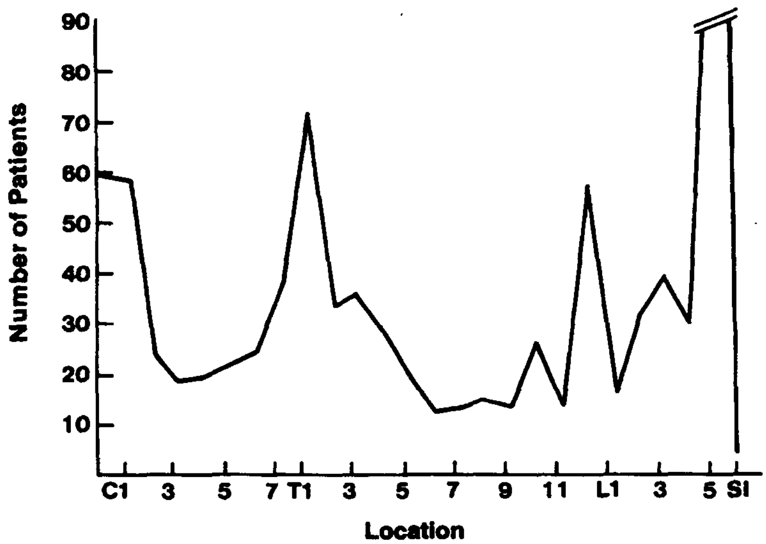

Fig 5. *Incidence of palpatory findings in ambulatory study in 200 patients by Heilig,[5] using position, motion, and tenderness.*

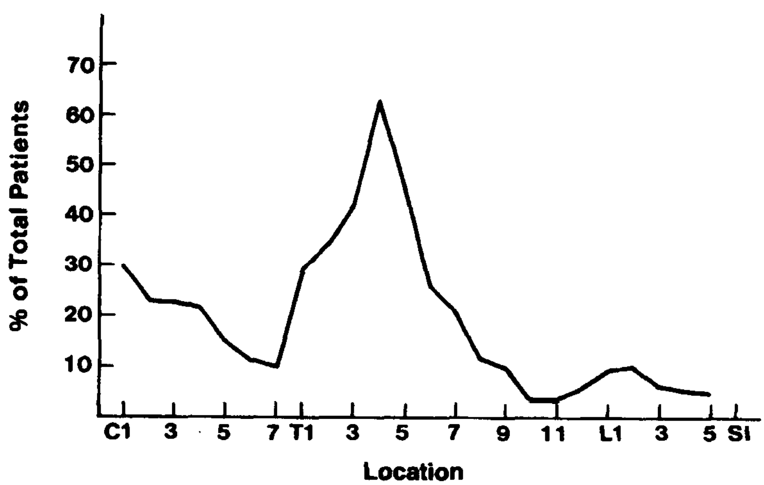

Fig 6. *Incidence of palpatory findings in blind ambulatory cardiac study in 97 patients by Cox and associates,[6] using range of motion, pain, tissue texture, and red reflex activity.*

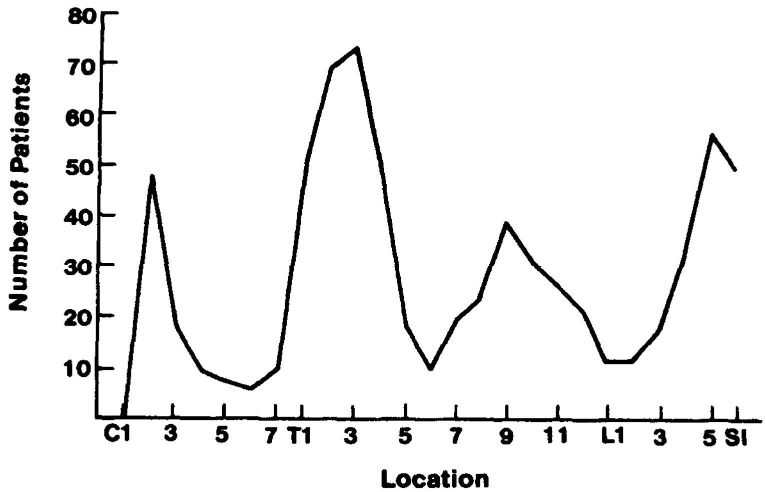

Fig 7. *Incidence of palpatory findings in blind hospital cardiac study in 76 patients by Beal and Kleiber,[7] using tissue texture, position. and joint motion.*

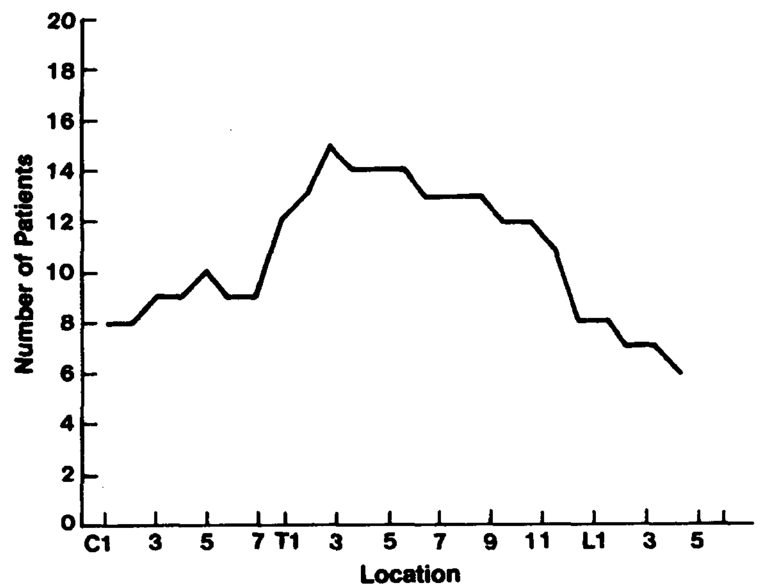

Fig 8. Incidence of palpatory findings in ambulatory pulmonary study in 44 patients by Miller,[8] using tissue texture and joint motion.

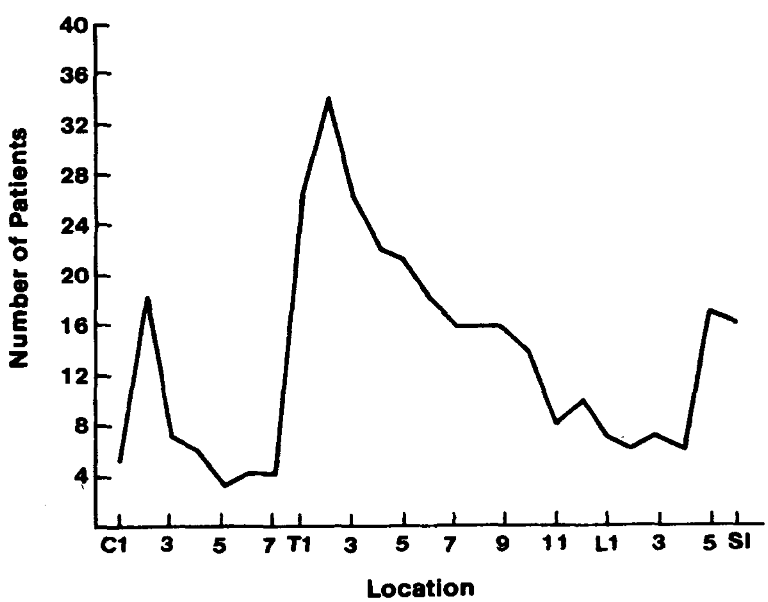

Fig 9. *Incidence of palpatory findings in hospital pulmonary study in 40 patients by Beal and Morlock,[9] using tissue texture, position, and joint motion.*

The increased incidence of findings in the transitional areas of the spine and their importance remains to be assessed as it relates to osteopathic theory and practice. A multiple factorial analysis including the variables of posture, short leg, visceral dysfunction, somatic injury or stress, and pre-conditioning influences should be the basis for the assessment of the patient's musculoskeletal history and examination.

The basic osteopathic hypothesis of the importance of somatic dysfunction on health and disease requires epidemiologic data on the incidence of somatic dysfunction in a normal or asymptomatic population. Such information is essential to develop a base line for comparative purpose with disease states and could greatly aid research in assessing the role of somatic dysfunction in health and disease.

Protocols for epidemiologic data will require a standardization of medical records of osteopathic diagnostic tests and treatment procedures. Research designs need to develop uniformity of testing methods using similar criteria for positive findings based on location, status, and significance of somatic components.

Attention to differential diagnosis evaluating palpatory findings consistent with multiple etiologic variants should give greater clarity to the importance of the factors encompassed in the diagnosis of somatic dysfunction. Coupling diagnostic information with an analysis of the response to manipulative treatment should further enhance our understanding of the role of manipulative treatment in health and disease. The need for further osteopathic clinical research in the epidemiology of the incidence of the somatic components in health and disease should he paramount.

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VIII

Manipulative Technique

Dr. Paul Kimberly discusses the indications for manipulation, and the various methods of treatment that are available, in his article "Formulating a Prescription for Osteopathic Manipulative Treatment". In the article "Fundamentals of Technic" Dr. Stinson reviews some of the basic concepts in the application of manipulative procedures, and Dr. Allen emphasizes the fundamentals of psychomotor skill learning in his article " Reeducation in Technic "

In the next article "Method of Determining the Most Applicable Technic" Dr. Russell Peckham states that technic selection must be adopted which directs force to the location of the lesion pathology and must be appropriate for the pathology present.

Current technique teaching emphasizes the teaching of individual procedures rather than the common relationships among techniques. In addition it should be recognized that all technique is modified each time it is used. Thus, the principle of the procedure should be stressed in teaching technique rather than focusing on producing a simulation of the procedure demonstrated. These are some of the details set forth in the article "Teaching Basic Principles of Osteopathic Manipulative Technique".

The next four articles deal with specific technique procedures: Direct Action Technic by Robert Kappler, Muscle Energy Technique by John Goodridge, Functional Technique by Charles Bowles, and Counterstrain Technique by Lawrence Jones. The last article in this section by Albert Kelso presents charts for recording a regional osteopathic physical examination as developed by the committee on a uniform records system of the American Academy of Osteopathy.

Formulating a prescription for osteopathic manipulative treatment

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The formulation of a prescription for osteopathic manipulative therapy requires thinking through (1) the method that is to be used, (2) the activating forces that are to be applied, (3) the amount or "dose" of the treatment, and (4) the frequency of each application. The methods to be selected are considered in terms of the "barriers" to motion offered by the presence of somatic dysfunction. The activating forces that are employed to remove the barriers are defined. The ways in which these forces can be combined are described in relation to specific problems affecting the vertebrae but the same principles apply to problems involving the extremities and the skull.

The word "prescription" brings to mind a small piece of paper upon which the physician has written instructions to the pharmacist for the dispensing of medication. A prescription is considered a recipe, which, in turn, is defined as "a method or procedure for doing or attaining something."'

The components of a prescription for medication include the following: (1) selection of a specific substance from a class of drugs; (2) a specified strength of the substance; (3) the quantity of the substance to be given to the patient; and (4) instructions regarding the frequency and method to be used by the patient for utilization of the substance prescribed. The prescription should be based upon an accurate diagnosis of the patient's problem and adequate consideration of the several substances available in the class of drugs chosen for therapy.

Present knowledge of osteopathic manipulative treatment makes it possible to write a prescription. At the least it is mandatory to think through (1) the method to be used, (2) the forces to be applied, (3) the amount to be given, and (4) the frequency of each application in exactly the same manner as the physician would select and prescribe a drug or other form of therapy. An accurate diagnosis is also important in the "prescription" for manipulative treatment if demonstrable, reproducible results are to be achieved.

Current knowledge of physiology recognizes the interplay between the musculoskeletal (MS) system and the other organ systems and the impact of emotional problems on health. This interplay requires the physician examining the MS system to evaluate identified somatic dysfunction as to its role in the current disease process. Is the dysfunction in the MS system the primary factor resulting in physiologic alterations of the total MS system (somatosomatic) and/or the other systems (somatovisceral), or are the MS system symptoms and findings secondary to and accentuating the physiologic alterations occurring elsewhere (viscerosomatic)? The answer to this question will determine the relative roles and possibly the sequence in which therapeutic tools such as manipulation, surgery, medication, and psychiatry are to be used.

The decision to use manipulation raises a number of other questions similar to those raised in making a decision to operate, to medicate, or to help the patient ventilate emotions. What procedure should be used? What adjuncts are necessary? What modifications are required in view of the age of the patient, his or her health status, the chronicity or acuity of the problem, and the ability of the physician?

The general indications for manipulative treatment are as follows:

(1) The need for moving body fluids, especially to open arterial and neural channels* and to promote better venous and lymphatic drainage;

(2) The need for modification of somatosomatic reflex patterns, such as found when a vertebral restriction results in muscle spasm about the area;

(3) The need for modification of somatovisceral reflex patterns illustrated by the vertebral restriction which creates excessive efferent flow over the autonomic nervous system and thus disturbs visceral function;

(4) The need for modification of viscerosomatic reflex patterns in which afferents from a viscus activate the anterior horn cells to produce a somatic response in the paravertebral tissues;

(5) The need for a tonic or bracing effect on circulation and general body function in the postoperative, acute infectious, or debilitated patient; and

(6) The need for maintenance care when somatic dysfunction is recurrent because of circumstances that cannot be eliminated. Palliative measures, usually at regular intervals, are required to prevent escalation of demands on the patient's accommodative mechanisms and to de-escalate them temporarily.

Methods

The procedures generally used in manipulation fall easily into three groups: (1) soft tissue procedures; (2) articulatory procedures; and (3) procedures to remove the restriction within a specific joint. Any one of the procedures may provide all that is needed for a specific dysfunction. However, all three procedures may be applicable to the same patient during a single visit for the same or for a different dysfunction. For example, many physicians will sometimes use a soft tissue procedure to prepare an articulation for correction, test the joint with an articulatory procedure, and finally introduce a technique to remove the restriction in the joint as a final phase of treatment.

Soft tissue procedures

Soft tissue procedures include such measures as massage, kneading, deep pressure, traction (manual or mechanical), and effleurage. Hydrotherapy, heat, cold, and support to rest a body part are adjunctive therapeutic modalities.

Soft tissue procedures are of great value in several areas. The emotionally tense person benefits greatly from massage and gentle traction of the tight musculature. The areas most involved are the muscles of the cervical column, the upper thoracic spine, the shoulder area, and the pectoral group. Special attention should be given to the small suboccipital muscles, especially when headache is also present.

Respiratory infections also call for soft tissue procedures among others. The stretching and relaxation of anterior cervical fascias and the myofascial mechanisms of the thoracic cage are especially important. After the muscles and fascias have been adequately relaxed, venous and lymphatic drainage can be further enhanced by articulatory (range-of-motion) procedures applied to the clavicle, shoulder, and ribs (simple rib raising).

Acute sprains involving articulations of extremities and inflammatory processes also benefit from the soft tissue procedure of effleurage applied *not* over the injury or inflamed site but above the area to promote better venous and lymphatic drainage. Here again, attention should be given to the muscles and fascias about the shoulder girdle to permit better lymph flow through the right lymphatic duct and/or the thoracic duct as they empty into their respective veins at the root of the neck.

Soft tissue procedures are also used to prepare an area for articulatory treatment and/or procedure to increase joint mobility.

Restrictive barriers

The discussion of articulatory procedures and joint mobilization requires consideration of "restrictive barriers."

The barrier (or zone) of restriction to motion has been discussed at length in osteopathic literature. There are many theories on the cause and/or the maintaining element of altered joint function (somatic dysfunction-osteopathic lesion). Korr[3] has theorized that where there has been sudden slackening of muscle due to unanticipated, abrupt external force or other such "surprise," the muscle spindle discharges are silenced while the central nervous system increases the gamma discharges to the intrafusal fibers, inducing strong contraction. This theory may account not only for resistance to motion but also to the "ropiness" of muscle often noted.

Wilson," presents the idea that all forces operating about an articulation eventually converge at a single focal point. Somatic dysfunction occurs when this focal point has been shifted. The articulation functioning about this new point with motion confined by anatomic restraints is recognized as being in a state of dysfunction (lesion).

Additional theories include that of Sutherland,[5] who referred to an alteration in the balance of the ligamentous and/or membranous tension of a part which resulted in palpable evidence of joint restriction. Patterson[6] has accounted for maintenance of maladaptive neural patterns by sensitization in spinal interneuron pools and by conditioning.

The components of joint motion recognized by palpation may be described by consideration of two factors, the physiologic barrier (or resistance) and the anatomic barrier or final limit to motion achieved by the ligaments and bone. Figure 1 illustrates this concept of motion.

With the articular components at rest, the patient can actively induce motion in both directions. However, when the limit of active motion is reached (physiologic barrier or resistance) the physician can passively induce further motion which is permitted by the resiliency or stretch of the muscles and fascias. Passive motion is normally stopped by increasing muscle tension, by the ligaments and/or by bone contact (anatomic barrier). At this point, further passive effort to induce motion tests the integrity of the ligaments or causes impingement of the bone. There is a certain amount of freedom between the articular components in the resting position that can be palpated by the examiner and is referred to by Mennell[7] as joint play.

The presence of somatic dysfunction places a barrier or zone of restriction somewhere within the active range of motion. This restrictive barrier may be near one end of the range, thus limiting active motion to less than 50 percent (Fig. 2) or near the opposite end, thus leaving more than 50 percent of active motion (Fig. 3). Figures 2 and 3 indicate the loss of passive motion beyond the restrictive barrier zone. This is an important diagnostic point when testing range of motion in an articulation. The presence of "normal" passive motion in one direction of a motion plane and resistance in the other is presumptive evidence of somatic dysfunction. Joint play is also reduced in these circumstances.

Although this barrier of somatic dysfunction may be anywhere within the normal range of active motion, it rarely exists at the extreme limits. Therefore, some active motion nearly always is present within the affected joint (Fig. 2). In some instances the restricted segment (component) may be riding against the restrictive barrier. In other situations, the barrier is not engaged; thus, the component, when starting motion from neutral, may have full range in one direction but strikes the barrier when moving in the other direction in the same plane (Fig. 3).

The aforementioned descriptions and Figures 1, 2, and 3 imply a single plane of motion. However, the concept applies to and needs to be evaluated for each plane of motion normal to the articulation being palpated and/or involved in dysfunction. The intervertebral articulations are tri-axial and thus are capable of movement in three planes. Somatic dysfunction involving sagittal plane movements will have a restrictive barrier in this plane only, limiting either flexion or extension. However, the amount of motion in the coronal and/or horizontal planes may be modified (usually reduced), but it does not carry the same palpatory sense of restrictive barrier as does motion loss in the sagittal plane. Compound intervertebral somatic dysfunction produced by movements starting from the neutral or anatomic position will have the restrictive barrier in both the coronal (sidebending) and horizontal (rotation) planes but may have only

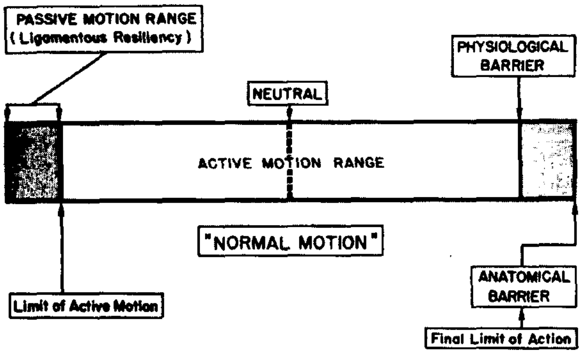
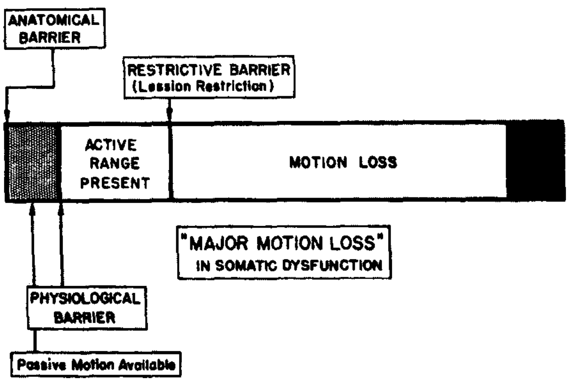


Fig. 1. *The components of joint motion may be described by the physiologic barrier (or resistance) and the anatomic barrier or final limit to motion achieved by the ligaments and bone.*



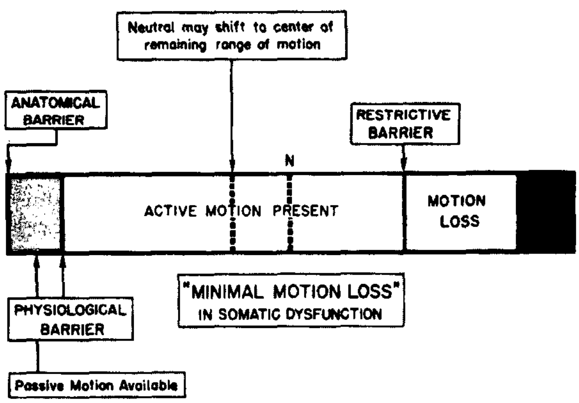


Fig. 2. *The presence of somatic dysfunction places a zone of restriction somewhere in the active range of motion. If the barrier is near one end of the range, it limits active motion to less than 50 percent. Fig. 3. When the zone of restriction is near the opposite end, it leaves more than 50 percent of active motion.*

reduced motion in the sagittal plane. However, compound intervertebral somatic dysfunction produced by movements starting from the nonneutral position (for example, lumbar forward bending) will have a restrictive barrier in three planes, although the amount of motion loss may vary in each plane.

The quality of motion present in an articulation also carries diagnostic significance and should be evaluated at the time of motion testing for restriction. During the acute phase of somatic dysfunction, the fluid changes about the articulation result in a sense of sluggish movement that is often restricted more by pain than a specific restrictive barrier. This sense of poor quality movement is similar to that seen in some patients who have focal infections, hypothyroidism, or a high sugar intake. In the latter, the findings are general, while in acute somatic dysfunction this quality change is limited to the area of injury. Chronic somatic dysfunction per se generally has good quality motion, but the range is restricted by an easily palpable, clearly defined barrier.

Articulatory procedures

Sliding the hands under the supine patient with the fingertips on a group of spinous processes permits the induction of backward bending at the segments being contacted. Slow, gentle but firm pressure followed by a slow release performed two or three times then moved to another group of vertebrae so that passive motion is accomplished throughout the thoracic and lumbar regions has a positive effect on the well-being of the bedridden patient, whether it is performed postoperatively, during an infectious process, or because of debilitation. We think this procedure aids the movement of venous and lymphatic fluids and probably induces a shower of impulses through the autonomics to influence the vasculature. Articulatory treatment of this type applied to patients who are relatively immobile in bed should be performed at least every 12 hours and preferably every 6 or 8 hours on an around-the-clock basis.

The indications for articulatory procedures would be (1) the need for modification of viscerosomatic reflexes (2) the need for a tonic or bracing effect on circulation, and (3) the need for moving body fluids. The combination of articulatory and soft tissue procedures has a wide range of use and is extremely effective when the procedures are properly selected and accurately applied in adequate dosage.

Mobilization of a specific joint

The selection of a method of positioning the restricted component in a joint, the mobility of which is to be increased, and the selection of an appropriate force to remove the restrictive barrier are key considerations in the removal of somatic dysfunction of a specific joint. These may be modified by factors identified in the diagnostic process. In addition to the identification of segmental motion restriction and/or malalignment of articular components, the history and the palpable soft tissue changes indicating acuity or chronicity of the problem play a role in selection of method and force. The soft tissue changes may also alert the astute physician to underlying organic disease that will influence prognosis as well as selection of method, dosage, timing, and force.

Other diagnostic examinations, such as x-ray and laboratory studies, may be indicated as a part of the procedure of differentiating somatic dysfunction from a disease process. The impaired or altered function of related components of the somatic system that is labeled somatic dysfunction is easily recognized when it has occurred in a previously normal articulation. However, when other articular problems, such as congenital deformities, disk degeneration, scoliosis, and the arthritides are also present and somatic dysfunction is added, then the problems of differential diagnosis become more complicated.

The selection of procedures to increase mobility by removing the somatic dysfunction without aggravating, or in spite of the other problems already present becomes a real art. The selection of "method" is based not only on soft tissue changes but also on range and quality of motion and the quality of the "restrictive barrier." The altered range of motion implies and often feels like a "barrier" has been placed within the joint. An analogy can be made to a small pebble under a door. The pebble restricts the swing of the door, but it may be small enough for the door to slide over with added pressure. Other times, the pebble size requires disengagement by return of the door to its starting position and removal of the pebble, so that the door can swing freely again.

The several methods available for positioning a joint preparatory to increasing its mobility are based upon the relation of the lesioned component to the restrictive barrier. Two methods will be discussed here. ("Exaggeration" and "physiologic response" are additional methods used by some physicians in specific situations.) The two methods are as follows.

(1) Direct method. The lesioned component engages the restrictive barrier in each plane of motion normal to the articulation so that the activating (corrective) force selected may carry it (lesioned component) through the restrictive barrier.

(2) Indirect method. The lesioned component is moved away from (disengages) the restrictive barrier in each plane of motion normal to the articulation to the point of balance or equilization of the soft tissue tensions around the articulation. The lesioned component gives a sense of "floating." The appropriate activating (corrective) force is then applied to remove the restriction.

To utilize these methods most effectively, each axis and plane of motion of the involved joint(s) must be fully understood and the position of the restrictive barrier relative to each of these axes and planes should be visualized fully.

A direct method procedure applied to a vertebral segment would require that careful positioning of the restricted component be done in all planes. Increments of sidebending, rotation, and flexion or extension must be utilized until the barrier has been fully engaged in all three planes. Correct engagement of the restrictive barrier is identified by a slight yield or resilience at the contact point. At this point the activating force(s) may be applied.

An indirect method procedure applied to a vertebral segment would require the same careful positioning of the restricted components in all three planes by the use of the appropriate increments of sidebending, rotation, and flexion or extension but the component is moved *away* from the restrictive barrier into the area of relative neutral (or remaining active motion range) for the present joint situation. Proper positioning is recognized by the equalization of the tensions of all soft tissues in all planes. There is a sense of the component "floating." Careful, frequent, small adjustments of position must be made for the activating force being used to remove the lesion barrier.

Activating force

(1) Inherent (vital) force. This is the natural tendency of the body to seek homeostasis. It functions as the rhythmic activity present in all living tissues that seems to improve the hydrodynamics and bioelectric factors around the lesioned articulation when the tissue tension has been completely relieved, thus reducing (removing) the restriction. It may be (a) inherent (implanted by nature, intrinsic, innate), or(b) vital (the energy which characterizes the living organism). *(2) Respiratory cooperation.* This is an activating force that is brought into play when the patient is instructed to increase the depth of inhalation/exhalation phases of the respiratory cycle. It is often used in situations in which the respiratory force will move the sacral base backwards as an aid to a corrective procedure or increasing the motion of ribs with forced respiration. It is applicable primarily to the spinal mechanism in response to respiration. *(3) Respiratoryforce (reinforcement).* This is the force brought to bear when the patient is instructed to hold his breath in either inhalation or exhalation beyond the usual comfortable limits so that a specific symmetric force will exert itself on the lesioned joint and/or myofascial structures (mechanism). (4) *Patient cooperation.* This is a mechanism used by instructing the patient to move his body in specific directions involving the various planes of an articulation as an aid to mobilizing an area of restriction. An alternate to this is when the patient positions his body at the direction of the physician to aid mobilization. (5) *Muscleforce (energy).* The common application is an isometric contraction by the patient. In technique, it is used against an equal counterforce exerted by the physician and upon direction of the physician. The *key to effectiveness* of this activating force is that both physician and patient relax their counter-forces simultaneously but that the physician *maintains* the lesion segment position then readjusts the lesion to compensate for the change made before repeating the process. There are also isotonic and "isolytic" forces that are sometimes used for treatment of fascias, while the isometric force is used more often in specific joint mobilization procedures. *(6) Operator guiding force.* The physician positions the patient away from the restrictive barrier to a point of release (the indirect method) and then guides the lesioned articulation through the various positions that move with ease until he has completely retraced the pathway of the lesioned component. (7) *Operator springing.* This is also known as a low-velocity, medium-amplitude force in which the operator makes his contact upon the restrictive barrier and with variable degrees of force springs the structure with intermittent pressure. *(8) Operator thrust.* The restrictive barrier is properly engaged, meaning that it will yield slightly under pressure, and a high-velocity, low-amplitude force is applied to the restrictive barrier.

There are several ways in which the methods and activating force(s) may be combined for specific problems. A primary chronic osteopathic lesion (somatic dysfunction) involving the spine in an otherwise healthy patient is most frequently approached by using the direct method (engaging the restrictive barrier) and operator thrust (a high velocity, low-amplitude force). When the slight yield of the properly engaged restrictive barrier is felt, the sudden application of very short range motion to the barrier will break through the resistance.

If the same primary lesion were acute and were treated in this manner, excessive discomfort and/ or guarding by the patient might be produced; thus, mobilization would be prevented. This acute problem can be approached by the same direct method but by changing the activating force from the operator thrust to the muscle force (energy). Thus, the lesion can be removed without patient discomfort and with equal effectiveness

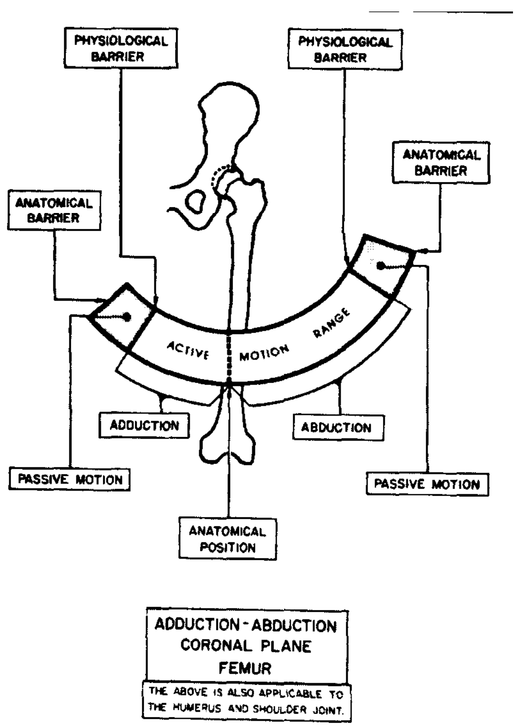


Fig. 4. *The neutral point (anatomic position) for the major joints of the extremities, which is not in the center 0f the actual range of motion.*

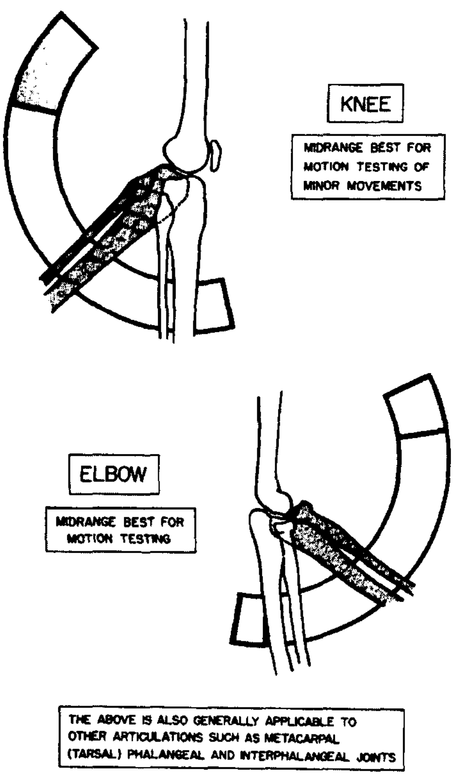


Fig. 5. *To facilitate testing the involuntary movements. the component may have to be moved into midrange.*

by intermittent, gentle working through the restrictive barrier until it disappears.

The addition of other complicating factors such as osteoporosis in an elderly patient would suggest the need for a "prescription" calling for an indirect method (disengaging the restrictive barrier) and the use of respiratory force as the activating mechanism.

Another complication often seen is the inertial injury with the potential of ligamentous sprain which is commonly seen in the cervical spine and sometimes referred to as "whiplash." Even when this situation involves a previously healthy, robust patient, manipulation is often viewed with reluctance by both the physician and the patient. The "prescription" for such a situation would also call for use of an indirect method. The activating force should be the inherent force instead of either the respiratory force or muscle force (energy) mechanisms. However, after the initial treatment with the indirect method in which inherent force is used, the next treatment might involve the indirect method with respiratory force. This could be followed later by the direct method with muscle energy forces. The patient may still need adjunctive measures such as a cervical collar, a lumbosacral support, or analgesics, but it will be more comfortable more quickly during the healing process when the somatic dysfunction has been removed.

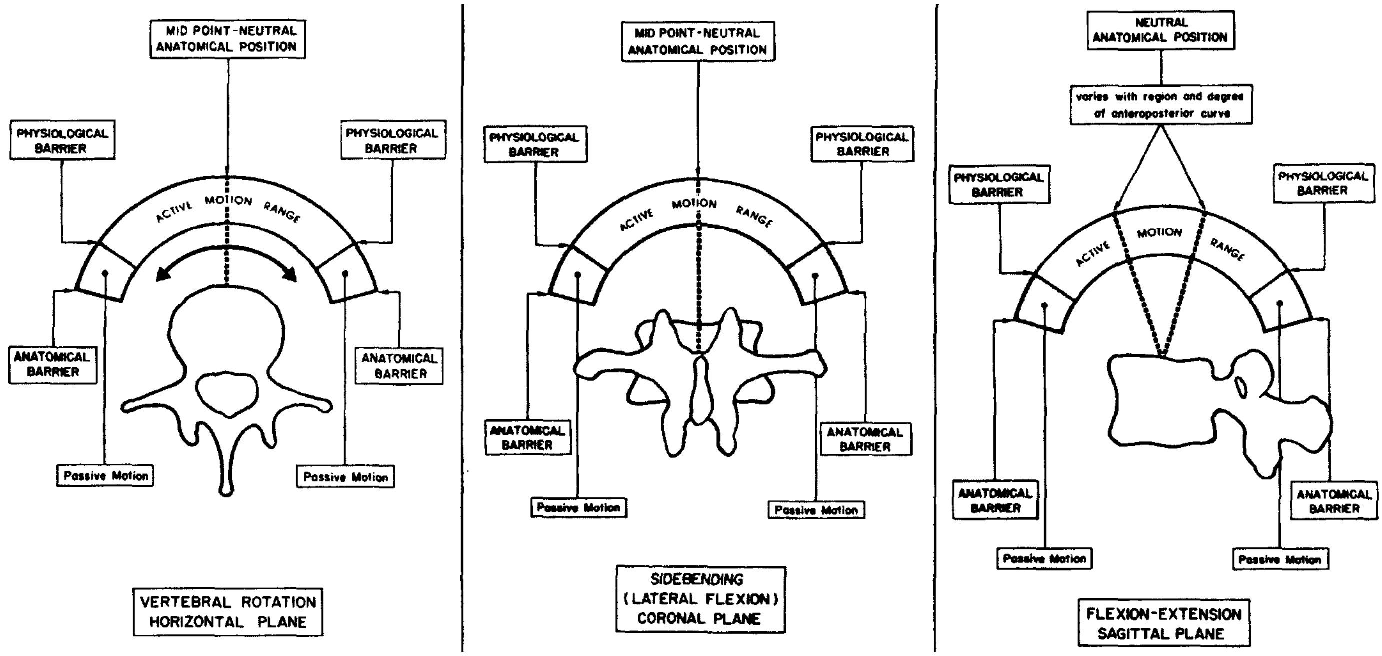
Comment

The examples presented have been directed primarily to the vertebrae. The same principles are equally applicable to the extremities and skull. Somatic dysfunction of the hip, shoulder, elbow, knee, wrist, ankle, carpals, tarsals, et cetera, is common and often limits the activities of the patient.

In addition to the planes of motion for each joint (voluntary movements) described in anatomy texts, the small involuntary movements (joint play of Mennell[7]) that are passively palpable need to be discussed. Examples of these would be the mediolateral and/or anteroposterior glide at the knee or the rotation and glide movements of the phalanges, none of which can be accomplished by voluntary muscle action. The lesions in such areas usually involve these involuntary movements and can be identified by careful motion testing of the articulation.

The neutral point (anatomic position) for the major joints of the extremities (Figs. 4 and 5) is not in the center of the actual range of motion as depicted for the vertebrae (Figs. 6 to 8). Thus the component may have to be moved into midrange (Fig. 5) (elbow, knee) to facilitate testing the involuntary movements. An awareness of these differences is also necessary for proper application of manipulative treatment.

The methods and activating forces that have been outlined are equally applicable to the extremities. The chronic somatic dysfunction involving a shoulder, hip, knee, or elbow is amenable to direct procedures. However, the disproportionate amount of myofascial (compared to vertebral) shortening may preclude the use of thrust (highvelocity, low-amplitude) as an activating force, to avoid soft tissue trauma. Here the use of muscle force (energy), usually isometric, but occasionally isolytic, to free the articulation is highly desirable and extremely effective.



Figs. 6-8. *The neutral point (anatomic position) for the vertebrae, which is in the center of the actual range of motion.*

Dose and frequency

The dose and frequency of manipulative treatment are matters of judgment that the observant physician develops with experience. However, certain guidelines may be helpful. The dose of “a treatment” may be the 1/2 to 1 minute of rib raising on a pneumonic infant to the 1/2 to 1 hour required to manage safely a patient with an acutely injured cervical spine. Generally, time is a poor criterion.

In the acute situation, the standards for judging the dose are (1) enough to effect a physiologic response but (2) not enough to overwhelm the patient. Here, the frequency may be measured in hours. In chronic somatic dysfunction, the dose is measured in tissue response. The response may consist of increased joint mobility, a vasomotor flush, circulatory changes palpable in periarticular tissues, or pain relief. The frequency should be such that each subsequent treatment builds on the effect obtained from previous treatments. Application at too wide intervals requires repeating the same treatment on the same problem with no long-term results. Too frequent treatment of the chronic problem does not give the patient time to reap full benefit from each visit; thus, the physician’s time and the patient’s money are wasted.

When the presenting problem is an acute sprain at the ankle, wrist, elbow, or fingers, direct procedures, especially those with thrust, are contraindicated. Treatment should be started with the indirect method (moving away from restriction) and either the use of breath control (respiratory force) and/or permitting the inherent forces to remove the restriction. As improvement occurs, a shift to direct method and muscle energy, isometric forces can be made. Thrust or high-velocity, low-amplitude forces can safely be used by a few expert operators. Most often, however, such techniques increase the trauma and have been discarded by many physicians and abhorred by the injured patient. Like the ligamentous sprains of the spine, those of the extremities may need adjunctive care such as wrapping, splinting, or analgesics.

The proponents of the cranial concept who were trained by W.G. Sutherland, DO.,[8] may recognize that his manipulative procedures fit into the outline presented. The indirect method and inherent forces used in mobilizing sphenobasilar sidebending rotation lesions and the direct method intermittent rocking procedures via the V-spread technique used to free lesions such as those in a sphenosquamous joint or occipitomastoid joint are prime examples. He used the direct method with guiding and/or respiratory forces on the infant skull before formation of the articulations.

Discussion

This discussion of the “manipulative prescription” is the result of an effort over the years to find the common denominators in manipulative procedures. Too often the osteopathic student has been exposed to only one type of manipulation and occasionally to a certain number of minutes on a rigid (for example, weekly) schedule. If he continues to seek knowledge, he will eventually meet others who propose an opposite approach, or so it seems. All these apparently divergent approaches to somatic dysfunction have their place. The key is an accurate diagnosis, good physician judgment as to dose and frequency, and a sufficiently broad armamentarium to be able to select the method and the activating force (procedure) specifically designed to fit the situation.

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Accepted for publication in May 1979. Updating, as necessary, has been done by the author.

This paper was prepared in partial fulfillment of the requirements for Fellowship in the American Academy of Osteopathy.

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Fundamentals of Technic*

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There is, has been, and perhaps always will be, a stem necessity for brevity, clarity and simplicity in discussion of osteopathic technic. All great truth is simple. Perhaps we have made this subject too complex, because of its importance and because of its many ramifications.

For the teaching of students, for the exchange of ideas among practicing physicians, for publication in our literature, and for explanations to patients and other interested lay people, we must avoid all possible confusion about technic.

Many of the older osteopathic physicians talked of a vertebra being "out" and of putting it "back in place." Sometimes it seems, from the maze of conflicting literature and discussion on the subject, that we might be better off if we had left it just that way.

But this is not a teachable thing. While some few will simply struggle along, palpating enough backs to develop a "lesion sense" and developing a technic in much the same way, others never learn technic because of a lack of understanding as to just what it is all about. Many skilled operators do not stop to analyze exactly what they do, and seldom take the trouble to interpret precisely what they feel. It is a difficult thing at best. It is hard to describe the color *red* to an individual who has never had vision. And until that extra keen, tactual sense has been developed, it is impossible adequately to describe the feel of a lesion. Obviously, not much in the way of technic can be learned until one can find the lesion.

A great forward step has been taken in the adoption of the report' of the Committee for the Study of Nomenclature and Terminology of Osteopathic Technic. This Committee under the chairmanship of W. W. W. Pritchard has labored hard and long to reach an understandable language. Now that this work is finished, the teaching in our colleges, all literature in our publications, and all state board examinations should be in the standard terminology; and in a very few years, we will all be able to understand each other when we talk technic.

This paper is an attempt to put into easily understandable language some of the fundamentals of technic. No new ideas will be introduced, and no effort will be made to discuss the past and present explanations of manipulative adjustive procedures.

We define an osteopathic joint lesion as a maladjustment of structure which perverts physiology, characterized by three things: (1) perceptible positional change of bone, (2) various types of soft tissue tension (ligamentous, tendinous and muscular), and (3) altered mobility. All this we must correct by adjustment.

The bony skeleton is the foundation of body structure. To this framework are attached the supports of viscera, as well as the muscles and ligaments which maintain position and also permit active motion. It must be obvious, then, that to correct maladjustments of structure, we *must move bones.* If we are to overcome and correct the effect of a spinal lesion, we, of necessity, must move at least one vertebra. To accomplish this, we must know something of joint mechanics and, in particular, of spinal joint mechanics.

We know that the bodies of the vertebrae and the intervertebral disc serve as weight-bearers while the articular facets serve to guide, direct and limit motion[2]. They (the facets) get into trouble when they have to carry weight, as we saw in the x-ray studies of sacral mechanics exhibited by E. R. Hoskins[3] at this A.O.A. convention. We know that any joint does its best job of weight-bearing when it is "centered" so that the "middle third" of the joint does most of the work.

We have seen the end result of lesion pathology in fibrosis, diminished nutrition and eventually atrophy of all soft tissues. In the joint there is manifested the so-called atrophic arthritis, as a result of one part of a joint trying to do all the work. We have seen the formation of spurs or exostoses from one side of a joint having all the weight-bearing to do. We know, then, that this spinal joint must be "centered" -not only from side to side, but also from *before backward.*

We know further, from a simple study[4] of joint mechanics, that the smaller and seemingly less important functional movements of a joint serve as an intrinsic protective mechanism, aiding the larger movements by preventing damage from overuse, and from exaggerations of normal ranges of motion. For instance, the spine as a whole does not bend sideward (lateroflex) without a certain amount of rotation. While rotation is not considered as a major spinal motion, yet when it is interfered with, then there is a diminished amount of forward and backward bending (flexion and extension). If these smaller motions are lessened or destroyed, as we can easily determine by testing the joint for movement, then we have a basis for the choice of a corrective adjustment. If the spinal joint is locked in rotation, preventing it from extending, (or flexing) to its normal range, then we know we must unlock this rotation. The same is obviously true for lateroflexion and, of course, for combinations of the two.

This altered mobility, then, with its possibilities for diagnostic purposes, is very valuable in affording us a choice of the most applicable technic, and also of a checkup, following an adjustment, to see whether we really have accomplished what we set out to do.

Technic consists of determining the type of restriction in a joint and then overcoming that restriction by proper adjustment.

It is sound mechanics and good engineering, that if we are to move one object to or from another, then one of them must be at least relatively fixed. This is true of any two parts of the body. It is particularly true of two vertebrae, because unless we localize our application of force, we will send stress up and down the spine. We cannot afford diffusion of force.

Since this is a somewhat dangerous procedure, we must strive for exact control of one vertebra, while we move the other one to or from it. This is the great fundamental of technic, the so-called "fixed point" principle-hold one and move the other. It is found as an underlying basis for all of Dr. Still's osseous technic. It has the virtue of exactness. It is a definite localization. It affords an opportunity for the holding fingers to "sense" the amount and direction of force necessary for correction. It has an additional value in that when we hold one, we have an opportunity to feel the adjustment take place.

Now it seems relatively easy, when we think of one vertebra as being too far back or too far to one side, to apply force to correct this condition. But when we think of one being too far toward the front the problem is not so simple. In the case of the direct bilateral forward slip, as in the anterior fifth lumbar which we saw on Dr. Hoskins' slides, it is a matter of holding the sacrum and lifting the entire spine back upon it, in order to get the fifth lumbar back into position. The same is true of the anterior upper dorsals, where we can fix the most posterior one and lift or pull the others back to this fixed point.

When we think of the one sided lesion, however we have been prone to consider one side as posterior and just applying force to push this side forward. Like the student whose slogan was "pop and pray," we find, unfortunately, that not much change for the better takes place in the patient. Clinically, we know that a much more desirable effect is produced if we unlock the anterior side of the lesion. (For if one side is posterior, the other must be anterior.)

It is a little hard to explain the mechanics of it, but it is possible to move the posterior side without restoring mobility to the locked anterior facet. When adjustment is made to the posterior side, the locked anterior facet must move, yet it may not become unlocked but simply carry the vertebrae immediately above or below with it, resulting in a different lesion. It is relatively easy to see that this front side of the vertebra is the more important from the lesion standpoint, for the ganglia of the autonomic nervous system are buried behind the pleural and peritoneal tissue close up to the sides of the bodies of the vertebrae. Their location is such that there is all the chance in the world for them to be affected by soft tissue pressures from intervertebral subluxations. In the acute lesion they may be chemically disturbed by the lessened alkalinity which occurs in the inflammatory stage. In the chronic lesion their nutrition can easily be disturbed by the lessened fluid content of fibrous tissue under tension.

It is claimed that all body processes are under the control of the autonomic nervous system. Every single cell in the body, to be functionally healthy, is dependent on adequate and uninterrupted flow of nerve impulses from this system. The cells of all glands must receive impulses from secretomotor fibers. Normal nerve impulses to all viscera over vasomotor fibers are necessary for normal metabolism. All somatic structure, likewise, depends upon adequate trophic innervation from this system.

It is my opinion that, traced to their source, all disease processes are primarily disorders of the autonomic nervous system. One of the world's foremost physiological chemists has stated that the chemistry of the blood is under control of the nervous system.

It seems logical, then, to direct our therapeutic effort toward the control of all life processes. It is more in keeping with the scientific approach to any problem of disease. We should try to reach the general manager-not futilely attempt an approach by way of an office boy. We find plenty of reasons then, for directing our adjustment towards the anterior side of the intervertebral lesion.

This matter of the choice of technic, of determining the effect of the anterior side of the lesion, has been in the minds of the more experienced operators for a long time. But it should be more than just a matter of opinion, more than just clinical observation. We should be able to offer some basis in scientific findings, for a definite choice of technics of adjustment.

There is at the present time in the Scientific Crime Detection Laboratory of Northwestern University in Chicago, a machine which automatically registers rate, rhythm and amplitude of pulse, (blood pressure) and respiratory rate. Its correct name is the Keeler Polygraph, but the newspapers have called it the "lie detector." It is an ingenious piece of apparatus. Accurate to within one-half of 1 per cent, it can be used very rapidly, and being a purely automatic process, it reduces to a minimum the possibility of human error.

This matter of possible human error is a serious one. Considerable work has been done in an attempt to verify the effect of adjustment by using the various laboratory procedures. Clinical evidence is being accumulated in the osteopathic institutions, checking temperature, pulse, blood pressure, white and red cell count, kidney and bowel elimination, etc., before and after adjustive procedures. The weight of numbers of these observations will be very valuable.

But to stand as research, the methods used must be free as far as possible from human error, such as might occur in laboratory findings. The use of the electrocardiograph will be very valuable for cardiac patients, even though this method is slow and will require considerable expense and time to build up any volume of evidence.

It is the plan of the A. T. Still Research Institute to use the polygraph extensively to determine the effects of adjustment by various types of technic. So, in addition to what we have found from experience and deduced from clinical results, we could have the automatically written records of one hundred patients who had been treated with a certain type of technic. And one hundred further records of the use of a different type of technic. We could have absolute findings that a certain choice of technic was right, for we would have the cardiovascular response of the individual patient to the chosen type of technic.

In time we would be able to offer positive, scientifically exact records that would tell in what position to place a patient, whether face down, face up, sitting up or on the side, and what type or technic was the most effective; which technics were stimulatory and which were inhibitory; just how, when, and how often to treat a patient for a given condition. If we think of angina pectoris patients, for instance, it will be seen that it is highly advisable to be able to choose an exact technic for the best results.

This thing of just saying "treat them osteopathically" is just as bad as saying "give the patient medicine," but without designating whether in pill, powder or liquid form, and not telling whether by the grain or drop, once an hour or once a week.

It would seem that for teaching purposes, for the exchange of ideas among practitioners, and for our literature, we should be able to say positively just what kind of technic, how much and how often to treat a patient. And more than that, to offer something besides our opinion for a choice of technic.

SUMMARY

Osteopathic manipulative technic is an art-the art of adjustive therapeutics. Part of osteopathic technic consists of applying adjustive procedures to overcome the osteopathic joint lesion, which we have already explained as a maladjustment of structure perverting physiology and characterized by three things: (1) perceptible positional change of bone, (2) various soft tissue tensions, and (3) altered mobility.

Since the bony skeleton is the foundation of structure, it is obvious that we *must move bones* in order to accomplish adjustment.

A study of joint mechanics reveals two important factors: (1) joints do their best work when they are "centered" so that the "middle third" of the joint does most of the work, (2) the lesser movements (rotation, lateroflexion) are intrinsic protective mechanisms. When locked or altered in any way, they interfere with the greater or major movements of the joint. This gives us the basis for a choice of applicable technic, and a test to determine how successful we have been in adjusting lesions.

To change the relationship of any two bones, it is necessary to "fix" one and move the other.

The anterior (front) side of the intervertebral lesion is the more important, because of its effect on the autonomic nervous system, and therefore adjustive procedures must be directed toward changing the anterior side.

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* Delivered before the 38th A.O.A. Convention, Wichita, Kans., 1934.

Re-Education in Technic*

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That skill in the application of osteopathic technic to lesion correction is a prime necessity to every practitioner is one of the axioms of osteopathy. It is necessary not only as a requisite of successful therapy, but also as the tangible evidence of the truth of osteopathic theory. The purpose of this discussion of the subjective factors of skillful technic is to place before you certain considerations which we believe to be true, and certain general principles which we ask you thoughtfully to consider with reference to your own technic. Dalcroze[1] said, "the most profound thought may be distorted by deficiencies in the vehicle of its externalization." It rests with each one of us to see that the profound truths of osteopathic theory be not distorted by deficiencies in our technic.

We propose to show that in almost every instance our technic falls far short of what it should be, both as to the skill with which we apply our own methods, and as to our ability to broaden and increase the scope of those methods by the adoption of new technic. This is true, first, because we are constantly concerned with the end to be gained to the almost total exclusion of any consideration of the means whereby that end is to be attained; second, because we have followed a process of intuitive imitation both as we began to learn technic, and later in any effort to add new methods to our armamentarium; third, because we have followed the trial and error method rather than that of reason; and fourth, and quite inclusively, because of the very nature inherent in the methods by which we learned and continue to learn technic.

First, then, what is meant by the statement that we have overemphasized the end, and underemphasized the means whereby that end is to be gained? If one will think back over all the discussions of technic that he has heard, he will note that they are primarily objective studies. They include the anatomy, physiology, pathology, and mechanics of the lesion and the mechanics of the corrective manipulation to be applied. This is absolutely necessary and worthwhile, and I would be the last to subtract one word or thought from the vast amount of fine work done in that direction. But that phase of technic we leave for the moment to others. The correction of the lesion is the end to be gained, an end to be thoroughly understood and completely visualized in every detail before we are ready to apply force to its accomplishment in technic. What we are concerned with here however, is the means whereby that end is to be gained, the method by which the operator is to apply the force through his own hands and body in order to correct the lesion. And it is our contention that very little thought has been given to this phase of technic. As we go on we shall see more fully what should be involved in analysis of the means whereby corrective effort is applied.

The second point follows closely, for much of our technic is the more or less close imitation of that of someone else. In imitating another, with our own minds focused primarily upon the end both are seeking, we note the more *apparent* factors in the other's technic, and attempt to imitate them intuitively. They may be wholly irrelevant personal peculiarities of action, but because they are peculiarities they are more obvious, and hence more subject to imitation, sometimes to the exclusion of any consideration of the really fundamental factors of the technic imitated. We shall show later that even though we have noted factors that are not peculiarities but that are fundamental, our method of intuitive imitation is most apt to be ineffective. An example or two is here in order.

For several years I was associated with a most excellent technician who weighed 225 pounds and was perhaps five feet, eight inches tall. I weigh one hundred and forty pounds and am almost six feet tall. Does it not seem obvious that his eighty-five additional pounds and the shorter leverages incident to his lesser height would enable him to use successfully some methods that I could not hope to imitate as such ? The reverse is equally true. There is another excellent technician in our state who can perform tremendous feats of strength. Some things which he does with ease I could not do at all. Shall I blindly imitate his technic? The point is that blind imitation must in this case be replaced by rational translation into terms of the fundamental mechanic of the operator's use of himself. Does this point seem too obvious to merit mention? And yet, I observed a technician instructing a group at a school as a special instructor. Most of the students were tall and thin, some of them women with anything but husky physiques; the instructor was short and fat, with a well-rounded abdomen. The patient was seated on the table, pulled over off balance and leaned against the instructor's body, while a lower cervical correction was made, easily, smoothly and effectively. The students were uniformly failing to follow suit. Not one could support the leaning weight of the patient easily as did the stronger instructor. The fact that the students had no protruding abdomen and heavy chest permitted the patient to fall too far over and hence out of the correct position, and too close to the student to permit him to use his longer arms at effective leverages. Yet my suggestion that these points might be factors in their failure was dismissed as being unworthy a moment's thought. Instructor and pupils were concerned solely with the ends to be gained and with the grosser imitative factors. I am sure that that hour was largely wasted. Does not your own experience indicate that these considerations are worthy of more attention than we usually give them?

We noted, third, that our methods are based mostly on trial and error, and again we are thinking here not of the mechanics of the lesion as we might put it through a trial motion in sensing the requirements for correction, but of the mechanics of the operator as he applies his force. We have given little thought to a *reasoning* analysis of how we use our own organism in the application of force to the correction of a lesion, and this important point we will consider later in greater detail.

Fourth, we have said that by its very nature our method of learning technic possesses inherent qualities that effectually prevent our perfecting it as we should in most instances. To demonstrate this, let us look back to our earliest efforts to correct a lesion. We had, necessarily, spent hours familiarizing ourselves with the physical, functional, and mechanical components of the lesion, and our attention was fixed upon the end to be gained, namely its correction. We approached it rather fearfully, for we had had it impressed upon us, properly of course, that too much force or force wrongly applied might traumatize tissues. We observed the method our instructor used, and because none of us had given much thought to a careful analysis of the use of the operator's own body to produce and apply force, we observed chiefly the grosser elements in his technic. Then we tried to follow him and to make the correction, and no doubt failed, and tried again and again, using our entire organism in a tense, awkward and wholly inefficient manner. Somewhere in the course of these trials the correction was accomplished and upon our sensitive subconscious mind was registered a picture of our tense, wrongly used body as it triumphantly gained the end. The subconscious mind immediately associated the satisfaction of gaining the end with the means whereby it was won, no thought being given to the poor thing indeed that this means was; and thus was established upon a wholly illusory basis a sensory impression of right feeling, so that this so incorrect method felt right to us, seemed to us skillful. Again and again we succeeded in making the correction, always in the same tense way, always with the same awkward, improper use of our self until this misleading sensory impression became fixed as the sine qua non of effective technic. It follows that no matter how much we seek to improve and polish our technic, no matter how skillful it becomes, it is conditioned by the necessity for making it "feel right," in terms of this habitual familiar sensory impression which because of its genesis is almost certain still to be incorrect and misleading. Hence, however much we will to incorporate new and better methods into our habitual procedures, we fall far short of that which we ought properly to expect of ourselves unless we analyze the subjective factors of our technic in a critical and objective manner.

At the risk of repetition and for the sake of emphasis, let us recapitulate with a little different approach. F. Matthias Alexander[2] in his book, "The Use of the Self" discusses his difficulty in correcting certain bad habits in the use of his voice and states: "I was indeed suffering from a delusion that is practically universal, the delusion that because we are able to do what we 'will to do' in acts that are habitual and involve familiar sensory experiences, we shall be equally successful in doing what we 'will to do' in acts that are contrary to our habit and therefore involve sensory experiences that are unfamiliar." His basic contention, and he goes to great length to prove it effectively, is that man, living under modem conditions, possesses a distorted sensory appreciation that is thoroughly inadequate and unreliable. Sensory appreciation pertains in the case of osteopathic technic both to the sensing of what is to be done, i.e., of the conditions that exist with respect to the lesion at hand; and to the sensing of our own muscle and nerve activity in response to the mental command by which we initiate and carry through the requisite movement of correction. That which is habitual with us is the act or method which feels right as we do it; and we have seen that the feeling that a given technic is right and that it is skillfully done has no such realty as we attribute to it, for it is extremely unlikely that our habitual mode of execution is right.

Our first steps were halting and uncertain. We had an inadequate conception of the thing to be done, of the method of doing it, because both were based in the beginning upon theory and not upon experience. We were a bit fearful of the danger of doing it wrongly. The result inevitably was a state of tension on our part, muscles wrongly used; inefficient, improper leverages; poor timing; no follow through. Long before we could have had time to work out the correct method, even if we had been approaching the problem with clear reason rather than by instinct and intuition, we had established habits of action that were, and are, inescapably bad. Because our method of self-improvement is by imitation and by trial and error, much of this habitual tension and ineffectiveness of incorrect use of self carries over from the old into every successive attempt at self-improvement, thus perpetuating the bad habits of use. Our mind is so fixed upon the end which we have in view, that we disregard the means whereby that end is to be gained, and intuitively, fall into the habitual wrong use of our organism, the while having the sense of right feeling and of satisfaction with our work. The result of this process is that the harder we try, the more fixed is our attention upon the end to be gained and the more we revert to the habitual and wrong use of our organism.

Having thus shown that our technic is so unlikely to reach the perfection that we seek, we seem to be left running in circles in a blind alley, except that this same Alexander[2] comes to our rescue with a means of extricating us from our predicament. His method seems disarmingly simple in theory, but to put it into practice is another and far more difficult thing.

In applying his method to this problem, the first emphasis is laid upon the fact that the new and better technic contemplated must be worked out, step by step, in detail, first, as to the precise conditions of the lesion and the mechanics of its correction; and second, as to each successive step in the particular and correct use of our own bodily mechanism in such a way as adequately to meet the requirements placed upon it by the nature of the lesion. In other words, every detail of the lesion must be visualized, then each successive step in the procedure of correction must be completely worked out, so that one has clearly in mind the precise method whereby the operator uses himself to apply his force, in order that it will be possible for him consciously to project the directions required for putting into effect this new means to the end.

Let us outline very briefly a few of the factors to be considered in such an analysis of a procedure of technic. It is assumed that one has already visualized the mechanics of the lesion which determine the direction and the distance through which the corrective force must move, and the tissue resistance which conditions the amount and speed of the force One then considers the use of his own body, determines which of the available fulcra is to be the fixed anchorage and which the subsidiary moving fulcra so that the leverages of his body may be used to the best advantage. He recognizes that short leverages are best for accuracy and ease in the application of force; and that his muscles work best when they and the levers upon which they operate move close to the middle of their possible range. He senses in advance the feel of his own muscles as he expects them to act and move to accomplish his purpose. He considers the follow through and visualizes the smooth acceleration of force to the maximum at the point of thrust, and equally the deceleration to a state of dynamic relaxation. Thus each phase of the movement which he is about to initiate is clearly reasoned through and keenly sensed.

To these few factors that we have outlined one may readily add others. So, having in mind each carefully reasoned successive step of the new technic one proceeds to put it into effect. But here failure again faces us, for the mind leaps instantly to the end to be gained, and the immediate response to the order of our mind to act is always the intuitive, the habitual response, and not a response in the direction of this new use. This will be especially true since certain elements of the old and habitual method have probably been found good and have been thought worthy of incorporation into the new; and their presence is an additional urge to fall back upon the old in toto.

Alexander[2] faces this impasse with the principle of *inhibition* of the *immediate response.* Recognizing the certainty that the body's immediate response to the mind's order to act in each successive step of the new technic will be the habitual and probably incorrect response, one gives the mental order and then consciously inhibits or holds in abeyance the active response to that order, consciously reviews and senses again in detail what the body must do to accomplish this first projected phase of the procedure in the new manner and brings one's sensory awareness of it into line with the premeditated new plan of action. This means that one places oneself and the patient in position for the corrective movement, then, consciously assuming a state of dynamic relaxation, projects the mental orders needed to initiate and carry through the first phase of the technic previously determined. Actual and complete action, however, is inhibited, while one's position, physical reaction, and readiness to go on with it are studied. Then when one is sure that the first phase of the old method is completely inhibited and that the new is thoroughly sensed and understood, one practices this first step, always under conscious direction, until it is thoroughly familiar and is no longer a new sensory experience. Each successive step is thus practiced under conscious direction, beginning always with the mental projection of the contemplated act, and the inhibition of the immediate response, and followed finally by the act itself. When all phases have individually become familiar sensory experiences, they can be linked together as the completed procedure, which is then carried out in its entirety, still under conscious control. Only when the completed act has been carried out many times under conscious control can it be safely dropped into the subconscious and permitted to become habitual. It is particularly emphasized that it is the *means whereby* the correction is to be made and not the end to be gained that is here under conscious scrutiny. We must believe that our reasoning has not led us astray, and that, therefore, the means having been thought through correctly, the end must necessarily follow without our taking thought of it at this time-else at any stage we slip back into habits that still feel right because they are still relatively more familiar.

Undoubtedly such a process of re-education is difficult-how much so we will realize fully only as we try it and find how completely we tend to fall back into the old channels. Such a method certainly requires detailed study, painstaking, time-consuming practice. I believe, however, that if we apply this method to the perfecting of one technical procedure at a time, it can be utilized practically in everyday work, and that in so doing we will find ourselves amply repaid. We will eventually develop far more effective technic which will be applied smoothly and easily and with great conservation of time and energy. We will find that our whole bodily organism will be used with far greater facility and proficiency than any of us has as yet experienced. I am convinced that we will note a surprising renewal of mental and physical energy and a consequent easy assurance and dextrous effectiveness in our work that will greatly enhance our value as physicians and our personal satisfaction and pleasure in our work. Few of us realize, fewer utilize, the vast potentialities that lie within us. The purpose of this paper is to aid us to do so, by presenting a plan for conscious control and re-education in the use of the self in effecting lesion correction.

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***Delivered before the General Sessions at the Forty-First Annual Convention of the American Osteopathic Association at Chicago July, 1937.**

Method of Determining the Most Applicable Technic*

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It is the purpose of this paper to show first, that technical procedures are subject to classification in accord with the local pathology of lesions, and second that examination of the lesion area sufficient to indicate the types and location of pathology, predicate the choice of manipulation.

CLASSIFICATION OF PERIARTICULAR PATHOLOGIES

Periarticular pathologies are most easily understood from the viewpoint of their usual progressions. It is unnecessary, for the purpose of this discussion, to review the details of physiology which bring about the sequences. It will be sufficient to mention the predominating changes which typically occur around a joint.

In accord with this idea, trauma will be considered the agent of lesion production and it is of no importance whether the trauma results from sudden, violent strain or whether its influence upon the joint is effected through many and continued lesser strains.

The irritation produces inflammation. The early inflammatory stage demonstrates the characteristic early responses of supporting tissues to inflammation, namely general accumulation of fluid wherever space permits. This fluid is intracellular and extracellular and the edema involves the cartilaginous surface of the joint, the disk, the intravertebral ligaments andextends outward into the muscular components. The edema increases the elasticity of normally inelastic white fibrous material and decreases elasticity of yellow elastic fibrous material. The consistency of the hyaline cartilage is varied by its accumulation of fluid with the joint surface becoming changed in contour and irregular of surface. The accumulation of fluid in this tissue is believed to be greatest where pressure is least. Thus abutments occur around the margins of opposed bony surfaces.

Characteristic changes take place in muscle in that the presence of the inflammation, together with the disturbed nerve reflexes to them and the tension variabilities which accompany the lesion, bring about a marked increase in muscle tone and metabolic rate.

This stage of early inflammation, upon examination, presents the following characteristics: The joint is somewhat impaired in quality and freedom of mobility; the tissues feel heavy and are spongy or logy and the deep layers return the characteristic responses of tense, angry, hypertonic muscles. Tenderness is diffuse, though more marked at some points. This stage is sometimes described as the stage of soft pathology.

The second characteristic stage represents the condition of a joint in which the end product of an earlier inflammation predominates. This stage has been variously denominated as chronic lesion, fibrotic state, and by other descriptive terminology. It might well be termed the stage of hard pathology. It is the result of the accumulation of white fibrous material. An inflammatory state, if long maintained, accomplishes the destruction of some portion of functional tissues related to the joint. Thus, yellow elastic fibrous material may be succeeded by white fibrous material and muscle fibers may be replaced by white fibrous material. In addition to tissue replacement, a new deposit of cicatrix occurs which increases the total as well as the proportionate amount of periarticular white fibrous material when compared with that of a normal joint.

It is well established that impairment of joint movement and the loss of alternating pressures on hyaline cartilage will result in thinning of the cartilage at some points and thickening of the cartilage at other points. In fact, this is one of the intrinsic adaptations of a joint to lost movement.

It should also be noted that normal bone formation follows and meets stress requirements; it is common and to be expected that some slight or considerable change in bone formation will be present in this stage of lesion pathology. A good illustration of these osseous changes is seen in the marginal infiltrations of beginning exostoses.

Examination of such a joint demonstrates an expected finding; joint mobility is actually decreased in range. This impairment of movement is characteristic in that such movement as is present is accomplished with as much ease as in normal joints, but the actual range of movement is markedly decreased. The tissue does not feel angry and edematous, but hard, stiff, and rigid. Usually, the total amount of soft tissue is decreased and the articulation feels "naked."

It is obvious that the classification given above is inadequate and some exposition is necessary to make it comprehensive. It is probable that neither of the typical conditions described above is often found uncomplicated. The first could only be found where recent injury had been imposed upon a hitherto normal joint. All experienced operators are aware of the infrequency of such circumstances.

It is likewise true that a lesion in the chronic state, entirely devoid of active inflammation, is rare. The acute or early inflammatory stage does not cease abruptly to be followed instantly by the chronic changes, but gradual reduction of acute inflammation and the gradual inclusion of fibrotic infiltration occurs simultaneously, with the result that the earlier stage shades off into the later. Also a new injury with its complement of new inflammation is frequently superimposed upon chronic lesion pathology, thus giving combined pathologies. As a matter of fact, most lesions under treatment are representative of this mixed stage, in which, however, the acute process or the chronic process predominates. These two types must be considered as representative of an idea rather than as actualities. The classification is none the less practical because, even though the perfect picture may not obtain, lesions in which one of these pathological types predominate to the practical exclusion of the other are the rule. It is fundamental to good therapeutic procedure that the operator make differentiation in order that the most effective therapeutic measure be intelligently inaugurated.

TYPES OF NORMAL MOVEMENT

A typical spinal articulation is subject to several different types of movement. Extension, flexion, sidebending and rotation represent the simple movements. Of these, it is generally agreed that sidebending and rotation are complementary movements. Appreciable sidebending occurs only with some associated rotation and appreciable rotation occurs only with some degree of sidebending. It is also well understood that exaggeration of, or decreases in, the normal anteroposterior spinal curve exerts well defined influence upon the association of these complementary movements, and thus upon total spinal joint movement. Much clarification of this subject is due to the work of Drs. Fryette, Chester H. Morris, W. A. Schwab and others. A thorough knowledge of the mechanics explanatory of physiological movements is prerequisite to skillful technic. It is not the purpose of this paper to discuss the details of this problem. Mention of this phase of technical study meets the immediate requirement. Its elucidation may be effected in the demonstration of technic.

These types of movements become important in selection of a technic in order that force may be directed to the restricting pathology.

LOCATION OF PATHOLOGY

It is seldom, if ever, that the associated factors which produce inflammation in the joint impose equal injury upon all parts of the tissue which comprise the joint. Greatest injury occurs on one side or the other, anteriorly or posteriorly, in disk or in one capsule, etc. For that reason, the pathological deposits are not symmetrically placed and the findings which are included in the diagnosis of the lesion are, in large measure, based upon asymmetrically placed pathology and the asymmetry in osseous position and unequal ranges and freedom of movement resulting from it. It is this unequal deposition of inflammation and end products of inflammation which cause and maintain articular malposition. Frequent error in viewpoint results from the thought that malposition determines the presence of pathology rather than that the pathology determines the malposition.

SELECTION OF THE MOVEMENT DIRECTION FOR THE MANIPULATION

It is to the selection of manipulations to overcome the restricting factors in lesioned joints, that interest is next directed. The problem is divisible into two considerations: First, a movement which will direct force against the restraining factors, and second, a type of force which will be properly effective when applied to the special type of pathology. The selection of type of movement is determined upon knowledge of movements to which a normal joint is subject, together with a knowledge of the specific impairment of normal mobility found in the lesioned joint.

It has frequently been said that good technic consists of requiring a joint to pass through all of its normal ranges of movement. This statement is literally true but not practically subject to literal application. The actual problem is not as easy as this simple statement of intent suggests.

It is not sufficient to apply equal force to a joint in all of its expected directions of movement, upon the assumption that such a force will result in the inauguration of total freedom of movement. It is obvious that a deposit of pathology in a joint which is capable of producing and maintaining malposition is as strong, if not stronger than the normal restraints for that joint. Thus, equal force applied against a joint to produce all of its possible directions of movement would result unfavorably because a force adequate to overcome restraining pathology would be a force sufficient to injure normal joint restraints, and a force which would not injure normal restraints would have no appreciable effect upon the pathology.

It therefore becomes necessary to determine the specific interference with movement or loss of mobility, to place this impairment exactly in its categorical classification of possible joint movements and to devise a movement, either simple or combined, which will permit the application of force exactly to the restraining pathology. By so doing, greater force may be applied without detriment to those parts of the joint which are normal and with greater effectiveness to the pathological constituents of the joint, which it is the intent of the manipulation to reach. The joint should be examined for lost extension or flexion, and for lost rotation or sidebending to one side or the other. The manipulation should be such as would specifically tend to overcome the lost mobility by overcoming the specific restraint. In some lesions, it would only be necessary to effect extension or flexion; in others, rotation in others, rotation and sidebending; in another, flexion with rotation and sidebending or in another, extension, rotation with sidebending, etc. Careful examination of a lesion usually demonstrates greater impairment in one or two of these types of movements. It is possible, of course, for a joint to be impaired equally in all of its movement ranges. Here again, the discourse deals with a principle by which an intelligent application may be made. Such a viewpoint takes the problem of lesion diagnosis definitely out of predetermined classification of lesion, and permits the operator intelligently to consider every possible impairment variation of joint mobility.

TYPES OF FORCES

All experienced operators recognize that the quality and the amount of force necessary to effect adjustment of lesions is subject to wide variation. Experienced operators have learned, by one means or another, how to predetermine the nature and amount of force which the joint to be treated requires. The force element in technic is subject to such diversification in classification that no one classification of force is truly comprehensive. It is best that force be applied to a joint only when the subject has permitted proper relaxation. This demand has given origin to classification of force which permits smoothness in operation. It is also necessary that the operator develop intrinsic neuromuscular coordination and this requirement is the progenitor of classification of force in terms of the activity of the operator. Paul van B. Allen and James A. Stinson have made notable contributions in this field. Also, comprehensive classification of the force factor as related to the lesion proper has been presented. Time does not permit a much needed review of this phase of a study of technic. Only such a consideration of this problem will be included as will apply to the two general types of lesion pathology discussed in this paper.

In the edematous stage of lesion, which includes hypertonicity of intrinsic muscles of the region, rapid movement with or without great force, is not effective. Force applied to such a joint must be of such rate of speed as will permit the movement of fluid and give sufficient time for the relaxation of muscle. It is to be remembered that the infiltration of fluid involves not only ligaments and capsules. but also the disk and hyaline cartilaginous suface of the joint. It is also essential that the force be applied only after test movements have demonstrated that the joint has approached the position where adjustment may logically be expected. It is imperative that sufficient relaxation of muscle and sufficient movement of fluid take place before the application of a major force, that the force, at the end of the manipulation, be applied against the major restraining factors. Moreover, failure to avoid the influence of an unknown quantity of edema, and of an undeterminable degree of muscle contraction, deprives the operator of the certainty that proper complementary movements will occur. The force may, therefore, result in a marked increase in joint injury.

It may be generally stated that force applied to lesions in which the inflammatory stare predominates, should be applied slowly and through a considerable range of movement with the greatest actual force at the end of the manipulation. This terminating force should not be applied until the operator is assured that the joint has approached a position proper to receive it.

In the typical chronic lesion, a very different condition exists. The problem is primarily one of destruction of established cicatrix. The quantity of force must be adjusted to two requirements; it must be sufficient to destroy the continuity of some proportion of the limiting fibrous material, but it must not be great enough to produce injury which will establish a condition of joint inflammation beyond physiological hyperemia. It is known that these fibrous materials, when ruptured, will be absorbed, if the condition surrounding the broken fibers permit an adequate circulation. It is corollary to this that ruptured fibers are not absorbed and that new fibrous deposit follows the destruction of cicatrix in which the circulation is not adequately maintained. The force must be apportioned to meet both of these demands.

As stated earlier in this paper, if any movement is present in a typical chronic lesion, that movement is easily affected within its actual range. This, of course, is due to the absence of free fluid accumulation. Also, as earlier stated, the impairments of movement in chronic lesions are impairments of actual range rather than impairments of freedom of movement or quality of movement. It may, therefore, be assumed that a chronic lesion while being placed in position for adjustment, will move through its range of movement without difficulty and be stopped by the presence of the abnormal fibrous accumulation. It sensibly follows that the force should not be of the long range type, but must be one of considerable amount. In order that considerable force may strike the pathology accurately, it is essential that the lesion joint be carried to the position for adjustment and that all freedom of movement in that direction be effaced. When this has been accomplished, a strong force of short range movement accomplishes the intended and desired result. Long range, forceful movement would **cause** too much destruction of cicatrix. No rule can be formulated which will indicate the amount of force which a given lesion may require. This decision is a matter of careful thought and experienced judgment. It is apparent that the ability to make this decision is not impossible to an operator who endeavors to avail himself of it.

It may be generally stared that chronic lesion pathologies are best treated with movements of short range and considerable force.

GENERAL CONSIDERATION

Such formulary as has been presented might be subject to apt and adverse criticism if some thought to practical adaptations were nor included. The most concise presentation of this phase of technical study has come from John A. MacDonald. First of all, most lesions are representative of the dual pathology, but of far greater importance in the application of this idea, is the fact that the types of pathology in lesions under treatment vary from treatment to treatment. In those lesions in which the acute pathology predominates, if the manipulations are properly chosen, the acute stages gradually disappear and the operator finds himself dealing with the residue of an earlierpathology or residue of the recent inflammatory state. The intent of the force application should be altered immediately by this change in the lesion condition. Also, in chronic lesion subjected to intelligent manipulations, dissolution and resorption of the fibrous material occurs. It is the desire of all operators to bring about recovery from chronic pathology as rapidly as possible. This desire frequently results in the application of a force which is somewhat greater or too frequent than is best, with the result that some degree of general inflammation results. When such an occasion arises, the treatment should be changed immediately to come into accord with the pathology which is present. Failure to recognize these changes constantly occurring in areas of lesion results in most unfortunate outcomes.

CONCLUSION

The most acute problem of the technician is that of selection of manipulation which meets the demand of the pathology of the lesion. Such a manipulation must be adapted to at least two requirements; the manipulation must be one which directs the desired force to the location of the pathology of that lesion, and it must be one which includes a force adapted to the type of pathology present.

***Read before the Technic Section, A.O.A. Convention, Detroit, 1932.**

Teaching of basic principles of osteopathic manipulative techniques

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Individual manipulative techniques are emphasized in osteopathic teaching, rather than relationships among procedures which are founded on basic principles. Manipulative techniques can be classified as long- or short-leverage procedures which are modified and adapted to the individual patient. Accurate localization and monitoring of forces are critical factors in the skillful use of manipulative technique.

The goal of teaching of osteopathic manipulative techniques is to convey to the student an understanding of both basic principles and basic technique procedures and their appropriate modifications. Ideally, each physician should be capable of devising his own technique procedures based upon an accurate diagnosis, a knowledge of basic principles, and adaptations to meet the specific needs of the patient. Each physician modifies his technique according to the treatment situation. The acme of skill in the use of manipulative technique is the ability to select procedures appropriate to the patient's condition, to modify them properly, to control and accurately localize the introduction of motion into a joint, and to monitor it during the course of treatment.

Osteopathic manipulative techniques are usually taught as individual procedures; seldom are fundamental relationships among procedures emphasized. The present method of teaching reinforces the sense of uniqueness of each technique which is created by the lack of appreciation of the basic similarities in procedures.

Students become overwhelmed by the large number of techniques which they are required to learn rather than appreciating that there are basic principles of technique which are common to all procedures. There are also basic procedures which are modified in different ways by each physician as he applies them to the unique circumstances of individual patient care.

Classification of techniques

The barrier of resistance to joint movement is used as the basis for classifying osteopathic techniques as direct, indirect, and combined procedures. Direct techniques such as articulation, thrust, and muscle energy, use operator forces against the resistant barrier. Indirect techniques such as functional and balance and hold techniques, direct operator forces away from the resistant barrier. Combined techniques utilize a combination of indirect and direct principles. The fundamentals of patient positioning, localization and monitoring of forces, are equally applicable in direct, indirect, and combined techniques. In this discussion, direct techniques will be used to illustrate basic technique principles.

Direct manipulative techniques may be further classified as long- and short-leverage techniques. The majority of direct techniques are long-leverage procedures. Either the joint segment below is fixed and the body unit above, including the joint segment above, is moved in relationship to the fixed segment below, or, conversely, the upper segment is fixed and the body unit below, including the segment below, is moved in relationship to the fixed segment above.

In short-leverage techniques, forces are localized at the joint as body units above and below are either locked or positioned to limit movement. Force is directed to the upper or lower joint segment against the secured opposite joint segment. Examples of short-leverage procedures are those using forces applied to the spinous process or transverse process of a vertebra.

Modifications

All direct techniques may be described as modifications of long- and short-leverage principles. Variations include the following: (1) Patient position (may be standing, sitting, or sidelying, either supine or prone); (2) operator position (will be adapted to the patient position); (3) placement of the operator's hands; (4) method of localizing forces; (5) amount and direction of force; and (6) use of patient cooperation, for example, the use of breathing, muscle contraction, and relaxation.

Minor modifications of a basic technique may be illustrated by the use of a knee thrusting procedure in the thoracic spine whereby the operator's hands may be placed on different parts of the patient's arms or the patient's arms may be placed in different positions. Examples of variations of handholds used to secure the patient are the position of the patient with his hands clasped behind his neck or his arms crossed on his chest. These may be described as minor variations of the basic knee thrusting procedure, rather than describing each separate handhold as a different technique.

An example of a major modification of a basic procedure is when the knee thrusting technique is used in the lumbar spine in contrast to the thoracic spine. Not only are the handholds varied under these circumstances, but consideration must also be given to the different conditions to be addressed including the different joint facet facings, different leverages, and the necessary changes to obtain localization of forces. This is quite in contrast to the minor modifications used to secure the patient by a change in the position of the patient's or operator's hands.

The use of major and minor modifications of a basic technique demonstrates the wide range of changes in a basic procedure that are available to the physician. A major goal for students of manipulative technique is to be able to take the basic principles and procedures and modify them according to the unique circumstance in which they are applied in patient care. Technique procedures are selected and modified to meet the needs of a particular patient situation. If greater force is required, a long-leverage technique will be selected. Short-leverage procedures permit greater control and fineness of movement.[1] In general, modifications of technique will consist of minor and major variations of a basic procedure. Further variations in technique result from the physician's assessment of the clinical situation.

Some factors to which the physician responds are as follows: (1) size of the patient; (2) acuteness or chronicity of the problem; (3) patient's age and physical conditions; (4) patient's ability to relax; (5) physical condition of the physician; and (6) available physical facilities and equipment.

These factors will affect such aspects of treatment as dosage, duration, timing, and use of body weight.

Localization

The principles of localization of forces and/or joint locking are essential elements of skillful technique. In situations in which minimal corrective forces are utilized, localization of the apex of the force at the joint may be achieved by a counter movement above, in contrast to the movement below. In cases where greater corrective force is necessary, localization may be effected by a fixation of one segment of the joint and a counter movement through the other segment introducing localization at the joint. In addition, localization may be effected by a combination of focusing forces and joint locking. One segment of the joint is fixed and the other segment including the body unit is carried into a position of joint locking. This minimizes movement in the joints adjacent to the one being treated. Once localization is obtained, the corrective force may be achieved by use of long- or short-leverage technique principles.

Localization is achieved by placing the fingers of one hand at the joint to monitor the introduction of movement. Precise localization is essential to control the application of force. The timing, speed, direction, and amount of force must be monitored, as well as the response of the joint tissues to treatment.

In the spine, movement may be monitored at the interspinous interval, the transverse processes, or the facetjoints. As movement is introduced into a joint, motion is also created in the joints above and and below. However, the apex of the force is localized in the joint to be treated. Motion in the neighboring joints is controlled by accurate localization or joint locking, or a combination of both. This is essential to minimize the forces in the neighboring joints and to ensure exact localization of forces in the joint to be treated. Accurate localization of forces permits the use of less force in the technique procedure.

In a direct technique procedure, movement is introduced into the joint and taken up to the barrier of resistance. In the case of a spinal joint, usually flexion or extension is introduced first, followed by sidebending and rotation. It should be noted that the introduction of flexion or extension limits the range of the subsequent movements to a minor degree as they approach the cumulative resistant barrier. The forces are accumulated just short of the sense of hard contact. At this point, forces are localized at the joint so that any of the direct technique procedures could be introduced-articulation, thrust, or muscle energy. The technique selection requires the introduction of the variations that are appropriate to the chosen procedure. Corrective forces that may now be introduced by direct technique have a short range, which is usually less than l/8 inch.[2] The maximum amplitude and range of force occurs at the joint being treated, so that movement above and below the joint are of a lesser magnitude and well accommodated. In no case should movement exceed the anatomic barrier of any joint.

Fixation or locking

The principle of joint fixation and/or locking is carried out by fixing one segment of the joint complex as movement is introduced through the other component. For example, in the spine, the lower segment is fixed and then either flexion or extension is introduced up to the resistant barrier. In the case of extension, the facet joints become more fully congruent or assume a closely packed position,3 which is further accentuated as small increments of sidebending and rotation are introduced. The spine acts as a rigid rod and thus limits movement in the joint above the point of fixation. Movement is taken up to the point of maximum tissue tension, described as "taking out the slack." In the position of flexion, locking is similarly obtained by joint apposition which is increased by small increments of sidebending and rotation. Locking is also obtained by a greater degree of tissue tension as the fibrous capsules and ligaments are placed in a position of maximal tension. When joint locking is employed, movement at the joint to be treated is carried to the point just short of the close-packed postion allowing a small degree of motion attributed to the elastic deformity of the articular cartilage and joint ligaments.[3]

It should be evident that the degree of force that must be employed in a technique procedure is related to the precise localization of forces. If forces are improperly accumulated at the joint above that which is to be treated, more force will be necessary to attain the proper degree of force in the joint to be adjusted. There is also the danger of adversely disturbing the joint above. The degree of force should be only that which is sufficient to obtain the desired result from treatment. A trial of treatment is sometimes employed to assess the degree of tissue resistance. Sufficient force is then introduced to address the barrier of resistance. Skillful technique should be silent and painless. The range of final movement should be finite and the forces should be just sufficient to overcome the resistance. The speed and timing are variations that have to be adjusted to the individual circumstances. Speed may be appropriate for smaller operators lacking the ability to use body weight. Speed may also be necessary along with accurate timing in the apprehensive patient in order to take advantage of the patient's momentary ability to relax. Relaxation is often assisted by positioning the patient just short of the resistant barrier rather than firmly against that point.

Summary

Direct technique procedures employ either long- or short-leverage principles which are modified by the physician to meet the specific needs of the patient. Manipulative technique not only requires a knowledge of the principles of leverage, but also the ability to localize and monitor forces accurately. Proficiency in the use of manipulative technique is based upon a knowledge of basic principles and their application to patient care.

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Accepted for publication in January 1982.
This paper was presented at the Metropolitan General Hospital meeting, St. Petersburg, Florida, on February 7,1981.

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Direct action techniques

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The focus of this presentation is joint mechanics, motion disturbances, and direct action osteopathic manipulative techniques. Appropriate and inappropriate applications are given, and various theories about joint restriction are explored.

Osteopathic manipulative treatment is one of the many tools used by osteopathic physicians in the treatment of patients. It is important to remember that we are treating patients, not just joint disturbances. Conceptually, we should not remove the musculoskeletal system or the disturbed joint from the patient, treat it, and put it back.

The osteopathic philosophic understanding of structure-function interrelations leads the osteopathic physician to conclude that musculoskeletal changes are related to the health of the patient, and treatment of musculoskeletal problems improves the level of function (or health) of the patient.

MacBain,[1] in identifying the visceral, psychic, and somatic components of disease, enlarged the basis of understanding of ourpatient-oriented approach to diagnosis and treatment. Still[2] stated that health is normal in a structurally sound body, while disease is normal in a structurally unsound body.

Although my paper focuses on joint mechanics, motion disturbances, and thrust-type manipulative techniques, it should be kept in mind that these are descriptions of tools used in diagnosing problems and treating patients. Our overall concern is with the patient, not just a joint.

The purpose of my paper is to discuss direct-action techniques or, more specifically, thrust techniques. I shall attempt to describe how they are carried out or at least what the operator thinks is being done. I shall attempt to describe what the operator observes as a result of applying the technique and to generate some postulates regarding what might have happened. Lastly, I shall raise questions.

First of all, I should like to define some terms or key words and present some basic information which I believe is essential to the understanding of this discussion.

Somatic dysfunctions or motion disturbances associated with the osteopathic lesion can be described or named in three ways, (1) the direction of increased freedom of motion, (2) the position in lesion, and (3) the direction of limitation of motion. There is usually an asymmetric pattern of motion in somatic dysfunction, with restriction in one direction and increased freedom of motion in the opposite direction. In most cases the position and direction of free motion are the same. The term "barrier" is used to describe the end point of permitted motion in the direction of limitation.

A hypothetical somatic dysfunction will illustrate this point (Fig.1). Let us assume that the fourth thoracic segment exhibits restriction of left sidebending in relation to the fifth, is freer in right sidebending, and is in a right sidebent position. If the operator introduces left sidebending to the extent of permitted motion, the barrier is engaged. Other terms which have been used to describe the dysfunction include "taking up the slack or free play" and "engaging the restriction."

The terms direct and indirect technique become applicable at this point. Direct technique involves engaging the barrier. In the example under consideration it would involve moving the fourth thoracic segment to the left to the limit of permitted motion. Indirect technique involves moving away from the barrier, usually to a point where tension is balanced in all directions. In the present example, T4 would be moved to the right.

If direct technique is applied, the next stage after the barrier has been engaged is the activating force. In thrust technique this is applied by the operator in the form of a "thrust." Velocity and amplitude have been used to describe the nature of the final activating force, for example, a high velocity/low amplitude technique. Such a technique involves a quick (high velocity) thrust carried through a short distance (low amplitude). The treatment procedure described as articulatory is a low velocity/high amplitude treatment, in which the rate of motion is slow and the distance great. In the spectrum of thrust-type manipulative procedures, some thrusts involve high velocity/high amplitude technique, in which the corrective force is carried through a great distance rather than a minimal distance. In some situations the velocity is varied, so that some thrust techniques actually are low velocity/low amplitude maneuvers. I think all osteopathic physicians have observed a total spectrum of variations of amplitude and velocity in the application of technique.

Appropriate and inappropriate applications

An example of inappropriate technique is a rebound thrust in which the force is directed away from the barrier and not into the barrier. An alternate term for this is "exaggeration thrust." Some chiropractic techniques utilize this type of rebound. I never have been taught this type of technique, and perhaps it is for this reason that I choose to condemn it. I believe that this type of technique introduces an excessive amount of force, which the patient's body must absorb as a side effect, or perhaps iatrogenic effect.

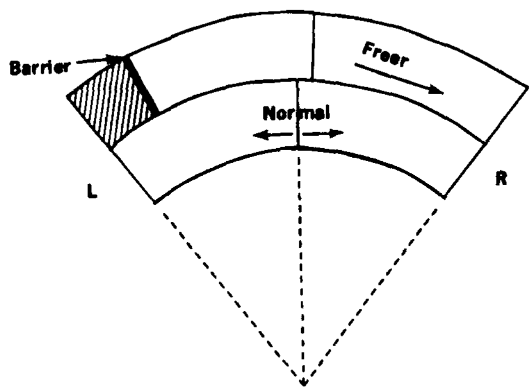

Fig. 1. *Schematic drawing representing normal joint motion and disturbance of motion associated with an osteopathic lesion. The limitation of motion is seen to occur within the boundaries of the normal physiologic range of motion. Subluxation and dislocation occur outside the normal boundaries and are orthopedic problems. The positional change in an osteopathic lesion usually occurs in the direction of increased freedom of motion.*

There are forms of "exaggeration technique" which are effective and nontraumatic, however. Within my own therapeutic practice I use indirect nonforceful technique, and I should urge anyone who wishes to treat a lesion by moving away from the barrier to use indirect technique rather than a rebound thrust.

Another inappropriate technique is a high velocity/high amplitude thrust, in which the barrier usually is not engaged. Instead, the starting point is the neutral midrange. The process of cranking a neck to the right and to the left with considerable force is an example. There are other situations in which the barrier is engaged, but the amplitude is excessive. Once the thrust is applied, the lesion segment is carried through a great range of motion. This often is a byproduct of excessive force. The greater the amplitude, the more difficult it becomes for the operator to localize the force precisely. This type of application results in side effects and occasional iatrogenic problems.

Another inappropriate application of thrust technique results from failure to diagnose the condition. There are many highly skilled and highly effective practitioners who fine-tune the localization of force without ever consciously thinking about how they are doing it. In the office setting they are not required to translate what they feel through their hands into descriptive terms such as flexion-extension, rotation, and sidebending. Such descriptions are necessary in teaching and may be useful in records, but the accurate localization of force must be felt by the operator. In contrast, often a manipulative procedure is employed without any attempt at diagnosis. The patient is subjected to a series of mechanical maneuvers with the hope that "If it is out, it will go back, and if it is not out, nothing will happen." Although this type of manipulative treatment often is better than nothing, I have to classify it as mediocre.

In the diagnosis of motion disturbances, some physicians try to interrelate pain and direction of restriction of motion. Maigne,[3] who was a student of Dr. Myron Beal, attempts to do this. While it may be appropriate to consider that manipulative technique should not be painful, this is not the basic issue. It is my personal observation that many thoracic extended lesions exhibit pain on exaggeration of the lesion (backward bending) and also exhibit pain on engagement of the barrier (forward bending). Diagnosis of motion disturbance must be done directly by motion testing.

On the basis of the foregoing information I shall proceed to discussion and analysis of thrust-type techniques.

I should like to describe a typical case involving use of a thrust technique. The patient complains of midthoracic discomfort. Musculoskeletal evaluation shows that T7 is flexed, rotated right, and sidebent right, with limitation of extension, rotation left, and sidebending left. Muscle hypertonicity and change in tissue texture are palpated at T7 right. The physician elects to use a knee-in-back technique with the patient seated on a stool. The patient is instructed to clasp his hands behind his neck. The operator places his left knee on the transverse process of T8 left and reaches his hands under the patient's axillae to contact the patient's wrists. Backward bending at T7 is introduced, and sidebending left is begun by moving the lesion complex with the operator's knee to the right and sidebending the upper part of the torso left. Left rotation is introduced through the patient's shoulders. The operator senses that the barrier has been engaged and all free play has been taken out. The final corrective thrust is executed as a quick increase of force from above, together with a force applied by the knee. The thrust is associated with a "pop." The condition is reevaluated, and the muscle hypertonicity is found to be gone and the motion normal. The patient reports that the discomfort is gone and the area now feels loose rather than tight.

This theoretical case history illustrates what frequently happens, and also serves to focus on some important questions. The first question is: "What is maintaining the restriction at T7?" I should like to explore several theories and explanations. For purposes of discussion, I shall classify these theories as mechanical and functional.

Mechanical theories

Within osteopathic literature there is a discussion of Webster's tripod. While I must confess that I probably do not understand this as Webster[4] did, I shall attempt to explain it. Webster likened a vertebra to a tripod with three points of contact for motion, namely, the two facets and the vertebral body or disk. Motion is facilitated by transferring weight to one of the legs of the tripod, which becomes a fulcrum around which motion occurs. Simple motion disturbances are those in which motion occurred, but return to original position became restricted. Complex motion disturbances involve an initial motion in which one of the legs of the tripod is the fulcrum, then weight is shifted so that a different leg of the tripod becomes a new fulcrum about which new motion occurs. Treatment of complex motion disturbances requires a two step procedure, undoing the motion pattern in the manner in which it occurred.

The Europeans have suggested the meniscoid theory.[5] This holds that motion disturbance is based on the physical entrapment of an anatomic substance (meniscoid) within the joint capsule. An essential component of treatment involves traction, which allows freeing of the trapped meniscoid. While traction often is not used in the description of a procedure, the actual application of most thrust techniques involves some element of traction.

Mennell[6] introduced the term "joint play." Not only has he written about this in his books and articles, but he demonstrated it at a previous Academy convocation. The simplest way that I can define joint play is to consider translatory motions or gliding motions of a joint. While flexion-extension may be the major motion of a joint, there is a certain freedom of side-to-side and fore-and-aft movement of this joint. These motions may be described as joint play. Osteopathic physicians talk about a principle in manipulative technique in which the minor motions, not the major motions, of a joint are the ones involved in restriction and in need of manipulative procedures. In a joint in which flexion-extension is the major motion, restoration of the fore-and-aft or side-to-side or translatory motions, joint play, or minor motions is the objective of the manipulative procedure. Sensing the nature of these types of restrictions may yield a somewhat different description for the usual three cardinal planes of motion, flexion-extension, rotation, and sidebending. Maybe in motion testing the physician is in fact sensing one thing and talking about something else.

In the fall of 1980 at Michigan State University College of Osteopathic Medicine I participated in an international conference on concepts of mechanisms of neuromuscular function. The Germans displayed some slides illustrating various mechanical principles involved in joint restriction. One illustration involved a dresser drawer. Normally, the drawer can be pulled in and out easily. However, if the drawer is skewed to one side, it becomes stuck. There were other slides with differing illustrations of the concept that a slight malposition can result in a major loss of motion.

It is comfortable for me to accept a postulate that mechanical malposition can affect joint motion. This mechanical malposition may be the result of trauma, mechanical forces, or contraction of muscle or connective tissue, or perhaps there are other causes. It is comfortable for me also to assume that direct technique can alter the mechanical malposition and result in freedom of motion. However, I am sure that any simplistic theory falls short of explaining complex dynamic living processes.

Functional theories

With regard to functional theories, I should like to explain what Dr. Norman Larson described to me as his understanding of the process of motion disturbance secondary to a visceral problem. Disturbed patterns of neural input result in hypertonicity of somatic muscles. Facilitation of an area of the cord takes place. Changes in somatic and autonomic outflow result in palpable changes in tissue texture and palpable hypertonicity of muscle.

Initially, there is a change of quality rather than of quantity of motion. Passive motion testing reveals no loss or minimal loss in the total range of motion, but the operator force required to reach the end point of motion is increased. The terms reluctance or hesitancy in motion have been used to describe this situation. To the operator carrying out the passive motion testing, the end feel as the barrier is engaged resembles that of engaging more and more rubber bands and not approaching a definitive end point of motion. Dr. Larson further explained that initial motion loss is primarily in one plane. As the process continues, the pattern of disturbed motion becomes more definite. Mechanical forces acting on the joint are a significant factor in determining exactly how that joint is to become restricted. For example, a somatic dysfunction will become a flexed or an extended somatic dysfunction, depending on flexion-extension forces. As the process continues toward the chronic state, all three planes of motion become involved, and there is loss of range of motion. Viscerosomatic lesions of this type are classified as secondary rather than primary and have been observed clinically. Somatic dysfunction and motion disturbance do occur as a result of visceral disturbance. In their early stages, thrust type manipulative procedures are not highly effective because the motion disturbance is not well defined. In the subacute and chronic stages thrust type manipulative procedures are effective. In the early stages, manipulative procedures designed to calm neural hyperactivity seem to be indicated. For some acute conditions it has been demonstrated clinically that manipulative procedures do result in immediate neurophysiologic changes.

Wyke[7] talked about joint mechanoreceptors and described four types. He stated that manipulators are professional stimulators of joint mechanoreceptors. Joints normally are protected from mechanical assault by reflex activity, which calls on muscles to stabilize and support the joint when the connective tissue which limits permitted motion is being stretched. Some joint mechanoreceptors fire when being stretched, and others are inhibited. The stretching of a joint capsule which is associated with thrust technique results in a cessation of activity of some of the joint mechanoreceptors. If these mechanoreceptors were involved in reflexes maintaining joint restriction, temporary elimination of this reflex activity allows for restoration of normal function. Wyke postulated that inhibitory pressure exerts a favorable influence by inhibiting certain joint mechanoreceptors, with the result that muscle activity is decreased. It is my personal belief that further study, exploration, and understanding of the role of joint mechanoreceptors will provide improved understanding of joint restriction.

What about fascial restriction of joints? The anatomy books describe fascia as collagenous connective tissue and tend to suggest that muscle tonus is the factor responsible for changes of fascial tension. However, fascia is a living substance, and I believe that there is a change in the biomechanical properties of fascia associated with living processes and that fascia is dynamic as well as static.

Differentiation of joint versus muscle restriction

Within the context of my own personal evaluation and assessment of joint motion, I believe that I can distinguish motion disturbance associated with the joint and joint capsule from motion disturbance caused by increased tension or shortening of muscles and other supportive tissues. In evaluating motion disturbance, I pay particular attention to the quality of motion. In motion disturbance, there is usually an asymmetry of motion, with freer motion in one direction than in the other. As one moves toward the barrier there is progressive resistance. If the barrier is reached and a reasonably finite end point is felt, I would feel comfortable in using a thrust procedure. Here I believe that the restriction of motion is maintained by the joint and that a high velocity thrust will overcome the restriction. If, on the other hand, the barrier is not a finite point but a range, depending on the amount of passive force being applied, I feel that a thrust procedure will not work well. I suggest that the restriction of motion is being maintained by muscle hyperactivity. Within the increased reflex activity associated with muscle hypertonicity, I do not believe that the joint mechanoreceptors are a significant component of this type of activity. Noxious stimuli associated with inflammation may be a component. In any event, the manipulative procedure to be employed should reduce hypertonicity. Soft tissue treatment or myofascial techniques frequently are employed. Muscle energy techniques also are employed. In any event, thrust techniques are not indicated until other procedures allow the barrier to be reached.

Popping joints

I should like to consider what happens when the "pop" or "click" is heard. This phenomenon has been discussed at previous Academy convocations. While several theories exist, the most important factor from my point of view is the lack of interest of the osteopathic profession in finding a correct scientific explanation. While it is recognized that many successful thrust manipulative procedures are associated with the "pop," it is recognized also that the "pop" is not essential and that restoration of normal motion can occur without noise. My personal belief is that we should be focusing on how to achieve restoration of motion and should place the question of the "pop" in a position of secondary importance.

Applying thrust techniques

An effective way to approach thrust begins by identifying the restriction and engaging the barrier. It is not necessary to name three planes of motion, although that is helpful for the record. The physician needs the palpatory capability of sensing the restriction and sensing when the barrier has been effectively reached in all planes. This means that the skills involved in diagnoses and in treatment become interwoven and similar. Localization of force at the restriction is imperative. Conceptually, forces from above and forces from below should meet at the restriction. Maintaining a precise localization of forces during the thrust is essential. Experience is a great help to the physician in tailoring the final force to the specific problem. Sometimes a quick thrust is helpful, particularly for a patient whose overall ranges of motion are greater than normal. Joints that tend to be arthritic or mechanically compromised often respond better to a slow, carefully controlled force as in teasing the joint. If it does not feel right, if the barrier does not seem to be finite, if it is impossible to take up the slack, a thrust might not work.

Complications and contraindications

Excessive force or failure to localize force results in dissipation of physical forces, with varying results. The ability of the patient to absorb these extra forces will determine whether they are harmful to the patient. In general, I subscribe to the approach of increasing finesse, not force. Executing a manipulative thrust in the wrong direction may or may not be harmful. In my experience, the worst mistake is to apply an extension thrust to an extended thoracic lesion. This often exaggerates the patient's complaint. Joints which are hypermobile and unstable, with ligamentous laxity (plastic deformation of tissues), will be traumatized further by repeated doses of forceful thrusting manipulation. The lumbosacral and low cervical areas are particularly susceptible. Patients do not ordinarily require thrust-type manipulation on a daily basis. Normal joints can be made hypermobile by excessive manipulation. If a patient does not respond appropriately to manipulative treatment, the plan of management should be to address those factors which are causing the recurring somatic dysfunction rather than continuing manipulative procedures ad infinitum. Moreover, manipulation of the cervical spine has been associated with vertebral-basilar thrombosis. While there is more to be learned about this rare but disastrous complication, I believe that proper and appropriate manipulative procedures are safe.

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Accepted for publication in September 1981. Updating, as necessary, has been done by the author.

This paper was presented to the Conclave of Fellows, American Academy of Osteopathy, Colorado Springs, Colorado on March 28, 1991

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Muscle energy technique: Definition, explanation, methods of procedure

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Muscle energy technique as defined may be applied in treatment of dysfunctions not only of the extremities, but also of the ribs, spine, and pelvis. The technique may involve either isotonic or isometric contraction and calls for varying amounts of force by the patient and counterforce by the operator, depending on the length and strength of the muscle involved and the patient's symptoms. Localization of force is more important than intensity of force and depends on the operator's perception of movement or resistance to movement.

Muscle energy technique has been defined[1] as a form of osteopathic manipulative treatment in which the patient actively uses his muscles, on request, "from a precisely controlled position in a specific direction, against a distinctly executed counterforce." Muscle energy techniques are used to mobilize joints in which movement is restricted, to strengthen weak muscles, to stretch tight muscles and fascia, and to improve local circulation. Muscle energy techniques involve the patient's *active* cooperation, whether that cooperation be in contraction of a muscle or muscles to inhale or exhale or to move one bone of a joint in a specific direction on the adjacent bone.

Muscle energy procedures may be classified (Table 1) as *isotonic* and *isometric contractions.*[2] With *isometric contraction,* the distance between the origin and the insertion of the muscle in contraction remains the same: the muscle contracts without changing its overall length. With *isotonic contraction,* the overall length of the muscle usually shortens to approximate the positions of the origin and insertion of the muscle but may actually lengthen. Isotonic contractions, therefore, may be classified further as *concentric* and *eccentric,* which mean acting with the movement and against it, respectively.

Rasch and Burke[3] give the following definitions:

Concentric contraction. When a muscle develops tension sufficient to overcome a resistance, so that the muscle visibly shortens and moves a body part in spite of a given resistance, it is said to be in *concentric contraction.* For example, the biceps brachii muscle contracts concentrically when a glass of water is lifted from a table toward the mouth. In this case, the resistance is the combined weight of the forearm, the glass, and the water, and the source of resistance is the force of gravity.

Eccentric contraction. When a given resistance overcomes the muscle tension so that the muscle actually lengthens, the muscle is said to be in *eccentric contraction.* Although developing tension (contracting), the muscle is overpowered by the resistance. For example, when a glass of water is returned from the mouth to the table, the biceps brachii muscle contracts eccentrically. Actually, of course, muscular contraction is not essential in this instance. If the muscles were simply relaxed, gravity would extend the elbow joint and lower the glass, albeit with unwanted and disastrous consequences. Still another way of getting the glass to the table would be to contract the triceps brachii muscle concentrically, thus adding to gravitational force and extending the elbow with great vigor. Such an action might be appropriate in driving nails with a hammer, but not in the example cited.

Both concentric and eccentric contraction are known to physiologists as *isotonic* contraction.

Muscle energy techniques are carried out within a range of movement against a sense of increased tension or resistance. One may perceive the quality of resistance in several ways. Any one of the following procedures is acceptable for determining asymmetry:

(1) In abduction of the femur of a supine person, one may carry the femur forcefully to the anatomic limit and compare abduction to the left with abduction to the right. Resistance perceived this first way is analogous to that of meeting a wedge or steel barrier (end point).

(2) One may abduct the femur slowly and carefully, noting a sense of increased tension long before the anatomic limit is reached. The sensation perceived by this second method might be likened to that of reaching the end of a restraining rope within the range of movement, like that of a dog reaching the end of a leash.

(3) One may initiate abduction of the femur even more slowly in order to perceive an even earlier beginning of the tension increase, using the sense of that subtle resistance to compare left with right. The effect of this third procedure is similar to sensing the initial illumination of a rheostat controlled light switch.

One way to develop a sense of this beginning resistance is to practice the following steps (Fig. 1);

(1) After grasping the supine patient's foot and ankle in order to abduct the lower limb, the operator closes his eyes during abduction and feels in his own body, from his hand through his forearm into his upper arm, the beginning sense of resistance.

(2) He stops when he feels it, opens his eyes, and notes how many degrees in an arc the patient's limb has traveled.

(3) He compares that arc with the arc produced on the opposite side.

In treatment, for example, if the abducted right femur reaches resistance sooner than the left, restriction of abduction exists. To remove this restriction, the patient's limb is positioned in that arc of movement where resistance is first perceived, and at this point the physician employs a muscle energy technique to

TABLE 1. CLASSIFICATION OF CONTRACTIONS.

Type of contraction	Type of tension	Effect on muscle length	Counterforce in muscle energy technique
(Isotonic) concentric	Acceleration	Shortens	Less than or equal to patient's force
(Isometric) static	Fixation	None	Equal to patient's force
(Isotonic) eccentric	Deceleration	Lengthens	Greater than patient's force

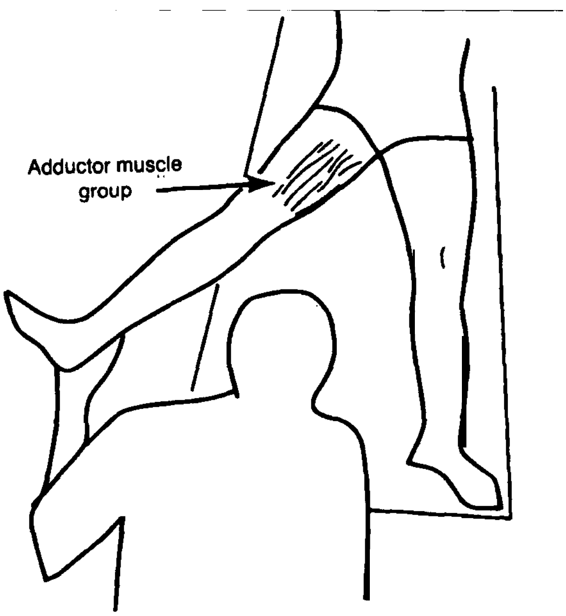

Fig. 1. *Abduction of the hip, showing focus on group of adductor muscles.*

lessen the sense of resistance and increase the range of movement.

Resistance has been referred to[4,5] as a *barrier.* The sense of resistance might be represented in three ways by visualizing a gate in open, partially closed, and closed positions (Fig. 2). The striking bar on a gatepost represents an end point much like that of a bony ridge in the body's skeletal system (Fig. 2, left). A wet rope attached to that gate might restrain its range of motion and prevent it from closing; and when the rope has dried and is shortened, it offers further restraint to motion, somewhat resembling that of a muscle that is shortened (Fig. 2, center). If the gate has springtype hinges, they will produce greater initial resistance to movement than ordinary hinges, requiring initial force to overcome the spring resistance before the gate is moved (Fig. 2, right). A similar proprioceptive sensation may be perceived as one initiates passive abduction of a patient's hip. This restraint may be muscular or ligamentous and voluntary or involuntary. Any of the three ways previously described may be used to perceive the quality of resistance; but when the two sides are compared, the same method must be used for each.

Within the muscle energy concept (Fig.3), when a left-with-right asymmetry in range of motion exists in the extremities, that asymmetry may be due to either a hypotonic or a hypertonic condition. Differentiation is made by testing for strength, comparing the left and right muscle groups. If findings suggest weakness as the cause of asymmetry in range of motion, the appropriate muscle group is treated to bring it to equal strength with its opposite number before range of motion is retested to determine whether shortness in a muscle group also may contribute to the restriction.

The steps in a muscle energy procedure to strengthen (to recruit additional muscle fibers to contract) a muscle group are as follows:

(1) The operatorpositions the bone or joint so the muscle group will be at its resting length and thus will develop its strongest contraction.

(2) The operator instructs the patient about his participation, explaining the *direction* in which to move limb, trunk, or head, the *intensity* of contraction, and the *duration* of contraction.

(3) The patient contracts *(force)* to a maximum with the objective of moving the body part through a complete range of motion quickly (2 seconds).

(4) The operator contracts *(counterforce)* less than the patient's contraction, maintaining counterforce throughout the range of motion.

(5) Both patient and operator cease contractions.

(6) Steps 1 to 5 are repeated several times, with progressive increases in counterforce.

(7) The operator reevaluates the muscle group for symmetry of range of motion.

There are several ways to lengthen shortened muscles by muscle energy procedures. For example, if the range of abduction movement to the right is restricted and the goal is to lengthen the right shortened adductor muscles, lengthening may be accomplished by any of the following methods:

(1) While the patient contracts the right abductor muscle group, the right adductors will relax and lengthen by reciprocal inhibition. Contractions may be isometric or isotonic (concentric).

(2) While the patient contracts the right adductor group, the operator applies a force counter to and greater than the patient's own, so that the right adductor group will lengthen eccentrically.

(3) While the patient contracts the right adductor group, the operator applies an isometric force counter to and equaling the patient's own (isometric counterforce). On cessation of both forces, the abductor muscle group may be longer, permitting a greater range of abduction.

The effectiveness of the latter two methods may be explained by the increase in tension of the tendons of the muscles, which stimulates the afferent firing of the Golgi bodies and causes the muscle fibers to relax and lengthen.

A muscle energy procedure to lengthen shortened muscles consists of the following steps:

(1) The operator positions the bone or joint.

(2) The operator instructs the patient about his participation, explaining the *direction* in which to move the limb, trunk, or head, the *intensity* of contraction, and the *duration* of contraction.

(3) The patient contracts (force).

(4) The operator contracts *(counterforce):*

(a) Equal to patient's force (isometric or isotonic concentric)

(b) Less than patient's force (isotonic concentric)

(c) Greater than patient's force (isotonic eccentric)

(5) The operator maintains forces from 3 to 5 seconds.

(6) The patient ceases contraction.

(7) The operator ceases counterforce.

(8) The operator takes up the slack permitted by the isometric procedure. (Increased range of motion is perceived during isotonic procedures.)

(9) Steps 1 to 8 are repeated once or twice.

(10) The operator reevaluates the original dysfunction.

When the operator's counterforce that is equal to the patient's force does not maintain the same distance between muscle origin and insertion, an isotonic, rather than an isometric, contraction takes place. Therefore, in describing a muscle energy procedure, it is more important, accurate, and simpler to state that the operator's counterforce is less than, equal to, or greater than the patient's force than it is to classify the action as isometric or isotonic.

There are two variations within a procedure in which the operator exerts a counterforce equal to the patient's force for treatment of a problem in the lumbar spine. These procedures illustrate the use of *isometric versus isotonic* contractions. The following description of the assessed problem may help the reader understand the procedures: Asymmetries in the lumbar area are fairly easy to identify when the patient is seated on a stool as the operator sits behind him. Because the operator needs to tangentially sight the relation of the transverse process of each vertebra to the coronal plane, he looks at his thumbs as they compress the paravertebral soft tissues posterior to the transverse processes. By placing his thumbs at varying segmental levels, he is able to identify the vertebra with the most exaggerated asymmetry when the patient is in a flexed or extended position precisely at that vertebral level. If the left transverse process of L5 is more posterior when the patient is flexed, one postulates that the left caudad facet of L5 did not move anteriorly and superiorly along the left cephalad facet of Sl as did the right caudad facet. The movement to resolve the nonmovement is postulated to have minute movements in the directions of flexion, lateral flexion to the right, and rotation to the right restricted. It is further postulated or conceptualized that the nonmoving side is restrained by hypertonicity (or shortening) of some muscle fibers. Therefore, the operator devises a muscle energy procedure to decrease the tone of (to lengthen) the affected fibers.

In order to increase flexion, right lateral flexion, and right rotation of L5 on Sl, the following variation may be carried out (Fig. 4): The patient is seated with his left hand between his thighs and pointing toward the floor and his right hand lateral to his right hip and pointing toward the floor. The operator stands to the patient's left, facing him. The operator places a finger of his right hand at either the spinous or the left transverse process of L5 in order to monitor both the localization of forces to L.5 and the movement of L5. Then, he places his left anterior axillary fold and the upper part of his chest against the patient's left shoulder and his left hand against the patient's right anterior shoulderjoint. Within this framework, the patient is asked to "slouch," in order to flex his lumbar spine so that the apex of the posterior convexity can be seen at the L5-Sl articulation. With this positioning, the operator controls the patient-initiated right lateral flexion of the lumbar spine, with the patient reaching his right hand toward the floor, to localize at the L5-Sl articulation. Continuing to maintain this positioning, the operator produces right rotation of the vertebral column, with his left hand in contact with the patient's right shoulder, producing enough rotation to be palpated with the right finger at L5. From this position the patient may be asked to

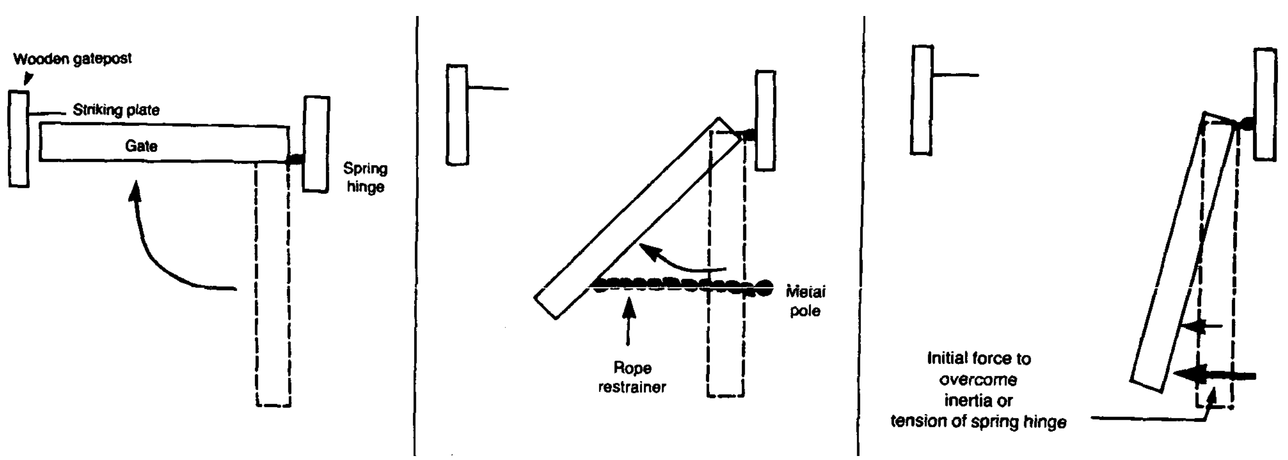

Fig. 2. *Superior view of swinginggate at three positions: left abduction against an endpoint (striking plate); center, restraint of abduction by shortened muscles, as by drying of a previously wet rope; right, initial restraint of abduction by short muscles or ligaments, as by tension of a spring.*

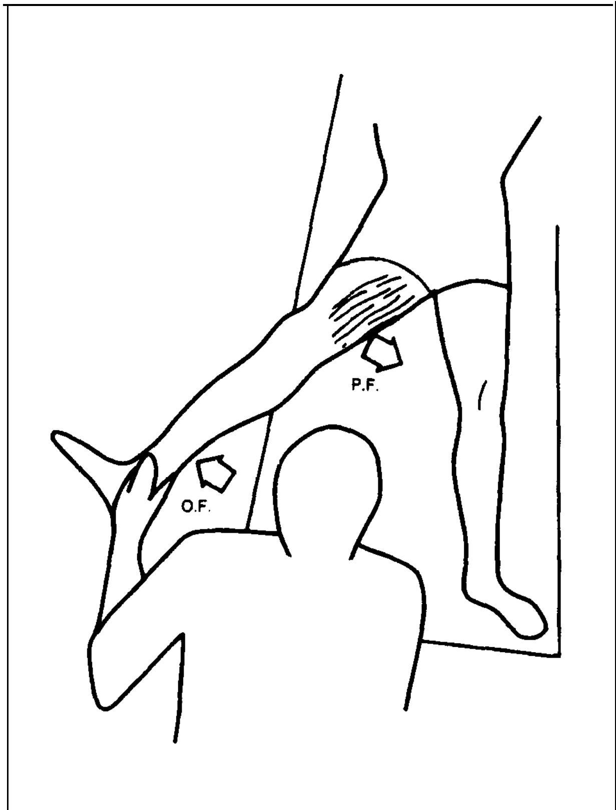

Fig. 3. *Muscle energy procedure to reduce hypertonicity of group of adductor muscles. PP., patient force; OF., operator force.*

move in one or more directions singly or in combination with each other. The directions are flexion left, rotation left, and/or extension of the vertebral column against the operator's counterforce. These actions constitute an isometric procedure. The patient is contracting muscles on the left side of the spine but is not changing the distance between the origin and insertion of muscles on either side of the spine.

In a second, more easily controlled variation (Fig. 5), the positioning is the same as in the first, and the patient is directed to move both shoulders in a translation to the left against the operator's left anterior axilla or chest. Neither of the shoulders should rise or fall from the line of translation. While the patient performs this movement, the operator can palpate increased right lateral flexion at the L5-Sl area. As the patient discontinues his translatory force, the operator can increase right rotation of the vertebral column until he once again feels restraint or resistance at L5-Sl. This procedure achieves the same objective as the isometric maneuver, but is classified as a concentric isotonic procedure because of the right lateral flexion of the thoracolumbar spine.

Muscle energy techniques may be applied using either the direct or indirect method. The aforementioned illustrations used the direct method. With the indirect method, "the component is moved (by the operator) away from the restrictive barrier;"[5] the operator's counterforce, equal to the patient's force, is directed away from the sense of resistance, even though no visible movement of a component takes place.

Fig. 4. *Active rotation and/or lateral flexion by patient to left (isometric).*

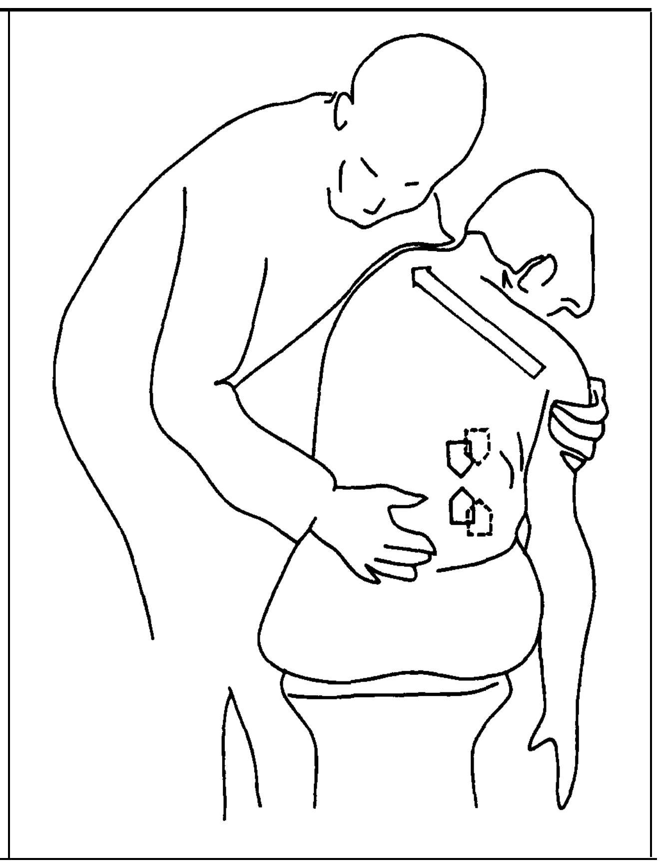

Fig. 5. *Active translation of both shoulders to left (isotonic).*

Management of a patient with an acute stiff neck illustrates the direct and indirect methods. The patient presents with his neck held close to his right shoulder; passive left lateral flexion is restricted and painful. To use the direct method, the operator applies an equal counterforce to flex left as the patient flexes right. To use the indirect method, the operator's counterforce is to flex right, away from the sense of resistance, as the patient flexes left. Clinically, the patient may find his active right lateral flexion against the operator's counterforce painful and his active left lateral flexion against a counterforce not painful.

Muscle energy technique is not a wrestling match. The amounts of force and counterforce are governed by the length and strength of the muscle group involved as well as by the patient's symptoms. A small amount of force should be used at first, with increases as necessary. This is much more productive than beginning with too much force. Care must be taken to limit counterforce, because the patient will work to equal it. Pounds of force may be considered in dealing with large muscles, as in the hip, but *ounces* of force should be considered when weaker, shorter, and smaller muscles such as those in the cervical vertebrae are being treated.

Localization of force is more important than intensity of force. Localization depends on the operator's palpatory proprioceptive perception of movement (or resistance to movement) at or about a specific articulation. Such perception enables the operator to make subtle assessments about a dysfunction and to create variations of suggested treatment procedures.

Monitoring and confining forces to the muscle group or level of somatic dysfunction involved are important in achieving desirable changes. Poor results are most often due to improperly localized forces, usually too strong. When an operator introduces motion in any plane at an articulation a segment or two below the dysfunctional one, the chance for success is diminished because the forces have been misdirected, almost as if they had been dissipated. In some instances lateral flexion is restricted at a segment superior to the one identified for treatment; this will interfere with the localization inferiorly, and the superior segment will need to be treated before treatment of the inferior segment is begun.

The concept of muscle energy treatment has been defined and illustrated here by using examples of abduction of the lowerextremity and of dysfunction in the lumbar spine. The same principle applies to the treatment of dysfunctions of all joints of the appendages, ribs, spine, and pelvis. F.L. Mitchell, Sr.,[4] described "muscular energy technique" in 1958. F.L. Mitchell, Jr., and associates[6] compiled a reference work on muscle energy procedures in 1979. Over the years, individual physicians using the muscle energy principle have modified the procedures first demonstrated to them, increasing their sophistication and effectiveness, but the principle has remained the same. I hope that the foregoing explanation of the principle will provoke the reader to investigate uses of the technique, which is not a panacea but an addition to one's store of professional resources.

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Accepted for publication in June 1981. Updating, as necessary, has been done by the author.

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Functional technique: A modern perspective

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Functional technique is a form of osteopathic manual medicine that is unique in accuracy and universal non-traumatic application. This is because all therapeutic maneuvers are strictly controlled by physiologic responses in the area of somatic dysfunction under the palpating fingers. To achieve this control, the palpation must be light and non-intrusive, taking its clues from the compliance or non-compliance (ease and bind) of the structures as they attempt to respond to the motion demands of the treatment. Functional technique has a twofold appeal. Its obvious non-traumatic efficiency is one. The other, and not the least, is the scientific curiosity aroused by a physiologic approach to the structural aspects of the osteopathic somatic dysfunction.

Functional technique represents a return to basic principles of osteopathic manipulative therapy. Because the manipulation is guided by functional clues, the changes in somatic dysfunction can be continually monitored by the physician as they occur.[1] The physician has a specific and delightful sense of total control during the therapy. For this reason alone functional technique has caught the interest of many osteopathic physicians. It is the purpose of this paper to explore the conceptual framework of functional orientation which eventually led to the development of functional technique and to explain how it can be easily learned and applied in the office.

Historical background

Dr. Andrew Taylor Still found dysfunctions under his hands that he could ameliorate but could not fully explain. A hundred years later, these findings still await a fuller explanation and understanding. The somatic dysfunctions that Still first identified as being prime targets of effective therapy remain prime targets for osteopathic physicians who realize the importance of structural-functional integrity in health and disease. As the years have gone by, more sophisticated and effective techniques have been developed. Functional technique is one of them.

The term "functional technique" is itself somewhat of a misnomer since all osteopathic manual technique is primarily structural and treats structural dysfunctions. However, common usage has seemed to establish it as if not the best, the easiest way to refer to an osteopathic therapy that had its resurgence in the 1952-57 Study Sessions of the New England Academy.[2,3] These sessions were under the general heading of "a functional approach to specific osteopathic manipulative problems," so this is probably where the term "functional technique" originated.

This functional approach was stimulated by a lot of exciting things that seemed to be happening all at once in 1952. H.V. Hoover[4] was using an osteopathic technique partly inherited from Fryette, Fryette's father, and even A.T. Still. It was a technique that evaded all attempts to explain its effectiveness in purely structural terms. But there were new approaches possible. The scientific literature of the times was incandescent with new discoveries and theories in the fields of communications and feedbacks.[5-12] Korr had just come out with a report on his research at the Kirksville College of Osteopathic Medicine noting that the somatic dysfunction that we had been calling the "osteopathic lesion" had a neural basis and thus was amenable to "communication theory" study.[13] Functional technique has become quite comfortable in today's scientific climate as well as streamlined and highly effective in practice.[14] In short, over the past 25 years functional technique has come of age!

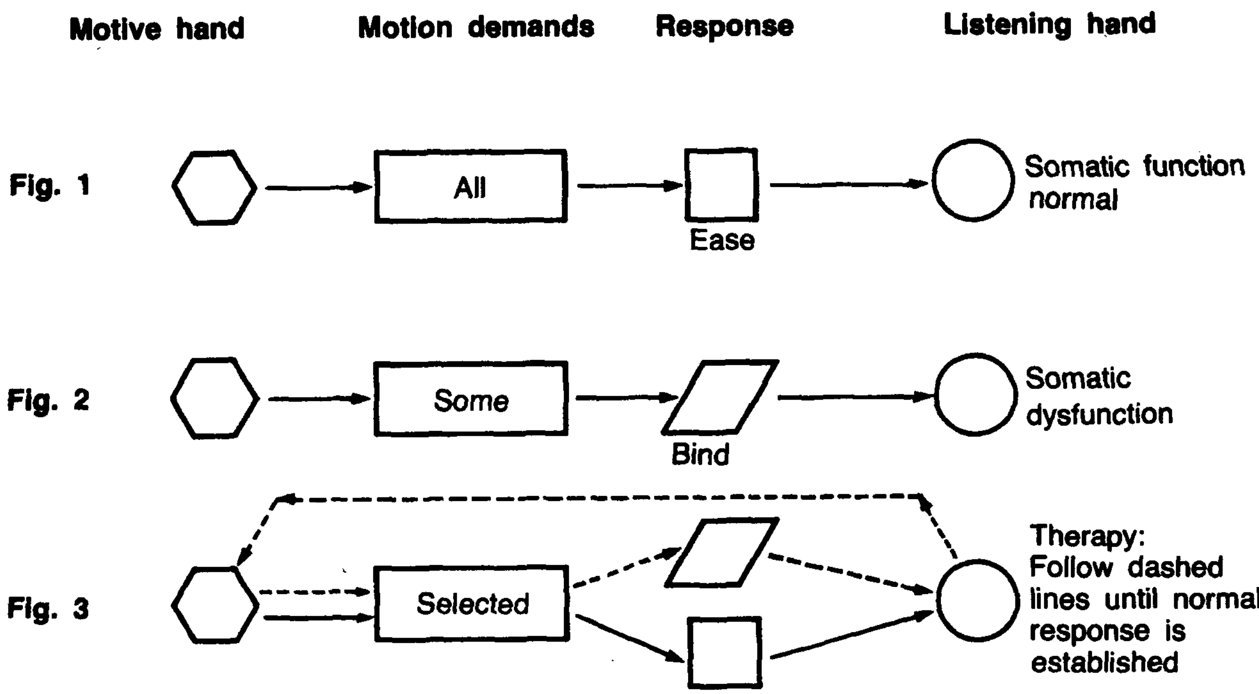
Learning to use functional technique

There are two ways to describe and teach a new procedure. One is to figure out the "why" and from it develop the "how." The other is to describe the "how" and develop the "why" from it. We will begin with the "how."

Of great importance are the palpation fingers. They must not move. They must not initiate any stimuli of their own. They are there for one reason and one reason only-to receive information from the tissues under the skin. They are "tuned" to action taking place within the skin. (Later they will use this information to direct therapy.) They are instructed to temporarily ignore superficial tissue texture, skin temperature, skin tension, thickening or doughiness of deep tissues, muscle and fascial tensions, relative positions of bones, and range of motion, in short, most of the classical signs and symptoms of various stages of somatic dysfunction. All of these signs and findings are of immense importance[15] and as signposts should be checked routinely during osteopathic examination, but it is tissue change in response to motion demand that holds high priority in functional palpation.[16] It is the deep segmental tissues, the ones that support and position the bones of a segment, and their reaction to normal motion demands that are the heart of functional technique specificity.

The palpating fingers are part of what has been dubbed the "listening hand." If functional technique were to have a trademark, it would be a listening hand! Dr. Thomas Northup

Functional Technique Schematic



Figs. 1-3 *provide a base procedural model for functional technique (See text discussion.)*

once cogently remarked when we were trying to explain what we meant by a listening hand-"You can't talk and listen at the same time!" A simple experiment that you can do right now illustrates functional palpation better than words can. Stand up, place your fingers quietly along each side of your neck. They will lie approximately over the transverse processes of the cervical vertebrae. Now walk. Try hard to ignore the skin and the bones. Concentrate on "listening" to the action as you walk. It is fascinating how much you will feel going on in the deep supportive and positioning tissues of the cervical segments as they respond to the general motion demands that walking elicits.

Now this action that the listening fingers learn to register and evaluate for compliance or noncompliance will furnish the functional clues for treatment that were mentioned in the opening statement, enabling functional technique to be highly specific, non-traumatic, and highly controllable during corrective treatment. The reasons for this are understandable if one realizes that the changing structure is continually furnishing the central "computers" of the body with streams of informational afferents which, if received in normal fashion and in proper sequences, result in normal efferents sent out in proper sequences to achieve a phased and compliant positioning of every bone in the body in relation to its neighbors and the whole skeleton.[17] The central nervous system responds to normal input patterns with patterns of efferent impulses to cause normal adaptive responses. No example of this is more obvious than a perfect golf swing. Every bone in the body, especially of the spine, must be in the right place at the right time, and it must get there with an accuracy of motion and acceleration or deceleration that defies the imagination! This phased and compliant positioning is a continually operating process whether at work or at rest, whether body motion is active or passive, or a combination of both. This is the sort of action you felt going on in your neck as you walked and let your fingers do the listening.

Admittedly there is more to it than just described; for example, what would be the role of the gamma system?" Nevertheless, this description is a good start toward understanding the reasonableness of the functionally oriented approach to Osteopathic manipulative therapy. Normal somatic function is a well-organized complexity and is accompanied by an easy action under the functionally oriented palpating fingers. This "message" from within the skin is dubbed a sense of "ease" for convenience of description. Somatic dysfunction could then be viewed as an organized dysfunction and recognized under the quietly palpating fingers as an action under stress, an action with complaints, an action dubbed as having a sense of "bind." Thus far we have described a type of functional palpation that is relatively easy to learn. We have indicated that those fingers pick up a signal of "ease" if somatic function is within normal parameters and, conversely, a signal of "bind" if a significant somatic dysfunction is present. If we can add the terms of "normal motion demand" and "motive hand" to the three terms we already have, namely, "listening hand," "ease," and "bind," we should have a verbal armament with which we can pursue the subject of functional technique without too much linguistic embarrassment, and with the elimination of quotes around each term.

Functional technique sets up a demand-response situation in which somatic dysfunctions are identified and restored to normal functions. Figure 1 shows schematically the sequence of normal somatic function identification. The motive hand initiates a motion demand that moves through a part of the body to be examined; it could be an appendage, a spinal segment, or the head. For discussion let's say it is L-l. The listening hand monitors the action at L-l and registers ease in response to all normal motion demands if L-l is functioning normally. Figure 2 illustrates a somatic dysfunction; not *all* normal motion demands give a signal of ease. The listening hand will register bind in response to some of the motion demands but not to all of them. L- 1 is afflicted with a somatic dysfunction. It doesn't respond with a normal ease action to all the motion demands. Figure 3 shows the listening hand telling the motive hand what to do to get the normal ease back again. When the ease response has been fully established at L-l, it is as if the segment had been rephased to the normal pattern of function. It is no longer "out of sync" with its neighbors. The situation in Figure 1 now obtains. The listening hand reports signals of ease in response to any and all normal demands for motion that the motive hand may choose to impose on the segment, and that's about as near to normal somatic function as you can get!

The reason for the schematic drawings is to illustrate graphically the circular nature of functional technique. The osteopathic manipulative therapy is monitored by the listening hand and fine-tuned information as to what-to-do-next is then fed back to the motive hand. As the dashed lines of Figure 3 are followed, motion demands are selected which give an increasing response of ease and compliance under the quietly palpating fingers. Figure 3 is justifiably named "therapy," because once the ease response is elicited it tends to be self-maintaining in response to all normal motion demands. In short, the somatic dysfunctions are no longer dysfunctions. There has been a sort of spontaneous release of the holding pattern. It is worth restating: Once the distress of a somatic dysfunction is eased by functional technique or any other effective technique, the motion characteristics of a segment tend to remain normal to all reasonable demands put upon it. While the schematics are essentially true, they can only present a bare procedural model that needs the personal skill and virtuosity of the individual osteopathic physician to be of practical use in the office.

Across the top of the Functional Technique Schematic there are fourheadings: *Motive hand, Motion demand, Response, and Listening hand.*

Motive hand

This can mean a hand, or hands, or fingers, or thumbs, or even verbal commands for motion alone or assisted by hints and helps from a hand. In fact, "motive hand' stands for any means whatsoever that gets a patient to put a motion demand through the body area under the listening hand. The patient may be standing, sitting, or reclining; it makes no difference.

Motion demands

These may be flexion, extension, side-bending, rotation, or a series of sequential combinations of all four. They imitate the normal motion demands of normal daily living and working. They are the first half of the demand-response sequence that is basic to functional technique. They test for segmental *response,* not segmental position. It should be noted that the various

Fig. 4. *Use of a functionally oriented technique for release of somatic dysfunction in the region of T-12--L-1.*

positions, or postures, the body assumes in daily living are a result of a continual complex flow of sequential, synchronized, ebband-flow motion demands throughout the body. As Sherrington once said with deep insight (as quoted by Boyd), "Posture accompanies movement like a shadow. . ."[18]

Response

The motive hand has set up a controlled facsimile of a normal motion demand flowing through the segment under the listening hand.[19] The action response noted at the segment is to that specific motion demand.

The listening hand

Again this represents any tactile part of the physician which he can use conveniently to assess local response in the segment under examination. While it may be a whole hand, it is usually a finger or fingers, or a thumb. The importance of a quietly, non-intrusive, non-perturbing listening hand cannot be overemphasized. The total effectiveness and efficiency of functional technique rest upon the proper interpretation of the varying responses of ease and bind that the listening hand monitors. It is from these signals that the listening hand decides what to tell the motive hand to do to obtain more ease in the response, and it is from these signals that the physician decides that he has improved the somatic dysfunction enough to go on to other areas that need attention as part of a total improvement in the patient's condition. The listening hand continually alters the motive hand's demands in such a manner that signals increasing ease. Each increase in ease is welcomed by the body's central computer and that ease tends to be cumulative and self-maintaining until the action of the segment is back in phase with normal total motion demands and all normal motion demands can be met with satisfactory somatic function.

Many excellent technicians make some use of the basic functional technique mechanism without actually verbalizing it in functional technique terms. And conversely any two physicians using the basic functional-technique outline will not look alike as they work, because there are many efficient and skillful ways of using the demand-response situation effectively. But each of them will be moving the patient through a somewhat devious but well directed series of sequential positions until a response of maximum ease and compliance is obtained. It is as if he were threading a maze and his guide from dysfunction to function is the increasing ease signal. The comment of an English D.O. is interesting. He said "It seems to me that this method is an attempt to restore authority to the nervous system."[20] The exact mechanism of the change from dysfunction to function (spontaneous release) is not fully understood. It furnishes an interesting question for research. As the scientist J.R. Pierce once said, "Human beings learn by doing and by thinking about what they have done.[21]

Functional technique in the office

Figure 4 shows an osteopathic physician using functionally oriented technique to release a somatic dysfunction in the region of T- 12-L-l. His left hand is the listening hand, and he is using his index finger to monitor the bind in the region of the right transverse process. His right hand is the motive hand and he is probably suggesting that the patient follow the directions for gross motion that the motive hand is indicating. As the patient moves in arcs of increasing ease, he is probably asking the patient to breathe. A deep breath sometimes magnifies the bind-to-ease transaction and enables him to obtain the maximum therapeutic ease response more accurately.

Experimenting with this type of osteopathic technique may be frustrating at first. For one thing it will be extremely difficult to keep the listening hand quiet and non-intrusive; old habits are hard to break. The attainment of a maximum therapeutic ease response may at first seem extremely laborious, if not impossible. But perseverance pays off. Physicians who use functional technique constantly soon learn to go to the therapeutic ease response quite accurately and quickly, and with a minimum of exploratory motion demands. A reduction of a somatic dysfunction in one area is seldom enough. The whole spine must be scanned by whatever method the physician is accustomed to, with attention being given sequentially to other areas needing treatment. This is because a change in one area is reflected in the improvement or worsening of other areas. The osteopathic treatment is not finished until an optimum of somatic function is restored to all areas. This allows the improvement in somatic functioning to gain momentum between treatments until the body has relearned how to maintain a satisfactory level of functioning on its own and treatments are no longer needed.

Of course, this is basic holistic osteopathic philosophy and functional technique may have no particular advantage in long-term management. But where it does have a distinct advantage is in acute situations such as an acute and painful low back.

Here the patient may be treated in the sitting position and the whole functional-technique process is miniaturized. The motion demands are tiny to avoid setting up spasms, the changes toward ease from bind are minimal but definite and cumulative. The operator goes from area to area for the length of the spine, gaining a little here, a little there, all that he can in each area without setting up spasms. It may not seem that he has been able to accomplish much, but the total effect of all these little improvements is gratefully accepted by the patient who sometimes has to be warned that he is not as well yet as he may think he is! Using a functional-technique method, osteopathic therapy can usually be employed early in almost all acute conditions as it is absolutely trauma-proof.

While its non-traumatic nature makes it valuable in acute situations, the specificity of functional technique is useful in chronic conditions where somatic dysfunctions have become deeply established and extremely compounded in nature. It is a corollary of functional thinking, and there may be some truth in it, that the somatic dysfunctions of the Still syndrome stem from a mix-up in the afferent-efferent bone positioning mechanisms of the body. The newer understandings of gamma system operations suggest that there may be more than "some" truth in it." In some way the bone-postioning mechanism has been thrown out of phase; its smooth and usually invisible functioning has suddenly become highly visible[22] in the form of structural and motion distortions which we now call somatic dysfunctions. Thus, the theory goes, this continual distortion of relative bone position and motion with its accompanying binding action (loss of universal ease response) is a source of obnoxious bombardments which, if allowed to go on for any length of time, may lead to a chronic somatic pathology that is recognized as the "chronic lesion." Now, the theory continues, if abnormal action leads to abnormal structure, then the best way to restore normal structure is to re-establish normal action. From personal experience, I have found that a limited range post-cast knee showed as much improvement in range from increasing its functional ease as might be expected from physical therapy stretching sessions. While no great significance can be attached to a single example, it was an interesting experience and somewhat thought provoking.

Conclusions

It would seem that the work started 20 years ago in the New England Study Sessions has been viable. Functional technique as an effective form of manual osteopathic medicine is taught "actively," to quote a communication, in the European School of Osteopathy, as well as in this country. The interest in America is growing in a newer functional approach to the time-honored problems of structural somatic dysfunctions.

Once it became clear that the word "functional" was not a challenge to the word "structural," butperhaps was just another, more dynamic view of structure, it was realized that the functional orientation strengthened rather than weakened the basic tenets of osteopathic medicine that structural integrity was of prime importance to the best level of health. And the reason for this is that the functional approach not only furnishes an increasing understanding of why and how structure went wrong, but also indicates better and more logical ways of regaining structural integrity.

We have an increasing interest in functional technique by people who watch the ease, control, and precision exhibited by functional technique demonstrations. We have the people who have an increasing interest in functional-technique principles by reading about them and then adapting their own skills to a functional orientation. We have what are perhaps the most significant contributions that functional-technique methods have stimulated over the years, namely, new ways of looking at old problems, ways that raise new questions that are more amenable to scientific study and understanding. Many of the old questions perhaps were unanswerable because of wrong premises, as an example, questions about the nature of the restricted motion we find in somatic dysfunctions. As long as the premise assumed that the restriction was purely articular, questions as to the nature of that restriction were unanswerable in any known scientific manner. Now that we are beginning to realize that perhaps the seemingly structural restriction is actually the "shadow" of a disturbed motion mechanism (to quote Sherrington again as reported by Boyd[18]), the subject is opened up again to questions that may some day be answered. Why is the restricted motion of a somatic dysfunction so dynamically different from the static sort of restriction caused by arthritis or any condition that affects the range of articular template? Why are the restrictions of a somatic dysfunction so easily eliminated by skillful osteopathic therapy? Why, if not eliminated, is it detrimental to health? Why is a somatic dysfunction amenable to the circular listening hand-motive hand method of functional technique? Why does a skillful thrust seem to "fix" it? What are the mechanisms that start this syndrome that Still first identified? What are the mechanisms that maintain it, once established? What are the mechanisms that sometimes self-cure it? What is the mechanism of spontaneous release?

Questions like these are only the beginning. The science of osteopathic medicine is truly in its infancy.

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Accepted for publication in August 1979. Updating, as necessary, has been done by the author.

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Spontaneous Release by Positioning

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Discovery of what appears to be a new principle of lesion production has resulted in a simple, easy method of correction without the use of force.

Undoubtedly many osteopathic physicians have observed occasional cases of spontaneous lesion correction. Probably most of them have shrugged and wished that all lesions might be corrected so easily -but that it is a one-in-a-thousand phenomenon and not worth thinking about, just a fortunate combination of influences.

Most osteopathic physicians can remember some case that was seemingly impossible; a case that resisted all their skill, diligence, and ingenuity, and continued to defy their best efforts again and again until only stubbornness kept them from admitting they were stumped. Each visit became a maddening frustration. Suppose that after months the disorder one day spontaneously corrected completely and easily before their eyes.

This background of frustration is included because it furnished the necessary inspiration for 10 years of experimentation.

The ease and effectiveness of this technique and the revolutionary concept it entails are very difficult to believe by osteopathic physicians who have accepted as necessary the use of a certain amount of force to attain a correction on hundreds of thousands of lesions in their regular practices. Yet, demonstrations in seminars in the western states have shown most of the osteopathic physicians attending that the technique is practical for them on their first or second attempt. They are convinced only after feeling it happen under their own fingers or on their own lesions.

• **BACKGROUND.** In the original case a fortunate combination of accidents made the correction possible. A man had had a very severe and painful second lumbar lesion with psoasitis for a long period, and I had been unable to correct it despite maximal efforts. He had complained of being awakened every few minutes during the night by his pain. I was devoting an entire treatment period to finding, if possible, a position of relative comfort which he might use to secure rest without heavy sedation.

We finally found a position which achieved a high degree of comfort, but it was astonishingly extreme. It was unbelievable that such a rigid patient could tolerate, let alone enjoy, such a position. He was nearly rolled into a ball, with the pelvis rotated about 45 degrees and laterally flexed about 30 degrees.

The patient was so well relieved that he was propped up and left in the position while I treated another patient. When I returned and restored him to a normal position, he remained comfortable! Examination revealed an excellent correction of the lesion, with marked improvement in free mobility and two-thirds reduction in pain and tenderness. To accomplish a correction so easily in a case so desperately "impossible" was hardly believable. It was too impressive to be ignored.

Experimentation was begun on other second lumbar lesions. Many were corrected in positions similar to the one that had been effective for the first man. Most of the others responded to minor modifications of the original position. Experimentation seemed relatively safe, because no force was necessary and a position which brought immediate comfort could hardly be construed as an injury. Gradually the time of support in the position of release was reduced from 20 minutes to 10 and then to 5. Success continued down to a period of 90 seconds. Below this time, success was irregular, even though we achieved an excellent position for relief of pain and tenderness in the lesioned joint. It still appears to be the minimum, though probably some skilled technicians will be able to reduce it further.

Success with second lumbar lesions encouraged attempts on other lesions. Some results were gratifying, others disappointing, but little by little it became clear to me that all osteopathic lesions will correct spontaneously in a position of release, and that a large proportion of lesions of a given joint will follow a pattern of position common to other lesions of thatjoint.

During this time the position of release and comfort was found in a high percentage of the cases to be simply an exaggeration of the abnormal bony relationship found upon examination. This has occurred so consistently that I have accepted it as proof of diagnosis. On the occasions where the two do not agree, I distrust my diagnosis and rely on the position of release as both diagnosis and treatment.

• **SOME APPARENT PRINCIPLES.** Most lesions can be corrected in exaggeration of the diagnosed abnormal bony relationship. Occasionally diagnoses are not clear. We are saved from testing aimlessly by the fact that most lesions of any given joint are likely to follow a pattern. Through the years I have been able to accumulate a list of the more common lesions. In three fourths of the lesions in which the diagnosis was not clear, disorders were found to respond to positioning according to the directions on the list, with minor variations.

This list, which will be presented later, is offered not to be blindly imitated, but as means of saving the busy physician the time-consuming experimentation needed to develop it. He must never lose sight of the principle. The techniques are successful only if they achieve the position of relief of tenderness and pain. If unsure of his diagnosis, he tries the basic positions first. Then, if necessary, he abandons them and learns the effective position by trial and error, secure in the knowledge that there is such a

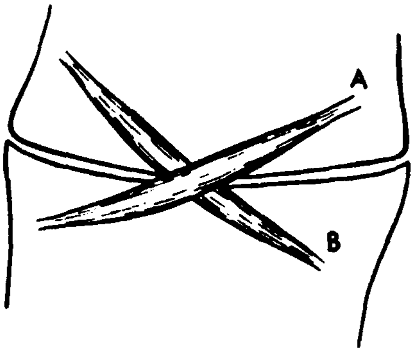

Fig. 1.

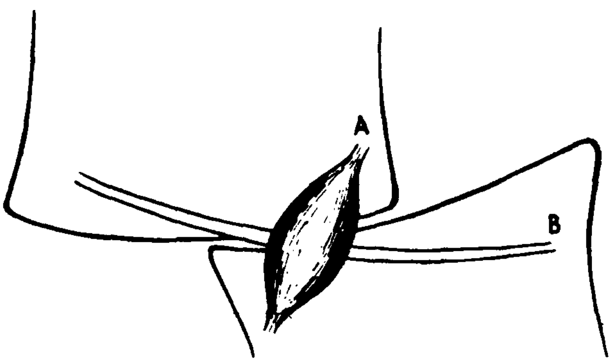

Fig. 2.

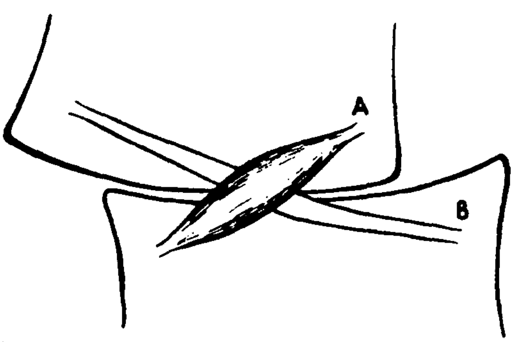

Fig. 3.

position for each lesioned joint. After a few weeks of practice he will not need to delay long on any lesion.

Can this simple, easy method of correction be possible? How can it be, and yet have escaped the notice of thousands of osteopathic physicians all these years? Yet the first published reference I could find to any similar work done is a statement by Dr. Ira C. Rumney of Kirksville College of Osteopathy, in January 1963.[1] In a summary of forces which can be used to re-establish normal spinal motion, he lists: "Inherent corrective forces of the body-if the patient is properly positioned, his own natural forces may restore normal motion to an area."

The phenomena demonstrated in this work indicate that the lesion formation occurred in a position much more extreme than the position in which we found the lesioned vertebrae upon examination. The patient had no pain in this extreme position. He reported, "It hurt when I started to straighten up." It hurt more as he continued to straighten. Muscles which were relatively relaxed in the extreme position tensed in an effort to splint this lesioned joint from further strain.

Is the muscular tension arranged so as to splint this joint, to prevent it from moving back into its eccentric position? *No!* The muscular tension *resists any motion away from the extreme position in which the lesioning occurred.*

Even the severest lesions will readily tolerate being returned to the position in which lesion formation originally occurred, and only to this position: When the joint is returned to this position, the muscles promptly and gratefully relax. These joints do not cause distress because they are crooked; they are paining because they are being forced to be too straight. This is the mechanism of strain. This protective muscle splinting is the "bind."

The three schematic drawings of joints in Figures 1, 2, and 3 illustrate a normal joint in normal position, a normal joint in extreme position in which lesion formation occurs but not strain, and the joint as found by the physician in lesion and in strain. Muscular tension is not the result of muscle stretching or a reflex splinting to prevent return of the joint to the extreme position. It is the opposite. It is the reflex muscle splinting which *prevents further movement away from the extreme position* where lesion formation occurred.

In Figure 3, muscle "A" is splinted in chronic contraction. Muscle "B," though stretched, is not splinted or contracted. The effect is that the joint may easily move back to the extreme position which brings relief. Any movement away from the extreme position increases the strain and is resisted by increased splinting of muscle "A." To initiate a spontaneous correction, a relaxed patient is positioned so as to return the joint to the extreme position, hold it for 90 seconds, and return the still-relaxed patient to normal.

• DISCUSSION. In the light of this knowledge, what happens to some of our concepts of the osteopathic lesion? Could exaggeration of a deformity bring immediate relief to a lesion if the main factor of that lesioning were strain of ligaments or other periarticular tissues or compression of the emerging nerve? It appears likely that exaggeration of the deformity would aggravate the pain in either case because of further overstretching of ligaments or compression of nerves. Local edema begins to resorb immediately upon achieving the position of release, but it requires some time. What "released," so that it could start to resorb? I still have no satisfactory explanation. Yet this new knowledge does upset many of the accepted concepts of the mechanism of producing and maintaining factors of the osteopathic lesion.

It would be a tremendous task to check each muscle and ligament involved in an osteopathic lesion to prove this theory. However, we can reason backwards. The joint is rigid; periarticular tissues are tense. The joint seems to resist all motion. The position of greatest resistance and pain is a position opposite to that of the original abnormality. For instance, a lesion of left laterol flexion resists most violently a bend into right lateroflexion. On the other hand, even the most acute lesion will readily submit to passive movement in exaggeration of the diagnosed lesion, *and in this direction only!*

The physician palpates the tense lesioned area while moving the patient into a position of exaggeration. When he attains the optimum position, there is an almost instantaneous relaxation of tense tissues which is so marked that it is palpable by any osteopathic physician with ordinary skill. At the same time the patient if questioned will report that "you took the pressure off." Localized edema is felt to start to "melt" immediately, but it requires many seconds for the effect to be complete. This perhaps is the factor requiring the 90-second support of the joint in the position of release to effect a correction.

The concept of tissue stasis in lesions seems to be borne out, but what was the instantaneous "catch" that started it, and where? For a long time the theory of deformity of the nucleus pulposus seemed secure. Yet the principles described apply as well to all appendicular lesions as to spinal lesions. Where was the "catch" there? What have we left? Something in or around the joint is "caught."

Exactly what it is, we do not know, but it occurs in a markedly eccentric position and goes into a strain pattern when pulled away from that position. It will correct itself spontaneously if it is supported in the original eccentric position and then is returned, still related, to normal. Once the physician has attained the position of release, no further effort is necessary. Happily back out of the continuous strain it has been suffering, the joint can in 90 seconds restore its own normal function again.

• **SPECIFIC MYOFASCIAL TRIGGERS.** Many patients complain of tenderness remote from the vertebral area. Since my philosophy has always been along the lines of specific lesion for a specific pain, I have always attempted to pin down an association between a certain pain and/or area of acute sensitivity with a specific lesion. But we find that many patients are so vague about the nature and distribution of their pains that from a practicing physician's viewpoint the areas of acute sensitivity prove to be much more reliable. These are the myofascial triggers.

These triggers are a valuable aid to diagnosis for any osteopathic physician, and there are many fairly successful tricks of counterirritation used by some physicians in treatment. In this treatment by use of the position of release they are of inestimable value in eliminating guesswork.

For instance, in lower lumbar lesions it is easy to mistake paravertebral tenderness of a fourth for that of a fifth lumbar lesion; in many instances, tenderness close to the spine may be so mild as to dissuade the operator from giving either diagnosis much credence. On the other hand, their specific trigger points are inches apart and are so sharply sensitive as to remove all doubt of which lesion is the offender. Whereas the vague tension and tenderness near the spinal joint may give a relatively inconclusive manifestation of success in finding the position of release, pain at the trigger point dissolves as if it has suffered a power failure. The sudden definite release is so complete that the uninitiated patient will doubt that you are still probing the right spot. The physician knows his treatment is correct, and the patient also immediately knows.

Some of the triggers and maybe all have been known for many years. Works by Chapman, Travel], Judovich and Bates, and Yoshio Nakatani are extensive. The triggers offered here for your convenience are easily found and *are definitely specific manifestations of specific lesions.* Relief of the trigger point is accomplished only by relieving the causative lesion in the responsible joint.

Though we use the relief of tenderness in the trigger point as evidence of the correct position ofrelease, we are treating not myofascial triggers but spinal lesions. Tension and tenderness near the spinal lesion are relieved simultaneously with relief of the trigger.

*** SPECIFIC TRIGGERS AND ASSOCIATED LESIONS**

Right sacroiliac:
Different triggers are usually relieved by different methods (see suggested techniques). The upper trigger is 1 inch from posterior spine of ilium, at 5 o'clock. The middle trigger is near the third sacral foramen, or about 21/2 inches from posterior spine, at 7 o'clock. The lower trigger is just lateral to sacral cornu (associated with coccygeal pain and tenderness). The trochanter trigger is on the posterior superior surface of greater trochanter of femur. The pubic trigger is on the superior margin of pubic bone 11/2 inches lateral to symphysis. (These last two are used in treating a supine patient.) *Rightfifth lumbar:* The upper trigger is on the medial margin of ilium near the posterior superior spine. The lower trigger is in the notch just caudad to the posterior superior spine.

Right fourth lumbar: This trigger is about l/2 inch posterior to tensor fascia lata and 2 inches caudad to the rim of the ilium.

Right third lumbar: This trigger is 1 to 1 l/2 inches caudad to the anterior superior spine of the ilium or in tensor fascial lata. The posterior third lumbar trigger is a point 2 l/2 inches lateral to the posterior superior iliac spine and 13/4 inches caudad to the iliac crest.

Right second lumbar: One trigger is on the lateral side of the middle of the right inguinal ligament. Another is on the anterior inferior iliac spine.

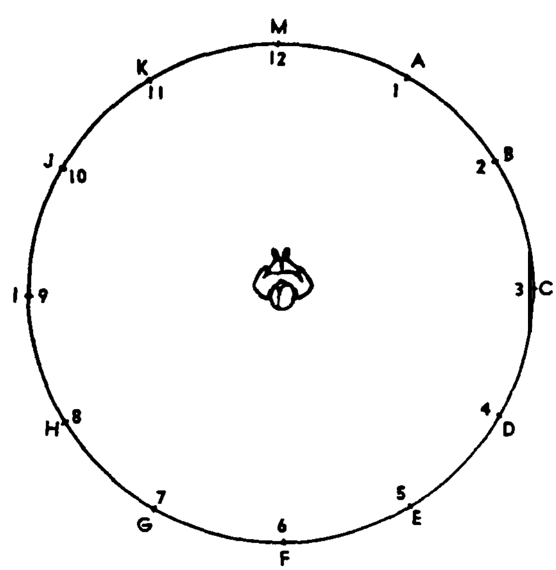

Fig. 4. Bird's-eye view of a man standing on a clock face.

Right first lumbar: This trigger is 3/4 inch below and medial to the anterior superior iliac spine.

Right twelfth thoracic: This trigger is on the inner border of the iliac crest, about 2 inches from anterior superior iliac spine.

Right *eleventh thoracic:* This trigger is on the inner border of the crest of the ilium in the midaxillary line.

Eighth and ninth flexion lesion: This is associated with tenderness 2 or 3 inches below the xiphoid process, and often with epigastric pain and ileitis. Paravertebral tenderness and pain here is often so slight as to be overlooked.

Third Thoracic: This trigger is a point 2 l/2 inches caudad to the spine of the scapula and 1 inch medial to the lateral border of the scapula.

Second thoracic: This is a point l/2 inch above the spine of the scapula and 2 inches medial to the acromial process.

Secondcervical: This trigger is just beneath the superior nuchal line, 1 l/4 inches lateral to the midline.

First cervical: The trigger is on the posterior border of the ramus of the mandible, 3/4 inch above the angle.

Humerus: Affectations here appear to be actual lesions of the humeral joint, although different ones are often associated with upper thoracic lesions as indicated. Treatment is directed to a position of release in the humeral joint (see suggested techniques). (1) The first trigger is a point on the short head of the biceps 1 l/2 inches below the coracoid process of the scapula (often associated with first thoracic lesion); second is a point about 1 inch posterior to trigger above. (2) Another trigger is at the middle of the deltoid, I inch beneath the acromion (usually associated with a second thoracic lesion). (3) Another is on the posterior margin of the deltoid muscle, 1 l/2 inches from the acromial process of the scapula (often associated with third thoracic lesions). (4) Another is deep in the posterior fold of the shoulder near the tendon of the teres major (often associated with fourth thoracic lesions). (5) The circumflex nerve trigger is about 1 l/4 inches below the spine of the scapula and 3 inches medial to the acromion.

Elbow lesion: Elbow tenderness is on head of the radius or in the belly of the brachioradialis muscle (tenderness on lateral epicondyle usually is a trigger from first thoracic or first rib). Tenderness on medial epicondyle usually is a trigger from the *fourth* thoracic or the fourth rib, or a simple extension of the ulnohumeral joint.

. **BASIS OF SUGGESTED TECHNIQUES.** A large proportion of spinal joint lesions will be found to follow a pattern. The majority of lesions of each joint tend to be lesioned in a position common to thatjoint. Though there are many atypical lesions that do not conform, the busy physician may save much time by checking out probable positions first. If successful, he has verified his positional diagnosis while making his correction.

However, he will encounter enough atypical or less common lesions that he will continually find it necessary to abandon the hope of the typical lesion and rely upon his own diagnosis of the position of the lesion. After diagnosing it he will exaggerate the position to the position of release. Occasionally the diagnosis will not be clear, and he will need to search by trial and error. This will not discourage him when he becomes certain

Fig. 5. A demonstration of the technique used for the upper trigger of the fifth right lumbar vertebra (J).

that every osteopathic spinal lesion has a position of release and that by finding it he can produce a correction.

Contemplation of the thousands of possible positions may seem overwhelming until we reduce the consideration of the possible positions to their three basic elements. We need to consider only the direction of rotation and/or bend and how much.

1. Rotation can be only to the right (indicated by "R") or to the left (indicated by "L"). These are described according to the direction of rotation the body of the superior vertebra in relation to the body of the inferior vertebra.

2. Bending (use of such words as flexion and extension is avoided because they mean different things to different osteopathic physicians) can be toward any one of 360 degrees, but requirements for use here are only that we bend in a direction within 30 degrees of the ideal direction. Forward or backward bending is considered simultaneously with side bending as one bend, because it is one bend and not two as we are used to thinking

Fig 5. A demonstration of a technique for right twelfth thoracic correction (KR).

Fig. 7. A demonstration of forward bending for right eighth and ninth thoracic correction (JL).

of it.

Then, if we imagine our patient to be standing in the center of a large clock face which has been placed face up on the floor and standing so that he faces the mark of 12 o'clock (Fig. 4), he may be considered to bend in the direction of any hour on the clock face. This will be accurate enough for effective practical use, though minor modifications may increase the effectiveness. For example, rather than to describe the position of a lesioned joint as right side bending and forward bending, we can say toward 2 o'clock.

To further simplify for the purpose of record keeping, we may substitute a letter for each hour and record a bend toward 2 o'clock as "B," or a bend toward 6 o'clock as "F," and so forth.

3. The amount of bend needed is quite uniform and can easily be learned with practice.

Now, since we have indicated rotation right as "R" and rotation left as "L," we can indicate a fourth lumbar lesion bent to the left side and backward and rotated to the left as "4L-HL." (Note that "M" is used at 12 o'clock rather than "L" to avoid confusion.)

Description of specific suggested techniques will include these symbols to indicate the influence brought to bear on the lesion under discussion.

In most cases the pelvis is thought of as if each side were swinging on the sacrum on a transverse axis. This does not cover oblique bends.

• **TECHNIQUES.** *High right ilium:* The posterior superior spine of right is higher cephalad than the left. The patient is prone on the table. Find the trigger point (probably the middle or upper trigger; see section on trigger points). Raise the right thigh, extending the hip; start a little abduction of the thigh, for midtrigger relief (E). The upper trigger needs no abduction (F); the lower trigger requires a little adduction (G).

Low right ilium: The posterior superior spine is lower on the right. Treat the patient in a supine position, using the trochanter or pubic trigger. The thigh is flexed about 135 degrees on the hip; usually about a 20-degree abduction of the thigh is required, and slight medial turning in of the leg on the thigh.

Right oblique, sacroiliac: The trigger here is on right side of posterior surface of sacrum. (1) Heavy pressure (40 pounds) is applied over the base of sacrum on the left side. (2) Heavy pressure is applied near the apex of the sacrum. (3) Apply pressure as in (1), but over the right side of the base.

Right fifth lumbar: (1) This technique is for the lower trigger. The patient is prone. Find the trigger under posterior superior spine. Hang the patient's right thigh vertically off the side of the table; the doctor holds the leg a few inches below the knee and abducts leg on thigh moderately (B). (2) For the upper fifth lumbar trigger, the technique is the same except that the pull is on the other leg and side bending is in the opposite direction(J). (See Figure 5.) (3) This technique involves simple rotation, as in fourth lumbar, R or L. (4) This technique is used in lordotic spines. The patient is prone; the doctor stands at the left and places his right foot on the near edge of the table, reaches across, and lifts the patient's right leg onto the doctor's thigh just below patient's knee (GL).

Right fourth lumbar: (1) This is similar to the fifth lumbar upper trigger technique. (2) The patient is prone; the doctor stands at the left side and reaches across to grasp the patient's anterior ilium. He rotates the patient's pelvis about 45 degrees, and leans back so that his body weight does the work (L). (3) This technique is like (4) in fifth lumbar correction.

Third lumbar: (1) This is opposite of (2) for fourth lumbar (R) correction. (2) This is like (4) for fifth lumbar correction.

Third, fourth, or fifth lumbar with lordosis or definite spondylolisthesis (1) The patient is in a prone position with the doctor at his left side. The doctor puts his right foot on the table and raises the patient's right leg up about 30 degrees and toward him, until the pelvis is rotated about 30 degrees (GL). For spondylolisthesis, repeat from the opposite side (ER).

Right second lumbar: The patient is in a supine position. Find the trigger point in front of the right ilium near middle of inguinal ligament to the lower end. Bend thighs to a little above vertical, with knees bent. Rotate the pelvis toward the left side of the patient's body, and side bend toward the left to the point of trigger relief (JR). Support the top ilium against excess adduction of the flexed thigh by a forward pull on the top of the ilium.

Right First lumbar, and eleventh and twelfth thoracic: The patient is supine, with a folded pillow beneath the lower lumbar area. In marked antexion, thighs are flexed to about a 45 degree angle with the body. Then the knees are brought slightly to the patient's right and feet slightly towards the patient's left (KL). A variation would be opposite rotation (KR) (Fig. 6).

Right tenth and eleventh thoracic: (I) With the patient prone, the doctor, at the patient's right, grasps the left anterior superior spine by reaching over the right side. He rotates the pelvis to a point of trigger release (about 45 degrees) (R). The trigger here is paravertebral. (2) This technique is like that used for correction of the seventh, eighth, and ninth thoracic, right.

Right seventh, eighth, and ninth thoracic: The patient is prone, arms hanging off the table, and the doctor is at the left side. He raises the patient's right arm up beside his head, holds the arm near the axilla, rotates the upper chest to the right, and side bends to left (RI).

Eighth and ninth flexion lesions: The patient is prone, with a large pillow folded under the lower half of the sternum.

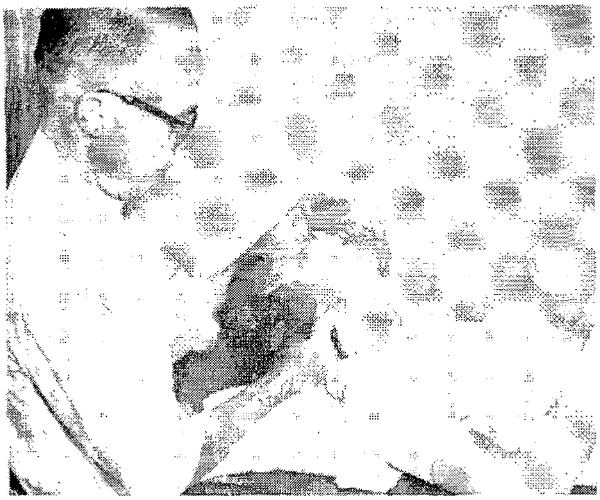

Fig. 8. A demonstration of techinque for correction of a right first cervical lesion (EL).

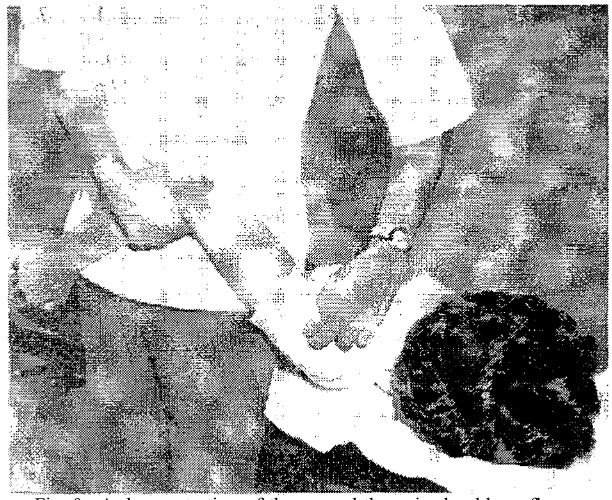

Fig. 9. A demonstration of the second thoracic shoulder reflex. The upper arm is at 8 o'clock, in 60-degree abduction, and under slight traction.

The doctor lifts up on either shoulder and rotates (BR or JL) (Fig. 7).

Right fifth and sixth thoracic: (1) This technique is as in seventh, eighth, and ninth thoracic correction. (2) The doctor is on the right side. He reaches across to left shoulder; the patient's right arm is up beside his head, or at least hanging more cephalad, and the left arm is hanging. He pulls the left shoulder back and around the caudad (JL).

Rightfourth and second thoracic: The patient is prone, arms hanging. The doctor's hand is placed on the patient's chin and cheek. He bends the neck backward, to the left, and rotates slightly to the right (GR). Variations include left rotation (CL), and right side bending (ER or EL).

Right third thoracic: Raise the patient's right arm beside the head, rotate, and side bend the head and neck toward the left, letting the head hang partly off the table in flexion of the upper thoracic area. Elevate the right shoulder in posterior direction, with the doctor's arm under the patient's axilla (JL).

Right first thoracic: Extend, side bend, and rotate to the right (DR). This is irregular; it may be necessary to side bend left (HR).

Right eighth cervical: The patient is in a supine position. Mild forward bending, rotation, and side bending away from lesioned side are applied. (Palpate the transverse process in the side of the neck) (IL).

Sixth and seventh cervical: The patient is in a supine position, head off the end of the table. Back bending, side bend away and rotate toward the side of lesion or as indicated by the position of spinous process (GR). For seventh cervical lesions, rotate left (GL).

Fifth cervical: This technique is similar to that for eighth cervical correction except that more forward bending is used; it may be necessary to reverse sides (KL).

Fourth cervical: (1) This area frequently is in either back bending or spondylolisthesis. Lesions are corrected in marked backward bending and slight side bending as indicated. Check progress by the tender transverse process (GR). (2) Use rotation and side bending to the same side without any back bending (IL). Try the opposite if the first attempt fails (CR).

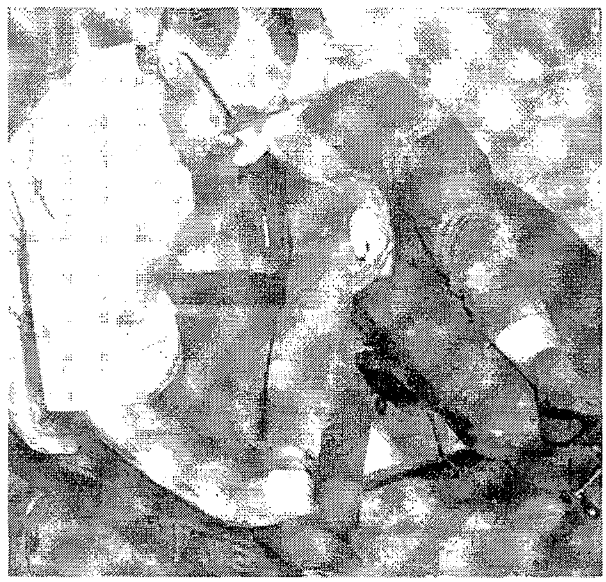

Fig. 10. A demonstration of correction of the right medial meniscus lesion. Internal rotation, adduction, and slight flexion are applied.

Third cervical: (1) Use side bending and rotation toward the side of the prominent tender spinous process of the second cervical vertebra, with fairly marked forward bending (AL),. (2) An alternative is the same except for opposite rotation (AR).

First and second cervical: (1) Correction usually is attained with the patient in marked backward bending and with slight side bending and mild rotation as indicated by diagnosis and comfort (ER or EL) (GR or GL) (Fig. 8). (2) An alternative is marked rotation as indicated, with QO bending (L) or (R).

Shoulder joint: Frozen shoulder may be eased beyond aid obtained by upper thoracic and lower cervical corrections by finding an arm position which relieves the tender spot in the shoulder (see trigger points). Shoulder stiffness with triggers 2, 3, and 4 are relieved in the prone position with the elbow behind the midline with abduction varying from 80 to O degrees (Fig. 9).

Trigger 1 usually is relieved in a supine position with the upper arm vertical and the forearm halfway between cephalad position and across the shoulder girdle. Ten pounds of pressure are applied downward through upper arm and shoulder. Both may be further improved by traction in a caudad direction, usually with 30-degree abduction, occasionally adducted, across chest following the corrections above.

Acromio-clavicular: The upper arm is fully abducted and the forearm cephalad.

Elbow, right radial head: Usually supination is used; occasionally some abduction or adduction are necessary. (Tenderness of the lateral epicondyle indicates probably a first thoracic or first rib lesion.)

Wrist, thumb, and other fingers: All can be easily relieved by finding tender spots and locating the position of release. The thumb is usually bent backward and rotated. Tenderness is near the metacarpophalangeal joint or the carpometacarpal joint.

Knee: The medial meniscus is nearly always relieved by. internal rotation of the extended leg on the thigh, usually with slight flexion and adduction (Fig.10). The lateral meniscus usually requires external rotation.

Feet: ankle sprain: There is tenderness l/2 inch below the malleolus, usually a little anteriorly. This usually is relieved by inversion of the foot with external rotation, occasionally by eversion or dorsiflexion. An ankle sprain is an osteopathic lesion and can be treated in this manner, giving much relief.

Calcaneus: There is tenderness beneath the proximal head; this usually is corrected in eversion or outward rotation of heel on foot.

Cuboid: There is tenderness beneath it. There is eversion of the lateral side of the foot with moderate dorsiflexion.

Navicular: Inversion and a little internal rotation of front of foot, with some dorsiflexion.

Fibula, proximal head: (1) One method is similar to the treatment for ankle sprain. (2) It may be held forward by thumb pressure.

Bunion: There is tenderness at lateral sesamoid, which is relieved by flexion, abduction, and eversion of the great toe until sesamoid tenderness is relieved.

Right ribs: (1) The patient sits with his back to the doctor. The doctor's left foot is on the table, with a pillow on the doctor's knee. The patient drapes his left arm over the pillow, tilts his pelvis to the left, puts his feet at the right side of his hips. The position is marked right side bending, moderate forward bending, and right rotation. It takes 1 to 2 minutes to achieve the necessary relaxation. The position is (BR), or rarely, the opposite rotation (BL). (2) The patient lies on his left side, with his thighs flexed 90 degrees and his right arm hanging behind him. The doctor stands behind and holds the patient's head forward, side bent, and rotated right, and presses caudad on the right shoulder (BR).

Fifth, sixth, and seventh, and eighth ribs: Use a folded pillow under left shoulder.

. GENERAL RULES.

1. Treat "hot " lesions first.
2. Straighten the patient out slowly enough that he can remain relaxed. He will resist and tense if rushed.
3. Check for relief of pain after correction, if only to demonstrate its absence to the patient.
4. An especially "dry" lesion will sometimes be tender after correction. A minute's traction will ease it.
5. Patients will try to help you. Don't let them.

. SUMMARY. Osteopathic spinal and appendicular lesions occur in positions more eccentric than that found by the examining physician. They are in a state of strain because the natural position of the patient holds him away from the eccentric position. The strain is relieved by exaggerating the deformity found upon examination. The lesions will release and correct spontaneously if held relaxed in the exaggerated position for 1 l/2 minutes. The correction itself is restful and comfortable.

Grateful acknowledgment is given to many who have contributed techniques or ideas, in particular: Harry Davis, D O, deceased; G E Holt, D O, Pendleton, Ore; Hugh Barr, M D, Penticton, B C; Annabelle F Thorne, D O, San Francisco, Calif; Margaret W Barnes, D O, Carmel, Calif; Carl L Fagan, D O, Monterey, Calif; James E Spencer, D O, Palo Alto, Calif; Melvin Hennigson, D D S, Hayward, Calif; Rollin E Becker, D O, Dallas, Texas; Harold V Hoover, D O, Tacoma, Wash; T J Ruddy, D O, Los Angeles, Calif; Harold S Saira, D O, Vancouver, B C; and Paul K Theobald, D O, Oakland, Calif

Reference

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Records to assist osteopathic physicians

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Public desire for better health care and for a better understanding of medical services has resulted in an increasing number and variety of demands being made of the profession. In response to public pressure, the federal government and professional societies are transforming these demands into paper work required of individual physicians. The American Academy of Osteopathy believes that physicians' and patients' interests are being lost in the health care bureaucracy and wishes to assist them with the development of a practical medical record system designed to fit their practices. Ideally, the system will require little change in an existing practice and will provide records that (1) will document each patient's health status and (2) will document the total services provided for the patient.

A major interest of the American Osteopathic Association and the Academy is the documentation of the unique aspects of osteopathic medicine. Therefore, the initial effort of the Academy's Uniform Records System (URS) Committee has been to provide for the recording of findings related to somatic dysfunction. Expertise varies among physicians, and the diagnosis of any dysfunction rarely is achieved in a single step. Consequently, the URS Committee has provided in its plans for a clinical investigation consisting of several steps, leading from a preliminary or minimal physical examination that includes somatic findings to the eventual identification of somatic dysfunction.

Clues from a patient's initial physical examination help the specialist as he attempts to further define the patient's health problems. For example, for the cardiologist, findings such as "arrhythmia, " "murmur," and "heart rate" indicate the need for a thorough examination of the cardiovascular system. In their initial physical examinations, osteopathic physicians must record the findings which indicate the need for a thorough examination of the somatic system. The URS Committee recommends use of the terms "asymmetry," "tissue change," and "motion change." The presence of one or more of these somatic findings indicates *possible* somatic dysfunction and should direct the physician to further scrutiny.

Physicians in private practice and in hospitals cooperated with the URS Committee in the trial use of suggested physical examinations that included the recording of somatic findings. Hospital house staffs needed to establish a patient's health status upon admission and needed to meet the AOA requirement of recording osteopathic findings. Practicing physicians used minimal examinations for complaint oriented care. In both hospital and private practice, the initial examination was limited and an almost unanimous request was made for a limited record form.

The Regional Physical Examination (Osteopathic) has been designed as an initial step in the clinical investigation of a patient's health status. The forms indicate the content of the examination for each region. Positive findings are recorded on one form by dictation or in writing and on the other form by check mark. In addition, the physician can further indicate the scope of his attention and his expenditure of time by recording "omitted" or "no findings" where appropriate. There is no difference in the content of the examinations on the two forms. The choice of either narrative or automated recording should make the forms compatible with existing health care record systems.

The AOA Bureau of Professional Affairs, the Committee on Hospitals, the Committee on Colleges, and the specialty boards are cooperating in the development of the uniform records system. The AOA Board of Trustees approved the position of the Bureau of Professional Affairs in recognizing the trial use of the (minimal) Regional Physical Examination (Osteopathic). It is important that the record forms be made available not only to osteopathic physicians in osteopathic colleges and hospitals but also to osteopathic physicians practicing or receiving training in hospitals with joint staffs, in the armed services, or in shared facilities.

The Uniform Records System Committee is interested in receiving comments, advice, and criticism or favorable reaction to the suggested content and to the concepts of recording both health status and physician services. The record form can serve in the initial physical examination, which leads to the use of more definitive forms for each system to be investigated further. They represent one way in which the content of a minimal examination can be organized.

1. Does the system meet current practice needs?
2. How useful is the provision for gradual steps in the clinical investigation?
3. Does experience with use of the system reveal any merits, deficiencies, or problems?

The record forms may be duplicated and the American Academy of Osteopathy will make available forms with open headings for inserting office, hospital, and patient identification information.

**In use, the REGIONAL PHYSICAL EXAMINATION (OSTEOPATHIC) form (at right) is clamped on a legal size hospital chart. The suggestions for use (below) appear first. On the back of this is physician and patient information, followed directly below by the examination record.*

REGIONAL PHYSICAL EXAMINATION (OSTEOPATHIC)*

Suggestions for Use

1. **Complete a regional physical examination, including examination for symmetry, limited motion and tissue change.**
2. **Use the record form as a guide to insure that all items listed are included in the examination.**
3. **Record significant findings for use in assessing health status.**
4. **Record omitted examinations to identify the extent of the examination.**
5. **Record no findings to insure against misinterpretation as "omitted."**
6. **Other findings which are not part of the requested data can be added as a narrative report.**
7. **The examination form can serve as a dictation guide if your records are to be transcribed.**

(HOSPITAL or PHYSICIAN IDENTIFICATION) **Record No.** ____________

REGIONAL PHYSICAL EXAMINATION (OSTEOPATHIC)

Name ______________________ **Birth date- / / Sex- Race** ________

Address ______________________________________

City ____________________ State Zip- ______ **Home Phone ( )**

EMPLOYER ______________________ **Business Phone ( )**

Source of Payment ______________________________________

REGIONAL PHYSICAL EXAMINATION (OSTEOPATHIC)* Record No. ____________

Findings - Indicated by [x] and Written Notes | No Findings | Omitted

General Appearance [] []

Nourishment [], Growth [], Development [], Conscious [], Oriented [], Memory [], Stress [], Posture [][], Movements [][], Skin [][]

Head [] []

Masses or swellings [], Inflammation [], Trauma [], Shape [], Scalp [], Face [], Eyes [], Ears [], Nose [], Mouth [], Tongue [], Jaw [][], Teeth [], Pharynx [], Reflexes [], General senses [], Cranium [][]

(Special Head) [] []

Tonometry [], Ophthalmoscopic [], Vision [], Hearing [], Speech [], Taste [], Smell []

Neck [] []

Masses or swellings [], Inflammation [], Trauma [], Shape (contours) [], Cervical spine [][], Motion [][], Tissues [][], Thyroid [], Nodes [], Pulses [], Swallowing []

Upper Extremity (Right, Left, Bilateral can be used in box if desired) [] []

Masses or swellings [], Inflammation [], Trauma [], Shape [], Motion [][], Tissues [][], Reflexes [], Pulses [], Nodes [], Sensation [], Muscle strength []

Thorax [] []

Masses or swellings [], Inflammation [], Trauma [], Shape [], Thoracic spine [][], Spinal motion [][], Respiratory motion [][], Tissues [][], Nodes [], Pulses [], Breast [], Heart [], Lungs []

Lower Trunk (Abdomen, Back) [] []

Masses or swellings [], Inflammation [], Trauma [], Shape [], Lumbar spine [][], Spinal motion [][], Tissues [][], Nodes [], Pulses [], Reflexes [], Sensation [], Bowel sounds [], Liver [], Spleen [], Kidneys []

Pelvic [] []

Masses or swellings [], Inflammation [], Trauma [], Shape [], Pelvic motion [][], Sacroiliac motion [][], Coccyx [][], Tissues [][], Pulses [], Nodes []

(Special Pelvic) [] []

Genitalia [], Anus [], Rectum []

Lower Extremity (Right, Left, Bilateral can be used in box if desired) [] []

Masses or swellings [], Inflammation [], Trauma [], Shape [], Motion [][], Tissues [][], Pulses [], Nodes [], Reflexes [], Sensation []

GENERAL COMMENTS

____________________ ___/___/___

Examiner Date

Hospit; or Physician
Identification

Patient Identification

REGIONAL PHYSICAL EXAMINATION (OSTEOPATHIC)
(Suggestions for dictation on reverse side)

After physical examination of the region for the indicated descriptors describe significant findings. If the region has no findings, indicate "no findings." If the region is not examined indicate "omitted." If somatic dysfunction* is suspected indicate your finding of "asymmetry," "tissue change" and/or "change in motion" for the region.

General Appearance
Nourishment, Growth, Development, Conscious, Oriented, Memory, Stress, Posture,* movements,* Skin

Head
Masses or swellings, Inflammation, Trauma, Shape, Scalp, Face, Eyes, Ears, Nose, Mouth, Tongue, Jaw,* Teeth, Pharynx, Reflexes, General senses, Cranium*

(Special Head)
Tonometry, Ophthalmoscopic, Vision Hearing, Speech, Taste, Smell

Neck
Masses or swellings, Inflammation, Trauma, Shape (contours), Cervical apine,* motion,* Tissues,* Thyroid, Nodes, Pulses, Swallowing

Upper Extremity (R, L, Bilat.)
Masses or swellings, Inflammation, Trauma, Shape, Motion,* Tissues,* Reflexes, Pulses, Nodes, Sensation, Muscle strength

Thorax
Masses or swellings, Inflammation, Trauma, Shape, Thoracic spine,* Spinal motion,* Respiratory motion,* Tissues,* Nodes, Pulses, Heart, Lungs

Lower Trunk
Masses or swellings, Inflammation, Trauma, Shape, Lumbar spine.* Spinal motion,* Tissues,* Nodes, Pulses, Reflexes, Sensation, Bowel sounds, Liver, Spleen, Kidneys

Pelvic
Masses or swellings, Inflammation, Trauma, Shape, Lumbosacral motion,* Sacroiliac motion,* Coccyx,* Tissues,* Pulses, Nodes*

(Special Pelvic)
Genitalia, Anus, Rectum

Lower Extremity (R, L, Bilat.)
Swellings or masses, Inflammation, Trauma, Shape, Motion,* Tissues,* Pulses, Nodes, Reflexes, Sensation

SUGGESTIONS FOR DICTATION

Dictate your information on the combined physical and osteopathic examination. Please use the indicated sequence to assist the transcriber. Your record will be transcribed onto a form, and out-of-sequence dictation increases the time required to transcribe your record. Quotes are used around terms which follow to indicate suggested dictation terms.

Dictation

1. **"Title" of exam, "patient identification," "examiner," "date," "time."**
2. **"Section heading" and report of findings. Please use headings on the dictation guide to help transcription, and use recommended terms on the guide to insure accurate transcription.**

   NOTES: a. Any section can be skipped - dictate "section heading," "no exam."
   b. Scan the section descriptors and dictate "findings" or "no findings."
   c. "Findings" or "osteopathic findings" can be described as part of dictation.
3. **Accurate transcription is insured if you use listed headings and suggested terms.**
4. **Be concise. Be consistent in your use of terms so that the transcription of future examinations can be checked by the transcriber against your previous reports. It saves errors and everyone's time to have concise and consistent dictation.**
5. **Check the transcription for completeness or errors, and sign and date the transcribed records as soon as possible.**

IX
Research

In the initial article Dr. Albert Kelso discusses planning, developing, and conducting osteopathic research. He presents an overview of osteopathic research, a critical assessment of research methods, and opportunities for the osteopathic profession. His observations are based upon practical experience as a basic scientist working with osteopathic physicians in clinical research.

In the next article Dr. Kelso presents a research record system for clinical research. This is followed by a proposal for guidelines for designing osteopathic research protocols. Dr. Kelso states that there is an urgent need for the establishment of standards for osteopathic palpatory diagnosis and the administration of osteopathic manipulation in clinical research.

In a brief report Dr. Michael Patterson addresses the subject of research designs for manipulative treatment. Some of the problems involved in clinical research employing osteopathic treatment in a private practice are discussed by Stephen Husband.

The last article by Joseph Keating presents intrasubject research designs that are applicable to clinical practice. Several research designs are considered which are applicable to the study of the use of osteopathic manipulative procedures.

Louisa Burns Memorial Lecture 1981: Planning, developing and conducting osteopathic clinical research

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The honor and privilege of presenting the 1981 Louisa Bums Memorial Lecture is greatly appreciated. It provides an opportunity to recognize the contributions of my colleagues at the Chicago College of Osteopathic Medicine (CCOM) to clinical research (see acknowledgments) and to suggest a plan for more rapid development of osteopathic clinical research. (A glossary of terms is appended.)

We honor Dr. Louisa Bums for her contribution to osteopathic research. Dr. Wilbur Cole,[1] in an earlier Louisa Bums Memorial Lecture, provided us with insight on hercharacteristics as a researcher and as one of his mentors. I was impressed with the enthusiasm she generated in her students and colleagues. The most impressive characteristic was her ability to conceptualize from clinical practice and create research designs to test her concepts. We need more osteopathic physicians with similar motivation and drive in order to develop osteopathic clinical research as a major research program in our profession.

Osteopathic research has a long history at CCOM. Some of our earlier research efforts included development of postural radiographic techniques by Dr. Thomas H. Grant and an unpublished study by Drs. W. Fraser Strachan, R.M. Thompson, and W. Don Craske, Sr., on predicting outcomes of appendectomies from osteopathic examination prior to surgery. Dr. J.S. Denslow's research career was initiated at CCOM; my introduction in 1939 to osteopathic research included a trip to Kirksville to see his laboratory and discuss CCOM's proposed research. The project with Drs. Seaver A. Tarulis and Arthur H Steinhaus looked at inter and intra-examiner reliability and an instrumental method for identifying osteopathic lesions.

Our current osteopathic clinical research efforts began in 1963, when we accepted clinical research studies into our research training program. In the ensuing years we have placed increased emphasis on the use of human research subjects for both descriptive and experimental research. My colleagues and associates during these later years deserve recognition for their contributions and in particular for their willing cooperation.

Introduction

Historians will report the growth of osteopathic medicine in several eras. In the first era A.T. Still proposed and disseminated a doctrine which emphasized care for physical man. In a subsequent era there was continued growth while our practitioners, schools, and hospitals emphasized delivery of health care. Our present era is one in which our colleges and profession are gaining recognition for developing fundamental research and for making contributions to primary care. In an era just beginning, we will gain recognition for establishing the scientific basis for osteopathic theory and practice through clinical research.

It is appropriate as we enter the era of osteopathic clinical research to look ahead. Is there a need for osteopathic clinical research? Will osteopathic clinical research answer the demand of our students, our profession, and the public for evidence to support osteopathic theory and practice? Our students have a fantasy of pressing the MEDLARS (medical literature analysis and retrieval system) button and obtaining scientific documentation for osteopathic theory and practice as voluminous as a complete library. The physicians of our profession need security which can be provided by documenting that somatic dysfunction and manipulative treatment are as well founded as any other aspect of medicine. The public wants evidence that the osteopathic physician's services contribute to health care.

Although the needs of students, the profession, and the public for evidence differ, it is my opinion that the trust or faith in evidence produced by clinicians will be more satisfying than evidence from fundamental research. Clinical research has the advantage of providing direct evidence on the contributions of osteopathic medical practice while fundamental research only provides additional evidence to support osteopathic theories.

The background for osteopathic research

The osteopathic profession was founded on the premise that the somatic system plays an important role in health and disease. Osteopathic physicians identify and treat somatic dysfunction. Colleges of osteopathic medicine have departments which teach osteopathic theory and practice. Osteopathic hospitals have staff members responsible for providing the unique aspects of osteopathic health care. Researchers study the influence of the somatic system as an indicator of somatic or visceral disturbance.*

These activities rely on an organized body of knowledge which represents over 100 years of clinical experience, over 40 years of emphasis on fundamental research, recent developments in osteopathic clinical research, and an effort to integrate

*There are several theories on the etiology of somatic dysfunction. A.T. Still originally theorized that arterial circulation determined the health of man. A subsequent theory emphasized structural influences on the neuromusculoskeletal system. Later theories emphasized visceral influences on somatic function.[2] At least four mechanisms can be identified to explain or support these theories: (I) somatosomatic reflexes.[3] (2) viscera-somatic reflexes,[4] (3) facilitation of synaptic transmission in a segment or region of the spinal cord,[5] and (4) learned responses engrammed in the spinal cord [6] Other osteopathic physicians andresearchers have postulated that somatic dysfunction influences health by focalizing stress responses into tissues innervated from the portions of the spinal cord associated with somatic dysfunction[7] or by creating a sympathetic dysfunction which accompanies somatic dysfunction[8] research contributions into the fabric of osteopathic theory and practice. Figure 1 illustrates the multiple sources of contributions to knowledge and the organization of that knowledge as it relates to osteopathic theory and practice.

One source of knowledge, the authoritative source, is the creative osteopathic physician who searches for explanations of what he encounters in practice and who contributes to osteopathic concepts (Fig. l--osteopathic concepts). Dr. Still progressed from founding the profession to explaining his approach to medicine in terms of nineteenth century anatomy and physiology. The history of osteopathic medicine identifies and will continue to identify clinicians whose thoughts and writings integrate clinical experience, the knowledge of man and medicine, into concepts which guide continued growth of practice and research.

Scientists involved in osteopathic research are another major source of an integrated body of knowledge. We are indebted to Dr. Irvin M. Korr's continued efforts to interpret osteopathic theory and practice in terms of scientific progress (Fig. l-osteopathic concepts), which have been collected and published in a single volume by the American Academy of Osteopathy.[9] This volume should, but will not, satisfy the student's desire for a MEDLARS printout, but it is a real boon to osteopathic researchers. Again, history will identify many researchers who not only study fundamental or clinical aspects of the role of the somatic system but also integrate their conclusions into the broader knowledge base concerned with man's health.

Fundamental and clinical research are other major sources of knowledge which support osteopathic theory and practice (Fig. 1). Both fundamental and clinical research are needed to expand knowledge, and emphasis on osteopathic clinical research is not intended to deny the importance of, or to suggest decreased efforts or decreased support for, fundamental research. There is a need to plan as we enter an era and dedicate resources of the colleges and profession to osteopathic clinician research. This presentation addresses issues related to planning.

Planning osteopathic clinical research

One of the stages of planning is goal setting. Goal setting provides the criteria to be used a decade from now when we answer the question, What did we accomplish? Goal setting also ensures a broader look at planned development and it tends to counteract tunnel vision. Other methods-planning on the basis of resources, planning on the basis of experience, or no planning-are likely to overlook some potentials for development.

Osteopathic clinical research should focus on the goal of understanding somatic dysfunction if we expect to identify all the potential sources of knowledge. Other subjects may be equally or more productive; however, focus on somatic dysfunction will ensure that the definition of somatic dysfunction continues to take on new meanings and a broader application. Our present descriptive[10] or operational[11] definition of somatic dysfunction will be modified as research identifies somatic dysfunction's clinical role in health and disease. During development of osteopathic clinical research, the definitions of somatic dysfunction and manipulative treatment should be included in the protocol and these definitions should appear in publication.

The role of somatic dysfunction in personal health needs attention. We need to recognize the broader implications of the influence of somatic dysfunction on health and to avoid the attitude that finding and treating somatic dysfunction is the only concern of the osteopathic profession. Somatic dysfunction should be identified for its influence on health. Manipulative treatment should be described for its influence on health status. Descriptive research on somatic dysfunction could answer our student's, practicing physician's, and public's question, What is the evidence which supports osteopathic theory and practice?

Some basic questions are: (1) What disability results from somatic dysfunction? (2) What is the effect of somatic dysfunction on human performance? (3) What is the effect of somatic dysfunction on health?

Dr. Korr has tried repeatedly to arouse interest in studies on somatic dysfunction as a risk factor in health, and his conceptualization of the spinal cord as a lens which focuses response to stress is an excellent guide to planning such research.[12] Dr. Michael Patterson's Louisa Burns Memorial Lecture 1980[13] provides similar insight for clinical research designs for the effect of "learned" responses relative to somatic dysfunction and its effects. Osteopathic researchers and clinicians so far have not looked at the implications of somatic dysfunction as a learned response.

In order to conduct osteopathic clinical research, we need experienced osteopathic physicians and information on their performance in diagnosing somatic dysfunction or administrating manipulative treatment. Conduct of osteopathic clinical research should be limited to qualified physicians. Clinical research rarely involves a one-time encounter between the investigator and human subject. Consequently, the influence of two or more physicians encountering the patient or the same physician encountering the patient at different times introduces potential errors in the research data. Studies of physician judgement and performance in history and physical examination, and in reading electrocardiograms or radiographs indicate that 40 to 60 percent inter- or intra- physician agreement is all that can be expected, *unless preplanned procedures, criteria for judgement, and methods of reporting* are used.[14,15] Studies at CCOM and Michigan State University- College of Osteopathic Medicine support the concept that preplanned data collection procedures increase agreement between physicians.[16-21] Retrospective studies of heterogenous data which are not collected and reported

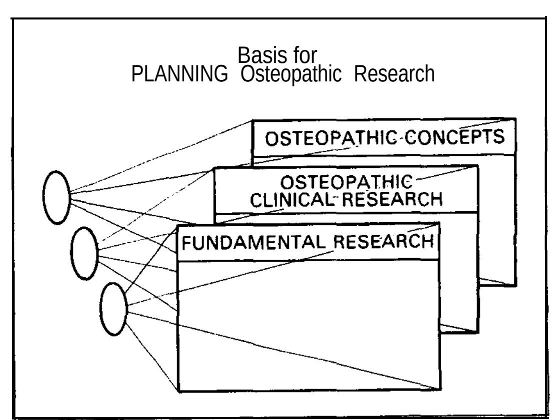

Fig. 1. *Knowledge related to osteopathic theory and practice. Osteopathic physicians contribute authoritative statements on their perceptions of osteopathic medicine. Researchers contribute reasoned statements on the implications of research for osteopathic medicine. Fundamental research supplies the scientific basis for osteopathic medicine while clinical research provides direct evidence to support osteopathic practice.*

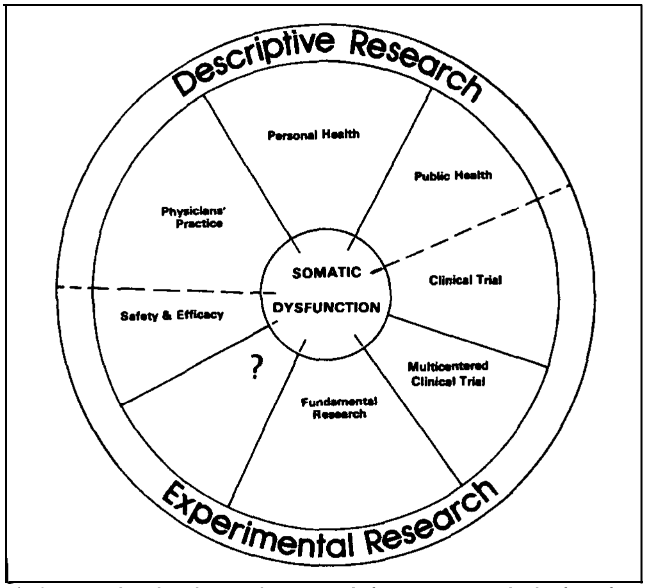

Fig. 2. *Osteopathic clinical research. Somatic dysfunction can provide the focus for developing a body of knowledge concerning osteopathic medicine. Descriptive research has the objective of describing osteopathic medical practice, the role of somatic dysfunction in personal health, and the epidemiology of somatic dysfunction. The objectives of experimental research include the following aspects: determining the safety and efficacy of manipulative treatment, conducting clinical trials of somatic dysfunction and its treatment, and utilizing human subjects for fundamental research.*

TABLE 1. COMPARISON OF FUNDAMENTAL AND CLINICAL RESEARCH DESIGNS.*

	Fundamental	**Clinical**
Questions/hypothesis	Yes	Yes
Preplanning		Informed consent, consultants
Method		
Specification	Variables	(1) Subjects-characteristics, sampling (2) Disease(s)-diagnosis, staging, criteria, response to therapy (3) Treatments-randomization
Measurements	Instrumental	(1) Physician judgment (2) Normative or ordinal data (3) Data collection protocol and record (4) Missed data, patient compliance
Statistics	Inferences and significance	Inferences and significance - semiquantitative data, nonparametric data
Miscellaneous		(1) Incidents (2) Monitoring ("good" or "bad" treatment)

Fundamental research even with human subjects is less complex than clinical research. Clinical research is complicated by heterogeneous subjects, variability of disease, and possibility of bias, and it is constrained by ethical considerations.

according to some plan are unlikely to contribute to understanding of somatic dysfunction.

Figure 2 indicates a plan for developing osteopathic research which utilzes two different research designs. In descriptive research the investigator relies upon nature to provide the experimental variable. In experimental research the investigator manipulates one or more variables. Figure 2 also emphasizes the use of experimental procedures to study fundamental aspects of somatic dysfunction.

Descriptive research is essential to identifying the role of the somatic system in health and disease. The researcher's role in descriptive research is to devise the question to be asked, to develop the methods for collecting data, and to make an analysis of the data which provide the answer to the question. The dotted lines in Figure 2 indicate a decreasing role of descriptive research as the knowledge base for somatic dysfunction develops; however, descriptive research always will remain as an important method for answering questions.

Experimental research contributes to knowledge by investigating ideas generated through reasoning about the authoritative concepts and the descriptions which answered questions concerning the nature of somatic dysfunction and its treatment. In experimental research, hypotheses and related questions are stated, methods are developed for specific testing of the hypotheses, and statistics are used to interpret the data and to allow inferences (predictions) to be made from the research. The researcher's role in experimental research requires information on the current status of knowledge and expertise in the methods, designs, and statistics used. The researcher utilizes his knowledge and expertise to investigate specific problems in order to advance the frontiers of knowledge.

Another aspect of planning is to establish objectives. Objectives guide immediate and long-range endeavor. Objectives are statements of measurable progress in reaching the goal of osteopathic clinical research. The potential for reaching the goal of understanding somatic dysfunction indicated in Figure 2 as eight long-range objectives. Epidemiologic studies which describe the dynamics of somatic dysfunction in public health and descriptive clinical research on personal health and on osteopathic physicians' practice are research methods which will achieve some objectives. Clinical trails of safety and efficacy, multicentered clinical trials, clinical research on specific roles of somatic dysfunction in disease, and fundemental research using human research subjects will achieve other objectives.[22] Epidemiology, clinical trials, and experimentation with human subjects can utilize a general research design which is then modified for the specific differences related to each type of research.[23]

These eight long-range objectives (Fig. 2) can be identified with specific questions and a hypothesis for developing osteopathic clinical research. Epidemiologists in the past 30 years have developed research designs which readily identify health problems and their dynamics.[24] Use of epidemiologic research designs, possibly developed and coordinated by the American Osteopathic Association, would increase our knowledge on the impact of somatic dysfunction on personal and public health and on health care costs. If we were to use the epidemiologic design and resources which were used to identify and define Legionnaires' disease, we might have answers within the decade. On the other hand, if somatic dysfunction is intermediate as a threat to health, some place between a common cold and Legionnaires' disease, it may take longer. In addition, the public's increased concern for health maintenance could lead to research on the role of somatic dysfunction as a risk factor in personal health much sooner.

Osteopathic physicians along with other practitioners who use manipulative treatment in research must answer two questions (Fig. 2--safety and efficacy): First, what risks are associated with manipulative treatment? Second, what benefit does manipulative treatment provide? The continued willingness by a third party to pay for manipulative treatment may rest on the answers. We are indebted to Dr. Edward Stiles[25] for his study on manipulative treatment and length of hospital stay as another approach to validating the contribution of manipulative treatment to health care. Our students' respect for manipulative treatment will change with the realization that the various manipulative procedures have indications and contraindications.

The U.S. Senate in its wisdom has mandated protection of patients and the public during the delivery of health care.[26] In the past decade new Food and Drug Administration regulations have raised the standards for approving drugs, medical devices, diagnostic testing, and quality control of laboratories involved in clinical research.[27] Similar requirements for approval of manipulative treatment could be published. When research designs are developed to evaluate manipulative therapy, consideration should be given to the criteria used to judge efficacy. Should the criteria be pain, somatic dysfunction, or some other measurable phenomenon?

Clinical trials (Fig. 2) utilize research designs which compare efficacy of therapeutic treatments or results between groups of patients subjected to naturally occurring variables. Since 1977, considerable interest in clinical trials is resulting in publication of the research methodology which ensures both humane research and sound methodology.[28] The major characteristics of clinical trial designs are that every detail is defined: patient selection, disease, controls, randomization, data collection, criteria for analysis of data, statistical design, and power of the method.

Multicentered clinical trials (Fig. 2) have designs similar to the clinical trial conducted by one investigator. However, management of the trial and centralized coordination of research become dominant factors.[29]

Human research subjects have been used for osteopathic research. Dr. Denslow's[3] electromyographic measurements of paravertebral muscle tension and subsequent studies at the Kirksville College of Osteopathic Medicine by Korr, Thomas, and Wright[30] on skin temperature and sweating contributed to our knowledge on somatic function. There have been others, and there will be many more investigations which will contribute to knowledge of somatic function and dysfunction in man.

There are probably many unmentioned potential areas for development of osteopathic clinical research (Fig. 2--?). Creative thinking will formulate specific questions to be asked. Physicians in industrial medicine could identify the extent to which somatic dysfunction exists in industrial settings and its effect on employee performance. Osteopathic physicians in sports medicine could determine the influence of the presence of somatic dysfunction and its treatment on the performance of highly skilled athletes. Orthopedic specialists could readily compare efficacy of manipulative treatment to orthopedic forms of treatment.

I have indicated opportunities and only goal setting and objectives for planning. Methods can be developed to answer the research questions when they are needed. The researcher should seek out appropriate research designs and consultants to improve the contributions which can accrue from his/her research.

Development of osteopathic clinical research

Probability of success in planned research can be increased by preliminary trials, pilot studies, and/or feasibility studies. The purpose of the initial trial is to ensure that the selected research design and methods for collecting and recording data will function as planned. Table 1 indicates that fundamental research is a simpler task than osteopathic clinical research. This is oversimplified in Table 1; however, the experienced investigator has established research designs, established methodologies, instrumental measurements, and well known statistical methods for estimating the degree of significance and for drawing inferences from the data. In contrast there are no established clinical research designs.[31] The clinical research first of all is dealing with a heterogeneous population that requires special consideration if the research results are to be applied to practice. Additionally, the need to eliminate bias, the influences on research subjects introduced by the presence of other disease and use of other therapy, the utilization of data based on patient and physician judgment, and administrative problems make the clinical researcher's tasks complex and difficult. There may be questions at the end of a clinical study because of dropped cases, missing data, and variability in data collection: Can statistics be used? Can any inference be drawn? The clinical researcher is also required and constrained by ethical concepts to obtain preapproval for conducting research, to obtain informed consent from the human subjects (or surrogates), and to discontinue research when incidents occur which indicate unexpected risk or to change research designs if one therapeutic treatment appears to be better.

Other considerations which are presented in Table 1 emphasize that planning of the final research endeavor requires institutional review with an identification of risk to subjects, indication of expected benefits, and assurance of scientific merit.[32] If manipulative treatment is used in experimental research (but not in descriptive research), a sham treatment control group needs to be incorporated into the design. Specific philosophic questions concerning sham treatments need to be addressed: Is the subject to be treated in the absence of somatic dysfunction? What criteria will be used to determine efficacy of treatment? What other controls could be used? A study by Drs. Beal, Goodridge, Johnston, and McConnell" on negotiated criteria for evaluating efficacy of treatment provides insight in answering some of these questions.

Conduct of osteopathic clinical research

One of our studies will be used to illustrate conduct of osteopathic clinical research.[33] The study was planned using many of the considerations aforementioned, although our experience has emphasized the need for some additions. Dr. Larson[34] in clinical practice previously had identified and treated hemiparesthesias of upper and/or lower limbs. Planning our study required about 6 months, and this period included establishing a clinic to provide care for patients who might be research subjects. The plan utilized a flow chart which sketched the sequence of patient selection, the measurements to be used, a physician-blind control, a control placebo treatment, and recruited co-investigators. The plan was subjected to a trial period of a year, after which we revised the plan and then conducted a 3-year investigation in which only holidays interrupted the weekly research clinic.

The question for the research was, What is the effect of manipulative treatment on peripheral nerve complaints? The patients for this study were referred to Drs. Larson and Walton for care. Over 750 patients were referred from CCOM's hospitals and clinic for care, and 433 participated in the study. A physician-blind control research design was developed. Patients were randomly assigned to treated and sham-treated groups. The research protocol specified the patient, the condition being studied, the criteria for accepting or rejecting patients from the study, the treatment and control groups, and the measurements for data collection. Subjective data were based on answers to preselected questions. Similarly, the physician's observations were based on predetermined observation and criteria for recording.

The study benefited from planning, preliminary testing, and attention to administrative details, which included obtaining cooperation from all departments and persons affected by the research program. Our contingency plans accounted for everything except Dr. Larson's untimely illness.

Conclusion

A case is made for using descriptive research (not anecdotal tales but sound, planned research) in the initial efforts to provide clinical evidence to support osteopathic theory and practice. Emphasis is placed on developing experimental clinical research on somatic dysfunction and manipulative treatment while continuing and expanding fundamental research on osteopathic theory in order to ensure continued growth of the osteopathic profession. Research opportunities, the need to plan and establish osteopathic clinical research designs and a role for the AOA, osteopathic specialists, and many osteopathic general practitioners are identified as essential ingredients in the success of the next decade's osteopathic research endeavor.

Acknowledgments

In appreciation, I would like to acknowledge the contributions of the following persons:

The late Dr. Richard N. MacBain, former president of CCOM, introduced me to the fact that the dedicated osteopathic physician makes a major contribution to knowledge and sets the stage for research. We had many long discussions as he prepared his A.T. Still lecture entitled "The somatic components of disease." Through these discussions I became aware of the importance of theories of referred pain, the anatomy and function of the autonomic nervous system, and the segmental basis for interrelating somatic and visceral functions.

Dr. Thomas W. Allen, now dean and vice-president of CCOM, as a freshman student wanted to do clinical research. He played a major role in bringing clinical research into our student research training program. Dr. George Marjan offered to sponsor a study on use of the thoracic pump, also known as Miller's lymphatic pump, in treatment of chronic obstructive pulmonary disease. The patient returned to work as a janitor in less than a year, and became a research subject for a subsequent study in which manipulative treatment for somatic dysfunction replaced the use of the thoracic pump.

Dr. Alexandra A. Townsend, another student research fellow and long-time research colleague, published eight studies on fundamental and clinical research as a student, intern, and practicing physician. Her clinical contributions included one clinical research study on manipulative treatment in a case of congenital kyphoscoliosis and another research study on total health care for a case of chronic obstructive lung disease. In addition, she has been a valuable consultant on methods for developing clinical research records that are compatible with the philosophy and methods of recording used for problem-oriented medical records.

Drs. Norman Larson and Mark Walton were coinvestigators in a study of the effect of manipulative treatment on peripheral nerve complaints. They established a record for CCOM, 3 consecutive years in which their research clinic met every scheduled session, missing only holidays. Their research assistant, Mrs. Alice Townsend Hendrickson, followed up on missing patients, kept patients on schedule, and scheduled each clinic to capacity. With CCOM's patient population, we needed that kind of assistance.

Dr. Robert Kappler has been our backup research physician and a coinvestigator on the studies of osteopathic findings in hospitalized patients and chronic obstructive lung disease. His dedication and unquestioning assistance saved these studies through two staff resignations and the problems of changing facilities to accommodate building and occupying two new clinic facilities. Our experience emphasized the need for contingency planning for clinical research. Dr. William Johnston has been a delightful colleague for the past several years. His commuting trips to Chicago have been frequent and our association has led to some very productive thinking about clinical research.

It is most appropriate to say that osteopathic clinical research would still be at ground zero at CCOM if Dr. Robert A. Kistner had not provided resources and administrative support; Ms. Rose Sage had not been a most able administrative assistant; and my wife, Peggy, and my family had not been both tolerant and supportive of these efforts.

We have provided research training for many students and have had many others as research assistants. It was our good fortune to have their dedication and cooperation at a time when our resources were limited. I regret that we did not have our present resources at CCOM. If we had had, the new generation of osteopathic physicians would include several D.O./Ph.D.s and others already trained and active in clinical research.

The following osteopathic clinical research abstracts and papers were assisted by funds from the Bureau of Research, American Osteopathic Association, National Osteopathic Foundation, and A.T. Still Research Foundation.

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Appendix

Glossary

Descriptive research is conducted without introduction of experimental procedures which will affect the patient. Scientific method requires that descriptive research minimize researchers' bias, account for variability in disease processes define and specify details of procedures used, and recognize the multiple influence of health, health care, and environment on patients. Descriptive research uses statistics which identify mean, mode, or median; range, deviation, or variance; and test significance by measures of ratios or distributions.

Experimental research utilizes an experimental procedure which will affect measurable outcomes (the experimental variable or criterion measure) that are determined as a difference between control measures and measures which are made relative to introduction of the experimental procedure.

Fundamental research is investigation which is conducted for the purpose of contributing to knowledge.

Clinical research is research on health, disease, and the diagnosis and treatment of disease. Recent development has added investigation of health care delivery and health care costs as a component of clinical research.

Osteopathic clinical research is the study of somatic dysfunction, including diagnosis and treatment.

Clinical trial is a research design which is used to study treatment.

Informed consent is the procedure and documentation required on ethical grounds and mandated by the U.S. Federal Department of Health and Human Services for protection of human research subjects.

Somatic dysfunction is the diagnosis of the somatic component of health and disease.

Osteopathic lesion is synonymous with somatic dysfunction as a diagnosis that is, it is what was treated by manipulative therapy prior to acceptance of the term "somatic dysfunction." However, osteopathic literature includes conceptual discussions of etiology and significance of the osteopathic lesion and the characteristics of osteopathic lesion, which are described and are more extensive than the characteristics used to make a diagnosis of osteopathic somatic dysfunction.

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A research records system to meet osteopathic clinical research requirements

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The records of a clinical research study must meet requirements related to patients' rights, to adequate research controls, and to research funding or publication of research. Increased emphasis on patients' rights has created the need for additional documentation in the health-care and research records.[1] A minimum research control insures that the clinical evaluation of the patient's response to research treatment is made without knowledge of the patient's treatment,[2] experimental or control. Additional research control is desirable to minimize the patient's awareness of the type of treatment rendered, and to minimize the osteopathic physician's knowledge of the research results.[2] Both funding by a grantor[3] and acceptance of research publications* are based upon assurance that records of the research activity and documents that indicate compliance with various requirements are adequate.

The following discussion describes a records system which was designed to meet the stated conditions. The system is analyzed for feasibility in a double-blind clinical research study.

Documents in the records system should indicate protection of the patient's rights. The patient has the right to adequate health care, the right to informed consent, and the right to comprehend the consequences of any decisions that are related to consent.[1] These rights are accepted without discussion of the issues which are currently being debated.

The record of health care is kept in the usual clinic or hospital chart. The progress notes in these charts should indicate the occurrence of research visits for treatment, testing, or clinical evaluation. In problem oriented records the problem list should contain the problem, "research participation," in addition to the progress notes on research visits. These entries on research participation and research visits provide information to other physicians who may use the charts, and the entries provide some protection of the research project against the effects of change in patient management.

The research patient's health record should contain a standard data base** and a special data base related to research. The hospital or clinic chart should also contain documents or entries in the progress notes when informed consent is obtained. A copy of the informed consent for research participation should be placed in the chart. Other informed-consent records should be handled in the routine manner. An entry in the progress notes should indicate the procedure used for patient education. Entries should include discussion and/or printed directions or information given to patients which concerns the research, health status, patient's role in health care, and reviews of clinical progress.

Clinical research requires as a minimum control the evaluation of the influence of research care without knowledge of which treatment-research or placebo-a patient received.[2] Additional controls that minimize the patient's and the research physician's knowledge of research test results are desirable as is a clinical evaluation of the patient's progress.[2]

If the treatments are medication, the double-blind research controls are readily achieved. However, when the treatments involve personal services to patients, a rigid double-blind control is difficult to achieve. Procedures in osteopathic treatment involve both patient contact and patient manipulation, which are difficult to duplicate as placebo procedures. If the osteopathic physician rendering research treatment is restricted from access to information on the patient's health status and his responses to treatment, the treatments have little resemblance to osteopathic treatments used in routine health care.

In our research, the experimental patients who receive no osteopathic treatments for the specific region of the body

(cont. next page)

*** Editorial policy of many journals requires evidence of compliance with the principle of humane ethics in the use of humans or animals as experimental subjects as a prerequisite for acceptance of manuscripts.**

*Chicago College of Osteopathic Medicine, in unison with other Illinois colleges of medicine, will initiate the use of problem oriented records in 1975. In order to establish a uniform records system for the research project, which may extend beyond 1976, we are using *Format & Forms: Guidelines for Problem-Oriented Medical Records* (Illinois Regional Medical Program, Chicago, 1973) to develop problem-oriented records.

**Automated history and physical examination record forms and a basic set of laboratory test results, x-rays, and electrocardiograms insure that all research patients' health-care records contain similar resource information. The use of automated record forms insures recording of what is omitted and what is normal, as well as clinically suspicious findings. A properly designed form also provides a guide or control which develops efficient routines. The resistance to check-off records or computer-controlled data collection has been minimal *after* physicians have tried the system. The need *for added data* to meet in-depth or individual variations is met by space for narrative additions. If the spaces for narrative additions are provided in logical locations, record reviews provide a means of updating the automated record with an increased data base. We have developed unpublished check-off forms for history and physical examination in addition to the osteopathic examination form. These forms and instructions for use will be available upon request.

related to the research problem receive either an extended osteopathic examination, nonspecific manipulative treatment, or specific manipulative treatment to areas of the body not related to the research problem. The experimental patients are scheduled for research visits on the control patients' treatment schedule. The procedures described minimize the patient's knowledge of controlled or placebo osteopathic treatment. The effectiveness of the placebo as a blind control for the patient is adequate for naive patients but inadequate for patients who have received osteopathic treatments frequently before participating in research.

Additional research control has been achieved by keeping two sets of records on the research activity. The osteopathic physician keeps records of the osteopathic examination and records of osteopathic or placebo treatments of research patients in a separate file which is not available during clinical evaluation of a patient's research project. There are two types of osteopathic examination: a periodic total examination* and an examination to determine the manipulative procedure to be used. The latter examination is recorded in terms of restricted movement or type of tissue change. The osteopathic treatment is recorded by indicating: (1) the specific purpose of the manipulative procedure; (2) the type of force applied and details of direction, duration, and intensity; and (3) the physician's judgment of whether or not the patient responded in the manner stated in the purpose. The osteopathic examinations provide one basis for analysis of research results. In addition, the osteopathically treated patient's need for and response to manipulative treatment provides additional information to document osteopathic aspects of health care.

The project director keeps the remainder of the research records which are not available to the osteopathic physician in a research file. This research file contains the original informed consent to participate in research,** the record of the institutional approval of the project,[1] records of reports on institutional review of the patient's involvement,[1] test results of research and clinical evaluation of the patient's research-related progress, and reports on periodic review of the patient's health care and research records. The osteopathic physician's records and the research file partially fulfill the requirements to grantors[3] for records of research activity, and for the information needed to document that adequate attention has been given to protect the research patient's rights to health care, informed consent, and adequate knowledge of the consequences of the decisions.

The procedures, records, and record-handling system which have been described insure a blind-controlled clinical research study. There are some controls, the placebo substitute for treatment and separate research files for osteopathic records and for other research records, which provide a degree of doubleblind control for the study. Because all the physicians responsible for health care and research use the patient's health-care chart and are not restricted in discussion of the patient's health problems and care, there is incomplete control of the osteopathic physician's knowledge of the patient's progress. The lack of complete control is compensated by insuring that the study relates to how an osteopathic physician usually cares for a patient, and all physicians in the research study become responsible for insuring total health care

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*An automated form for recording osteopathic examination findings is used in our studies. The examination procedure and form are described in a publication which is in preparation, and available upon request.

**The content of the informed consent to participate in research that we use includes:

a. The definition of the need and goal of the research study.
b. The definition of patient time and activity required beyond the time and activity related to health care.
c. The designation of research grouping and the general research procedure related to each group.
d. The definition of estimated risks of additional testing and of control or experimental procedures.
e. The description of possible influence of participation on future health status.
f. A statement, to be signed, that procedures and risks have been explained and that the patient voluntarily agrees to participate.

The request for participation in the research study is made to selected Patients in the presence of a third party. The patients are assured that the decision will not influence the health care they receive and that they are free to drop out of the study without any effect on their future health care. It is emphasized that no rewards or remuneration is given for participation, but that costs of extra testing related to research and their visits for research treatment will be rendered without charges to the patients. Each item of the consent form is explained and discussed. If the patient agrees to participate, the three parties present sign the consent form and a copy is given to the patient.

Appendix

Summary of Records

A. Health-care chart
  1. Problem-oriented record
  2. Automated history, physical examination, and osteo pathic examination, and a defined set of routine labora tory tests and special tests used for selection of patients
  3. Research entries in problem list and progress notes
  4. Copy of informed consent to participate in research
  5. Documentation of other informed consent
  6. Documentation of patient education

B. Osteopathic physician's records
  1. Automated record of osteopathic examination findings
  2. Record of osteopathic examinations to identify need for treatment
  3. Record of osteopathic treatment for control patients
  4. Record of placebo procedure for experimental patients

C. Research file
  1. Original informed consent to participate in research
  2. Test results and analysis of research-related testing
  3. Record of clinical evaluation of patient progress in

research related health problems

4. Record of reports, inspections, and institutional action on approval and supervision of the research study

1. U.S. Department of Health, Education, and Welfare: The institutional guide to DHEW policy on protection of human subjects. DHEW Publication (NIH) 72-102, December 1, 1971. U.S. Government Printing Office, Washington, D.C., 1972.

2. Cox, K.B.: Planning clinical experiments. Charles C Thomas, Publisher, Springfield, Ill, 1968, p. 34.

3. American Osteopathic Association Bureau of Research Handbook. Ed. 3. American osteopathic Association, Chicago, 1968.

Format Forms: Guidelines for problem oriented medical records. Illinois Regional Medical Program, Chicago, Jan 73

The records on osteopathic examinations and treatment and the research study described in this article were developed with the aid of grants (T-XX67) from the AOA Bureau of Research and the A.T. Still Foundation.

GUIDELINES FOR DESIGNING OSTEOPATHIC RESEARCH PROTOCOLS AND REVIEWING PROTOCOLS, REPORTS AND PUBLICATIONS

ALBERT F. KELSO, Ph.D.

NEED

There are no standard procedures for making osteopathic palpatory diagnosis and administering osteopathic manipu tive treatment. Until standards are established, some method is needed to insure a degree of uniformity in describing and recording procedures. Guidelines for osteopathic research would provide a basis for comparison of results.

Comments: Standards are established by agreement between experts or developed as the result of research. Establishment or acceptance of standards advances science and practice more rapidly because standards insure communication, and provide a benchmark for comparison.

Researchers, without guidelines or standards, will utilize different procedures and it will require considerable time to develop sufficient information to promulgate standards.

Flexibility is needed in research until standards are established. Consequently guidelines should provide for flexibility whileensuring a common basis for describing the methods used in study of somatic dysfunction.

METHOD

Provide guidelines for researchers whose research involves osteopathic diagnosis or treatment. Provide the same guidelines for reviewers who evaluate osteopathic research protocols, reports or publications. Periodically (one and five years) evaluate the impact of the guidelines on research proposals, contributions made to knowledge from research that follows the guidelines, and trends towards standardization. Revise or abandon the use of guidelines based upon the evaluations.

SUGGESTED GUIDELINES

Ostepathic palpatory examination:

The examination should be described in research protocols and reported in records, reports and publications in terms of 1) tests (specific palpatory procedure), 2) criteria for a positive finding (for each test),3) criteria for an assessment of segmental or regional somatic dysfunction from the findings. The description should follow the generally accepted grouping of terms in categories of Asymmetry, Range of motion, and Tissue texture change, and provide information on location and attributes (acute/ chronic, severity, history of occurrence and treatment, and reactivity) of somatic dysfunction.

Comment: These guidelines are sufficient to insure adequate information on osteopathic palpatory examination, findings, and assessment.

The procedures provide the researcher with a method for comparing pre and post treatment status and following the course of somatic dysfunction. Another osteopathic physician or knowledgeable person can visualize how somatic dysfunction and changes in somatic dysfunction were identified.

Osteopathic manipulative treatment:

The treatment should includedescription: 1) of location, 2) of the treatment goal, i.e. what change is expected to occur in the diagnosed somatic dysfunction; 3) of technique(s) used; 4) of response to treatment in terms of changes in palpatory tests, and 5) of the time when changes were observed. Research on response to manipulative treatment should categorize the degree of somatic dysfunction response and include in the analysis of results responders versus non- responders.

Comments: The procedure provides the researcher with sufficient freedom to design treatment.

The guideline allows differentiation between studies of procedures and studies of therapeutic response. Research can focus on manipulative technique, i.e. the use of a stereotyped method, or it can focus on manipulative practice, i.e. the physician's decisions on technique, duration, intensity and frequency of treatment.

The guidelines emphasize the importance of describing and recording changes in somatic dysfunction that accompany treatment. The researcher needs to recognize that changes in somatic dysfunction include three components, asymmetry, range of motion, and tissue texture. These components do not change synchronously. Range of motion may be detectable immediately, while asymmetry and tissue change are delayed. Each component follows a different course of change. Reviewers of osteopathic research protocols. reports or publications need to evaluate whether or not the researchers report of results and conclusion is consistent with the purposeof the research. Osteopathic manipulative treatment, like other treatment modalities, may provide immediate relief or change or it may require a series of treatments. The reviewer should note when single treatments are used to produce long term changes. Also, it is important to note when variations within normal range are sufficient to account for the variation attributed to somatic dysfunction or its treatment.

Note: Variability in persons, their health status, problems, and response to treatment makes it difficult to demonstrate association between two observed phenomenon. Osteopathic philosophy and theory emphasize somatic dysfunction as a primary component. Research should make somatic dysfunction, its diagnosis and treatment, the independent variable unless the protocol justifies some other research strategy.

Qualification of person providing diagnosis or treatment.

The protocol should identify physician(s) qualifications or level of expertise. The control for inter and intra physician valiability should be described if more than one physician is involved or the study extends over a long period of time.

Comment: Many studies on physician decisions have emphasized the variability in decisions. Methods should be designed to reduce the variability and to assess the influence of the variability on the results.

Plan for reporting results

The research protocol, report or publication should indicate how severity of and changes in somatic dysfunction are used in analysis of results.

Comments: Most osteopathic research investigates the relationship between somatic dysfunction and some aspect of health. However, many research protocols, research reports, and publications omit thedetails on somatic dysfunction. This makes it difficult for the reviewer or reader to evaluate the relationship between somatic dysfunction and health status. Identifying changes in somatic dysfunction, changes in health status, and degree ofassociation of the two changes will advanceknowledge on the role of the somatic system in health and health care.

Priorities for osteopathic research:

The primary purpose of osteopathic clinical research is to provide evidence that osteopathic palpatory diagnosis and manipulative treatment contribute personal or public health benefits. The development of a theoretical basis for osteopathic practice and the conduct of basic and clinical research to test the theories are equally important but non essential unless the primary purpose is achieved.

Contribution of osteopathic palpatory diagnosis and manipulative treatment to personal and public health includes evidence on:

1) the safety and efficacy of osteopathic palpatory diagnosis and manipulative treatment,
2) the effectiveness of manipulative treatment in managing somatic dysfunction,
3) the influence of somatic dysfunction on health,
4) the relative effectiveness of osteopathic palpatory diagnosis and manipulative treatment, compared to other methods, and
5) the cost effectiveness of these procedures.

Albert F.Kelso, Ph.D. l/l/88

Clinical research designs for manipulative treatment

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Clinical research is a relatively young area of research design. Indeed, the whole field of clinical research has only evolved in the past 40 years. One of the major topics of concern for clinical research design is the construction of appropriate control contrast groups against which the effectiveness of a clinical entity may be tested. The genera1 mode1 for such contrasts is the double-blind placebo control that tests for the effectiveness of a chemical substance while controlling for the expectations of the subject.

Research designs for testing manipulative treatment as it is used in the osteopathic profession have been difficult to construct owing to technical and conceptual problems that are not yet resolved in the research design community. The design of a protocol for manipulative treatment must meet the criteria of good design, yet satisfy the practitioners of the treatment that the actual treatment is being put to a test. The central issue in designing a suitable clinical design for any such test is the experimental question being asked.

It seems appropriate to consider in this light what the actual substance of the manipulative treatment involves, and whether this is completely comparable with the usual drug trial in which a chemical is being tested. If, then, the experimental question is to test the effect of manipulative treatment as performed by the osteopathic physician, it seems that the appropriate control contrast is a group that receives no such treatment. In such case, the commonly used "placebo" control for hands-on effects and such is inappropriate, because the hands-on portion of the treatment is properly part of the active ingredient. On the other hand, if the experimental question is to test the effect of some manipulation per se, such as the effect of lateral recumbent roll, the appropriate control contrast would be a positioned subject without the thrust. In the case of a test of manipulative treatment tests, it would certainly be appropriate, on finding a significant effect, to design further studies to factor the effect into component parts, such as hands-on, movement, thrust, and so forth, but to try to do so in the initial study would seem inefficient and counterproductive. Thus, we suggest that a careful consideration of the experimental question will lead to the appropriate design of studies of the efficacy of manipulative treatment or manipulative techniques, but that the question must be carefully thought out and understood.

Osteopathic manipulative treatment clinical research in a private practice setting: Lessons learned in a pilot study

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This presentation will address some of the perils and pitfalls in conducting "real-life" clinical research with osteopathic manipulative treatment (OMT) in a private practice setting. In a pilot study intended to relate the efficacy of OMT for patients with back pain to patient demographic or psychological variables (or both), such as depression, perception of pain, and hopelessness, a number of problems were encountered that eventually confounded completion of the study as it was originally envisioned.

The purpose of this presentation is to discuss some of the problems inherent in conducting OMT research, as well as highlighting strategies for avoiding or overcoming problem areas using our experiences with the pilot study to illustrate points. Some of the potential problem areas that may be encountered by the OMT researcher include the following:

1. Subject selection criteria such as volunteer bias, self-selection, impact of informed consent, and the like. For example, in our pilot study patients did not volunteer to participate for a number of reasons; these reasons will be discussed along with ways to minimize this kind of problem.

2. Patient-related variables such as "positive malingering," insurance coverage status, litigation or worker's compensation status, psychological status, prior experience with and expectations of OMT, and referral source.

3. Environmental variables such as demand characteristics of the office setting, degree of confidentiality of data collected (both real and perceived), the use of psychologically oriented instruments in a physical medicine setting, and the time required for subjects to complete the instruments.

4. Research management issues such as researcher-clinician interaction, control of the data collection process, difficulties in collecting data in a private office setting, the need for on-site research assistants and management of the assistants, and the way in which the research is presented when recruiting subjects from patients in a private practice office.

Intrasubject experimental designs in osteopathic medicine: Applications in clinical practice

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Intrasubject experimental designs provide an inexpensive alternative and adjunct to large-scale, control-group (intersubject) clinical trials of osteopathic manipulative treatment (OMT) and other health-care methods. These designs may promote development of the osteopathic clinical scientist by providing experimental strategies that do not require large numbers of patients, and that may be implemented by the solo practitioner as well as the institutionally based osteopathic researcher. Several intrasubject designs, such as multiple-baseline, reversal, and combinations, are considered especially appropriate for OMT research. Visual and statistical methods of causal inference are reviewed briefly in terms of their applicability to the kinds of data these designs generate. Ways in which intrasubject designs contend with common threats to experimental validity in manipulative studies are discussed. Ethical concerns that arise in intrasubject clinical research are complex, but guidelines for confronting these issues are available.

Osteopathic medicine may legitimately claim to be a science despite its primary function as a service oriented profession. Since the chartering of the first osteopathic school, the profession has sought to fulfill the founder's mandate to "improve our present system of surgery, obstetrics and treatment of diseases generally, and place the same on a more rational and scientific basis."[1] The earliest concerted research efforts at the American School of Osteopathy predate the turn of the century.[2] Clinical contributions to the medical, surgical, and manipulative literatures are abundant, and programmatic studies, such as those of Denslow, Korr, Patterson, and others at the Kirksville College of Osteopathic Medicine laboratories[3-5] may be characterized as systematic, well-planned, and carefully conducted basic science. University affiliation has allowed increased resources, productivity, and diversity of osteopathic research; this is reflected in the pages of JAOA and the proceedings of the annual AOA Research Conference. Access to the osteopathic literature has been facilitated by the AOA's library retrieval services, and the profession is currently in the strongest position it has ever known in terms of research potential.

Despite its lengthy commitment to research, osteopathic medicine has not realized its potential as a clinical science, nor has it succeeded in integrating osteopathic research into clinical practice.[6] Few role models exist for those students wishing to make a rational inclusion of osteopathic manipulative treatment (OMT) in the general practice of medicine, despite recent efforts, such as increased recognition and use of manipulative theory and methods in osteopathic hospitals.' Partly because of the profession's early decision to focus on basic science research,[3] few well-designed clinical trials of manipulative therapy are available, and very little of this is osteopathic.[8-11] A consequence has been an unnecessary gap between the researcher and the clinician. Osteopathic general practitioners, clinical specialists, and researchers have had few guidelines for translating the results of basic science findings into clinically useful information. The "scientist-practitioner" mode[12-14] has not taken hold in osteopathic medicine.

These inadequacies have not gone unnoticed. Indeed, the profession should be credited for attempts, such as that at Texas,[15] at critical self analysis and restructuring of curricula and training models so as to diminish the distance between the scientist and the clinician. Unfortunately, the experimental paradigms best known to clinical researchers (intersubject or between groups designs)[16] are not readily adaptable to the realities of the osteopathic clinical situation. In most cases only the well-staffed, well-funded clinical research laboratory can hope to contend successfully with the problems of elaborate, intersubject, controlled, clinical trials, such as subject recruitment, screening, monitoring, and treatment,[11] in numbers sufficient to allow statistically significant effects, which constitute the hallmark of between-groups designs. There are few such facilities at osteopathic institutions, and fewer still that are focusing on clinical outcome studies of OMT.

Clinical research designs

The case study appears to have been the principal method of clinical investigation through the first half of the twentieth century. Typically, a clinician observed considerable improvement in the problem being treated, and communicated these findings to colleagues. In the typical case study, a description of the patient, treatment, and results is presented, and post-hoc explanations of the findings are suggested. Case studies permit illustrations of theoretical principles, allow quantification of the course of treatment, and inspire more controlled investigations. The nonexperimental case report provides a focus upon the individual that is often lost in the analyses of variance (comparisons of means and dispersions of groups of patients) characteristic of intersubject research. In osteopathic medicine, the quality of case reports has improved dramatically over the course of the profession s development. Recent articles in JAOA compare favorably with other blind-peer-reviewed clinical science journals. Such reports show concern for detail, replicability, and quantification.

The case study, however, cannot ordinarily contend with many common threats to "internal validity.[17] In the nonexperimental case analysis one cannot confidently conclude that a particular treatment, such as OMT, produced a particular clinical effect (internal validity), nor that the cause-effect relationship, if actually present, would be replicated with other patients, diseases, ordoctors (external validity). Moreover, strictly case-study literatures are notorious for nonreport of treatment failures.

Intrasubject experimental designs provide a compromise between the case study and control-group clinical trials. Without large patient samples, these designs eliminate or control for many of the common threats to the internal validity of clinical research: history, maturation, regression to the mean, instrumentation, and interactions of these.[17] Although the generality of findings in the intrasubject investigation, like the case study, is severely limited, that is, the external validity of findings is unknown, the internal validity of single-subject and small group designs justifies their status as true experiments. Intrasubject strategies can allow the weaknesses inherent in the uncontrolled case study to be overcome, so that a genuine experiment emerges.

Single-subject and small-group designs are well suited to clinical outcome studies, as evidenced by their acceptance in physical therapy[18] and epileptology,[19,20] and their preferred status in behavior modification, as seen in the *Journal of the Experimental Analysis of Behavior* and *Journal of Applied Behavior Analysis.* Manipulative methods may also produce sufficiently pronounced effects on clinical health indices to allow demonstrations of the causal influences of treatment in these small scale studies. Although the smaller number of patients that such studies typically involve limits the extent to which results can be generalized to larger populations, the accumulation of such reports can increase confidence in the robustness and reproducibility of therapeutic effects. Moreover, these designs may suggest novel views of manipulative[21] and emergent phenomena, and allow for the experimental analysis of some rare clinical phenomena.

Single-subject (intrasubject) and small group experimental designs are not common in the health care science literature. Not one study employing an intrasubject design could be found in a search of JAOA volumes 73 through 82, exclusive of AOA Research Conference abstracts. Indeed, clinicians and scientists in diverse fields have not discriminated between the uncontrolled case study and the single-subject experiment.[22] However, by combining the flexibility of the case study with the experimental control of the intrasubject designs, the osteopathic scientist-practitioner can capitalize upon the patterns of opportunities and restrictions unique to the particular discipline, patient, and clinical setting. Moreover, these designs can allow even the osteopathic physician in solo practice to make valuable experimental contributions to the manipulative and general medical literature.

Intrasubject experimental designs

Multiple baseline design (MBD)

In the MBD the effects of osteopathic methods on health and/or disease may be demonstrated experimentally by sequential introduction of treatment to three or more different baselines (Fig. 1). Each baseline represents the repeated monitoring of some relevant health parameter, such as symptoms, physiologic measures, or spinal lesions. If each baseline changes independently, that is, only when the treatment is introduced, then changes can be attributed to the treatment rather than to alternative factors, such as a concurrent event, spontaneous recovery or chance.

A hypothetical example of the MBD across-individuals is displayed in Figure 1. In this illustration the abscissas represent time, and the ordinates plot some variable, such as arterial blood pressure, cardiac output, or pain. The broken lines vertically intersect with the line representing the patients' health indicators; this intersection indicates the onset of the experimental procedure (for example, OMT, chemotherapy). These hypothetical data strongly suggest that the independent variable is responsible for change in the health outcome (dependent) variable, because change occurs only on sequential introduction of treatment. Gross and coworkers[23] provide an example of the MBD across-subjects in their report of control of joint flexion as measured by a goniometer. Similarly, Blount and associates[24] employed an MBD to demonstrate experimental control of bruxism in two retarded females.

The MBD may employ any number of subjects. When only one subject is available, the practitioner chooses at least three health indices, symptoms, or kinds of behavior to monitor across time. If the clinician's theory suggests that application of the therapeutic modality produces change only when focused on a particular health indicator, then sequential, random or staggered introduction of treatment across several health indices may show change only when treatment is focused on a particular index. For example, if it could be expected that lumbar dysfunction improves only with lumbar manipulation, thoracic dysfunction only with thoracic spinal manipulation, et cetera, then sequential introduction of regional manipulation and sequential change in regional dysfunction could demonstrate the value of several specific manipulative treatments in a single patient. Figure 2 displays a hypothetical example of an MBD across symptoms in a single patient where the effects of OMT appear to reduce cephalalgia, pain on respiration, and lumbago through the manipulation of the corresponding region, that is, cervical, thoracic, and lumbar. Similarly, Schafer and coworkers[25] used this

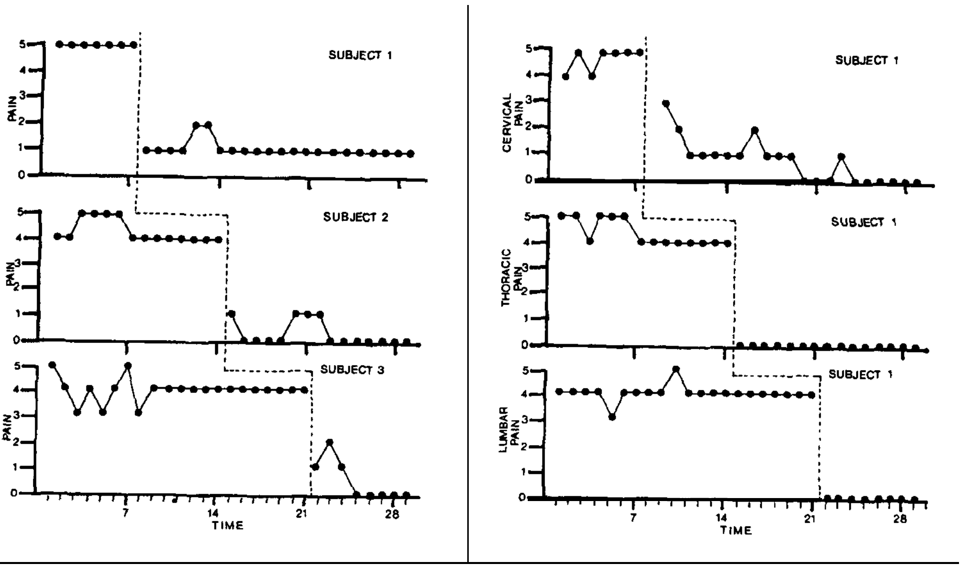

Fig.1 *Hypothetical example of an MDB across-subjects. Each abscissa represents the time course of pain intensity in 1 of 3 imaginary patients. The onset of treatment (for example, OMT) is indicated by the broken vertical lines. Fig. 2. Hypothetical example of an MBD across-symptoms. Each abscissa represents the time course of pain intensity in one of three body regions in a single imaginary p The broken vertical lines indicate the onset of an osteopathic manipulative technique (cervical, thoracic, and lumbar mobilizations) applied sequentially to each of three spinal regions hypothesized to regulate the corresponding areas of pain.*

kind of MBD (MBD across-responses) demonstrated increased compliance to a diabetic regimen.

Variations of the MBD across-subjects are demonstrated by Watson and Workman[26] and by Sander,[27] who recommend a nonconcurrent MBD across-subjects for researchers in applied settings. Because patients with similar health problems may not present themselves to the clinician at the same time, this variation of the MBD may be especially useful for the osteopathic physician in solo practice who wishes to contribute to the literature on outcome of osteopathic treatment. The nonconcurrent MBD allows the physician to impose methodologic structure upon her or his present practice.

In the nonconcurrent MBD (Fig. 3), the practitioner initially determines the duration of several baselines, say, 5,10, or 15 days. When a patient with the problem of interest, such as diminished vital capacity in patients with respiratory infections, is referred, the physician then randomly assigns the patient to one of the predetermined baseline durations. The relevant outcome parameters are repeatedly measured, and treatment (for example, thoracic manipulation) introduced at the designated time, while recording continues. When the next patient with the problem of interest comes to the doctor, he or she is randomly assigned to one of the remaining baseline lengths, and treatment is implemented at the designated time for that particular baseline. Each additional patient undergoes the same procedure until all predetermined baseline lengths are assigned.

Reversal designs (ABAB)

Reversal designs are known as ABAB designs because of the alternating baseline (A) phase and treatment(B) phases (Fig. 4). The effects of the intervention are clear when the phenomenon of interest, such as symptoms, improves during the first treatment phase, reverts toward baseline levels when treatment is withdrawn, and again shows improvement when the treatment is reinstated. Of course, the effects of the treatment must be reversible, as in health problems of chronic etiologies, or when treatment is palliative, and withdrawal of treatment must be ethically justifiable.

Examples of reversal designs, which are also known as withdrawal designs,[22] can be found in the literature of several health-care professions. For instance, Liberman and associates[28] employed reversal designs to investigate the effects of behavioral, psychopharmacologic, and placebo effects upon psychotic symptoms, and Zlutnick and coauthors[29] demonstrated control over seizure activity with the ABAB design. Other applications of this design have included studies of pain,[30-31] myopia,[32] upper extremity function in hemiplegia,[33] and Raynaud's phenomenon.[34]

The ABAB design (and variations, for instance ABABAB or ABCBC) seems well-suited to osteopathic clinical outcome studies. They are simple in strategy, presentation, and interpretation (Fig. 4) and might be useful in studying the efficacy of many osteopathic remedies wherein intervention effects last only so long as treatment is continued, as, for instance, in palliative care or disorders with chronic etiologies. For example, if a specific manipulative procedure is effective in relieving pain or increasing function only so long as treatment is continued, then experimental control might be demonstrated in a single patient by sequentially introducing and withdrawing OMT while monitoring the corresponding rises and falls in outcome parameters (Fig. 4). The tactic is, of course, analogous to the practice of prescribing "drug holidays," a commonly accepted clinical strategy for evaluating treatment efficacy of pharmacologic agents.

The reversal design might also be used to substantiate prior studies lacking in experimental controls. For example, Klatz and associates[35] studied the effects of gravity inversion traction on systemic blood pressure, intraocular pressure, and central retinal arterial pressure. Measures of blood pressure were taken only once prior to inversion, twice during inversion, and once after inversion. The paucity of data points and nonexperimental nature of their design limits the credibility of their conclusions, despite the use of 20 subjects. Had this study employed a reversal design, one subject might have sufficed to

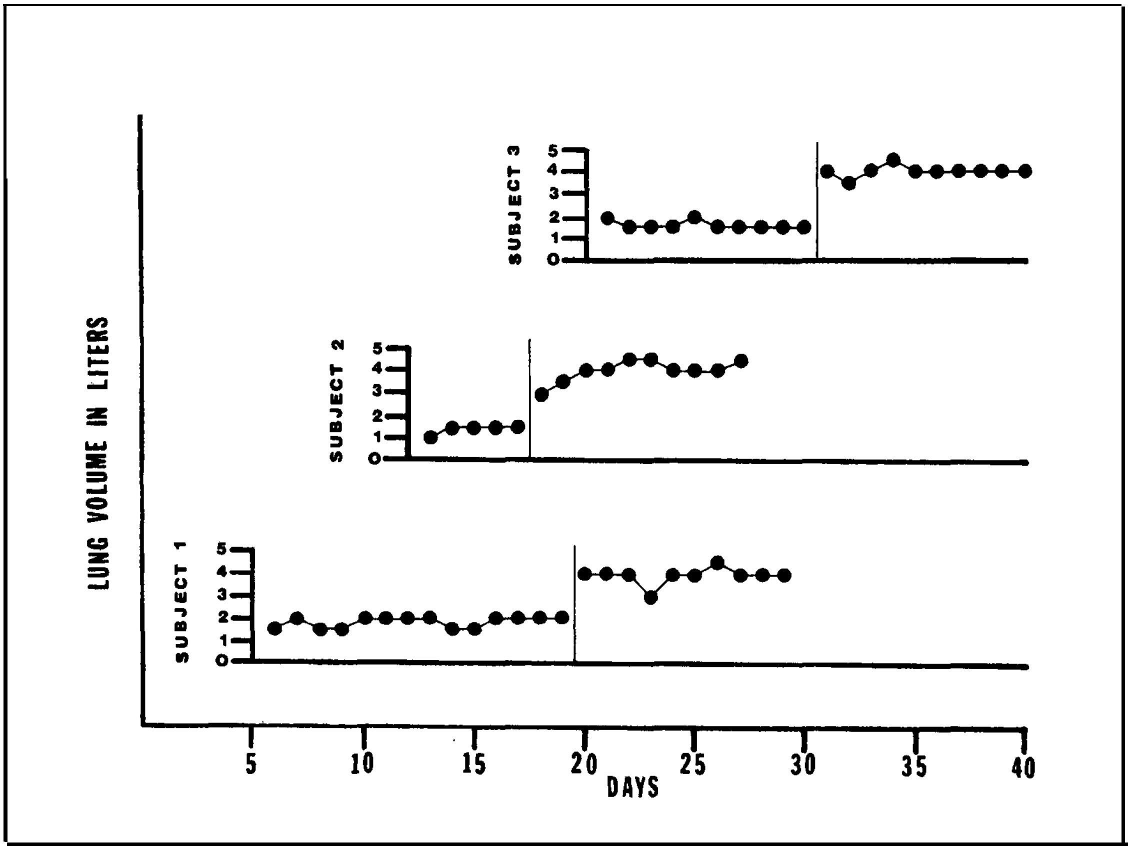

Fig. 3. *Hypothetical example of a nonconcurrent MBD across-subjects. Each abscissa represents the time course of lung volumes in each of 3 imaginary patients with respimtory tract disease. The thin vertical lines indicate the onset of treatment (for example, thoracic spinal manipulation) in each patient.*

demonstrate a cause-effect relationship between inversion and changes in circulatory pressures. This is illustrated with hypothetical data in Figure 5.

Combination designs

Combination designs may employ any combination of two or more features from the various experimental designs. They are often employed to strengthen experimental control, and they are especially useful in clinical settings where it is not always feasible to wait for a baseline to become stable. By demonstrating that the intervention effects meet the requirements of more than one design, the clarity of experimental control is enhanced. For example, Singh and coworkers[36] combined an MBD across-settings with a reversal design in their study of the effects of response-contingent aromatic ammonia in the treatment of hyperventilation. Also, several treatments were studied sequentially by Sanders[27] in an innovative, nonconcurrent MBD across-patients; he found that relaxation training was useful in reducing chronic low-back pain and medication use. Various combination designs may be employed to evaluate the effects of OMT. An example, with hypothetical data, is shown in Figure 6. In this illustration the effectiveness of OMT for the relief of low-back pain is studied in an MBD across-subjects with reversal for all subjects. Perhaps the osteopathic physician in this case is interested in evaluating the efficacy of a specific low-back manipulation; (s)he tests the hypothesis by implementing the same treatment in 3 patients. When the pain ratings have been significantly reduced in all 3 patients, daily treatment is discontinued. When the physician re-evaluates the pain level of each patient some days later, it is evident that pain levels have begun to rise again, and the same treatment is reinstituted. When OMT again results in pain reduction, the doctor has good reason to believe that some aspect of osteopathic care is responsible for these effects. This is but one of many possible design combinations that may be useful in osteopathic research.

Other designs

The designs that have been discussed are those that we believe are the most applicable for osteopathic clinical researchers. However, several other intrasubject experimental designs are available, and they may be appropriate for the study of manipulative and other osteopathic medical and surgical methods. Among these are the repeated pretest/post-test single-subject experiment,[37] the changing criterion design,[3 8] the periodic treatments and the alternating treatments[12] designs, and any combination of these.

Interpretation of experimental data

The purpose of experimentation in any field is to evaluate cause-effect relationships so as to support or refute the hypothesis and theory being tested. Clinical applications of intrasubject experimental designs in osteopathic medicine will accomplish this purpose by providing many credible comparisons of patients' responses under varying conditions. In the few designs that have been discussed here, the causal relationship between some independent variable X, such as OMT, and some dependent variable Y, such as pain or respiratory volumes, is recognized when comparisons within and among patients yield results that are unlikely to occur by chance. In the ABAB design, for example, predicted changes in level, slope, or variability at each of three phase changes, that is, from A to B, from B to A, and from A to B, can provide convincing evidence for the effect of the experimental treatment. [12] Similarly, the MBD permits comparisons or tests of therapeutic efficacy both within subject, as, for example, in an A to B phase change, and between subjects, as with the B phase of the first-treated patient versus the concurrent A phase of the second-treated patient.[12]

Intrasubject data frequently require little more than careful graphic display to indicate a clinically significant experimental effect; for example, if the measured values obtained during one phase do not overlap with values from another phase, as in Figures 1-3, a change in level of the values will be readily apparent. In other cases, such as seen in Figures 4-6, some degree of overlap among values obtained during A and B phases does little to impair the credibility of experimental effects.

When greater overlap and within-subject variability are encountered, the technique of blocking or intrasubject averaging[12] may help to focus a less obvious change in level, slope, or variability, but cannot diminish the variability per se. However, if these hypothetical data (Fig. 7) were replicated several times, for example, by MBD or ABABAB, one could make a convincing case for a treatment effect.

Blocking is also useful when the effects of an experimental treatment are gradual or delayed. For example, in evaluating the usefulness of a treatment expected to yield clinical improvement only after repeated administrations over extended weeks (as with certain manipulative methods, spinal feedback training, or exercise regimens), lengthy treatment and nontreatment data might be plotted in monthly averages (Fig. 7, part D). Relatedly, Hayes[39] has recommended subtraction procedures for graphically highlighting changes in trend that may be revealed by the reversal and periodic treatments designs.

Although the descriptive statistical methods noted here are generally accepted in intrasubject ,studies, the use (or not) of inferential statistics, such as chi-square, t test, analysis of variance (ANOVA), has been controversial. Part of the reason is because an important assumption underlying such tests, random sampling of independent events, is violated when within-cell error variance is based on the scores of only one subject; in other words, successive observations may not be independent (serial dependency). Other authors, such as Barlow and associates,[12] have argued against reliance upon statistical rather than clinical significance in judging change in clinical studies. Some suggest that treatment effects that can be discerned only by averaging over large samples of patients may have little practical value to the clinician, who seeks a subjectively and objectively defined clinical improvement for the patient. Experimental logic, it is argued, does not require specification of an alpha level nor of the chance probability of observed results; rather, it is necessary that the treatment effect be clear and reproducible. Intrasubject experimental designs seem capable of demonstrating the kinds of cause-effect relationships of most pressing importance to osteopathic clinical research, that is, manipulative trials, and of doing this frequently with little or no use of inferential statistics.

Others have sought new methods of statistical inference appropriate to the kinds of data that intrasubject designs yield. Kazdin[40] has suggested, for example, that if serial dependency in a patient's data can be ruled out, as, for example, by auto correlation (correlogram), then t tests (for example, AB or BC kinds of comparisons) and ANOYAs (for example, ABACA comparisons) may be employed. Their use in such cases permits estimation of the probability that the observed changes in level of

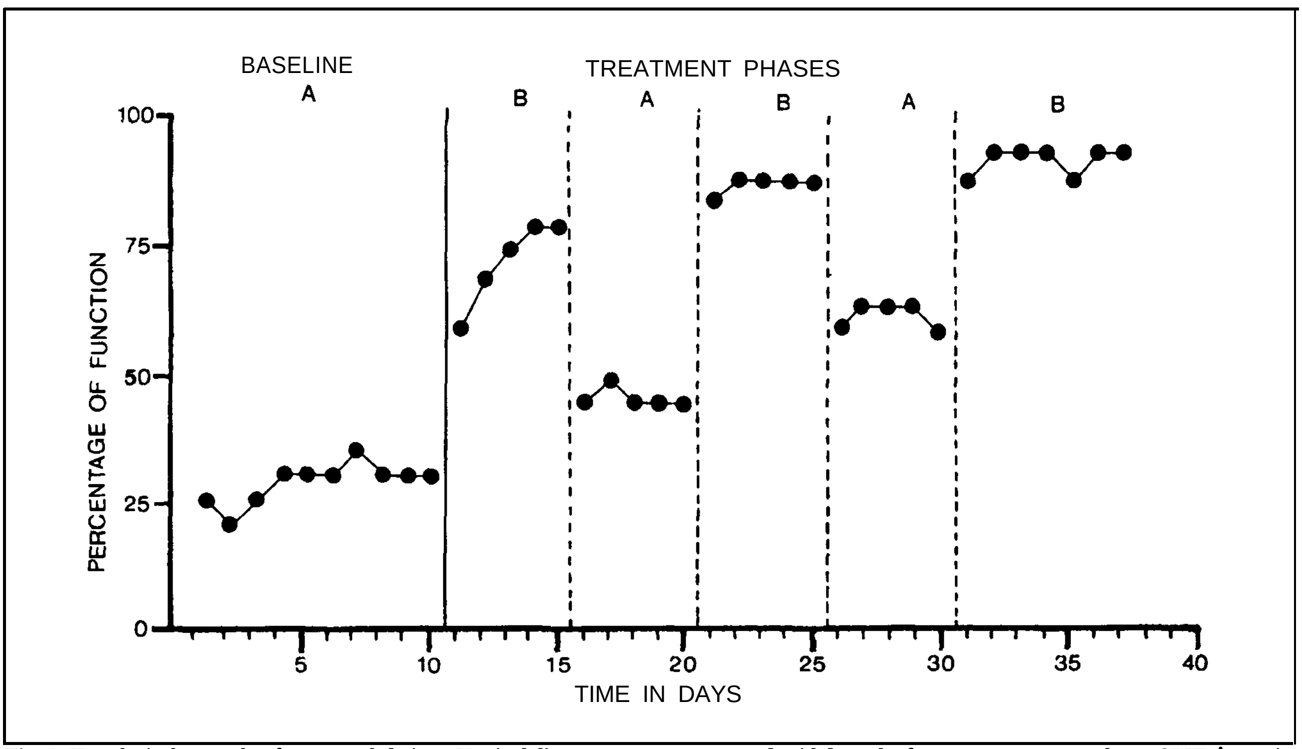

Fig. 4. *Hypothetical example of a reversal design. Vertical lines represent onset and withdrawal of some treatment such as OMT* in a *single imaginary patient. (A) represents the baseline or nontreatment phase, (B) the phase of active intervention.*

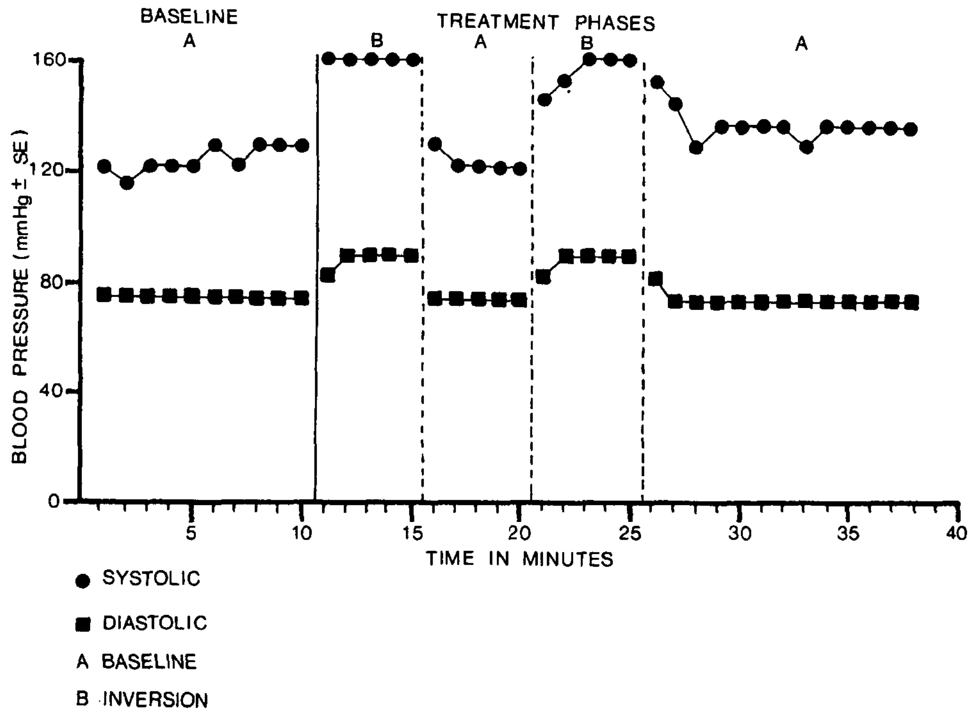

Fig. 5. ***Hypothetical example of a reversal design employed to demonstrate experimental control of blood pressure by inversion-traction (B) versus upright seated posture (baseline/no-treatment phase) (A) in a single imaginary patient.***

the dependent measure occurred by chance.

When serial dependency cannot be ruled out, several alternative inference methods, including time-series analyses, randomization tests, the Rn statistic, and others may control or account for serial dependency.[40] Also, a correlated t test could be employed to evaluate the significance of observed changes in level across phase in the MBD across- subjects; in this case the issue of serial dependency is moot, since within-cell, that is, within-phase, error variance is computed from data derived from independent sources (patients). An additional limitation of *t* tests and ANOVAs, however, is their insensitivity to changes in slope; the split middle method of trend estimation[40] may be employed where statistical evaluation of changes in the slope across phases within a sole patient is advised.

Most reviews of inferential statistics for intrasubject experiments caution against over attention to the issue of statistical significance, particularly when this obscures recognition of important clinical trends. Statisticalmanipulation of intrasubject data cannot be replace careful examination of individual differences, as, for example, the clinical series wherein some patients evidence rapid change after initiation of treatment while others show little or no change or other countertheoetical effect. Thoughtful analysis of differences in therapeutic responses among patients can often lead to new insights regarding clinical indicators or the experimental treatment. or about the mechanism(s) of therapeutic action. Statistical inference, it must be remembered, is but one tool in the clinical researcher's armamentarium.

Ability of intrasubject designs to deal with problems of OMT research

Although intrasubject designs may not be able to eliminate all potential threats to clear-cut experimental conclusions, they seem adequate in many instances.[41-42] Haldeman[43] has suggested five rival hypotheses that compete with theories of therapeutic effectiveness in clinical trials of manipulation. These include the following: (1) misdiagnosis; (2) natural remission of symptoms; (3) illness with exacerbations and remissions; (4) multiple simultaneous treatments; and (5) placebo effects. How well do intrasubject designs deal with these threats to internal validity?

Misdiagnosis

Haldeman[43] first noted that conclusions regarding the effectiveness of spinal manipulative treatment may be incorrect because the patient did not actually have the disorder for which treatment was applied. In between-groups designs this is a serious flaw; intersubject trials involve recruitment of an homogeneous sample of patients, such as low-back pain patients without signs of organic disease. To the extent that an inappropriate patient is included in the sample, such as a low-back pain patient with occult organic disorder, data-based conclusions may be incorrect. For instance, failure to demonstrate a therapeutic effect might result from inclusion of inappropriate (misdiagnosed) patients in the sample, and wrongly lead to acceptance of the null hypothesis. Spinal manipulative treatment in this case might be appropriate only for correctly diagnosed patient-examples of the disorder of interest.

For the clinical scientist who employs intrasubject designs, this problem is no more or less important than for the investigator who relies on traditional control-group comparisons. However, the issue of choosing an appropriate sample will occur less frequently; the clinician does not ordinarily choose patients-patients choose the clinician. Either type of investigator is obligated to provide thorough assessment information so that others may judge the correctness of the diagnosis. Additionally, as published applications of single-subject and small group studies accumulate, the adequacy of patient descriptions increasingly determines the legitimacy of between-study comparisons (external validity). It might be expected that greater attention to the individual case (characteristic of intrasubject designs) might decrease the likelihood of misdiagnosis, but this advantage is perhaps mitigated by the greater number of assessors and diagnostic criteria that may be employed across published intrasubject reports.

Natural remission of symptoms

Many disorders for which manipulative practitioners claim efficacy are self-limiting conditions; that is, diseases from which the patient can expect to recover whether treated or not. In between-group research, this alternative explanation of outcome is ruled out by comparing symptomatic change among treated and untreated patients. An MBD across-subjects, by providing variable baseline durations among a few subjects, could rule out the rival hypothesis of natural remission if three conditions are met: The natural history of the disease is well known; all patients studied can be considered to be at approximately the same stage of disorder at the study onset; and the effects of manipulative intervention are more rapid than spontaneous remission. Alternatively, a treatment expected to hasten spontaneous recovery might be studied by reversal designs, and graphically analyzed so as to emphasize potential slope changes across phases, as shown, for example, by Kazdin[40] and Hayes.[39]

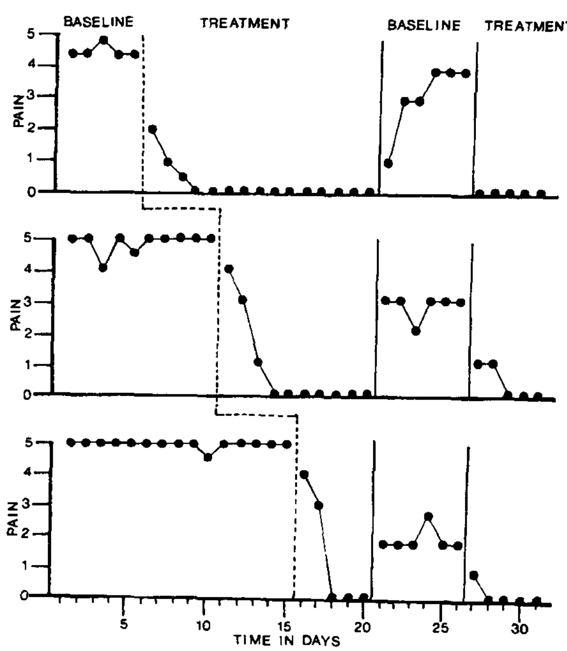

Fig. 6. ***Hypothetical example of combination design, in this case, an MBD across-subjects with a reversal design. The broken vertical line indicates the onset of treatment, such as OMT, in 3 imaginary patients with some painful disorder. The thin, solid vertical lines indicate the termination of the first treatment phase and the onset of treatment reintroduction.***

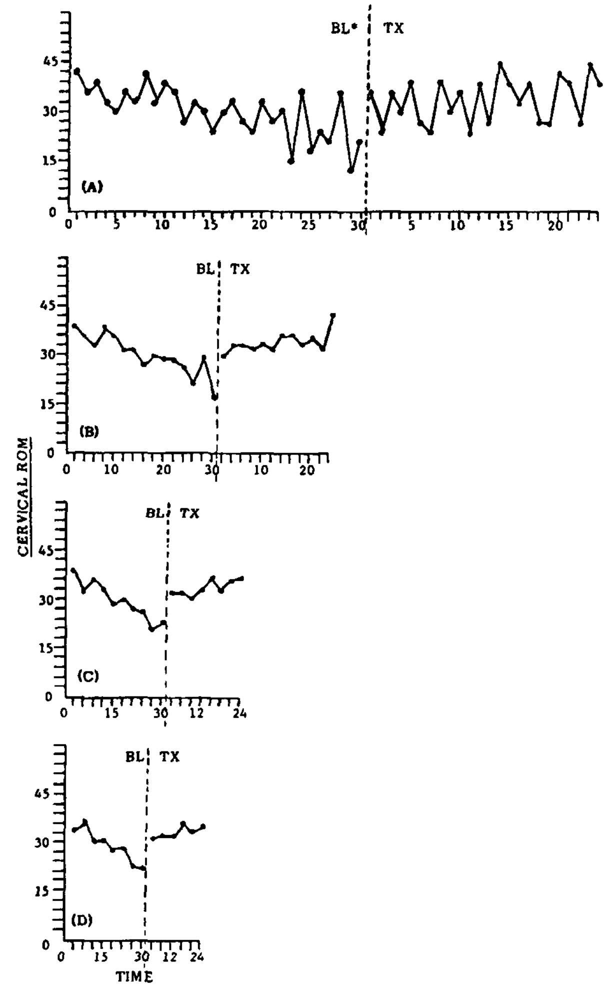

Fig. 7. ***Hypothetical data illustrating change in level and slope of some clinical outcome parameter such as cervical range of motion (ROM). This apparent effect at the phase change is plotted over four time intervals: (A) some standard unit of time (SU); (B) mean of data for two consecutive SUs; (C) mean of data for three consecutive SUs; and (D) mean data for four consecutive SUs. BL = baseline; TX = treatment***

Illness with exacerbations and remissions

As is true in the treatment of self-limiting disorders, symptom reduction may occur during manipulative treatment because of the cyclical natural history of the health-care problem. In addition, this kind of disease will show spontaneous recurrences of characteristic signs and symptoms. The cyclical nature of such disorders, of which depression and migraine are examples, may pose less difficulty for clinical outcome researchers than do brief, time-limited disorders, provided that the natural history is recognized, and adequate baseline and extended followup observations are conducted.

Intra- and intersubject designs do not differ in their methods of controlling for this rival hypothesis. In either type of experiment, an extended followup must be conducted to rule out the possibility of symptom recurrence. The method of long-term interrupted sampling or periodic post-treatment "probe" assessments is noteworthy here, because it promotes economy while extending perspective.

Multiple simultaneous treatments

In between-group designs, multiple concurrent treatments are handled in two ways: by holding all treatments (except the one to be tested) constant across groups; or by including for study one patient sample for each of the therapeutic combinations studied and additional patient groups for appropriate controls. Although the first strategy may require as few as two groups, the latter design can quickly become unwieldy. For instance, to demonstrate the efficacy of only two concurrent therapies, at least four groups (no treatment, treatment 1, treatment 2, and treatments 1 and 2) are necessary for thorough analysis of causal influence.

Alternatively, in cases of palliative treatment the efficacy of multiple simultaneous treatments may be demonstrated convincingly within a single patient, as, for example, with the alternating treatment design.[44] While the same number of treatment conditions are required as in the between-groups models, a within-subject model will suffice to show a causal relationship between treatment and outcome in cases where the effects of treatments are very rapid and reversible. Similarly, reversible but more gradual treatment effects could be evaluated by combining several treatment and nontreatment phase changes (for example, ABCBC or ABABCBC); potential order effects, for example, ABC versus ACB might subsequently be ruled out in other patients.[12] The MBD across-subjects could be employed where treatment effects are not reversible, as, for example, with etiologic (curative) remedies. For instance, if all concurrent treatments except the experimental one had been introduced during baseline, staggered introduction of the experimental treatment across-subjects might allow a causal demonstration of effectiveness.

Placebo effects

In intrasubject as in intersubject research, the difficulties involved in blinding therapists and patients to the presence of the "active" treatment limits one's ability to control entirely for placebo effects. However, manipulative methods can be compared with credible placebo conditions in a single patient (for example, manipulation versus sham manipulation, detuned diathermy, massage, or relaxation training). Moreover, as a clinical scientist the osteopathic physician's' first concern is to demonstrate the *efficacy* of OMT methods, and only secondarily to fully explain their mechanisms; intrasubject experimental designs seem adequate to the first goal and can contribute to the latter.

Ethical considerations

The ethical considerations involved in combining research and clinical practice are complex. The well-being of an individual patient, of foremost importance in clinical practice, may be compromised by the necessary rigor of research methodology. Even though the results may benefit many, is it justifiable to make a few bear the cost of finding the answers? The Declaration of Helsinki[45] addresses this issue with the following guideline: "The doctor can combine medical research with professional care, the objective being the acquisition of new medical knowledge, only to the extent that medical research is justified by its potential diagnostic or therapeutic value for the patient."

Potential values for the patient should be the focus of ethical concern in any clinical research; this includes the small-scale, intrasubject designs discussed here.

Some clinicians may find it ethically impossible to withhold treatment for prolonged periods. Some may be troubled, therefore, by the delays, as in the baseline periods, and withdrawals of therapy, as in treatment holidays, inherent in some intrasubject experimental designs. However, this attitude is often based on the assumption that the treatment is actually effective. Since an impetus for clinical research is the lack of evidence to support or refute the assumption of efficacy, one could alternatively consider it unethical to persist in administering and receiving payment for treatments of experimentally unknown merit and safety.

Of primary concern in the issue of the ethics of clinical research is the notion of "informed consent," or the knowledgeable consent of a person exercising free choice in the absence of undue constraint or coercion.[46] According to Capron[47] the function of informed consent is to promote individual autonomy, protect the patient/subject's status as a human being, and avoid fraud and duress. The clinician contemplating clinical research must be aware of these issues and know how to deal with them in a practical manner. For example, an informed consent form might be incorporated into the usual clinical routine to assure the patient and the practitioner that ethical guidelines are being followed.

Barlow and coauthors[12] distinguish between "treatment research" and "treatment evaluation." In treatment evaluation the patient's needs are foremost; in treatment research the scientific hypothesis is the foremost consideration. Similarly, others have differentiated between research and "investigational practice."[48] These distinctions suggest a goal-oriented first step in the ethical review of clinical research: If the goal of the research activity is to help the patient involved, then it is easily justified. In other words, unless the experimental procedure is expected to help the patient, it should be considered treatment research. In the latter case, the practitioner must consider an independent review of ethical issues, such as is typically conducted by institutional review boards. Intrasubject designs are ethically justifiable in practice in the following circumstances: The scientific goal is subsumed under the goal of improving the patient's health, or the ethics involved in research that does not directly benefit the patient is formally reviewed by an independent panel. In either case, the goal of this or any clinical research must foster the improvement of good clinical practice. In the final analysis, the protection of patients' rights rests on the conscience and compassion of the clinician.

Conclusions

In recent years the profession has heard an increasing number of calls[49-52] for osteopathic clinical experimentation. Concurrently, the pressing need to develop a cadre of "DO clinical investigators" has been recognized, and preliminary efforts in this direction, such as the Medical Scientist Training Program at Michigan State University College of Osteopathic Medicine, have been initiated.[50] Moreover, the first century of osteopathic research efforts, which has been primarily focused on basic science, may provide important tools in the development of osteopathic clinical research (for example, electrophysiologic measures of spinal function and Pavlovian techniques in the remediation of somatic dysfunction). Osteopathic medicine has the potential in its second century to realize the integration of clinical art and scientific method to which it has long aspired.

Osteopathic scientist-practitioners will require methods of exploring causal relationships that are compatible with the clinical situation. While in no way disallowing the large-scale, control-group clinical trial of manipulation recommended elsewhere,[11] the intrasubject experimental designs noted here could permit a greater number of physicians and surgeons to make experimental contributions to the clinical science literature. The potential benefits of intrasubject designs in terms of increased quantity, quality, and diversity of osteopathic clinical studies greatly outweigh the cost in sample size and external validity. Use of these designs may even encourage more expensive large scale clinical trials, thus accelerating the rate of growth of osteopathic clinical science. They appear to be capable of controlling for many of the common threats to valid conclusions in the clinical situation. The ethical issues raised by clinical research are complex, but are frequently similar to those routinely confronting the practitioner.[39] These designs can promote the experimental investigations needed to support the utility of osteopathic methods and can help narrow the gap between the role of scientist and the role of clinician. Training in intrasubject research should be provided to those most familiar with osteopathic phenomena-physicians and surgeons, D.O.

Appreciation is expressed to Phyllis Hazekamp, MLS, director of the library of Palmer College of Chiropractic1 West, for assistance in the gathering of source materials.

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Accepted for publication in January 1985. Updating, as necessary, has been done by the authors.

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D. Educational Videotapes

Videotapes have been used in teaching osteopathic examination and technique skills in most of the osteopathic colleges. The television media offers the advantage of consistent instruction precisely reproduced each time it is shown, and sets a standard of performance for learning osteopathic manipulative procedures. All students have an unobstructed view of the procedures shown on the tapes and are assured that the instructions are given in a consistent manner. The tapes are helpful in teaching basic aspects of technique performance such as the positioning of the patient and physician, the placement of the physician's hands, and the various aspects of movement relative to the physician and patient. The television camera can often attain angles and close ups that are not possible in a live teaching demonstration.

Although many osteopathic colleges use videotapes in their teaching, they are for the most part in house teaching aids and are not available for general distribution. Videotapes made at Michigan State University for class instruction of the osteopathic examination curriculum have been professionally produced in the university television studies. They are available for rental and purchase through the Marketing Division, Instructional Media Center, Michigan State University, East Lansing 48824.

These tapes were produced by William L. Johnston and Myron C. Beal with the assistance of Bruce Miles and Larry McMullen. The tapes range from 12 to 19 minutes in length. They consist of two series:

I. Series A

- Structural Examination I: Initial Screen
- Structural Examination II: Local Scan
- Structural Examination III: Segmental Definition
- Gross Motion Testing

II. Series B

- Soft Tissue Techniques I: Introduction
- Articulatory Procedures
- Thoracic Region I: Upper Thoracic
- Thoracic Region II: Mid/Lower thoracic
- Thoracic Cage I: True Ribs
- Cervical Region I: Introduction to Direct Technique
- Cervical Region II: Occipitoatlantal
- Lumbar Region I: Introduction to Direct Technique
- Lumbar Region II: Direct/Indirect Technique
- Pelvic Region I: Iliosacral
- Pelvic Region II: Sacroiliac
- Pelvic Region III: Alternate Direct Technique
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