Advancing the Understanding and Treatment of the Thoracic Inlet and Incorporation of a New Still Technique—Part 1

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

FAAO THESIS

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.

From the Des Moines University College of Osteopathic Medicine in Iowa.

Financial disclosures: none reported.

Correspondence address:
Drew D. Lewis, DO, FAAO, FNAOME, FAOCPMR, FAAPMR
Associate Professor, OMM Department
Des Moines University College of Osteopathic Medicine
3200 Grand Ave
Des Moines, IA 50312
(515) 271-1429
drew.d.lewis@dmu.edu

Submitted for publication April 24, 2017; final revision received September 7, 2017; manuscript accepted for publication October 19, 2017.

Dr Lewis prepared this manuscript as one of the requirements to earn fellowship in the American Academy of Osteopathy. The Committee on Fellowship in the AAO provided peer reviewing for this article, and it was edited to conform to the *AAOJ*'s style guidelines.

Because of the length of this manuscript, it has been divided into two parts. The second part will be published in the March 2018 issue of the *AAOJ*.

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.[1,2] 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.[3]

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.[1(p786),3(p111),4,5] 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[6] but also from the entire body.[3(p9,87),4(p490),7] 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.[8,9,3(p50,87),10,11]

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

(continued on page 20)

(continued from page 19)

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.[8] 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.[12,13]

Viscerosomatic 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.[14] 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.[12] A key component is the movement of low-pressure fluids, eg, the lymphatic system.[15]

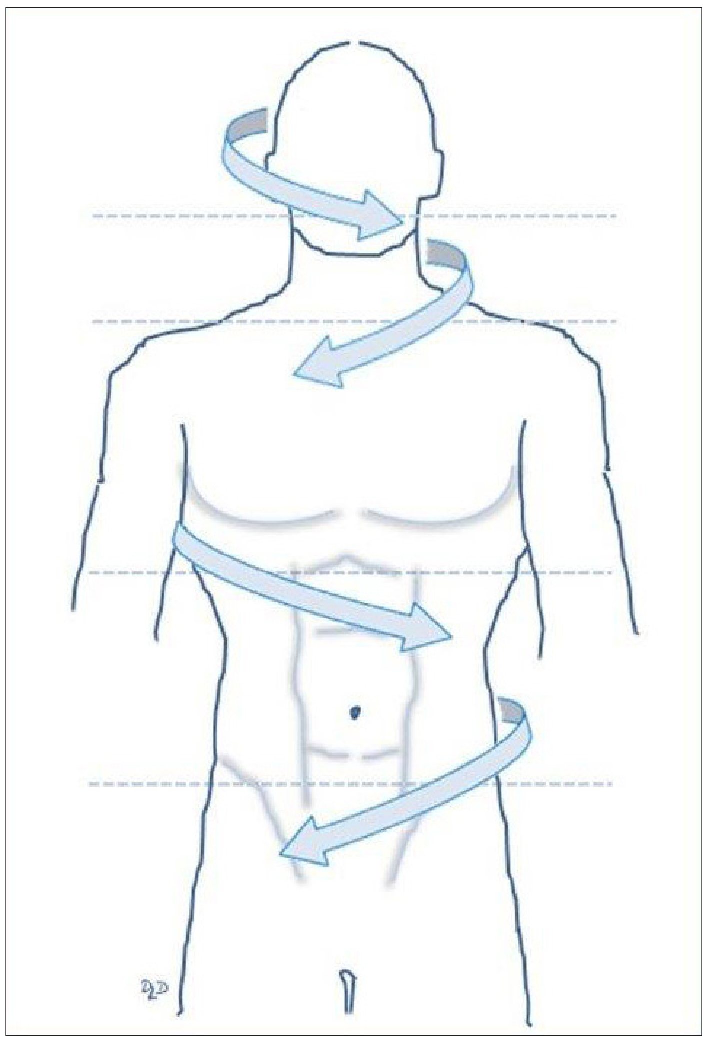
The aim of Zink's whole body approach with OMM is to promote effective negative intrathoracic pressure through improved bellows mechanism of the thoracic cage and thoracoabdominal diaphragm.[16] This approach improves venous and lymphatic return and facilitates a return to homeostasis and improved overall health.[1(p793,799),10,11,14,15] Zink detailed a whole-body structural evaluation focused particularly on somatic dysfunctions related to abnormal fascial patterns directly affecting the four diaphragms to quickly determine "problem areas that inhibit diaphragmatic breathing."[14]

Zink's common compensatory pattern

When examining fascial patterns related to the major diaphragms, Zink found that a majority of patients had common findings.[8,14] Found at the transitional areas, the common fascial patterns, or common compensatory pattern (CCP), were found to alternate when viewed from top-down or bottom-up *(Figure 1)*. These common fascial patterns were related to normal torsional movements

(continued on page 21)

Figure 1. *Alternating fascial patterns of CCP at transitional zones.*



(continued from page 20)

of the body as in the walking cycle and were felt to contribute to postural balance.[2] 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.[18] 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.[14] 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.[1(p792),3(p50,87),8,9,10,11] 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.[3(p9)] In addition, conditions with sympathicotonia can impair lymph drainage

(continued on page 22)

(continued from page 21)

due to the sympathetically controlled valves between the thoracic duct and the venous system.[1(p792)] 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.[22]

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.[6] 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.[10]

The thoracic inlet has myofascial relationships to structures superior and inferior; superficial and deep. Of particular note, the clavipectoral 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.[23(p817,952)] The posterior layer of the clavipectoral fascia fuses with deep cervical fascia, and inferiorly it blends with the axillary fascia.[23]

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.[24] Viscerosomatic reflexes associated with organs above the thoracoabdominal diaphragm (heart, lungs, thyroid, head, and neck) can cause somatic dysfunction in the upper thoracics.[25] For instance, with cardiac pain, Beal noted changes from T1-5.[26] These upper thoracic somatic dysfunctions caused by viscerosomatic reflex may resist even properly applied OMT and should raise the concern of a visceral etiology.[27,28]

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 lumbopelvic 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.[2] Dysfunction in these regions can lead to compensation in multiple regions and planes and impaired venous and lymphatic return.[2]

Postural dysfunction also can extend into the limbs, where for example, protracted shoulders have been implicated with shoulder impingement.[25] 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.[2]

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.[3(p488),19(p15)] 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).[3(p479)]

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.[14]

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, RlSr 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 (NSlRr or NSrRl).

(continued on page 23)

(continued from page 22)

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.[19] 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.[3(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

1. Kuchera ML. Lymphatics approach. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:799.
2. Kuchera ML. Postural consideration in osteopathic diagnosis and treatment. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:438-448.
3. DeStefano L, ed. *Greenman's Principles of Manual Medicine*. 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2011:254.
4. Nicholas A, Nicholas E. Lymphatic techniques. In: *Atlas of Osteopathic Techniques*. 2nd ed. Philadelphia, PA: Lippincott, Williams & Wilkins; 2012:489-490.
5. Zink JG. The osteopathic holistic approach to homeostasis: 1969 Academy lecture. In: Barnes MW, ed. *1970 Year Book of Selected Osteopathic Papers*. Carmel, CA: Academy of Applied Osteopathy. 1970:1-10.

(continued on page 24)

(continued from page 23)

6. Heinking KP, Kappler RE, Ramey KA. Head and suboccipital region. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:506.
7. Heinking KP. Lumbar region. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:558.
8. Wallace E, McPartland JM, Jones JM III, Kuchera WA, Buser BR. Lymphatic system. In: Ward RC, ed. *Foundations for Osteopathic Medicine*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2003:1062-1063.
9. Heinking KP, Brolinson PG, Goodwin TA. Large joint injury in an athlete. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:945-950.
10. Zink JG, Lawson WB. Pressure gradients in the osteopathic manipulative management of the obstetric patient. *Osteopath Ann.* 1979;7(5):208-214.
11. Zink JG. Respiratory and circulatory care: the conceptual model. *Osteopath Ann.* 1977;5(3):108-112.
12. Kuchera ML. Lymphatics approach. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:792-793.
13. Simons DG, Travell JG, Simons LS. *Travell and Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual*. Vol 1. Upper Half of Body. 2nd ed. Baltimore, MD: Williams & Wilkins; 1999:506-508.
14. Zink JG, Lawson WB. An osteopathic structural examination and functional interpretation of the soma. *Osteopath Ann.* 1979;7(12).
15. Willard FH, Jerome JA. Introduction: the body in osteopathic medicine—the five models of osteopathic treatment. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:54.
16. Zink JG, Fetchik WD, Lawson WB. The posterior axillary folds: a gate-way for osteopathic treatment of the upper extremities. *Osteopath Ann.* 1981;9(3):81-88.
17. Kuchera ML. Postural consideration in osteopathic diagnosis and treatment. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:443.
18. TePoorten BA, Boesler D, Woolley A, Klock G. DMU Course # OMM1101, Year 2013-2014.
19. Van Buskirk RL. First Ribs. In: *The Still Technique Manual*. 2nd ed. Indianapolis, IN: American Academy of Osteopathy; 2006:19. ■