

The AAO


FORUM FOR OSTEOPATHIC THOUGHT

JOURNAL

Official Publication of the American Academy of Osteopathy

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**Osteopathic approach to
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Correction: In the March 2011 issue of *The AAO Journal*, the name of “Evaluating the perception of motion in osteopathic medical students, residents and physicians” co-author Kevin Dankert, OMS IV, was misspelled. *The AAO Journal* apologizes for the error.

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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.

IN THIS ISSUE:

AAO Calendar of Events 5
CME Certification of Home Study Forms 36

EDITORIAL:

Flawed science is not evidence-based osteopathic medicine..... 6
Murray R. Berkowitz, DO, MA, MS, MPH
A conversation with the dean: A true story.....8
Robert C. Clark, DO, MS

REGULAR FEATURES:

View From the Pyramids 4
Raymond J. Hruby, DO, MS, FAAO
From the Archives..... 49
Component Society Calendar of Events 56

ORIGINAL CONTRIBUTIONS:

The use of videos in teaching psychomotor skills: A look at a new way of teaching osteopathic manipulative treatment to a remote campus..... 10
Mariko Ferronato, OMS IV; Raymond J. Hruby, DO, MS, FAAO
The iliolumbar ligamnets: A literature study.....23
Luc Peeters, DO (UK)
Jenette “Nettie” Bolles: The first woman to pioneer osteopathy 32
Janice Blumer, DO
Osteopathic approach to a patient with chronic fatigue syndrome 37
Anne Chong, MS; Murray R. Berkowitz, DO, MA, MS, MPH
Relieving depression in an elderly woman with osteopathic manipulative treatment: A case report..... 51
Angela Gough, OMS III; Allen Kalich, DO

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Finding a mentor: Why and how?

Raymond J. Hruby, DO, MS, FAAO

A couple of events these days have been reminding me of the immense benefit that comes from having a mentor in life. First, I was privileged to have been invited to give a presentation for the Heilig Symposium at the Philadelphia College of Osteopathic Medicine. This is a memorial event held every year to honor the late David Heilig, DO, FAAO, long a member and Fellow of the AAO, well known throughout the osteopathic profession, and also greatly respected and admired as one of the finest human beings one could know. My presentation centered around the application of osteopathic philosophy and principles in practice, and I and fellow speakers stressed, more than a few times, that learning how to truly practice as a DO is a lifelong process that goes much easier if one has a mentor to function as a guide.

The other event surfaced as I returned home from Philadelphia, only to be in the midst of commencement activities at the college of osteopathic medicine where I work. I attended the awards ceremony, where I was privileged to present an award to a graduating student whom I've known since her pre-med days, worked with on numerous projects during her Predoctoral OMM Fellowship and had a hand in mentoring with her Master's Degree thesis. As I sat through the ceremony, I thought about the numerous students I've met over the years, and felt a sense of pride and accomplishment that I might have been able to help some of them in some small way as they experienced their journey toward becoming osteopathic physicians. I thought about how important it is to be, and to have, a mentor for this journey.

I have always thought the practice of osteopathic medicine is an art that is tempered with science. In the book *On Doctoring* by Reynolds and Stone (New York: Simon and Shuster, 1991), in an essay entitled "Medicine: The Art and the Science," Herrman Blumgart, MD, states, "The science of medicine consists of the entire stockpile of knowledge accumulated about man as a biologic entity. The art of medicine consists in the skillful application of scientific knowledge to a particular person for the

maintenance of health or the amelioration of disease. For the individual physician, the meeting place of the science of medicine and the art of medicine is the patient." Later on in the same essay, he says, "Without scientific knowledge, a compassionate wish to serve mankind's health is meaningless. But scientific knowledge is more readily taught, whereas the application of knowledge at the bedside is largely a function of sagacity inherent in, or personally developed by, the individual physician."

To me, this skillful joining of the science and art of medicine into practice can best be developed through experience with patients and working with osteopathic physicians who are already skilled in this endeavor. As such, it means to me that every osteopathic student should acquire a mentor, even a whole cadre of mentors, to make this process faster, smoother and more efficient. To that end, based on my own experience, I would offer the following advice to any osteopathic medical student (or anyone, for that matter) searching for a mentor:

- Know yourself. You should have a clear idea about your own personality and communication style. This can help determine what kind of mentor you think would be good for you. In general, I think you should look for someone who has the kind of life and career you would like to have.
- When you ask someone to be your mentor, it's most helpful to explain: a) why you're asking for a mentor, b) what you'd expect to get from this relationship, and c) your reasons for asking this particular person.
- You can test drive your mentoring relationship. Before asking someone to be your mentor, perhaps you could seek input on a single specific topic. If that goes well, then maybe this is the mentor for you.
- Look for ways, however small, that you can show gratitude to your mentor.
- Mentoring can take many forms, such as a monthly lunch, a quarterly phone call or even a steady email

correspondence. Your mentor may not even live in your city or region.

Having a good mentor can save you time, energy, and frustration, and make your journey to osteopathic medical practice even more enjoyable. Good luck!

- It's okay to have more than one mentor. You might want to choose different mentors for different facets of your professional (and even personal) life.
- Don't get discouraged if people say no. It's not a personal issue. Good mentors are also busy people, and it's possible they might not have time to make this commitment. If the first person on your list says no, move on to the second.

2011 AAO Calendar of Events

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

June 8	Postdoctoral Standards and Evaluation Committee Teleconference
June 10-12	<i>Osteopathic Considerations in Sports Medicine</i> combined with a little GOLF! Kurt Heinking, DO, FAAO; Mark McKeigue, DO—CCOM, Downers Grove, IL
July 9-10	AAO Board of Trustess Meeting—University Place Conference Center & Hotel, Indianapolis, IN
July 12-14	AOA Board of Trustees Meeting—Chicago, IL
July 15-17	AOA House of Delegates—Chicago, IL
July 15-16	AAO Osteopathic Diagnosis & Treatment Education Service—Chicago, IL
August 5-6	Education Committee Meeting—University Place Conference Center & Hotel, Indianapolis, IN
August 5-6	SAAO Council Meeting—University Place Conference Center & Hotel, Indianapolis, IN
August 25-28	<i>Rapid OMT for the Busy Practitioner</i> (Co-Sponsored by Florida East Orlando Hospital) Ann L. Habenicht, DO, FAAO; Wm. Thomas Crow, DO, FAAO Contemporary Resort at Walt Disney World, Orlando, FL
September 23-25	<i>Seated Facet Release: Techniques of the Still Family</i> Karen M. Steele, DO, FAAO—Virginia Beach, VA
October 7-9	<i>Prolotherapy Weekend</i> —Mark S. Cantieri, DO, FAAO; George J. Pasquarello, DO, FAAO UNECOM, Biddeford, ME
October 30	AAO Board of Trustees Meeting—Orlando, FL
October 30	<i>Progressive Inhibitions of Neuromusculoskeletal Structures</i> (Pre-OMED) Dennis J. Dowling, DO, FAAO—Orlando, FL
Oct. 31- Nov. 2	<i>AAO Program at OMED</i> —Kendi L. Hensel, DO, PhD, Program Chair—Orlando, FL
October 31	Fellowship Committee Meeting—Orlando, FL
October 31	Postdoctoral Standards & Evaluation Committee Meeting—Orlando, FL
November 1	Education Committee Meeting—Orlando, FL
December 3-4	AOBNMM Examinations—Indianapolis, IN
December 9-11	<i>Visceral Approach to the Sacrum and Pelvis</i> —Kenneth J. Lossing, DO—COMP, Pomona, CA

Flawed science is not evidence-based osteopathic medicine

Murray R. Berkowitz, DO, MA, MS, MPH

In the last issue, I addressed the need for research and publication in the osteopathic profession.¹ I lamented the decrease in the number of scholarly osteopathic journals as venues for the dissemination of experimental or observational research. I wrote of the importance of what I termed “evidence-based osteopathic medicine,” and encouraged the submission of case reports and case series for consideration and possible publication as at least an initial basis for performing meta-analyses. I have always encouraged the submission of Letters to the Editor as a basis for intellectual argument, discussion and debate of various scientific and clinical aspects of osteopathic medicine. I am personally concerned with characterizations of osteopathic manipulative medicine (OMM) and osteopathic manipulative treatment (OMT) as “alternative” or “complementary” by those within the osteopathic medical profession, per se, and the broader osteopathic scientific community. While there are applications of complementary and/or alternative modalities by both osteopathic and allopathic physicians alike, OMM and OMT are considered “mainstream” by this profession.

I am also concerned with the lack of response by the broad membership of this Academy to the attacks on at least some aspects of the professional practice of OMM and OMT by members of our own osteopathic scientific community. A prominent example is the several publications by Steve E. Hartman, PhD, and James M. Norton, PhD, both members of the basic sciences department at the University of New England College of Osteopathic Medicine in Biddeford, ME. Drs. Hartman and Norton have “together or separately, publicly or privately, and on many occasions shared (their) ‘cranial’ skepticism with colleagues around the world.” They have contributed to the education and training of numerous osteopathic physicians through the excellence of their teaching of the basic sciences of anatomy and physiology. These contributions cannot, and should never be, minimized or slighted. That said, they are not, and have never purported themselves to be, clinicians. Not being osteopathic physicians, they have no formal education or training in OMM or OMT. Thus, they completely lack any capability to perform palpation of any facet of the primary respiratory mechanism via palpating the cranial rhythmic impulse.

I attack their “science,” not them. They have published several articles^{2,3} and Letters to the Editor^{4,6} advocating deleting the teaching of Osteopathy in the Cranial Field (OCF) from the DO curriculum⁵ and its being

examined by the Comprehensive Osteopathic Medical Licensing Examination of the United States (COMLEX-USA) of the National Board of Osteopathic Medical Examiners (NBOME).⁶ These articles and letters contain many references; however, they all essentially cite and follow from a single article, “Interexaminer Reliability and Cranial Osteopathy” published in *The Scientific Review of Alternative Medicine* in 2002, which they authored.

Unfortunately, I find this study to be flawed in the following ways. First, Drs. Hartman and Norton confuse “craniosacral therapy” and “cranial osteopathy”—more formally, “Osteopathy in the Cranial Field (OCF).” “Therapy” is not “treatment.” Treatment is prescribed and rendered by physicians. Therapy is performed by mid-level providers and non-physicians. Formally, OCF is only taught to fully licensed physicians (both allopathic and osteopathic), to dentists and to osteopathic medical students and residents. It is not taught to physical therapists, physician assistants (PAs) or nurses. Thus, physical therapists, PAs or nurses do not possess the clinical or palpatory skills required. They do not have the background for training in OCF. Even osteopathic medical students have not (yet) developed the palpatory skills needed to master OCF. They receive an introduction, and much of what they do learn in osteopathic medical school regarding OCF is didactic. This, then, invalidates three of the six studies cited by Drs. Hartman and Norton in their 2002 article.

The most commonly accepted measure of interexaminer reliability is the Kappa statistic.⁷ The problem for two of the cited studies is that the number of subjects (n) is small.^{8,9} In biostatistics, when the n is small, the 95 percent confidence interval is wide. This allows a greater variation in interpretation (of the examiners results). Furthermore, in one of these two studies, not all subjects were evaluated by all examiners.² This results in gaps in the data used in calculating the Kappa statistic and results in a lower Kappa value. This, then, is interpreted as lack of interexaminer reliability. Thus, the studies cited by Drs. Hartman and Norton lack statistical significance and reliability. The use of the underlying flawed studies cited by Drs. Hartman and Norton results in their study being flawed by a “fallacy of composition.” Self-citing a flawed study is biased, certainly in the statistical sense, and meaningless. This neither supports nor refutes the determination of interexaminer reliability with regard to palpation of the cranial rhythmic impulse.

Evidence-based medicine is not a panacea. Very little of what is done by both allopathic and osteopathic physicians alike has any evidence-based medicine basis. If we removed everything that is done today that does not have randomized, placebo-controlled clinical trials to support it from the practice of clinical medicine, there would undoubtedly be an increase in morbidity and mortality. The unfortunate consequence of the underlying (flawed) study, and the self-cited articles and letters that subsequently followed, is that they are often used by policy-makers and even the leadership within the Osteopathic Medicine profession. Even Deans of several osteopathic medical colleges have cited these as the “Evidence-based medicine” basis to try to remove OCF from the curriculum. This Academy recently concluded its annual convocation—this year being devoted to Osteopathy in the Cranial Field. I only wish that Dr. Hartman and Dr. Norton and other detractors had been present to discuss developing better scientific and clinical outcome studies with the practitioners—that is, the licensed and certified osteopathic physicians. We don’t understand the underlying mechanisms for how and why many things in clinical medicine work—we just know that they do. We know that patients get better. We need more and better science, and clinical studies, to try to learn the why and how. But until

then, we need to be able to apply the art of medicine to the care of real patients and to alleviating suffering.

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Clinical Anatomists at any level who would like to further develop their career by focusing on medical education are encouraged to apply. Individuals who have enjoyed a successful academic career in Clinical Anatomy and are still interested in teaching and interacting with medical students are also encouraged to apply.

Interested parties should submit a CV, a brief statement of teaching experience and philosophy and contact information for three referees to Dr. B.A. Flumerfelt, Chair of Selection Committee, at bflumerfelt@aucmed.edu. Applications will be considered until the position is filled.

10308S

A conversation with the dean: A true story

(Or why the good manipulators are so quirky!)

Robert C. Clark, DO, MS

Some years ago, in the previous century, the dean (now retired) called me into his office, and we had a friendly chat. It seems that I, among others in my group, had roused a bit of rabble and ruffled each other's feathers, and we now had to be settled and aimed in the right direction once again. He reminded me he was on our side, and we all had the same goal of training tomorrow's doctors. I responded with the contrary view that we were training tomorrow's osteopaths. But that is yet another story!

What he said went something like this: Every time the deans of the DO colleges get together, they discuss their problems and try to help each other find solutions to them. But my dean said that all the deans consistently have problems with one department. It is the same department with different names from school to school. He looked at me and said that he was sure I knew which department he was talking about. Of course I did. I shared with him that I wasn't surprised either! His eyebrow rose questioningly at that response.

It should really come as no surprise that the department we were talking about was the Department of Osteopathic Principles and Practices (OPP), Osteopathic Manipulative Treatment (OMT), Osteopathic Manipulative Medicine (OMM) or whatever. Why should this group—who are supposedly the torchbearers of osteopathy, the purveyors of the spirit, the epitome of the heritage of the profession—be the source of so much administrative headache for our colleges' deans?

The obvious answer is that it is because these people are the torchbearers, purveyors of spirit and the epitome of heritage that they are the thorn in the side of each dean and probably each college. After all, they constitute a minority of a profession that is founded on the role of the structure in health and disease, and the role of OMT in health and disease. They actually believe in and practice these ideas.

To survive as a minority and function as a profession's conscience requires some very strong survivalist qualities. That means that each one is an individual whose personality translates, from the administrator's point of view, as a very quirky person! My colleagues and I are

a very idiosyncratic bunch. Put a dozen of us in a room and each simultaneously has a dozen ideas on how the profession should lead the world to health and how OMT fits into modern practice. And guess what? You won't find two identical ideas in the bunch. You may not find two SIMILAR ideas in the bunch either!

We really don't want to hurt our deans or make them crazy. We do want to keep them focused on the fact that we are osteopaths and that we are training osteopaths and not just doctors. We know we aren't as good as the MDs because we know we are *better*! As a rule, we hate mediocrity. And, of course, we each define mediocrity differently. This leads to a seemingly continuous state of confusion and disagreement within our departments, between our schools and so on. Each of us is working hard and butting heads to find the best ways to produce the best Osteopaths. Osteopaths that Dr. Still would be proud of! But, to the deans, we are the ones who run with scissors and don't play well with others!

The dean was trying to do the right thing and steer us toward our common goal of training tomorrow's osteopaths and doing the best job we can. It really takes all of us to do the job, and the sooner everyone sees it our way, the easier it will be for us all to do our jobs. I told you we were quirky! And stubborn, too—ask my wife!

Another reason for the seemingly quirky nature and idiosyncratic behavior of the best manipulators is that they have discovered they can often do the supposedly impossible. I am guilty of that stunt, too. And, after a while, you get to the point that either one of two things happens. A few get very humble and become quiet about this strange ability. But most become affected by it, jaded even, and things change for them. Their attitude becomes, "Osteopathy enables me to do this." So few of the DOs are even willing to try the easy cases and so many attempt the "impossible" that it's a derision of the heritage. And that makes me (us) angry!

Said another way, we get used to doing the impossible so often that we can't understand why others who could, won't!

Now, the next level of this problem becomes the different definitions of “impossible” that are held by each of the hot shot manipulators. Then, to add insult to injury, those who have chosen not to do the things we find ourselves doing, begin to put us down, insult us and even doubt that this stuff works at all! That is like pouring gasoline on the fire or salt in the wound!

Medicine and osteopathy have sought to enhance the scientific basis of practice. But medicine is an artful application of science. Osteopathy is an even more artful application of medicine and much more. We are the artists of the profession. Who out there hasn’t made some comment about the quirky behavior of an artist? At one time, Salvador Dali had his photograph taken as he was suspended from a helicopter by his mustache! All we do is help people get better by bending and twisting and reshaping their bodies and/or their heads. And there are people who castigate us for being unscientific, despite our high rate of success in helping those whom science has failed.

The artist in us wants freedom. Freedom to express ourselves. Freedom to use the art and the science in an artful way. Freedom from the ridicule of those who refuse

to be artisans. The scientist in us wants the others to hear our observations. All science starts with observation and then tries to explain that observation. After all, an observation is irrefutable. The interpretation is the part that is argued.

We are proud of the osteopathic heritage. And we are proud of a system of health care that works! Much of what we do may be hard to explain in scientific terms, but it is easy to explain in human terms—and that is what counts when you are treating patients and helping students become Osteopaths.

By the way, deans, we will probably continue to make you crazy, but if we continue to produce quality osteopaths for the twenty-first century, I guess you’ll just have to get used to it!

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The use of videos in teaching psychomotor skills: A look at a new way of teaching osteopathic manipulative treatment to a remote campus

Mariko Ferronato, OMS IV, Pre-Doctoral Teaching Fellow V; Raymond J. Hrubby, DO, MS, FAAO

Abstract

Osteopathic Manipulative Medicine (OMM) is the application of a distinct osteopathic philosophy to patient care and physician training. Osteopathic physicians receive training in osteopathic manipulative techniques (OMT) – psychomotor skills that allow treatment of patients through manual medicine, in addition to the highest standard of medical care. Traditionally, psychomotor skills are taught through didactic lecture and lab-based sessions. However, advances in technology have led to the use of video and multimedia, such as computer-assisted instruction (CAI) in teaching psychomotor skills such as cardiopulmonary resuscitation and basic life support. With the opening of satellite osteopathic medical school campuses, the use of live video streaming for teaching OMT has been raised. A thorough review of the literature shows that videos and CAI have been prominent in nursing education and general surgery resident training, yet the studies regarding the use of video in teaching a psychomotor skill have had varying results and severe study design flaws. No studies have been done on the use of videos in teaching psychomotor skills and their efficacy when it comes to teaching OMT. While the majority of OMM departments utilize multimedia in the form of PowerPoint when teaching, only nine of them have online videos – which are intended solely as a study adjunct and not as a replacement for lab sessions. Currently, live videos do not appear to be a viable alternative to traditional didactic lecture and lab-based practice sessions under direct instructor guidance when it comes to teaching OMT.

Introduction

Osteopathic Manipulative Medicine (OMM) is the application of a distinct osteopathic philosophy when it comes to patient care and training osteopathic physicians. It takes into account the five models of osteopathy – biomechanical, neurological, respiratory/circulatory, metabolic and psychosocial – when diagnosing and treating a patient. Osteopathic physicians are trained in the use of osteopathic manipulative techniques (OMT) – psychomotor skills that allow them to treat patients through the use of manual medicine, in addition to the highest standard of medical care. Traditionally, OMT is taught through didactic lectures and lab-based practice time under direct

supervision of clinical faculty, and occasionally pre-doctoral teaching fellows and teaching assistants (R. Hrubby, personal communication, October 13, 2010).

In September 2009, two videos were created about performing upper extremity and lower extremity structural exams. These videos served as adjunctive independent study materials for second-year osteopathic medical students at the College of Osteopathic Medicine of the Pacific (COMP) in Pomona, CA, to use in addition to traditional lecture and laboratory practice time when preparing for practical examinations. Given the recent opening of satellite osteopathic medical school campuses, video technology is also being utilized to provide instruction on OMT. In this era of distance learning, the use of videos in teaching psychomotor skills and their efficacy has not been directly explored when it comes to teaching OMT.

The purpose of this paper is to determine whether live video streaming is a viable option for teaching OMT to satellite osteopathic medical school campuses. By conducting a thorough review of the literature on the use of video in teaching psychomotor skills in the healthcare field, this paper examines the history of how psychomotor skills are traditionally taught. It also addresses the use of video in teaching various psychomotor skills, including basic life support (BLS) and cardiopulmonary resuscitation (CPR), various nursing tasks and surgical skills. It will also examine the recent trend in teaching surgical skills using virtual reality. This paper ultimately seeks to determine if the use of video is a viable alternative to traditional didactic lecture and instructional experience. Using a review of literature and e-mail correspondence with other OMM departments at the 28 osteopathic medical schools throughout the United States, this paper will elaborate on the utilization of video in teaching OMT to first- and second-year osteopathic medical students.

Review of Literature

Bloom's Taxonomy and the Psychomotor Domain

Bloom's taxonomy has long been the cornerstone of educational objectives and curriculum development.¹ It

has served as a popular instrument to analyze and consider the goals of educational activities, programs and entire curriculums. One important item to note, however, is that Bloom's taxonomy, as originally published, addressed only two domains – the cognitive² and the affective.³ The third domain – the psychomotor skills domain – was not discussed at that time. Over time, multiple authors have presented various hierarchies and taxonomies to cover the psychomotor domain.^{4,5,6} Many of these taxonomies appear to be most applicable to primary and secondary education. However, some authors have created psychomotor domain taxonomies directed toward higher education, and even based on specific occupational careers.⁷ This is associated with an emphasis on the development of manual skills related to the performance of professional responsibilities, which students attend graduate school to obtain. Clearly, the psychomotor skills domain is one of the more difficult domains to classify through a taxonomy or hierarchy. This may contribute to the difficulty in teaching psychomotor skills and testing them, both effectively and accurately.

The History of Teaching Psychomotor Skills

The teaching of psychomotor skills requires a different emphasis than the teaching of purely cognitive or intellectual sets of skills or facts. Students must not only recognize the cognitive and affective domains or knowledge bases behind a skill set, but must also learn how to physically perform a specific task or action. This is particularly evident in the health profession fields, be it nursing, dental, medical, chiropractic, or physician assistant. Students in the health profession fields are not only expected to learn the cognitive and affective aspects of their professions, but are also expected to be competent in performing psychomotor skills such as physical diagnosis, procedures, or treatments. While there has been a shift in emphasis in health profession curriculums from psychomotor performance to cognitive domain,⁸ the psychomotor component has never disappeared.

Historically, psychomotor skills were often taught through demonstration or modeling, in which a single faculty member would demonstrate a specific technique and ask students to mimic what they saw.⁹ There may be a single faculty member for the entire class, or there may be adjunct faculty who monitor student performance and give feedback. The amount of feedback varies depending on the technical level of difficulty of the psychomotor skill, and can be tailored to each individual learner's needs.⁹ This notion of modeling is also the fundamental basis in cognitive apprenticeship, as is often seen in surgical residencies.¹⁰ One scheme for technical skill development has three major steps: perception, integration, and automatization.¹¹ In order to achieve automatization, the

surgical resident must not only have book knowledge and affective awareness, but also psychomotor excellence.¹⁰ The cognitive apprenticeship, although it has the word "cognitive" in it, actually helps to facilitate psychomotor development and excellence. The surgical resident is transformed over time from a novice to an expert through modeling, coaching, scaffolding, articulation, reflection, and exploration.¹⁰

With advances in technology came a new method of teaching psychomotor skills through the utilization of computers, video and interactive CD-ROM. Plain film, while often static in nature and not interactive, allowed students to view the material at their own pace, and often freed instructors to devote their time to the clinical situation or students that needed them the most.¹² While multimedia, self-instructional packages have been shown to be equally effective in the dental realm for teaching cavity preparation procedures, they were never meant to replace the clinical judgment of the instructor in a clinical setting.¹² Multimedia simulations can teach complex skills, such as physical diagnosis and procedures, and can provide a comprehensive introduction to the cognitive processes and motor skills involved in performing procedures.¹³ Some studies have shown that students who used interactive videos scored higher on cognitive measures than those taught by traditional methods, but faculty contact remained an important factor when students were learning to perform a basic psychomotor skill.¹⁴ Other studies have found that learning cognitive content via interactive video does not significantly differ from learning by traditional lecture methods.¹⁴

When it comes to examining the effect of interactive videos on learning psychomotor skills, there are very few studies, and most of them have mixed responses. One study found that the use of computer-assisted interactive video instruction (CAIVI) led to better performance of sterile technique than linear video; yet another found no significant difference between a traditional lecture group and CAIVI when performing CPR.¹⁴ Some of the advantages in using CAI include the constant individual contact, the ability for the learner to control the pace, and immediate feedback.¹⁵ Some of the disadvantages include the inability to work in large groups and the lack of communication and interaction between students.¹⁵ Despite the various views on the efficacy of multimedia in teaching psychomotor skills, with the continual development of new technology and high fidelity models, the utilization of videos, CAI and CAIVI slowly became more and more prominent in the health professions when it came to teaching psychomotor skills.

Teaching Basic Life Support (BLS) and Cardiopulmonary Resuscitation (CPR) Through Video

BLS and CPR are two fields that require both cognitive and psychomotor knowledge and competency. While BLS and CPR are traditionally taught in the classroom setting, they are both time consuming and very costly.¹⁶ Students often fail to even achieve long-term retention of the psychomotor skill set.¹⁶ Recently, programs have been developed that utilize video, interactive computer modules, film and self-training methods in teaching BLS and CPR. Several studies indicate that adults who receive training with video self-instruction may be able to achieve similar or superior performances in CPR than those trained with the traditional classroom training method.^{17,18} One study even showed improvement of the psychomotor skill of bag-mask ventilation.¹⁹ However, another study showed an improvement in cognitive assessment, but no improvement in the motor skills needed to provide adequate CPR.²⁰ Regardless of the learning method, it has been shown that students who receive hands-on practice time perform CPR more successfully than those who do not.²¹ Thus, it seems that the key components to successfully teaching the psychomotor skills involved in BLS and CPR are adequate hands-on practice time and appropriate utilization of that practice time.

Teaching Nursing Students Psychomotor Skills Through Video

The majority of studies looking at the effects of multimedia-based CAI or video on nursing students' learning of psychomotor skills tends to focus on the cognitive knowledge gained rather than the performance of a specific set of skills itself. It has been shown that students who learned through a web-enhanced approach, that included CAI and interactive video, performed significantly better on the cognitive final exam, but did not show significantly superior performance skills.²² Other studies have shown no significant difference in written examination scores or practical performances.²³ Yet, although multimedia based CAI and video can complement traditional lecture style, it should not replace instructor demonstration.²⁴

In addition, many studies focus on the acceptance and satisfaction of nursing students with traditional lecture-based instruction when compared to flexible, web-enhanced and multimedia-based CAI.²⁵ While it has been shown that students utilizing CAI were more satisfied with the overall course,²⁶ it is important to recognize that these students are often comfortable with technology, and perceive this style of learning to be more compatible with their work and lifestyle balance.²⁵ Conversely, students

who report high satisfaction with a traditional lecture and instructor demonstration are often less comfortable utilizing technology to access online learning modules.²⁵

An important item to consider is the validity of many of the studies that look at the use of CAI or computer-assisted learning (CAL) for clinical skills education in nursing. Common problems in much of the published research on the use of CAL in nursing education included small sample size, lack of random assignment, questionable reliability, and validity of the research instruments.²⁷ These problems can also be seen in the use of CAL in undergraduate medical education. A review of 12 randomized controlled trials of the use of CAL in medical education found concerns with lack of statistical power, contamination between intervention and control groups, and high rates of sample attrition.²⁸ Thus, while there is a paucity of literature on the use of CAL in nursing and medical education, there is the need for more rigorous and academic research in the realm of the performance of psychomotor skills, while paying particular attention to sample size, range of skills and longitudinal follow-up.²⁹

Teaching Surgical Skills Through Video and Virtual Reality

The teaching of surgical residents has long been the mantra of "see one, do one, teach one." Yet, in an era of work hour restrictions, increasingly sick patients, and the increased cost of operating time and complications, new methods of teaching and practicing surgical skills and techniques have been called for by both public and professional societies. This goes from complicated surgeries, such as minimally invasive laparoscopic gastric bypass, to the simple act of suturing and knot-tying. It has been shown that computer-based video instruction is equally effective as summary expert feedback in the instruction of basic technical skills to medical students.³⁰ While the one-on-one apprenticeship model may be the gold standard for teaching psychomotor skills, the utilization of computer-based video instruction or CAI often frees up staff in order to be more effective and efficient teachers, who can help to fine-tune skills. CAI can potentially be linked with expert feedback; one study has shown that the combination of external feedback with CAI led to a higher level of mastery of knot-tying than CAI on its own.³¹

Box trainers are one method of utilizing video and CAI to teach psychomotor surgical skills to residents. They use real surgical instruments and equipment including video monitors, cameras and laparoscopes.³² Various targets can be manipulated within the box using the instruments, and visual information is relayed via a video source and

display that is similar to ones used in most operating rooms. One limitation is that while the instruments are real, the “tissue” within the box is not.³² This limits the amount of tactile feedback that can be experienced. Yet, practicing skills and tasks that resemble parts of true operations, such as laparoscopic cholecystectomies via a box trainer, has been shown to stimulate the learning of psychomotor skills.³² Box trainers have been shown to be effective in teaching psychomotor skills, particularly to junior or novice residents or medical students.³³ Residents who receive training on laparoscopic box trainers have been shown to perform dissection more quickly, made fewer errors and had higher economy-of-movement scores during a laparoscopic cholecystectomy than residents who did not receive virtual reality training.^{34,35}

Virtual reality surgical simulators are some of the latest developments in the area of surgical simulation and technical skills training. They provide a more believable practice environment than box trainers, which in turn provides higher validity and fidelity.³² They are available for more advanced and complicated procedures that require a higher degree of dexterity and technical skill, such as carotid artery stenting.³³ The Minimally Invasive Surgical Trainer (MIST) is one of the most extensively validated virtual reality training systems.³² Surgical residents who practiced with virtual reality simulators, such as MIST, and performed a diathermy task to an expected level of performance, went on to perform faster and with fewer errors in excising the gallbladder off the liver bed than those who had not had such practice time.³⁴ While it has been demonstrated that psychomotor skills improve after training on both video and virtual reality trainers, the virtual reality training group improved more than the video training group, and the ultimate operative performance improved only in the virtual reality training group.³⁵ Yet, it is important to note that even the most advanced virtual reality training systems that offer built-in haptics or force feedback has not yet been shown to significantly contribute to training, although it does significantly contribute to the cost of the devices.³⁷

Methodology

It was assumed that the literature used for the review was written within the last ten years, with the exception of literature used for historical context and background history. Second, it was assumed the target audience had basic knowledge of the topic.

This paper has a limited application. It was developed for a target audience of people who have achieved degrees in higher education. It was also developed in a retrospective design, since the video component had been created a year

prior to writing this paper.

Various research methods were utilized in writing this paper. These included online search engines, search terms, Boolean strings expert consultation and direct e-mail correspondence with OMM department representatives and experts in the field of OMT and education.

There were four search engines utilized in the search of literature: Google, PubMed using LinkOut, Ovid and ERIC. Google was the first search engine used, simply due to its broad nature. The first search term used for the search of the literature was “video teaching psychomotor skills.” This search term brought back 16,500 results, and Google Scholar had 9,540. From browsing through the first 40 results on Google Scholar, three articles and book chapters were found that were applicable to this paper. The next Boolean string used in Google was “teaching psychomotor skills AND video.” This Boolean string brought back 17,200 results and 8,820 from Google Scholar. This search yielded four articles that were applicable to this paper. Another search term was “video psychomotor skills,” which yielded 33,200 results in Google. From this search, one PowerPoint presentation and one book chapter were found to be related to this paper. The final search term was entered as a Google Advanced Search, which included the words “video teaching psychomotor skills” and excluded the words “virtual” and “reality.” This search resulted in 8,510 articles and books, of which one article was found to be highly relevant to this paper.

PubMed using Linkout was the next search engine utilized. From one of the previous searches in Google, the article by Reznick¹⁰ had been found. The title of this article was entered into PubMed, which came back with 88 results that had the same phrases or relation to the article. Of those results, four articles were found to be relevant to this paper.

The Ovid Nursing Database was another search engine utilized in the review of literature. The search term “video teaching psychomotor skills” was entered with the “include related terms” option, yielding 9,201 results. When the same search term was entered with the “limit to full text” option, 3,427 results were found. This result yielded three articles that were relevant in the review of literature, although one of them was a duplicate article already found through PubMed.

From an expert consultant, a file folder containing articles on teaching and testing psychomotor skills was obtained. After looking through the articles, two were found to be relevant to this paper. The article by Salyers²² proved to be the most helpful and relevant. The title of the article was entered into the Google search engine, which came up with 13 other articles that had cited it as

A.T. Still University Kirksville College of Osteopathic Medicine

Osteopathic Manipulative Medicine (OMM)

Faculty Position Opening



Requirements

- NMM/OMM or CSPOMM Board Certification
- Proficiency in both Direct and Indirect OMT Techniques such as HVLA, Muscle Energy, Counterstrain, Cranial, and Balanced Ligamentous Tension
- Able to work as part of a team
- Eligible for Medical License in the State of Missouri

Job Duties

- Table training OMM skills laboratories
- Coordinating, preparing and delivering OMM lecture and laboratory didactics
- See OMM patients in outpatient and inpatient settings
- Additional duties as directed by Department Chair or Dean

Additional qualifications recommended

- Experience with inpatient OMM
- Proficiency in OMM for children, infants and newborns
- Experience in OMM research
- Proficiency with Microsoft Word and PowerPoint

Salary and Benefits

- Salary derived from both academic salary and clinical income
- Full benefit package – health, life, dental, vision, retirement
- Paid leave and CME money available

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a reference. Of these 13 articles, three were found to be useful for this paper. Google also cited articles that were “related articles,” of which two were found to be useful. One of these articles was found in the ERIC database. A search was then performed in the ERIC database using the Boolean string “teaching psychomotor AND video NOT virtual reality,” with limits for articles published within the last ten years. There were ten results, none of which were helpful in writing this paper. Another Boolean string was entered, this time “teaching psychomotor skills NOT virtual reality” with the same search parameters. This time, 209 results were found, of which 69 were under a subheading of “skills development.” Of these articles, one was found to be useful for this paper.

While 22 articles and two book chapters were found using search engines and online databases, the sources they cited provided the rest of the information. By reading through each of the articles and then looking at their own sources, the additional articles for the review of literature were obtained. This was perhaps the most helpful and most useful part of reviewing the literature, as it provided new articles and new journals as sources.

From the same expert consultant that had a folder full of various articles, of which two were ultimately useful for this paper, an e-mail list of the national representatives of the different OMM departments at various osteopathic medical schools was obtained. An e-mail was individually sent to the representative at each school, asking four questions about their OMM curriculum for first- and second-year osteopathic medical students (Appendix A). A total of 26 e-mails were sent to the individuals who represent the osteopathic medical schools in the United States on the Educational Council on Osteopathic Principles (ECOP), under the aegis of the American Association of Colleges of Osteopathic Medicine. The 26 osteopathic medical schools are located in Arizona, California, Colorado, Florida, Georgia, Illinois, Iowa, Kentucky, Maine, Missouri, Michigan, New Jersey, New York, Nevada, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Virginia, Washington and West Virginia. One e-mail was returned due to an inaccurate e-mail address. Of the 25 e-mails that were successfully sent, 12 responses were received by October 13, 2010—four weeks after the initial e-mail was sent. No follow-up or reminder e-mails were sent to attempt to increase the response rate due to time constraints.

Results

As technology has become more and more advanced, it has been applied to various aspects of education and academia. Recently, it has been used in the

teaching of psychomotor skills, often in the healthcare field. Although the use of videos appears to be an extremely useful adjunct to the teaching of various psychomotor skills, they are not a complete substitute or replacement for instructor guidance in a lab-based setting when it comes to learning OMT.

In this era of technological dependence, videos and multimedia simulations have been utilized in teaching psychomotor skills. It has been shown that simulations which take advantage of videos and computer technology provide a comprehensive introduction to the motor skills involved in performing physical procedures.¹³ Some studies have shown that videos may lead to superior performances in CPR than traditional classroom training¹⁸ and improvement in psychomotor skills such as bag-mask ventilation.¹⁹ However, it is important to note that video and multimedia technology only provide a superficial introduction to the overall knowledge and skill set needed to perform a psychomotor skill. Faculty contact remains a very important factor when students are learning to perform basic psychomotor skills.¹⁴ Hands-on practice time has also been shown to improve the execution and performance of psychomotor skills.²¹ It has been noted that OMT is a hands-on skill that requires someone present to assist and facilitate in student learning, and that OMT may become a lost art if osteopathic medical schools become completely reliant on videos to teach it (A. Woolley, personal communication, October 5, 2010).

Videos and multimedia simulations have also been used to teach basic psychomotor skills for both nursing and medical students, as well as surgical residents. While cognitive final exam scores improved after the use of web-enhanced learning that included video, there was no significant performance difference in performance skills.²² This would indicate that, although video may enhance cognition and awareness, it does not improve actual execution of a psychomotor skill set. It has been noted before that CAI with interactive video should not replace instructor demonstration.²⁴ Often, students need to physically see a task performed in order to process the subtle nuances and spatial relations. The specific details of spatial relations can be difficult to illustrate in only two dimensions, as they are shown in videos. The use of videos in teaching medical students basic psychomotor skills has been shown to be as effective as summary expert feedback, which occurs when the instructor provides feedback to the students at the end of their performance.³⁰ However, the presence of the instructor and the ability to give feedback immediately following the completion of a psychomotor task or skill cannot be undervalued. The combination of both external feedback from an expert with CAI has been

shown to lead to a higher level of mastery in tying surgical knots than CAI on its own.³¹ Thus, the presence of an expert instructor in the classroom or laboratory setting to provide instant feedback and demonstrate techniques as needed cannot be replaced by CAI or video alone.

OMT cannot be completely related to various other psychomotor tasks that are taught to nursing and medical students, or even to surgical residents. Unlike medical skills such as blood draw or lumbar puncture, where results are seen when fluid such as blood or cerebrospinal fluid is obtained, OMT requires palpatory feedback that is not easily visualized. Students often need affirmation and confirmation that what they think they are feeling beneath their hands is true. This tactile experience and tactile feedback cannot be accomplished by video alone. Even advanced virtual reality training systems that have haptics or force feedback have not been shown to contribute significantly to the training of a surgical resident.³⁷ One product that was once marketed was a virtual spine, which osteopathic medical schools could purchase and utilize in the teaching classroom for students to obtain palpatory and tactile feedback on a quantitative scale (R. Hruby, personal communication, October 13, 2010). However, these devices have not made it into mainstream use as a tool for teaching palpation and psychomotor skills to osteopathic medical students. Thus, the limited amount of technology that is available for teaching psychomotor skills illustrates the need for personal interaction and instruction, and emphasizes the need for table trainers and preceptors to be physically and readily available when teaching these types of skills.

The use of multimedia and video has become prominent in educational curriculum, and concurrently has been reflected in the methodology of teaching of OMT to osteopathic medical students (Appendix B). Of the 12 OMM department representatives who responded to the e-mail survey, all of them indicated they utilize instructors during lab time to teach OMT (Appendix B). These instructors included physicians, faculty, pre-doctoral teaching fellows, teaching assistants, visiting or rotating students, sports medicine fellows and neuromusculoskeletal medicine/osteopathic manipulative medicine fellows (Appendix B). The prevalence of instructors that are involved in the lab and teaching OMT reflects the integral part they play in the accumulation of knowledge and skill. All of the OMM department representatives also indicated they utilize PowerPoint in teaching, and four of them record the lab sessions so they may be viewed by students at a later time if needed (Appendix B). Nine of the schools indicated they have online video as part of their educational curriculum (Appendix B). It is important to note that

the OMM department representatives stressed in their e-mail responses that these videos were only intended for additional study and as an adjunct to lecture and lab, and were not meant to replace the lab experience or instructors' guidance. Only two of the schools indicated they used live video feed to teach OMT (Appendix B). None of the schools relied completely on video to deliver their curriculum and to teach OMT to the osteopathic medical students (Appendix B). Thus, while multimedia simulations and videos serve as a valuable adjunct and additional tool for instructors to teaching OMT, it has not replaced the need for facilitator contact or instructor demonstration and guidance. Live video does not, at this point in time, appear to be a viable alternative to traditional didactic lecture and lab-based practice sessions under direct instructor guidance when it comes to teaching OMT.

Learning Objectives

1. Illustrate the history of how psychomotor skills have traditionally been taught.

The first learning objective was met, mainly through a thorough review of the literature. In the review of literature, Bloom's taxonomy of psychomotor domains was covered,^{4,5,6} and the progression of how psychomotor skills were traditionally taught was reviewed. This included modeling and demonstration,⁹ acquisition of motor skills^{10,11} and multimedia simulations¹³ including CAI and CAIVI.¹⁵

2. Evaluate the current use of video in teaching BLS and CPR.

The learning objective was met, mainly through a thorough review of the literature. Videos for teaching BLS and CPR have been utilized with varying degrees of success,^{17,18,19,20} and that hands-on practice time improves performance regardless of instructional method.²¹ This indicated that, while video may be used to teach a psychomotor skill in the healthcare field, there are varying degrees of success with its utilization. It also demonstrated that the most important part of learning a psychomotor skill was hands-on practice time, which illustrated the need for protected practice time with instructor availability.

3. Determine how video has been utilized in nursing education to teach psychomotor skills.

The learning objective was met through a thorough review of the literature. Nursing education has also utilized video in teaching psychomotor skills, often with increased student satisfaction.²⁶ Yet it is important to note that many of the studies on the use of video and multimedia in nursing education have severe methodological flaws that limit their external validity.^{27,29}

4. Understand the differences between video and virtual reality in teaching surgical skills.

The learning objective was met through a thorough review of the literature. Both videos and virtual reality have been utilized in teaching surgical residents psychomotor skills. Videos, through the use of box trainers, have been shown to improve the performance of psychomotor skills in the operating room,^{33,34,35} although the limitation of not having actual contextual or tissue feel was noted.³² Virtual reality has been very promising as a high fidelity model for teaching and testing psychomotor skills, and it has been shown to improve operative performance,³⁶ yet it can be very costly and difficult for many programs to obtain.³⁷

5. Identify the utilization of video in teaching OMT in osteopathic medical schools in the United States.

The learning objective was met, although there were difficulties with a limited number of e-mail responses from the OMM department chairs at the 26 osteopathic medical schools in the United States. The lack of e-mail response had a moderate effect on the learning objective since not all of the schools responded, thus limiting the amount of data and information obtained to those of the respondents. While many of the osteopathic medical school campuses utilize video as an adjunct to traditional didactic lecture and lab-based practice session, only two utilize live video feeds as part of their curriculum (Appendix B). It appears videos are utilized in teaching OMT mainly as a study adjunct and not as the main educational tool for curriculum delivery.

6. Determine if the use of live video streaming is a viable option for teaching OMT to remote osteopathic medical school campuses.

The learning objective was met through a thorough review of the literature, critical analysis, and application of the literature and data obtained from e-mails from OMM department representatives (Appendix B). At this point in time, live video streaming is not a viable option for teaching OMT to remote osteopathic medical school campuses, and technology alone is not enough to teach a psychomotor skill. This is illustrated by the varying degrees of success in improving performance when utilizing video or CAI.^{17,18,19,20,24} Additionally, all of the OMM departments at the osteopathic medical schools utilize various instructors during their lab-based sessions (Appendix B), which provides a high amount of individualized attention and feedback for the students. The reliance on personal attention and low student-to-facilitator ratios appear to be integral in the ability of students to perform the psychomotor skill of OMT, although no formalized studies have ever been conducted.

Discussion

With advances in technology, multimedia and video have been utilized with increasing frequency in education, particularly in the realm of teaching psychomotor skills. It is seen in the fields of cardiopulmonary resuscitation and basic life support, nursing education, medical student education and surgical resident education. The studies find the results to be varied, with some evidence supporting that the use of video improved performance of psychomotor skills, and others finding improved psychomotor performance through the use of traditional instructor-based lab sessions. Recently, live video streaming has been proposed to teach OMT to osteopathic medical students in a remote satellite campus. There have been no studies thus far that examine the use of multimedia simulations or videos in teaching OMT, let alone using it as a mechanism for curriculum delivery to a remote campus. Currently, very few osteopathic medical schools utilize live video feeds as part of their curriculum, although the majority utilizes some form of multimedia.

Conclusions

While multimedia simulations and videos are valuable adjuncts when it comes to teaching psychomotor skills, the use of live video streaming is not a viable alternative to traditional didactic lecture- and lab-based practice sessions with direct facilitator contact and instructor demonstration and guidance when it comes to teaching OMT to osteopathic medical students in a remote satellite campus.

Implications

The implications of this study mainly impact OMM departments that develop osteopathic practice and principles curriculums and osteopathic medical students who receive it. It has implications beyond the single satellite campus and for the osteopathic profession in general. It has shown that video alone is not a viable mechanism for teaching psychomotor skills, and that instructor guidance and feedback is needed in order to achieve improved performance and proficient skill. It illustrates the need for protected instructor and facilitator time to provide feedback to students, and that a curriculum which focuses on teaching psychomotor skills cannot completely rely on technology alone.

Recommendations

There have been no studies on the effect of teaching OMT through the use of video alone. These studies must be done to see if students who learn from multimedia or video instruction rather than human

connection and lab practice sessions with instructor guidance and feedback perform differently on practical examinations. Furthermore, studies need to be done which look at the outcomes of various teaching methodologies on student performance of psychomotor skills. Other studies might examine the relationship between faculty-to-student ratios and the performance of OMT on a practical examination or in clinical practice.

Appendix A

E-mail Sent to ECOP Representatives

Dear Dr. _____,

My name is Mariko Ferronato, and I am a fifth-year Pre-Doctoral Teaching Fellow at the College of Osteopathic Medicine of the Pacific (COMP). I received your e-mail contact information from Dr. Ray Hruby. Throughout my time at COMP, I have concurrently been working on a Masters Degree in Health Sciences, focusing on Health Professions Education. One of the requirements in completing this degree is that I complete a final special project and write a thesis.

My thesis topic looks at the use and efficacy of video in teaching psychomotor skills. I am particularly interested in this application when teaching OMT. As more and more satellite campuses are opening, how to deliver OMM curriculum to students at these remote campuses, which do not yet have robust OMM departments or teaching fellows, has become a challenge. One of the proposed methods is the use of live video streaming of lectures, along with a handful of table trainers.

I am currently in the process of doing research for my thesis. In addition to doing a thorough literature review on the use of video in teaching psychomotor skills, I am also contacting each of the OMM departments at the osteopathic medical schools. The information I would like to obtain includes the following:

- 1) How many students are in each of the classes that are taught? Are all the first years taught at the same time or are the classes split? What about the second years?
- 2) How many table trainers does your department have? How many faculty? How many undergraduate fellows? How many teaching assistants?
- 3) Do you use any type of media, including PowerPoint, videos or other?
- 4) Do you make use of videos in teaching?

The information may be included in my final thesis, which will be presented to three members of the College of Allied Health Professions faculty during my thesis defense, along with one member of my NMM/OMM Department. If you prefer that your information be kept anonymous, please let me know. I am mainly looking to see if any other campuses have experience using videos and remote teaching of OMT.

Thank you very much for your time and consideration!

Sincerely,

Mariko Ferronato, OMS IV

Pre-Doctoral Teaching Fellow V

Appendix B

Survey of Osteopathic Manipulative Medicine Department Representatives

Students per Class	Students per Lab	Instructor Type	Media Used	Live Video	Online Video
134 - 142	80	Physicians	PowerPoint, recorded labs	No	Yes
220	45	Faculty, PdTF's, Teaching Assistants	PowerPoint, recorded labs	No	Yes
240	120	Faculty, PdTF's, Fellows (SM)	PowerPoint, video, clickers	No	Yes
300	25-60	Faculty, Fellows (NMM/OMM)	PowerPoint, Polycom	Yes	No
175-217	110, 158	Faculty, Residents, Teaching Assistants	PowerPoint, video	No	Yes
125-130	125	Faculty, PdTF's, Teaching Assistants	PowerPoint, video	No	Yes
135	45	Faculty, PdTF's	PowerPoint, video	No	Yes
270	64-66	Faculty, PdTF's, students	PowerPoint, video	No	Yes
250	250	Faculty, PdTF's, Teaching Assistants	PowerPoint, recorded lab	Yes	Yes
80-91	25-30	Faculty	PowerPoint	No	No
56	56	Faculty, visiting students	PowerPoint	No	No
220	110	Faculty, PdTF's, Teaching Assistants, visiting students	PowerPoint, recorded lab	No	Yes

*PdTF's = Pre-Doctoral Teaching Fellows

*Fellows (SM) = Sports Medicine Fellows

*Fellows (NMM/OMM) = Neuromusculoskeletal Medicine/Osteopathic Manipulative Medicine Fellows

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Ann Habenicht, DO, FAAO, FACOFP, Program Chair

Dr. Habenicht, a 1982 graduate of Midwestern University/CCOM, is board certified in both OMM and Osteopathic Family Practice. She is a Professor of OMM at CCOM, and is in private practice in Oak Forest, IL, and urgent care in Orland Park, IL. Dr. Habenicht is a Fellow of the AAO and the American College of Osteopathic Family Practitioners. She is a Past President of the AAO, and has served as Chair of the organization's Education Committee.

Wm. Thomas Crow, DO, FAAO, Presenter

Dr. Crow is a 1987 graduate of the University of North Texas Health Science Center/TCOM, and is certified by the American Osteopathic Board of Neuromusculoskeletal Medicine. He is the Director of the Family Medicine/ NMM Residency Program at Florida Hospital East Orlando. Dr. Crow is a professor at the University of Health Sciences at Kansas City, Pikeville College of Osteopathic Medicine and Nova Southeastern College of Osteopathic Medicine. He has lectured in widely in the United States, as well as in Japan, Australia and Germany, and is the author of multiple research papers.

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The iliolumbar ligaments: A literature study

Luc Peeters, DO (UK)

1. Introduction

As A.T. Still stated, anatomy is the most important basic medical science upon which osteopathy is based. In this context, the following literature study of the anatomy and the resultant biomechanics and palpation provides an update of anatomy and biomechanical functional knowledge of the osteopath.

2. Development

Ligaments normally develop during the late embryonal or early fetal period. After dissection of five newborns, Luk, et al., found no iliolumbar ligaments.¹

These authors researched the anatomy and histology of the iliolumbar ligaments in cadavers of newborns to elderly specimens. They found the structure of the iliolumbar ligaments to be muscular—not ligamentous—between the ages of 10 and 20 years.

The ligamentous structures were formed by metaplasia of certain fibers of the quadratus lumborum muscle. As of 20 years of age, the definitive ligaments are formed. In older cadavers, degenerative changes were found in the iliolumbar ligaments. They concluded that the iliolumbar ligaments most likely play a stabilizing role in the general lumbosacral stability in patients with disc degeneration, degenerative spondylolisthesis and pelvic unlevelling due to neuromuscular scoliosis.

Uthoff studied 21 fetus cadavers younger than 11 weeks and identified no iliolumbar ligaments.² In 12 older fetus cadavers (older than 11.5 weeks old), they found the iliolumbar structures, contradicting Luk et al. The iliolumbar ligaments were recognizable from the transverse process of L₅ to the anterior surface of the ilium and dividend into anterior and posterior parts. These could clearly be separated from the quadratus lumborum, most notably due to different fibre orientation. In only two cases were the iliolumbar ligaments found to be from the transverse process of L₄ and clearly defined from the intertransverse ligaments.

Pun, et al., studied the presence of iliolumbar ligaments in quadrupeds and in rhesus monkeys.³ The difference between both groups is that the rhesus monkeys frequently sit, while the quadrupeds do not sit and therefore the spine remains horizontal. Iliolumbar ligaments were found in the rhesus monkeys but not in the quadrupeds. The

iliolumbar ligaments bound the last, sometimes the second-last lumbar vertebra to the ilia. They concluded that the mechanical stress upon the lumbosacral structures due to the vertical sitting position in the rhesus monkeys plays an important role in the formation of these ligaments.

Jiang, et al., studied the presence of lateral ligaments in the spine of quadrupeds and in bipeds.⁴ They found anterior and posterior ligaments, but no lateral ligaments in quadrupeds compared to the bipeds. Furthermore, scoliosis does not develop in quadrupeds, but is a frequent occurrence in bipeds.⁵ This suggests that the lateral ligamentous structures play an important role in standing postures.

3. Anatomy

The anatomic descriptions of the iliolumbar ligaments do not provide a unanimous view of these structures. More specifically, the attachments onto the ilium demonstrate significant variation. Agur and Dalley and Moore and Dalley describe the attachments as being onto the ilium. Hollinshead describes them as being onto the internal surface of the ilium.^{6,7,8} Boileau, Grant and Basmajian, Hall-Craggs and Snell describe the attachment onto the iliac crest.^{9,10,11} Wood Jones describes the attachment as being the medial lip of the iliac crest.¹² Romanes, Woodburne and Burkel describe the attachment as onto the posterior surface of the internal lip of the iliac crest.^{13,14} Hanson and Sonesson describe the attachments as being the upper and anterior surface of the iliac tuberosity.¹⁵

In *Gray's Anatomy*, the iliolumbar ligaments are described as running from the tip of the lower anterior part of the transverse process of L₅, with a weak part from

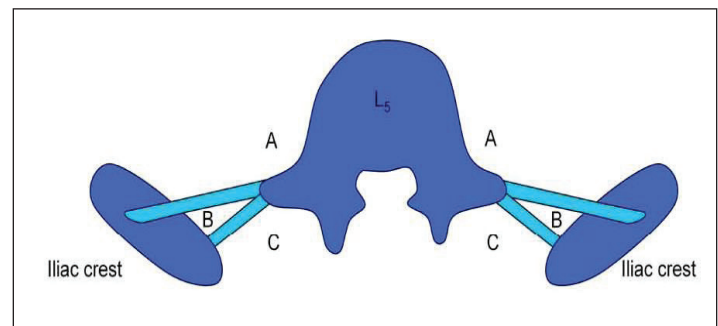


Figure 1: Two bands attaching onto the tip of the transverse process L₅

the tip of the transverse process of L₄ to lateral/posterior, attaching onto the anterior/upper surface of the iliac crest.¹⁶ A lower part of the ligament is also described from the tip of the transverse process of L₅ to the anterior surface of the sacrum.

Luk, et al., found the iliolumbar ligaments to be two different bands, both beginning from the tip of the transverse process of L₅ (**Figure 1**).¹ The anterior part lies predominantly in the coronal plane to terminate into the periosteum of the anterior edge of the iliac crest. The posterior part runs oblique and posterior to insert into the posterior surface of the iliac crest. The quadratus lumborum (B) lies between both parts. The psoas (A) lies on the anterior surface of the ligament and the erector spinae (C) upon the posterior side.

In their study, they found these structures in newborns were muscular, while, between the ages of 20 to 40 years, muscular fibers were still found between the ligamentous fibers. From the age of 50 years, clear degeneration and fatty infiltrations were seen. Such fatty infiltrations were more evident in women than men.

The change from muscular to collagen fibers occurs as from the transverse process and gradually spreads toward the iliac crest.

Bassadonna, et al., described the anterior part of the iliolumbar ligament as broad and flat, from the inferior, lateral part of the tip of the transverse process spreading to the anterior part of the iliac tuberosity, caudal from the posterior part of the ligament.¹⁷ The posterior part of the ligament descends from the apex of the tip of the transverse process of L₅ to the iliac crest (anterior edge to apex). The posterior part is thinner and rounder than the anterior part.

Fujiwara, et al., studied the morphology, the length and the width of the iliolumbar ligaments, and could identify two different types:¹⁸

Type A: The anterior and posterior parts were in different directions.

Type B: The anterior and posterior parts were in the same direction.

The angle of the posterior part of the Type A ligament was oriented more to posterior than that of the Type B ligament. The posterior part was also shorter and orientated more to posterior in males than in females.

Rucco, et al., analysed 15 volunteers via MRI.¹⁹ They found the part of the iliolumbar ligament that originated from the transverse process of L₅ consists of two bands (anterior and posterior). The anterior band is flat and

broad and has two anatomical varieties: type 1, originating from the anterior part of the inferolateral surface of the transverse process of L₅ and attaching broadly onto the iliac tuberosity; type 2, originating from the anterior, lateral and posterior part of the inferolateral surface of the transverse process of L₅ and attaching broadly onto the anterior part of the iliac tuberosity.

The posterior band attaches onto the apex of the transverse process of L₅ and is fusiform. It runs to the anterior edge of the apex of the iliac crest.

In the transverse plane, the anterior band is in a horizontal line through the transverse process of L₅, and the posterior band forms an angle of 45°-55° (open posterolateral). In the coronal plane the iliolumbar ligament shows more variation related to the size of the vertebra. If L₅ is situated low in the pelvis, the iliolumbar ligaments are longer and more oblique, while, if the L₅ is situated high in the pelvis, the iliolumbar ligaments are shorter and more horizontal. The posterior band is thinner and rounder than the anterior band, which leads to more susceptibility for over-stretch and torsion. This is a likely explanation for the painful iliolumbar ligament syndrome.

Hanson, et al., found the length of the iliolumbar ligaments was also different between races.²⁰ Black subjects had longer (mean 61.6 mm) iliolumbar ligaments than Caucasian subjects (mean 33.2 mm). This difference was demonstrated in both sexes. One band was more common

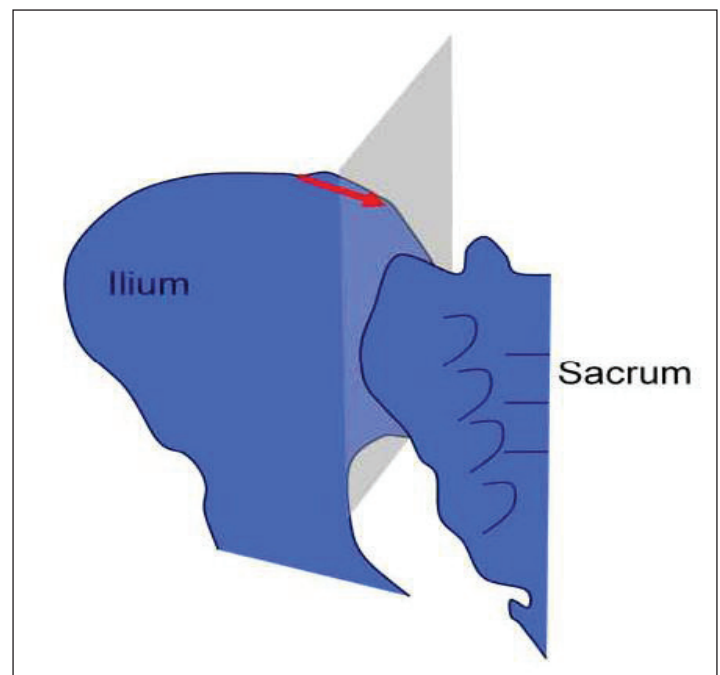


Figure 2: Posterior part directly along the plane of the IS joint.

among blacks, whereas caucasians demonstrated a split into two bands.

4. Biomechanics and function

4.1. Influence upon the iliosacral stability

Pool-Goudzwaard, et al., found, following severing of the iliolumbar ligaments, the range of motion of the iliosacral joint was significantly higher.²¹ According to that study, the anterior part of the ligament provides the strongest influence upon this mobility. They suggested that it is highly likely that surgical severing of this ligament during lumbosacral surgery could explain post-operative symptoms and instability.

The direction of the posterior part of the iliolumbar ligament is directly along the plane of the iliosacral joint (**Figure 2**). It also provides a compressing/coaptating function for the iliosacral joint.

4.2. Influence upon the stability and mobility of L₅ and L₄

4.2.1. In flexion/extension

Snijders suggests the iliolumbar ligaments play an important role in the motion of the lumbosacral junction in the sagittal plane.²² Counter-nutation places the ligaments under stretch and nutation shortens it. In osteopathic terms, this means an unstable pelvis involves shortening of the ligaments and a fixed pelvis involves ligaments under stretch.

4.2.2. During anterior glide

Aihara, et al., fixed the sacrum and ilia in five fresh cadavers with spondylolysis of L₅.²³ They induced varying flexion/extension and left/right rotation force upon L₄ and L₅ in flexion/extension, before and after severing of the iliolumbar ligaments. They found flexion and axial rotation is strongly regulated by the iliolumbar ligaments, most notably by the posterior part of the ligaments. They concluded the integrity of the iliolumbar ligaments, certainly the posterior part, determines the stability of the lumbosacral junction (**Figure 3**), as well as the grade of anterior glide of L₅ upon the sacrum.

While providing local treatment for an anterolysthesis of L₅, this fact must always be kept in mind. In this case, the iliolumbar ligaments must not be placed under extreme stretch so additional anterior glide is avoided.

4.3. Biomechanics in the frontal plane

The iliolumbar ligaments have a stabilizing capacity in the frontal plane at the spinal levels of L₅ and L₄ (**Figure**

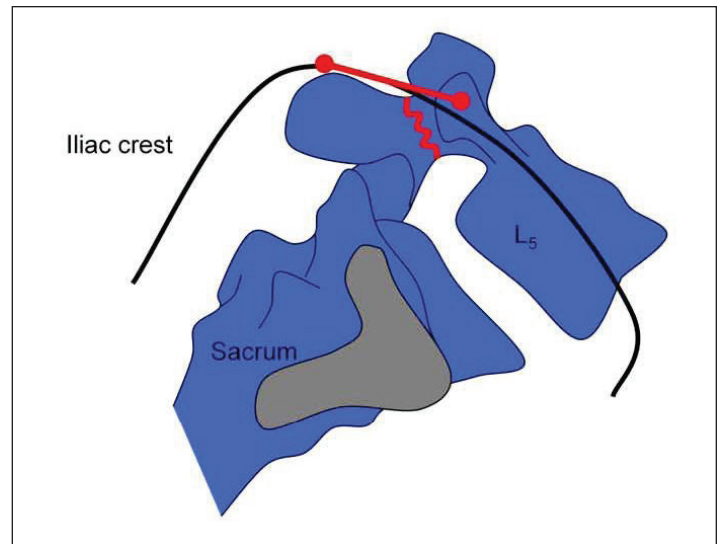


Figure 3: Side view of spondylolysis

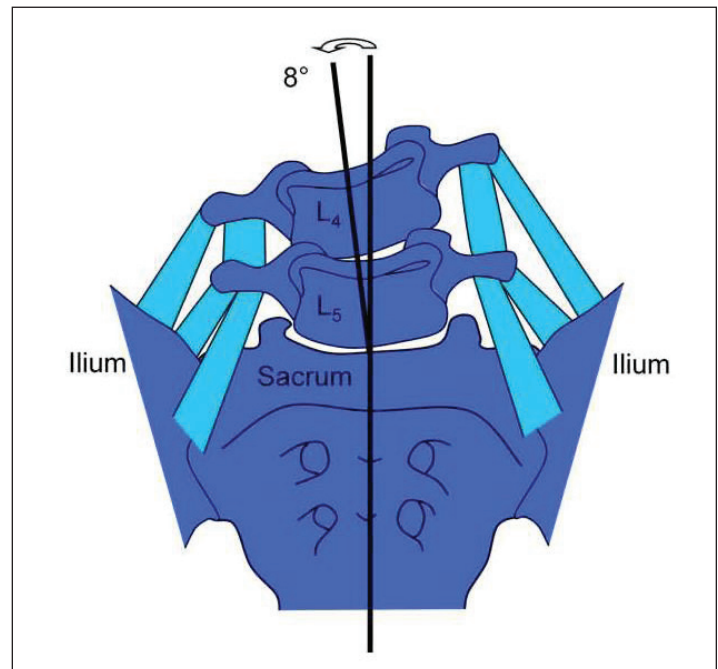


Figure 4: Stability in the frontal plane

4). While the iliolumbar ligaments are not always attached to the transverse process of L₄, the stabilizing capacity is continued to L₄ via the intertransverse ligaments (**Figure 5 & 6**). The stabilizing function allows approximately eight degrees of left sidebending and eight degrees of right sidebending. More sidebending than this means likely overstretch of the ligaments.

4.4. Biomechanics in the sagittal plane

The iliolumbar ligaments stabilize the lower lumbar spine in the sagittal plane (**Figure 7**). They act to control

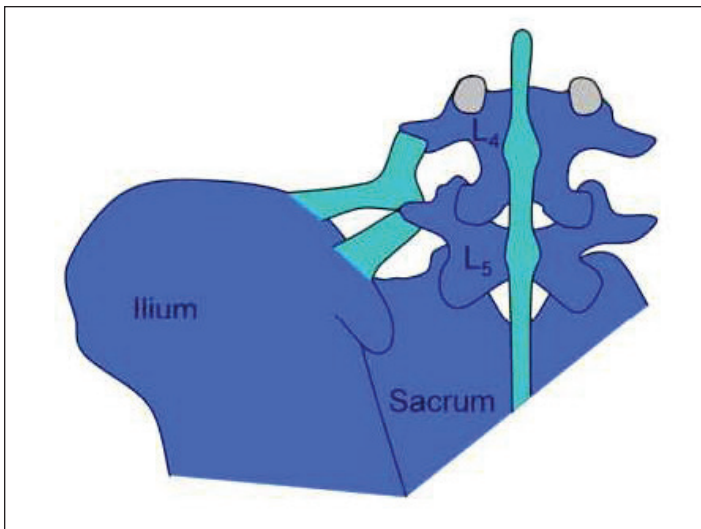


Figure 5: Anatomical variants

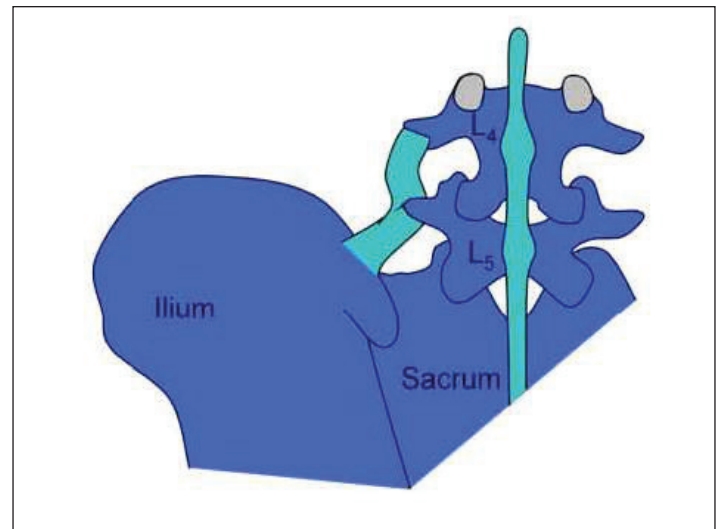


Figure 6: Anatomical variants

the flexion/extension mobility of L₄ and, most importantly, L₅.

During flexion, the iliolumbar ligaments are under stretch while they shorten during extension.

4.5. Biomechanics in the horizontal plane

In the horizontal plane, the iliolumbar ligaments also have a stabilizing role and limit the rotation of L₅ (**Figure 8**). In this way, the facet joints are protected from intense and repetitive compression. In cases of severed iliolumbar ligaments, facet degeneration is frequently found.

5. Pathology

5.1. Disc degeneration

In cadavers with disc degeneration of L₄-L₅ more than L₅-S₁, the anterior and posterior bands of the iliolumbar ligaments were generally shorter and thicker. In cadavers with disc degeneration of L₅-S₁ more than L₄-L₅, the ligaments were noticeably longer. From these observations, Aihara concluded short, strong iliolumbar ligaments protect the disc of L₅-S₁ against degeneration.²⁴ Fujiwara made the same conclusions in another study.²⁵

Ahn, et al., used MRI examinations to conclude it is not actually the length of the iliolumbar ligaments, but the left/right asymmetry in the orientation of the ligaments that plays the most important role in unilateral disc herniation of L₅-S₁.²⁶

5.2. Over-stretch

Ligamentous tension can lead to ligamentous complaints. Specifically, lower lumbar kyphosis leads—even without the factor of bodyweight—to over-stretch according to Snijders, who advises a sitting posture that is

not in kyphosis but more straight-back or with a lumbar support.²¹

According to Sims and Moorman,²⁷ microtraumas of the iliolumbar ligaments are often the cause of chronic lower back pain. The ligaments have significant nociceptive innervation and are placed under stretch during sacral flexion (sacrum posterior, fixed pelvis).

Keel showed this in a case study.²⁸

Hirschberg described the “Iliac Crest Syndrome,” in which the patient complains about unilateral pain over the iliac crest.²⁹ The pain can also present bilaterally, and occurs mostly after long periods of sitting and/or bending forwards.

Chronic over-stretch or traumatic over-stretch can lead to inflammation. This can in turn lead to periostitis, even osteitis at the insertion of the involved ligament. Traumatically, this can occur in sports (such as gymnastics) where extreme motions of the lumbosacral junction and legs are required.

5.3. Influence on the spinal ganglion of nerve root L₅

Briggs and Chandraraj dissected 65 cadavers and identified the iliolumbar ligaments in all specimens.³⁰ In 34 percent of the cases, the ligament made contact with the ventral ramus of L₅, and, in nine percent, there was a clear presence of flattening and compression of the ramus. The nerve was then clearly thickened and showed an increase in perineural connective tissue. The cells in the spinal ganglion were smaller than normal and surrounded by connective tissue, most notably at the peripheral part of the spinal ganglion.

In the cases where compression of the spinal nerve

L₅ was found, a narrowed lumbosacral space was also identified. The disc was also seen to be degenerated in these cases. On the same side, fibrotic changes of the facet joint were found. Therefore, compression of the spinal ganglion can occur not only in the intervertebral foramen but also just distal from the foramen.

5.4. Calcification

After dissecting 22 cadavers aged over 60 years, Luk, et al., found degeneration of the iliolumbar ligaments in 70 percent of the cases.¹ Some of the examples were even calcified.

This means the osteopath must be careful if manipulating this region in this age group.

The European Guidelines for the Management of Chronic Non-specific Low Back Pain advised against using prolotherapy (sclerosing injections) for the iliolumbar ligaments.³¹

6. Provocation and palpation

The palpation of the iliolumbar ligaments (**Photos 1 & 2**) is not simple due to their position— deep to the posterior muscles and fascia and ventral to the iliac crest.

The iliolumbar ligaments are associated with the inferior insertion of the thoracolumbar fascia and the quadratus lumborum muscle, which also complicates the palpation.^{32,33,18,34,35}

The direct palpation from posterior to anterior is made very difficult by the presence of the thoracolumbar fascia, the erector spinae and the quadratus lumborum. A more lateral approach avoids the erector spinae. However, the latissimus dorsi, transverse abdominal, external oblique and quadratus lumborum muscles cannot be avoided.

Palpation from the lateral edge of the paravertebral muscles to ventral/medial and caudal is the best choice. It is important to position the patient so the muscles superficial to the ligament are as relaxed as possible.

The palpation of the iliolumbar ligaments can be done with the patient sitting (**Photo 1**) with slight lumbar lordosis while supporting themselves with the hands behind the back or with the patient prone (**Photo 2**) with the hips in slight extension or in the so-called “sphinx position.”

The pain provoked by this palpation is not sharp but deep and aching. As well as the pain, the elasticity of the ligament can also be evaluated. Elasticity loss can indicate retraction, tension or even calcification of the ligament.

The pain from the provocation should not be confused with pain due to entrapment of the dorsal ramus L₁ or L₂

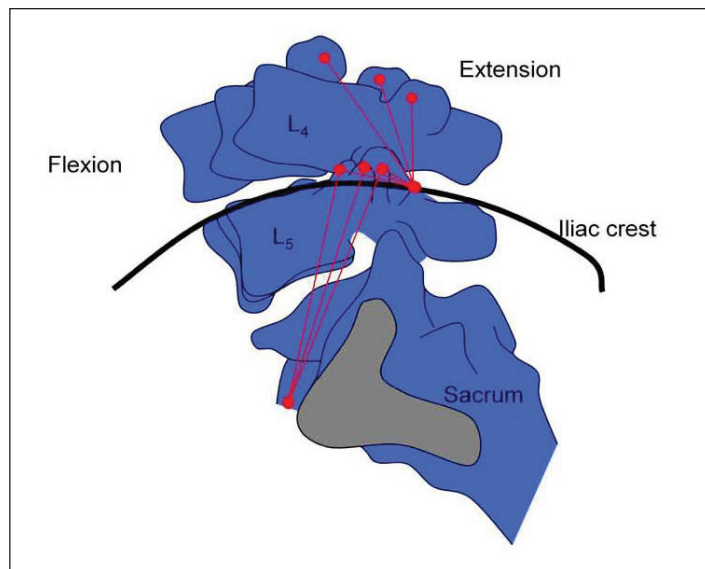


Figure 7: Stabilizing function in flexion/extension

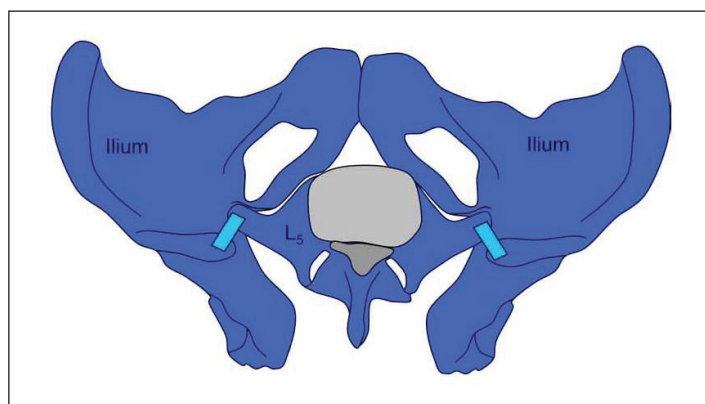


Figure 8: Horizontal view of the posterior section

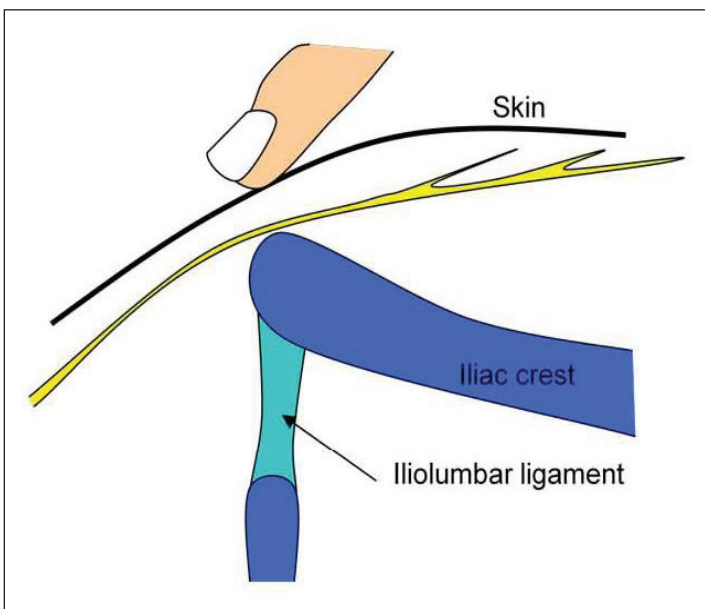


Figure 9: Palpation in case of nerve entrapment



Photo 1: Palpation of patient sitting

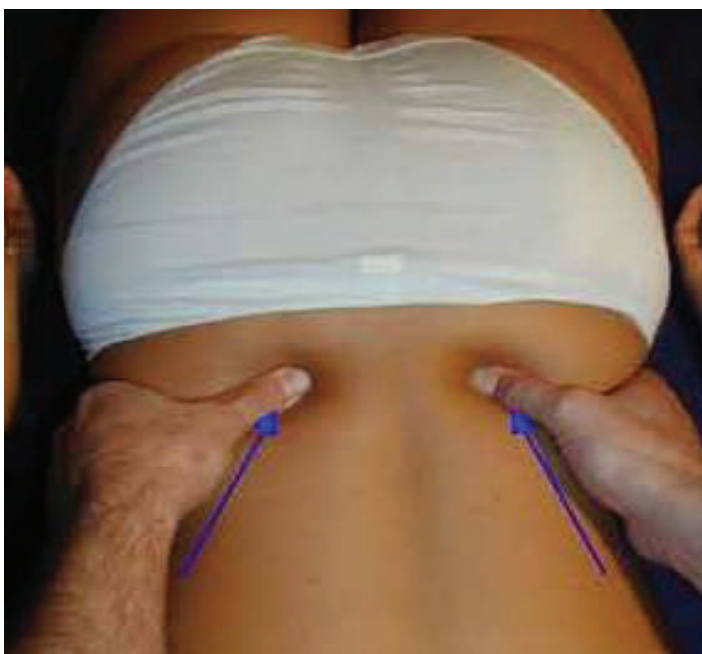


Photo 2: Palpation of the prone patient

nerve roots (**Figure 9**). These nerves cross the iliac crest approximately seven centimeters from the middle line and run through an osteofibrous opening where entrapment is possible. Maigne et al. first discovered these entrapment locations.³⁶

7. Conclusion

The iliolumbar ligaments play an important role in the stabilization of L₅, most notably limiting the flexion. In the frontal plane, they also act to stabilize the L₅ and L₄. In cases of spondylolysis of L₅, they are the only limiting factor for the anterior glide of the L₅. Symmetrical length and quality act to protect the facet joints from compression during axial rotation. They also function to stabilize the

iliosacral joints by compressing them.

The iliolumbar ligaments are frequently the painful structure in lumbosacral lower back pain. They can be over-stretched due to a flexion lesion of L₅ or due to a fixed pelvis (sacrum posterior), and can be retracted due to an extension lesion of L₅ or due to an unstable pelvis (sacrum anterior). They are placed under stretch during kyphotic sitting, and can be injured, and even tear, during sports that require extreme motion of the lumbosacral junction.

In cases of tearing or weakening of the iliolumbar ligament, the facet joint loses its protection against compression, and thus degeneration occurs more rapidly. Tearing or weakening also result in lost iliosacral joint coaptation, whereby hypermobility in the joint can result with more rapid degeneration. They play an essential protective role for the disc.

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CME QUIZ

The purpose of the quiz found on page 36 is to provide a convenient means of self-assessment for your reading of the scientific content in “The iliolumbar ligaments: A literature study” by Luc Peeters, DO (UK).

Answer each question listed. The correct answers will be published in the September 2011 issue of the *The AAO Journal*.

To apply for Category 2-B CME credit, transfer your answers to the *AAOJ* CME quiz application form answer sheet on page 36. The AAO will record the fact that you submitted the form for Category 2-B CME credit and will forward your test results to the AOA Division of CME for documentation. You must have 70 percent accuracy in order to receive CME credits.

Seated Facet Release Technique from the Still Family

September 23-25, 2011

Cavalier Hotel, Virginia Beach, VA



Faculty:

***Karen M. Steele, DO, FAAO, Program Chair
Thomas F. Steele, DO; Sarah Steele-Killeen, DO***

CME: This course anticipates being approved for 20 Hours Category 1-A by the American Osteopathic Association

Course Description:

During the late 1980s, Dr. Karen Steele spent Wednesday afternoons in the office of Richard Still, Jr., DO, great grandson of Andrew Taylor Still, founder of the osteopathic profession. During these afternoons in his office, Dr. Steele observed and assisted Dr. Still treating patients in the manner he was taught by George Andrew Laughlin, DO, son of Blanche Still, DO, daughter of A. T. Still.

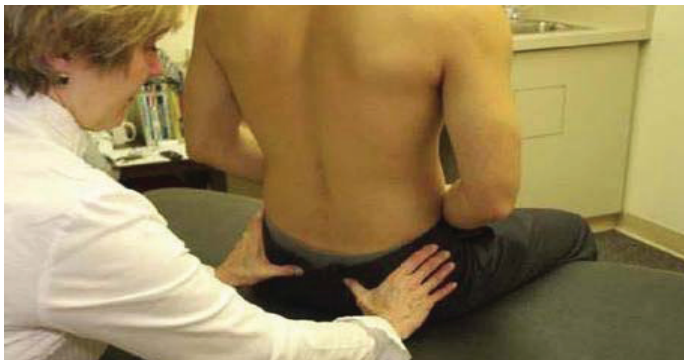
This technique treats the patient in the seated position, and relies on subtle palpation of the facet joints for diagnosis, positioning and release. The osteopathic physician is either standing or seated behind the patient. Thus, Dr. Still and Dr. Steele have chosen to call this approach the Seated Facet Release Technique (SFR).

In 2009-2010, Drs. Still and Steele collaborated on the creation of a course to teach this approach.

Objectives:

At the end of this course, students should be able to:

- * Describe the basic principles of the SFR technique
- * Test for and diagnose individual somatic dysfunction
- * Treat facet restrictions of the axial skeleton, ribs and sacroiliac areas with the SFR technique
- * Diagnose facet joint restriction in patients in the seated position
- * Guide seated patients into treatment position, so patients control their own weight while balanced over their pelvis
- * Induce movement in patients so the entire body is balanced on one facet joint while palpating for tissue response and avoiding strain on the operator.





Karen M. Steele, DO, FAAO, Program Chair and Presenter

Dr. Steele is a 1978 graduate of Kirksville College of Osteopathic Medicine. She is certified by the American Osteopathic Board of Family Physicians and the American Osteopathic Board of Neuromusculoskeletal Medicine. She is Professor and Associate Dean of Osteopathic Medical Education at West Virginia School of Osteopathic Medicine. Clinically, she focuses on the osteopathic treatment of children and is active in osteopathic research. Dr. Steele is also co-author of the recently released *Pocket Manual of OMT: Osteopathic Manipulative Treatment for Physicians*, 2nd Edition.



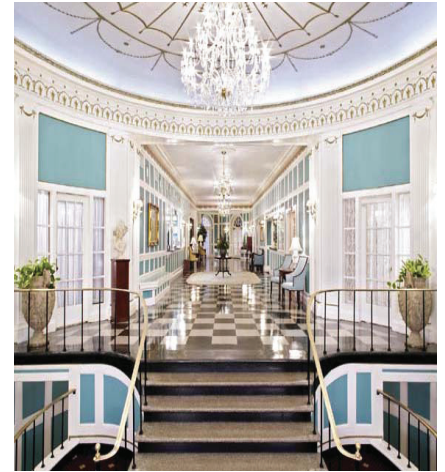
Course Location:
 The Cavalier Hotel
 4201 Atlantic Ave
 Virginia Beach, VA 23541
 (757) 425-8555 / (800) 446-8199
 www.cavalierhotel.com

Room rate: \$129 (single and double)
 Registration Deadline: August 23
 Please make room reservations
 PRIOR to August 23.

For the history buffs:
<http://www.cavalierhotel.com/history/index.cfm>

**For things to see and do in
 Virginia Beach:**
<http://www.cavalierhotel.com/attractions/index.cfm>

Cavalier Hotel Lobby



Photos courtesy of the Virginia Beach Convention and Visitors Bureau and Cavalier Hotel.

Cancellation and Refund Policy:

The American Academy of Osteopathy reserves the right to cancel an educational program if an insufficient number of physicians register. Sufficient registrations must be received 30 days prior to the opening of the course. If you are considering registering for a course less than 30 days prior to the opening, contact the Academy office before making travel plans. In the event of course cancellation due to lack of registrations, all registration money will be refunded. Cancellations from participants received in writing up to 30 days prior to the course opening are subject to withholding of a 20 percent administrative fee, or registrants may transfer 80 percent of their tuition to another educational program to be held within the next 12 months. For cancellations received in writing less than 30 days prior to the course opening, registrants may transfer 80 percent of their registration fee to another course to be held within the next 12 months. Registrants who fail to appear for an AAO program can transfer up to 50 percent of their registration fee to another AAO educational program to be held within the next 12 months if a written and signed explanation is received at the AAO office within 10 days of the scheduled course. All other cancellations will receive no refund or transfer of registration fees.

Registration Form

**Seated Facet Release Technique from the Still Family
September 23-25, 2011**

Name: _____
 Nickname for badge: _____
 Street address: _____

 City: _____ State: ___ Zip: _____
 Phone: _____ Fax: _____
 E-mail: _____

By releasing your fax/e-mail, you have given the AAO permission to send marketing information regarding courses to your fax or e-mail.

AOA#: _____

I require a vegetarian meal

(The AAO makes every attempt to provide meals/snacks that meet participants' needs but cannot guarantee to satisfy all requests.)

Registration Rates

On or before 8/23/2011 After 8/25/2011

AAO member	\$ 680.00	\$ 780.00
Non-member	\$ 780.00	\$ 880.00
Intern/Resident/Student	\$ 580.00	\$ 680.00

The AAO accepts checks, Visa, Mastercard or Discover

Credit card #: _____

Cardholder's name: _____

Expiration date: _____ 3 digit CVV#: _____

I hereby authorize the American Academy of Osteopathy® to charge the above credit card for the full course registration amount.

Signature _____

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Jenette “Nettie” Bolles: First woman to pioneer osteopathy

Janice Blumer, DO

In the days of pioneer spirit and “prairie schooners,” one powerfully determined Jenette “Nettie” Hubbard Bolles was the first woman to get an osteopathic medical degree from the American School of Osteopathy. It was a time when women were yet to have the right to vote. Henry Ford had not yet thought of the automobile, and commercial electricity was not readily available.

The year was 1894, and there were only 44 stars on the flag of the United States. Though much is written of the founder of osteopathy, Andrew Taylor Still, little is known about the feats of Nettie Bolles and her vast contributions to women and the osteopathic profession. In a time when women were rarely educated past primary school, Nettie received three higher education degrees and overcame colossal obstacles to become a beacon for the profession.

Women seeking higher education in the late nineteenth century encountered fierce resistance from the male dominated world of academia. In 1873, E. H. Clarke wrote in his book *Sex Education, a Fair Chance for Girls*, “Higher Education for women produces monstrous brains and puny bodies: abnormally active cerebration and abnormally weak digestion; flowing thought and constipated bowel.”¹ This was the prevailing attitude among the mostly male-dominated education system of the time. The 1850 class of male medical students at Harvard University, “Resolved, that no woman of true delicacy would be willing, in the presence of men, to listen to the discussion of the subjects that necessarily come under the consideration of the student of medicine,”¹ and further felt the female student “... is disposed to unsex herself, and to sacrifice her modesty by appearing with men.”¹

Many woman saw the frontier as their opportunity to help the sick and heal the ailing, as long as they could convince their patients that seeing a woman physician was better than dying. The male dominated miners, trappers and farmers of the time would endure pain and suffering rather than endure the embarrassment of seeing a woman to help them with their ailments. Women physicians had to withstand ridicule and harassment from skeptics and male physicians of the time, many of whom felt women should not engage in the medical profession at all.

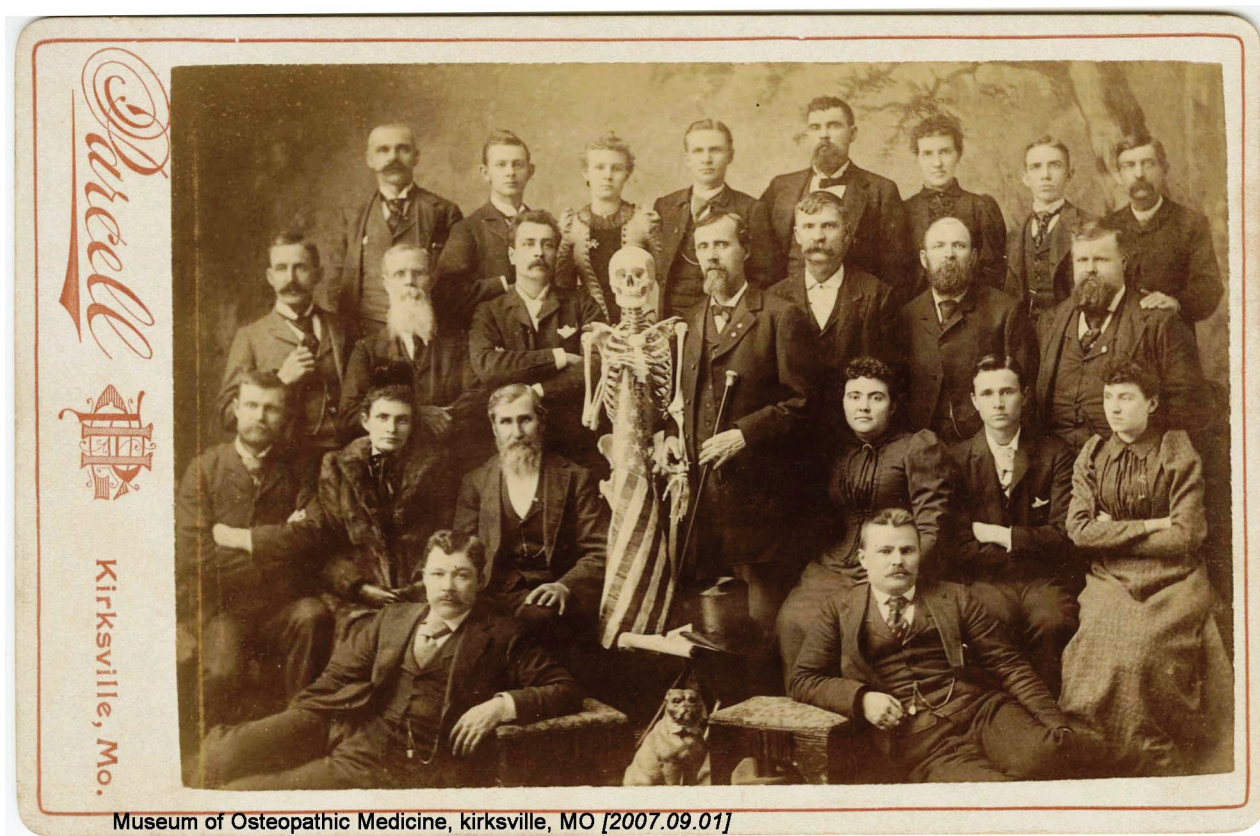
Andrew Taylor Still was a visionary who saw the future of medicine, and his vision took the frontier

physicians and gave them usable skills and a solid sense of anatomy with which to guide them. He envisioned a school that included women in medicine and saw them as integral to the fabric of the time. His school would provide many of the pioneer physicians and surgeons who were bound for the west.

Nettie Bolles was one of those pioneer spirits, and her accomplishments are extraordinary even by today’s standards. She achieved her status as a physician and academician before women even had the right to vote. The standards for the time dictated that women would marry, have children and focus on the household. Elizabeth Blackwell became the first woman to graduate from a U.S. medical school in 1848, and in a letter dated 1847 states, “But a strong idea, long cherished till it has taken deep root in the soul and become an all-absorbing duty, cannot thus be laid aside. I must accomplish my end. I consider it the noblest and most useful path that I can tread, and, if one country rejects me, I will go to another.”² Her tone, though positive, reflects the strong opposition to allowing women to practice medicine in the early nineteenth century. One hundred years after the first woman physician graduated from the osteopathic medical school, less than five percent of students entering medical schools were women.

Nettie Bolles was born September 12, 1863, in Douglas County, Kansas, to David and Jeanette Hubbard. Their family pioneered near Lawrence, Kansas. Nettie was educated in the public schools of Lawrence and Olathe, where her family settled and she lived until her marriage. At the age of 15, she spent some months traveling through France, Germany, Austria and Switzerland. She attended the University of Kansas and received her first degree, a Bachelor of Science, at age 18.

In the days before the Civil War, Nettie’s father was a militiaman in “bloody Kansas” when he was shot by a bushwhacker during the Quantrell raid. The bullet passed through his lung and into the door behind him. His recovery back was due to the skill of a young country doctor, none other than A.T. Still, MD. More than 30 years later, Nettie’s father had heard of a Kirksville, Missouri, doctor who was producing wonderful cures and felt he might be able to help Nettie’s mother, who was paralyzed with “rheumatism.” Coincidentally, it was the same doctor who had saved him in his militia days, Dr. A.T. Still.



The first graduating class of the ASO, 1894. Nettie Bolles is seated third from right in the second row.

Nettie married Nuwton Alden (N.A.) Bolles in 1887 in Olanthe, Kansas. They spent their honeymoon in the mines and orange groves of Hermosillo, Mexico. "Alden," as he was called, was superintendent of a gold mining business in Hermosillo, having extensive background in metallurgy and chemistry, and a degree from the University of Kansas.

At her father's request, Nettie came back from Mexico to take her mother for treatments in Kirksville. Nettie lived with Dr. Still and Blanche Still Laughlin in 1891. She watched with amazement as Dr. Still and his colleagues treated her mother with osteopathic manipulation. She was impressed, and during that year of living with Dr. Still and watching his philosophy in action, Nettie asked, "I wish you could teach me to do this."³ She was only 28 in 1891.

The next year, Dr. Still opened the American School of Osteopathy (ASO), and Nettie became one of five women students to enroll in the first class. Dr. Still openly embraced women in his new philosophy of medicine, allowing them to study and teach in his new school. Two of these women dropped out before graduating, leaving Nettie Bolles, Mamie Harter and Lou J. Kern to graduate

in 1894. Due to the alphabetical order of their last names, Nettie graduated first, giving her the honor of being the first woman osteopathic physician. After living and studying with Dr. Still, she stayed on and taught anatomy for two years at the ASO under Dr. Smith. [*Editor's note: Dr. William Smith was a physician recruited by Dr. Still to be the professor of anatomy at the ASO*]. She eventually replaced Dr. Smith as an anatomy professor at the ASO, becoming the first woman to teach anatomy in an osteopathic medical school. She stayed on as a professor at ASO for three years. During her first year, she had not yet finished her medical training.

In 1896, her pioneer spirit took her west to Colorado, where she had a sister living in Denver. She set up practice in Denver, and by then, her husband had left mining, enrolled in the ASO and was studying under Dr. Still. Colorado was the only state in the union at that time that allowed women the right to vote, having passed legislation to that effect in 1893. Women in the rest of the union would not have the right to vote until 1920. This may have been a factor in Nettie's decision to move to Denver, as well as her pioneer spirit, and the need for pioneer physicians. Four years after moving to Denver, Nettie and Alden established the first osteopathic school in Colorado,

the Bolles Institute of Osteopathy, where Nettie taught anatomy, gynecology and obstetrics. It operated from 1900 to 1904, when it merged with the ASO.

These years were rocky, as the profession was not yet widely known. Nettie was called a “quack” and resistance from the Denver medical community was fierce. It was Nettie’s character and persistence that won the community over. She had a genuine thirst for knowledge and an innate curiosity. In addition to her B.S. and D.O. degrees, she obtained an A.M. (Master’s) degree from the University of Denver. She joined the Chautauqua movement, an independent course of study for adults held regionally, usually in tents on a “well-drained field,” which she completed in 1891. She belonged to numerous organizations that spoke to the level of her character, such as the Daughters of the American Revolution, Osteopathic Women’s National Association (which she founded), the national sorority Phi Beta Phi, and the Order of the Eastern Star, a fraternal organization associated with the Masons. She also volunteered her medical expertise at local churches. Nettie was a crusader for children’s clinics in Denver, teaching public health and sanitation for the prevention of illness. She became a trustee and chairperson for the Committee for Public Health, and was a two-time vice president of the American Osteopathic Association (AOA), in 1897 and 1905. Three women, in fact, founded the AOA—Cornelia Walker, Minnie Potter and Irene Harwood—after reading *The Journal of Osteopathy*, of which Nettie was the first editor. These women felt the need to link osteopathic medical school graduates and students, and felt the AOA could fill that need.

It was her friendship with the wife of Colorado Supreme Court Judge Stuart D. Walling that helped Nettie navigate rocky times in her early Denver years. Mrs. Walling had influence and social status in Denver society, and this allowed Nettie to slowly win over the medical community. By the time the state association had been established, there were enough DOs in Colorado to develop credibility and influence as a profession. Nettie was not one to rest on the laurels of her professional success. She served for 19 years as hygiene chairperson, press chairperson and vice president for the Colorado Parent Teacher Association, reflecting her interest in the welfare of children. She set up numerous conferences on child welfare, and set up welfare clinics at many of the osteopathic conventions—all of this while continuing to teach anatomy, osteopathy, obstetrics and gynecology at the Denver school. Nettie was not only a clinician, academician and teacher, but also a mother and wife. She had two daughters, Helen Bolles and Esther Bolles, and raised her daughters to uphold her ideals. Esther

Bolles became an osteopath herself, graduating from A.T. Still College of Osteopathy in 1924. She also married an osteopath, Dr. Charles Robert Starkey.

By 1905, Nettie retired from teaching with the closing of the Denver school. The students of what was then the Colorado College of Osteopathy finished their training at the ASO in Kirksville. The number of students at the Colorado school was much smaller than those at its partner school, the ASO, so it was no longer financially viable. The Colorado School of Osteopathy closed its doors in 1905. However, Nettie continued to practice in Denver and uphold the numerous agencies and clubs to which she belonged.

By 1909, the Bolles’s marriage was failing, and Nettie filed for a divorce from Alden, citing “non support.” In the July 1909 issue of *The Osteopathic Physician*, an article stated, “It appears that Dr. N. A. Bolles has developed marked idiosyncrasies in the last year or two which have carried him so far into the realm of theories as to render him impractical and impossible as a husband and father... Dr. Bolles believed that he was on the highway to making important scientific discoveries ... abandoning all interest or effort in behalf of the welfare of his family.”⁴ The article goes on to say, “It was the strangest, yet withal, one of the most interesting hearings ever held... strange because of the apparent willingness ... of Dr. Bolles to permit his wife to have her decree... and anything she might demand... strange because of his perfect indifference.”⁴ Dr. N. A. Bolles became so wrapped up in his experiments and “new-thought religion” that he became unable to support his family. The presiding judge said in his closing statement, “The best thing that you can do, Doctor (N.A.) Bolles, which will be more to your credit than pursuing the visionary schemes for the betterment of humanity, in which you have been wasting your time for so many years, will be to set yourself to work and try to win back the love which your wife once had for you. You can do it if you will. You have lost that love simply because you have been so wrapped up in the pleasures of scientific research and inventive experiments.”⁴

After years of work in mining and metallurgy, one might wonder if Dr. N. A. Bolles was suffering from mercury poisoning. The description above fits the profile of the “mad scientist.” The *Osteopathic Physician* article states Dr. N. A. Bolles had to borrow money from his friends to pay the rent to prevent him from having to move his family.⁴

During this time, Nettie’s careful bookkeeping showed she more than doubled her income to help cover the

family debts. She held her family together and managed to support her family through this rocky time, and at the same time, be a mother to her daughters and a physician and leader in her community. During the divorce proceedings, she never once slandered her husband, indicating only “non support” as her reason for the divorce. Once again, her character was of the utmost quality. She was awarded \$2,000 in alimony paid in four quarterly installments and \$50 a month in child support.³

Nettie continued to live and work in Denver, and had the honor of giving the commencement address at her daughter Esther’s graduation from the A. T. Still College of Osteopathy in 1924. She also played a part in getting Esther’s husband, Dr. Charles Robert Starkey, to become an osteopath. The three of them practiced together for a short time in Denver.

Nettie traveled much in her later years, representing the profession and her many professional organizations. In the “Forum of Osteopathy” of March 1928, she made a triple presentation and received three gavels that day, one whittled from the wood of Dr. A. T. Still’s fireplace. In 1930, Nettie Bolles succumbed to heart disease, and the profession lost a pioneer spirit and an amazing woman.

As the profession embarks on the addition of another osteopathic college, COMP- Northwest in Lebanon, OR, I am reminded of her pioneer spirit that emblazoned the profession of osteopathy forward. It is due to pioneers like Nettie Bolles that we can enjoy such successes today. I have a deep place in my heart for her vision, her persistence and her perseverance in the early days of osteopathy. I can only hope, as assistant professor at the newest member of the osteopathic colleges, the spirit of Nettie Bolles is evident in all that I do as an osteopathic physician.

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B. False
- The iliolumbar ligaments have a stabilizing capacity in the frontal plane at the spinal levels of:
A. T₁₀ and T₁₁
B. L₁ and L₂
C. L₄ and L₅
D. S₁ and S₂
- The iliolumbar ligaments play an important role in the stabilization of:
A. T₁₂
B. L₁
C. L₃
D. L₅
- The iliolumbar ligaments function to stabilize the iliosacral joints by compressing them.
A. True
B. False

March 2011 *AAO Journal* CME quiz answers:

- C
- A
- C
- D

Answers to June 2011 AAOJ CME quiz will appear in the September 2011 issue.

Osteopathic approach to a patient with chronic fatigue syndrome

Anne Chong, MS; Murray R. Berkowitz, DO, MA, MS, MPH

Abstract

Chronic fatigue syndrome (CFS) is a type of illness characterized by a prolonged feeling of tiredness and exhaustion, even after days of rest. Its cause is unknown, but research has been done to prove it is caused by virus. A 29-year-old female complained of experiencing chronic fatigue for two years. Her symptoms included poor blood circulation, chronic feelings of coldness, sudden loss of muscle flexibility, muscle weakness, muscle ache (especially in the limbs and neck), weight loss, short term memory loss, onset of blurred vision and sore throat. She also experienced sudden chills while exercising, and sometimes exercising made her feel worse. She complained of sleep cycles that were not refreshing due to insomnia or hypersomnia. She also had trouble concentrating, remembering facts and coping with normal daily activity. She often felt depressed and unmotivated. Her symptoms were similar to those listed in previous case studies and research performed concerning chronic fatigue syndrome. She was treated with Osteopathic Manipulative Treatment (OMT), which improved her range of motion, muscle pain and flexibility. Infectious etiology, co-morbid depression, immunology and differential gene expressions are discussed.

Introduction

CFS affects 0.2 percent to 0.7 percent of the Western population,¹ and there have been numerous terms used to describe chronic fatigue syndrome.² CFS is also known as neurasthenia,³ post viral fatigue syndrome,⁴ fibromyalgia,⁵ myasthenia,⁶ myalgic encephalomyelitis,⁷ Iceland disease⁸ and chronic Epstein-Barr virus syndrome.⁹ The Centers for Disease Control and Prevention (CDC) has come up with a list of unified symptoms to diagnose patients with chronic fatigue syndrome.¹⁰ The CDC describes chronic fatigue syndrome as physical or mental tiredness that can reduce a person's daily performance by at least 50 percent.² This fatigue syndrome does not have a specific known cause and cannot be explained scientifically.¹⁰ In order to diagnose someone as having chronic fatigue syndrome, CDC states that a person has to experience at least four of the following eight criteria: sore throat, painful cervical or axillary lymphadenopathy, muscle discomfort

or pain, sleep disturbance, prolonged generalized fatigue after usual levels of activity, headaches, arthralgias and neuropsychological disorders (difficulty concentrating and remembering).²

History

A 29-year-old, well-groomed Asian female visited the Osteopathic Manipulative Medicine clinic with a documented history of chronic fatigue syndrome. Before experiencing chronic fatigue syndrome, she had suffered from minor depression for two years and intense fever for five days. The cause of the fever was suspected to be a viral infection. She had been experiencing chronic fatigue for almost two years. Inability to concentrate and remember facts negatively affected her academic performance. Additional symptoms included poor blood circulation, chronic feeling of coldness, sudden loss of muscle flexibility, muscle weakness, muscle ache (especially in her limbs and neck), short term memory loss, onset of blurred vision and sore throat. She also experienced sudden chills while exercising, and sometimes exercising made her feel worse. Her legs became extremely tense when she walked for greater than 30 minutes. This symptom worsened when she was stressed or cold. She complained of sleep cycles that were not refreshing. She also had trouble concentrating, remembering facts and coping with normal daily activity. She had lost 20 pounds due to loss of appetite. She had trouble getting up in the morning, even after sleeping for at least eight hours. She did not feel refreshed after sleeping for at least eight hours. She complained of having pain in the back of her neck and unusually cold feet and hands. She does not use tobacco or alcohol. She complained of having diarrhea and poor blood circulation in times of stress. She has no family history of diabetes, and her grandfather suffered from liver cancer. She has no allergies, but experienced nausea when penicillin was orally ingested. She was never treated with any kind of medication because she was concerned about side effects associated with the medication.

Physical Exam

The patient's chief complaint was intermittent muscle ache/weakness. The history of the present illness started

about three years ago. She also complained of joint pain and bilateral problems with cold hands and feet. She showed no acute distress. Her blood pressure was 116/76. Her pulse rate was 80 beats/minute and respiration rate was 16. Her head was normocephalic, atraumatic and extra ocular muscles were intact. Her neck was supple without lymphadenopathy or thyromegaly. There was positive tenderness in the paraspinal muscles of the cervical spine bilaterally. She had no heart murmurs, gallops or rubs. Capillary refill was less than two seconds. Lungs were clear to auscultation bilaterally. Neurologic examination revealed cranial nerves II to XII were grossly intact. Muscle strengths were 5/5 all around. She showed no sensory deficit. She showed normal gait with her feet outturned approximately 30 degrees. Deep tendon reflexes were +2 all around and Romberg test was negative. Her hands and feet were cold to the touch and lower extremity digits 2 to 5 were blue. She had normal arches. Osteopathic structural examination revealed tender splenius capillus muscles bilaterally. Tenderness was greater on the left side. She had hypertonic paravertebral muscles in the cervical spine. Cervical rotation was 70 degrees to the right and 45 degrees to the left. Rotation at C2 was 45 degrees to the right and 20 degrees to the left. C3NR_RS_R, C4FR_RS_R, T₃₋₉FR_RS_R and L₄₋₅FR_LS_L. Standing flexion test was positive on the left 1.5 inches. She had a deep left sacral sulcus and right inferior lateral angle was inferior/posterior. Anterior and posterior superior ischial spines (ASIS and PSIS) and ischial tuberosities were equal bilaterally. Right hip flexion was 30 degrees and left hip flexion was 50 degrees. Right first rib was elevated. Upper extremity abducted 90 degrees bilaterally and flexed 80 degrees bilaterally. She showed positive results for the Adson test bilaterally. She showed

tenderness in her forearms with a longitudinal compression. Tenderness in the right forearm was greater than the left.

The standard fibromyalgia tender point survey was performed. A score of zero out of 10 was given on mid-forehead, supraspinatus (above medial border of scapular spine), gluteal (upper-outer quadrant of buttocks), low cervical (anterior aspect of intertransverse space of C5 to C7), second rib (second costochondral junction), lateral epicondyle (two centimeter distal to epicondyle) and dorsum right forearm (junction of proximal 2/3 and distal 1/3). A score of six out of 10 was given on right occiput (sub-occipital muscle insertion) and eight out of 10 was given on left occiput. A score of five out of 10 was given on both right and left trapezius (midpoint of upper border). There were four positive survey sites, and the total of site score was 24. The fibromyalgia intensity score was 1.3. The tender point survey was consistent with the pain she was experiencing. The feelings of pain were prominent in her shoulder and neck areas.

The results of the laboratory studies performed during the initial evaluation are shown in **Table 1**.

Neutrophil and white blood cell counts fell below the normal range. Her erythral sedimentation rate was elevated. Her rheumatoid factor and nuclear antibody test (ANA) were positive; ANA positive (negative) ANA titer \geq 1:1280 (\leq 1:40). These clinical results showed she had mild neutropenia, which may be the result of the viral infection she experienced before the blood analysis. Glucose, blood urea nitrogen, creatine, glomerular filtration, sodium, potassium, total plasma protein, albumin, globulin, bilirubin and alkaline phosphatase levels were within the normal ranges.

Laboratory Studies	Results for the Patient	Reference Range
White Blood Cells (WBC)	2.5 K/uL	4.8-10.8 K/uL
Neutrophils	42 K/uL	50-75 K/uL
Absolute Neutrophils	1.05 K/uL	1.50-7.80 K/uL
ESR	38 mm	0-20 mm
Rheumatoid Factor	32 IU/mL	0-14 IU/mL

Table 1: Laboratory results obtained from the patient's initial evaluation.

Assessment and Diagnosis

The diagnosis of chronic fatigue syndrome (CFS) has to be clinical because there is no biological marker for CFS.¹¹ According to criteria established by the CDC and the CFS International Study Group, a patient can be diagnosed with CFS if he/she has been experiencing both mental and physical fatigue for at least six months.¹² The patient's daily tasks at both school and home were significantly affected. According to the blood test performed, there was no presence of biomarkers indicating medical or psychiatric diseases to rule out CFS. The patient had been experiencing memory and concentration disturbances, painful cervical adenopathy, myalgia, articular pain without phlogosis and unrefreshing sleep cycles. A patient cannot be diagnosed with CFS if there are other illnesses that can explain the fatigue.¹⁰ A patient also cannot be diagnosed with CFS if she/he has previously suffered psychotic disorders such as schizophrenia, bipolar affective disorders and dementia. If a subject is obese or has a history of substance/drug abuse within two years prior to the onset of CFS, a patient cannot be diagnosed with CFS.¹² Various assessments were made based on the tests performed. The patient was diagnosed with thoracic outlet syndrome based on positive Adson test results. She was also diagnosed with chronic fatigue syndrome based on problems with memory, concentration, sleep, muscle pain, muscle tenderness, joint pain in hands and feet, sore throat and nausea. The patient did not meet the American College of Rheumatology criteria for Fibromyalgia Syndrome. She had cervical spine somatic dysfunction, sacral somatic dysfunction, costal/rib somatic dysfunction and thoracic spine somatic dysfunction.

Treatment Plan

Cervical spine somatic dysfunction was proposed to be treated with OMT to normalize and increase the range of motion and decrease tenderness. Sacral somatic dysfunction was treated with articulatory OMT to normalize and increase the range of motion and decrease muscle tenderness. The patient had a negative standing flexion test. An attempt was made to treat costal rib somatic dysfunction, but it was unsuccessful due to right upper extremity shoulder impingement. An unsuccessful attempt was made to treat thoracic spine somatic dysfunction due to stiffness at the time. New blood and chemistry tests were considered since last lab tests were performed 18 months ago. A thyroid function test was also considered. Imaging was considered to rule out physical cause for the impingement.

Thoracic outlet syndrome was treated with OMT (direct myofascial release), and it gave a negative Adson

test result on the right side and improved Adson test result on the left. Electromyogram was suggested to rule out other etiologies for the muscle weakness and to confirm the cause for the weakness was not due to neurologic etiology. Ultrasound of spleen to rule out splenomegaly was suggested. Exercise was prescribed, and stretching techniques pertaining to left and right extremities were demonstrated.

Discussion

Rest and Chronic Fatigue Syndrome

Studies show that muscle weakness in patients with chronic fatigue syndrome may be due to prolonged rest.¹³ A 40 percent reduction in muscle strength is seen as a result of four to six weeks of rest.¹⁴ Lack of muscle use has a negative effect on the function of mitochondria.¹⁵ Myosin ATP is not as active,¹⁶ and proteins involved in muscle synthesis and oxidative enzyme content are reduced.¹⁷ Neural changes are seen by reduced local electromyographic activity.¹⁸ As a result of bed rest, depletion in bone mineral density is seen, and this can take up to six months to recover.¹⁴ Basal metabolic rate¹⁹ and immunity, especially T lymphocyte, are also affected by prolonged periods of rest.²⁰ These neural and physical effects can further debilitate a patient's mentality as he/she is trying to cope with daily life.² However, prolonged periods of rest cannot be the cause of chronic fatigue syndrome because the patient in the current study has difficulty recovering from the fatigue and atrophy, although she is not undergoing prolonged periods of rest. Although it cannot be the cause of chronic fatigue syndrome, prolonged periods of rest can further debilitate an individual who is already suffering from chronic fatigue syndrome due to other causes.

Other factors contributing to muscle weakness in CFS patients may be due to increased levels of oxidative stress and longer duration of M wave during the recovery period following exercise.²¹ When the levels of oxidative stress biomarkers, ascorbic acid and thiobarbituric acid reactive species, were measured during and after exercising, the maximum consumption of these biomarkers were significantly higher in CFS patients. Also, the consumption of these biomarkers increased significantly during earlier stages of the exercise. These results meant CFS patients were experiencing greater oxidative stress during exercise and during the recovery period, and increased levels of oxidative stress led to changes in the muscle excitability that was seen by increased duration of the M wave.²¹ In addition, lower maximum oxygen uptake capacity during rest and higher plasma nitrate (NO metabolite) following

exercise were seen in CFS patients as compared to the control group.²² NO (synthesized by endothelial nitrogen oxide synthase, eNOS) is produced in response to stress during exercising.²³ An appropriate amount of NO is beneficial during exercise because it acts as an antioxidant by neutralizing O.²⁴ However, when iNOS is induced in response to reactive oxygen species or inflammatory cytokines, such as IL-1, TNF, and INF-gamma, the dramatically increased levels of NO can be detrimental.²⁵ This leads to an increased level of peroxynitrite, which can inactivate the mitochondrial enzyme and cause mitochondrial electron transport to become dysfunctional.²⁶ Also, oxidative stress in CFS patients can dramatically increase the induction neuronal NOS (nNOS), which leads to the increased level of NO in the central nervous system.²⁷ Patients with CFS may be less efficient at performing aerobic activities due to reduced oxygen uptake. Due to their reduced ability to use the available oxygen, they may experience greater oxidative stress in response to moderate physical activities that are not as stressful to healthy individuals. The level of stress may lead to increased induction of iNOS, which ultimately results in dysfunction of mitochondria, which impairs the production of energy.²² CFS patients may also experience impairment in memory function and mental exhaustion due to increased levels of nNOS in the brain and lower levels of oxygen uptake in the brain tissue.

Depression & Chronic Fatigue Syndrome

It is important to distinguish patients with psychotic depression from those with chronic fatigue syndrome. One way to distinguish between them is that chronic fatigue syndrome is rarely characterized by feelings of guilt, low self esteem and self blame.²⁸ Chronic fatigue syndrome is characterized by greater physical weakness that causes role limitation, impaired social function and emotional weakness.²⁹ A test to distinguish between patients with depression and chronic fatigue syndrome is that patients with depression are tested with high levels of cortisol and increased activity of the hypothalamic pituitary adrenal axis, while patients with chronic fatigue syndrome are characterized by low levels of cortisol and decreased activity of the hypothalamic pituitary adrenal axis.³⁰ Also, Zhang and his associates confirmed that CFS patients had differential gene expressions than patients with depression.³¹

Infectious Etiology

Studies have shown that patients suffer from chronic fatigue syndrome after they have been infected with a virus, such as the influenza virus, *Borrelia burgdorferi*,

enterovirus, *Brucella bovis*, *Toxoplasma gondii*, Borna Disease virus and viruses in the family of the herpes virus (Epstein-Barr virus, cytomegalovirus, human herpes virus, type 6 herpes virus, type 7 herpes virus, and varicella zoster virus).³² Nicolson, et al., showed that patients with chronic fatigue syndrome did not have antibodies against *Mycoplasma fermentans*. Fifty-two percent of those patients had *Mycoplasma* species present in their peripheral blood mononuclear cells, while only 15 percent of healthy controls had mycoplasma present.³² According to Nicolson et al., 30 percent of the CFS patients were infected with type 6 human herpes virus (HHV-6), while only nine percent of the control subjects were infected with HHV-6. Fifty-two percent of the CFS patients were infected with *Mycoplasma* species, while seven percent of the control subjects were infected with *Mycoplasma* species. Seven point five percent of the CFS patients were infected with *Chlamydia pneumonia*, while only one percent of the control subjects were infected with *Chlamydia pneumonia*. These findings indicate virus may be the cause of chronic fatigue syndrome. Also, when CFS patients were instructed to score the severity of their symptoms from zero to 10 (10 being the extreme), the highest scores were given for night sweats/fever, sleep disturbances, joint and muscle aches, depression, balance disturbances and memory loss.³²

According to Di Luca, et al., 83 percent of the healthy blood lymphocytes were infected with human herpes virus -7 (HHV-7), while 82 percent of the CFS patients were infected with HHV-7. Twenty-five percent of the healthy individuals were infected with variant B strain of human herpes virus-6 (HHV-6), while 22 percent of the CFS patients were infected with the variant B strain. However, 22 percent of the CFS patients were infected with variant A HHV-6, while only four percent of healthy individuals were infected with variant A HHV-6.³³

According to Embom, et al., CFS is not associated with HHV-6 or HHV-8 because there was no significant difference in the presence of HHV-6 and HHV-8 in both the CFS patients and the control subjects.³⁴ According to real-time polymerase chain reaction (RT-PCR), quadriceps muscle tissue of 20 percent of the CFS subjects were infected with enterovirus, while none of the control samples were infected.³⁵ Also, when the amount of venous plasma lactate was measured in the CFS patients before and after exercise, the CFS subjects showed an abnormally high amount of lactate.³⁵ These results showed there was an association between enterovirus and the CFS subjects, and there was an indication of abnormal lactate response to exercise in the CFS subjects.³⁵

Research findings stating CFS is caused by retrovirus are controversial because, according to Gow, et al., there

was no significant difference in the presence of human T lymphotropic virus (HTLV) in the CFS and the control patients. The study showed exogenous retrovirus sequences are not present in peripheral blood and muscle cells of CFS patients.³⁶

When the CFS subjects were tested for the presence of GB virus-C (GBV-C), which is a type of flavivirus, there was no evidence that CFS was associated with GBV-C virus.³⁷ Xenotropic murine leukemia virus-related virus (XMRV) is a type of gammaretrovirus, and xenotropic murine leukemia virus (MuLV) shares 90 percent of its genomic sequence with XMRV. When the polymerase chain reaction (PCR) analysis was performed to test for the presence of the XMRV sequence, 67 percent of the CFS subjects were infected with XMRV, while only three percent of the control samples were infected.³⁸ Also, when the western blot analysis was performed in those patients infected with XMRV, *gag* and *env* proteins were present. These results further indicated the association between CFS and XMRV.³⁸

However, in contrast to Lombardi, et al., Switzer, et al., did not support the association between CFS and XMRV. When the serologic test was performed using

western blot, the CFS subjects were tested negative for the presence of MuLV and XMRV antibodies. PCR test results showed absence of XMRV *gag* sequence and XMRV polymerase sequence.³⁹ These results did not support the association between MuLV and XMRV and CFS.³⁹ When PCR analysis was performed to find XMRV or murine leukemia viral sequence using specific oligonucleotide primers, none of these sequences were detected in United Kingdom patients.⁴⁰ Also, when PCR and RT-PCR analysis were performed with blood samples of 65 Chinese patients infected with CFS, XMRV was not found in any of those patients.⁴¹

Martin, et al., cultured atypical cytopathic virus from a blood sample of a CFS patient. This atypical virus had a cytopathic effect on different species, and had an appearance similar to herpes virus under the electron microscopy. Ironically, PCR and immunological tests to detect cytomegalovirus from the same sample gave negative results. However, a low stringency-PCR test using primers related to cytomegalovirus and human T lymphotropic virus-II showed the atypical virus was human cytomegalovirus in origin and showed heterogeneity of the virus. PCR and immunological tests showed negative



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results for cytomegalovirus because the virus that infected the CFS patient could have undergone mutation. When the blood samples were collected from the patient and cultured over a three-year period, the presence of the atypical virus was evident throughout the period. This suggested the virus had established a colony of chronic infection that was neurotropic but non-inflammatory. Although this virus may be human cytomegalovirus in origin, it did not trigger a typical immune viral response because a portion of the DNA sequence that leads to the typical immune response may have been deleted or mutated. People with CFS have been shown to be infected with this atypical virus, which is also found in people with various psychiatric, neurological and autoimmune diseases. The atypical viruses that are cytopathic, but do not show positive immunological or molecular test results similar to typical viruses, such as human herpes viruses, have been given the term “stealth viruses.”⁴²

Stress and Chronic Fatigue Syndrome

Stress at a low level can elicit a strong immune response, but when it exceeds the level that can be handled by an individual, stress can impair an immune response to virus by disturbing the HPA axis.³⁰ In healthy individuals, cortical releasing factor from the hypothalamus leads to the production of adrenocorticotrophic hormone from the pituitary gland. Adrenocorticotrophic hormone causes the adrenal cortex to produce cortisol. Cortisol plays a role in the negative feedback inhibition by inhibiting the production of cortical releasing factor from hypothalamus. Patients with CFS show impairment in the HPA axis because they have low levels of cortisol and adrenocorticotrophic hormone. Compared to those patients with depression, patients with CFS had reduced adrenal mass.⁴³ One study predicts that the reduction in the production of neuroendocrine hormone is due to a reduction in the growth hormone in response to insulin-induced hypoglycemia.⁴⁴ Overproduction of prolactin and thyroid stimulating hormone may also contribute to a reduction in the growth hormone.⁴⁴

Immunology

According to the lymphocyte analysis, the amount of CD8 cell was 19 percent higher in the CFS patients compared to the control samples. The subset of CD8 samples (cells that co-expressed both CD8+12+) was 67 percent higher in the CFS patients. Twenty-nine percent of the CFS patients had CD2+CDw26+ cells that reacted with monoclonal antibodies, while only 17 percent of control lymphocytes reacted with CD2+CDw26+ monoclonal antibodies. Patients with CFS showed decreased CD4+/
CD8+ ratio. Also, CD4+CD45RA+naïve helper T cells had decreased while the availability of NK cells (CD56) had increased. The CFS patients had higher CD2+/
CDw26+ and higher CD21+CD20+ cells (B cell subsets). When the lymphocytes were stimulated to proliferate with phytohemagglutinin and pokeweed mitogen, the CFS patients had lymphocytes that had lower rate of proliferation. Compared to the control samples, the proliferation rate of the CFS patients had decreased by 42 percent when stimulated with phytohemagglutinin and 66 percent when stimulated with pokeweed mitogen. The ability of CFS to produce gamma interferon had decreased by 42 percent when stimulated with phytohemagglutinin and 66 percent when stimulated with pokeweed mitogen.⁴⁵ The elevated level of leukocyte^{2'}, 5'-oligoadenylate synthetase indicate there were constant viral infections in the CFS patients.⁴⁶ Constant viral infections in CFS may exhaust the cells' ability to produce gamma interferon.⁴⁵ CFS patients may not be effective at dealing with viral infections due to their decreased ability to produce the gamma interferon that is responsible for presenting antigens to natural killer (NK) cells. Less antigen being presented to NK cells leads to decreased cytotoxicity of infected cells by NK cells.

Although Klimas et al., found normal levels of CD4 cells and elevated levels of CD8 cells, other studies have obtained different results. Increased levels of CD4 cells were found, while normal levels of CD8 cells were noted by Strauss and associates.⁴⁷ The variability in CD4 and CD8 findings may be due to dynamic nature of clinical manifestation at different stages of CFS.⁴⁵ When the levels of IgG and IgM were analyzed, there was no significant difference between those of the CFS patients and those of the normal subjects.⁴⁸ When lymphocytes were stimulated to proliferate by Con A, there was no significant difference between the proliferation rate of the control group and the CFS subjects⁴⁸. A significant level of IgM anti-Coxsackie antibody or neutralizing antibody to coxsackie viruses was not found.⁴⁸ Also, according to Miller and his associates, there was no significant difference between the amount of IgM and IgG in the CFS patients and the control subjects, but there was a decreased amount of NK cells and B lymphocytes in the CFS patients.⁴⁹ Seventy-eight percent of the CFS patients showed antibody reaction against enteroviral polypeptide, while only ten percent showed antibody reaction against coxsackie B IgM and Epstein Barr virus.⁵⁰ When muscle biopsy was performed, 91percent of the CFS patients had normal appearance, and all the patients did not have any signs for inflammatory infiltrate, muscle necrosis, or phagocytosis. Twenty-three percent of the patients showed muscle atrophy or

hypertrophy. The CFS patients had plasma carnosinase and creatine kinase activities within the normal range, but their skeletal muscles' RNA and protein content had decreased.⁵⁰

The impairment in the function of CNS may be due to increased level of cytokines. Immunity of CFS patients is characterized by abnormality of immune cell function, chronic activation of immune cells and expression of proinflammatory cytokines.⁵¹ Chronic activation may be due to exposure to foreign virus or self-antigen due to expression of Th2 cytokine.⁴⁵ Impairment in the function of NK cells and suppression of Th1 cytokine may also cause CFS patients to be more susceptible to viral infections.⁵²

Gene Expression

When gene expression profiling of peripheral blood mononuclear cells was performed within the same age group of CFS patients and control patients, there were nine major genes that were expressed differently between the two groups. According to the discriminant analysis, the following four genes were determined to be most discriminant: CDK-interacting protein, transcription factor CMRF35, ICAM2 and ETR 101.⁵³ The expressed genes that distinguished the CFS subjects were the genes involved in glycolysis, oxidative phosphorylation, glucose metabolism, and purine and pyrimidine pathways.⁵⁴ Whistler and his associates concluded CFS was a heterogeneous illness.

When human genes from peripheral blood mononuclear cells of CFS patients were analyzed using single color microarray and Taqman RT-PCR, 16 genes were expressed abnormally high or low. These genes were involved in T cell activation and mitochondrial and neuronal functions.⁵⁵ The up-regulated gene consisted of KH-type splicing regulatory protein (KHSRP), breast cancer metastasis suppressor 1 (BRAMS 1) and GABA receptor associated protein-like 1 (GABARAPL1), ATP binding cassette, subfamily D, member (ABDC 4), protein kinase C-like 1 (PRKCL1), mitochondrial ribosomal protein L23 (MRPL 23), CD2 antigen binding protein 2 (CD2BP2), gelsolin (GSN), neuropathy target esterase (NTE), polymerase II polypeptide G (POLR2G), peroxisomal biogenesis factor 16 (PEX16), eukaryotic translation initiation factor 2B subunit 4 (EIF2B4), APC11 anaphase promoting complex subunit 11 homologue (ANAPC11) and programmed cell death 2 (PDCD2). The down-regulated gene was interleukin 10 receptor alpha (IL10RA).⁵⁵ CD2BP2, IL-10RA, moesin, ITGA, NFATC3, cathepsin C were involved in T cell activation and PRKCL1 partook in the immune response. Molecule-possessing ankyrin repeats induced by lipopolysaccharide (MAIL), was a transcription factor involved in the activation of

lymphocytes.⁵⁶ MAIL led to the up-regulation of interleukin 6 (IL 6) via lipopolysaccharide.⁵⁷ Increased production of IL6 may contribute to sleepiness during the day.⁵⁸ Also, IL 6 may cause production of cytokines, such as Th2 by stimulating the HPA axis.⁵⁹ Differently expressed genes involved in the immune response explain the activation of the immune system, which leads to increased production of cytokines and T cells. PRKCL1, NTE, GSN, GABARAPL 1, KHSRP and EIF2B4 are involved in neuronal function. Thyroid gland, neurons and skeletal muscles may become impaired as a result of abnormal GSN expression, which is involved in cell growth and amyloidosis.⁶⁰ EIF2B4 is a mitochondrial translation initiation factor that may be associated with hypomyelination of CNS,⁶¹ and the abnormal expression of this gene may play a role in cognitive abnormality.⁶² KHSRP is involved in splicing of protooncogene in neuronal cells,⁶³ and GABARAPL1 is involved in the expression of neuronal cells.⁶⁴

In addition to neuronal genes that are involved in cognitive function, genes that are involved in mitochondrial function are also up-regulated.⁵⁵ Abnormal expression of MRPL23, EIF2B4 and EIF4G1 may explain the lack of energy in subjects with CFS.⁶⁵ In order to cope with oxidative stress, genes such as PEX16 and ABCD4, which are involved in peroxisomal function, may have been up-regulated.^{66,67}

Following Kaushik and associates, Kerr and associates analyzed the expression of 88 genes in patients with CFS using PCR and microarray.⁶⁵ Kerr and associates further confirmed the differential expression of 16 genes analyzed by Kaushik and associates. Eighty-five genes were up-regulated, while three genes were down-regulated in subjects with CFS.⁶⁵

Zhang and his associates further supported that CFS patients had differential expressions of 88 human genes. Compared to the healthy individuals, CFS patients had 84 genes that were up-regulated and four genes that were down-regulated.³¹ This differential expression of genes distinguishes CFS patients from patients diagnosed with depression.

Chronic Fatigue Syndrome is a Diagnosis of Exclusion

Although a large portion of the world population has CFS, it remains a diagnosis of exclusion because some physicians do not recognize the symptoms as being CFS, or simply do not view CFS as being the existence of illness. Despite the scientific research that has been performed since the 1980s, contradicting beliefs still exist about CFS due to its causes and symptoms not being firmly established.

CFS is a diagnosis of exclusion because there are no definite set of causes to support that a patient has the syndrome. Under the assumption that CFS is caused by a virus, numerous research has been performed to find a single microbe that could cause CFS. However, a group of research shows that the type of virus present in each subject is inconsistent. Nicolson and his associates found that some CFS subjects were infected with *Mycoplasma* species, some with type 6 human herpes virus and others with *Chlamydia pneumonia*.³² The type of virus present in each patient was inconsistent, making it difficult to recognize a single microbe to be the cause of CFS. If virus were the main factor causing CFS, many different types of virus could potentially cause the illness. Not one type of virus, but many different types, can lead to CFS.

Not only is the type of virus found in patients with CFS inconsistent, but there are also inconsistent research results concerning the presence of a certain type of virus. One of the reasons for the unknown cause of CFS may be due to inconsistent research results. For example, DeFreitas and his associates stated there was an association between CFS and human T lymphotropic virus (HTLV) based on their research results.⁶⁸ However, in 1992, Gow and his associates disproved the claim of DeFreitas. Research findings from Gow et al. showed there was no significant difference in the presence of HTLV in CFS and control subjects.⁶⁹ Their research findings also showed that exogenous HTLV sequence (retrovirus sequence) was not present in peripheral blood and muscle cells of CFS patients.⁶⁹ The research findings to support the association between CFS and HTLV were inconsistent. Inconsistencies in research findings make it difficult to find a cause, and this unknown cause contributes to CFS as being a diagnosis of exclusion.

Physicians may also categorize CFS as a diagnosis of exclusion because there are no specific set of biomarkers to test it. Because no known cause/microbe has been established, there is no single biomarker to recognize CFS, which makes it even more complicated to detect a microbe that may cause CFS, because it may be caused by a “stealth virus.”⁴² A “stealth virus” is any kind of atypical virus that may have a known origin but give negative immunological or molecular results due to a mutated or deleted sequence.⁴² An atypical virus may be associated with CFS because Martin and his associates cultured it from a blood sample of a CFS patient. Its appearance was similar to the herpes virus under the electron microscope, but the high stringency PCR test against the cytomegalo-viral sequence gave negative results. Although not a stealth virus, another type of atypical virus was prevalent in subjects with CFS.

Di Luca and his associates found that variant A strain human herpes virus-6 (variant A HHV-6) was prevalent in patients with CFS. This variant A strain is not commonly detected in healthy individuals. In CFS patients, variant A HHV-6 was detected through a variant-specific, restriction-site analysis.³³ The presence of a stealth virus or an atypical virus that may have multiple variant sequences makes it almost impossible for the virus to be recognized or detected in patients with CFS. If viruses was the main cause of CFS, the nature of the virus that commonly undergoes mutation would contribute to the difficulty of detecting a single microbe. Because there is no specific microbe known to cause CFS, there is no biomarker to detect CFS. Therefore, CFS still remains as a diagnosis of exclusion.

Conclusion

Since the 1980s, CFS has been claimed to be caused by virus, and there has been no single research to disprove this claim because, up to this date, no individual diagnosed with CFS has been proven to be completely free of viral infection. Under the assumption that CFS is caused by virus, numerous research has been performed to find the specific type of virus that may trigger CFS. Research results show the presence of various types of viruses in patients with CFS. Perhaps any type of virus may have the potential to cause CFS or be associated with it. In order to test this hypothesis, a retrospective study can be done in animal models after infecting them with various type of virus and testing their oxidative stress levels after a physical performance test. If a known cause of CFS was established, it may be necessary to modify the current definition, which states it is a fatigue syndrome without a specific known cause.¹⁰ As this case illustrates, until an etiology for CFS is determined and an appropriate treatment protocol established, an exercise prescription and stretches to increase the patient’s endurance, range of motion and flexibility, and the application of OMT to treat the somatic dysfunctions and musculoskeletal components of CFS will increase the patient’s functional capacity and enhance the patient’s quality of life.

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Prolotherapy Weekend

October 6-8, 2011 at UNECOM

Course Outline:

Thursday, October 6 (5:00 pm - 10:00 pm): This is required for those physicians who have not taken a prior course in prolotherapy. It will include an introduction to prolotherapy, wound healing, degenerative postural cascade, coding and billing.

Friday and Saturday, October 7 - 8 (8:00 am - 5:30 pm): Participants will be divided into two groups, beginners and advanced. These two groups will alternate between lectures in anatomy and injection technique, while the other group will be in the anatomy lab performing injections under supervision and reviewing prosections.

**Principles of Prolotherapy* by Ravin TH, Cantieri MS and Pasquarello GJ, will serve as course syllabus. Please see <http://principlesofprolotherapy.com/index.html> for details.

Presenting:

Mark S. Cantieri, DO, FAAO, Program Chair
George J. Pasquarello, DO, FAAO

Prerequisites:

Functional Anatomy: (1) Level I course or equivalent

CME:

The program anticipates being approved for 20 hours of AOA Category 1-A CME credit pending approval by the AOA CCME.

Who May Attend Policy:

The primary educational objective for AAO is to provide programs aimed to improve understanding of philosophy and diagnostic/manipulative skills for AAO members, DOs who are not AAO members, individuals who are licensed for the unlimited scope and practice of medicine, and for those in programs leading to such licensure.

Course Location:

University of New England, Biddeford Campus
11 Hills Beach Road
Biddeford, ME 04005
(207) 283-0171
<http://www.une.edu>

Travel Arrangements:

Globally Yours Travel
Tina Callahan at (800) 274-5975

*A rental car is recommended since the campus is located about 15-20 minutes from most hotels and restaurants.

Cancellation and Refund Policy:

The American Academy of Osteopathy reserves the right to cancel an educational program if an insufficient number of physicians register. Sufficient registrations must be received 30 days prior to the opening of the course. If you are considering registering for a course less than 30 days prior to the opening, contact the Academy office before making travel plans. In the event of course cancellation due to lack of registrations, all registration money will be refunded. Cancellations from participants received in writing up to 30 days prior to the course opening are subject to withholding of a 20 percent administrative fee, or registrants may transfer 80 percent of their tuition to another educational program to be held within the next 12 months. For cancellations received in writing less than 30 days prior to the course opening, registrants may transfer 80 percent of their registration fee to another course to be held within the next 12 months. Registrants who fail to appear for an AAO program can transfer up to 50 percent of their registration fee to another AAO educational program to be held within the next 12 months if a written and signed explanation is received at the AAO office within 10 days of the scheduled course. All other cancellations will receive no refund or transfer of registration fees.

Registration Form

Prolotherapy Weekend, October 6-8, 2011

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I require a vegetarian meal

(The AAO makes every attempt to provide snacks/meals that meet participant's needs but cannot guarantee to satisfy all requests.)

Registration Rates

- \$1,200 - I already own a copy of *Principles of Prolotherapy*
- \$1,510 - Please order me a copy of *Principles of Prolotherapy*

The AAO accepts checks, Visa, Mastercard or Discover

Make checks payable to "American Academy of Osteopathy"

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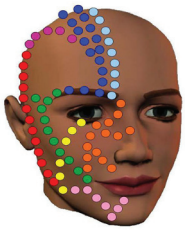
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Progressive Inhibition of Neuromusculoskeletal Structures (PINS)

Orange County Convention Center - Orlando, Florida October 30, 2011 (Pre-OMED)

Course Description:

This Level I course, developed by Dennis J. Dowling, DO, FAAO, presents a system of diagnosis and treatment in which the osteopathic practitioner locates two related points and sequentially applies inhibitory pressure along a series of related points.

Progressive inhibition of neuromuscular structures (PINS) is a technique that can be included in the osteopathic manipulative treatment repertoire. It relies on knowledge of anatomy and neuromuscular physiologic features, as well as on standard forms of osteopathic palpatory diagnosis and treatment. It is a variant of the inhibition technique that has been taught as an osteopathic manipulative technique for many years, and it bears some resemblance to other manual medicine techniques. The emphasis of the approach is the determination of the alteration of the tissues due to dysfunction, delivering treatment based on palpatory evaluation and patient feedback. Two related points are initially chosen, followed by a progression from one to the other. Relationships to similar techniques will also be discussed. Theoretical as well as selected practical applications will be presented.

Course Times:

Sunday, October 30, 2011 12:00 PM - 6:00 PM

Dennis J. Dowling, DO, FAAO



Dr. Dowling is a 1989 graduate of New York College of Osteopathic Medicine. He specializes in Osteopathic Manipulative Treatment in private practice in Syosset, NY, and is the Director of Manipulation in the Department of Physical Medicine and Rehabilitation at Nassau University Medical Center in Long Island, NY. He is also Director of Osteopathic Manipulative Medicine (OMM) Assessment for the National Board of Osteopathic Medical Examiners Clinical Skills Testing Center. Dr. Dowling is the former Chair of the OMM Department at NYCOM, and a Past President of the AAO. In addition to co-editing *An Osteopathic Approach to Diagnosis and Treatment*, he is a contributor and illustrator for several other textbooks and journals. He frequently lectures throughout the United States and abroad.

Prerequisites:

Basic understanding of functional anatomy

CME:

The program anticipates being approved for 6 hours of AOA Category 1-A CME credit pending approval by the AOA CCME.

Registration Form PINS Course * October 30, 2011

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From The Archives

From: Booth ER. *History of Osteopathy and Twentieth-Century Medical Practice*. Cincinnati: Press of Jennings and Graham; 1906: 23-24.

A Philosopher

Philosophers are often found in the common walks of life. One of the first to appreciate Dr. Still's work and comprehend its possibilities, was Mr. Robert Harris, a gunsmith of Kirksville, whom the writer had the pleasure of meeting many times. He was the first to say to Dr. Still, "Plant that truth right here." Dr. Still says of him, "He was Osteopathy's first advocate in Kirksville. I said, after a long conversation with him, 'Mr. Harris, let me ask you one question, Why is it, in your judgment, that people are so loath to believe a truth?' He said, 'Dr. Still, in my opinion, a man dreads that which he does not comprehend.' A man dreads to give up his old boots for fear the new ones will pinch his feet. We have gone from generation to generation imitating the habits of our ancestors."

Dr. Still is a born philosopher. He always works towards first principles. The comprehensiveness of his philosophy is noticeable in all his work. No sign seems to have been neglected that would lead him in the paths of truth. His knowledge is broad. He is conversant with a great number of subjects: history, science, and philosophy, all have a charm for him. The universe, with God and man in the center, is his field for thought. Hence man has been his constant study, and such a mind as he possesses could not help asking the questions, "What is man?" "What is God?" Note the following:

"Over twenty years, I have stood in the courts of God as an attorney. I have questioned and cross-questioned, and directed my questions positively on all parts of this subject that I desired to investigate. The questions that I asked myself were about the following: 'Have I a mind capable of comprehending or solving, by my force of philosophy, the great question, 'What is man?' You remember that I spoke then as a man whose mouth would not be closed through fear. That question, 'What is man?' covers all the questions embraced in the universe—all questions, none left. 'What is God?' 'What is life?' 'What is death?' 'What is sound?' 'What is love?' 'What is hatred?' Any individual one of these wonders can be found in that great combination—man. Is anything left? Nothing. Do you find any principle in heaven, on earth, in mind, in matter or motion, that is not represented by kind and quality in man's make-up? You

find the representation of the planets of heaven in man. You find the action of those heavenly bodies represented in yours. You find, in miniature, mind controlling the power of motion. You find, in reason, that it is the result of a conclusion backed by the ability known as the power of knowledge. And when the machine was constructed, it was given the power of locomotion, self-preservation, all the passions of all the beasts of the field, and all the aspirations of God Himself in kind. All these qualities you find in man. The same qualities you find in a more refined condition in woman, she being the sensitive part of the whole make-up of the human race. She is a finer principle than man. She is sensory, man motor. He is motor, she is intellectual." —Autobiography, pages 393-4.

The crowding in upon his mind of such thoughts as expressed above often give to his lectures, and even his conversation, an air of mysticism—of the supernatural. His ideas generally outrun his expression of them. His deepest thoughts often come to his mind with such rapidity, and are uttered in such quick succession, that the hearer may become dazed in attempting to follow him, and perhaps wonder whether there was a coherent principle underlying his expressions. A more thorough acquaintance with the Old Doctor and his methods of thought and work always convinced us that he had delved beyond our view, and that we had failed to comprehend his meaning.

We often come across passages in his writings that are incomprehensible at first. A more thorough study of them or a few words of explanation often make such passages perfectly clear and reveal a mine of thought hitherto uncomprehended. To fully understand Dr. Still, it is almost absolutely necessary to have a personal acquaintance with him. It is only by coming in close touch with him that his character becomes fully revealed. Often thoughts with which he was not supposed to be familiar would be expressed in an unexpected moment. A single terse sentence, apparently not connected with anything preceeding [*sic*] or following, would often be uttered and proclaim a profound truth.

Relieving depression in an elderly woman with osteopathic manipulative treatment: A case report

Angela Gough, OMS III; Allen Kalich, DO

Introduction

Depression is a prevalent and costly problem in the United States. Twenty-two million Americans have a depressive episode every year.¹ Depression is a special problem in the elderly population, with one third of nursing home residents receiving the diagnosis.² The economic impact of depression on the United States is also extensive. In 1990, depression was estimated to cost the U.S. \$43.7 billion each year.³ Well over \$1 billion is spent annually on pharmaceutical treatments alone.⁴ Depression also represents a significant drain on healthcare resources. Elderly depressed patients make almost two times the number of office visits as nondepressed elderly patients⁵ and have higher medication and laboratory costs.⁶

As widespread and expensive as depression is, many patients are still not receiving adequate treatment. Only 20 percent of patients with depression receive timely treatment, and depression goes undiagnosed or misdiagnosed over half of the time.⁷ Depression may be especially overlooked in the elderly. In one study, only 39 percent of elderly patients with depression were prescribed antidepressants in primary care settings.⁵ The attitudes of elderly patients regarding medications, specialists and the diagnosis of depression itself may make treatment much more challenging. Katon, et al., found that only 20 percent of patients prescribed first-generation antidepressants, and 34 percent of patients prescribed newer antidepressants, filled those prescriptions four or more times in six months.⁸ Additionally, another study showed that, even when elderly depressed patients were referred to mental health specialists, only half followed up with those specialists.⁹

Depression is pervasive and expensive, and yet is still underdiagnosed and undertreated, especially in the elderly population. Clearly, alternative methods of treatment are needed to address this growing problem. Osteopathic manipulative treatment (OMT) may provide another avenue for addressing depression. This case study provides one example of the successful treatment of depression using OMT.

Case Presentation

“Ms. A” is an 86-year-old female who initially presented to an Osteopathic Manipulative Medicine specialty clinic for the treatment of neck and back pain. She has been coming to this clinic for five years and receives treatment weekly. Her past medical history includes cataracts, gastroesophageal reflux, hyperlipidemia, hearing loss, cervical polyradiculopathy, osteoporosis, degenerative disc disease, spondylosis, atherosclerosis, follicular thyroid adenoma, adrenal exhaustion and recurrent pancreatitis. Her family history is significant for heart disease, and her surgical history includes a phacoemulsification procedure for cataracts. She has prescriptions for cortisone, porcine thyroid hormone and an estrogen cream. She is divorced and lives alone.

During her weekly 30-minute visits to the clinic, the osteopathic doctor who treats Ms. A addresses her neck and back pain, as well as GERD and abdominal pain associated with her recurrent pancreatitis. The doctor’s techniques consist of cranial treatments and indirect methods, including ligamentous articular strain and a mesenteric lift treatment in the knee-chest position.

During one visit, Ms. A mentioned to the doctor that she had recently been feeling depressed. She described a lack of energy, anhedonia and episodes of crying. She was not eating well and expressed a desire to remain in bed all day. She did not want to take antidepressants and sought a more natural therapy. After taking a history, the doctor began performing the same OMT Ms. A usually received, focusing on cranial, abdominal, and back and neck treatments. The doctor informed Ms. A he was unsure whether or not the treatments would help her depression, but it was possible she might experience some relief. She was asked to return to the clinic one week later.

On Ms. A’s follow up visit the next week, she enthusiastically reported that her depression was gone. Her energy and appetite had returned, and she had not cried since the treatment. She was convinced the OMT was the sole reason for her dramatic improvement, as she had not tried any other methods of treatment nor had there been any other changes in her life.

Ms. A continues to receive weekly OMT for her neck, back and abdomen. She has not had another episode of severe depression since the first incident.

Discussion

OMT represents a valuable option for the treatment of depression in elderly individuals. Many forms of procedural touch, including OMT, have been shown to result in a decrease in depressive symptoms, especially for elderly patients.¹⁰ One study found that all patients who were treated with OMT, in addition to an antidepressant, scored in the normal range of the Zung Depression Scale after eight weeks of treatment, while 70 percent of patients who were treated with the antidepressant alone still exhibited some moderate depressive symptoms.¹¹ Gamber, et al., showed that fibromyalgia patients who received OMT reported feeling depressed less often, having a better appetite and sleeping better than fibromyalgia patients who were not treated with OMT.¹²

Krishnahari S. Pribadi, MD, a doctor in Indonesia who trained in The Cranial Academy, asserts, "Most psychiatric symptoms are caused by the dysnergistic state of the human body."¹³ He states that depression can increase the cranial rhythmic impulse (CRI), while severe depression can decrease the CRI in frequency and amplitude.¹³ Pribadi's research shows that OMT can increase the efficiency of the respiratory mechanisms of the body and can also result in emotional releases.¹³ It was also found that cranial treatment can result in the shift of brain wave patterns from beta waves to alpha waves or even theta waves.¹³ Other research supports Pribadi's work. Plotkin, et al also found a decreased CRI in depressed patients and an increase in those patients' CRI following OMT.¹¹ Thus, the authors of that study suggest that the CRI may be a way to monitor a patient's depression and the progress and efficacy of the treatment.¹¹

Untreated pain seems to be correlated with depression,¹⁴ so the treatment of a patient's pain with OMT may provide another angle of addressing depression. It has been shown that patients with medical conditions have a greater chance of suffering from chronic depression.¹⁵ Conversely, depressed patients tend to report poorer physical health.¹⁶ Therefore, it is hypothesized that both depression and medical illness share common chemical pathways in the brain.¹⁶ Patients receiving OMT report poorer health, including poorer mental health, than the general U.S. population, possibly because most patients receiving OMT have chronic musculoskeletal conditions.¹⁷ Licciardone, et al., found that patients with chronic musculoskeletal pain "attend to pain cues selectively,

view their environments to be fraught with danger and uncertainty, [and] focus on catastrophic outcomes of negative life events."¹⁷ Chronic pain patients report feeling stigmatized and marginalized by the healthcare profession,¹⁷ so it may be possible to provide some relief from depression simply by offering help in the form of OMT, thereby legitimizing the patient's pain and frustration.

Conclusion

The direct cause of Ms. A's improvement from depression remains unclear. The cranial treatments may have normalized inefficient body rhythms that were causing her symptoms. Her depression may have been related to her chronic neck and back pain, and receiving OMT to those areas may have relieved her depression indirectly by treating the cause of her physical pain. She may have simply been in need of support, and the therapeutic touch of the physician or the attention to her troubles may have made her feel cared for. Clearly, there is still much research that needs to be done regarding the specific effects of OMT on depressed patients.

However, regardless of the direct cause, Ms. A's depression was completely alleviated and she credits her recovery to OMT. The literature is filled with similar cases. Hopefully, as more research elucidates the causes of depression and the ways patients can be helped, OMT will become a more prevalent alternative for patients who may have been undertreated in the past.

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Visceral Approach for the Sacrum and Pelvis

December 9-11, 2011 at Western University/COMP in Pomona, CA

[**Note:** Due to overwhelming response at the March 2010 pre-Convocation course, Dr. Lossing has agreed to repeat this course for the AAO membership.]

Course Description:

This course will look at the most common medical and osteopathic problems in the sacrum and pelvis from a visceral osteopathic perspective. It will explore medical and osteopathic conditions such as coccygodynia, dyspareunia, menstrual irregularity, infertility, uterine fibroids, chronic low back pain, sacral fractures, stress incontinence, benign prostatic hypertrophy, chronic prostatitis, pelvic pain and pelvic floor dysfunction. During the course, participants will palpate, diagnose and treat fascial chains from the feet to the pelvis, the coccyx, the sacrum (including sacral fractures), sacral ligaments, pelvic floor muscles, the lymphatics of the pelvis and its organs, the prostate, cervix, fallopian tubes, ovaries, and bladder. **Internal exams and treatment will be taught where appropriate.**

Course Location:

Western University of Health Sciences
309 E. Second Street
Pomona, CA 91766
(909) 469-5505
www.westernu.edu

Kenneth J. Lossing, DO, Presenter

Dr. Lossing is a 1994 graduate of Kirksville College of Osteopathic Medicine. He completed internship and residency programs at Ohio University College of Osteopathic Medicine, and is certified by the American Osteopathic Board of Neuromusculoskeletal Medicine and the American Osteopathic Board of Family Physicians. Dr. Lossing studied under French osteopath Jean-Pierre Barral, DO, and is known internationally as a lecturer on visceral manipulation. He is currently in private practice in San Rafael, CA.



Except for acting as the 2012 AAO Convocation Program Chair in Louisville, KY, Dr. Lossing has decided to take a sabbatical from teaching in 2012. Visceral Approach to the Sacrum and Pelvis is the last AAO course Dr. Lossing will teach until 2013. Mark your calendars now and do not miss this opportunity!

CME:

The program anticipates being approved for 24 hours of AOA Category 1-A CME credit pending approval by the AOA CCME.

Cancellation and Refund Policy:

The American Academy of Osteopathy reserves the right to cancel an educational program if an insufficient number of physicians register. Sufficient registrations must be received 30 days prior to the opening of the course. If you are considering registering for a course less than 30 days prior to the opening, contact the Academy office before making travel plans. In the event of course cancellation due to lack of registrations, all registration money will be refunded. Cancellations from participants received in writing up to 30 days prior to the course opening are subject to withholding of a 20 percent administrative fee, or registrants may transfer 80 percent of their tuition to another educational program to be held within the next 12 months. For cancellations received in writing less than 30 days prior to the course opening, registrants may transfer 80 percent of their registration fee to another course to be held within the next 12 months. Registrants who fail to appear for an AAO program can transfer up to 50 percent of their registration fee to another AAO educational program to be held within the next 12 months if a written and signed explanation is received at the AAO office within 10 days of the scheduled course. All other cancellations will receive no refund or transfer of registration fees.

Registration Form

Visceral Approach for the Sacrum and Pelvis December 9-11, 2011

Name: _____

Nickname for Badge: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____

E-mail: _____

By releasing your fax/e-mail, you have given the AAO permission to send marketing information regarding courses to your fax or e-mail.

AOA#: _____

I require a vegetarian meal

(The AAO makes every attempt to provide meals/snacks that meet participants' needs but cannot guarantee to satisfy all requests.)

Registration Rates

	<u>On or before 11/9/2011</u>	<u>After 11/9/2011</u>
AAO member	\$ 960.00	\$1,060.00
Non-member	\$1,060.00	\$1,160.00

The AAO accepts Check, Visa, Mastercard or Discover

Credit Card #: _____

Cardholder's Name: _____

Expiration Date: _____ 3-digit CVV# _____

I hereby authorize the American Academy of Osteopathy® to charge the above credit card for the full course registration amount.

Signature: _____

American Academy of Osteopathy®
3500 DePauw Blvd., Suite 1080, Indianapolis, IN 46268
Phone: 317/879-1881 • Fax: 317/879-0563
Register online at www.academyofosteopathy.org

Component Societies and Affiliated Organizations

Upcoming Calendar of Events

June 23 - 26

98th Annual Northwest Osteopathic Convention & Primary Care Update

Semiahmoo Hotel & Conference Center, Blaine, WA
CME: 25 Category 1A AOA credits anticipated
Phone: (206) 937-5358 Fax: (206) 933-6529
E-mail: kitter@woma.org
Web site: www.woma.org

July 15 - 17

Kirksville College of Osteopathic Medicine Primary Care Update

Hilton Promenade at Branson Landing, Branson, MO
CME: 15 Category 1A AOA credits anticipated
Phone: (660) 626-2232 Fax: (660) 626-2931
E-mail: cme@atsu.edu
Web site: <http://www.atstu.edu/kcom/cme/>

July 22 - 24

Intro to Osteopathic Medicine and Evaluation & Treatment: Lumbar Spine

UNECOM, Biddeford, ME
CME: 20 Category 1A AOA credits anticipated
Phone: (207) 602-2589 Fax: (207) 602-5957
E-mail: cme@une.edu
Web site: www.une.edu/com/cme

July 24 - 27

Alabama Osteopathic Medical Association 21st Annual Emerald Coast Conference

Hilton Sandestin Beach Golf Resort, Destin, FL
CME: 20 Category 1A AOA credits anticipated
Phone: (256) 447-9045 Fax: (256) 447-9040
E-mail: alosteoma@aol.com
Web site: www.aloma.org

August 5 - 7, 2011

Indiana Academy of Osteopathy Annual Seminar: Stiles Approach to Still Functional Techniques Co-sponsored by the Indiana Osteopathic Association

CME: 20 Category 1A AOA credits anticipated
Hilton Garden Inn, Indianapolis, IN
Phone: (317) 926-3009 Fax: (317) 926-3984
E-mail: info@inosteo.org
Web site: <http://inosteo.org>

August 13 - 14, 2011

The Illinois Society of the American College of Osteopathic Family Physicians & The Illinois Osteopathic Medical Society 6th Annual Summer Primary Care Update - Women's Health

Four Points Sheraton, Fairview Heights, IL
Phone: (312) 202-8174 Fax: (312) 202-8224
E-mail: ioms@ioms.org
Web site: www.ioms.org

August 20 - 21

Dallas Osteopathic Study Group Basic Course Ligamentous Articular Strain Techniques

Dallas, TX
CME: 16 Category 1A AOA credits anticipated
Contact: Conrad Speece, DO
Phone: (214) 321-2673
E-mail: cjspeece@yahoo.com

September 9- 11

Osteopathic Physicians and Surgeons of California 22nd Annual Fall Conference

InterContinental The Clement, Monterey, CA
CME: 22 Category 1A AOA credits anticipated
Phone: (916) 822-5246 Fax: (916) 822-5247
E-mail: opsc@opsc.org
Web site: <http://www.opsc.org>

September 16 - 18

Florida Osteopathic Medical Association Mid-Year Seminar

Grand Hyatt Tampa Bay, Tampa, FL
CME: 27 Category 1A AOA credits anticipated
Phone: (850) 878-7364 Fax: (850) 942-7538
E-mail: admin@foma.org
Web site: www.foma.org

September 23 - 25

Intro to Osteopathic Medicine and Evaluation & Treatment: Thorax and Rib Cage

UNECOM, Biddeford, ME
CME: 20 Category 1A AOA credits anticipated
Phone: (207) 602-2589 Fax: (207) 602-5957
E-mail: cme@une.edu
Web site: www.une.edu/com/cme

AAOJ Submission Checklist

For more information on the elements in this checklist, see “AAOJ Instructions for Contributors” at www.academyofosteopathy.org

Manuscript Submission

- Submission e-mailed to AAOJ’s Scientific Editor at editoraaoj@gmail.com or mailed on CD-ROM to the AAOJ’s Managing Editor, American Academy of Osteopathy, 3500 DePauw Boulevard, Suite 1080, Indianapolis, IN 46268
- Manuscript formatted in Microsoft Word for Windows (.doc), text document format (.txt) or rich text format (.rtf)

Manuscript Components

- Cover letter addressed to the AAOJ’s Scientific Editor, Raymond J. Hruby, DO, MS, FAAO, with any special requests (e.g., rapid review) noted and justified
- Title page, including the authors’ full names and financial or other affiliations, as well as 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
- One to 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

Graphic Elements

- Graphics should be formatted as specified in the “Graphic Elements” section of “AAOJ Instructions for Contributors”
- Each graphic element cited in numerical order (e.g., *Table 1*, *Table 2*, and *Figure 1*, *Figure 2*) with corresponding numerical captions in the manuscript
- For reprinted or adapted tables, figures and illustrations, a full bibliographic citation given, providing appropriate attribution

Required Legal Documentation

- For reprinted or adapted tables, figures and illustrations, permission to reprint from the publisher in the AAOJ’s print and online versions accompanied by photocopies of the original work
- For photographs in which patients are featured, signed and dated “Patient-Model Release” forms submitted
- For named sources of unpublished data and individuals listed in the “Acknowledgments” section, permission to publish their names in the AAOJ obtained.
- For authors serving in the U.S. military, the armed forces’ approval of the manuscript and institutional or military disclaimers submitted

Financial Disclosure and Conflict of Interest

Authors are required to disclose all financial and non-financial relationships related to the submission’s subject matter. All disclosures should be included in the manuscript’s title page. See the “Title page” section of “AAOJ Instructions to Contributors” for examples of relationships and affiliations that must be disclosed. Those authors who have no financial or other relationships to disclose must indicate that on the manuscript’s title page (e.g., “Dr Jones has no conflict of interest or financial disclosure relevant to the topic of the submitted manuscript”).