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JOURNAL
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TRADITION SHAPES THE FUTURE
VOLUME 24 NUMBER 2 JUNE 2014

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THE AAO FORUM FOR OSTEOPATHIC THOUGHT

JOURNAL

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The mission of the American Academy of Osteopathy is to teach, advocate, and research the science, art, and philosophy of osteopathic medicine, emphasizing the integration of osteopathic principles, practices, and manipulative treatment in patient care.

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Abstracts:

AAO Calendar of Events

Mark your calendar for these upcoming Academy meetings and educational courses.

2014

June 13-15	"Osteopathic Considerations in Sports Medicine"—Kurt P. Heinking, DO, FAAO—Midwestern University/Chicago College of Ostoepathic Medicine, Downers Grove, Illinois
July 4	Independence Day—AAO office closed
July 11	Committee on Fellowship teleconference, 8:30 p.m. Eastern time
July 12–13	AAO Board of Trustees meeting—Indianapolis
July 18–19	"Ultrasound-Guided Injections"—Sajid A. Surve, DO—University of North Texas Health Science Center—Texas College of Osteopathic Medicine, Fort Worth, Texas
Aug. 6	Birthday of Andrew Taylor Still, MD, DO
Aug. 8–9	AAO Education Committee meeting—Indianapolis
Aug. 8–9	SAAO Council meeting—Indianapolis

The Gamification of Medical School

Kate McCaffrey, DO

Playing games at school? You bet!

Luminosity is an example of a game interface with which you may already be familiar. A few of the more popular medical games are www.prognosisapp.com, www.scrubwars.com and www.picmonic.com. These apps are widely used by medical trainees.[1]

Several studies now support the video game model as an effective tool for studying medicine. A wise mentor told me, "If we want to effectively teach the millennial generation, then we need to play in their sandbox." And we need to find out what they are using to build sand castles. Staying culturally sensitive is another reason to explore the crossover of using their "toys" in medical education and training. The definition of *culture* is to "maintain…conditions for growth."[2] Culture can also be defined as "the beliefs, customs, arts, etc., of a particular society, group, place or time,"[2] and the millennial generation fits this definition of a group in time with a particular set of beliefs and customs. As medical educators, we will want to get out our passports and explore this foreign culture and learn its customs if we want to make a significant impact on the next generation of osteopathic physicians. They will be caring for us, after all.

So how does gaming work to enhance learning? Gaming increases comprehension and keeps a learner's interest using a multilayered approach. Morris et al, propose that gaming uses *motivational scaffolding* such as feedback, rewards, and flow states to keep learners engaged.[3] A *flow state* is a heightened state of focus and engagement coupled with low anxiety. Also used is *cognitive scaffolding*, such as simulations and reasoning skills. Gaming may also change attitudes toward failure. In a game, errors are experienced as constructive feedback instead of failure. This small change may alter the anxiety that failure produces, especially in medical school where the threat of failing can be emotionally devastating. Failure in medical school can sometimes mean giving up, whereas failure in video games translates into persistence.

If you take students or residents for clerkships or if you teach them at the medical school level, keep an open mind to integrating creative ways of teaching like gaming and quizzes. I am all for preserving our trainees' self-esteem and producing intact healers when they finally get through their grueling medical training.

References

1. Stevenson V. The gamification of medical training. 2013; KevinMD.com; http://www.kevinmd.com/blog/2013/12/gamification-medical-training.html. Accessed May 10, 2014.
2. Culture; Merriam Webster Online; http://www.merriam-webster.com/dictionary/culture. Accessed May 10, 2014.
3. Morris BJ, Croker S, Zimmerman C, Gill D, Romig C. Gaming science: the "Gamification" of scientific thinking. *Frontiers in Psychology*. 2013;4:607.

Millennials, Cranial Courses, and the Death of the Slide Projector

Janice U. Blumer, DO

For the first time, incoming osteopathic medical students, members of the millennial generation, have had computer technology and Internet access for their entire lives. This has changed the way this cohort learns and interacts with material. Labeled the "me, me, me generation" by *Time* magazine, they have been told they are special, and they have been given awards just for showing up. They expect as much in training. These are multidevice users, and they are not without one to three devices in hand, often interacting in different ways on each device or seemingly "multitasking."

So how is this changing the way we teach osteopathic cranial manipulative medicine? How do we interact with this generation's "edutainment" needs to make teaching cranial "sexy"? How do we slow down these fast-paced students enough so they are able to feel the cranial rhythmic impulse and so they actually take the time to learn the palpation involved in cranial? The answer is we don't.

For generations, osteopathic cranial manipulative medicine has been taught in the exact same way: at tableside with interspersed lectures, usually involving a slide projector. This model, though it worked for the previous generations, is challenging the teachers of osteopathy in the cranial field who interact with this generation of students. Today's students struggle with slowing down enough to feel the subtle rhythms and strain patterns. They are skeptical and go to the Internet to validate ideas before the lecture is done. In the blink of an eye or flash of the keyboard, they are already dismissing the entire concept before even a chance to defend it arises.

Of course I am not in the typical cranial course, as I am an assistant professor in one of the few medical schools that still offers a 40-hour course to students. My students come to pass the course and their national boards, not necessarily because they embrace the idea. Still, I wonder whether we are losing some because we missed the memo that what worked before isn't working with this generation.

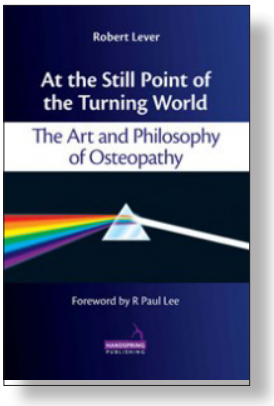
Is it time to "flip" the cranial course, ditch the slide projector, and meet the technology generation somewhere in the middle? Some would say technology itself is a hindrance to teaching cranial, but how do we know unless we test it? I don't have the answers to these questions, but I can say, if these courses don't evolve in some way, we will lose this generation in the "lack of technology" void.

Book Review—*At the Still Point of the Turning World: The Art and Philosophy of Osteopathy* by Robert Lever

Hollis H. King, DO, PhD, FAAO

No matter where you are in the world, if you are an osteopathic physician, an osteopath, a patient of one of the foregoing, or a faculty member at an osteopathic training institution, the philosophy of osteopathy has confronted you at some point. For those involved in the professions of osteopathic medicine and osteopathy, Robert Lever's book *At the Still Point of the Turning World* is most helpful in refining and developing your thoughts about osteopathic philosophy. As one who has taken a crack at writing about osteopathic philosophy, I am impressed with how well the author expresses complex ideas, and I found myself looking at ideas from new angles. Readers will be rewarded with an enriched database and perspective on osteopathic philosophy.

In the foreword, R. Paul Lee, DO, FAAO, FCA, observes that Lever writes from a "British perspective," but I found that Lever's is a truly universal osteopathic perspective. Regardless of the degree or initials following one's name or on which side of the Atlantic Ocean one resides, this book provides a critical contribution to osteopathic philosophy and to the understanding of the cranial concept in osteopathic medicine. It is not a fast read, as the integration of relevant philosophical ideas from quantum physics to the five phenomena of W. G. Sutherland's primary respiratory mechanism are placed alongside and melded into each other.



Juicy and thought-provoking discussions develop throughout the book. One of my favorites is in the chapter titled "Reciprocity, Relationship, Spaces." Lever states:

> "…the concept of interconnectedness, or reciprocity of function, is not anathema to conventional medical theorists. It is simply that so often, the therapeutic approach that is implemented is extremely targeted and linear, and in this sense, the body is not always treated with respect to its unity."

Lever holds that osteopathy—and I maintain, osteopathic medicine—contributes the necessary professional service to improve health care in any context and should be allowed, even encouraged, to be taught widely in all venues or professions that purport to treat the human condition.

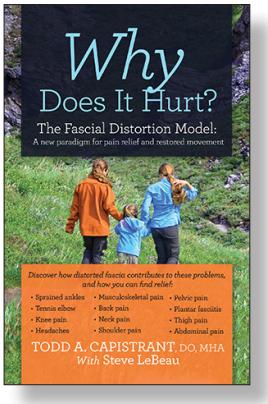
This reviewer recommends *At the Still Point of the Turning World* to any physician or other health care professional anywhere in the world, especially if that professional uses his or her hands to deliver health care. For the discerning American Academy of Osteopathy member or subscriber who already may be conversant with international osteopathic publications, this book already may be in his or her library.

Book Review—*Why Does It Hurt?* by Todd Capistrant, DO, MHA, With Steve LeBeau

Claire M. Galin, DO

Todd Capistrant, DO, MHA, with the help of Steve LeBeau has written *Why Does It Hurt? The Fascial Distortion Model: A New Paradigm for Pain Relief and Restored Movement*. This book is specifically written for lay people experiencing pain. It is easy to read and well illustrated, and it is well balanced between being just scientific enough to explain the fascial distortion model yet not so scientific to be confusing to people outside the medical profession. The stories told and the explanations given become a compelling invitation to a person suffering pain to seek out treatment in this model. And it is always useful to get material into the hands of the public that leads people to seek out DOs who do osteopathic manipulative medicine in any form.

However, *Why Does It Hurt?* has some obvious flaws. Multiple claims are made with no supporting data: All of the evidence is purely anecdotal. There are some confusing points made about the osteopathic medical profession, including that it does not offer anything but conventional medicine for a patient with tennis elbow (page 24) and a brief history of the profession that tends toward mythology. Dr Capistrant also makes unsubstantiated comments such as in the old model of medicine, the doctor did all the talking (page 41).



I can recommend this book for members of the public who are seeking information on treatment of pain, but I hope that in his next edition, Dr Capistrant will support his claims with data and, therefore, show the true value of the fascial distortion model.

For more information on osteopathic terminology used in *The American Academy of Osteopathy Journal*, see the

Glossary of Osteopathic Terminology

by the American Association of Colleges of Osteopathic Medicine.

Ultrasound-Guided Injections

July 18–19, 2014 • University of North Texas Health Science Center—Texas College of Osteopathic Medicine in Fort Worth

Course Description

This course is designed for physicians who are novices at sonographic guidance for injections. Under the direction of physiatrist Sajid A. Surve, DO, course participants will be introduced to the basic principles of ultrasound, they will learn proper injection techniques with ultrasound guidance, and they will learn proper billing and coding for ultrasound injections. Cadavers will be available for practice, and table trainers will ensure a low faculty-to-participant ratio. The course will focus on the injection of the major joints: glenohumeral, sacroiliac, hip and knee.

Course Objectives

Upon completing this course, participants will be able to:

- apply the basic principles of musculoskeletal ultrasound;
- comfortably navigate the necessary equipment required for sonographic guidance of injections;
- use proper injection techniques under sonographic guidance for the glenohumeral, sacroiliac, hip and knee joints;
- bill, code and document correctly for ultrasound-guided injections; and
- avoid common pitfalls associated with ultrasound injections.

CME

16 credits of AOA Category 1-A continuing medical education is anticipated.

Course Director

Sajid A. Surve, DO, is a 2005 graduate of what is now the Rowan University School of Osteopathic Medicine (RowanSOM) in Stratford, NJ. After completing a traditional rotating internship at Delaware County Memorial Hospital in Drexel Hill, Pa., he became an inaugural resident and the first chief resident of the physical medicine and rehabilitation residency at Long Beach (New York) Medical Center. He joined the faculty of RowanSOM in 2009 and completed a neuromuscular medicine and osteopathic manipulative medicine residency in 2010.

Course Location

University of North Texas Health Science Center—
Texas College of Osteopathic Medicine
3500 Camp Bowie Blvd.
Fort Worth, TX 76107

Course Times

Friday and Saturday: **8 am - 5:30 pm**
Breakfast and lunch provided. Please contact the AAO's Sherrie Warner with special dietary needs: (317) 879-1881 or swarner@academyofosteopathy.org.

Travel Arrangements

Contact Tina Callahan of Globally Yours Travel at (800) 274-5975 or globallyyourstravel@cox.net.

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July 18–19, 2014

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The Bioenergetic Model in Osteopathic Diagnosis and Treatment: An FAAO Thesis, Part 2

Jan T. Hendryx, DO, FAAO

Click here to download Part 1 of "The Bioenergetic Model in Osteopathic Diagnosis and Treatment," published in the March 2014 issue of The AAO Journal. *Part 2 concludes Dr Hendryx's thesis.*

Fascia and the Extracellular Matrix

Andrew Taylor Still, MD, DO, placed much emphasis on the fascia and its relationship to health. He wrote, "I know of no other part of the body that equals the fascia as a hunting ground [sic for health and disease]…. By its action we live, and by its failure, we die."[75]

Anatomically, *fascia* is defined as a sheet of fibrous tissue that envelops the body beneath the skin that encloses the muscles and groups of muscles separating them into several layers.[76] Willard et al[77,78] have classified the ubiquitous fascia into four basic divisions: *pannicular* (superficial, subcutaneous); *investing* (deep, axial, appendicular); *visceral* (pleural, pericardial, peritoneal); and *meningeal* (dural). Investing fascia not only covers the surface of skeletal muscles but also branches deeply into the muscle interior in which case it is termed *myofascia*.

Depending on the type and location of fascia, one finds various structures (vascular, lymphatic, neurological) traversing through it, as well as acellular and cellular components. Fascia is composed of three basic fiber types—collagen, elastic, and reticular—immersed in a sea of colloidal proteinaminoglycans. It is this acellular fiber-colloid part of the fascia that is referred to as the *extracellular matrix*, or ECM.[58]

Cellular fascial components include various leukocytes, plasma cells, mast cells, macrophages, pluripotential cells, fibroblasts and myofibroblasts. Interestingly, myofibroblasts contain actin and myosin filaments and can provide a contractile force to fascia.[79] Myofibroblast contraction within the fascia has been theorized to be contributory to tissue stiffness.[80,81]

Fascia performs numerous functions in the body, including structural support, compartmentalization, nutritional support, immunity, tissue repair and communication.[79] As we shall see later, the extracellular matrix can modulate cell function and pathophysiology.[60]

O'Connell[82] has described fascial architecture of the body as consisting of two functional subdivisions. *Horizontal diaphragms* are myofascial or fibrous partitions that act as tension-countertension sheets. They include the tentorium cerebelli, thoracic inlet/outlet, respiratory diaphragm, pelvic diaphragm and plantar fascia. *Longitudinal cables* run superior to inferior in the body and include various muscles (psoas major, abdominals, quadratus lumborum), spinal dura and longitudinal ligaments (occiput to S2), fascia (prevertebral, alar, buccopharyneal, pericardial, investing of lower extremity) and organs (trachea, esophagus).

The ECM has been referred to as part of the "living matrix" by Oschman.[58,60] He calls it "living" because it is much more than a passive network of fibers and ground substance holding the body and its organs together. The ECM is dynamically active and connects to the most intimate reaches of cells through the cell surface, cytoskeleton, and nuclear matrix. The dynamic nature of the living matrix can be palpated as rhythmic inherent motion that can be influenced by various forms of osteopathic manipulation and bioenergetic fields. *Inherent motion* is defined as the "spontaneous motion of every cell, organ, system and their component units within the body."[67]

Lee has elegantly synthesized information from numerous sources to describe possible origins of the oscillatory animation of this life force in the fascia, ie, *the primary respiratory mechanism (PRM)*.[52,83] First described by Sutherland, the source, or "initiative spark," of the PRM was what he termed the "Breath of Life."[84] He referred to the fluid fluctuation of the inherent motion palpated in the tissues as the "Tide."[85] Recent scientific research suggests that the source of the inherent motion of the cranial rhythmic impulse may be due to or related to the Traube-Hering baroreflex.[86,87]

Through the biophysical principles of tensegrity and piezoelectricity, fascia influences cell physiology and pathophysiology. It provides for instantaneous holographic access and communication outside the nervous system that extends all the way down to the level of the cell nucleus and DNA. It serves as a large source of the bioenergetic fields that traverse through and extend outside the body.[60]

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Collagen fibers in the ECM attach directly to the cellular cytoskeleton through specialized proteins in the cell membrane called *integrins* and *cadherins*. These molecules transmit mechanical forces from the fascia to associated focal adhesions, junctional complexes, and ultimately the cytoskeleton in the interior of the cell by a process known as *mechanotransduction*.[88,89] Mechanotransduction controls many cellular processes, including cell division, differentiation, migration, protein synthesis, DNA and gene expression, immune function, and even pathological processes.[90-93]

Tensegrity is a term coined by R. Buckminster Fuller from the words *tensional* and *integrity* to describe structure maintained by forces transmitted through a system of interconnected solid struts and flexible cables. A classic example of a tensegrity system is geodesic dome architecture.[89] Thus, *biotensegrity* refers to efficient maintenance of the structural integrity of whole living systems or even cells. In the human being, physical forces are distributed through the strut (bones) and cable (muscles, tendons, ligaments, fascia) components of the neuromusculoskeletal system. Similarly, in the cell, the cytoskeletal components (microtubules, microfilaments, microfibrils) provide the structural support in both the cytoplasm and nucleus.

One of the pioneering researchers in the fields of mechanotransduction and biotensegrity is Donald Ingber, MD, PhD. He has written and co-written numerous articles on these subjects. From an osteopathic perspective, Ingber has applied these principles in explaining how various forms of manual therapies may influence structure and function down to the cellular level.[89-91] Recently, Swanson[94] published an excellent, thorough review of biotensegrity and mechanotransduction and their relevance to osteopathic medicine, education and research.

Communication in the body occurs through two main bioelectric systems—*neurological* and *non-neurological*. Neurological communication throughout the central, peripheral and autonomic nervous systems and neuromuscular components happens because of the physiological processes resulting in ionic currents. Ionic currents are produced by ionic movement through membranes and resultant polarity reversal that is propagated along the length of nerves. Depending on the extent of myelination of nerve fibers, ionic currents have varying conduction speeds, and thus, this type of communication happens over varying amounts of time.[58]

Non-neurological communication occurs throughout the fascia. Because of their piezoelectric nature, collagen fibers and ground substance function to create instantaneous communication outside of that provided by the nervous system. Thus, electrical currents can also be carried all the way to the intracellular level.[58] This is accomplished by bioelectric semiconductor currents. Semiconductor currents differ from ionic currents of nerves and neuromuscular junctions in that they travel in fascia and the perineurium surrounding nerve fibers.[58]

The movement of electricity along a conductor or semiconductor (nerves, fascia) produces bioelectromagnetic fields that can be detected with sensitive instrumentation or by certain sensory receptors in the skin. These fields extend into and outside the body indefinitely. They may be influenced by external electromagnetic fields.[58,60] A complete discussion of the theoretical relationship between bioenergetics and somatic dysfunction can be found elsewhere.[54]

O'Connell has given a thorough review of the biomechanics and biophysical properties of the myofascia in relation to diagnostic palpation, myofascial release (MFR) technique and bioelectric fascial activation and release. Both O'Connell[49,61] and Oschman[60] have theorized a bioenergetic-holographic model for the human myofascial system based on these biophysical properties. In this model, one can access any part of the living system from any location by lightly palpating and applying gentle forces through the elaborate fascial network of horizontal diaphragms and longitudinal cables and tubes. Holland also has described a system of diagnosis called *perceptual transference* in which the examiner holographically senses in his or her body the area of key somatic or visceral dysfunction in a patient's body while gently contacting the patient.[74]

Comparison of Dynamic Strain-Vector Release and Neurofascial Release

Two osteopathic manipulative treatment (OMT) techniques will be discussed to show how the bioenergetic model may be used to diagnose and treat patients. These are dynamic strain-vector release (SVR) and neurofascial release (NFR). Experientially, this author has found these techniques extremely effective in treating patients, whether these techniques are used alone or in conjunction with other manipulative modalities. Often, SVR and NFR have been integral in enhancing therapeutic effects when traditional biomechanical techniques are limited.

Dynamic Strain-Vector Release

Dynamic strain-vector release is a bioenergetic technique developed by this author in 1999-2000.[54] Its principles arose from palpatory experimentation with inherent tissue motions and acupuncture points in a patient with chronic refractory pain. It was observed that tissue somatic dysfunctions possess abnormal inherent motions that can be normalized without applying any direct or indirect mechanical forces

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to the tissues. Dynamic strain-vector release is directed toward assessing dysfunctional tissues for an inherent motion abnormality known as a *dynamic strain* or *pathological strain-vector* and then treating the abnormality by touching and holding a strain-vector release point located on, inside, or off the body in the biofield. Resolution of the pathological strain-vector results in resolution of the tissue dysfunction and re-establishment of normal inherent tissue motion.

Normal inherent tissue motion is a subtle rhythmic oscillation occurring at a frequency of approximately 8 to 14 cycles per minute. A slight pause, or "neutral zone," occurs at the midpoint of each back and forth motion, somewhat similar to the cranial rhythmic impulse.

A *dynamic strain* is defined as "a palpable distortion of motion in the tissue and/or human energy field that pulls 'pathologically' along a certain direction with a certain force (vector), while continuing to move with inherent tissue motion."[54] This abnormal motion is a strong tissue pull in a specific direction, and it lacks the neutral zone found in normal inherent motion.

The efficacy of the SVR technique relies on the physician's ability to layer palpate to the level of the dysfunctional tissue, assess subtle inherent tissue motion for pathological dynamic strain-vectors located in areas of dysfunction, and find and treat a strain-vector release point with the nonpalpating hand. Strain-vector release points are located by moving the nonpalpating hand in the direction of the tissue pull of the pathological strain-vector. Tissue under the palpating hand tightens up and reaches maximal tension when the nonpalpating hand finds the exact location of the release point. All inherent motion stops briefly (still point) and restarts when the tissue releases. If, after re-evaluation, some pathological vectors remain, the technique is repeated until normal inherent tissue motion is restored.

SVR is effective in treating patients for acute, subacute, and chronic somatic, visceral, neurological, and energetic conditions, some of which may not be responsive to other classic forms of OMT. Apparently, all tissues can have pathological strain-vectors within.

Neurofascial Release

Neurofascial release[43] is a bioenergetic technique developed in 1987 by Stephen M. Davidson, DO. With NFR, the physician assesses dysfunctional tissues for abnormal texture, tone, range of motion (fascial), and inherent motion restrictions and treats these by touching and holding a neurofascial release point located on the body until tissue texture or motion normalizes. Neurofascial release is based on a model of standing waveforms and interference vibratory patterns produced, or held in tissues. These patterns are thought to be responsible for somatic and

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visceral dysfunctions. NFR is applicable to fascial, dural, intraosseous, and visceral strain patterns; painful tissue; the re-establishment of craniosacral rhythm, and inherent tissue motion, as well as mental, emotional, and toxic themes.[43,95-97] The biotensegrity of the fascial system is the main focus, and the patient is examined and treated from an integrated whole person perspective. Global and local fascial restrictions or laxity, as well as inherent fascial motion, are evaluated in an effort to find key dysfunctions ("key lesions").

Neurofascial release points are then located that 1) help to normalize abnormal tissue tone and release restrictions or 2) restore inherent tissue motion. In the NFR model, the release point is hypothesized to shut down the fascial wave generator that is creating abnormal fascial tension patterns and related somatic and visceral dysfunctions.

Fascial restrictions are treated by finding a related neurofascial release point on the body and holding it until the tissue tension normalizes. This process can be facilitated by creating a slight strain in the fascial restrictive barrier, winding up the tension throughout the fascia in the body, and maintaining the tension until the tissue releases (ie, "recruiting the strain"). For tissue exhibiting abnormal tightness or spasm, touching a neurofascial release point will cause the tissue to relax. Conversely, in lax tissues, a point can be found and touched that actually increases tone.

The locations of neurofascial release points can vary from patient to patient and treatment session to treatment session. Some release points, however, have been found consistently in the same locations among patients. Many of these correspond to acupuncture points and locations that were used by Fulford in treating patients with the percussor hammer.[32]

Discussion

Energy, mass, and matter are inextricably linked together by the famous Einstein equation $E=mc^2$.[98] Energetic exchanges and transformations occur at all levels in the universe and are, thus, an integral part of the structures and functions found in living systems.[60] Energy exchanges also occur in interactions among living systems, such as between a physician and patient.[58]

Two OMT techniques, dynamic strain-vector release and neurofascial release, were presented, both of which appear to primarily adhere to a bioenergetic diagnostic and treatment model. Comparison of these techniques reveals some similarities and differences.

In both SVR and NFR, the patient's tissues are assessed for inherent motion abnormalities. In SVR, the examiner is focused on finding a pathological strain-vector in dysfunctional tissue that has a specific force and direction of pull.[54] The direction of tissue pull leads the examiner toward the pathological strain-vector "release point," which is palpated and held through a still point with the nonpalpating hand. Tissue dysfunction resolves and normal inherent motion returns once the pathological strain-vector or layered vectors disappear.

Dysfunctional tissues under the palpating hand tighten while the examiner moves the nonpalpating hand toward the exact location of the strain-vector release point, which may be located on, inside, or off the body in the biofield.

In NFR, the release points are typically located on the surface of the body in mostly nonpredictable locations. Inherent tissue motion (cranial rhythmic impulse, primary respiratory mechanism, visceral) is assessed primarily for its presence or absence, although quality is also important. If inherent motion is absent, it may be restored by touching a release point. If tissue is too tight, such as typically found in a somatic or visceral dysfunction, palpation of a release point allows the abnormal tissue to loosen. If tissue is too loose, release point palpation may actually allow the loose tissue to tighten. No pathological strain-vectors should be palpated with this technique.

NFR also can be used to release larger area fascial strains throughout the body. In this case, the examiner passively moves a region of the body into the restrictive barrier of the strain irrespective of inherent motion qualities. The NFR release point is held until the body region moves through the barrier.

What is the nature and cause of inherent tissue motions? What is the nature of the release point in each technique, and how does palpating and holding it alter inherent motion abnormalities without applying any mechanical forces to the tissues?

Theories on the origin and nature of inherent tissue motion and still points have been previously discussed in detail.[54] Inherent motion may originate from biodynamic (physiological) and biokinetic (pathophysiological) energies,[41] yin-yang polarities and qi movements in the tissues, coaxial energetic core coherent wave propagation,[99] subtle energies,[65] and the Traube-Hering baroreflex.[87]

Lee[100] has discussed the central role of water in homeostasis and the interface between spirit and the living material body of the human being. He suggests the oscillations palpated as inherent tissue motion may be due to sinusoidal waves of change in calcium concentrations within the ECM, with accompanying flow of water, changes in electrical charges, and tissue viscosity.

What is the nature of strain-vector and neurofascial release points? It may be that they are holographic biofield switches that turn on or turn off bioelectric circuits and influence

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inherent bioelectromagnetic activity. Some correspond with acupuncture points and may be connected to meridian systems.[60]

Interactions of bioelectromagnetic fields with fascia could explain the instantaneous response of the body to touching specific release points or palpating the energy field off the body.[60] To some extent, fascial tension is due to sol-gel conversion. Electromagnetic fields can affect sol-gel conversion. Semiconductor currents induced in the fascia either by direct passive contact, stretching, acupuncture needles, or interaction with the biofield may explain the palpatory phenomena experienced by both the physician and the patient.[54]

Davidson has suggested that abnormal standing wave forms in the fascia along with interference patterns may be responsible for fascial dysfunction and the response of tissues to touching neurofascial release points.[96] Oschman discusses holographic interference patterns relating to wave front disturbances within the living matrix and its implications for potential therapies.[60] These concepts are also supported by dynamical medicine principles as presented by Holland.[71] Thus, there are many plausible scientific explanations for what energetic phenomena are behind palpatory findings of dysfunction or normal tissues, inherent motions, and the therapeutic response of the patient to the physician's touch. The scientific discipline central to the exploration of these topics is biophysics.

As far back as the late 1930s, Carl Philip McConnell, DO, discussed how important it was for osteopathic physicians to recognize the key role of biophysics in understanding anatomy, physiology, health, and disease.[55] In an article titled "The Osteopathic Approach,"[101] he challenged the osteopathic medical profession to stretch beyond precedence and dogma to learn about and apply biophysical principles so that our treatments would truly become individualized, comprehensive, and maximally effective. Our profession is slowly beginning to make that stretch as evidenced by the presentation of biophysics-related topics at recent continuing medical education events[102] and in osteopathic scientific literature.[30,47,51,54,61] DiGiovanna,[103] O'Connell,[61] DeStefano,[104] and Greenman[105] have reintroduced the "bioenergetic," or "bioenergy," model into mainstream osteopathic medical textbooks.

It is this author's opinion that the stretch needs to be transformed into a quantum leap. Biophysical principles and applications to osteopathic diagnosis and treatment should be integrated into the educational process for medical students and physicians alike. Why? It is part of the reality with which we deal every day in the diagnosis and treatment of our patients. Biophysical principles and mathematics are behind the functioning of all living systems. The physics of biological systems has been studied and documented for more than a century. Interestingly, McConnell cites a 1921 reference book titled *An Introduction to Biophysics* by David Burns.[106] This was apparently the first time the term *biophysics* was used

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in a book title.[107] Why, then, have we not made this subject a focus in osteopathic principles and practice?

Part of the problem in making this leap is that biophysics and related topics are taught somewhat sparingly in conventional biology and in medical school. The biochemical nature of life is emphasized, presumably because medicine is focused on the chemical human being. Energetic phenomena are acknowledged, especially in biochemistry, physiology, and pharmacology, they but are not stressed as ways to influence biological systems from the standpoint of healing.

During the past several decades, we have exponentially increased our knowledge about energetic interactions in living systems and how they may be related to healing and health.[58,60] Now emerges the subject of "quantum biology"[108] with descriptions of quantum properties and phenomena occurring in several different "quantum biological systems."

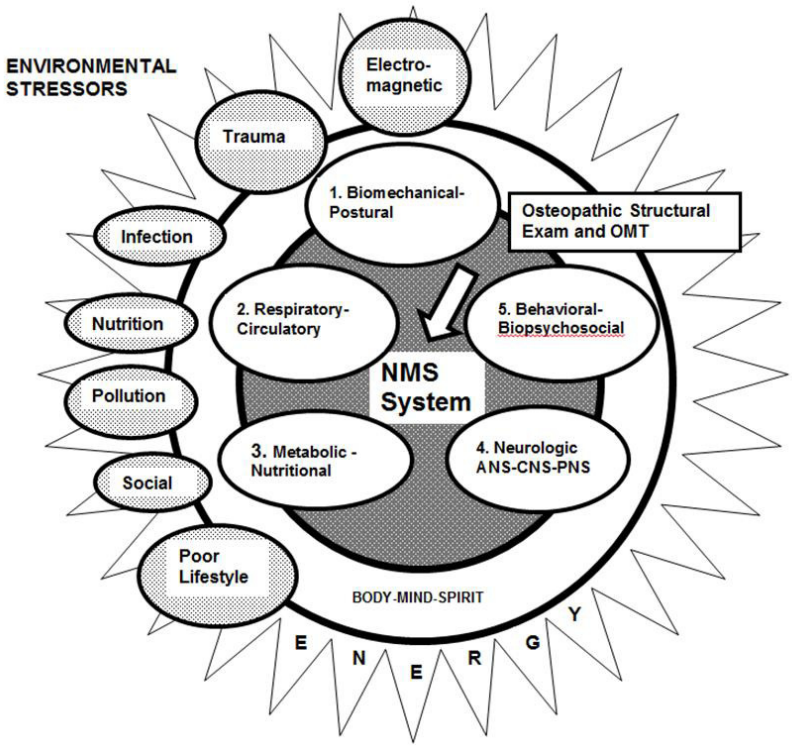

Figure 2. The classic osteopathic model is expanded to six concepts, with bioenergy serving as the foundation. Additional environmental stressors have been added (poor lifestyle, pollution, electromagnetic exposures, etc.). Energy is the primary adaptive response to stressors. The holistic view of the patient includes body, mind, and spirit.

An integrative model of biophysics links all medical disciplines together in a unified manner to explain anatomical-physiological relationships, diagnosis, and treatment of patients. Although it may seem that we are dealing with a physical body, underlying that physicality are vibrating energies of various types that are constantly being interconverted to other types of energies in the dance we call life.

Six Osteopathic Models

Energetic principles described by mathematics and physics ultimately govern the functioning of living systems from the atomic or molecular level to the synthesized whole organism. Energy of various types is constantly exchanged, transformed, and communicated within the individual in all aspects of body, mind, and spirit to maintain homeostasis and health. Thus, this author proposes expanding the classic osteopathic five model concept into six models, with bioenergy as the foundation of all. *(See Figure 2.)*

A proposed definition of the bioenergetic model for osteopathic medicine is:

> The *bioenergetic model* seeks to address the bioenergetic nature of the human being in health and disease, striving to maintain or support the return to homeostasis through the application of biophysical principles in the biofield. This can be accomplished by using a wide range of osteopathic manipulative techniques such as dynamic strain-vector release, neurofascial release, bioelectric fascial activation and release, facilitated oscillatory release, myofascial release, trauma vector release, percussor treatment, and osteopathic cranial manipulations. Bioenergetics serves as the foundation and integration point for all other osteopathic models of care, and the bioenergetics model can be used to diagnose and treat all levels of dysfunction.

The bioenergetic model brings to the table real-time assessment and treatment based on what is happening with the patient at the visit. It examines another dimension that is typically ignored in most of medicine. Patients may have classic patterns of somatic or visceral dysfunctions that, from a biomechanical standpoint, are easily documented and, theoretically, should respond to classic forms of OMT, but for whatever reason, they don't respond completely or at all. Evaluation of abnormal bioenergetic phenomena and biophysical fascial abnormalities underlying these dysfunctions adds significantly to the information available to the physician on how to treat more appropriately, effectively, and efficiently.

Combinations of bioenergetic techniques, including acupuncture, are often used effectively and gently to decrease chronic pain and dysfunction and to increase health and homeostasis. Given the potential adverse effects of other common treatments (opiates, antidepressants, nonsteroidal anti-inflammatory drugs, muscle relaxants, anxiolytics,

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corticosteroid injections, epidurals, surgeries, ganglion blocks, neuro-stimulator implants, etc.), one must ask why bioenergetic evaluation and treatment aren't attempted initially in patients. There are virtually no adverse side effects.

In part, the answer may lie in the fact that the bioenergetic model typically is not presented to students and physicians as a viable alternative to other models, even though biophysics has a long history, is a widely recognized scientific discipline, and has a massive research database. Biophysics is probably a lot more solid from a theoretical and practical standpoint than are biology and pharmacology.

Conclusions

Dynamic strain-vector release and neurofascial release are effective bioenergetically based modalities for treating patients for tissue dysfunctions of all kinds. In this author's experience, SVR and NFR can be used quite effectively to move patients to a much higher level of functioning when traditional manipulative and nonmanipulative modalities fail. This is especially true for patients with chronic pain who have exhausted all avenues of conventional treatment, including medications and surgery.

Both SVR and NFR can treat most tissues exhibiting somatic and visceral dysfunctions, and emotional and toxic states can be reached. These two techniques can be mixed and matched, not only with each other but also with any other OMT techniques and with acupuncture.

Although these bioenergetic techniques currently can be taught to and used by osteopathic medical students and physicians, relatively few clinicians take advantage of these treatment modalities. Biophysical principles should be incorporated into both undergraduate and medical curricula to balance the conventional emphasis on biology, anatomy, physiology, and biochemistry. This would require osteopathic medical schools to assimilate these concepts and terms into common medical vocabulary. The profession should consider integrating biophysical principles into the core osteopathic competencies. This would allow for the knowledge and its applications to be spread throughout the curriculum and into graduate medical education.

This integration is crucial to the total holistic approach to patients, which is central to osteopathic philosophy. Additionally, we now enter an uncertain future in medicine in which we are mandated to become more proficient, efficient, effective, and prevention-oriented physicians. Patients are awakening to the fact that current conventional medical interventions are often dangerous, costly, and ineffective. There is something wrong with a medical system that is the third largest cause of death, lagging only behind cardiovascular disease and cancer.[109]

It is, therefore, imperative that we provide the most advanced and highest quality health care possible. We should consider researching how biophysics and the bioenergetic model can be incorporated into a quality and totally integrated health care system. This would put osteopathic medicine at the cutting-edge of health care in the 21st century, as it is the natural progression of our philosophy and principles.

More research needs to be done into how endogenous and exogenous bioelectromagnetic field therapies, including OMT, affect the body from postural, gait, and biomechanical (somatic and visceral) dysfunction standpoints. One suggestion would be to use gait and postural analysis video and computer technology to document specific changes before and after a bioenergetic treatment. This could be accomplished acutely or long-term.

Additionally, one might use a superconducting quantum interference device (SQUID) magnetometer to measure biomagnetic changes of a specific somatic dysfunction before and after treatment.

A preliminary research project is under way by this author to further assess relationships between acupuncture points and somatic and visceral dysfunctions.

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Neural Prolotherapy Can Resolve Neuralgia

Eileen M. Conaway, DO; Brian L. Browning, DO

The following submission tied for first place in the residents' case history category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

Introduction

Neuralgia and peripheral neuropathies are notoriously difficult conditions to treat. Mainstays of therapy are neuropharmaceuticals and neurosurgery.

Case description

Patient No. 1: Hispanic female, 63 years old, complaining of 13 years of burning pain of the face and scalp due to V1 neuralgia after neurosurgical intervention for cerebral aneurysm. Patient

No. 2: Caucasian female, 61 years old, complaining of acute on chronic lateral leg pain due to meralgia parasthetica.

Technique

Neural prolotherapy is an adapted prolotherapy technique in which subcutaneous tissue is injected with a 5% dextrose solution. Technicians prepared 3mL syringes with D5W and a 31g 0.5 inch needle. Neural prolotherapy was performed for both of these patients by injecting tender points in the subcutaneous tissue along the affected nerve paths, V1 and lateral femoral cutaneous nerves, respectively, with approximately 0.5mL of D5W at each point at a 45-degree angle 1 to 2 cm apart. The needle was inserted to the appropriate depth, and the solution was injected while withdrawing the needle to create a skin bleb.

Results

Patient No. 1 reported complete resolution of V1 neuralgia after 3 neural prolotherapy treatments. Patient No. 2 reported significant, satisfactory relief in pain from meralgia parasthetica after 8 treatments.

Conclusion

Neural prolotherapy is a simple office procedure, easily done without imaging, which may lead to relief from neuropathic pain. The most common side effects reported were temporary pain with injection and local bruising. The proposed mechanism of action is agonism of TRPV1 receptor. There are literature reports of this technique being employed for Achilles tendinosis, and we hypothesize that this technique could be employed for a variety of peripheral neuralgias.

Management of Levator Ani Syndrome With Osteopathic Manipulative Treatment: A Case Study

Miho Yoshida, DO, NMM+1; Dominic Derenge, OMS IV; and Katherine Worden, DO, MS

The following submission tied for first place in the residents' case history category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

Background

Levator ani syndrome describes a disorder in which pelvic pain is attributed to short, tight, and tender pelvic floor muscles, commonly occurring in conjunction with hypersensitive tender points. It can cause chronic pelvic pain, which can be sufficiently debilitating to a patient by interfering with daily activities and the patient's sense of well-being. Osteopathic manipulative treatment (OMT) can be beneficial in treating this disorder. This case describes how treating patients who have levator ani syndrome with OMT produces positive results shown objectively via improvement on imaging and subjectively through reassessment by the patient.

Material and Methods

The patient in this study complained of pain with sitting, identified to be caused by spasm of her levator ani muscles. She was treated with OMT for five months. The unrestricted OMT protocol included intrarectal treatment of levator ani and coccygeal muscles. Two months into her treatment, the patient received pelvic floor physical therapy (PT) in adjunct to OMT. This facilitated improvement of symptoms. Magnetic resonance images (MRIs) of the pelvis were obtained pre- and post-treatment, five months apart.

Results

Subjectively, the patient reported a 60% reduction in symptoms since starting OMT after five months of treatment. Objectively, a post-treatment MRI of the pelvis, taken five months after pre-treatment MRI, showed significant changes to the pubococcygeus and other levator ani muscles. Improved palpable changes were found on exam.

Conclusions

Both objective improvement and subjective improvement were found using OMT to treat patients for levator ani syndrome. In this case, OMT in combination with pelvic floor PT has been shown to be beneficial in treating levator ani syndrome. Thus, OMT should be considered as the standard of care for patients with this disorder.

The Bioenergetic Model *(Continued from page 18)*

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Address correspondence to:

Jan T. Hendryx, DO, FAAO
5401 Peach St., Suite 3400
Erie, PA 16509

Comparison of Patient Records From the Still-Hildreth Sanatorium With Published Reports

Leslie M. Ching, DO, OGME4; Harriet H. Shaw, DO

The following submission won first place in the residents' clinical research category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

Introduction

At the Still-Hildreth Sanatorium (SHS), the first osteopathic sanatorium, the majority of patients were diagnosed with psychiatric disorders, and physicians designed treatments around treating the whole patient. This study is a retrospective chart review from patients admitted in the 1910s to the 1930s (the only known medical records) and shows improvements in pyschiatirc conditions at the SHS were greater than nonosteopathic contemporary statistics.

Methods

The Museum of Osteopathic Medicine in Kirksville, Missouri, redacted and compiled charts from 1,891 patients. The investigator reviewed the chart information and compared it to an SHS pamphlet showing patient statistics from March 1914 to March 1931.

Results

Rates of hospital admission diagnoses and results were compared, focusing on patients with psychiatric diagnoses. Recovery rates in the extant records largely correspond to published reports.

Conclusion

Published data of SHS may be considered generally correct when compared with extant medical records. Other research avenues could be considered from this database.

Traumatic Groin Injury in a Football Player: A Case Report

Daniel Tsukanov, DO; Dennis J. Dowling, DO, FAAO; Lyn Weiss, MD

The following submission won second place in the residents' clinical research category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

History

A 15-year-old male patient with no significant history presented to an osteopathic manipulation clinic following an unrestrained motor vehicle accident in July 2012. He was discharged from the hospital with significant injuries and required crutches for weight-bearing secondary pain in the groin. The patient denied any weakness, numbness, tingling, bowel or bladder dysfunction. He was to start junior high school in the fall, and his football training was to resume in August.

Physical Examination

Lumbar spine range of motion was 110 degrees flexion, 25 degrees extension with tenderness. Mild muscle spasm was noted over the L4-L5 on the right side. Straight leg raise testing was negative. Hip on right noted for swelling in groin region near the pubic symphysis and adductor insertion with tenderness to palpation. The patient had pain on internal rotation, adduction and flexion. Manual muscle testing of right hip adduction and flexion 4/5 was limited by pain. Gait was antalgic with bilateral crutches.

Differential Diagnosis

Pubic shear, pubic bone fracture, adductor tear, rectus abdominus tear, and inguinal hernia were ruled out.

Tests and Results

July 11, 2012: Pelvic X-ray showed misalignment of the symphysis pubis with left articular surface displaced anteriorly with respect to the right measuring 6mm.

July 17, 2012: Pelvic magnetic resonance imaging showed diastasis of symphysis pubis with subluxation and associated with mild diastasis of sacroiliac joints. The patient had high-grade strain and detachment of right adductor and external obturator origin.

Aug. 27, 2012: Ureteral stump evaluation showed neutral alignment of the pubic symphysis.

Final Working Diagnosis

Pubic shear, right adductor, and obturator tear were diagnosed.

Treatment and Outcomes

The patient was evaluated in the manipulation clinic and found to have somatic dysfunctions in the lumbar spine, pelvic, and pubic symphysis areas. Treatment consisted of manipulation, specifically a traction tug to the right pubic symphysis was performed, after which the patient reported greater than 70% reduction in symptoms and was able to ambulate without crutches. Physical therapy and acetaminophen as needed for pain were also initiated, as well as follow-up manipulation treatments. At the end of August, the patient was cleared by his orthopedic surgeon for progressive return to sports, and the patient reported minimal groin pain. Ureteral stump evaluation revealed realignment of the pubic symphysis.

Treatment of Common Fibular (Peroneal) Nerve Palsy With Osteopathic Manipulative Medicine: A Case Study

Bradley M. Jahnke, OMS V; Puanani Hopson, OMS V; Katherine Worden, DO, MS

The following submission won first place in the students' case study category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

Context

This study was designed to present a case in which osteopathic manipulative medicine (OMM) was used to treat a patient for common fibular nerve entrapment.

Methods

A previously healthy 50-year-old female patient with a 2-month history of tripping on flat surfaces presented to an osteopathic manipulative medicine (OMM) clinic for osteopathic evaluation and treatment. Electromyography (EMG) nerve testing completed prior to treatment was consistent with right common fibular nerve palsy. The patient presented clinically with right lower extremity pain, weakness, and decreased sensation over the lateral right leg and foot. Osteopathic examination was most significant for myofascial strain and a posterior fibular head. The patient was treated for these findings in conjunction with other significant areas of somatic dysfunction using a variety of osteopathic manipulative treatment (OMT) techniques.

Results

Over the course of several treatments, the patient's response was notable for decreased episodes of pain and discomfort of her right lower extremity, as well as decreased foot drop. Neurologist follow-up and repeat EMG after four months of OMT found some improvement in conduction velocity of the right common fibular nerve.

Conclusion

Our patient presented with foot drop and pain in the right lower extremity, and on review of the literature, these symptoms were found to correlate with an osteopathic finding of posterior fibular head. This case demonstrates both clinical improvement and EMG alteration after providing OMT for common fibular neuropathy. Further studies with objective or neurologic results should be conducted to determine the efficacy of OMT and support the use of this treatment modality in clinical cases.

Application of OMT in a Pediatric Postoperative Ileus Case

Rebecca S. Domalski, OMS III; Laura Nimkoff, MD; Sheldon C. Yao, DO; Patricia S. Kooyman, DO

The following submission won second place in the students' case study category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

Introduction

Postoperative ileus refers to the failure to pass gas or stools and intolerance of oral intake due to disruption of the normal propulsive activity of the gastrointestinal tract during the postoperative period. Postoperative ileus may lead to increased patient pain and discomfort while prolonging the duration of hospital stays.[2] Multiple pathophysiologic mechanisms contribute to postoperative ileus. The success of treatment remains limited due to the complexity of neurologic and inflammatory control of gastrointestinal function. Despite the huge cost associated with postoperative ileus, there have been very few medical advances for treating patients for postoperative ileus.[3]

Case Description

A 17-year-old Hispanic female patient post laparoscopic appendectomy complained of a bloating sensation, and she confirmed that she had not had a bowel movement. Osteopathic examination revealed hypertonic paraspinal musculature in the thoracic and lumbar spines and diffuse bogginess of the abdomen. Osteopathic manipulative treatment (OMT) techniques were selected to impact each component of the complex pathophysiology of postoperative ileus. These techniques included suboccipital release, ribless rib raising, myofascial technique, and mesenteric lifts. Twenty minutes following treatment with OMT, the patient reported having a bowel movement.

Discussion

Inhibitory neural reflexes are believed to have local action via noxious spinal afferents, which increase inhibitory sympathetic activity.[1] OMT was used to help normalize the autonomic nervous system (ANS) with the rib/ribless rib raising techniques. Intestinal manipulation and trauma lead to macrophage activation and an inflammatory response, slowing motility.[1] This was addressed with OMT to help normalize the ANS with suboccipital release. Neurohumoral peptides such as nitric oxide, vasoactive intestinal peptide, and possibly substance P are also thought to slow transit time in the gut.[4] This was addressed with OMT by providing myofascial release to the thoracic and lumbar spines. OMT helps remove structural restriction to lymph flow and promote lymphatic flow.[3] The mesenteric lift technique was used to decrease venous congestion and decrease inflammation of the gut.

Conclusion

This case illustrates the effectiveness of OMT in a postoperative ileus case. Consideration should be given to the role of OMT as an adjuvant approach to mainstay therapies for treating patients for postoperative ileus.

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The Role of Osteopathic Manipulative Medicine in the Treatment of Dacryostenosis

Theresa E. Apoznanski, OMS III; Reem Abu-Sbaih, DO; Sheldon C. Yao, DO

The following submission won third place in the students' case study category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

Abstract

Dacryostenosis is found in up to 20% of newborns and up to 6% are symptomatic. While 90% of cases resolve spontaneously within 6 months, the rate of spontaneous resolution decreases after 6 months, and invasive treatment may be necessary.[1] The standard of care for symptomatic patients younger than 6 months is nasolacrimal massage and topical antibiotics as needed. After 6 months of age, nasolacrimal probing under anesthesia may be required. The authors present a case of persistent dacryostenosis in a 9-month-old male patient with recurrent epiphora and ocular discharge since birth. He was scheduled for surgical nasolacrimal probing because he showed little improvement with standard treatments. Osteopathic examination revealed several cranial and cervical somatic dysfunctions, and they were addressed with cranial and cervical techniques. The patient's epiphora improved immediately, and it continued to improve during the following weeks and months. At 6 months post-treatment, the patient no longer needed surgical probing. This case suggests that osteopathic manipulative medicine (OMM) can help relieve nasolacrimal duct stenosis by addressing the somatic dysfunctions of the cranial bones, improving cranial bone articulation, and augmenting the drainage of the lymphatics of the head and neck. In turn, this may decrease epiphora and dacryocystitis, ultimately decreasing patient discomfort and the need for invasive and expensive procedures.

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Is There a Place for Osteopathy in Parkinson Disease Management? A Retrospective Case Control Study

Michael P. Catanzaro, OMS III; Kathleen M. Vazzana, OMS IV; Annie Chen, OMS II; Jayme D. Mancini, DO, PhD; Sheldon C. Yao, DO

The following submission won first place in the students' clinical research category in the Louisa Burns Osteopathic Research Committee's poster presentation at the AAO Convocation in Colorado Springs, Colorado, on March 21, 2014.

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Context

Parkinson disease (PD) is a severe neurodegenerative disease whose treatment involves a multifaceted approach. Osteopathic manipulation medicine (OMM) may play an important role in PD management.

Objectives

This study was designed to determine the difference in the presence of somatic dysfunctions and the treatment approach with OMM between PD cases and matched control cases.

Methods

This retrospective case control study was conducted at the Academic Health Care Center at the New York Institute of Technology College of Osteopathic Medicine (NYIT-COM) using charts of patients seen from January 1, 2010, to August 1, 2013. A search of the electronic medical record system eClinicalWorks© was performed using International Classification of Disease 9th (ICD-9) codes. The ICD-9 codes for PD (332.0) and thoracic somatic dysfunction (739.2) were searched, yielding 322 charts of patients with Parkinson disease. Of these, 80 met our inclusion criteria. The control group was identified by ICD-9 codes for thoracic somatic dysfunction (739.2) and a musculoskeletal complaint: low back pain (724.2), back pain (724.5), thoracic back pain (724.1), cervicalgia (723.1), and sacrococcygeal disorders (724.6). The cases were matched to controls by age, gender, and treating physician. Outcomes were measured by comparing the presence of somatic dysfunctions of each body region between the groups using McNemar's test with alpha set at 0.05. The number of body regions treated in each group and the frequency of use of active and passive techniques were also recorded, and they were compared using paired t-tests.

Results

Parkinson disease cases had significantly more head/cranial ($p < 0.01$, or = 0.21) and cervical somatic dysfunctions ($p = 0.01$, or = 0.28). The control cases had significantly more pelvic somatic dysfunctions ($p < 0.01$, or = 3.14). PD cases received OMM treatments in significantly more body regions than the matched control cases ($p < 0.01$, CI [-1.184, 1.466]). There was no significant difference between the frequency of use of different passive ($p = 0.148$, CI [-0.0690, 0.4487]) and active ($p = 0.242$, CI [-0.0516, 2016]) treatment techniques between PD cases and control cases.

Conclusion

Head/cranial and cervical somatic dysfunctions were significantly greater in the Parkinson disease cases, indicating that patients with PD may be more susceptible to dysfunctions in these regions. PD cases also received treatment in significantly more body regions than the control cases. These findings can help to establish a PD OMM protocol. Additional studies should be aimed at correlating successful treatment of these regions with improved quality of life in patients with PD.

Osteopathic Manipulative Treatment in Vestibular Neuritis: A Case Report

Brendon S. Ross, DO, MS; Virginia M. Johnson, DO, C-NMM/OMM

Abstract

Vestibular neuritis is a benign, self-limited disease process characterized by new-onset vertigo with symptoms persisting for days or months. Current medical management with medication use and vestibular rehabilitation exercises has shown limited success. The following case report highlights the use of osteopathic manipulative treatment (OMT) in a 56-year-old male patient who developed vestibular neuritis following dental trauma. The patient reported a significant improvement in his vertigo symptoms in both frequency and duration following multiple sessions of osteopathic manipulation targeting the craniocervical regions and temporal mandibular joint (TMJ). Osteopathic evaluation and manipulative treatment should, therefore, be considered in the treatment of patients diagnosed with vestibular neuritis.

Introduction

Current understanding of the pathophysiologic mechanisms and appropriate treatment of patients for vestibular neuritis remains incomplete. Disabling vertigo is the hallmark symptom of this disease process. Most current treatments aim to manage the autonomic symptoms associated with the condition—nausea, vomiting, and vertigo—by using anticholinergics, antihistamines, or antidopaminergic agents. These treatments have had minimal success. Corticosteroids have been shown to significantly improve vestibular function in patients at a 1 year follow-up compared to patients taking placebo, but valacyclovir alone or in combination with corticosteroids provided little benefit.[1] Recent research indicates that vestibular rehabilitation exercise prescription, specifically Cawthorne Cooksey exercises (*Table A*) and balance training using the Nintendo Wii may aid in the recovery process from this condition.[2,3] Given the success of osteopathic manipulative treatment in other types of vertigo, a distinctive osteopathic approach in the treatment of this disease process should also be explored.

Vestibular neuritis is defined as a benign, self-limited disease characterized by new onset vertigo—the physical sensation of motion in one's self or environment—with associated autonomic symptoms, primarily nausea and vomiting.[4] This syndrome was first described by Dix and Hallpike as a distinctive disturbance of the vestibular function leading to vertigo without associated deafness or tinnitus.[5] The persistence of symptoms from days to months—along with the absence of hearing loss—differentiates this disease process from Meniere's (*Table B, page 28*). The vertigo may be so severe as to often require immobility to cope with the attacks.

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Table A. *Vestibular Rehabilitation Exercises*

In bed or sitting
Eye movements (first slowly, then quickly): up and down, side to side, focusing on finger moving from 3 feet to 1 foot away from face
Head movements (first slowly, then quickly with the eyes open and then with eyes closed)
Bending forward and backward
Turning from side to side
Sitting
Eye movements and head movements as above
Shoulder shrugging and circling
Bending forward and picking up objects from the ground
Standing
Eye, head, and shoulder movements as before
Change from sitting to standing position with eyes open and then closed
Throwing a small ball from hand to hand (above eye level)
Throwing a ball from hand to hand under knee
Changing from sitting to standing and turning around in between
Moving about
Walk across the room with eyes open and then closed
Walk up and down slope with eyes open and then closed
Walk up and down steps with eyes open and then closed
Any game involving stooping, stretching, and aiming, such as bowling or basketball

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Vestibular neuritis is thought to be related to an antecedent viral upper respiratory tract infection, although this theory has yet to be validated. This disease has been reported to occur in multiple family members affected by an upper respiratory tract infection and has seasonal variation, which strengthens the viral prodromal theory.[6] Vestibular neuritis is associated with selective damage to the superior part of the vestibular labyrinth (horizontal and anterior semicircular canals and utricle).[7] The subsequent hypofunctioning of the vestibular apparatus in maintaining balance results in vertigo, which may last for weeks or months after the first acute episode. Clinically, this disorder tends to affect young to middle-aged adults, and it seems to have no sex preference.

Research regarding incorporating osteopathic manipulative treatment (OMT) into the treatment plan of patients suffering from vertigo and balance issues is growing considerably. The ability of the growing elderly population of the United States to maintain balance is of paramount concern in the prevention of falls.[8,9] In a recent study, Fraix demonstrated that patients suffering from benign paroxysmal positional vertigo (BPPV) who received OMT showed statistically significant improvement in the dizziness handicap inventory and in the physical, functional, and emotional subscales.[10]

This paper presents the case of a 56-year-old male patient with onset of vestibular neuritis following extensive dental intervention with probable mechanical effects on the structural and functional integrity of the temporal mandibular joint and the temporal bone. After receiving OMT for six weeks, the patient reported significant improvement in his vertigo and associated musculoskeletal dysfunction.

Report of Case

Presentation

A 56-year-old Caucasian man presented to the OMM clinic at Western University of Health Sciences Patient Care Center in Pomona, California, for an osteopathic evaluation regarding a chief complaint of tingling and occasional numbness in his right arm, affecting mostly the fourth and fifth digits of his right hand for four months. The patient denied any traumatic incidents or motor vehicle accidents associated with the onset of symptoms. Upon further questioning, the patient stated that most of these symptoms started after being immobile in bed for prolonged periods of time secondary to severe attacks of vertigo. Review of symptoms revealed ringing in his right ear occasionally but was otherwise negative.

History

Six months previously, the patient had an upper tooth abscess requiring extensive dental work, including dental extraction and subsequent implants of temporary crowns placed in his upper left maxillary molar region. It was after the patient underwent dental extraction related to the abscess that he suffered the first terrible attack of dizziness and nausea described as acute vertigo. He underwent testing at a local emergency department to rule out emergent conditions causing his acute vertigo, all of which were negative. The patient was later seen by several physicians for this condition, and he has undergone extensive imaging studies, including computed tomography and magnetic resonance imaging of the head, neck, and inner ear with unremarkable results. His current neurologist provided the diagnosis of vestibular neuritis. The patient had been treated with corticosteroids and antihistamines with no appreciable success.

The episodes of vertigo had been recurrent since the initial attack, restricting his daily activities as well as putting him in bed, immobilized for long periods of time. The dental work was still ongoing with his current dentist. Past medical, family, and surgical histories are noncontributory. The patient had no known drug or seasonal allergies. The patient has smoked 10 cigarettes per day on average for more than 10 years. The patient denies using alcohol, caffeine, or recreational drugs.

Physical Examination

Vital signs were within normal limits for this patient. Physical examination was significant for tissue texture changes and tenderness to palpation in the suboccipital muscles and temporal mandibular joints bilaterally, as well as in the thoracic inlet bilaterally. A temporary dental crown was noted

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Table B. *The persistence of symptoms from days to months along with the absence of hearing loss differentiates vestibular neuritis from Meniere disease.*

Seconds	Hours	Days	Months
• perilymphatic fistula • cervical vertigo • diplopia • positioning vertigo • BPPV	• Meniere disease • syphilis • vestibular migraine	• vestibular neuronitis • labyrinthitis • head trauma	• acoustic neuroma • cerebellar tumor • multiple sclerosis • ototoxicity • ateriovenous malformation

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on the left upper second molar, and the absence of the left lower second molar was noted. Nystagmus was elicited on the lateral gaze, and the tympanic membranes were clear with reflective cones of light. Cardiovascular and respiratory auscultation and examination were noncontributory. Abdomen was soft, nondistended, and nontender to palpation with equal bowel sounds in all four quadrants. Lumbar spine revealed ropy tissue texture changes with mild decrease in overall range of motion. Neurological examination revealed no gross deficits in cranial nerves II-XII, normal strength and reflexes in the upper and lower extremities, but diminished sensation to light touch in the lateral aspect of the left thigh and proximal lower leg. Vertigo symptoms were not elicited with the Dix-Hallpike maneuver.

Osteopathic Structural Examination

Osteopathic structural examination revealed a right lateral strain at the sphenobasilar synchondrosis with associated right occipitomastoid suture and right condylar compression in the cranial region. There was hypertonicity bilaterally in the temporalis muscles. The cervical vertebrae were compressed at C2/C3 with C2 rotated right, and ribs 1 and 2 on the right were elevated and restricted in inhalation. The thoracic spine had a decreased kyphotic curvature with T2 and T5 having FSRr and ESRr diagnoses, respectively, and the thoracic diaphragm was held in inhalation. Lumbar spine examination revealed lumbosacral compression. Examination of the pelvic and sacral structures revealed bilateral hip motion restriction with a left leg length discrepancy of 1 mm to 2 mm. A right posteriorly rotated innominate was also diagnosed in the pelvis with an associated right on left backward sacral torsion.

Diagnoses

Diagnoses included vestibular neuritis and thoracic outlet syndrome, given the neurological complaints the patient had upon initial presentation. Somatic dysfunction of the head, cervical spine, rib cage, thoracic spine, lumbar spine, pelvis, and sacrum were also diagnosed in this patient. There were distinct strain patterns that most likely developed in response to his dental work in the cranium, and there were notable fascial strains in the lumbosacral region and hips.

Treatment

The periods of immobility secondary to the vertigo may have contributed to compensatory changes in the structure and function of his body, which were considered the likely cause of the thoracic outlet syndrome. The application of various OMT techniques, such as balanced ligamentous tension and myofascial release,[11] to specific anatomical structures restored a degree of structural balance and symmetry for this patient. For example, the shoulder girdle, scalene muscles, thoracic inlet, and cervical spine treatments focused on addressing the patient's upper extremity complaints and somatic dysfunction. A segment of the patient's OMT targeted the suboccipital muscles, which are integral in the reflex arcs affiliated with our eye movements, balance, and the vestibular system.[12] The restoration of normal structure and function of the head and occipito-atlantal regions using osteopathic cranial manipulative medicine, however, remained the primary focus of treatment for this patient, given his history of developing vertigo after his initial dental procedures.

Post-treatment, the patient reported no adverse effects. The patient was instructed to monitor his symptoms and the frequency of vertigo attacks. Counseling on smoking cessation was performed, given his smoking history. The patient was also instructed to drink plenty of water, and he was educated regarding any transient treatment reactions such as soreness and mild myalgia that may develop 24 to 48 hours post-treatment.

Clinical Follow-up

The patient was followed on a weekly basis and received osteopathic manipulation based on his subjective complaints and structural examinations. The continued primary focus of treatment was on the restoration of normal structure and function of the head and occipito-atlantal regions. At the fifth follow-up visit, the patient reported almost a complete resolution of his upper extremity complaints, with infrequent tingling and numbness in his right upper extremity and hand.

On the sixth follow-up visit, the patient reported reduced dizziness relative to when he was first seen in clinic six weeks prior. He still had occasional flares of vertigo, more noticeable in the afternoon, but timing and frequency decreased appreciably overall. The right upper extremity complaints still remained near resolution, with infrequent episodes of numbness and tingling. The patient was practicing pilates daily, and after six weeks, he was pleased with the overall progress of his symptoms related to his vestibular neuritis and thoracic outlet syndrome.

Discussion

The dental trauma and procedures our patient endured required extensive time with his mandible open, leaving the mandible and temporal bone susceptible to malalignment due to the effect on ligaments and muscles in the region. Both of these bones share an intricate relationship with the muscular, ligamentous, and bony complex of the TMJ and associated temporal bones. Magoun has described how malalignment of these bony structures causes associated muscular spasms surrounding the TMJ from dental trauma, causing myodural and membranous strains comprising temporal bone motion.[13,14] This patient had bilateral TMJ dysfunction, tenderness, and temporalis hypertonicity secondary to his

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dental history. Furthermore, any changes to occlusion that may have been introduced by the extraction or the placement of his temporary crown may have disrupted long-established mechanical relationships in the region of the TMJ and the temporal bone, which houses the vestibular apparatus along with its arterial and nerve supply, as well as the lymphatic and endolymphatic systems.

The motion of axis for the temporal bone runs along the petrous ridge from the jugular surface to the petrous apex and engages in internal and external rotation during normal physiologic motion.[15] The petrous ridge is also a major area of attachment for both the upper and lower portions of the dural meninges. The vestibular portion of CNVIII, which is responsible for equilibrium, passes through the facial canal to the internal auditory meatus of the temporal bone. Any discrepancy between the coordinated motions of the temporal bones and vestibular firing patterns, which may occur after dental trauma, could cause the central nervous system to interpret this signal abnormally, and vertigo and dizziness may develop.[13] Magoun hypothesized that dural tension surrounding CNVIII can also lead to lowered resistance to infection, a factor that may have significance given the viral prodrome thought to be associated with vestibular neuritis.[14] Additionally, early discoveries by Young revealed that pharyngotympanic backwash and increases in labrynthine fluid pressures can lead to endolymphatic distortions resulting in vertigo.[16] Restoring normal function of the patient's jaw muscles, mandible, maxilla, and temporal bones using balanced membranous and ligamentous tension was employed to attempt to restore temporal bone motion and CNVIII function.

Sphenoidal motion will also be influenced by affecting the "strut-like" Vomer through maxillary manipulation and by affecting the connections to mandibular motion through the pterygoid plates and sphenomandibular ligament. Normal motion of the sphenoid will assist in restoring physiologic motion and mechanical tension across the various dural attachments in the reciprocal tension membrane system, all the way down to the superior or anterior portion of S2 and the coccyx.[17]

Conclusion

Ballesteros et al describe how the endolymphatic system of the inner ear, which is key in vestibular functioning, shares indirect but important embryonic and structural relationships with the surrounding craniocervical region and TMJ.[16] Magoun is quoted as saying, "In the author's experience by far the commonest cause [of vertigo] is an increase in craniocervical tension and a consequent shift in temporal bone position from the unequal pull of muscles or from trauma."[18] Disruption and asymmetry in craniocervical biomechanics will precipitate challenges in other systems, such as metabolic, respiratory, circulatory, biopsychosocial, and—most importantly in this case—neurologic functioning, namely the vestibular system.

Targeting OMT to restore craniocervical and temporal bone structural symmetry helped diminish the disabling vertigo in this patient and normalized the sensorineural firing of the vestibular system after six OMT sessions. This case demonstrates the influence OMT can have outside of the musculoskeletal or biomechanical system, and it demonstrates that OMT should be an appropriate treatment modality to consider when encountering vestibular neuritis clinically.

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Health Status Comparison of Lebanon, Oregon, and Lobitos, Peru: A Pilot Study Using a Novel Investigative Study Tool

Kathryn E. Kimes, OMS III; David F. Goldman, OMS III; Meghan Aabo, OMS III; Dave Aabo, MS; Katherine Peters, OMS III; Katie Zeiner, MAg; Kate McCaffrey, DO; John T. Pham, DO; Robyn Dreibelbis, DO; John Mata, PhD

Abstract

As the global burden of disease shifts away from communicable diseases toward noncommunicable diseases, new models for surveillance will improve intervention strategies. A pilot study was designed to test the hypothesis that a single survey model with direct home interviews and collection of health-related measurements could be applied globally. The study's goal was to determine the utility of this model in two divergent communities as a means of assessing the general health status and basic medical knowledge of the community. Lebanon, Oregon, and Lobitos, Peru, are two rural communities continents apart that were chosen because they are easily accessible, representative of small underserved communities, and safe. Health questionnaire responses were compiled and analyzed as contingency tables, using two-tailed Fisher exact tests. Statistical results revealed that the answers to questions pertaining to education, preventive health care, and lifestyle differed significantly between the Lebanon and Lobitos communities. Limitations to the study reflect intrinsically flawed aspects of the door-to-door survey method, question design, and flow of the survey questions. However, the results suggest that this model may be useful for identifying gaps in medical knowledge and care access. Further, this health data collection model avoids inherent biases in self-reporting of current health status. This study allows for further development of a collective and digitized community assessment survey model that could be implemented within any global community.

Introduction

Advances in technology, communication, and economics have led to a gradual shift in the global burden of disease from communicable to noncommunicable diseases.[1,2] Cardiovascular disease, respiratory disease, cancer, and type 2 diabetes mellitus are the four most common noncommunicable diseases, and they are responsible for 36 million deaths worldwide each year.[3-6] Among the most common noncommunicable diseases, 80% share four common risk factors: tobacco use, physical inactivity, harmful use of alcohol, and poor diet,[4] clearly illustrating that the most common causes of death worldwide are preventable. When targeting the areas of greatest need for improvement, global efforts toward disease prevention must be unified to understand and integrate into each community's culture, beliefs, and value systems.[2,7-10] Developing a universal assessment tool that can be implemented anywhere in the world to objectively measure community health will greatly improve decision making and quantify the impact of a public health intervention or program.[2,11,12]

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OMM in Vestibular Neuritis *(Continued from page 30)*

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Address correspondence to:
Brendan S. Ross, DO
Western University of Health Sciences
College of Osteopathic Medicine of the Pacific
Department of Neuromusculoskeletal Medicine and Osteopathic Manipulative Medicine
309 E. Second St.
Pomona, CA 91766-1854

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The sites chosen to implement the community assessment survey tool were Lebanon, Oregon, and Lobitos, Peru. These two communities differ in regard to geographic location, culture, socioeconomic status, available resources, and access to health care.[13-16] A pilot study in these two locations was conducted to test a model of community health screening. The goal of this work is to develop an assessment tool that can be applied in a variety of settings to better characterize health status and identify potential areas of intervention.[12,17]

Lobitos is a small fishing village located in the northwest district of Talara, within the province of Piura.[16,18] According to Peru's Ministry of Health, 1,624 individuals live in Lobitos, and there is currently only one health care worker to serve the community.[15,16] Lebanon, population 15,305, is a rural city within Linn County.[14] Its beginnings are based in the timber and sawmill industries, and more recently, it has become home to light industrial and manufacturing companies.[13,19]

In 2015, Lebanon welcomed its first class of osteopathic medical students to a new campus of the Western University of Health Sciences College of Osteopathic Medicine of the Pacific–Northwest.[20] Medical students are required to take a service learning course that links medical students with community programs and provides mentorship opportunities for local students.[21] The arrival of the new medical students and their work within the city of Lebanon have focused attention on the need for clear measurable baseline data regarding health status, health information, and adoption of healthy lifestyles. Collecting such data will allow future assessments of the impact from the influx of osteopathic medical students involved with their community.[22,23]

Community health assessments are often conducted in the United States by county public health departments; however, data are reported for entire counties rather than for individual cities and towns.[24] Rural communities, such as Lebanon, face circumstances that differ from other cities within Linn County, Oregon, and thus the county data are not necessarily representative.

Methods

The study design is a cross-sectional survey. The methodology, survey questions, and consent forms were approved by the Institutional Review Board of the Western University of Health Sciences in Pomona, California, Institutional Review Board (IRB). Designated groups of two to three trained medical student volunteers administered the door-to-door community assessment survey. Each site was divided into districts, and teams administered surveys. Each team of survey administrators was assigned to a district. The random sampling procedure consisted of determining the geographic center of each district and choosing a direction in which the team would begin the door-to-door survey at random. A sampling interval of four was selected prior to commencement of survey administration. Every fourth house was visited to minimize selection bias. Inclusion criteria for study enrollment were as follows: 59 months of age or older and current resident of Lebanon or Lobitos. Exclusion criteria of enrollment were as follows: too ill or unable to provide required information, absent from home on more than 3 occasions, refusal to participate, or refusal to sign the informed consent. Upon meeting inclusion criteria, participants were registered with their name, sex, address, and date of enrollment. Each participant was assigned a study number based on district, household number, and number of individuals within the household. This unique identifier ensured each participant anonymity and protection of personal health information during data entry and analysis.

The community assessment survey was conducted within the participants' homes. Survey administrators read each question aloud, and the participants provided verbal responses to be recorded. Due to language barriers in Lobitos, each team had an assigned translator to assist this process. Survey questions were divided into different categories for assessment. Categories included demographics and health status consisting of: education, general health, lifestyle, behavioral health, recent medical conditions, and immunization history. After all community assessment survey questions were completed, vital signs were collected, including height, weight, pulse, respiration rate, and blood pressure. The same three lead investigators trained each medical student volunteer in interview techniques and vital sign collection.

After completing the survey, data were compiled and entered into contingency tables for all nominal and ordinal data. Contingency tables were created using location (Lebanon or Lobitos) as the independent variable in the rows. Dependent variables were placed in the columns. All 2x2 contingency tables were analyzed with GraphPad Prism 6.01™, using a two-tailed Fisher exact test statistical analysis to attain direct p values. Contingency tables larger than 2x2 were analyzed with R version 3.0.1 statistical software. The significance level for this study was set as p less than or equal to 0.01 (p value ≤ 0.01).

Results

Education

Level of education attained and employment status questions were asked of both the Lebanon and Lobitos communities. Level of education attained and employment status were significantly different between Lebanon and Lobitos. All respondents in Lebanon had completed primary school, and the majority had completed secondary education. The majority of those in Lobitos had not progressed past primary

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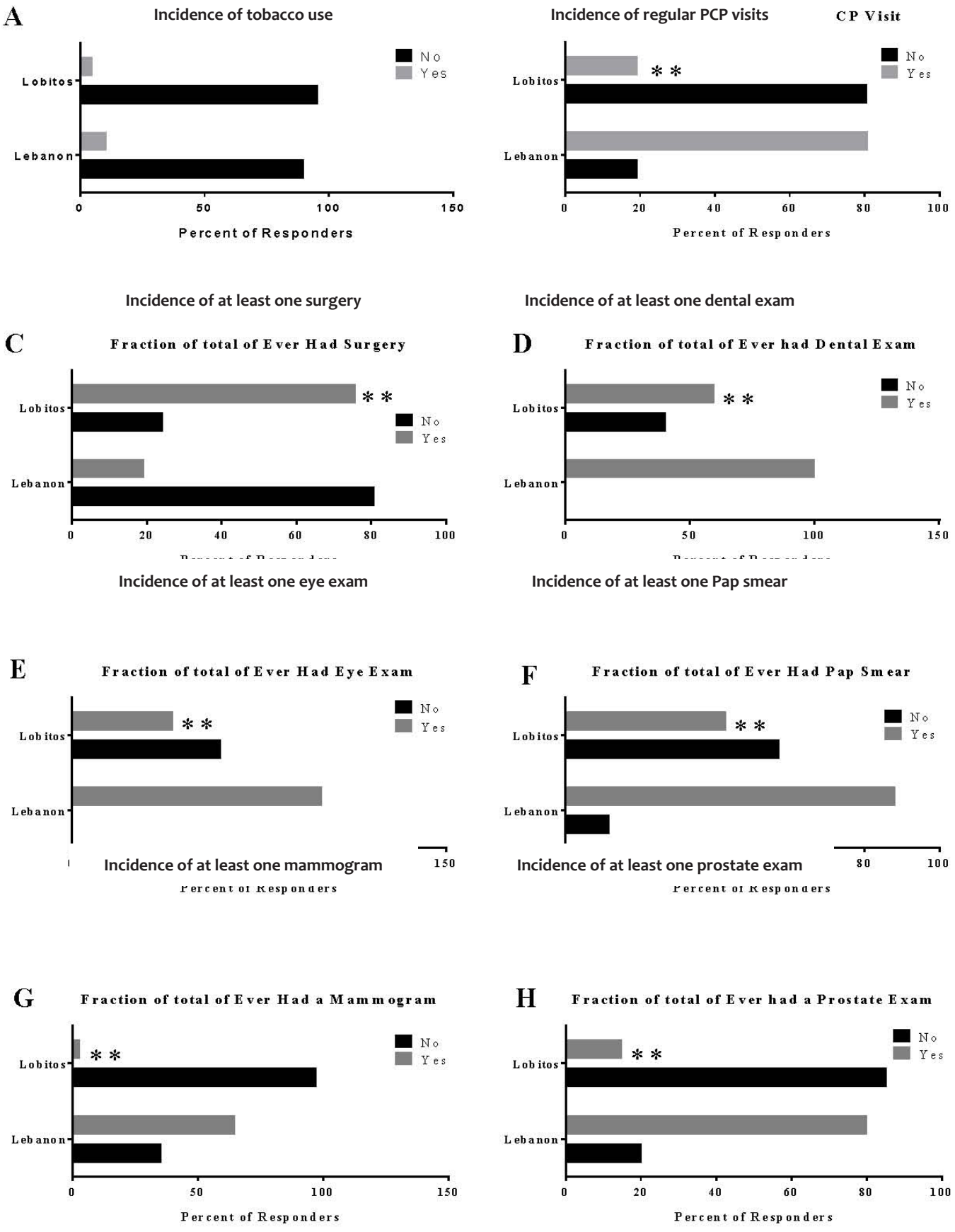
Figure 1. *Comparison of percent of responders in Lobitos, Peru, and Lebanon, Oregon, for survey questions focused on (a) tobacco use, (b) regular primary care physician (PCP) visits, (c) surgeries, (d) dental exams, (e) eye exams, (f) Pap smears, (g) mammograms, and (h) prostate exams. ** Denotes a significant difference between the two locations ($p \leq 0.01$).*



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school. No respondents in Lobitos had attained bachelor's degrees or higher, while one third of respondents in Lebanon had bachelor's degrees or higher.

Although the level of education of respondents was higher in Lebanon, there was significantly more unemployment. Of the people surveyed in Lebanon, 46% were unemployed, compared with 3.2% in Lobitos. There were many more students and self-employed people in Lobitos than in Lebanon. None of the responders from Lebanon worked "in home," while the majority of workers in Lobitos worked "in home." Of workers surveyed in Lebanon, 83% worked "outside the home."

General Health

The general health section included questions on sleep, substance use, dental health, screening exams, and past medical history. There were no significant differences observed between tobacco or recreational drug use in Lebanon and Lobitos. While smoking is a valuable indicator of health status, only 5% of respondents in Lobitos reported smoking, while 12% of those in Lebanon did. Not a single responder in either community reported recreational drug use.

The reported number of primary care provider (PCP) visits differed significantly between the Lebanon and Lobitos respondents. As shown in *Figure 1B* on page 33, more than 80% of those surveyed in Lebanon said that they regularly see their PCPs, compared with only 19% of those in Lobitos. These statistics are supported by the significant difference in the number of PCP visits in the last year. Only one respondent (3.8%) in Lebanon had not been to the PCP in the last year compared with 32% of responders in Lobitos. In addition to the differences in PCP visits, the survey revealed a significant difference in the number of surgeries between Lebanon and Lobitos, while the number of hospitalizations in the previous year was not significantly different. More than 80% of the survey population in Lebanon had surgery compared with 25% in Lobitos *(Figure 1C)*.

The dental health questions revealed significant differences in brushing, flossing, and dental exam incidence *(Figure 1D)*. Significantly more respondents in Lebanon had had dental exams at least once and floss their teeth more than those in Lobitos. However, respondents in Lobitos brush their teeth significantly more often than those surveyed in Lebanon. In fact, 49% of respondents in Lobitos brush their teeth 3 times or more per day compared with only 12% in Lebanon. This is intriguing in the context that 100% of respondents in Lebanon have had a dental exam compared with 40% in Lobitos.

Preventive health screenings were significantly more common in the Lebanon responder group, with more people receiving eye exams, Pap smears, mammograms, and prostate exams, as seen in *Figures 1E, 1F, 1G, and 1H*, respectively.

Family history questions focused on heart disease, high cholesterol, diabetes, cancer, and high blood pressure. In Lebanon, 65% of respondents had family histories of cancer, 62% had family histories of high blood pressure, 50% had family histories of heart disease, 46% had diabetes, and 38% reported family histories of high cholesterol. Only one Lebanon respondent (4%) reported no families history of disease. In Lobitos, 50% of respondents reported no family histories of disease, 20% reported hypertension, 20% reported high cholesterol, 17% reported cancer, 16% reported diabetes, and 6% reported heart disease in family histories.

Lifestyle

The survey collected data on the number of meals, the kind of food people ate, and physical activity levels.

With regard to nutritional intake on a daily basis, respondents in Lebanon consume significantly more supplements, eat more servings of vegetables, and eat more servings of meat or dairy than those in Lobitos. Fruit consumption and number of meals per day were not significantly different between the two communities.

The data suggest that respondents in Lebanon get significantly more physical activity than those in Lobitos. Of those surveyed in Lebanon, 73% got more 5 hours of physical activity per week compared with 39% in Lobitos. There was no significant difference in the amount of time spent on sedentary behavior.

Behavioral Health

The behavioral health questions attempted to assess satisfaction levels, interpersonal relationships, and stress levels. The mental health questions did not show any significant differences between the two communities. Overall, most people were satisfied with their current situations, had a trusted person to talk to, and were split when it came to current stress levels and whether stress had impacted their health. Current stress levels were higher in Lebanon and approached significance (p=0.03), but they did meet the p value ≤ 0.01 threshold for this study.

Recent Medical Conditions

A total of 38 different medical conditions were assessed. When questioned about symptoms in the previous month, only pain and stuffy nose were significantly different from responders in the two locations, as shown in *Figures 2A* and *2B* on page 35, respectively. In Lebanon, 77% of people had some sort of chronic or acute pain in the previous month compared with 23% in Lobitos. Discrimination between

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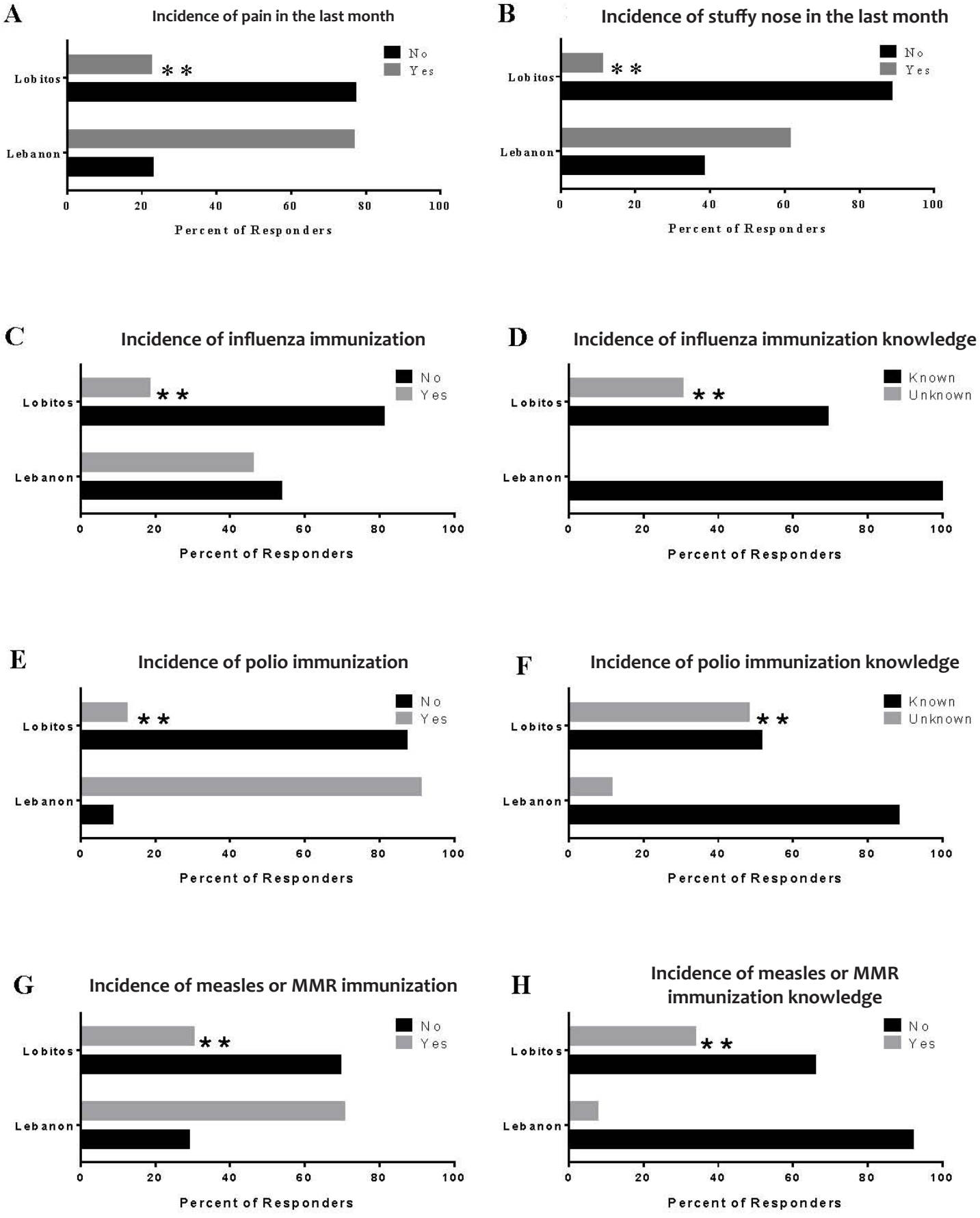
Figure 2. *Comparison of percent of responders in Lobitos, Peru, and Lebanon, Oregon, for survey questions focused on (a) pain in last month, (b) stuffy nose in last month, (c) influenza immunization, (d) influenza immunization knowledge, (e) polio immunization, (f) polio immunization knowledge, (g) measles or MMR immunization, and (h) measles or MMR immunization knowledge. ** Denotes a significant difference between the two sites ($p \leq 0.01$).*



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the types or causes of pain was not recorded. Stuffy nose was more common in Lebanon than in Lobitos.

When asked about symptoms during the previous three months, only type 2 diabetes mellitus (T2DM) showed significance. The results revealed that 19% of respondents in Lebanon have been diagnosed with T2DM compared with no respondents in Lobitos.

Immunizations

Immunization status and knowledge among study respondents was assessed. Lebanon had significantly higher immunization status for influenza, polio, measels or measles mumps rubella (MMR) as shown on page 35 in *Figures 2C, 2E, 2G*, respectively. Lobitos had a higher immunization status for hepatitis (data not shown). Knowledge of immunization status was significantly higher for the influenza, polio, measles/MMR in Lebanon responders compared to those in Lobitos. Similar data were obtained for *neisseria meningitidis* and tetanus toxoid (Td/TT data not shown). While the results were not significant, respondents in Lobitos had more knowledge of immunization status for hepatitis B than did respondents in Lebanon (data not shown).

Vital Signs

There was no significant difference in body mass index (BMI) or blood pressure between study sites. However, there were 10 underweight individuals in Lobitos compared with none in Lebanon. The majority of people in both communities had BMIs above the normal range, yet very few people in either community reported feeling overweight or obese in the previous 30 days (*Figures 3A* and *3B* on page 36). In contrast, the observed and self-reported data related to hypertension were closely aligned in both communities.

Discussion

Education

The trend among Lobitos respondents to be less educated than those in Lebanon may be partially a result of a younger sampling population in Lobitos. However, some useful trends still emerge. Most apparent was the lack of any bachelor's degrees or higher education in Lobitos. This may be due to a difference in opportunity or access to higher education. If this trend held true in a larger sampling, it may represent a need for the Lobitos community.[25]

The average age of the sampled population in Lebanon was 53.5 years whereas the average age in Lobitos was 33.8. This suggests that the data may be biased to have fewer students and more retirees in Lebanon. As a result, *retired* may be a good option to add in future iterations of the survey because in the current survey, retired individuals were counted as *unemployed*. Furthermore, individuals who self-identified as employed students also created inconsistencies in the data, as there were only selections denoted for *student* or *employed*. In future surveys, it may be better to remove *works in home* and *employed outside the home* and instead look at *self-employed* or *employed* to differentiate between the two economies and increase the clarity of the question.

Tobacco and Drug Use

Interview-based questioning pertaining to drug use is notably unreliable.[26] Plus the group interview setting created a situation in which sensitive and private information could have been revealed to other household occupants, thus violating the confidentiality of participants. Additionally, these questions were placed at the beginning of the survey, leaving little time for the investigators to build rapport with the interviewees. These questions are better suited for the lifestyle section later in the survey, as they might fit better for study organization and cadence. Finally, there was no question about alcohol use. Such a question should be included in future surveys, as it has been shown that alcohol use is a large contributing factor to the incidence and prevalence of noncommunicable diseases.[4]

General Health

Considering the lack of oral health professionals in Lobitos, it is interesting that the respondents indicated a higher frequency of brushing per day in comparison with respondents in Lebanon. However, Lebanon respondents reported a greater amount of flossing.[15] The higher frequency of brushing in Lobitos may be attributable to local nongovernmental organizations (NGOs) and government health programs in the area.[27] A follow-up question as to how residents obtain dental health care knowledge may be appropriate.

All of the questions pertaining to preventive health screenings revealed significant differences between sites. A greater number of participants in Lebanon regularly visited primary care physicians and obtained eye exams, Pap smears, mammograms, and prostate exams compared with the Lobitos sample. It is well established that early screening is paramount to better outcomes for breast cancer, cervical cancer, and prostate cancer, as well as for ensuring or improving quality of life.[28] The lower incidence of visits to primary care physicians and screening exams in Lobitos may suggest a need for preventive health programming within the community. The lack of primary care and preventive screenings may directly contribute to the lack of knowledge of disease status, which in turn may contribute to the discrepancies in reported family medical histories between Lebanon, and Lobitos. The survey did not standardize the questioning about family history. In future studies, for reliability, this question should only

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ask about the medical histories of the respondents' children, siblings, parents, and grandparents.

Lifestyle

Although both sites had the same number of meals per day, respondents in Lebanon had more servings of vegetables and meat and/or dairy per day. In a future expansion of this study, it may be important to separate these questions to allow for more specific data, as some study respondents had difficulty discussing meat and dairy together. The questionnaire did not ask about servings of grains, which may be valuable information for obtaining a true comparison of food habits. Future versions of the questionnaire should probably have one fruit category to minimize confusion created by asking about servings of fruits and servings of whole fruits per day. Supplement use is a very broad label and a follow-up question regarding specific supplements would allow for greater understanding of the differences between communities.

Behavioral Health

The behavioral health questions addressed some of the basic indicators of mental health and well-being. Expanding on these questions to investigate whether people have ever felt depressed and then following up with a question about clinical diagnoses of depression may provide greater insight into the mental health status of communities. This may provide valuable information for groups trying to provide care in these communities.

Recent Medical Conditions

Questions regarding acute or chronic pain in the previous month elicited a broad spectrum of responses. It could not be determined whether the pain was due to a medical condition or an accident. Taken literally, the question would likely have a 100% response rate, indicating some episode of pain in the previous month. As a result, this question gives more insight on the cultural perception of pain. With regard to this study, it would appear that respondents in Lebanon had a lower threshold for pain. However, it is also possible that the results are due to a difference in translational meaning, or they may be due to which investigator asked the question. As a result, this question should likely be split into two questions, asking about acute pain and chronic pain separately. In future studies, a follow-up question pertaining to the source of pain would generate more specific information.

The results for prevalence of type 2 diabetes mellitus (T2DM) within the respondent groups revealed that 19% of Lebanon respondents have this diagnosis compared with no respondents in Lobitos. Although we feel this is a significant number, the data are likely skewed because of the age difference between the sampled populations. Conversely, the lack of health screenings in Lobitos may contribute to the low number of responses for T2DM. The addition of a glucose test in future studies would yield very interesting results and potentially help the communities identify the prevalence of T2DM.

Immunizations

One of the more challenging groups of survey questions related to immunizations because many people do not know or do not remember what immunizations they have obtained in their lifetime. Some general trends emerged. For instance, those in Lebanon received more immunizations and remembered getting them more often than did those in Lobitos. This was true for most immunizations with the exception of the hepatitis B immunization. Not only were respondents in Lobitos more likely to be immunized for hepatitis B than for any other disease, but they also knew their immunization status for hepatits B better than did respondents in Lebanon. Hepatitis B was also the only immunization for which Lobitos responders had a higher immunization status than Lebanon responders. The reason for this result is not apparent but would be an interesting topic for further investigation.

Vital Statistics

Above-normal body weight is an issue among responders in both sites, as the majority of those surveyed had a BMI above the normal range. While this is not surprising given the obesity pandemic, it is interesting to observe that the majority of respondents did not feel overweight. Our data revealed that the perception of being overweight was significantly lower than the vital statistics collected (*Figures 3A, 3B, 3C* on page 38). Given the direct correlation between increased BMI and the prevalence of cardiovascular disease, diabetes, and cancer,[29] this finding is significant because a simple survey without measuring vital statistics would not reveal the disparity between the perception of obesity and an objective measure of obesity.

Study Assessment

The assessment tool was found to be useful in several aspects. Questions that elicited significant differences in responses between Lebanon and Lobitos identified areas that may be a result of differences in health care infrastructure and cultural norms. Furthermore, responses revealed similarities between the two communities in risk factors that contribute to noncommunicable diseases.

Strong attributes of the design of this community assessment survey were specific questions regarding lifestyle and recent medical conditions that are not currently available via county community health assessments. This assessment tool could allow a community to identify subclinical diseases and

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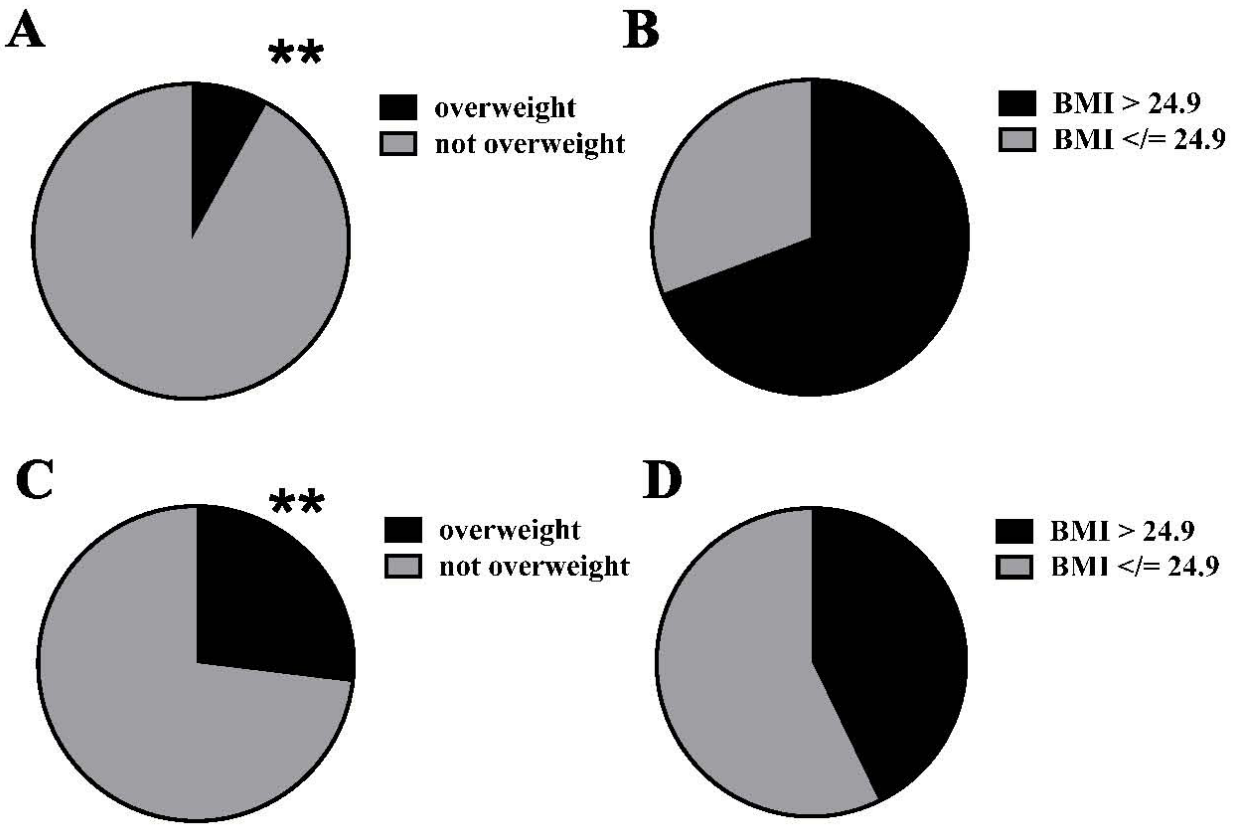
Figure 3. *Comparison of perception of being overweight (panels A,C) with calculated BMI > 24.9 (Panels B,D) in Lobitos, Peru, (A,B) and Lebanon, Oregon, (C,D). ** Denotes a significant difference between perception of being overweight with a BMI 24.9 ($p \leq 0.01$).F*



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ailments and target health programming and to prevent or treat specified symptoms.

There are intrinsic aspects to the study design that contributed to low participation and skewed results. First, most of the data collected relied on self-reporting from participants. Specifically, survey questions pertaining to lifestyle choices, such as diet, exercise, tobacco, and drug use, were asked by medical students, which may have contributed inaccurate reporting of these data.[26] Modifying the survey to allow the participants to read and record their own responses could address the issue of reliability and biased reporting.[30] However, if the survey were to accommodate self-administered responses, wording of the survey must take into consideration the education level of the studied population.

Increasing the number of participants is of high importance for data to be complete and generalizable to the population. On average, the survey took 1 hour to complete. The lack of a foreseen benefit or incentive for participation combined with the time commitment led to decreased study enrollment. Paring down the number of questions in the survey would mitigate the time commitment and possibly lead to greater enrollment.

The lack of interest on the part of volunteer investigators was detrimental to the study design's reliance on high numbers of investigators to blanket the two communities. The low volunteer turnout resulted in a decreased number of visited households and, thus, a low study enrollment. Creating an incentive for medical students to volunteer by incorporating the survey administration into the requisite service learning course in the medical school curriculum would easily rectify this obstacle.

The usefulness of the collected data are limited in that the results of this assessment survey can be used as a baseline only if future surveyors follow the same participants without enrolling new participants. If the survey were to continue to be conducted in the original manner with enrollment of new participants, information could not be analyzed to directly measure the impact of health programs and interventions. However, continuous cross-sectional surveys could be administered to obtain a general picture of health status as long as investigators are careful to not report information as a health baseline.

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Conclusions

The purpose of this pilot survey was to identify the current health status, health maintenance behavior, and lifestyle choices of citizens in Lebanon, Oregon, and Lobitos, Peru. The collected data did provide valuable insight into the health status of the two communities, and the data provided insight into the survey design and protocol. The necessary infrastructure for administering this survey in the future must include a set of institutional goals so that the survey can be optimized to track those goals. With significant modification, the impact of health programs, interventions, and institutions could be measured and followed with this survey tool.

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Address correspondence to:
Kathryn Kimes, OMS III
kkimes@westernu.edu

Introducing MAAP: The Modified ASIA Examination for Ambulatory Patients

Drew D. Lewis, DO; Jose S. Figueroa, DO; Garth K. Summers, OMS II; J.D. Polk, DO

Abstract

For the practicing clinician evaluating a patient for musculoskeletal condition, the modified ASIA examination for ambulatory patients (MAAP) introduced here is a valuable assessment tool to help identify neurological red-flag findings before making decisions regarding treatment, especially osteopathic manipulative treatment (OMT). This new tool is based on and incorporates the guiding principles used in the American Spinal Injury Association (ASIA) examination.

Performing the MAAP as a part of the thorough evaluation of patients for musculoskeletal conditions can be an extremely useful guide to identify the appropriate use, or restraint, of OMT in patients who may be neurologically compromised. It may also identify previously undiagnosed neurologic disease, prevent untoward outcomes, and help physicians avoid litigation from missed neurologic disease.

We present this modified examination, which has been tailored to the ambulatory setting.

Introduction

Recent reports have shown a decrease in skillful performance of the musculoskeletal exam by medical students.[1] Simultaneously, successful litigation concerning spinal disease is on the rise in both the United States and the United Kingdom.[2] While these statistics may be multifactorial, it is particularly concerning considering the well-documented high frequency of primary patients with musculoskeletal conditions seeking care in outpatient clinics and the need for accurate diagnosis.[3]

As physicians, our role is to assess patients for conditions that may cause the their symptoms and to screen for both common and potentially serious issues that may be subclinical or asymptomatic (preventive health care). A chief initial focus in evaluating patients for musculoskeletal conditions is assessing for red flags in histories and physical examinations.[4]

For instance, in the case of a patient with low back pain, red-flag history findings include history of cancer, age older than 50 years, unexplained weight loss, bowel or bladder incontinence or retention, impotence, duration of pain greater than one month, pain while sleeping, and unresponsiveness to previous therapies.[4,5]

We also can consider red-flag physical examination findings such as neurological abnormalities leading to sensory and motor impairment, reflex abnormalities, dural tension signs, capsular pattern restrictions, pain upon palpation, and such significant function impairments as ambulatory limitations related to neurogenic claudication.[4,6]

Despite advanced imaging and other diagnostic tools, a thorough history and physical exam are necessary and significant components of an accurate musculoskeletal diagnosis.[7]

An appropriate assessment of many patients with musculoskeletal presentations should include a corresponding evaluation for causative or concurrent neurologic deficits.

We present the modified American Spinal Cord Injury Association (ASIA) examination for ambulatory patients (MAAP) in detail. In the experience of the authors (DL, JF), this examination is extremely beneficial, not only for properly diagnosing patients' conditions but also for identifying conditions in which an untoward outcome may result without a MAAP preceding manipulative treatment.

MAAP and the Osteopathic Physician

As one of the core principles of the osteopathic medical profession, the interrelationship of structure and function has long been emphasized for proper osteopathic health care.[6(p3)]

In addition to providing a patient with standard medical care, the osteopathic physician focuses on the host environment (structure) which the patient's disease or condition is inhabiting.[6(p12)] The osteopathic physician is trained to provide a thorough structural examination for and diagnosis of somatic dysfunctions, with the expectation of providing osteopathic manipulative treatment (OMT) directed at the patient's underlying condition. In advocating OMT to treat patients for somatic dysfunctions, textbooks on osteopathic manipulative medicine (OMM) point to particular treatment approaches that may be relative or absolute contraindications

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in cases in which there are known or suspected neurologic conditions.[8]

However, many neurologic diseases and impingements can mimic or exhibit musculoskeletal findings, and they can be confused with an overuse syndrome or somatic complaint. With this in mind, there is a recognized need for an in-depth neurologic examination as a part of a complete assessment prior to providing OMT.[6(p987),9(p300,390,433)]

MAAP and OMT

When considering OMT as a part of the therapeutic approach, it is imperative to rely on an examination that includes an efficient and effective neurological screen to identify red flags. Red flags help dictate decisions regarding initiating OMT, other common treatment options, further diagnostic evaluation, and consultations (see *Figure 1*).

In his text, Greenman emphasizes that the goal of OMT is to restore the maximum functional capacity a patient's anatomy will allow. Greenman highlighted the importance of evaluating patients for neurologic deficits, and he reported that using OMT is "advisable to achieve the maximum possible functional capacity" of a patient after the diagnosis of a neurologic deficit.[9(p52,484)]

This article introduces a neurologic exam that can be useful for improving the clinical diagnoses of patients with neurologic lesions, including identifying significant red-flag findings. This exam also will serve as a guide to help identify the appropriate use, or restraint, of OMT in a patient who is neurologically compromised.

Why We Modified the ASIA Exam

The American Spinal Injury Association (ASIA) examination is a standardized examination developed to document impairment in patients with spinal cord injuries. The exam and is endorsed by the *International Standards for Neurological Classification of Spinal Cord Injury*.[10] The ASIA examination is well known to physical medicine and rehabilitation (PM&R) physicians, as physiatrists are expected to become highly proficient with it during their residencies. The examination (see *Figure 2* on page 42) was designed to be performed

Continued on page 42

Figure 1. *Proposed algorithm for management of patients presenting with spine pain.*

Acute or Chronic Lumbar or Cervical Spine Pain Algorithm

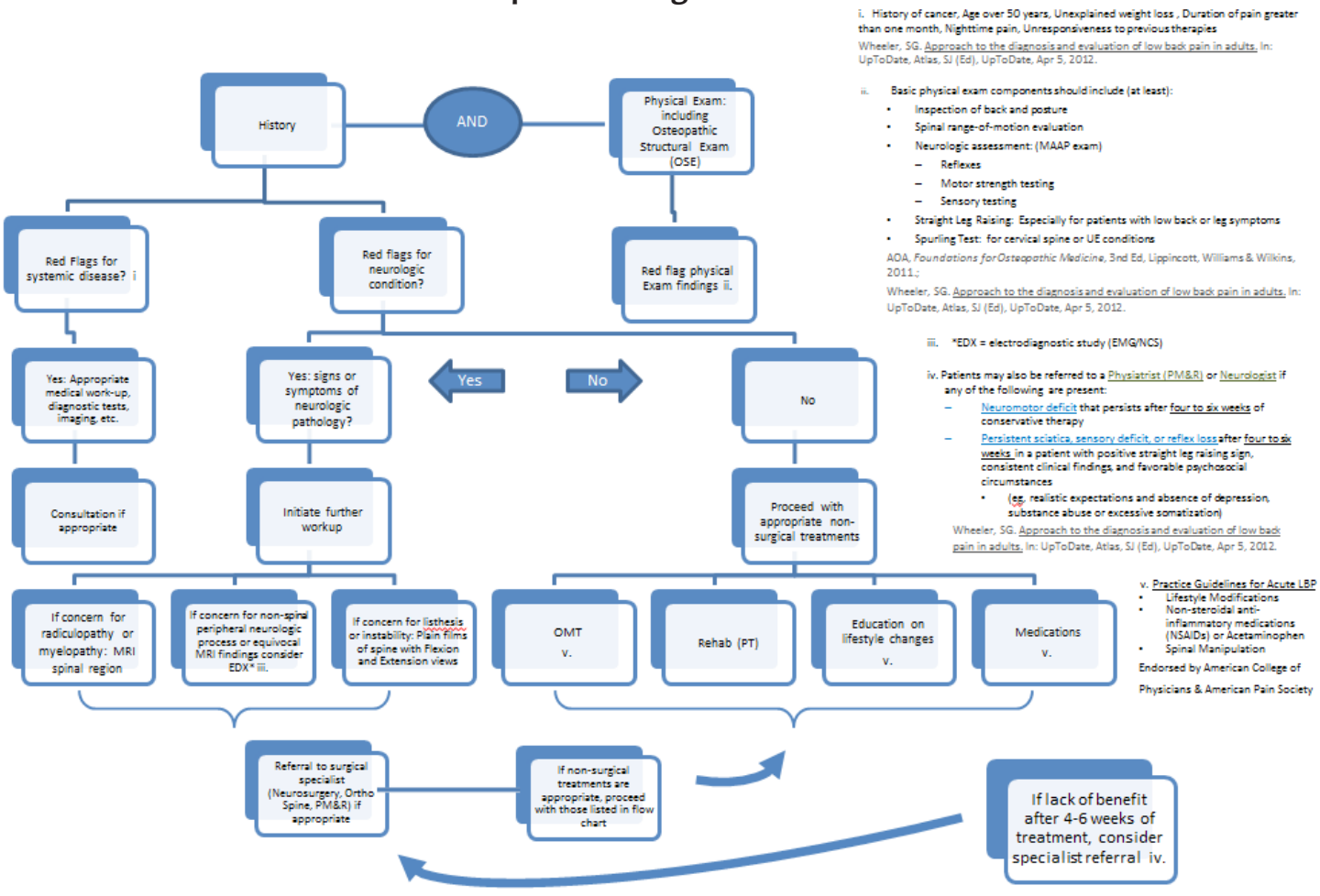
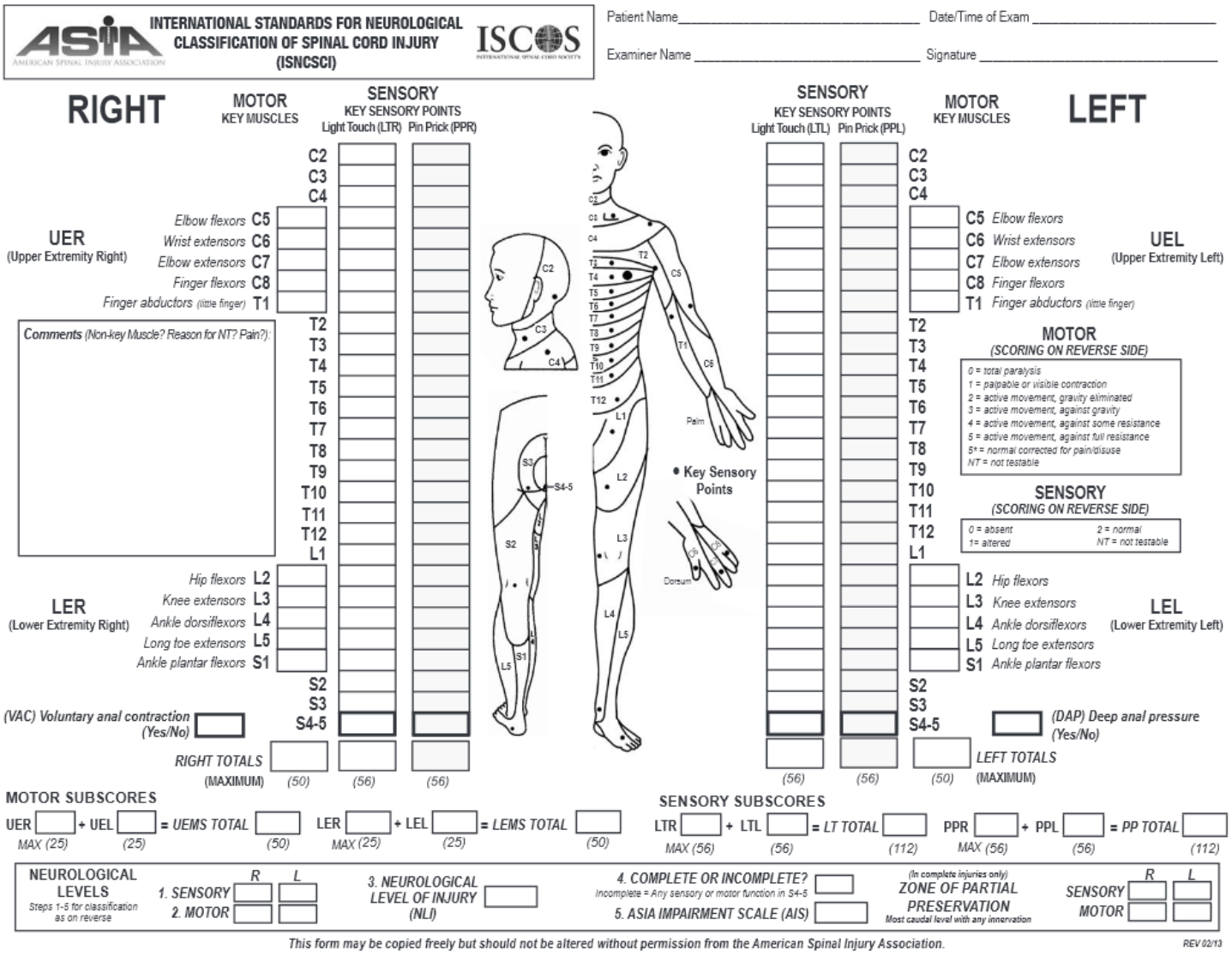


Figure 2. *American Spinal Injury Association:* International Standards for Neurological Classification of Spinal Cord Injury, *revised 2013; Atlanta, Georgia. Reprinted with permission 2014.*[10]



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predominantly as an acute in-patient spinal cord assessment. It is composed of sensory and motor components, and it is designed to be performed with patients in the supine position. The MAAP, in turn, was developed for the outpatient ambulatory setting employing ASIA's guiding principles.

Our modified version of the ASIA exam can be readily performed on ambulatory patients primarily in the seated position during outpatient clinical assessments.

The goal of the MAAP is to screen for and identify any neurologic manifestations or potential diagnoses that would be contraindications to manipulative treatment or for which manipulative treatment would otherwise have deleterious outcomes. If such a sign, symptom, or lesion is identified, the next step in the neurologic evaluation is to identify whether the manifestation is more likely to be in the central nervous system or the peripheral nervous system. While sensation abnormalities and motor weakness may be seen in either type of neurologic lesion, abnormally strong reflexes are associated with a central nervous system lesion. Central nervous system lesions can be further evaluated for the presence of hyper-reflexia or other pathognomonic responses with such means as the extensor plantar response and Hoffman's sign (see *Figure 3*).[6(p519)] Therefore, it becomes clinically relevant to use the reflex assessment in addition to pattern recognition of motor and sensory neurologic abnormalities to

Figure 3. *Hoffman's Sign*

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differentiate between central and peripheral nervous system lesions.

Introducing MAAP

Lower Quarter (Lumbar Spine or Below)

In addition to the other physical examinations (range of motion, inspection, palpation, abdominal exam, etc.), it is important to perform neurologic testing on the lower extremity, in particular the L2-S2 nerve roots for patients with musculoskeletal symptoms in the lower half of the body (lumbar spine and below). The outcome of this exam may necessitate a further or subsequent follow-up neurologic examination. For instance, brisk reflexes unilaterally in the lower extremity or a plantar extensor response raise the concern that the patient may have an upper motor neuron lesion, in which case the neurologic exam should be expanded to include the upper extremity.

The lower quarter exam should consist of the following:

Reflexes: patellar (L4), hamstrings (optional) (L5), Achilles' (S1).

Motor: hip flexion (L2), knee extension (L3), ankle dorsiflexion (L4), extensor hallucis longus (L5), ankle plantarflexion (S1).

Sensation: For root level dermatome assessment, we recommend the ASIA points for specific dermatome assessment. Light touch and pinprick can be used for sensory testing. *(See Figure 4 on page 44.)*

Upper Quarter (Neck, Shoulder Girdle, Upper Extremity)

In addition to the other typical examinations (range of motion, inspection, auscultation, palpation, etc.), it is important to perform neurologic screening on the upper and lower extremities, in particular the C5-T1 and L2-S2 nerve roots for patients with musculoskeletal symptoms in the neck, upper extremities, or trunk. A lesion in the upper thoracic spinal cord may produce abnormal neurologic findings only in the lower extremities. Findings may range from obviously abnormal upper motor neuron signs to only mild hyper-reflexia on patellar and Achilles responses. Such findings should warrant examination beyond the MAAP screen (eg, expanded sensory evaluation of the trunk).

In addition to the above, the upper quarter exam should consist of the following:

Reflexes: biceps (C5), brachioradialis (C6), triceps (C7).

Motor: elbow flexion (C5), wrist extension (C6), elbow extension (C7), long finger flexion (C8), abductor digiti minimi (T1).

Sensation: For root level dermatome assessment we recommend the ASIA points for specific dermatome assessment (see *Figure 4*).

Important caveats with the examination

When evaluating deep tendon reflexes, the goal is to ensure *reproducibility* of the maximum response. Try to ensure complete relaxation of the muscle group being assessed.

Distraction can be used for deep tendon reflexes (eg, Jendrassik maneuver) without changing the grading of the response. However, if you need to augment a reflex (eg, mildly contract the muscle), this would require downgrading the response (eg, a 2 out of 4 becomes a 1 out of 4).

A very effective convention for motor testing is full contraction and trying to "break it."

Sensory testing is typically performed with light touch and pinprick. Ask the patient, "Do you feel this on both sides, and does it feel normal?"

When possible, the physician should use the same muscle for sensory testing as for the motor testing (eg, abductor digiti minimi).

Ankle plantar flexion motor testing needs to be done with single leg calf-raise with 10 repetitions. Grade down if unable to complete.

Conclusion

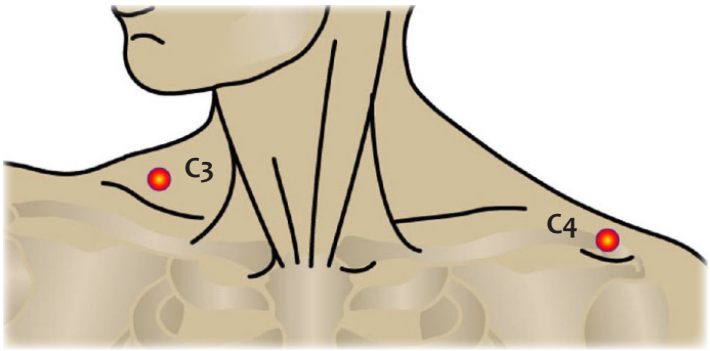
In the thorough evaluation of many patients with pain or musculoskeletal presentations, it is prudent to evaluate patients for causative and concurrent neurologic issues. Routinely performing a standardized neurologic exam such as the MAAP in conjunction with the musculoskeletal exam, improves quality of care by screening for significant conditions that may be causing or contributing to patients' conditions. In patients to whom you are considering offering OMT, using the MAAP can identify conditions for which certain treatment approaches may be contraindicated (eg, high-velocity, low-amplitude technique in a patient with suspected radiculopathy of unknown cause). In addition, with using a routine screening neurologic exam, physicians can expect to decrease their liability and negative outcomes by improving their identification of conditions with risk of significant morbidity and mortality.

The MAAP provides a clinically useful screening instrument for musculoskeletal conditions. In the experience of the authors (DL, JF), MAAP is:

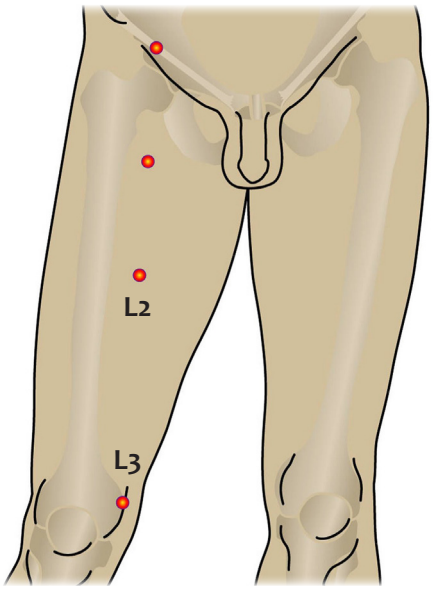
- a sensitive tool to screen for common and important neurologic conditions such as cervical and thoracic myelopathy, radiculopathy, and peripheral neuropathy;

Continued on page 45

Figure 4. *ASIA sensory dermatomes.*[10] *American Spinal Injury Association: International Standards for Neurological Classification of Spinal Cord Injury, revised 2013; Atlanta, Georgia. Reprinted with permission 2014.*

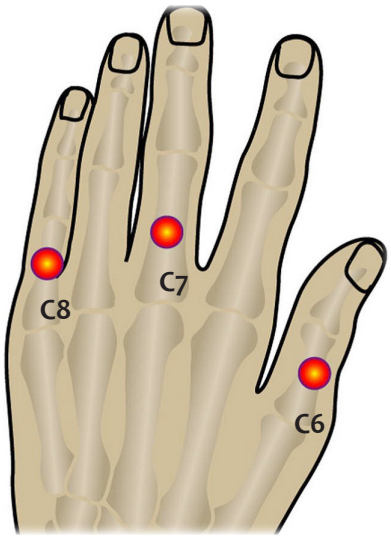


C3. In the supraclavicular fossa, at the midclavicular line.
C4. Over the acromioclavicular joint.

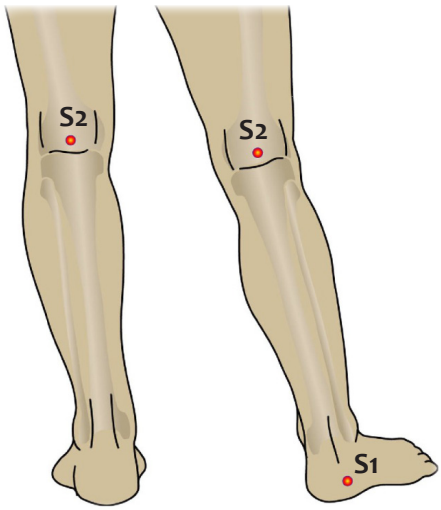


L2. On the anterior-medial thigh, at the midpoint drawn on an imaginary line connecting the midpoint of the inguinal ligament and the medial femoral condyle.
L3. At the medial femoral condyle above the knee.

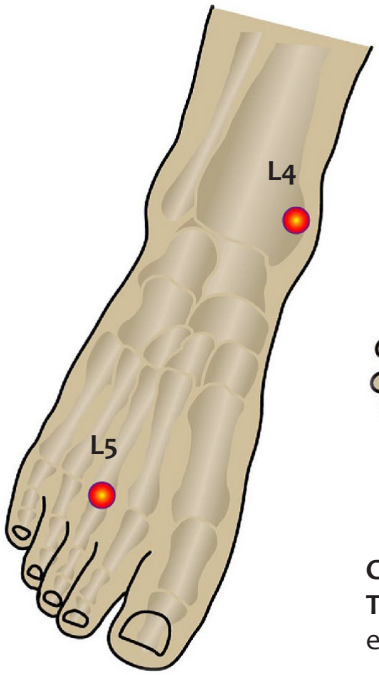
C6. On the dorsal surface of the proximal phalanx of the thumb.
C7. On the dorsal surface of the proximal phalanx of the middle finger.
C8. On the dorsal surface of the proximal phalanx of the little finger.

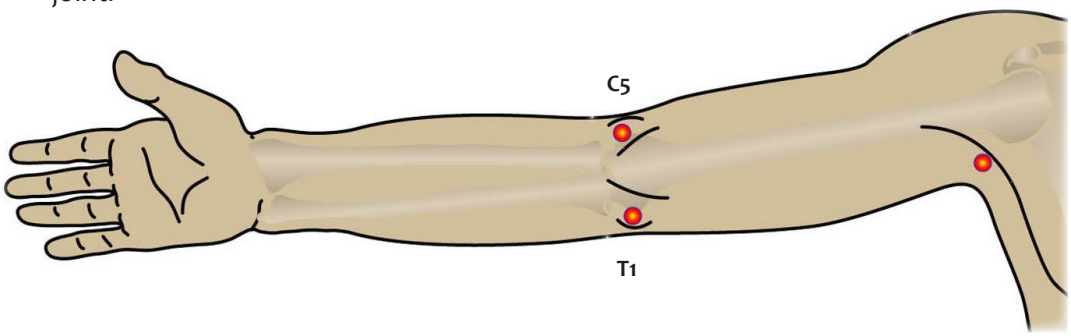


S1. On the lateral aspect of the calcaneus.
S2. At the midpoint of the popliteal fossa.



L4. Over the medial malleolus.
L5. On the dorsum of the foot at the third metatarsal phalangeal joint.





C5. On the lateral (radial) side of the antecubital fossa just proximal to the elbow.
T1. On the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.

- a rapid way to help discriminate concern of nervous system lesion to an upper motor neuron or lower motor neuron lesion.

Abnormal findings in the MAAP may indicate the loss of neurologic function and can alert physicians to the presence of more critical pathologic conditions.

For physicians evaluating patients for musculoskeletal conditions, the MAAP is an extremely valuable assessment to use before making decisions regarding treatment, especially OMT.

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Address correspondence to:
Drew D. Lewis, DO
Des Moines University College of Osteopathic Medicine
3500 Grand Ave
Des Moines, IA 50312-4326

Continuing Medical Education Quiz

The purpose of the quiz—found on page 46—is to provide a convenient means of self-assessing your comprehension of the scientific content in "Introducing MAAP: The Modified ASIA Exam for Ambulatory Patients" by Drew D. Lewis, DO; Jose S. Figueroa, DO; Garth K. Summers, OMS II; and J.D. Polk, DO.

Please answer each question listed. The correct answers will be published in the next issue of the *AAOJ*.

To apply for two credits of AOA Category 2-B CME credit, record your answers to the *AAOJ* CME quiz application form answer sheet on page 46. The AAO will note that you submitted the form and forward your results to the AOA Division of Continuing Medical Education for documentation. You must score a 70% or higher on the quiz to receive CME credit.

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Name of Article: Introducing MAAP: the Modified ASIA Exam for Ambulatory Patients

Authors: Drew D. Lewis, DO; Jose S. Figueroa, DO; Garth K. Summers, OMS II; and J.D. Polk, DO

Publication: *AAO Journal*, Volume 24, No. 2, June 2014, pp. 40-45

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Complete the quiz to the right by circling the correct answers. Mail your completed answer sheet to the American Academy of Osteopathy. The AAO will forward your results to the American Osteopathic Association. You must answer 70% of questions correctly to receive CME credits.

March 2014 *AAO Journal* CME quiz answers:

1. A
2. E
3. D
4. D

Answers to the June 2014 *AAOJ* CME quiz will appear in the September 2014 issue.

Mail this page to:
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1. Why is performing the MAAP exam beneficial prior to providing OMT?
   a. It can help detect neurologic lesions contributing to a patient's symptoms.
   b. It can help you decide if further diagnostic evaluation is warranted.
   c. It can help identify conditions that may have significant morbidity or mortality risk.
   d. It may prevent untoward outcomes and avoid litigation.
   e. All of the above.
2. Based on the MAAP motor root levels, which motion (manual muscle test) is assigned to the L5 nerve root and appropriate for a 45-year-old male patient with suspected L5 radiculopathy?
   a. Ankle dorsiflexion (not the toes)
   b. Ankle plantar flexion
   c. Big toe extension (EHL)
   d. Hip adduction
   e. Knee extension
3. Which of the below findings was *not* discussed in the article as a red-flag physcial exam finding for low back pain?
   a. Decreased sensation
   b. Dural tension signs
   c. Motor weakness
   d. Pain upon pinching
   e. Reflex abnormalities
4. Which portion of the neurological examination particularly helps to discriminate between upper motor neuron lesions (central nervous system) and lower motor neuron (peripheral nervous system) lesions?
   a. Dural tension signs
   b. Motor examinations
   c. Reflex examination
   d. Sensory examination

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Manuscript Submission

- ☐ Submission emailed to *AAOJ* scientific editor at editoraaoj@gmail.com or mailed on a flash drive to the *AAOJ* managing editor, American Academy of Osteopathy, 3500 DePauw Boulevard, Suite 1100, Indianapolis, IN 46268-1136
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- ☐ Title page, including the authors' full names, financial and other affiliations, and disclosure of the financial support related to original research described in the manuscript
- ☐ "Abstract" (see "Abstract" section in "*AAOJ* Instructions for Contributors" for additional information)
- ☐ "Methods" section
  - the name of the public registry in which the trial is listed, if applicable
  - ethical standards, therapeutic agents or devices, and statistical methods defined
- ☐ Four multiple-choice questions for the continuing medical education quiz and brief discussions of the correct answers
- ☐ Editorial conventions adhered to
  - units of measure given with all laboratory values
  - on first mention, all abbreviations other than measurements placed in parentheses after the full names of the terms, as in "American Academy of Osteopathy (AAO)"
- ☐ Numbered references, tables, and figures cited sequentially in the text
  - journal articles and other material cited in the "References" section follow the guidelines described in the most current edition of the *AMA Manual of Style: A Guide for Authors and Editors.*
  - references include direct, open-access URLs to posted, full-text versions of the documents
  - photocopies provided for referenced documents not accessible through URLs
- ☐ "Acknowledgments" section with a concise, comprehensive list of the contributions made by individuals who do not merit authorship credit and permission from each individual to be named in print
- ☐ For manuscripts based on survey data, a copy of the original validated survey and cover letter

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Financial Disclosure and Conflict of Interest

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Please include permission to forward the manuscript to *The Journal of the American Osteopathic Association* if the *AAOJ*'s scientific editor determines that the manuscript would likely benefit osteopathic medicine more if the *JAOA* agreed to publish it.

Questions? Contact AAOJ Scientific Editor Kate McCaffrey, DO, at kmccaffrey123@gmail.com.

Component Societies and Affiliated Organizations Calendar of Upcoming Events

June 19-22, 2014
The Osteopathic Cranial Academy
Annual Conference
Beyond Sutherland's Minnow:
Anatomy, Perception and Treatment
Conference director: Melvin R. Friedman, DO
Sheraton Indianapolis City Centre, Indianapolis, Indiana
(317) 581-0411 • Fax: (317) 580-9299
info@cranialacademy.org • www.cranialacademy.org

July 14–18, 2014
American Academy of Pediatric Osteopathy
with Osteopathy's Promise to Children
Expanding the Osteopathic Concept Into the Cranial Field
Program chair: Raymond J. Hruby, DO, FAAODist
Hilton Doubletree San Diego-Mission Valley,
San Diego, California
CME: 40 Category 1-A AOA credits anticipated
(619) 548-8815
info@the-promise.org • www.the-promise.org

July 18–20, 2014
The Holonomic Institute of Integrative Medicine –
Northern California Academy of Osteopathy
Level One Fulford Percussion
Program chair: Richard W. Koss, DO
Co-sponsored by the AAO
CME: 24 Category 1-A AOA credits anticipated
Contact Kate Price at (707) 824-8764

July 19–21, 2014
American Academy of Pediatric Osteopathy with
Osteopathy's Promise to Children
Intensive Course in Pediatric Osteopathy
Program chair: Shawn Kristian Centers, DO
Hilton Doubletree San Diego-Mission Valley,
San Diego, California
CME: 24 Category 1-A AOA credits anticipated
(619) 548-8815
info@the-promise.org • www.the-promise.org

September 19-21, 2014
The Osteopathic Cranial Academy
Cranial Base Course
Course director: James W. Binkerd, DO
Associate director: Paul E. Dart, MD, FCA
Renaissance Suites O'Hare, Chicago, Illinois
(317) 581-0411 • Fax: (317) 580-9299
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October 5-6, 2014
American FDM Association
Sixth FDM World Congress
Hotel Contessa, San Antonio, Texas
CME: 24 Category 1-A AOA credits anticipated
www.orthopathy.com/worldcongress.html

October 31-November 2, 2014
Michigan Osteopathic Association
10th Annual Autumn Convention
Devos Place, Grand Rapids, Michigan
(800) 657-1556
https://www.mi-osteopathic.org/
2014AutumnConvention

November 7-9, 2014
The Osteopathic Cranial Academy
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