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An Overview of Osteopathic Medicine

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INTRODUCTION

Despite an initial lack of acceptance by mainstream medicine, and amidst projections of a serious oversupply of physicians, the osteopathic profession continues to grow, successfully competing for shrinking health care resources and attracting the attention of insurers and those in managed care.[1] However, a recent telephone survey of 800 health maintenance organization beneficiaries suggested that the public is not yet familiar with osteopathic medicine.[2] The history, philosophy, and current status of the osteopathic profession are presented, along with theories of the physiologic basis of and supporting evidence for palpatory diagnosis and manipulative therapy.

DEFINITION

Osteopathic medicine is a diagnostic and therapeutic system based on the premise that the primary role of the physician is to facilitate the body's inherent ability to heal itself. Osteopathic philosophy maintains that the structure and function of the body are inseparable and that problems in one organ affect other organ systems. It is the smaller of the 2 major schools of medicine in the United States, the other being allopathic medicine. Doctors of osteopathy follow accepted allopathic methods of diagnosis and treatment but place additional emphasis on the achievement of normal body mechanics as central to good health. Because of the close association between the spinal vertebrae and the autonomic nervous system via the sympathetic trunk and ganglia, the neuromuscular system is considered to play a vital role in maintaining homeostasis. This association is believed to be one mechanism by which changes in the musculoskeletal system can affect other organs (somatovisceral reflex) or allow visceral pathology to manifest as aberrations in musculoskeletal tissue texture and intervertebral joint motion

(viscerosomatic reflex).[3-5] These aberrations are termed "somatic dysfunctions" and can be useful aides in the physical diagnosis of both musculoskeletal and visceral disease.[3-9] Whereas allopathic practitioners of manual medicine use manipulation to address problems that are primarily limited to the musculoskeletal system, osteopathic teaching posits that manipulation has a distinct effect beyond the musculoskeletal system. Manipulation is not considered a substitute for conventional allopathic therapy and should be used only when not contraindicated or in conjunction with other therapies.

HISTORY

Andrew Taylor Still, MD, founded osteopathy in 1874.[4-5,10] The son of a Methodist minister, Still attended the College of Physicians and Surgeons in Kansas City, Kan, served as a state legislator,[3-5,10] and enlisted in the Ninth Kansas Cavalry and attained the rank of major during the Civil War.[4-5,10] He was an ardent abolitionist and held stong opinions on other controversial subjects. After the war, Still provided health care to settlers and American Indians. As he faced the epidemics of his time such as cholera, pneumonia, smallpox, diphtheria, and tuberculosis, he became increasingly disenchanted with many prevailing medical practices.[4-6,10] Searching for adjuncts or substitutes for various medical therapies, he eschewed the liberal use of drugs and compounds. Still believed that the primary role of the physician was to facilitate the body's inherent ability to heal itself.[4-6,10] He also believed that the structure and function of the body were closely related and that problems in one organ affected other parts of the body.[4-6,10] He maintained that the physician could best promote health by ensuring that the musculoskeletal system was in as perfect alignment as possible and obstructions to blood and lymph flow were minimized or eliminated.[4-6,10] To that end, Still developed various manipulative techniques and a philosophy of medicine similar to, but separate from, allopathic medicine.

Still's intent was not to create a separate profession, but, as stated in the charter of the first osteopathic medical school, "To improve our present system of medicine"—that of the 19th century—by giving it "a more rational and scientific basis."[10] The medical milieu of the 19th century was characterized by multiple schools of healing, many of dubious value, and physicians who were often poorly or incompletely trained.[4-5,10] Treatments such as bloodletting and the use of purgatives, mercury, or alcohol-based compounds were not uncommon.[4-5,11] The American Medical Association was the dominant medical organization of the time. In trying to establish order and improve quality, the American Medical Association had little tolerance for yet another school of thought.[11-12] Still's ideas were initially rejected by his peers, and this instigated a half-century long struggle for acceptance. On one occasion, after he successfully treated several people with manipulation, the local church authorities attributed his success to the devil.[13] Ostracized by both medical and societal organizations, Still was forced to become an itinerant physician in Kansas and Missouri. However, his attempts to improve circulation and correct altered mechanics through the use of manipulation became more successful.[13] Increasing demand for his services led to the establishment of the first osteopathic medical school, the American School of Osteopathy, which opened in Kirksville, Mo, in 1892, with a class of 17 students.[13] The curricula emphasized anatomy, histology, physiology, toxicology, and manipulation.[13]

In 1896, Vermont became the first state to establish formal licensure for DOs.[13] In 1897, a group in Kirksville organized the American Academy of Osteopathy, which in 1901 became the American Osteopathic Association (AOA).[13] The AOA is the main governing body for the osteopathic profession, enforcing a code of ethics, supporting professional development, providing accreditation, and lobbying politically. Membership in the AOA is limited to graduates of approved osteopathic schools, none of which are located outside the continental United States. There are osteopathic schools in England, but the scope of practice of graduates of these schools is limited to manipulation only. In 1902, the AOA adopted formal standards of approval of osteopathic colleges and began on-site inspections of training programs.[13] In 1934, the Advisory Board for Osteopathic Specialists was formed, and by 1943 there were 11 specialty boards.[13] Early osteopathic medicine was primarily outpatient based. Formal hospital-based programs were not established until 1936.[13] In 1947, the

AOA granted formal approval for hospital residency training programs. In 1950, Missouri became the first state to allow DOs to practice in public hospitals with the same unrestricted privileges granted to their MD counterparts.[13] Osteopathic physicians were drafted in both World War I and World War II, but were not allowed to serve as medical officers. In 1950, the osteopathic profession petitioned the US Senate Armed Services subcommittee for legislation that would allow DOs to be commissioned as medical officers. However, owing to the opposition from the American Medical Association, this law was not implemented for another decade.[13]

On the civilian front, the struggle for autonomy climaxed in California in 1962 when the California Medical Association attempted to garner a majority in the American Medical Association. The California Medical Association relaxed its opposition to the osteopathic profession and invited all osteopathic physicians to join the state allopathic medical association.[4, 13] The College of Osteopathic Physicians and Surgeons in Los Angeles, Calif, was converted to an allopathic college.[4, 13] This institution, with the approval of the state Osteopathic Medical Association and the California Medical Association, and on receipt of $65 per applicant, granted approximately 2500 unearned MD degrees to DOs in that state.[4, 13] The offer was also open to all DOs in the United States.[4, 13] Although a significant number of DOs accepted the offer, most declined and chose to retain their osteopathic identity and degrees. However, a referendum was then passed that prohibited the granting of new medical licenses to DOs in California. Lengthy court litigation ensued, and the California Supreme Court later overturned the ruling.[13] By 1973, DOs had been granted full practice rights in all 50 states. Recently, Germany became the first European country to offer a full license to US-trained osteopaths.[14] The same offer does not apply to graduates of British osteopathic schools. Additionally, the German Society of Manual Medicine, a component of the German Medical Association, offers a 480-hour osteopathic manipulative therapy (OMT)/manual medicine curriculum to residency-trained physicians. More than 8000 doctors of medicine in Germany practice manual medicine.[14]

CURRENT STATUS

Presently, there are 41,631 licensed DOs in the United States.[13] They compose about 5% of the physician population and provide about 10% of the physician-provided health care.[4, 15] More than half practice in primary care, with 16,311 in family practice, 2423 in internal medicine, 2121 in emergency medicine, 1005 in obstetrics, 822 in pediatrics, 827 in psychiatry, and 677 in general practice.[13, 15] Most practice in Michigan, Pennsylvania, and Ohio, with 4864, 4844, and 3282 licensed DOs, respectively.[13] Areas with the fewest include Vermont, Washington, DC, and Wyoming, with only 50, 36, and 35, respectively.[13] In the military, 1131 are on active duty, which represents approximately 20% of the military physicians on active duty.[13] Ninety-five are in the public health service.[13]

In the United States, there are 16 fully accredited colleges of osteopathic medicine. The colleges have a total of 9167 faculty, either full time, part time, or volunteer.[13] Three new osteopathic schools have recently opened amid concerns that training programs should be downsized rather than expanded in light of the potential surplus of physicians.[1]

The number of applicants for the 1996 entering class increased by 568 to 10,781 in the past year.[13] There were 6603 applicants for 2535 positions, of which ethnic minorities and women composed 20% and 36%, respectively, of the total enrollment.[13] Mean grade point average was 3.33 and mean Medical College Admissions Test scores were biology, 8.47, physical science, 8.09, and verbal reasoning, 8.39.[13] Only 1.8% of the students withdrew or were dismissed.[13] Students of osteopathic medicine train for the same length of time and according to the same standards applied in allopathic medical schools. Osteopathic physicians have the same courses and are eligible to take the same examinations as their allopathic colleagues, which has benefited the profession.

Until recently, all osteopathic graduates were required to do a 1-year rotating internship before specializing. The osteopathic medical profession believed that this was a necessary factor in the complete education of a

physician. Allopathic graduates do not have the same requirement. Currently, osteopathic training programs have relaxed this standard. The wisdom of abandoning this requirement in light of the increasing popularity of the holistic concept and demand for well-rounded primary care physicians is questionable.

MANIPULATIVE THERAPY

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Manipulation is thought to cause mechanical, neurophysiological, and psychological effects.[9, 16-18] Mechanically, manipulation can help restore normal positional relationships of vertebrae and also reduce disk protrusion.[17-18] Neurophysiologically, it stimulates mechanoreceptor endings, which results in the inhibition of the presynaptic cells of the substantia gelatinosa at the level of the posterior horn, possibly resulting in a reduction of nociceptive activity.[4, 9, 16-18] Manipulation also generates afferent input and activates Golgi tendon organs, which in turn diminishes fusimotor motor neuron discharge and relaxes intrafusal and extrafusal fibers.[4, 16-17] Manipulation is also thought to enhance the release of endorphins, cause an increase in the water content of collagenous and cartilaginous structures, and stimulate glycosaminoglycan synthesis, thereby increasing the pain threshold, cellular transport, and the lubrication of joint surfaces.[16-20] Immobilization of joints or prolonged periods of reduced range of motion are thought to result in the formation of abnormal collagen crosslinks. Manipulation may lyse these abnormal crosslinks and enhance the formation of normal ones.[17] Axoplasmic flow and the microcirculation of nerves are adversely affected by compression.[19-20] Manipulation, by reducing compression, might enhance axoplasmic intraneuronal flow.[20]

The "laying on of hands" or tactile nature of manipulation also has a strong psychological effect that is further reinforced by the interest and concern of the evaluator. Patients experience a sense of satisfaction and relief due, in part, to a closer evaluation of their symptoms. In some cases, pain is reduced after a detailed musculoskeletal examination alone.[17]

Osteopathic manipulative therapy contains over 100 different techniques or procedures.[4-7] They are broadly grouped into 6 major types: high-velocity-low-amplitude (also called thrust or mobilization with impulse), muscle energy, counterstrain, myofascial release, craniosacral, and lymphatic pump techniques. High-velocity-low-amplitude, also known as mobilization with impulse, is a general type of manipulative treatment that involves a quick thrust over a short distance through what is termed a pathologic barrier. The movement is within a joint's normal range of motion and does not exceed the anatomic barrier or range of motion. With proper positioning of the patient, high-velocity-low-amplitude requires very little force and can be targeted to specific spinal segments. The goal of the treatment is to restore joint play or a desirable gap between articulating surfaces that permits free translational or gliding motion in addition to the usual angular motion.[21-22] Of all the osteopathic techniques, high-velocity-low-amplitude most closely resembles the chiropractic technique and has the greatest number of contraindications. Contraindications include rheumatoid arthritic involvement of the cervical spine, carotid or vertebrobasilar vascular disease, the presence or possibility of bony metastasis or severe osteopenia, and a history of pathological fractures.

Muscle energy techniques involve the manipulator exerting an equal and opposite force to the patient's active force from a certain position and in a specific direction. The result is repeated isometric contractions with passive range of motion through the barrier after each isometric contraction. The goal is to increase joint mobilization and lengthen contracted muscles. Because no thrusting is done, this procedure has a very low likelihood of producing complications and can be used where high-velocity-low-amplitude is contraindicated. The mechanism of action is thought to be at least 2-fold: (1) through reciprocal innervation and (2) through the Golgi tendon reflex.[4, 16] When a stretch reflex excites one muscle, reciprocal innervation causes simultaneous inhibition of the antagonist muscle.[4] The Golgi tendon organ reflex is an inhibitory reflex that can cause relaxation of a muscle when sufficient tension is placed on the Golgi tendon organ through either stretching or contracting the muscle.[4-5]

When performing counterstrain, the manipulator places the symptomatic joint in the position of least

discomfort while at the same time monitoring the degree of tenderness at a nearby tender point. This position of minimal discomfort is usually a position where the muscle is at its shortest length. The position is held for 90 seconds and the joint is slowly and passively returned to the neutral position.[23] This prolonged shortening of the muscle causes shortening of both the intrafusal (muscle spindle) and extrafusal fibers. The gamma motor neurons then increase their firing rate to maintain tone in the muscle, and the muscle spindle fibers become hypersensitive. If the hypersensitive muscle is now lengthened too rapidly, a reflex overstimulation of the alpha motor neurons will occur.[4, 23] This sensory input travels to the higher centers of the central nervous system, which may misinterpret this input and respond with excessive gamma motor stimulation, maintaining the spasm. Reshortening the muscle allows the muscle spindle to shorten and resume normal firing. The central nervous system then resets its gamma motor neurons after about 90 seconds.[4, 23] The only contraindication for counterstrain is patient unwillingness or inability to cooperate.

Myofascial release techniques are similar to deep massage, but the hands of the manipulator are not merely slid along the skin surface. The goal is to stretch muscles and fascia to reduce tension. Traction is applied to the long axis of muscles. The mechanism of action is due in part to the Golgi tendon organ reflex and reciprocal innervation. Myofascial techniques can also be adapted to promote venous and lymphatic drainage.

Lymphatic pump techniques involve physical measures such as pectoral traction, postural drainage, effleurage, thoracic expansion, and rhythmic passive dorsiflexion of the feet in an attempt to enhance lymphatic return either by influencing negative intrathoracic pressure or mechanically assisting return of lymph from the lower extremities.[24] Lymphatic techniques should not be performed in the presence or potential presence of metastatic cancer or active pulmonary tuberculosis or miliary tuberculosis.

Craniosacral therapy is based on the supposition that oscillatory motions of the cranial bones and sacrum exist. These movements are barely perceptible and are mediated through the tension of the various dural membranes such as the falx cerebri, tentorum cerebelli, and the dura along the entire spinal cord. Their amplitude and rate are thought to provide information about the patient's health and are thought to be influenced by the application of gentle pressure over specific areas of the cranium and sacrum. Craniosacral therapy is also thought to influence parasympathetic tone because the origins of parasympathetic division of the autonomic nervous system are located in the craniosacral regions.[15, 25]

COMPLICATIONS FROM MANIPULATION

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An estimated several hundred million manipulations are preformed each year.[26] Determining the frequency of complications from manipulation is difficult because of uncertainties in the actual number of manipulative treatments performed and the number of unreported complications. Doctors of osteopathy occasionally perform manipulation as part of an office visit for other conditions and do not bill it as a separate procedure. It is therefore harder to determine the actual number of osteopathic manipulations that are performed as opposed to chiropractic manipulations because chiropractors usually generate a separate bill for each manipulation.[27-28]

Manipulation is relatively safe.[29-30] In more than 15 controlled trials of manipulation, there were no adverse effects from manipulation.[31] A review of 128 articles published between 1925 and 1993 revealed that there were 185 specific cases of major complications. Approximately 66% were cerebrovascular accidents, 12% disk herniations, 8% pathologic fractures or dislocations, and 3% general increase in pain.[26] Of these, only 2 cases involved osteopathic physicians.[26]

One difference between osteopathic manipulative therapy and chiropractic therapy is that chiropractors may manipulate an affected joint beyond its physiologic and anatomic range of motion. Doctors of osteopathy look for restrictions in joint movement that occur within the normal or physiologic range of motion of the joint and attempt to correct them by moving the joint through the abnormal pathologic barrier, usually not beyond the physiologic range of motion. This may be one reason for the low incidence of adverse effects from OMT.

Ladermann[32] reviewed the world literature and discovered 135 case reports of serious complications. Most involved chiropractic cervical treatments and were due to misdiagnosis or the unrecognized presence of neoplastic disease.[32] The most common complication was a delay in diagnosis and treatment, and the most serious complication was paraplegia from manipulating a patient with a bleeding disorder who developed a meningeal hematoma.[32]

EVIDENCE FOR PALPATORY DIAGNOSIS

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A MEDLINE literature search was conducted using the terms "manipulation," "osteopathic manipulative therapy," "random," "clinical trials," "diagnosis," and "cohort studies" from 1966 to present. All controlled trials that were identified were included in this report. The reference sections of controlled trials were also culled for other trials. Standardized or systematic analysis of the identified trials was not possible because of variation in quality of design and method and because of the breadth of articles included. Emphasis was given to controlled trials and studies that used appropriate comparison groups. Where possible, guidelines of McMaster were used.[32-35] Published case reports were excluded at the recommendation of the peer reviewers. Historically, the osteopathic profession has not emphasized research, so there are very few controlled trials of osteopathic manipulation.

In addition to the reasons discussed elsewhere,[36-38] research on the effectiveness of palpatory diagnosis and manipulation is troublesome because of the difficulty of standardizing treatments and responses, the apparent lack of interexaminer agreement, and the self-limited natural history of many musculoskeletal conditions. Additionally, a completely double-blinded trial of manipulation is impossible because the third level of blinding cannot be met, ie, the treating clinician knows what treatment was rendered.[29] The long-term results of manipulation for lower back pain are difficult to assess because given enough time, many patients will recover regardless of the treatment.[27, 29, 39] Interexaminer agreement of osteopathic palpatory diagnosis has not been widely studied. In one small study, experienced osteopathic practitioners achieved a 62% rate of agreement.[40] Other studies have shown variable amounts of agreement.[41-44] Recurrent patterns of somatic dysfunction in some patients have been identified. A review of 9 studies suggests that somatic dysfunctions are more likely to occur in the cervicothoracic and lumbosacral transition areas of the spine.[41] However, the incidence of somatic dysfunction in normal or asymptomatic populations is unknown.[41] Finally, osteopathic diagnosis is sometimes based on subtle or minimal physical findings and subjective reporting of symptoms.

In an effort to reduce subjectivity and more objectively quantify one aspect of palpatory diagnosis, Warner et al[45] developed a technique of motion analysis that uses an anatomical torsion monitor and a hysteresis feedback loop to measure the lower back tissue response. Tissue response or quality of motion is a reflection of how the tissues of the musculoskeletal system react when force is applied, maintained, and removed. "Ease," "stiffness," "end-feel," "crepitant," and "joint play" have been used to subjectively describe tissue response. Although the pathological significance of seemingly minor physical examination findings may be questionable, some studies have suggested an association between palpatory findings and diseases for which musculoskeletal palpation is considered to have little or no diagnostic role, such as hypertension, myocardial infarction, psychiatric illness, and carpal tunnel syndrome.[41, 46-55] In a case series of 150 consecutive patients with noncongenital heart disease, 92% were noted to have both radiographic and palpable evidence of somatic dysfunction at the T1 through T6 vertebral levels.[46] Manipulative therapy was often followed by varying degrees of relief of both musculoskeletal and cardiac symptoms, while discontinuation of manipulative therapy was usually followed by exacerbation of symptoms and varying degrees of cardiac decompensation.[46] However, the examiner in the study was not blinded, no comparison of palpatory findings in a group of patients without heart disease was made, and no comparison to a placebo or "sham manipulation" for effect was made. In a randomized, examiner-blinded study in which patients were matched as closely as possible to controls including body habitus and cardiac monitoring equipment, patients who had a recent myocardial infarction had a significantly higher incidence of soft tissue changes in upper thoracic

segments detectable by osteopathic examination as compared with control patients without infarctions.[47] There may be a relationship between a pattern of somatic dysfunction at the cervicothoracic junction and hypertension.[48-49] In an examiner-blinded examination, musculoskeletal lesions were twice as frequent in patients with hypertension as compared with normotensive patients.[48-49] The difference was statistically significant ($P<.001$) and present at both the initial examination and at follow-up examinations 4 and 8 months later. Psychotic and affective disorders may also have characteristic musculoskeletal manifestations; the former being associated with lower extremity somatic dysfunction and the latter with cervical and thoracic dysfunction.[51-55]

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Although many osteopaths use manipulation as an adjunct to treat many illnesses, there are no large controlled trials of the effectiveness of manipulation for conditions other than lower back pain. Several human trials have shown statistically significant benefits of manipulation for lower back pain.[29, 31, 56-63] Studies that have shown positive effects of manipulation for back pain have been criticized for not adequately controlling placebo effect.[29, 64] Studies that demonstrated no benefit from manipulation can also be criticized, mostly on the basis of selection bias. Doran and Newell[65] concluded after studying 456 patients that although a few patients responded rapidly to manipulation, there were no significant differences compared with physiotherapy, corsets, and analgesics. Follow-up was at 3 weeks, 3 months, and 3 years. The data were not analyzed to see if clinical response was associated with certain patient characteristics.[66] The study has significant selection bias because it only included patients referred to rheumatologists. Furthermore, many patients were excluded because of pregnancy, deviation of the lumbar spine from the vertical of more than 15°, or positive straight leg raising test. These are not considered contraindications for OMT. Another controlled trial of 94 patients suggested that a course of manipulation may hasten improvement, but there was no difference in long-term outcome.[67] However, patients were only enrolled if they had sufficient concern for ordering radiographs. In most uncomplicated cases of lower back pain, radiographs are not indicated unless there are warning signs such as weight loss, fever, or history of cancer. A controlled trial by Godfrey et al[68] showed no significant difference between manipulation and massage with electrostimulation. Approximately half of the patients who were initially referred to the study were excluded. During the study, an unblinded assessor had the option of breaking the randomization and reassigning the patients to different treatment or control groups. Nineteen patients from each group were reassigned because they reported no improvement, and their physical examination was unchanged. This occurred after the study design was complete, and although the authors stated it did not influence the results, they did not report the final outcome of these reassigned patients.

The long-term outcome for most uncomplicated cases of lower back pain is similar regardless of the type of treatment. However, several studies, including a systematic review, suggest that manipulation may shorten the duration of painful symptoms.[29, 31, 60, 67-69] If manipulated patients experience improvement sooner, they may be more likely to return to work sooner.[18] Hoehler et al[29] conducted a randomized controlled trial of 95 patients comparing manipulation with soft tissue massage. Even though the group receiving manipulation had a higher proportion of patients who reported their pain as "severe" or "very severe," the manipulated patients had significantly more subjective improvement in symptoms immediately after treatment. There was no significant difference at discharge and at 3 weeks after discharge.

IN A SYSTEMATIC review and meta-analysis of the effectiveness of spinal manipulation for lower back pain, Shekelle et al[69] concluded that the 2 studies with the highest quality scores both showed a statistically beneficial effect of manipulation in patient back pain that had been present for 2 to 4 weeks. The meta-analysis of 7 studies also showed a statistically significant effect of manipulation for recovery from acute lower back pain.[69] (Only 1 of the aforementioned 6 positive studies[60] was included in this meta-analysis.) There was insufficient data to support or refute the effectiveness of manipulation on chronic lower back pain. In 1995, the US Agency for Health Care Policy and Research concluded that manipulation is safe and effective

treatment for acute lower back pain but of unproven benefit for patients with radiculopathy.[30] A systematic review of 81 trials of manipulation for chronic lower back pain found that 25% were of high methodological quality.[70] Results of this review were reported on the basis of level of evidence. For chronic lower back pain, strong evidence showed that manipulation was effective.[70]

There is a small but increasing body of evidence that suggests that OMT may be beneficial in conditions other than lower back pain. Using an animal model of antigen-induced arthritis, Hallas et al[71] showed that rates that were treated with manipulation and exercise had statistically significant improvement on computerized motion analysis, knee circumference, stride length, and ankle lift. In a randomized, researcher-blinded trial comparing incentive spirometry to OMT in preventing postoperative atelectasis, patients treated with OMT had a statistically significant earlier recovery and quicker return to preoperative forced vital capacity and forced expiratory volume in 1 second than those treated with incentive spirometry.[72] However, more than 50% of the patients who were initially included in the study were excluded for various reasons. Lymphatic pump techniques have long been thought to improve cellular activity by mobilizing fluids, enhancing removal of metabolic waste, and possibly boosting immunity.[24] There are no controlled trials supporting this. Recently, however, volunteer medical students developed a transient but statistically significant increase in serum basophils after application of lymphatic pump techniques compared with students who did not.[73] In another study, serum antibody levels measured by enzyme-linked immunoassay of 19 volunteers who received the series of recombinant hepatitis B vaccinations were compared with those of 20 volunteers who, in addition to receiving the immunizations, had OMT consisting of lymphatic and splenic pump techniques. Fifty percent of the subjects who had OMT achieved protective hepatitis B antibody titers by the 13th week, whereas only 16% of the control subjects had protective levels.[74] The mean antibody titer in the treatment group was higher than in the control group at all time intervals from the sixth week to the final measurement at 34 weeks postvaccination.[74] However, it was only statistically significantly higher at 25 weeks postvaccination. In a cohort of patients with carpal tunnel syndrome, OMT was associated with both symptomatic and electrodiagnostic improvement.[50, 75] In a blinded, randomized, controlled trial (n = 14) comparing standard medical care with standard care plus OMT for hospitalized patients with pancreatitis, patients in the OMT group had significantly fewer days in the hospital (mean reduction, 3.5 days, $P = .04$).[76] There were no significant differences in time to oral feeding or amount of pain medications between the groups. Based on the exclusion criteria, the reader can infer that the 2 groups were roughly equal in terms of disease severity; however, the authors did not specifically state that the treatment and control groups were comparable based on Ranson criteria, Acute Physiology and Chronic Health Evaluation scoring, or some other objective measure of disease severity. Osteopathic manipulative therapy has been used as adjunctive therapy in the treatment of pneumonia since the early 1900s. The only large-scale study evaluating the efficacy of OMT against pneumonia was a case series that was collected during the 1918 influenza epidemic in the United States consisting of 6258 patients with influenza complicated by pneumonia. The average mortality rate for patients treated in the usual fashion with the prevailing therapy was approximately 25%. The mortality rate for patients who were treated with OMT in addition to the usual prevailing therapy was allegedly 10%.[77] The only randomized control trial of OMT in this same setting also revealed a favorable trend. In this trial, the mean duration of leukocytosis, intravenous antibiotic treatment, and hospital stay were shorter in the patients treated with OMT compared with the control group who received either a sham treatment or no additional physical contact. However, none of these differences were statistically significant, possibly owing to insufficient power from the small sample size. The only outcome measure that did reach significance was total time taking oral antibiotics while in the hospital.[77]

Osteopathic manipulative therapy provided acute benefits in a small group of patients with idiopathic Parkinson disease (IDP).[78] Ten patients with IDP and 8 age-matched controls without IDP having similar physical conditions, underwent computerized gait analysis before and after a single session of OMT. A separate group of 10 patients with IDP underwent a sham manipulative treatment. The patients did not know when the measurements for gait analysis were being taken, and were not aware of whether the treatment they were given was the sham treatment or OMT. Before motion analysis, all patients with IDP underwent a 12-hour medication washout period. All patients with IDP had mild to moderate disease with a Unified Parkinson's Disease Rating Scale Motor Score average of 14.3; however, the study lacks a comparison table, so how well the groups were matched cannot be fully determined. Patients with IDP who were treated with

OMT had statistically significant increases in stride length, cadence, arm swing, and maximum velocities of upper and lower extremities, compared with the control group without IDP. Significant differences occurred only in patients with IDP who were treated with OMT and not in IDP patients who received a sham treatment, suggesting that the improvements were the result of OMT. The duration of this beneficial effect is unknown because patients were not followed up further.

The single report of OMT as an isolated treatment for episodic tension-type headache found a reduction in pain intensity immediately after the treatment, but the subjects were also not evaluated further.[79] A controlled trial of chiropractic spinal manipulation did not show a positive effect on episodic tension-type headaches.[80] Another similar trial did, however, find a beneficial effect of manipulation on cervicogenic headache.[81]

CONCLUSIONS

Osteopathic medicine is similar to allopathic medicine, but places a greater emphasis on the importance of the musculoskeletal system and normal body mechanics as central to good health. To support this emphasis, more basic research and controlled trials for the effectiveness of manipulation are needed.

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Autonomic Innervation of Selected Viscera

Sympathetic fibers supplying the heart and lung and part of the esophagus originate in the first 5 thoracic segments. Those supplying the pancreas, liver, stomach, and gallbladder arise in the 5th through 10th thoracic segments, and those supplying the small and large intestine and kidneys arise in the eighth thoracic to second lumbar segments.

Facilitation

Facilitation is the maintenance of a pool of premotor neurons or preganglionic sympathetic neurons in 1 or more segments of the spinal cord in a state of partial or subthreashold excitation; in this state less afferent stimulation is required to trigger the discharge of impulses. It is also a neurophysiological theory regarding the neural mechanism of somatic dysfunction.

Somatic Dysfunction

Somatic dysfunction is the impaired or altered function of the skeletal, arthrodial, and myofascial structures and their related vascular, lymphatic, and neural elements. The positional aspects of somatic dysfunction are described using 1 or more of 3 parameters: (1) the position of the body part as determined by palpation and referenced to its adjacent defined structures, (2) the direction in which motion is freer, and (3) the direction in which motion is restricted. Somatic dysfunction is characterized by one or more of the following: vasodilatation, edema, tenderness, pain, constriction, asymmetry of motion, motion restriction, and changes in tissue texture. It may or may not be associated with organic disease.

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