In “Palpatory and Ultrasound Assessment of Cervical Dysfunctions and the Effect of Cervical High-Velocity, Low-Amplitude (HVLA) Technique,” the authors evaluate the use of ultrasonography to assess the rotational symmetry of cervical somatic dysfunctions after the use of HVLA.

Find the research article on page 9.
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in teaching, promoting, and researching the science, art, and philosophy of osteopathic medicine, with the goal of integrating osteopathic principles and osteopathic manipulative treatment in patient care.

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Time is precious and article writing is often triaged for busy physicians. In an effort to help guide the journal and stimulate interest in academic and scholarly activity, we are providing some broad topics that can be “reserved” for you. These are by no means the only topics for the journal, but it helps to eliminate the writer’s block that so many of us may face.

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- Osteopathic approaches for the cardiac patient
- The body triune: osteopathic treatment of mind and spirit for today’s patient
- Beyond Spencer technique: OMT for shoulder overuse
- Using OMT to treat patients with long-term side effects of radiation for cancer treatment

If you have interest in any of these topics, send an email to Lauren Good and reserve your topic today. Manuscripts should be emailed to editoraoj@gmail.com within three months of reserving a topic. See the AAOJ’s Instructions for Contributors for more information on submitting manuscripts.

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Editorial
View From the Pyramids: Transitions ........................................ 5
Janice Upton Blumer, DO, FAAO

The Techniques of Andrew Taylor Still:
The Importance of Knowing Them ............................................ 7
Raymond J. Hruby, DO, MS, FAAODist

Original Research
Palpatory and Ultrasound Assessment of Cervical Dysfunctions and the Effect of Cervical High-Velocity, Low-Amplitude (HVLA) Technique ............................................. 9
Theodore Flatum, DO, FACOFP; Arja Mirza, OMS IV; Frances Rusnak, OMS IV; Theresa Apoznanski, DO; Aida Munarova, DO; Joseph Mazzie, DO; Michael John Terzella, DO; and Sheldon C. Yao, DO

Advancing the Understanding and Treatment of the Thoracic Inlet and Incorporation of a New Still Technique ...................................... 19
Drew D. Lewis, DO, FAAO, FNAOME, FAOCPMR, FAAPMR

From the Archives
MRI Assessment of Changes in Swelling of Wrist Structures Following OMT in Patients With Carpal Tunnel Syndrome .......... 25
Kenneth A. Ramey, DO; Robert E. Kappler, DO, FAAO; Murthy Chimata, MD; John Hohner, DO; and Angelique C. Mizera, DO

Regular Features
AAOJ Submission Checklist ................................................. 4
AAO Calendar of Events ..................................................... 6
CME Certification of Home Study ......................................... 17
Annual Index ................................................................. 32
Upcoming CME ............................................................... 35
Component Society Calendar of Events .................................. 40

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<tr>
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TRADITION SHAPES THE FUTURE • VOLUME 27 • NUMBER 3 • DECEMBER 2017

The mission of the American Academy of Osteopathy is to teach, advocate, and research the science, art, and philosophy of osteopathic medicine, emphasizing the integration of osteopathic principles, practices, and manipulative treatment in patient care.
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Publication in the JAOA
Please include permission to forward the manuscript to The Journal of the American Osteopathic Association if the AAOJ’s editor-in-chief determines that the manuscript would likely benefit osteopathic medicine more if the JAOA agreed to publish it.
As I look out my window at the beautiful fall colors in Oregon this time of year, I am reminded of transitions. Transitions remind us there are seasons for medicine as well: the season of the student, the resident, and the practicing physician. For the practicing osteopathic physician, transitions of the spine are keys to change. In nature, transitions shift our attention and thoughts to preparation for the next phase in the cycle.

A.T. Still often wrote of nature and the transitions that it provided:

Through all the darksome night I lay enchained by slumber’s thrall, but with the first faint flushing of the dewy morn I arose and wandered forth.

All Nature seemed to wait in hushed expectancy. With the iron hand of will I barred the gates of memory, shut out the past with all its old ideas. My soul took on receptive attitude, my ear was tuned to Nature’s rhythmic harmony.¹

Like AT Still’s quote, my soul has taken on a “receptive attitude and my ear was tuned to Nature’s rhythmic harmony.”¹ It is my hope to bring new vitality to the AAOJ, exciting new articles and a venue for creative ideas to unfold. I want to continue to honor the rich history of osteopathic medicine and build on that, while tapping into the springtime of the profession as well.

I am honored to be chosen for this transition at such an important time in our profession, and I am grateful for the opportunity to be the next creative mind behind the rich history of The AAO Journal. I am thankful for the great AAOJ staff to help navigate these transitions smoothly, and finally I am grateful for you, the reader, and for your ideas and articles that keep this journal fresh. Look forward to things to come in the coming years.

Warmly,

Janice Upton Blumer, DO, FAAO

Reference
## AAO Calendar of Events

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

### 2017–18

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tr>
<td>Dec. 1</td>
<td>FAAO applications due</td>
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<td>Dec. 1</td>
<td>AAO osteopathic research grant proposals due</td>
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<td>Dec. 8-10</td>
<td>Evidence-Based Visceral Manipulation: Finding Best Practices for Evaluation and Management—Kenneth J. Lossing, DO, course director—University of North Texas Health Science Center Texas College of Osteopathic Medicine in Fort Worth</td>
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<td>Dec. 13</td>
<td>Committee on Fellowship in the AAO teleconference—8 p.m. Eastern</td>
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<td>Dec. 25</td>
<td>Christmas Day—AAO office closed</td>
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<tr>
<td>Jan. 1</td>
<td>New Year’s Day—AAO office closed</td>
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<td>Jan. 17</td>
<td>Committee on Fellowship in the AAO teleconference—8 p.m. Eastern</td>
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<tr>
<td>Jan. 25-28</td>
<td>Introduction to Osteopathic Manipulative Medicine—Lisa Ann DeStefano, DO, course director—University of North Texas Health Science Center Texas College of Osteopathic Medicine in Fort Worth</td>
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<tr>
<td>Feb. 2-3</td>
<td>AAO Education Committee’s meeting—AAO office in Indianapolis</td>
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<tr>
<td>March 18-20</td>
<td>Pre-Convocation course—Osteopathic Management of Chronic Fatigue Syndrome, Fibromyalgia and Multiple Sclerosis—Bruno Childy, MD, DO (France), course director—Hilton Anatole in Dallas</td>
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<tr>
<td>March 18-20</td>
<td>Pre-Convocation course—The Twig Unbent: An Osteopathic Approach to Common Orthopedic Problems in Children—Heather P. Ferrill, DO, MS MEdL, and Lisa Ann DeStefano, DO, course directors—Hilton Anatole in Dallas</td>
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<td>March 25</td>
<td>Committee on Fellowship in the AAO’s interviews and meeting—Hilton Anatole in Dallas</td>
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<tr>
<td>March 21-25</td>
<td>2018 Convocation—Osteopathic Legends: Their Legacies Live On—David R. Boesler, DO, program chair—Hilton Anatole in Dallas</td>
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<tr>
<td>March 25</td>
<td>Post-Convocation course—Residency Program Directors Workshop—Eric Hunter Sharp, DO, course director—Hilton Anatole in Dallas</td>
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<td>April 20-22</td>
<td>Muscle Energy for the Total Body—Walter C. Ehrenfeuchter, DO, FAAO, course director—The Pyramids in Indianapolis</td>
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<td>June 7-9</td>
<td>Prolotherapy and Platelet-Rich Plasma—Mark S. Cantieri, DO, FAAO, and George J. Pasquarello, DO, FAAO, course directors—Marian University College of Osteopathic Medicine in Indianapolis</td>
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The Techniques of Andrew Taylor Still, MD, DO: The Importance of Knowing Them

Raymond J. Hruby, DO, MS, FAAODist

Background

It is widely understood that Andrew Taylor Still, MD, DO, founder of the osteopathic profession, did not write technique manuals to illustrate the manipulative techniques that he developed. Instead, he insisted that his students use clinical reasoning to help them diagnose the patient's somatic dysfunctions and develop manipulative techniques that address each patient's needs individually. Because of this lack of writing, Dr Still's technique approach was essentially lost for most of the 20th century. The few written accounts of specific treatments performed by Dr Still were fragmented and insufficient for recreating valid descriptions of his techniques.

Nevertheless, there have been practitioners who have made notable contributions to the preservation and dissemination of knowledge of Dr Still’s techniques. For example, Stanley Schiowitz, DO, FAAO, had first-hand knowledge about Dr Still’s techniques from the personal experience of being treated by other DOs who had been taught these techniques. From around 1955, Dr Schiowitz embarked on a study of these methods that eventually led to him developing a technique approach that he named *facilitated positional release.*

Around 1970, Jerry L. Dickey, DO, FAAO, began teaching about the principles and techniques developed by Dr Still. Dr Dickey has spent more than 40 years studying the history of osteopathic medicine, and, in particular, doing research into the nature of Dr Still’s techniques. His study of osteopathic history includes reading published and unpublished works by Still and by some of Still’s notable students, family members, and conversations with DOs who were taught directly by Still. Dr Dickey uses the term *Still exaggeration technique* to describe his insight into Still’s work. This includes approaches that use the concepts of exaggeration, articulatory methods, an approach called *challenging the barrier,* and indirect approaches.

In 1989, Richard L. Van Buskirk, DO, PhD, FAAO, found some brief descriptions of Still’s techniques in a text by Charles Hazard, DO, who was a student of Still and a faculty member at the American School of Osteopathy. Using this information, Van Buskirk began to explore the techniques in clinical practice. Through much trial and error, he developed a specific method that proved to be useful for nearly every articulation of the body. He named it the *Still technique* to credit Dr Still with the development of the technique.

Finally, Karen M. Steele, DO, FAAO, is another practitioner who was able to learn from DOs who had excellent knowledge of Dr Still’s techniques. She has been able to disseminate her knowledge and experience through her own teaching of these concepts.

(continued on page 8)
In effect, there are now excellent resources available for learning the principles and techniques of Dr Still. Perhaps the time has come when all DOs and DO students should have a working knowledge of Dr Still’s methods. But why should we learn these methods? What exactly is their importance to us?

**Why Still’s Techniques Matter**

I suggest the following reasons for learning Dr Still’s techniques:

**To have a working knowledge of Dr. Still’s distinctive techniques**

When we choose to enter a noble profession, such as osteopathic medicine, it seems only logical that we should want to know the history of the profession and learn as much as possible about its founder. Knowing our roots, why and how the osteopathic profession came into being and developed, can only make us stronger in our commitment to practicing distinctive osteopathic care.

**As a basis for the evolution of other OMT modalities**

It could be argued that Still’s technique approach paved the way for developing some modern-day osteopathic manipulative treatment (OMT) modalities. For example, Still’s techniques have some of the characteristics of counterstrain technique, as well as having some of the characteristics of muscle energy; high-velocity, low-amplitude (HVLA); and facilitated positional release (FPR) techniques.\(^5\)

**To ensure that Still’s original approaches are not lost to the osteopathic profession**

Now that at least some information regarding Dr Still’s techniques has been rediscovered, and now that resources have been developed to disseminate this information, teaching it to more DOs and the use of it in practice will contribute to preserving this knowledge. In addition, this should lead to more research, refinement and development of these principles and methods.

**For the benefit of patients**

Most importantly, learning Still’s techniques provides yet another distinctive osteopathic method of treatment that can be of immense benefit to patients. The more knowledge and skill we have, the more patient problems we can improve or alleviate.

**Conclusion**

As DOs, we should all try to emulate the success of our founder. This process can be greatly enhanced by learning as much as we can about the history of the osteopathic profession, the life and times of Dr Still, and especially the techniques he employed that made him so successful.

**References**

1. Dickey JL. Personal communication, September 27, 2017.
Palpatory and Ultrasound Assessment of Cervical Dysfunctions and the Effect of Cervical High-Velocity, Low-Amplitude (HVLA) Technique

Theodore B. Flaum, DO, FACOFP; Arfa Mirza, DO; Frances Mary-Ann Rusnack, OMS V; Theresa E. Apoznanski, DO; Aida Munarova, DO; Joseph Mazzie, DO; Michael John Terzella, DO; and Sheldon C. Yao, DO

Abstract

Background
Ultrasound is commonly used to assess musculoskeletal abnormalities. High-velocity, low-amplitude (HVLA) is an osteopathic manipulative treatment technique commonly used by osteopathic physicians. The Shaw et al study has shown the reliability of ultrasound in measuring the improvement of rotational symmetry of lumbar somatic dysfunction (SD) after the use of HVLA.

Objectives
The purpose of this study was to evaluate the use of ultrasonography as a reference tool to quantitatively assess the rotational symmetry of cervical SD after the use of HVLA.

Design
The study was separated into 2 phases: 1) cervical diagnosis and pretreatment imaging and 2) HVLA or cranial vault hold (CVH) and post-treatment imaging.

Method
Two physicians independently diagnosed each participant (N = 51) with an SD between levels C2-C7; the key SD (the segment with the most posteriorly rotated articular pillar (AP)) was chosen. Ultrasound imaging was performed immediately after diagnosis. Next, the participants were randomly distributed into a treatment group, in which the participants were treated with HVLA, and a control group, in which a CVH was performed on the participant. Members of the HVLA group were then reassessed to confirm the key SD had resolved. Ultrasound imaging was immediately performed at the level of the segment with the key SD after HVLA reassessment or CVH completion.

Results
Physician reassessment confirmed SD resolution in 25 of 25 HVLA participants and 0 of 26 control participants. There was no significant change in ultrasound-measured AP rotation for the HVLA group (M=.05680 cm, P=.562) or control group (M=.02384 cm, P=.160).

(continued on page 10)
Conclusions
Despite a palpatory resolution of the cervical SD, ultrasound was not able to determine a statistically significant change in AP rotation in either the HVLA or the control group.

Introduction
High-velocity, low-amplitude spinal manipulation (HVLA) is a treatment approach commonly used by physicians of osteopathic medicine as well as chiropractors, physical therapists and other manual medicine practitioners.1 HVLA is notably used to treat patients who have common clinical complaints such as migraines, neck pain, back pain, upper- and lower-extremity joint conditions, and whiplash-associated disorders.

HVLA treatments have been linked to increased pain pressure thresholds and decreased pain perception.2 A single cervical HVLA manipulation is more effective in reducing neck pain at rest than a control.3 Spinal manipulation has a better effect than massage for cervicogenic headache and has been shown to be comparable to common first-line prophylactic medications such as migraines, and vascular, lymphatic, and neural elements.

The goal of HVLA is to restore physiological motion to the dysfunctional joint.8 The technique is initiated with a preload force where the dysfunctional facet joint is brought to its end range of motion; it is then followed by a thrust that moves the facet joint beyond its physiologic end range of motion. Herzog's study confirms that a thrust generated from HVLA does in fact move the target facet joint beyond the movement achieved by the initial preload force.9

Ultrasonography is a noninvasive and radiation-free method used to visualize bony landmarks and soft tissue. The benefits of ultrasound use in the cervical spine have been difficult to establish and require further investigation. Of the few studies that sought to validate images of specific cervical bony structures, none have accurately done so for all levels of the cervical spine.10 Studies that have shown success in imaging vertebral segments with ultrasonography have done so with the use of in vitro blinded gelatin models of the cervical spine.10,11

Due to the extensive experience and considerable time it takes to precisely identify a vertebral level, key surrounding landmarks of the cervical spine have been validated with ultrasound imaging that are helpful with identification of cervical vertebrae.10 An attempt to quantify the effect of HVLA on the cervical spine using ultrasound can further validate the role of HVLA in treating patients with SDs.

(continued from page 9)

(continued on page 11)
Materials and Methods

Participant recruitment methods consisted of post laboratory announcements and emails. A total of 51 medical students from a single medical college were recruited to participate in a randomized clinical trial conducted in the United States. Participants were randomly selected until an adequate sample size was obtained. Ethical approval was obtained from the college’s Institutional Review Board (BHS-988). Informed consent was obtained by board-certified physicians and the demographic information of age, gender, race, height, and weight were recorded.

Inclusion criteria consisted of asymptomatic, healthy participants, specifically with full range of motion and without tissue texture changes, asymmetry, restriction of motion, tenderness (TART) changes or pain. Exclusion criteria consisted of contraindications to spinal manipulation, such as spinal pain, radiculopathy, ligamentous laxity, prior back surgery, and history of seizure or stroke.

After assessment for inclusion and exclusion criteria, participants were randomly assigned to either a control group (participants who would receive the cranial vault hold) or an experimental group (participants who would be treated with HVLA). Participants were allocated to each group from a computer-generated list of random numbers. After the participants were assigned to interventions, the treating physician was told which intervention needed to be applied to each participant.

Phase 1: Cervical Diagnosis and Pretreatment Imaging

Two physicians independently diagnosed each participant with a dysfunction between levels C2 and C7. Starting at the C2 articular pillar (AP), slight cervical flexion and extension were induced with emphasis on the rotational preference of the segment. This procedure was continued for each level. The first physician noted the key somatic dysfunction as the segment with the most posteriorly rotated AP. The second physician independently confirmed the key somatic dysfunction and marked the level bilaterally with a washable marker. The participant walked to an adjacent room for imaging after the cervical diagnosis was complete.

During pretreatment imaging, participants lay in the prone position while a board-certified musculoskeletal radiologist, unaware of the group allocation or the diagnosis at the marked segment, performed initial imaging at the level of the marked dysfunction. The radiologist measured the tissue depths from the most superficial layer of the skin to the most posterior aspect of the AP of the key vertebral segment by evenly placing the ultrasound probe over the skin.
the marked segment. The radiologist obtained successful imaging by using adequate ultrasound gel and avoiding excessive downward force on the transducer.

**Phase 2: HVLA or Cranial Vault Hold and Post-Treatment Imaging**

**HVLA (Experimental Group)**

Immediately after the completion of pretreatment imaging, a physician performed HVLA to the localized cervical segment on participants in the experimental group.

With the participant supine and the physician at the head of the table, the physician contacted the diagnosed posterior AP with his second metacarpophalangeal (MCP) joint. The physician slightly extended the dysfunctional segment over his MCP joint and then introduced sidebending to the ipsilateral side until motion was felt at the level of the dysfunction.

Maintaining the sidebending component, the participant’s head was rotated to the contralateral side until motion was again felt at the monitoring level. All excess slack was removed through slight axial traction.

When the participant was fully relaxed, the physician applied a short, arc-like thrust with his MCP joint into the plane of the dysfunctional segment’s oblique facet. The physician determined treatment effectiveness by reassessing the rotational component at the diagnosed level and noting any improvements. Treatment was only performed once regardless of whether improvement was noted or not.

A second physician independently confirmed the original SD was absent.

**Cranial Vault Hold (Control Group)**

After the completion of pretreatment imaging, a physician performed a CVH on participants in the control group. With the participant in a supine position and the physician sitting at the head of the table, the physician’s hands cradled the participant’s head, making full palmar contact on both sides. The physician’s fingers rested as follows: the second digits on the greater wings of the participant’s sphenoid bone; the third digits on the zygomatic process of the participant’s temporal bone; the fourth digits on the mastoid process of the participant’s temporal bones; the fifth digits on the squamous portion of the participant’s occiput; and the first digits touching or crossing each other without touching the participant’s

(continued on page 13)
The CVH position was held for each participant for approximately 60 seconds.

The physician reassessed by confirming the presence of the original SD, and a second physician reconfirmed the original SD was still present. This technique was used as a control because it did not involve any movement or manipulation of the cervical spine.

**Post-Treatment Imaging**

After either HVLA or CVH, the participants returned to the ultrasound room for post-treatment imaging. The radiologist used the same procedure performed during the pretreatment imaging portion of the study. All data were recorded.

**Ultrasound Technique**

Imaging was obtained using the SonoSite M-MSK Ultrasound System and SonoSite M-Turbo HFL50x transducer. All ultrasonographic imaging and measurements were performed by a board-certified musculoskeletal radiologist. The posterior right (R) or left (L) AP was determined from the images as the side with the shortest tissue depth measurement from the skin of the posterior neck (Figure 1). Statistical analyses were performed using IBM SPSS software. The images obtained from ultrasound were compared to the physician’s findings in order to evaluate statistical significance using $P<0.5$ value as a significant result.

**Results**

Fifty-one participants ranging in age from 22 to 40 years of age participated in the study. Palpatory reassessment of SD independently agreed upon by 2 physicians confirmed SD resolution in 25 of 25 participants assigned to the HVLA group and in 0 of 26 participants assigned to the control group. There was no statistically significant change in ultrasound-measured AP rotation for the HVLA group ($M=0.05680$ cm, $P=0.179$) or control group ($M=0.02384$ cm, $P=0.160$).

Raw data for right articular pillar (RAP) and left articular pillar (LAP) depths during pre- and post-treatment imaging are shown in Table 1 (available online). An ultrasound image depicting the RAP and LAP of a cervical segment before and after HVLA is shown in Figure 2.

Each bar in Figure 3 represents the pre-CVH RAP and LAP difference (grey shaded area) as well as the post-CVH RAP and LAP difference (blue shaded area) for each participant. The 26 participants who received CVH are listed from 1 to 26 in Figure 3.

(continued on page 14)
Each bar in Figure 4 represents the pre-HVLA RAP and LAP difference (grey shaded area) and the post-HVLA RAP and LAP difference (red shaded area). The 25 participants who received HVLA are listed from 1 to 25 in Figure 4. The RAP and LAP difference is the change in the RAP and LAP depth at the vertebrae with the SD. Pre-treatment RAP and LAP difference is the change in RAP and LAP depth before HVLA. Post-treatment RAP and LAP difference is the change in RAP and LAP depth after HVLA.

Discussion

Results from this study indicate that ultrasound was not able to demonstrate a significant change in AP rotation following HVLA treatment. It was expected that a smaller difference in the RAP and LAP depths of the diagnosed vertebral level would be seen after treatment with HVLA. This would have resulted in smaller values calculated for the post-treatment RAP and LAP difference, indicating an evenness of the posterior AP and thus a resolution of the SD.

This finding contrasts to a 100% palpatory resolution of SD independently reassessed by 2 physicians in a cohort group of 51 participants. Furthermore, smaller values for post-HVLA RAP and LAP difference were seen with imaging in 19 of 25 participants. As represented in Figure 4, there are more participants with smaller values for red bars as compared to grey bars.

As CVH was the control technique, changes in pre-and post-CVH imaging were not expected. The pre- and post-CVH AP depths were not the same as demonstrated by the unequal blue and grey bars in Figure 3. Therefore, the calculated pre-CVH and post-CVH RAP and LAP differences of the diagnosed vertebrae were also not the same.

Some limitations noted were of the ultrasound technique itself that can be resolved in future studies to decrease variability and potentially allow for effective quantification of cervical spine diagnosis. Additional limitations include increased cervical spine range of motion, changes in cervical musculature and adjacent vertebrae after manipulative treatment, the effect of participant positioning on cervical intersegmental motion, and probe placement.

The kinematics of the cervical spine are highly variable and have a large range of motion, especially when compared to the lumbar spine. Table 2 compares values of cervical and lumbar range of motion. Cervical mobility may account for the inability of ultrasound to properly diagnose the cervical spine. The effectiveness of

(continued on page 15)
ultrasonography to assess the somatic dysfunction in the lumbar spine (as seen in the Shaw et al study) can be attributed to limited lumbar range of motion.\(^6\)

Another limitation is the change in the thickness in the spinal musculature due to muscle contraction that can influence the distance from the posteriorly rotated AP to the skin surface. A literature review analysis reported variability in the measured thickness of cervical muscles depending on the positioning of the participant.\(^16\) As a result, inconsistent measurements seen with ultrasound imaging from slight changes in the placement of the head and neck can be expected when cervical spine muscle contraction occurs. With regard to participant positioning, the variability can be quite significant when a participant is placed in a supine position for diagnosis as compared to a prone position for ultrasound imaging.

Table 2. Comparison of cervical and lumbar range of motion.

<table>
<thead>
<tr>
<th>Cervical(^7)</th>
<th>Lumbar(^5,17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>45-90°</td>
</tr>
<tr>
<td>Extension</td>
<td>45-90°</td>
</tr>
<tr>
<td>Sidebending</td>
<td>30-45°</td>
</tr>
<tr>
<td>Rotation</td>
<td>70-90°</td>
</tr>
</tbody>
</table>

Furthermore, the movement of adjacent vertebrae can occur following manipulative techniques. A quantitative analysis of adjacent vertebral segments after a thrust was induced at the target segment revealed substantial relative movement of the target and adjacent vertebral segments following cervical spine HVLA.\(^9\) Additional studies should attempt to resolve these limitations in order to signify the use of ultrasonography as an objective measure for cervical spine somatic dysfunctions.

The cervical spine has increased intrinsic instability due to the large degree of coupled intersegmental motion resulting.\(^17\) Inconsistent probe placement may have occurred as a result of this anatomical characteristic. In the Shaw et al study, the prone position allowed for flattening of the lumbar spine.\(^6\) This contrasts with the imaging performed on the cervical spine, where the prone position of the participant may not have flattened the lordosis of the cervical spine. Therefore, maintaining consistency of head placement in future studies can help contribute to the reproducibility of results.

In comparison to lumbar imaging, cervical ultrasound imaging was limited by a smaller surface area that made proper probe placement difficult with several participants. One cervical ultrasound study stated that the most efficient ultrasonography application technique is to apply a probe in the long-axis position, in a dorsolateral view at the level of the laminae.\(^10\) Future studies can potentially utilize this imaging technique for more consistent results.

Although the efficacy of HVLA treatment could potentially be evaluated with other techniques, such as magnetic resonance imaging (MRI) and computed tomography (CT), the portability, feasibility, and safety of using ultrasound for visualizing anatomy make it far more useful in comparison. Furthermore, incorporating ultrasound in the academic realm has been suggested to increase confidence of students’ palpatory skills in relation to locating a somatic dysfunction. With the increased need for evidence-based medicine, an objective measure for the assessment of palpatory and treatment methods will continue to be important for the future of osteopathic and manual medicine.\(^18\)

Conclusions

Despite a palpatory resolution of the SD, ultrasound was not able to validate a statistically significant change in AP rotation in the HVLA group or in the control group. Contributing factors may include the anatomy and functional mechanics of the cervical spine. Future studies should account for these limitations in order to obtain significant results when quantifying treatment techniques in the cervical spine.

References


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Authors: Theodore B. Flaum, DO, FACOFP; Arfa Mirza, DO; Frances Mary-Ann Rusnack, OMS V; et al

Publication: The AAO Journal, Vol. 27, No. 3, December 2017, pages 9-16

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Below are the answers to The AAO Journal’s September 2017 quiz on the article titled “Acupuncture Meridian-Based Myofascial Release to Treat Knee Pain in Sinding-Larsen-Johansson Syndrome: A Case Report” by Kevin David Valvano, DO, and Reddog Eitig Sina, DO, PhD.

1. d. SLJ is considered an apophysitis of the distal patella.
2. b. The treatment mechanism utilized via acupuncture meridians is myofascial release.
3. a. SLJ via acupuncture meridians is appropriately utilized in pediatric athletes because rotational restrictions are common.
4. c. Jumper’s knee is the alternative name for SLJ.
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Advancing the Understanding and Treatment of the Thoracic Inlet and Incorporation of a New Still Technique—Part 1

Drew D. Lewis, DO, FAAO, FNAOME, FAOCMPMR, FAAPMR

Abstract
The osteopathic profession has long emphasized the importance of improving homeostasis and overall health through the use of osteopathic manipulative treatment (OMT). The respiratory-circulatory model seeks to achieve these goals by resolving somatic dysfunctions (SD) that may restrict venous and lymphatic return. One of the most significant somatic dysfunctions to address in this model is the thoracic inlet. Despite the emphasis on this somatic dysfunction, classic treatment approaches of the thoracic inlet remain some of the most challenging corrections.

In this article, an approach to somatic dysfunction of the thoracic inlet (SDTI) with a new application of Still technique principles is presented. This technique offers a safe, efficient, and effective treatment approach for patients who may present with substantial comorbidities. Considerations for difficult to correct SDTI are discussed. In addition, a more global approach is presented—with an awareness of the dynamic structural relationships and functionality of the region—to treat SDTI with enhanced success.

Introduction
The thoracic inlet, or most superior aspect of the thorax, is a body region that holds common and clinically significant somatic dysfunctions. Located at the junction between the cervical spine and the thorax, it is a transition point in which the spine's sagittal plane curve reverses and therefore is subject to increased stresses and potential for injury. In addition, it is a region of significant communication of neural, vascular, lymphatic, and musculoskeletal structures from the head and neck to the trunk and appendages.

Many osteopathic manipulative medicine (OMM) treatment approaches include evaluation and treatment of the thoracic inlet, perhaps most exemplified by the respiratory-circulatory approach of J. Gordon Zink, DO. Zink detailed the importance of maximizing diaphragmatic respiration for improved homeostasis and overall health. Diagnosis and treatment of SDTI improves not only lymphatic drainage from the head and neck but also from the entire body. A classic treatment approach to enhance lymphatic drainage, therefore, may start at an area Zink described as the site of “terminal drainage,” the thoracic inlet.

Challenge of treating the thoracic inlet region
Successful OMT of SDTI can be challenging, which is one of the reasons we see so many techniques for the thoracic inlet (Walter C. Ehrenfeuchter, DO; e-mail communication; March 10, 2015). A single technique approach may not always resolve the somatic dysfunction and ultimately achieve one's goals. For instance, the SDTI restriction can be myofascial and/or articular in nature and effective...
treatment may involve addressing both components (Paul R. Rennie, DO, FAAO; e-mail communication; May 15, 2015).

Fascial dysfunction of the thoracic inlet can be associated with everyday microtrauma of abnormal head carriage (eg, head-forward posture) as well as stresses from the myofascial connections to the shoulders. Additionally, there are fascial connections between the scalenes, first and second ribs, and more directly between the scalenus minimus, pleura, and Sibson fascia. Because of these significant connections, scalene hypertonicity itself may contribute to congestion and provide further a challenge to correcting the elevated first rib component of the thoracic inlet.

Visceral-somatic relationships with organs in the thoracic cage as well as organs of the head and neck may, through facilitation, introduce strain and SD in the upper thoracics. This may confound one’s diagnosis or even contribute to atypical patterns (which Zink termed *disparent*) that do not follow the common compensatory alternating fascial patterns. An example would be a patient with a chronic cardiac condition who may have left-sided paraspinal changes and segmental dysfunction of the upper thoracics which may alter or add a layer of dysfunction to the more common compensatory pattern of right-sided rotation (G. Bradley Klock, DO, FAAO; e-mail communication; March 10, 2015).

Newer approaches for treatment of the thoracic inlet

Newer OMM techniques for thoracic inlet have expanded the possibility of treatment options from the more traditional direct approaches with muscle energy (ME) and high-velocity, low-amplitude (HVLA) to newer indirect approaches. Increasing the pantheon of treatment choices provides more options: a) for the clinician who may feel his or her skill-set matches best with a particular treatment; and b) for the clinician who is comfortable with all technique styles but who feels a particular technique may be best suited for a particular patient encounter. It also serves to provide a more comprehensive approach for a highly clinically relevant and sometimes challenging somatic dysfunction.

Respiratory-Circulatory Approach to Treatment/CCP

Respiratory-circulatory model of treatment

Following in the traditional teachings of Andrew Taylor Still, MD, DO, the respiratory-circulatory model seeks to use OMT to help maximize the body’s own healing potential. A primary focus is on allowing the body to optimally deliver cellular nourishment through circulation of oxygenated arterial blood and the removal of cellular waste products. A key component is the movement of low-pressure fluids, eg, the lymphatic system.
of the body as in the walking cycle and were felt to contribute to postural balance. While a goal for Zink was to return patients to the physiologically perfect “holographic image” (neutral, free of SD), patients in CCP were at least in a more posturally balanced, compensatory pattern.

CCP for the thoracic inlet
CCP findings for the SDTI include the first thoracic vertebra rotated and sidebent right with the first rib elevated on the left.14 This somatic dysfunction may be appreciated on a supine patient when palpating the most superior aspect of the first rib in the supraclavicular region. In CCP, the left side will be statically more superior, and it will resist dynamic inferior pressure. Palpation of the costoclavicular region just lateral to the manubrium and more laterally to the infraclavicular region will feel more posterior or “concave” and dynamically compress posteriorly more on the right.14

Zink’s CCP diagnosis of the thoracic inlet
Zink described “typical” CCP findings at the thoracic inlet as:

the cervicothoracic curvature rotates the first thoracic vertebra and side-bends it to the right, causing the first rib on the left to be moved anteriorly so that the infraclavicular-parasternal area on the left appears to be “full”, or convex; the first rib on the right is forced posteriorly. Therefore, the infraclavicular-parasternal area on the right seems ‘hollowed out’, or concave.14

As stated above, Zink inferred that the vertebra (T1) rotates and sidebends toward the concave side (on the right).

Diagnosis is classically performed on a supine patient. Sidebending diagnosis requires evaluating the superior aspect of the first rib for which is more cephalad or caudal, both statically and dynamically (evaluating “give” with caudal pressure to the first rib). Sidebending is to the opposite side of the superior first rib.18

Many authors feel that unexpected or aberrant spinal segmental findings are more likely to be observed in more pathologic dysfunctions, as those found after significant trauma,19 or acute or chronic illness.19 Similarly, it is also held that patients presenting with pain in the cervicothoracic region are more likely to have non-neutral, or “out-of-pattern,” thoracic inlet findings.

CCP treatment sequence
Because of its proximal anatomic relationship to venous and lymphatic return, a treatment approach to enhance lymphatic drainage therefore may start at the thoracic inlet.14,15,18,19,20,21 In discussion of treating the obstetric patient, Zink proposed his treatment sequence of starting with addressing the thoracic inlet, the upper thoracic vertebra and ribs and then the lower, the thoraco-abdominal transitional area, the lumbosacral transition area, and then proceeding to treat the cervical region before moving to the extremities.10

Biomechanics:
Relationship Between Structure and Function

Relevant anatomy of the thoracic inlet
In the anterior region of the thoracic inlet is the articulation of the first rib with the manubriogladiolar junction of the sternum. Posteriorly, the first rib articulates with T1 by a unifacet, and the second rib has two demifacet articulations, connecting it with T1 and T2.3

The anatomical thoracic inlet is defined as being bounded by the manubrium of the sternum anteriorly, the first thoracic vertebra posteriorly, and the right and left first ribs laterally.8,9,20 The functional thoracic inlet is described as including the manubrium of the sternum, first four thoracic segments, and the first and second ribs.8,20

To this functional definition, Greenman adds the medial end of the right and left clavicles.3 In addition to the skeletal and arthrodial structures of the thoracic inlet, there are significant myofascial, neurovascular, and visceral tissues in the region. This includes the esophagus, trachea, and major vessels of the neck and upper extremity.3

Thoracic inlet’s relationships to regional structures

Lymphatic system
Osteopathic medicine has long appreciated the importance of improving lymph drainage, going back to the writing of Millard.1(p792),21 While somatic dysfunction of the neck and cervical fascia can potentially restrict lymph drainage to the general circulation, it is particularly susceptible to fascial dysfunction of the thoracic inlet as all lymphatic fluid returning from any site outside the thorax must pass through this region.1(p792),6(p459,506),8

At the thoracic inlet, the thoracic duct must pass twice through Sibson fascia before lymph can drain into the venous system.1(p792) Sibson fascia is contiguous with the scalene fascia, and therefore restriction and congestion can be seen with tight scalene muscles.1(p792) Fascial restrictions of the thoracic inlet also can alter the biomechanics of the thoracic inlet and affect the emptying of the thin-walled lymph vessels into the venous system.1(p9) In addition, conditions with sympathicotonia can impair lymph drainage...
(continued from page 21)

due to the sympathetically controlled valves between the thoracic duct and the venous system. More regionally, somatic dysfunctions of the thoracic spine, ribs, clavicles, or thoracoabdominal diaphragm may all reduce respiratory excursion and therefore result in impaired lymphatic drainage. 

Myofascial relationships
Successful treatment of SDTI may require addressing somatic dysfunction not only with the thoracic spine and rib cage, but also with clavicles and entire shoulder girdle. Beyond treatment of the major articular restrictions related to the upper extremity, Zink emphasized the importance of reducing fascial drag on the fascia through which the blood vessels and nerves pass.

The thoracic inlet has myofascial relationships to structures superior and inferior; superficial and deep. Of particular note, the clavicular fascia plays a significant role in the connection of the upper limb to the thoracic inlet, with attachments from the clavicle, pectoralis minor and coracoid process; it surrounds the subclavius and the sheath of axillary vessels, and extends medially to the first rib and to the first two intercostal spaces. The posterior layer of the clavicular fascia fuses with deep cervical fascia, and inferiorly it blends with the axillary fascia.

Visceral relationship to the thoracic inlet
Important relationships exist between visceral organs and SDTI. Many studies have established the correlation of somatic dysfunction in the upper thoracic and upper rib regions with cardiovascular disease. Viscerosomatic reflexes associated with organs above the thoracoabdominal diaphragm (heart, lungs, thyroid, head, and neck) can cause somatic dysfunction in the upper thoracics. For instance, with cardiac pain, Beal noted changes from T1-5. These upper thoracic somatic dysfunctions caused by viscerosomatic reflex may resist even properly applied OMT and should raise the concern of a visceral etiology.

Relevance to clinical conditions
Postural dysfunction has been implicated in many painful conditions, and it is a contributor to SDTI. The transition zones of the spine, including the lumboaal pelvic region, thoracolumbar region, cervicothoracic region (thoracic inlet), and craniocervical region, are areas of crossover of the sagittal plane curves and are common regions for increased stress and articular and myofascial pain. Dysfunction in these regions can lead to compensation in multiple regions and planes and impaired venous and lymphatic return.

Postural dysfunction also can extend into the limbs, where for example, protracted shoulders have been implicated with shoulder impingement. Postural dysfunction therefore can contribute to articular and myofascial restriction of the thoracic inlet, confounding diagnosis, and as a perpetuator of dysfunction, challenging successful correction. Successful treatment of this postural decompensation can, therefore, not only improve pain, but also improve both respiratory homeostasis and venous and lymphatic return.

Diagnostic Considerations With The Thoracic Inlet
Leaders in the field of OMM have long noted correlation between painful or more clinically significant conditions and the presence of non-neutral (flexed or extended) segmental dysfunction of the spine. Additionally, Zink and more recent OMM leaders have detailed the importance of treating dysfunctions that are “out of (CCP) pattern” (G. Bradley Klock, DO, FAAO; e-mail communication; December 2, 2015).

These “disparent” findings are felt to be more relevant with patients presenting with painful conditions, and Zink describes them in patients who are acutely ill, possibly having a history of trauma, chronic illness, multiple pregnancies, or operations. He notes these patients may fail to respond to the ordinary approach to treatment. Zink recommended first focusing on treating the offending disparent SD and bringing them back to pattern. After that was achieved, he then recommended treating the common compensatory pattern to bring it back into physiologic neutral.

Non-neutral mechanics of the thoracic inlet and painful conditions
It is worth noting that in the evaluation of the alternating fascial patterns of CCP, one does find long neutral patterns with alternating sidebending. For example, sidebending to one direction from the upper cervical to the mid-thoracic, and then sidebending to the other direction from the mid thoracic to the lumbosacral region. These long neutral patterns have the potential for flexion/extension (non-neutral) dysfunction at the top, bottom, and crossover points (Paul R. Rennie, DO, FAAO; e-mail communication; May 15, 2015).

“Out-of-pattern” thoracic inlets:
Rotation and sidebending to opposite sides
If the thoracic inlet is “out-of-pattern,” either non-neutral (eg, FRrSr, or ERrSr), or otherwise not acting as a unit (eg, R1Sr or RrSl), it is disparent, and is therefore a significant somatic dysfunction. In these situations, one should consider the possibility of postural dysfunctions contributing to scoliotic curve that extends up to T1. Additionally, one should consider a viscerosomatic curve with cardiac or lung pathology facilitating upper thoracic somatic dysfunction and causing, for instance, a group curve extending up to the first thoracic vertebra (NSIRr or NSrRI).

(continued on page 23)
Van Buskirk details Fryette’s principles in his textbook, and in regard to segmental mechanics, he describes the possibility of “neutral mechanics” in the scenario of a single segment dysfunction in neutral (neither flexed nor extended), which when rotated to one side, will sidebend to the opposite side. These single segment type 1 restrictions are seen in cases of traumatic origin. And in his opinion, these dysfunctions need to be treated effectively first, before proceeding with the rest of the treatment. 19

With specific regard to SDTI, sidebending and rotation to the opposite sides would be “out-of-pattern (CCP)” findings, and thus an area of primary focus for Zink. This appears to concur with Van Buskirk’s belief that it is more efficient and less painful to first treat any neutral type 1 single segment dysfunction before proceeding with the rest of the treatment. 19

In addition to Zink’s findings of alternating, common compensatory patterns of fascial dysfunction, there also exist alternating spinal segmental compensatory patterns. 39 For instance, type 2 non-neutral dysfunctions can be found commonly at the bottom, top, or apex of type 1 group curves. If the non-neutral single segment were the primary dysfunction and if it involved, for instance, flexion, rotation, and sidebending to the right, one may find a type 1 multi-segment curve above this which is neutral, sidebent left, and rotated right. A rational explanation for this is that the body is attempting to compensate for the coronal plane distortion with contralateral sidebending. This balancing type of compensation would allow the body to keep the eyes level, one of our more primal survival instincts.

Comparing Established Approaches

Direct approaches for thoracic inlet

ME and HVLA

Classic treatment approaches for the thoracic inlet often involved direct approaches and were utilized effectively and efficiently by Zink. These include HVLA and ME techniques. I utilize HVLA and/or ME for somatic dysfunction of the thoracic inlet when appropriate.

Indirect and other approaches

Indirect myofascial technique

Traditional indirect myofascial release (I-MFR) approaches for the thoracic inlet involve applying gentle forces toward the position of ease. 5(p9),4(p125),29 “The seated “steering wheel” technique as detailed in Nicholas’ Atlas of Osteopathic Techniques presents a detailed description of an indirect MFR technique. 4(p125)

Perhaps less commonly performed MFR techniques for SDTI are direct MFR, which involves assessing for asymmetry of motion and then applying gentle forces toward the restrictive barriers.

Still techniques

Still techniques, as is suggested by the name, have been in use since the beginning of osteopathic medicine; however, they were not formally structured and classified until Van Buskirk published The Still Technique Manual. 4(p418),19

Attributed to A.T. Still, and redeveloped by Van Buskirk, the techniques involve addressing a somatic dysfunction first with an indirect approach (I-MFR set-up) followed by an articulatory/range-of-motion-type movement toward a direct barrier. 19,30

One of the distinguishing benefits of the technique is that one can address both myofascial and articular aspects of a somatic dysfunction in the same technique. Still techniques are indicated for both articular (eg, segmental) as well as myofascial or fascial restrictions, and they have relatively minimal and similar contraindications to other OMM techniques. 4(p419)

Still techniques established in the literature for the thoracic inlet

Current Still techniques taught for the thoracic inlet (or its components) include seated techniques for T1 and for the superior and inferior first ribs. These techniques involve a compression vector through the head and cervical spine as it is moved in an arc motion from an indirect to direct position. 19(p57-60),31,32 Additional Still techniques for the thoracic inlet performed supine including T1 and for the superior and inferior first ribs involve use of the upper limb with compression through the elbow and an arc motion to bring the first rib from an indirect position to direct for release. 19(p59-61),33

References


(continued on page 24)


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MRI Assessment of Changes in Swelling of Wrist Structures Following OMT in Patients With Carpal Tunnel Syndrome

Kenneth A. Ramey, DO; Robert E. Kappler, DO, FAAO; Murthy Chimata, MD; John Hohner, DO; and Angelique C. Mizera, DO

Abstract
We treated patients with carpal tunnel syndrome using OMT. Treatments were focused on the upper thoracic spine, lower cervical spine, and tenderpoints in the forearm muscles. OMT was not applied to the wrist in an attempt to stretch the transverse carpal ligament. MRI images were used to assess changes in fluid content in both the carpal tunnel and median nerve after OMT treatment. MRI measurements of median nerve area, carpal tunnel area and length of the transverse carpal ligament were also obtained. These measurements were correlated with changes in nerve conduction velocities (NCVs), pain ratings, wrist motion measurements, and somatic dysfunction information. The numeric data were compared and contrasted using Hest statistics. Significance probabilities of $P < 0.05$ were computed. Statistically significant changes were noted in pain ratings, wrist motions and nerve conduction (sensory amplitude). Five patients responded with improvement in symptoms and one did not. The responder group demonstrated a decrease in the amount of swelling of both the median nerve and carpal tunnel. The nonresponder demonstrated increased swelling in both the median nerve and carpal tunnel. Changes in the swelling of both the median nerve and carpal tunnel appear to more closely parallel changes in hand symptoms than nerve conduction results.\(^1\) No statistically significant increases occurred in the length of the transverse carpal ligament or the carpal tunnel area. Minimal changes in both the length of the transverse carpal ligament and carpal tunnel area did occur despite no active attempts to stretch this region. All six patients had a predominance of acute changes in the upper thoracic spine and upper ribs. Most patients had tension in the flexor muscles of the forearm. Treatment of the upper thoracic spine, upper ribs, and forearms are all important in the management of carpal tunnel syndrome.

Methods
Seven patients were identified as having clinical signs and symptoms of carpal tunnel syndrome. Patients excluded from the study include those with rheumatoid arthritis, osteoarthritis, Paget’s bone disease, gout, myxedema, multiple myeloma, acromegaly, current pregnancy, evidence of motor atrophy of the hands, diabetes, dialysis patients with A/V shunts, prior wrist fracture, hepatic disease, IV drug abuse, prior carpal tunnel release surgery, patients with impending litigation suits, and workman’s compensation cases. The institutional review board approved the project. Written informed consent was obtained from each patient.

The hospital nerve conduction criteria were used to confirm the diagnosis of carpal tunnel syndrome: median nerve motor latency (MML) (8 cm) > 4.0 ms or median nerve sensory latency (MSL) (14 cm) > 3.7 ms or median nerve sensory velocity (MSV) (14 cm) < 50 M/S.\(^2\) Bilateral carpal tunnel MRIs were obtained on each patient. Pretreatment pain and distress scales,\(^3\) hand pain analog scales, and wrist motion measurements were obtained on each patient. Each patient underwent six OMT treatments. Each of the first four treat-
ments were separated by a one-week interval. Each of the last two treatments were separated by a two-week interval. Treatments were focused on the upper thoracic spine, lower cervical spine and tender points in the forearm muscles. OMT was not applied to the wrist in an attempt to stretch the transverse carpal ligament. After the six treatments, the pain and distress scales, hand pain analog scales, wrist motion measurements, nerve conduction studies, and MRIs were repeated. One patient dropped out of the study after failing to keep several scheduled appointments due to work conflicts.

Analysis: Bilateral carpal tunnel MRIs were obtained on each patient. T2-weighted axial images were assessed using General Electric’s image analysis software. The hydration of the carpal tunnel was assessed by generating a line plot between the distal aspect of the hook of the hamate and the base of the trapezium. The computer will graph the pixel intensity of every structure along the line. The pixel intensity correlates with the level of hydration. A higher pixel intensity correlates with a higher level of hydration while a lower pixel intensity correlates with a lower level of hydration. If the cursor is moved along the line plot, the computer will generate the pixel intensity every 0.4 mm. The hydration of the structures located in the entire tunnel can be obtained by averaging the pixel intensities generated between the hook of the hamate and the base of the trapezium. The hydration of the carpal tunnel only (entire tunnel with median nerve removed) can be obtained by removing the pixel intensities for the median nerve when calculating the mean pixel intensity for the entire tunnel.

The hydration of the median nerve can be assessed by using the region of interest software. A 1.0 cm pixel box was placed around the median nerve. This function generates the mean and standard deviation for 121 separate pixel points within the box (see Figure 2).

Figure 1. MRI of the distal carpal tunnel. A line plot is generated between the hook of the hamate and the base of the trapezium. The computer generates the pixel intensity for every structure along the line. The cursor (long vertical line through center of median nerve) is positioned to obtain the pixel intensity every 0.4 mm along the line. Note the pixel intensity of 312 generated through the center of the median nerve.

Figure 2. A 1.0 cm pixel box is placed around the median nerve. The computer generates the mean and standard deviation for 121 separate pixel points within the pixel box.
The pretreatment and posttreatment MRI images require standardization because the overall pixel intensity of the picture can vary depending on where the controls on the console are set. This standardization necessitates the identification of a structure that has a relatively consistent pixel intensity pre- and posttreatment. The trapezium was chosen for this purpose. Pretreatment and posttreatment pixel intensities of the trapezium were obtained (See Figure 3). The pretreatment measurement of the trapezium’s pixel intensity was chosen as the standard. The posttreatment values for each individual patient were adjusted by a factor that would make the posttreatment pixel intensity of the trapezium consistent with the pretreatment value.

The cross-sectional area of the median nerve, the cross-sectional area of the carpal tunnel, and the length of the transverse carpal ligament were obtained at the distal portion of the carpal tunnel (narrowest region and most likely site of compression).

The numerical data obtained from the MRI images, pain ratings, wrist measurements, nerve conduction studies, and osteopathic structural examinations were compared and contrasted statistically using the SPSS PC+ for WINDOWS program. This program employs Student’s t-test statistics. Significance probabilities of \( P < 0.05 \) were computed.

**Results**

Five patients (cases 1-5) responded with improvement in symptoms, and one did not (case 6). Statistically significant changes were noted in pain ratings, wrist motions, and nerve conduction findings (sensory amplitude). Changes were also noted in pain and distress scale ratings, median nerve hydration and carpal tunnel area. The data and statistics are listed in Tables 1-4.

**Discussion**

Statistically significant changes were noted in pain ratings (Chart 1), wrist motions (Chart 2), and nerve conduction findings (sensory amplitude) (Chart 3). Changes were also noted in pain and distress scale ratings (Chart 4), median nerve hydration (Chart 5), carpal tunnel hydration (Chart 6), median nerve area, and carpal tunnel area.

Overall, five patients responded with improvement in symptoms (past week pain ratings) and one did not. The responder group demonstrated a decrease in the amount of swelling of both the median nerve and carpal tunnel. The nonresponder group did demonstrate improvement in pain and distress scale ratings and wrist motion measurements.

Changes in the hydration (swelling) of the median nerve and carpal tunnel appeared to more closely parallel changes in patient hand symptoms than nerve conduction studies. In the responder group, the amount of swelling in both the median nerve and carpal tunnel decreased; the nerve conduction findings improved, as did the hand symptoms. In the nonresponder group the amount of swelling in both the median nerve and the carpal tunnel increased; although the nerve conduction studies improved, the hand symptoms worsened. Perhaps more investigation in this area is warranted.

Changes in hydration in the carpal tunnel were two to nine times greater than in the median nerve. For years, the medical establishment has been dwelling on the point that there is not enough room underneath the transverse carpal ligament. The median nerve becomes compressed, ultimately leading to hand symptoms and debility. The question that needs to be addressed is: Why isn’t there enough space?
room underneath the transverse carpal ligament? This study may indicate that there is increased swelling in both the carpal tunnel and median nerve in patients with carpal tunnel syndrome. OMT effectively reduces this swelling and results in improvements in both nerve conduction parameters and hand symptoms.

What is the role of the sympathetic nervous system in the development of carpal tunnel syndrome? All six patients had a predominance of acute changes in the upper thoracic spine and upper ribs. Cell bodies of preganglionic sympathetic neurons concerned with the upper extremity are located in the upper thoracic spinal cord segments. The smooth musculature in the walls of lymphatic vessels contracts when sympathetic nerves are stimulated. This results in reduction in the size of the lumen, thereby impairing lymphatic drainage. Increased sympathetic tone can close down lymphatic channels and lead to congestion in regions of the body. Upper thoracic dysfunction increases sympathetic tone to the upper extremity and decreases lymphatic drainage. This may lead to the increased swelling observed within the carpal tunnel (and possibly the entire upper extremity) and the subsequent production of symptoms.

Do these findings support the role of the “double crush” in the genesis of carpal tunnel syndrome. The double crush hypothesis proposed by Upton and McComas explains that compression of axons at one location may not impair axoplasmic transport enough to result in denervation changes in their target structures, but if a similar amount of compression is simultaneously applied at a second location, the threshold for denervation effects is exceeded. The median nerve passes deep to the bicipital aponeurosis (the fibrous band connecting the biceps tendon to the forearm fascia). It then passes down between the two heads of the pronator teres and through the (continued from page 27)
Table 3. Individual Pain and Distress (PAD) Scale ratings, past week analog pain ratings, and wrist range of motion (ROM) measurements. The t-test statistics were performed on the mean pretreatment and posttreatment values for cases 1-5.

<table>
<thead>
<tr>
<th>Case No.</th>
<th>PAD Scale</th>
<th>Past week Pain</th>
<th>Wrist ROM</th>
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<tr>
<td>Case 1 Right*</td>
<td>46.0</td>
<td>38.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Case 1 Left</td>
<td>X</td>
<td>X</td>
<td>1.0</td>
</tr>
<tr>
<td>Case 2 Right*</td>
<td>37.0</td>
<td>36.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Case 2 Left*</td>
<td>X</td>
<td>X</td>
<td>8.0</td>
</tr>
<tr>
<td>Case 3 Right*</td>
<td>36.0</td>
<td>32.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Case 3 Left*</td>
<td>X</td>
<td>X</td>
<td>8.0</td>
</tr>
<tr>
<td>Case 4 Right*</td>
<td>53.0</td>
<td>30.0</td>
<td>10.0</td>
</tr>
<tr>
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<td>X</td>
<td>X</td>
<td>5.0</td>
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<td>Case 5 Right</td>
<td>46.0</td>
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<td>X</td>
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<td>10.0</td>
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<tr>
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<td>43.6</td>
<td>36.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Left mean SD</td>
<td>6.3</td>
<td>5.6</td>
<td>3.3</td>
</tr>
<tr>
<td>Case 1-5 mean SD</td>
<td>43.6</td>
<td>36.4</td>
<td>5.4</td>
</tr>
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<td>0.126</td>
<td>0.031</td>
<td>0.048</td>
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<tr>
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<td>58.0</td>
<td>44.0</td>
<td>8.0</td>
</tr>
<tr>
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<td>X</td>
<td>8.0</td>
</tr>
<tr>
<td>Case 6 mean SD</td>
<td>58.0</td>
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<td>8.0</td>
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Table 4. Nerve conduction examinations (median nerve).

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<tr>
<th>Case No.</th>
<th>Motor Latency (ms)</th>
<th>Motor Amplitude</th>
<th>Sensory Latency (ms)</th>
<th>Sensory Amplitude</th>
<th>Sensory Velocity (M/S)</th>
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<tr>
<td>Case 1 Right*</td>
<td>5.8</td>
<td>4.6</td>
<td>5.0</td>
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<tr>
<td>Case 1 Left</td>
<td>3.7</td>
<td>3.9</td>
<td>8.0</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
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<td>X</td>
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<td>7.0</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>3.4</td>
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<tr>
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<td>7.0</td>
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<td>5.1</td>
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<tr>
<td>Right mean SD</td>
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<tr>
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<tr>
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<td>3.9</td>
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<tr>
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<td>12.0</td>
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<tr>
<td>Case 6 mean SD</td>
<td>4.1</td>
<td>3.9</td>
<td>10.5</td>
<td>11.5</td>
<td>3.7</td>
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</table>

(continued from page 28)
fibrous arch formed by the flexor digitorum superficialis. Most of the patients in this study had tension in the flexor muscles of the forearm. It is possible that increased tension in the flexor muscles of the forearm is providing one part of the compression and making the median nerve more susceptible to compression distally. The increased swelling observed within the carpal tunnel may be providing the second portion of the compression, thereby leading to the production of carpal tunnel syndrome. Additional areas where the brachial plexus may become compressed include the interscalene triangle, the space between the clavicle and the first rib, and underneath the pectoralis minor muscle.

No statistically significant increases occurred in the length of the transverse carpal ligament or the carpal tunnel area. Minimal changes in both the length of the transverse carpal ligament and carpal tunnel area did occur despite no active attempts to stretch this region.

Changes in the length of the transverse carpal
ligament and cross-sectional area of the carpal tunnel did not conspicuously correlate with changes in the swelling of the median nerve and carpal tunnel, nerve conduction studies and patient symptoms. In the responder group, the transverse carpal ligament increased in length in 44.4% of the limbs, was unchanged in 22.2% of the limbs, and decreased in length in 33.3% of the limbs. In the nonresponder group, the transverse carpal ligament increased in length in one limb and decreased in length in the opposite limb.

**Chart 1.** Comparison of the changes in the past week hand pain analog scales for the responder group and the nonresponder (0=no pain, 10=unbearable pain).

**Chart 2.** Comparison of the changes in wrist motion measurements (combination flexion and extension) for the responder group and nonresponder.

**Chart 3.** Comparison of the changes in the sensory amplitude of the median nerve for the responder group and nonresponder.

**Chart 5.** Comparison of the changes in the hydration (swelling) of the median nerve for the responder group and the nonresponder.

(continued from page 29)

**Conclusion**
OMT is effective in the treatment of carpal tunnel syndrome. OMT results in significant improvements in pain symptoms, wrist motions, and nerve conduction parameters. OMT also results in decreased swelling in both the median nerve and carpal tunnel. Changes in the swelling of both the median nerve and carpal tunnel appear to more closely parallel changes in hand symptoms than

(continued on page 31)
with nerve conduction findings. Upper thoracic somatic dysfunction, acting by way of the sympathetic nervous system, may play a role in the development of swelling in the carpal tunnel and the development of carpal tunnel syndrome. Somatic dysfunction involving the forearm flexor muscles may be contributing to the “double crush” and the subsequent production of symptoms. Treatment of the upper thoracic spine, upper ribs, lower cervical, and release of forearm dysfunctions are all crucial in the treatment of carpal tunnel syndrome.

**Acknowledgments**

We would like to thank the Glaxo Wellcome Company for their support.

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Sina, Reddog Eitig, DO, PhD

Terzella, Michael John, DO

Valvano, Kevin David, DO

Yao, Sheldon C., DO

(continued on page 33)
Index by Subject

acupuncture

carpal tunnel syndrome


celiac disease

Centers for Disease Control and Prevention

cervical dysfunctions

clinical practice
Figueras JS, Juba AMH. A Still technique to correct upslipped innominate somatic dysfunctions. AAOJ. 2017;27(2):7-10.


common compensatory pattern

computed tomography (CT)

cranial vault hold

directory

Hruby RJ. The techniques of Andrew Taylor Still, MD, DO: the importance of knowing them. AAOJ. 2017;27(2):7-8.


FAAO thesis

fine needle aspiration

From the archives


headaches

high-velocity, low-amplitude


idiopathic steatorrhea

lymphatic system

malabsorption syndrome

magnetic resonance imaging (MRI)

muscle energy


myofascial pain syndrome

myofascial release

(continued on page 34)
(continued from page 33)

myofascial technique

nausea and vomiting

neck pain

needling technique

non-tropical sprue

opioid

original research

osteopathic manipulative treatment
Figueroa JS, Juba AMH. A Still technique to correct upslipped innominate somatic dysfunctions. AAOJ. 2017;27(2):7-10.


osteopathic profession
Hruby RJ. The techniques of Andrew Taylor Still, MD, DO: the importance of knowing them. AAOJ. 2017;27(3):7-8.

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pseudo-obstruction

Sinding-Larsen-Johansson syndrome

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osteoarthritis syndrome
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The AAO Journal

thoracic inlet

ultrasound

upslipped innominate
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View from the Pyramids

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In addition, osteopathic physicians who do not use osteopathic manipulative treatment (OMT) daily will find this course useful, as will other health care professionals with limited or no experience with manipulative techniques.

Through a combination of lectures and hands-on workshops, attendees will learn the basics of osteopathic manipulative medicine, which encompasses osteopathic tenets, palpatory diagnosis and OMT.

The curriculum includes lessons on muscle energy technique; thoracic spine technique; articulatory techniques; functional techniques; myofascial release; and high-velocity, low-amplitude thrust.

Course registration includes one copy of Greenman's Principles of Manual Medicine, 5th edition.

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Friday and Saturday from 8 a.m. to 6 p.m.
Sunday from 8 a.m. to 4 p.m.

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Course Location
University of North Texas Health Science Center
Texas College of Osteopathic Medicine
3500 Camp Bowie Blvd., MET – 470 Lab
Fort Worth, TX 76107

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A Pre-Convocation Course • March 18-20, 2018 • Hilton Anatole in Dallas

Course Description
Sometimes referred to as module 1, this introductory course is an excellent starting point on the journey of learning the fascial distortion model (FDM).

Attendees will be introduced to the theory of FDM while focusing on the shoulder, ankle and knee regions. Learn how FDM ties into traditional osteopathic education and expands the toolbox you use to help more patients.

This is an excellent opportunity for physicians just learning about FDM or for physicians who are familiar with it but want to dive a little deeper.

Continuing Medical Education
24 credits of NMM-specific AOA Category 1-A CME anticipated.

Course Times
Sunday through Tuesday from 8 a.m. to 5 p.m.

Meal Information
Breakfast and lunch are on your own. Coffee and tea will be provided.

Course Location
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2201 N. Stemmons Freeway, Dallas, TX 75207

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

Course Director
Todd A. Capistrant, DO, MHA, earned both his doctor of osteopathic medicine degree and his master in health administration degree in 1997 from the Des Moines (Iowa) University College of Osteopathic Medicine. He is one of only three physicians in the United States who are currently certified to teach seminars on the FDM, and he is the president of the American Fascial Distortion Model Association.

Dr. Capistrant specializes in OMM, and he is certified by the American Board of Family Medicine. He is a member of the growing OMM department at the Tanana Valley Clinic in Fairbanks, Alaska, and he serves as a regional dean for the Pacific Northwest University of Health Sciences, College of Osteopathic Medicine in Yakima, Washington.

Registration Fees

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Billing address (if different):

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

Signature:

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Register online at www.academyofosteopathy.org, or submit this registration form and your payment by email to GWatts@academyofosteopathy.org; by mail to the American Academy of Osteopathy, 3500 DePauw Blvd., Suite 1100, Indianapolis, IN 46268-1136; or by fax at (317) 879-0563.

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I will attend the AAO’s 2018 Convocation.

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View the AAO’s photo release statement.
Osteopathic Management of Chronic Fatigue Syndrome, Fibromyalgia and Multiple Sclerosis

A Pre-Convocation Course • March 18-20, 2018 • Hilton Anatole in Dallas

Course Description
A growing number of people are diagnosed with chronic fatigue syndrome, fibromyalgia and other chronic pain conditions. These patients need effective, noninvasive treatment that doesn’t aggravate their conditions. This course will provide participants the tools to recognize these conditions and to effectively treat those patients.

The assessment and treatment will be done over six specific key lesions (three in the front of the body and three in the back). The treatment will be a blend of Dr. Chikly’s lymph and brain techniques.

The lymph techniques will include lymph mapping and some specific viscera work using a lympho-fascia release approach to viscera such as the liver, pancreas, heart, etc. The brain techniques will include intracranial membranes using curved bionetility, brainstem, etc. Specific sacrum techniques also will be presented.

By the end of the course, participants will be able to identify several chronic pain conditions; describe the comorbidity, known causes, and differential diagnoses of these conditions; and explain the importance of the lymphatic system in addressing these conditions.

Continuing Medical Education
24 credits of NMM-specific AOA Category 1-A CME anticipated.

Course Times
Sunday and Monday from 8:30 a.m. to 6 p.m.
Tuesday from 8:30 a.m. to 4:30 p.m.

Meal Information
Breakfast and lunch are on your own. Coffee and tea will be provided.

Course Location
Hilton Anatole Dallas
2201 N. Stemmons Freeway, Dallas, TX 75207
Make hotel reservations now: click here.
To make your reservations by phone, call (214) 748-1200 and provide the group code (AAO for physicians).

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

Registration Fees

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<th>On or before Jan. 18, 2018</th>
<th>Jan. 18 through March 2, 2018</th>
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1 Registrations received after March 2 will be processed on-site, incurring a $150 late fee. 2 The AAO’s associate members, international affiliates and supporter members are entitled to register at the same fees as full members. This course is not appropriate for students.

☐ I am a practicing health care professional.
☐ I am a resident or intern.
☐ I will attend the AAO’s 2018 Convocation.

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Credit card No.: ____________________________________________
Cardholder’s name: __________________________________________
Expiration date: _________________ 3-digit CVV No.: ____________
Billing address (if different): __________________________________

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

Signature: __________________________________________
View the AAO’s cancellation and refund policy.

Register online at www.academyofosteopathy.org, or submit this registration form and your payment by email to GWatts@academyofosteopathy.org; by mail to the American Academy of Osteopathy, 3500 DePauw Blvd., Suite 1100, Indianapolis, IN 46268-1136; or by fax at (317) 879-0563.

Dr. Bruno Chikly, MD, DO (France), is a graduate of the medical school at St. Antoine Hospital in Paris, where his internship in general medicine included training in endocrinology, surgery, neurology and psychiatry.

Dr. Chikly also has the French equivalent of a master’s degree in psychology. In 2009, he received a doctorate in osteopathy from CROMON (Holistic Research Center for Osteopathic and Natural Medicine) and AIROP (Italian Association for Postural Occlusion Re-education) in Italy, and he is on the French National Registry of Osteopathy.

Dr. Chikly is an internationally renowned educator, lecturer and writer. He is the author of the book Silent Waves: The Theory and Practice of Lymph Drainage Therapy, as well as the creator of a DVD titled Dissection of the Brain and Spinal Cord, and he is working on a book about osteopathic manipulation and the brain. He lives in Scottsdale, Arizona, with his wife and partner, Alaya.
The Twig Unbent: An Osteopathic Approach to Common Orthopedic Problems in Children

A Pre-Convocation Course • March 18-20, 2018 • Hilton Anatole in Dallas

Course Description
This program is designed to focus on treating children with common pediatric orthopedic complaints using osteopathic manipulative treatment within the larger context of medicine. Attendees will learn a variety of approaches to treating upper and lower extremity dysfunctions, as well as scoliosis and headaches. Attendees will practice moving attention through bone, fluid and membrane to augment perception ability and treatment effectiveness.

Modalities include balanced ligamentous tension (BLT), balanced membranous tension (BMT), facilitated positional release (FPR), muscle energy technique (MET) and intraosseous techniques.

Continuing Medical Education
19 credits of NMM-specific AOA Category 1-A CME anticipated.

Course Director
Heather P. Ferrill, DO, MS MEdL, a 2000 graduate of the Michigan State University College of Osteopathic Medicine (MSUCOM), is a professor of osteopathic principles and practices (OPP) at the Rocky Vista University College of Osteopathic Medicine. Board-certified in family practice and neuromusculoskeletal medicine/OMM, her practice emphasizes osteopathic manipulative treatment in the pediatric population. Dr. Ferrill serves on the AAO’s Board of Trustees and the Education Committee.

Lisa Ann DeStefano, DO, has chaired the Department of Osteopathic Manipulative Medicine at MSUCOM since 2004. A protégé of the late Philip E. Greenman, DO, FAAODist, Dr. DeStefano edited the fourth and fifth editions of the textbook Greenman’s Principles of Manual Medicine.

Registration Fees

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I am a resident or intern.
I am an osteopathic or allopathic medical student.
I will attend the AAO’s 2018 Convocation.

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Course Description
In this course, attendees will explore the inherent motions, or motility, of the viscera of the thorax, abdomen and pelvis. These motions are not to be confused with the motility of the gastrointestinal tract as described in gastroenterology books, nor with mobility, which is movements caused by respiration. Visceral motility occurs at a rate of 5 to 7 cycles per minute, concurrent with a visceral motility of the brain. As the organ moves away from the midline, it is called inspir, and when returning to the midline it is called expir. This motion is three-dimensional. Its amplitude is small enough that it can’t be measured or seen radiographically, but it is palpable. In organs that are weak or strained, the motility is less. In addition to being palpable, the strength of motility can be palpated in the corresponding meridian. The motions reproduce the embryological development.

Visceral chains connect the cranium, the viscera, the upper and lower extremities and the spine. We find these chains in patterns, which allows us to be able to more precisely understand, diagnose and treat what appear to be cranial, musculoskeletal and visceral problems, in a more effective sequence.

“Central sag phenomenon” is a recent clinical discovery that connects Sutherland’s idea of sacral sag with spinal ligaments, visceral ptosis and prolapse, with the hips, psoas, and iliacus muscles. This sag phenomenon occurs quite frequently and is connected with recurrent low back pain, SIBO, bladder problems, urinary frequency and incontinence, BPH, fatigue, and difficulty standing for prolonged periods.

Course Times
Sunday and Monday from 8:30 a.m. to 5:30 p.m. and Tuesday from 8:30 a.m. to 4:30 p.m. Breakfast and lunch are on your own. Coffee will be provided.

Continuing Medical Education
22 credits of NMM-specific AOA Category 1-A CME anticipated.

Course Director
Kenneth J. Lossing, DO, has been studying visceral manipulation with Jean-Pierre Barral, DO (France), for 30 years. An internationally recognized lecturer, Dr. Lossing contributed to the second and third editions of the American Osteopathic Association’s Foundations of Osteopathic Medicine textbook.

As the Academy’s 2014-15 president, Dr. Lossing starred in a two-minute video segment of “American Health Front!” that focused on osteopathic manipulative medicine.

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

Course Location
Hilton Anatole Dallas
2201 N. Stemmons Freeway, Dallas, TX 75207
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Dec. 7, 2017
Indiana Osteopathic Association
**Preconference OMT Workshop**
JW Marriott in Indianapolis
8 credits of AOA Category 1-A CME anticipated
Learn more and register at [www.inosteo.org](http://www.inosteo.org).

Dec. 8-10, 2017
Indiana Osteopathic Association
**36th Annual Winter Update**
JW Marriott in Indianapolis
25 credits of AOA Category 1-A CME anticipated
Learn more and register at [www.inosteo.org](http://www.inosteo.org).

Jan. 12-14, 2018
Michigan State University College of Osteopathic Medicine
**Pediatric Manual Medicine**
Course director: Lisa Ann DeStefano, DO
East Lansing, Michigan
22 credits of AOA Category 1-A CME anticipated
Learn more and register at [com.msu.edu/cme](http://com.msu.edu/cme).

Jan. 18-21, 2018
Osteopathy’s Promise to Children
**The Motions, Life Forces and Healing Process: How to Work With the Dynamics of Life and the Breath of Life**
Course director: Philippe Druelle, DO (F-Qc)
Osteopathic Center San Diego
No credits of AOA Category 1-A CME anticipated
Learn more and register at [the-promise.org/cme/](http://the-promise.org/cme/).

Jan. 26-30, 2018
Michigan State University College of Osteopathic Medicine
**Craniosacral Techniques: Part I**
Course director: Barbara J. Briner, DO
East Lansing, Michigan
35 credits of AOA Category 1-A CME anticipated
Learn more and register at [com.msu.edu/cme](http://com.msu.edu/cme).

Feb. 9-12, 2018
Michigan State University College of Osteopathic Medicine
**Principles of Manual Medicine**
Course director: Lisa Ann DeStefano, DO
East Lansing, Michigan
28 credits of AOA Category 1-A CME anticipated
Learn more and register at [com.msu.edu/cme](http://com.msu.edu/cme).

Feb. 17-18, 2018
Osteopathy’s Promise to Children
**Introductory Course: A.T. Still’s Approach to the Foot and Ankle**
Course directors: Rue Tikker, DPM, and Charles A. Beck, DO, FAAO
Osteopathic Center San Diego
12 credits of AOA Category 1-A CME anticipated
Learn more and register at [the-promise.org/cme/](http://the-promise.org/cme/).

April 20-24, 2018
Michigan State University College of Osteopathic Medicine
**Muscle Energy: Park I**
Course director: Carl Steele, DO
East Lansing, Michigan
34 credits of AOA Category 1-A CME anticipated
Learn more and register at [com.msu.edu/cme](http://com.msu.edu/cme).

May 4-6, 2018
Osteopathy’s Promise to Children
**A Dental Course: Expanding the Osteopathic Concept—Beyond the Basics**
Course directors: Raymond J. Hruby, DO, MS, FAAODist, and Darick Nordstrom, DDS
Osteopathic Center San Diego
24 credits of AOA Category 1-A CME anticipated
Learn more and register at [the-promise.org/cme/](http://the-promise.org/cme/).

May 4-8, 2018
Sutherland Cranial Teaching Foundation
**2018 Basic Course: Osteopathy in the Cranial Field**
Course director: Hugh M. Ettlinger, DO, FAAO, FCA
New York Institute of Technology
College of Osteopathic Medicine
Old Westbury, New York
Learn more and register at [www.sctf.com](http://www.sctf.com).

June 1-3, 2018
Still Exaggeration Technique, LLC
**Introductory Exaggeration Course**
Course director: Jerry L. Dickey, DO, FAAO
New York Institute of Technology
College of Osteopathic Medicine
Old Westbury, New York
25 credits of AOA Category 1-A CME anticipated
Learn more and register at [stillexaggeration.com](http://stillexaggeration.com).

Visit [www.academyofosteopathy.org/affiliate-cme](http://www.academyofosteopathy.org/affiliate-cme) for additional listings.