# Classification of diagnostic tests used with osteopathic manipulation

URI DINNAR, PH.D.
Haifa, Israel
MYRON C. BEAL, D.O., FAAO
JOHN P. GOODRIDGE, D.O., FAAO
WILLIAM L. JOHNSTON, D.O., FAAO
East Lansing, Michigan
ZVI KARNI, PH.D.
Haifa, Israel
FREDERIC L. MITCHELL, JR., D.O., FAAO
JOHN E. UPLEDGER, D.O., FAAO
DAVID G. McCONNELL, PH.D.
East Lansing, Michigan

**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 musculoskeletal 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 II. 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, or passive; 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 geometrically*

*Some prefer the complementary description: resistance to motion.

*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

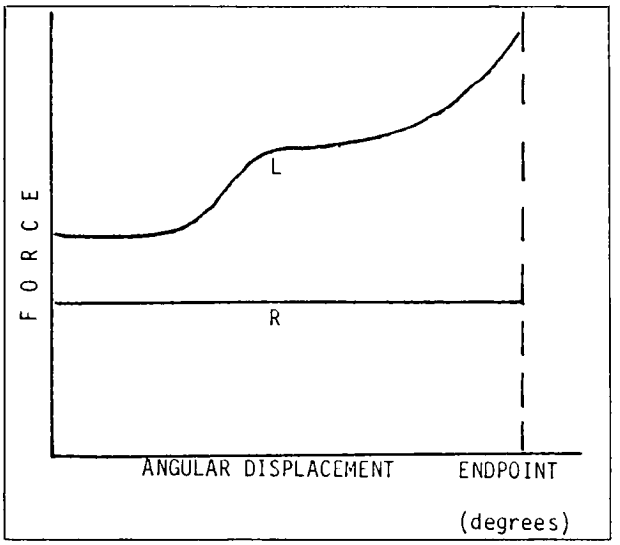


Fig. 1. *Recording of force versus displacement angle obtained during straight leg raising test for right (R) and left (L) legs. End points are predefined by a given displacement angle.*

best suited 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," "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 (1) palpatory definition of bony landmarks and visual measurement of their relative static positions, or (2) measurement of predefined landmarks at two positions, the beginning and end of a prescribed, active 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 localized area, or a point with its immediate environment, 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 localized response to determine 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. Modern 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 it 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 modern 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.


1. Upledger, J.E.: The relationship of craniosacral examination findings in grade school children with developmental problems. JAOA 77:760-6, Jun 78

2. Katz, W.A.: Rheumatic diseases. J.B. Lippincott and Co., Philadelphia, 1977, p. 143

3. Turek, S.L.: Orthopaedics. Principles and their application. Ed. 3. J.B. Lippincott Co., Philadelphia, p. 1329

4. Turek, S.L.: Op. cit., p. 1147

5. Katz, W.A.: Op. cit., p. 128

6. Kapandji, I.A.: The physiology of the joints. E and S Livingstone, Edinburgh and London, 1970

7. McConnell, D.G., et al.: Low agreement of findings in neuromusculoskeletal examinations by a group of osteopathic physicians using their own procedures. JAOA 79:441-50, Mar 80

8. Katz, W.A.: Op. cit.

9. Cyriax, J.H.: Textbook of orthopaedic medicine: The Williams & Wilkins Co., Baltimore, 1969

10. Maitland, G.D.: Vertebral manipulation. Ed. 3. Butterworths, Boston, 1968

11. McConnell, D.G., Greenman, P.E., and Baldwin, R.B.: Osteopathic general practitioners and specialists. A comparison of attitudes and backgrounds. THE DO, 103-18, Dec 76

12. Beal, M.C., et al.: Interexaminer agreement on patient improvement after negotiated selection of tests. JAOA 79:432-40, Mar 80



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



From the Department of Biomechanics, Michigan State University—College of Osteopathic Medicine, East Lansing, Michigan. Dr. Beal, Dr. Goodridge, Dr. Johnston, and Dr. Mitchell are professors of biomechanics. Dr. McConnell is a professor of biochemistry and biomechanics. Dr. Dinnar and Dr. Karni were with a Clinicians Research Group at Michigan State University—College of Osteopathic Medicine and are now with the Technicon Corporation, Haifa, Israel.

Dr. Beal, East Fee Hall, MSU-COM, East Lansing, Michigan 48824.