RVUCOM Osteopathic Principles & Practice

2025-2026 OPP III & IV Manual

Acknowledgements

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Chapter 1
An Introduction

The second-year curriculum builds upon the foundation of the principles and philosophies of osteopathic medicine established during the first year of medical school. The curriculum focuses on applying the principles in a more clinical manner. The first-year manual focuses on body regions: cervical, thoracic, lumbar, upper and lower extremities, etc. In contrast, this manual is organized by body systems: renal, cardiovascular, upper and lower respiratory, hematology/oncology, gastrointestinal, cranial, female and male reproduction, and finally the musculoskeletal system with specific concentration on the upper and lower extremities. This manual is designed to integrate with the systems courses to help enhance your knowledge of anatomic relationships as they apply to osteopathic principles and the clinical care of patients. This manual will walk through the clinical evaluation of patients as an osteopathic physician, paying close attention to certain patient populations.

There are several ways to structure the systems-based approach. This manual will use the "ABCS" format. The "A" stands for autonomics. In each system, the sympathetic innervation, parasympathetic innervation, and associated Chapman's points will be introduced. The "B" stands for biomechanics and details the relevant musculoskeletal anatomy and fascial relationships pertinent to each system. For example, in the chapter regarding the gastrointestinal system, muscles of the abdominal wall and the effects of their dysfunction can be found in the biomechanics section. The "C" stands for circulation and highlights the relevant arterial supply and venous and lymphatic drainage. For example, the venous sinuses outlined in Osteopathic Cranial Manipulative Medicine (OCMM) are relevant to both the circulation of the brain and to manipulative treatment techniques. Screening is the last component of the ABCS. Osteopathic screening includes not only an assessment of biomechanics (posture, gait, active and passive movement), but also biochemical and biophysical components of the patient's life such as laboratory evaluation (blood, urine, etc.), imaging (X-ray, CT, MRI), and biopsychosocial components (nutrition, sleep, exercise, mental health, spiritual and social contributions).

While the principles and techniques presented in the second year are compiled in this manual, it does not serve as an all-encompassing reference. Specific methods of diagnosis are explained in the first-year manual. An explanation of Fryette's spinal mechanics can be found in "Chapter 5: Thoracic Region" of the *RVUCOM OPP I & II Manual*. Treatment modalities including articulatory, high-velocity low-amplitude, muscle energy, myofascial release, and soft tissue can also be found in the first-year manual. Suggestions for how to address an attending physician regarding a proposed osteopathic manipulative treatment (OMT) plan and an example of appropriately charting for OMT can be found in the appendix of this manual, which also houses an approach to the hospitalized patient. The appendix of each manual contains a complete summary of autonomic innervations and Chapman's reflex points.

Upon completion of second year, the successful student will be able to confidently explain the theories and tenets of osteopathic principles, diagnose somatic dysfunctions with proficient palpation skills, and safely administer OMT.

NOTES

ABCs of Osteopathy[1]

This is a conceptual guide to be used when applying osteopathic principles to medical practice. While not an all-encompassing guide, it can aid in applying osteopathic manipulative treatment to many clinical scenarios. This is not a rote prescription because as osteopathic physicians we diagnose and treat based on the unique presentation of the individual.

Autonomics

The autonomic nervous system (ANS), as the involuntary arm of our nervous system, regulates physiologic functions required for survival. The ANS also mediates communication between the neuromusculoskeletal and visceral organ systems through interneurons. Stimulation of these interneurons can result in upregulation and feedback to the visceral organs associated with specific somatic structures; this feedback loop is termed a viscerosomatic or somatovisceral reflex, depending on the direction of stimulation. The manifestation of these reflexes within the central nervous system (CNS) is called central sensitization or facilitation. Facilitation refers to a decrease in the firing threshold of a reflex arc, thus requiring less stimuli to create a response. This is distinct from the osteopathic concept of a facilitated segment. A facilitated segment is a vertebral unit (two vertebrae and their related cartilaginous, ligamentous and muscular structures) that has responded to CNS facilitation by creating hypertonicity in the short restrictor muscles.[2] This hypertonicity, in turn, creates the TART changes we experience through palpation and which osteopathic physicians call somatic dysfunction. The hypertonicity creates range of motion restrictions, decreased circulatory flow resulting in venous and lymphatic stasis, and increased regional biochemical markers for pain (including lactic acid, nitric oxide, etc.). Resolving somatic dysfunction in structures associated with autonomic innervation can affect both the somatic and visceral systems associated with that vertebral unit.

Biomechanics

Freely moving joints and articulations are imperative for optimal function. This is true for both somatic and visceral systems. When restriction in range of motion is present, by definition, so too is somatic dysfunction. Relieving these biomechanical restrictions is important to the manifestation of healthy physiology. Sometimes, the most significant biomechanical restrictions and somatic dysfunctions are seemingly unrelated to the area of a patient's chief complaint. To reconcile this apparent incongruity, one must understand and apply the biomechanical principle of tensional integrity, or tensegrity. Tensegrity gives us a model to understand how physical forces in the body can impede the normal motion of a given structure.

Circulation

Optimal arterial, venous and lymphatic flow is essential for normal physiologic function. Vessels must cross transverse myofascial structures at the transitional zones of the body (e.g., the thoracic inlet/Sibson's fascia at the cervicothoracic junction). When functional, these structures act as diaphragms, pumping fluid and enhancing flow. However, when dysfunctional they act as baffles, restricting the flow of fluid. Assessing and treating dysfunctional diaphragms, such as the central diaphragms (i.e., the thoracic inlet, thoracoabdominal diaphragm, and the pelvic diaphragm) and peripheral diaphragms (e.g., the fascia of the antecubital and popliteal fossae), can help normalize circulation.

Screening

Screening the whole patient for somatic dysfunction ensures a comprehensive assessment and may uncover important somatic dysfunctions and dysfunctional relationships. Osteopathic screening includes not only an assessment of biomechanics (posture, gait, active and passive movement), but also biochemical and biophysical components of the patient's life such as laboratory evaluation (blood, urine, etc.) and imaging (X-ray, CT, MRI). The osteopathic physician should also recall the importance of the psychosocial aspects of health. These are considered below, along with some specific questions, which are relevant for a patient with disease in any system. Note that this is not a comprehensive list and that not all questions need to be asked with every patient. The biomechanical, biochemical, and biophysical exams relevant to each system will be considered throughout the rest of this manual.

- **Mental health:** *How are you feeling about your health? Have you felt down recently? Is anything worrying you?* Screening tools may quickly assess the risk of anxiety and depression during a clinical encounter, for example, the Patient Health Questionnaire (PHQ) for depression, and the Generalized Anxiety Disorder 7-Item (GAD-7) scale for anxiety.
- **Nutrition:** *Are you following any specific diet or nutrition plan? Has anyone put a restriction on specific nutrients (e.g., sodium intake)? What are you drinking to stay hydrated?*
- **Physical activity/exercise:** *How much physical activity do you get per day, per week? What level of intensity is it? Do you focus on a specific aspect of exercise (cardiopulmonary, strength, mobility, etc.)? Has any provider restricted your physical activity? Do you have any worrisome symptoms when you exercise (e.g., pain, dizziness)?*
- **Sleep:** *How is your sleep? When do you go to bed, and when do you finally fall asleep? When do you wake up? Do you wake up in the night and if so, why? Do you snore or choke in your sleep? Do you feel rested in the morning? Do you take anything to help you sleep? Do you keep good sleep hygiene practices (e.g., limiting screen time, alcohol, and food before bed)?*
- **Personal relationships/social support:** *Who do you ask for help when needed? Do you feel supported at home? In an emergency, who would you call for help?*
- **Employment/work:** *Are you able to fulfill the duties of your job? Are you missing work because of illness? Is your place of work a safe environment?*
- **Activities of daily living (ADLs):** *Are you able to take care of yourself at home? Do you need any help with dressing, bathing, or making meals for yourself? Is your home environment friendly to your physical needs (e.g., free of trip hazards, having support bars in the shower for those at risk of falls)? Do you use any equipment for mobility?*
- **Housing and transportation:** *Are you able to drive without difficulty? Has anyone told you that you should not drive anymore? Do you have any difficulty getting to your appointments? Do you have safe housing? Who lives at home with you? Are you able to maintain a safe environment (e.g., well-heated during winter, cooled during summer)?*
- **Community/spiritual/religious involvement:** *Do you have supportive relationships in your community? Do you have support for your spiritual or religious needs?*

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Chapter 2

Renal System

"An Osteopath reasons from his knowledge of anatomy. He compares the work of the abnormal body with the work of the normal body."

-A.T. Still, M.D., D.O.

Contents:

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Autonomics[2-5,9]

Autonomic Spinal Levels for the Renal System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Kidneys	T10-L1	CN X (Capsule Only)
Upper Ureters	T10-11	CN X
Lower Ureters	T12-L1	S2-4
Urinary Bladder	T11- L2	S2-4
Urethra	T10-L2	S2-4

Chapman's Reflex Points for the Renal System

	Anterior Point Location	Posterior Point Location
Kidneys	1 inch superior and 1 inch lateral to umbilicus	Intertransverse space between T12 and L1, midway between the spinous process and the tip of the transverse process
Bladder	Around the umbilicus	Superior aspect of transverse process of L2
Urethra	Medial aspect of the pubic ramus near the superior aspect of the pubic symphysis	Superior aspect of transverse process of L2

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Kidney

The role of the sympathetic innervation of the kidney is vasomotor control to the smooth muscle of the afferent and efferent arterioles. Increase in sympathetic input leads to a decrease in glomerular filtration rate (GFR) as well as a decrease in urine output. Both sympathetic and parasympathetic fibers innervate the kidney's mechanoreceptors and chemoreceptors, which play a role in renorenal and cardiovascular reflexes.

Ureters

Sympathetic innervation decreases ureteral peristalsis and may cause ureterospasm. Parasympathetic innervation increases ureteral peristalsis and basal tone of the smooth muscle. It also decreases ureteral arterial resistance using a mechanism involving endothelium-derived nitric oxide.

Bladder

Sympathetic innervation prevents urination by causing the internal sphincter to contract. It also leads to decreased bladder wall tone which can lead to vesicoureteral reflux and incomplete emptying of the bladder. Parasympathetic innervation has two effects on the bladder that encourage urination. The first is activation of the detrusor muscle which contracts the bladder. The second is inhibition of the internal sphincter, countering the contraction promoted by sympathetic tone, allowing urine to exit the bladder.

Urethra

Sympathetic innervation of the urethra comes from T10-L2. The parasympathetic fibers come from S2-4 via the pelvic splanchnic nerves. The specific role of autonomic innervation in urethral function is presently poorly understood.

Osteopathic Considerations in Autonomics Related to the Renal System

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and renal systems manifest in the tissues. Alterations in sympathetic tone due to renal or urinary dysfunction may present as paraspinal tissue texture changes and range of motion restrictions from T10-L2. Alterations in parasympathetic tone may affect the suboccipital region, possibly manifesting as muscular hypertonicity and OA/upper cervical somatic dysfunction due to facilitation of CN X. It may also present as dysfunction in the parasacral region due to facilitation of S2-4.

Biomechanics[2-5]

Kidneys

The kidneys are retroperitoneal. The right kidney is located between **L1-3** and articulates medially with the second portion of the duodenum and laterally with the ascending colon. It sits lower than the left kidney secondary to the location of the liver. The left kidney is located between **T12-L3**, articulates with the tail of the pancreas, the spleen, and the stomach, and is generally larger than the right kidney. Both kidneys contact the 12th ribs. Superiorly, the kidneys are associated with the diaphragm, and inferiorly they are associated with the psoas, quadratus lumborum and transversus abdominis muscles. Both kidneys are angled so that the inferior pole lies more laterally than the superior pole. Additionally, the hilar surface is oriented anteromedially secondary to the shape of the paravertebral gutter.

There is no ligament that holds the kidney in place vertically. This can lead to the inferior displacement of the kidney, which is called ptosis, and may lead to compression of the hilar vessels.

Ureters

The ureters are retroperitoneal structures that carry urine from the kidneys to the bladder. The ureter has association with the iliopsoas muscle from the lumbar spine to within the pelvis. There are three points at which the ureter narrows, making it vulnerable to obstruction. These include the hilum, the pelvic brim and the ureterovesicular junction.

Bladder

The bladder is covered by peritoneum superiorly and has anterior attachments to the median and medial umbilical ligaments (remnants of the urachus and umbilical arteries, respectively). The small intestine is also present superiorly, and in females, the uterine fundus can lie superior to the bladder. The bladder sits posterior to the pubis and is connected to it via the pubovesical ligaments and the pubovesicalis muscle. In females, the cervix and vagina sit posterior to the bladder. In males, the seminal vesicles are posterior to the bladder. Inferior to the bladder are the pelvic floor muscles, the obturator internus muscle and the urethra. In males, the prostate is located inferior to the bladder.

Osteopathic Considerations in Biomechanics Related to the Renal System

The physiological (or pathologic) functioning of the renal system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify an organ's function, the long fascial chains of the body can transmit forces from distal anatomic structures. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the renal system:

- Visceral dysfunction (altered mobility and/or motility) of the kidneys
- Ribs, especially 11-12 due to their proximity to the kidneys
- Respiratory diaphragm due to pumping action on the kidneys
- Lumbar spine due to proximity to the kidneys, attachment of relevant musculature
- Abdominal musculature including transversus abdominis, quadratus lumborum and psoas muscles due to their proximity to the kidneys and ureters
- Sacrum and pelvis due to proximity to the lower urinary tract structures, especially the pubic symphysis
- Pelvic floor due to support of lower urinary tract structures

Circulation[4,5]

Kidney

- Arterial: aorta → renal artery → kidney
- Venous: renal veins → IVC
- Lymphatic: right (caval) and left (aortic) lumbar lymph nodes → cisterna chyli → thoracic duct

Bladder

- Arterial: aorta → common iliac artery → internal iliac artery → bladder
- Venous: vesical venous plexus → internal iliac vein → common iliac vein → IVC
- Lymphatic: internal and external iliac lymph nodes → common iliac lymph nodes → caval and aortic lymph nodes → cisterna chyli

Osteopathic Considerations in Circulation Related to the Renal System

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory systems (venous and lymphatic systems). These baffles include the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. For a more complete review, please see your first-year manual or any of the referenced materials.

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the renal system. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the renal system. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the renal system. Next, biochemical and biophysical tests frequently used in the evaluation of the renal system are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

Osteopathic Structural Exam

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- OA, AA, C2 for the parasympathetic innervation from CN X
- T10-L2 for the sympathetic innervation of the renal system
- Ribs 11 and 12 for biomechanics of the kidneys (left 11^{th} rib contacts left kidney; 12^{th} ribs contact bilateral kidneys)
- Psoas, quadratus lumborum, transversus abdominis for biomechanical effect on kidneys and ureters
- Diaphragm for biomechanical effect on the kidneys and a baffle effect on circulation
- Pubic symphysis for biomechanical effects via ligamentous and muscular attachments to the bladder and urethra
- Pelvic floor/diaphragm for biomechanical support of the bladder and urethra
- Sacrum for biomechanical effect on lower urinary tract and parasympathetic innervation from S2-4
- Visceral mobility and motility of the kidneys

Testing

- Urinalysis for blood, bacteria, glucose
- Basic metabolic panel for electrolytes, glucose, blood urea nitrogen, and creatinine
- Kidney ureter and bladder (KUB) X-ray to identify radio-opaque structures in the renal system
- Renal or bladder ultrasound to identify echogenic structures and blood flow dynamics
- Abdominal/pelvic CT for detailed evaluation of all structures, masses, and fluids

Technique Contents:

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Posterior Diaphragm BLT/LAS[6]

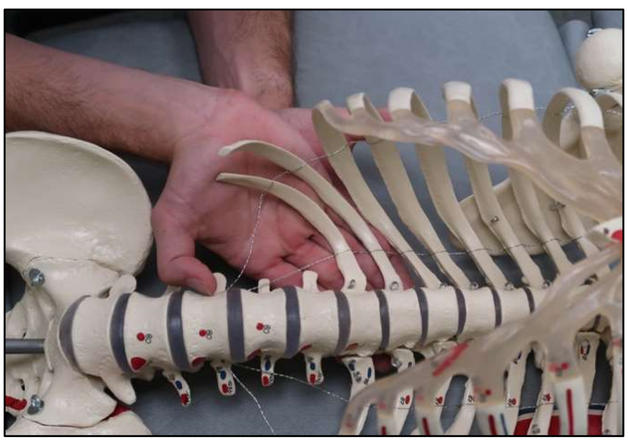
Example Diagnosis: Right hemidiaphragm inhalation dysfunction

Physician Position: Seated on the side of dysfunction

Patient Position: Supine

Procedure:

1. Place the caudad hand posterior to rib 12. Contact as much of rib 12 as possible with this hand. RELAX this hand COMPLETELY. This is the monitoring hand.
2. Place the cephalad hand posterior to the caudad hand. This is the treatment hand.
3. Engage the 12th rib by compressing anteriorly with the cephalad hand.
4. Gently distract laterally along the shaft of the 12th rib.
5. Add superior to inferior rib motion (abduct to adduct) until there is an increase in resistance. This resistance is the posterior diaphragm.
6. Fine tune the position (abduction, adduction, medial, lateral, etc.) until the posterior diaphragm tension is balanced.
7. Wait for the release.* The release should be achieved relatively quickly – a few seconds. If not, repeat step 4-6.
8. After a release is palpated, return the patient to neutral and reassess.



Hand position: Posterior Diaphragm BLT/LAS

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues, or a change in the patient's respiratory pattern.

Short-Lever BLT/LAS for Thoracic and Lumbar Joint Dysfunctions[6]

Example Diagnosis: L2 FRrSr

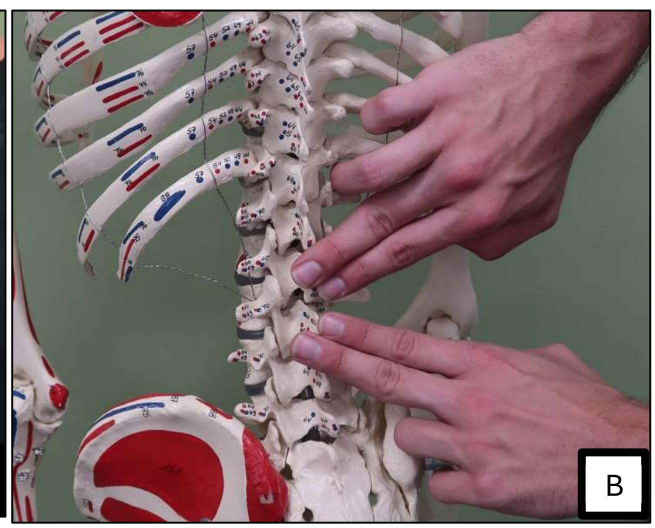
Physician Position: Seated at the side of the table

Patient Position: Supine

Procedure:

1. Contact the spinous process of the involved vertebra with the fingertips of the cephalad hand.
2. With the caudad hand, contact the spinous process of the next inferior segment.
3. Use the spinous processes to bring the involved segment into balance:
    a. Induce flexion by moving the two spinous processes away from each other in the sagittal plane.
    b. Induce extension by moving the two spinous processes toward each other in the sagittal plane.
    c. Induce rotation of the involved segment by pushing the tip of the spinous process away from you for ipsilateral rotation or drawing the tip of the spinous process toward you for contralateral rotation in the transverse plane.
    d. Induce sidebending with ulnar or radial deviation of the cephalad hand in the coronal plane. (This will be a minor motion.)
4. Make minor adjustments to all planes until the balance is achieved.
5. Wait for the release.* The release should be achieved relatively quickly – a few seconds. If not, repeat steps 3-4.
6. After a release is palpated, return the patient to neutral and reassess.

A. Treatment Position: Short-Lever BLT/LAS for Thoracic and Lumbar Joint Dysfunctions



B. Hand Position: Short-Lever BLT/LAS for Thoracic and Lumbar Joint Dysfunctions

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Myofascial Release (MFR)

Quadratus Lumborum (QL) Long-Lever Indirect MFR

Shin in armpit
- Flexion and ABduction

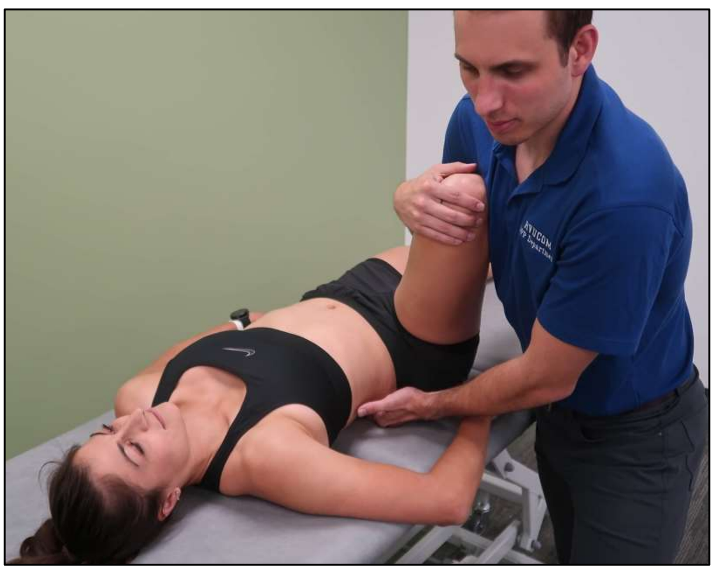
Example Diagnosis: Right QL restriction and tenderness

Physician Position: Seated or standing at the side of dysfunction

Patient Position: Supine

Procedure:

1. Contact the ipsilateral QL with the cephalad hand
2. With the caudad hand, bring the ipsilateral hip into flexion and abduction.
    a. This may be easier by placing the flexed knee in the physician's axilla, wrapping the arm around the leg, and directing the leg with the physician's body.
    b. Avoid excessive lumbar flexion.
3. Using the leg as a long lever, bring the QL into a position of ease.
4. Wait for the release.* The release should be achieved relatively quickly. If not, repeat steps 3-4.
    a. As the tissue tension changes, you may follow the myofascial creep.
5. After a release is palpated, return the patient to neutral and reassess.



Treatment Position: QL Long-lever Indirect MFR

*The release occurs when there is a change in the tension of the tissues. This can be perceived as a change (often a very subtle change) in the amount of force needed to maintain indirect engagement. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Visceral Techniques

Direct (Short-Lever) Kidney Visceral Treatment[7]

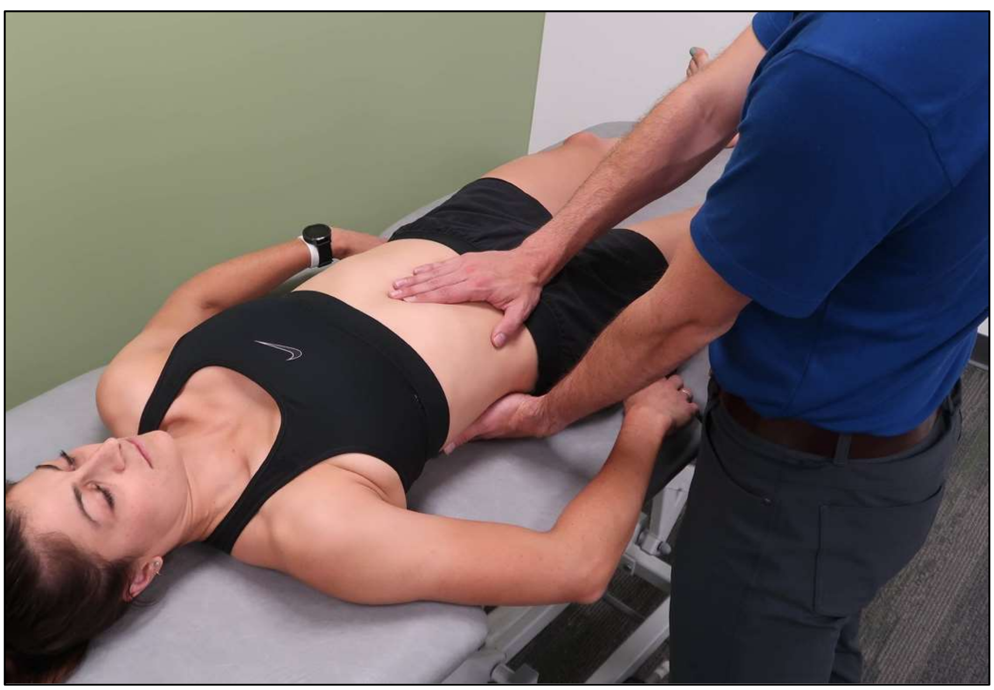
Example Diagnosis: Visceral dysfunction of the kidney; Right kidney inferior (ptosis)

Physician Position: Seated or standing on the side of dysfunction

Patient Position: Supine

Procedure:

1. With the cephalad hand, contact the ipsilateral quadratus lumborum posteriorly.
2. With the caudad hand soft and relaxed, place the palm anterior to the right iliac fossa:
    a. Orient the caudad hand with the longitudinal axis of the kidney (slightly superior-medial, inferior-lateral).
    b. The center of the palm should be just medial to the descending colon.
    c. GENTLY sink the palm posteriorly as the tissues allow.
    d. Add a GENTLE superior force until the inferior pole of the kidney is contacted. Gently lifting anteriorly with the cephalad hand may make this easier.
3. Gently support the inferior pole of the kidney with the caudad hand.
    a. With each inhalation, gently resist the inferior motion of the kidney.
    b. With each exhalation, gently accentuate the superior motion of the kidney.
4. Continue to treat for 5-7 respiratory cycles until no further superior motion is achieved.
5. Gently release the kidney on an exhalation, and then reassess the kidney motion for full excursion.



Treatment Position: Direct (Short-Lever) Kidney Visceral Treatment

Direct (Long-Lever) Kidney Visceral Treatment[8]

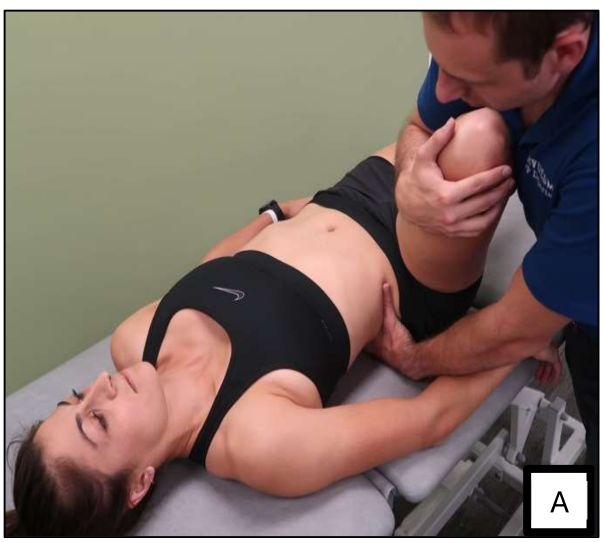
Example Diagnosis: Visceral dysfunction of the kidney; Right kidney inferior (ptosis)

Physician Position: Seated or standing on the side of dysfunction

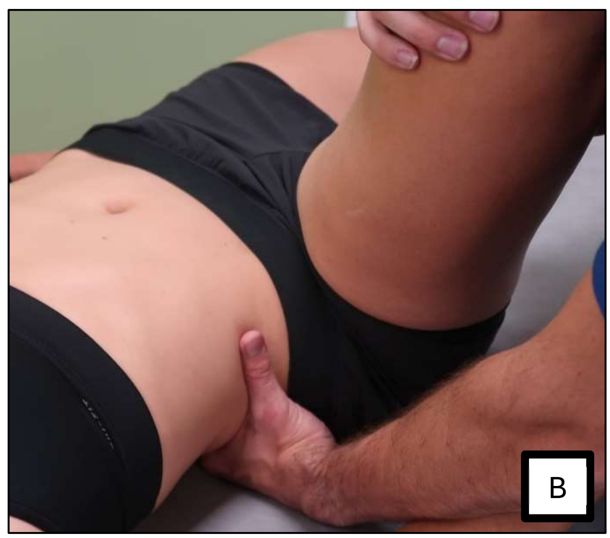
Patient Position: Supine

Procedure:

1. With the cephalad hand, contact the ipsilateral quadratus lumborum (QL) posteriorly.
    a. Layer-palpate through the QL to locate the inferior pole of the kidney posteriorly.
    b. Pronate the hand so that the lateral surface of the index finger supports the inferior pole of the kidney.
2. With the caudad hand, bring the ipsilateral leg into flexion, external rotation, and abduction.
    a. This may be easier by placing the flexed knee in the physician's axilla, wrapping the arm around the leg, and directing the leg with the physician's body.
    b. Avoid excessive lumbar flexion.
3. As the hip is flexed, the kidney should rise superiorly. Follow and support this motion with the cephalad hand.
4. Once the kidney is as superior as it can go, increase the anterior force from the cephalad hand to hold the kidney in place.
5. Adduct and internally rotate the hip.
6. While holding the kidney in place, extend the hip and knee.
7. Return the patient to neutral and reassess.



A. Treatment Position: Direct (Long-Lever) Kidney Visceral Treatment



B. Hand Position: Direct (Long-Lever) Kidney Visceral Treatment

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Chapter 3

Cardiovascular System

"The osteopath's foundation is that all the blood must move all the time in all parts to and from all organs."

-A.T. Still, M.D., D.O.[1]

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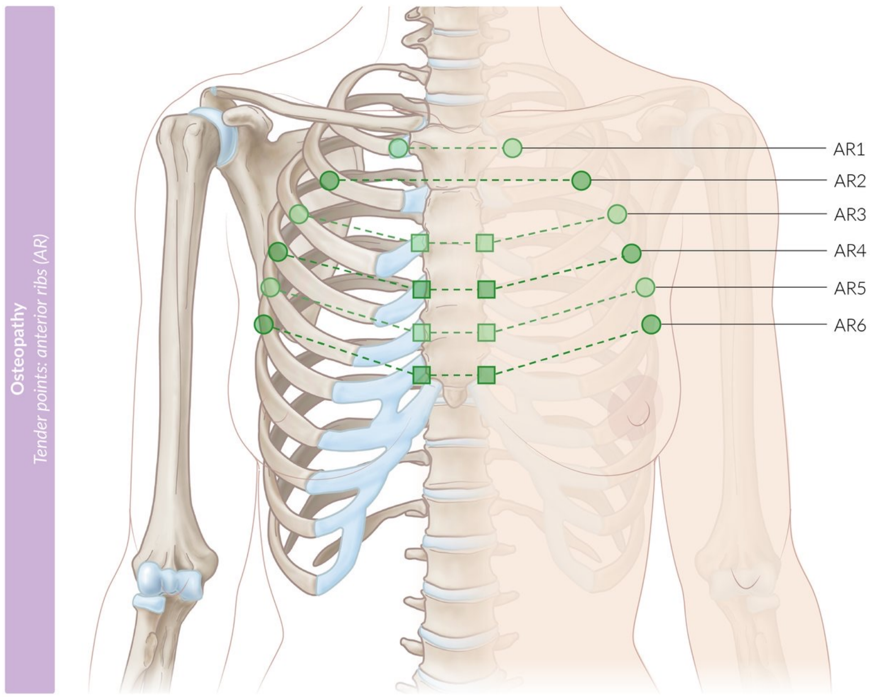

Osteopathy
Tender points: anterior ribs (AR)
AR1
AR2
AR3
AR4
AR5
AR6

Autonomics[2,3,8]

Autonomic Spinal Levels for the Cardiovascular System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Heart	T1-5	CN X
Carotid Body/Sinus	T1-4	CN IX, X

Autonomic Ganglia Related to the Cardiovascular System

Ganglia	Location	Preganglionic Fibers	Postganglionic Projections
Superior Cervical Ganglia	Adjacent to C2-3	T1-5	Head and neck via "hitchhiking" on the carotid arteries; heart via cardiac nerves
Middle Cervical Ganglia	Adjacent to C5-6	T1-5	Heart and neck
Inferior Cervical Ganglia	Adjacent to C7	T1-5	Fuse with first thoracic ganglia to form the cervicothoracic (stellate) ganglia; heart posterior cranial arteries; lower neck; arm
Cardiac Plexus	Around the Aortic Arch	Cardiac Nerves (T1-5 via cervical and thoracic sympathetic ganglia)	Heart structures including coronary vessels

Chapman's Reflex Points for the Cardiovascular System

	Anterior Point Location	Posterior Point Location
Myocardium	Intercostal space between the 2nd and 3rd ribs close to the sternum	Intertransverse space between T2 and T3, midway between the spinous process and the tip of the transverse process

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Heart

Sympathetic innervation to the heart is provided by preganglionic nerve cell bodies located within the intermediolateral cell columns of T1-5 segments of the spinal cord and postganglionic nerve cell bodies located in the thoracic or cervical chain ganglia.

Fibers to the heart coming from the thoracic cardiac nerves and cervical cardiac nerves have a right-sided and left-sided distribution. Those going to the right side of the heart pass to the right deep cardiac plexus and innervate the sinoatrial (SA) node while fibers to the left side of the heart pass to the left deep cardiac plexus to innervate the left myocardium and atrioventricular (AV) node.

Sympathetic stimulation increases heart rate (chronotropy), force of contractility (inotropy), and electrical impulse conduction velocity (dromotropy). These changes lead to shorter diastole and a rise in myocardial oxygen demand. While adrenergic stimulation of α1 receptors causes coronary vasoconstriction, stimulation of β2 receptors and local signaling molecules cause vasodilation, maintaining adequate blood flow to the myocardium in times of increased activity. Chronically elevated sympathetic tone may lead to cardiac remodeling and impaired lymphatic drainage.[5]

Parasympathetic innervation to the heart is provided by the vagus nerve (CN X) which gives distribution to both the right and left sides of the heart. The right vagus nerve innervates the SA node and right heart while the left vagus nerve innervates the AV node and left heart.

Effects of parasympathetic innervation on the cardiovascular system include decreased heart rate (chronotropy), reduction in contractility (inotropy), decreased blood pressure, and vasodilation of the coronary arteries. Other effects of parasympathetic innervation include improved lymphatic drainage.[5]

Think About It: Given what you've learned about autonomic distribution, what may be the effect of hypersympathetic and hyperparasympathetic stimulation to the heart?

- Hypersympathetic activity
  - Right side of the heart (SA node)→ sinus tachycardia, paroxysmal supraventricular tachycardia (PSVT)
  - Left side of the heart (AV node)→ ectopic foci, ventricular tachycardia, ventricular fibrillation
- Hyperparasympathetic activity
  - Right side of the heart (SA node)→ sinus bradycardia
  - Left side of the heart (AV node)→AV block

Osteopathic Considerations in Autonomics Related to the Cardiovascular System

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and cardiac systems manifest in the tissues. Alterations in sympathetic tone due to cardiac dysfunction may present as paraspinal tissue texture changes and range of motion restrictions from T1-5. Alterations in parasympathetic tone may affect the suboccipital region, possibly manifesting as muscular hypertonicity and OA/upper cervical somatic dysfunction due to facilitation of CN X. Additionally, TART changes may occur in the lower cervical spine because of facilitation of the cervical ganglia.

Biomechanics[2]

Pericardium

The pericardium is a closed, fibroserous sac surrounding the heart and origins of the great vessels between the levels of T4-8.

The parietal pericardium is formed by two layers of pericardial tissue. It prevents overfilling and anchors the heart to surrounding tissues. Anteriorly the fibrous pericardium is attached to the sternum via the superior and inferior sternopericardial ligaments. Posteriorly the pericardium attaches to the fascia of the esophagus. The pericardium attaches superiorly to the great vessels of the heart. The inferior attachment is to the central tendon of the diaphragm via the pericardiophrenic ligaments, which effectively tether the pericardium and heart within the thorax. Finally, the vertebropericardial ligaments attach the pericardium directly to the thoracic spine. The phrenic nerves lie near the pericardium.

The visceral pericardium, a thin serosal membrane, lines the surface of the heart and provides a smooth, nearly frictionless surface for the heart to move against during contraction.

Heart

There are three distinguishable surfaces of the heart: base, sternocostal surface, and diaphragmatic surface. The base is relatively flat and faces posteriorly. It is formed by the pulmonary veins of the left atrium at the level of T6-9. The sternocostal surface lies posterior to the sternum and costal cartilages of the five uppermost ribs on the left side. The diaphragmatic surface rests directly superior to the central tendon of the diaphragm.

Osteopathic Considerations in Biomechanics Related to the Cardiovascular System

The physiological (or pathologic) functioning of the cardiovascular system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify an organ's function, the long fascial chains of the body can transmit forces from distal anatomic structures. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the cardiovascular system:

- Thoracic spine due to proximity to heart and attachment via vertebropericardial ligaments
- Ribs due to proximity to heart and mechanical effect on respiration and intrathoracic pressures
- Sternum due to proximity to heart and attachment via sternopericardial ligaments
- Respiratory diaphragm due to proximity to heart and attachment via pericardiophrenic ligament
- Esophagus due to proximity to heart

Circulation[2]

Pericardium

- Arterial: aorta → internal thoracic artery → pericardiacophrenic artery → pericardium
- Venous: pericardium → pericardiacophrenic veins→ brachiocephalic vein → superior vena cava
- Lymphatic: pericardium → thoracic duct

Heart

- Arterial:
    - aorta → right aortic sinus → right coronary artery → branches to right atrium, right ventricle, SA node, AV node → terminates as the posterior interventricular branch (supplies inferior wall, posterior interventricular septum, and posteromedial papillary muscle)

- aorta → left aortic sinus → left coronary artery → immediately divides:
  - left anterior descending artery (supplies left and right ventricles, left atrium, bundle of His, anterior 2/3 of the interventricular septum and part of the right ventricle)
  - circumflex artery (supplies posterior left ventricle)
- Venous:
  - majority: myocardium → great cardiac vein (anterior interventricular region), middle cardiac vein (posterior interventricular region), small cardiac vein (right ventricle and right atrium) → coronary sinus → right atrium
  - minor: myocardium → anterior cardiac veins → right atrium and myocardium → smallest cardiac veins → right atrium
- Lymphatic:
  - myocardium → subepicardial lymphatic plexus → lymphatic vessels accompanying arteries → right inferior tracheobronchial lymph nodes → right lymphatic duct

Osteopathic Considerations in Circulation Related to the Cardiovascular System

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory system (venous and lymphatic systems). These baffles include the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. For a more complete review, please see the RVUCOM OPP I & II Manual or any of the referenced materials.

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the cardiovascular system. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the cardiovascular system. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the cardiovascular system. Next, biochemical and biophysical tests frequently used in the evaluation of the cardiovascular system are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

Osteopathic Structural Exam

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- OA, AA, C2 for the parasympathetic innervation from CN X
- T1-5 for the sympathetic innervation of the heart
- Clavicles and shoulders due to proximity to great vessels and superior attachment of pericardium
- Diaphragm due to inferior attachment of pericardium and effects of respiration on intrathoracic pressure

- Ribs, especially ribs 3-5 due to proximity of anterior attachment of pericardium
- Sternum due to anterior attachment of pericardium
- Psoas due to proximity to diaphragm and the inferior attachment of pericardium
- Evaluation of areas that may obstruct lymphatic flow
    - Thoracic inlet
    - Diaphragm

Testing

- CBC (RBC, WBC, Hgb, Hct, MCH, MCHC, MCV, RDW)
- BMP (Electrolytes)
- Cardiac biomarkers (CKMB, troponin I, troponin T)
- LDH (Tissue damage)
- TSH/ Free T4 (Thyroid markers)
- ECG (Electrical activity of heart)
- ECG Exercise Testing ("Stress Test"; electrical activity of heart with exertion)
- Echocardiogram (Ultrasound of heart chambers and valves, ejection fraction)
- Chest X-ray (Cardiac and pulmonary dimensions and margins)
- MRI and CT of the heart (Non-invasive evaluation of cardiac structure)
- Nuclear Cardiology (Non-invasive evaluation of cardiac pumping ability, myocardial perfusion, and localization of dysfunction)
- Positron emission tomography in heart disease (Utilization of radioactive tracers to evaluate damaged cardiac structure)
- Cardiac catheterization and angiography (Visualize blood flow in coronary vessels, coronary stent placement, and pressure measurements)

Technique Contents:

IBS

Cough

General:

MSK

Resp - Sinusitis,

CV

Derm-

Edema

-

Meds- No. [illegible]

Surg x

Caffeine ++

Stress? -

Systolic ejection murmur

HOCM

< >

Aortic Stenosis?

Aortic - reg

Atrial Septal Defect

BALANCED LIGAMENTOUS TENSION (BLT)/Ligamentous Articular Strain (LAS)

BLT/LAS/MFR for Sternum/Pericardial Ligament Dysfunctions[6]

Mechanism: To make this a BLT technique for the pericardial ligaments, direct attention past the fascia around the sternum to the sternopericardial ligaments. Visualizing the anatomy will help. The pericardial sac is bound to central tendon of the diaphragm inferiorly and bound to the sternum via the sternopericardial ligaments anteriorly.

Example Diagnosis: Sternum rotated right

Physician Position: Seated or standing at the head of the table

Patient Position: Supine

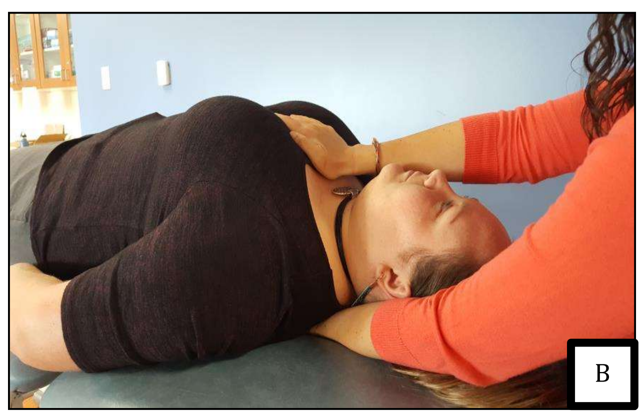
Procedure:

1. Place the heel of hand on the manubrium and rest the fingers on the sternal body. Place the other hand posterior to the patient's upper thoracic spine.
2. Engage the tissues in translation, rotation, and inferior-superior glide to reach a point of balance in the tissues for BLT/LAS, or to reach a position of ease or direct barrier engagement for MFR. The posterior hand may also be used in reciprocal motion with the anterior hand to find the best position. For BLT/LAS, the balance point is where the tension across the ligaments is equal.
3. Make minor adjustments to all planes until the best position is achieved.
4. Wait for the release.*
5. Return the sternum to neutral and reassess.

*If using indirect MFR, remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

*If using direct MFR, remain in whichever position creates more tension and follow the direct barrier until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

A) Hand Position for BLT/LAS/MFR for Sternum and Pericardial Ligament Dysfunctions



B) Treatment Position for BLT/LAS/MFR for Sternum and Pericardial Ligament Dysfunctions

BLT/LAS/MFR for Diaphragm and Lower Rib Cage Dysfunctions[6]

Example Diagnosis: Right hemidiaphragm extended, rotated right, sidebent right

Physician position: Standing at the side of the table. If treating unilaterally, stand on the side of dysfunction.

Patient position: Supine

Procedure:

1. To treat the right side alone, contact the right rib cage with thumbs in the right mid-axillary line and fingers spread over the ribs anteriorly and posteriorly. To treat both sides simultaneously, place thumbs over the costal margins with fingers spread over the ribs bilaterally.
2. Place attention on the structure to be treated (ribs at sternal or thoracic attachments, muscular diaphragm, central tendon, etc.). The diaphragm or lower rib cage can be treated based on layer palpation to the appropriate structures.
3. Engage the tissues in translation, rotation, and inferior-superior glide to reach a point of balance in the tissues if using BLT/LAS, or to reach a position of ease or direct barrier engagement for MFR. The balance point will be where the tension across the ligaments is equal.
4. Make minor adjustments to all planes until the best position is achieved.*
5. Wait for the release. If a release is not palpated, repeat steps 3-4.
6. Return to neutral and reassess.

*If using indirect MFR, remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

*If using direct MFR, remain in whichever position creates more tension and follow the direct barrier until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

A) Treatment Position for Bilateral Release in the Adult Patient

B) Treatment Position for Bilateral Release in the Pediatric Patient

C) Treatment Position for Left Release in the Pediatric Patient

Myofascial Release

Clavicle Release with Respiratory Assist[7]

Example Diagnosis: Thoracic inlet ERrSr, left clavicle abducted, stellate ganglion dysfunction, etc.

Physician position: Standing at the head of the table

Patient position: Supine

Procedure:

1. Place ipsilateral thumb and thenar eminence superior to the clavicle, contacting the SC joint. Spread the palm of your hand and remaining fingers over the rest of the clavicle, the AC joint, and the acromion.
2. With your other hand, contact the occiput and flex the patient's head and neck until you feel motion at the clavicle.
3. Apply an inferolateral force while rolling your thumb posteriorly to increase contact on the superior then posterior surface of the clavicle.
4. Resist superior motion during inhalation and encourage inferolateral motion during exhalation. Repeat as necessary.
5. Return to neutral and reassess.

Treatment Position for Clavicle Release with Respiratory Assist

Still Technique

Supine Still for Superior or Exhaled Rib 1[4]

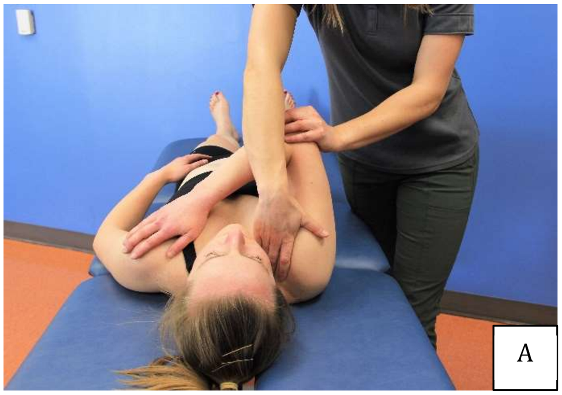
Example Diagnosis: Right superior first rib

Physician position: Standing on the side of dysfunction, facing toward the patient's head

Patient position: Supine

Procedure:

1. Flex the patient's elbow on the affected side and place their palm on their opposite shoulder/chest.
2. The physician's sensing hand is placed near the head of the first rib.
3. The physician's operating hand grasps the patient's elbow on the side of the affected rib. Adduct the patient's arm until the elbow is aligned with the head of the first rib.
4. Introduce compression from the operating hand through the elbow into the head of the affected rib. The sensing hand should feel relaxation around the head of the first rib.
5. While maintaining compression, bring the patient's elbow superiorly toward their ipsilateral ear. The patient's wrist will contact the physician's monitoring hand. This achieves internal rotation of the shoulder and engagement of the manubrial attachment of the first rib.
6. Swing the elbow laterally and in an inferior arc while maintaining compression.
7. Release the compression and return to neutral.
8. Reassess.



A) Initial Position

B) Intermediate Position

C) Final position

Supine Still for Inferior or Inhaled Rib 1[4]

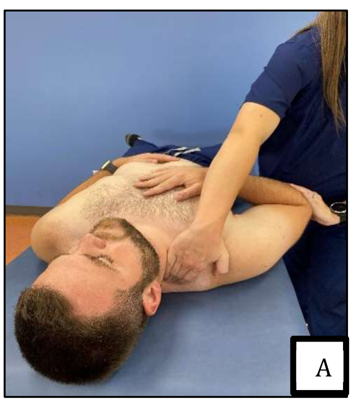
Example Diagnosis: Right inferior first rib

Physician position: Standing on the side of dysfunction, facing toward the patient's head

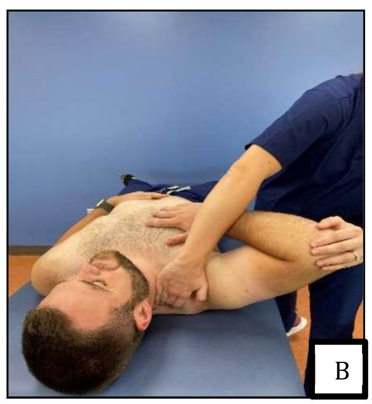
Patient position: Supine

Procedure:

1. Flex the patient's elbow, on the side that is affected, and place their hand palm-down on their chest just below the clavicular/manubrial articulation on the side of the affected rib.
2. The index finger of the physician's sensing hand is placed on the head of the first rib.
3. The physician's operating hand grasps the patient's elbow on the side of the affected rib. Using the elbow, move the patient's shoulder into abduction and slight extension. This positions the elbow roughly to nipple line.
4. Introduce compression from the operating hand into the head of the affected rib. The sensing hand should feel relaxation around the head of the first rib.
5. While maintaining compression, bring the patient's arm through an arc lateral and superior (abduct the arm) until the elbow reaches the level of the patient's ear, this introduces internal rotation of the shoulder.
6. While maintaining compression, the patient's elbow is carried medially to midline and inferiorly towards the chest (adduct the arm). When the elbow is at the level of the shoulder, the physician's sensing hand grabs the patient's wrist, and the entire arm of the affected side is brought down and inferior.
7. Release the compression and return to neutral.
8. Reassess.

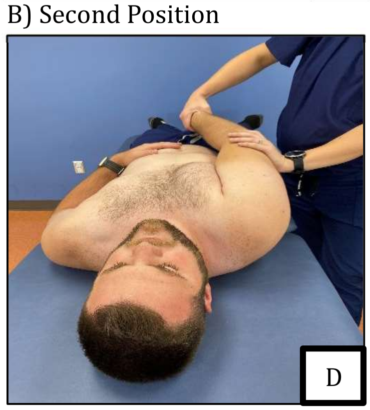


A) Initial Position



B) Second Position

C) Third Position



D) Final Position

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Chapter 4

Upper Respiratory System
Ear, Nose and Throat

"Sickness is caused by the stoppage of some supply of fluid or quality of life."

-A.T. Still, M.D., D.O.

Contents:

NOTES

Autonomics[2,7,12]

Autonomic Spinal Levels for the Upper Respiratory/ENT System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Sinuses, Middle Ear, Lacrimal Glands, Submandibular and Sublingual Salivary Glands	T1-4	CN VII and CN IX via sphenopalatine and otic ganglia
Parotid Glands	T1-4	CN IX via otic ganglia
Trachea	T1-4	CN X

Chapman's Reflex Points for the Upper Respiratory/ENT System[3]

	Anterior Point Location	Posterior Point Location
Larynx	Superior aspect of 2nd rib, 2-3 inches lateral from the sternum	Posterior aspect of the transverse process of C2, midway between the tip of the transverse process and the spinous process
Middle Ear	Superior aspect of the clavicle, just lateral to where it crosses the 1st rib	Superior, posterior aspect of the transverse process of C1
Neck	Medial aspect of proximal humerus from the surgical neck inferiorly	Across the transverse processes of C3-C7
Nose	Costochondral junction of 1st rib	Lateral aspect of the transverse process of C1
Pharynx	Anterior 1st rib for ¾ inch medial to where clavicle crosses the 1st rib	Posterior aspect of the transverse process of C2, midway between the spinous process and the tip of the transverse process
Sinuses	3.5 inches from sternum on superior aspect of rib 2 and in the 1st intercostal space; 1st rib at costochondral junction	Posterior aspect of the transverse process of C2, midway between the spinous process and the tip of the transverse process; under angle of jaw, parallel with line of mouth back to transverse process of C1
Tongue	Anterior aspect of 2nd rib cartilage ¾ inch lateral to sternum	Between the spinous process and the superior edge of the transverse process of C2
Tonsils	1st intercostal space close to the sternum	Posterior surface of the transverse process of C1, midway between median line of the neck and the tip of the transverse process

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Sinuses

Sympathetic innervation to the sinuses thickens the secretions of sinus fluid, whereas parasympathetic innervation to the sinuses thins sinus fluid secretion.

Salivary and Lacrimal Glands

Sympathetic innervation of the salivary and lacrimal glands thickens the glandular secretions, whereas parasympathetic innervation to the salivary and lacrimal glands thins glandular secretions.

Trachea

Sympathetic innervation of the trachea dilates the tracheal lumen and decreases secretion of mucus by mucosal cells. Parasympathetic innervation of the trachea constricts the tracheal lumen and increases mucus secretion.

Osteopathic Considerations in Autonomics of the Upper Respiratory/ENT System

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and upper respiratory systems manifest in the tissues. Alterations in sympathetic tone due to upper respiratory dysfunction may present as paraspinal tissue texture changes and range of motion restrictions from T1-4. Alterations in parasympathetic tone may affect the suboccipital region, possibly manifesting as muscular hypertonicity and OA/upper cervical somatic dysfunction due to facilitation of CN X. Additionally, TART changes may occur in the lower cervical spine because of facilitation of the cervical ganglia.

Biomechanics

Cranium

The osseous structure of the upper respiratory system, including the ear, nose, and throat, is composed of many individual bones joined by sutures. Many of these sutures demonstrate patency into late adulthood.[8] These sutures permit motion within the cranium, and their persistence into adulthood demonstrates the ongoing physiologic need for osseous mobility of the viscerocranium. Clinically, osteopathic physicians observe restricted motion in the bones related to a given upper respiratory disease (e.g. restricted maxillary bone motion in the setting of chronic sinusitis). An understanding of cranial anatomy will facilitate the application of biomechanics to the region.

The following bones form the nasal cavity: maxilla, sphenoid, vomer, palatine, lacrimal, ethmoid, frontal, nasal, and inferior concha. The maxilla, sphenoid, frontal, and ethmoid bones also contain the paranasal sinuses. The paranasal sinuses enhance phonation, humidify air, and provide immunological support when functioning appropriately. When dysfunctional due to impaired motion, the sinuses can become sites of infection, chronic inflammation and pain.

The basiocciput and basisphenoid border the superior aspect of the pharynx, while the styloid processes of the temporal bones sit laterally to the pharynx. The temporal bone also houses the structures of the ear and Eustachian tube, as mentioned below. The mandible and the muscles of mastication, which attach to the frontal, parietal, temporal, sphenoid, and zygomatic bones, can also exert a biomechanical effect on the upper respiratory system due to their proximity to the pharynx and their role in Eustachian tube clearance.

As detailed above, all the bones of the skull have a biomechanical relationship with the upper respiratory system. When dysfunctional due to impaired motion, these bones can impede normal physiologic function of the upper respiratory system, which can lead to clinical signs and symptoms of upper respiratory diseases like infections, chronic sinusitis, or sinus headaches, to name a few.[2]

Eustachian Tube, Middle Ear, and External Auditory Meatus (EAM)[1]

The Eustachian tube contains respiratory epithelium and functions to equilibrate pressures, aid in sound transmission, prevent reflux, and drain fluid from the ear. In infants and young children, the Eustachian tube has a more horizontal orientation, and is also more pliable and less cartilaginous than it is in adult ears. Both of these features make infants and young children more prone to middle ear infections caused by refluxed fluid. Eustachian tube dysfunction can be caused by abnormal patency, extrinsic obstruction (adenoids, tumor, or somatic dysfunction), or intrinsic obstruction (luminal narrowing secondary to edema or hypertrophy). Eustachian tube dysfunction is a common denominator in the otitis media spectrum of disease. The horizontal orientation of the Eustachian tube has been implicated in the higher incidence of otitis media in younger children, as the more horizontal orientation predisposes the child to reflux as well as reduces the middle ear's ability to drain fluid. The primary muscular coordinator of the Eustachian tube is the tensor veli palatini, which is innervated by CN V_3. Contraction of this muscle, which occurs via medial pterygoid muscle contraction during swallowing, yawning, or movement of the mandible, compresses and opens the Eustachian tube sequentially. Spasms of the tensor veli palatini muscle can cause distortion and extrinsic obstruction in children, and a patulous tube in adults. There are several other muscles associated with the function of the Eustachian tube including the levator veli palatini and salpingopharyngeus (both innervated by CN X).

The temporal bone and facial structures undergo tremendous change in the first 3-5 years of life, so that the shape of the pharynx widens, elongates, and develops a more vertical orientation. This impacts the orientation of both the EAM and the Eustachian tube. The vertical and lateral growth of the temporal bone, particularly the mastoid portion, changes the orientation of the EAM from an inferiorly facing structure in the infant and young child, to a more laterally facing structure in the adult. The position of the Eustachian tube shifts from a horizontal plane to a slightly anterior declined plane. This is the reason that the otoscope must be oriented more superiorly to see the tympanic membrane of a baby or young child.

Cervical Fascia

The cervical fascia is organized in concentric rings or cylinders, creating compartments for muscular, visceral, nervous, vascular, and lymphatic structures. These compartments maintain the mechanical, neural, and circulatory integrity of the cervical region and contribute to transmission of forces between head, neck, and thorax. Therefore, somatic dysfunctions manifesting fascial tension can affect components contained in the cervical fascia.

Osteopathic Considerations in Biomechanics Related to the Upper Respiratory/ENT system

The physiological (or pathologic) functioning of the upper respiratory system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify an organ's function, the long fascial chains of the body can transmit forces from distal anatomic structures. For example, there are many structures in the head and neck that are connected to the Eustachian tube including the posterior pharyngeal muscles and the hyoid bone. Assessing and treating these structures can help to equilibrate Eustachian tube pressure and augment lymphatic drainage. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the upper respiratory system:

- OA, AA, and C2 to address suboccipital muscle tension affecting cranial bone motion
- Cranial bone motion, especially the temporal bone which houses the Eustachian tube
- Typical cervical vertebrae and hyoid bone due to influence on cervical fascia tension
- Pharyngeal and palatal muscles due to mechanical influence on Eustachian tubes and pharynx
- Tongue musculature due to mechanical effect on palate and jaw motion
- Temporomandibular joint and muscles of mastication due to mechanical effect on pharynx and Eustachian tubes

Circulation

Sinuses

- Arterial:
  - maxillary sinus:
    - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → external carotid artery → maxillary artery → posterior superior alveolar artery and infraorbital artery → maxillary sinus
  - frontal sinus:
    - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → internal carotid artery → ophthalmic artery → supra-orbital artery and anterior ethmoidal artery → frontal sinus
  - ethmoid sinus:
    - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → internal carotid artery → ophthalmic artery → anterior and posterior ethmoid arteries → ethmoid sinus
  - sphenoid sinus:
    - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → external carotid artery → maxillary artery → sphenopalatine artery → sphenoid sinus
- Venous:
  - maxillary sinus:
    - external jugular venous drainage:
      - maxillary sinus → pterygoid venous plexus → maxillary vein → retromandibular vein → external jugular vein → subclavian vein → brachiocephalic vein → superior vena cava
    - internal jugular venous drainage:
      - maxillary sinus → superior petrosal sinus → transverse sinus → sigmoid sinus → internal jugular vein → subclavian vein → brachiocephalic vein → superior vena cava
  - frontal sinus:
    - frontal sinus → superior ophthalmic veins → cavernous sinus → internal jugular vein → brachiocephalic vein → superior vena cava
  - ethmoid sinus:
    - ethmoid sinus → ethmoidal vein → superior ophthalmic veins→ cavernous sinus → internal jugular vein → brachiocephalic vein → superior vena cava

- sphenoid sinus:
  - sphenoid sinus → superior ophthalmic veins → cavernous sinus → internal jugular vein → brachiocephalic vein → superior vena cava
- Lymphatic:
  - maxillary, frontal, ethmoid, and sphenoid sinuses → submandibular lymph nodes → cervical lymph nodes → thoracic duct (left) or right lymphatic duct (right)

Middle Ear

- Arterial:
  - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → external carotid artery → anterior tympanic and stylomastoid artery → middle ear
- Venous:
  - external jugular venous drainage:
    - middle ear → pterygoid venous plexus → maxillary vein → retromandibular vein → external jugular vein → subclavian vein → brachiocephalic vein → superior vena cava
  - internal jugular venous drainage:
    - middle ear → superior petrosal sinus → transverse sinus → sigmoid sinus → internal jugular vein → subclavian vein → brachiocephalic vein → superior vena cava
- Lymphatic:
  - parotid and retropharyngeal lymph nodes → upper deep cervical lymph nodes → thoracic duct (left) or right lymphatic duct (right)

Eustachian Tube

- Arterial:
  - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → external carotid artery →ascending pharyngeal artery and maxillary artery → Eustachian tube
- Venous:
  - Eustachian tube → pharyngeal venous plexus → internal jugular vein → subclavian vein → brachiocephalic vein → superior vena cava
- Lymphatic:
  - Eustachian tube → retropharyngeal lymph nodes → superior deep cervical lymph nodes → thoracic duct (left) or right lymphatic duct (right)

Salivary Glands

- Arterial:
  - parotid gland:
    - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → external carotid artery → transverse facial artery → parotid gland
  - submandibular gland:
    - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → external carotid artery → glandular branches of the facial artery → submandibular gland
  - sublingual gland:
    - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → external carotid artery → lingual artery → sublingual artery → sublingual gland
- Venous:
  - parotid gland:
    - parotid gland → internal jugular vein → brachiocephalic vein → superior vena cava
  - submandibular gland:
    - submandibular gland → facial vein → internal jugular vein → brachiocephalic vein → superior vena cava
  - sublingual gland:
    - sublingual gland → sublingual vein → lingual vein → internal jugular vein → brachiocephalic vein → superior vena cava
- Lymphatic:
  - parotid gland:
    - intraparotid lymph nodes → deep cervical lymph nodes → thoracic duct (left) or right lymphatic duct (right)
  - submandibular and sublingual glands:
    - submandibular lymph nodes → superior deep cervical lymph nodes → thoracic duct (left) or right lymphatic duct (right)

Lacrimal Gland

- Arterial:
  - aortic arch (left) or brachiocephalic artery (right) → common carotid artery → internal carotid artery → ophthalmic artery → lacrimal artery → lacrimal gland
- Venous:
  - lacrimal gland → superior ophthalmic vein → cavernous sinus → internal jugular vein → brachiocephalic vein → superior vena cava
- Lymphatic:
  - preauricular lymph nodes → superior deep cervical lymph nodes → thoracic duct (left) or right lymphatic duct (right)

Osteopathic Considerations in the Circulation of the Upper Respiratory/ENT System

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory system (venous and lymphatic systems). These baffles include the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. For a more complete review, please see your first-year manual or any of the referenced materials.

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the upper respiratory system. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the upper respiratory system. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful historical points and screening exams, and the areas most often found with somatic dysfunction in a patient with disease of the upper respiratory system. Next, biochemical and biophysical tests frequently used in the evaluation of the upper respiratory system are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

History

- Ill contacts (risk of disease transmission)
- Developmental milestones (poor sucking leading to Eustachian tube dysfunction)
- Recurrent symptoms (chronic dysfunction or impaired self-healing/regulating systems)
- Surgical history (adenoidectomy, tonsillectomy, tympanoplasty contributing to structural/functional change)
- Social history (tobacco users in the home contributing to functional changes)

Osteopathic Structural Exam[5,6]

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- OA, AA, C2 for the parasympathetic innervation from CN X
- Cranial bone motion for the parasympathetic innervation from CN VII and IX and the pterygopalatine ganglia, as well as biomechanical effects
- T1-4 for the sympathetic innervation of the upper respiratory tract
- Ribs due to impact on respiration and sympathetic chain ganglia
- Diaphragm due to influence of low-pressure fluid system pumping
- Thoracic inlet due to possible baffle effect on lymphatic flow
- Typical cervical vertebra, hyoid bone and TMJ due to influence on pharyngeal structures and cervical fascia

Testing

- Rapid strep (suspected streptococcal etiology), viral antigen or PCR testing (suspected influenza, COVID, or RSV)
- Mononucleosis lab testing (mononucleosis etiology)
- Head CT (sinusitis and deviated septum)
- Culture and antibiotic sensitivities (chronic bacterial sinusitis)
- Tympanogram (effusion, hearing loss)
- Audiogram (hearing loss)
- Laryngoscopy (visualization of upper airway structures and pathologies)

Technique Contents:

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Thoracic Inlet BLT/LAS/MFR

Myofascial Release (MFR)

Anterior Cervical Myofascial Release

Lymphatic Techniques

Cervical Chain Drainage

Orbital Nerve Release, Facial Effleurage and Sinus Tapping

Auricular Drainage

Galbreath Technique

Still Techniques

Still for Posterior or Exhaled Ribs 2-12

Still for Anterior or Inhaled Ribs 2-12

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

Thoracic Inlet BLT/LAS/MFR[9]

Mechanism: Using the principles of either BLT or MFR, restriction of the thoracic inlet can be reduced to allow for increased blood flow, increased lymphatic return and decreased nerve compression among other benefits.

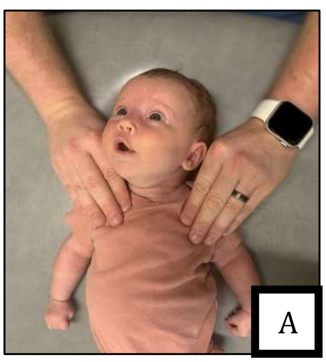
Example Diagnosis: Thoracic Inlet FRrSr

Physician Position: Seated or standing behind the patient

Patient Position: Supine or sitting facing away from physician

Procedure:

1. Contact the inferior border of the clavicles, first and second ribs, and possibly the manubrium anteriorly with first three fingers bilaterally and the costotransverse junction of T1 posteriorly with thumbs.
2. Gently lift superiorly on the clavicles to engage the subclavius muscle, which then also engages ribs one and two.
3. Assess the fascial restriction of the inlet by motion testing flexion/extension, side-bending and rotational barriers of both sides simultaneously or one side at a time.
4. Engage the tissues in the position that allows them to reach a balance point in all planes of motion. The balance point will be where the tension across the thoracic inlet is equal. Make minor adjustments to all planes until the position of best possible balance is achieved.*
5. Wait for the release.** The release should be achieved relatively quickly. If not, repeat step 4.
6. Return the patient to neutral by removing hands and then reassess.



A) Treatment Position: Thoracic Inlet BLT/LAS/MFR for pediatric patient

B) Treatment Position: Thoracic Inlet BLT/LAS/MFR for adult patient

*When using direct MFR, place the tissues in the position that creates more tension and follow the barrier as it moves until the release finishes. If using indirect MFR, place the tissues in the direction(s) of ease and follow until the release finishes. When using MFR, the release may feel more like an "unwinding" or pulling of the tissues in a new direction.

**When using BLT, the release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

MYOFASCIAL RELEASE (MFR)

Anterior Cervical Myofascial Release[9]

Mechanism: Utilizing the hyoid and its many fascial attachments, motion is restored to the myofascial tissues of the neck to improve function of the neck's various structures.

Example diagnosis: Restricted anterior cervical fascia, hyoid preferring left translation

Physician position: Seated next to table at patient's head

Patient position: Supine

Procedure:

1. Stabilize the patient's head by gently contacting the patient's forehead with cephalad hand.
2. Use caudal thumb and index finger to contact the lateral aspects of the hyoid bone.
3. Gently alternate medial pressure from thumb and index finger to move the anterior cervical fascia from side to side. Some crepitus may be encountered and is normal.
4. Continue this gentle alternating pressure while moving inferiorly along the thyroid and cricoid cartilages, focusing on areas of restricted motion
5. Return the patient to neutral and reassess.

Treatment Position: Anterior Cervical Myofascial Release

LYMPHATIC TECHNIQUES

Cervical Chain Drainage[10]

Mechanism: Using effleurage over and around the sternocleidomastoid, cervical chain nodes are encouraged to drain and resolve lymphatic congestion in the head and neck.

Example Diagnosis: Lymphatic congestion of the head and neck bilaterally

Physician position: Seated next to table at patient's head

Patient position: Supine

Procedure:

1. Stabilize the patient's head by gently contacting the patient's forehead with the cephalad hand.
2. Turn the patient's head away from the side being treated. Note: it may be helpful to have the patient's head slightly elevated on a pillow or by raising the head of the table.
3. Using caudal finger pads, make a wide contact above the proximal insertion of the sternocleidomastoid (SCM) above the sternum and clavicle. Make sure the compression is not over the carotid artery.
4. Apply a slight compressive force and slide fingers inferiorly following the muscle fibers of the SCM.
5. Reposition fingers slightly more superiorly along the muscle and repeat.
6. Repeat steps 3-4 until reaching the distal SCM at the mastoid process.
7. Repeat this procedure both anterior and posterior to the SCM to affect both anterior and posterior cervical nodes. Perform bilaterally, but do not treat both sides simultaneously.
8. Return the patient to neutral and reassess.

Treatment Position: Cervical Chain Drainage

Orbital Nerve Release, Facial Effleurage and Sinus Tapping[10]

Mechanism: Using effleurage and percussion to loosen sinus congestion and encouraged drainage to resolve lymphatic congestion of the sinuses and face. These techniques are useful to address somatic dysfunction of the sinuses in the setting of sinusitis, sinus congestion, and allergies.

Example Diagnosis: Bilateral maxillary and frontal sinus tenderness and tissue texture changes

Physician position: Seated at head of the table

Patient position: Supine

Procedure:

Orbital Nerve Release

1. Apply inhibitory pressure over supra- and infra-orbital foramina for 15-30 seconds.

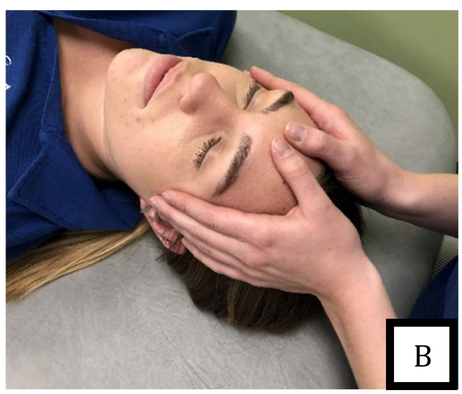
Facial Effleurage

1. Begin with thumbs over the midline at the glabella and gently sweep laterally over eyebrows toward temple region. Repeat this several times.
2. Begin with thumbs on either side of the nose and gently sweep laterally over the cheeks toward the ears. Repeat several times.
3. Begin with index finger over midline mandible and sweep laterally toward the TMJ. Repeat several times.

Sinus Tapping

1. Use index or middle fingers to gently tap over frontal and/or maxillary sinuses for 5-10 repetitions at each location.

A) Treatment Position:
Orbital Nerve Release



B) Treatment Position:
Facial Effleurage

C) Treatment Position:
Sinus Tapping

Auricular Drainage[10]

Mechanism: This is a myofascial technique that releases the fascia around the external auditory meatus and auditory canal to allow unrestricted motion and fluid flow creating optimal conditions for drainage and healing. It is an excellent technique for any inflammation of the external or middle ear, as well as for congestion in this area related to TMJ dysfunction or other jaw disorders.

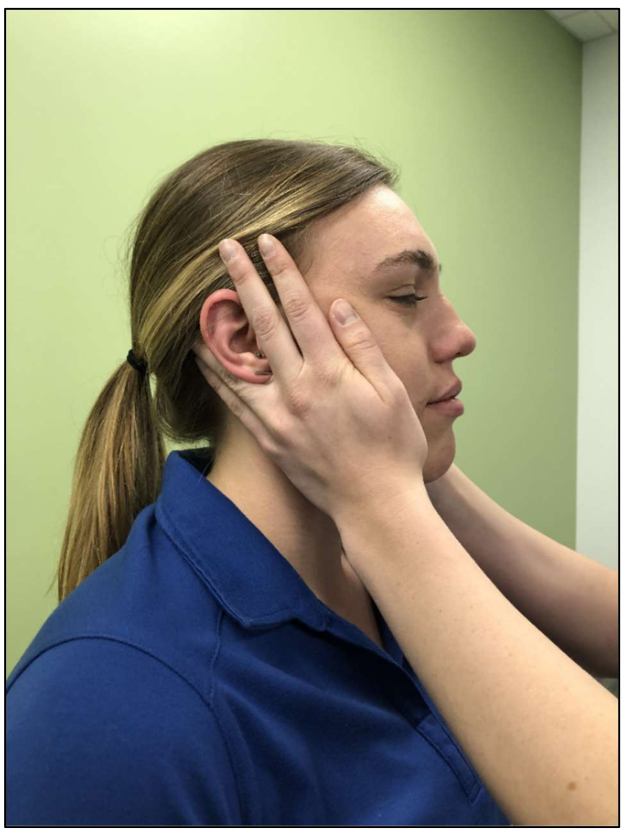
Example Diagnosis: Lymphatic congestion due to right otitis media

Physician Position: Standing facing the patient

Patient Position: Seated or Supine

Procedure:

1. Place each hand flat against the side of the patient's head, fingers pointing superiorly, with the patient's ear between the 3rd and 4th digit.
2. Make clockwise and counterclockwise circular motions moving underlying fascia and engaging the fascial barrier with each movement.
3. Continue for 30 seconds up to 2 minutes or until improved tissue motion is palpated.
4. Return the patient to neutral and reassess.



Treatment Position: Auricular Drainage

Galbreath Technique[4,10]

Mechanism: This technique is utilized to address somatic dysfunction of the Eustachian tube, which often contributes to otitis media in pediatric patients. This technique is an oscillatory technique (similar to articulatory) with the pulsating force directed to musculature. By engaging the musculature of the pharynx, which is directly attached to the Eustachian tube, the Eustachian tube is opened. This allows the fluid in the Eustachian tube to drain into the pharynx which helps the body to rid itself of the infection. This technique can be used to help clear middle ear fluid, improve ear infection symptoms, and prevent otitis media when a child is sick with an upper respiratory infection.

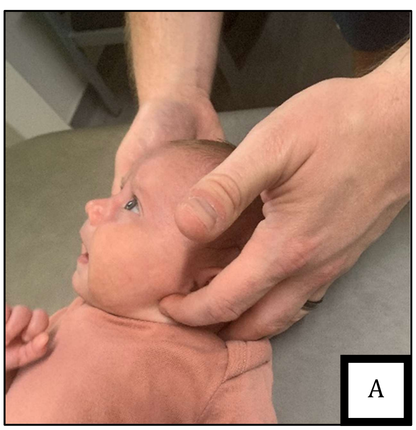
Example Diagnosis: Right sided Eustachian tube somatic dysfunction potentially associated with right otitis media

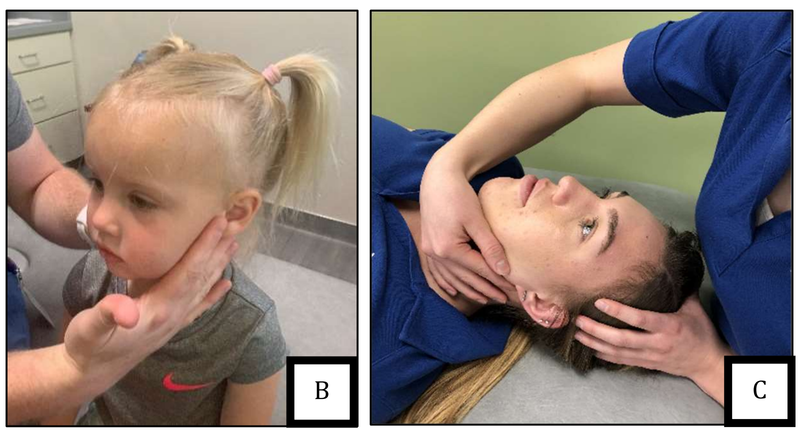
Physician Position: Seated or standing behind the patient

Patient Position: Sitting or supine

Procedure:

1. With the finger pad of the thumb or index finger, contact the angle of the mandible (A). [Alternative (classical) contact: contralateral hand contacts the angle of mandible with finger pads (B and C)]
2. Apply gentle inferior and medial pressure to engage the musculature of this area. Note the tissue texture changes of this area, including bogginess or tense musculature.
3. Begin to rhythmically pull the musculature anteriorly, inferiorly, and medially in the direction of the long axis of the mandible.
4. Continue this motion until a release is palpated and then reassess.





A) Treatment Position: Galbreath Technique on an Infant

Treatment Position: Galbreath Technique (Alternative/Classical Contact) on a toddler (B) and adult (C)

STILL TECHNIQUES

Still for Posterior or Exhaled Ribs 2-10[11]

Example Diagnosis: Right posterior rib 4

Physician position: Standing posterior to the patient

Patient position: Seated

Procedure:

1. The thumb or index finger of the sensing hand palpates the angle or head of the posterior rib. For the above diagnosis, the physician uses their left hand as the sensing hand.
2. The operating hand, the right hand, holds the patient's right elbow.
3. Using the elbow, extend the patient's right shoulder until the sensing hand feels relaxation of the head of the affected rib.
4. Introduce compression from the operating hand through the elbow into the head of the affected rib. The sensing hand should feel relaxation around the head of the rib that has been affected.
5. While maintaining compression, move the shoulder in a smooth arc through abduction with partial flexion to about 140 degrees.
6. While maintaining compression, carry the right arm into adduction, ultimately bringing the patient's arm into the area of the right abdomen.
7. Release the compression and return to neutral.
8. Reassess.

A) Initial Position

B) Intermediate Position

C) Final Position

Still for Anterior or Inhaled Ribs 2-10[11]

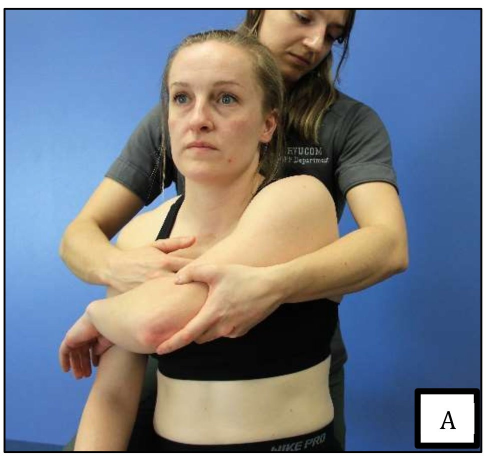
Example Diagnosis: Left anterior rib 4

Physician position: Standing posterior to the patient

Patient position: Seated

Procedure:

1. The sensing hand palpates the anterior surface of the affected rib. For the above diagnosis, the physician uses their right hand to reach around the patient and monitor the anterior surface of rib four.
2. The operating hand, the left hand, holds the patient's left elbow.
3. Adduct the patient's left arm across their chest. This also introduces slight right rotation of the thorax.
4. Introduce compression from the operating hand through the elbow into the head of the affected rib. The sensing hand should feel relaxation around the anterior portion of the affected rib.
5. While maintaining compression, move the shoulder in a smooth arc through 110 degrees of flexion, abduction, and extension.
6. Release the compression and return to neutral.
7. Reassess.



A) Initial Position

B) Intermediate Position

C) Final Position

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Chapter 5

Lower Respiratory System

"When you have adjusted the physical to its normal demands, Nature universally supplies the remainder."

-A.T. Still, M.D., D.O.[1]

Contents:

NOTES

Autonomics[1,2,6]

Autonomic Spinal Levels for the Lower Respiratory System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Lungs	T2-7	CN X

Chapman's Reflex Points for the Lower Respiratory System

	Anterior Point Location	Posterior Point Location
Bronchus	2nd intercostal space (ICS) close to the sternum	Posterior surface of the transverse process (TP) of T2, midway between the spinous process (SP) and the tip of the TP
Upper Lungs	3rd ICS close to the sternum	Intertransverse space between T3 and T4, midway between the SP and the tip of the TP
Lower Lungs	4th ICS close to the sternum	Intertransverse space between T4 and T5, midway between the SP and the tip of the TP

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Effects of Sympathetic Nerve Stimulation on Lungs

- Thickening of secretions and increased goblet cell quantity
- Decreased bronchiole smooth muscle cell tone and bronchodilation
- Vasoconstriction

Effects of Parasympathetic Nerve Stimulation on Lungs

- Thinning of secretions and decreased goblet cell quantity
- Increased bronchiole smooth muscle cell tone and bronchoconstriction
- Profuse secretions

Osteopathic Considerations in Autonomics Related to the Lower Respiratory System

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and lower respiratory systems manifest in the tissues. Alterations in sympathetic tone due to lower respiratory dysfunction may present as paraspinal tissue texture changes and range of motion restrictions from T2-7. Alterations in parasympathetic tone may affect the suboccipital region, possibly manifesting as muscular hypertonicity and OA/upper cervical somatic dysfunction due to facilitation of CN X.[2]

Biomechanics

Thoracic Cage

The thoracic cage (ribs, sternum, thoracic vertebrae) is a rigid structure as it provides protection for the thoracic viscera and some of the abdominal viscera. However, it also has elastic properties. These structures permit flexibility and allow the thoracic cage to absorb impacts and change shape during respiration.[3]

Thoracic Diaphragm

The primary muscle of inspiration is the diaphragm. The diaphragm in its relaxed state is dome shaped. During inspiration, an active process, the diaphragm contracts. Diaphragmatic contraction causes flattening and descent of the diaphragm. This contraction causes a decrease in pressure in the thoracic cavity and increased pressure in the abdominal cavity, thus encouraging blood flow return to the heart and lungs, as well as facilitating air flow into the lungs. Exhalation is mainly a passive process. During exhalation the diaphragm and accessory muscles of respiration relax, allowing elastic recoil of the thoracic cage, causing an increase in intra-thoracic pressure and encouraging expulsion of air from the lungs.[3]

The diaphragm attaches to the inferior six ribs. Inferiorly, the left and right crura of the diaphragm attach to the lumbar vertebrae (L1-3 and L1-4, respectively). The diaphragm also has apertures that allow the following structures to pass through: vena cava at the level of T8, esophagus (T10), and aorta and thoracic duct (T12). These apertures are important to consider when thinking about how restrictions in the diaphragm can affect circulation.[3]

Accessory Muscles of Respiration

Some accessory muscles of respiration have additional significance, due to their attachment onto the ribs and their use in different treatments like ME. Please note, this is not a complete list of accessory muscles of respiration. They include the following: middle and anterior scalene (attach to rib 1), posterior scalene (attach to rib 2), serratus anterior (attach to ribs 1-10), and pectoralis minor (attach to ribs 3-5). Accessory muscles of respiration are often recruited in labored breathing, inspiratory phases of coughing and sneezing, and pathologic processes such as asthma; observing muscles of respiration can reveal a lot about the status of a patient.[1,3,5]

Pleura

Each pulmonary cavity is lined by a pleural membrane (pleura) that consists of an inner visceral membrane and a shiny outer parietal membrane. Serous pleural fluid lies between the parietal and visceral layers and provides lubrication of pleural surfaces. The visceral pleura is intimately attached to the lung parenchyma. At the hilum of the lung, the viscera and parietal pleura become continuous. The pleura then extends throughout the entirety of the pleural cavity, adhering to the thoracic wall, mediastinum and diaphragm.[3]

Lungs

The respiratory activity of the lungs is mediated by the biomechanical structure and function of the thoracic cage, as well as the muscles of respiration.[3]

Osteopathic Considerations in Biomechanics Related to the Lower Respiratory System

The physiological (or pathologic) functioning of the lower respiratory system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify an organ's function, the long fascial chains of the body can transmit forces from distal anatomic structures. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the lower respiratory system:

- Typical cervical vertebrae due to attachment of scalene muscles and proximity to phrenic nerve
- Ribs due to mechanical facilitation of respiration and proximity to sympathetic chain ganglia
- Sternum due to mechanical effects on respiration
- Scapulae and clavicles due to attachment of accessory muscles of respiration
- Diaphragm as primary muscle of respiration
- Thoracic spine due to participation in mechanics of respiration
- Lumbar spine (L1-4) due to diaphragmatic crura attachments
- Abdominal wall muscles due to attachment at rib cage and sternum, participation in forced exhalation

Circulation[3]

Lungs

- Arterial:
  - pulmonary trunk → pulmonary arteries → lobar arteries → segmental artery → lung
  - aorta → left bronchial artery → left lung parenchyma
  - aorta* → right bronchial artery → right lung parenchyma

    *a single right bronchial artery, which can arise from the thoracic aorta, a common trunk with the left superior bronchial artery, or from a proximal posterior intercostal artery
- Venous:
  - distal lung parenchyma and visceral pleura → pulmonary veins → left atrium
    - right superior and middle lobes → superior right pulmonary veins → left atrium
    - left superior lobe → superior left pulmonary vein → left atrium
    - inferior right and left lobes → right and left inferior pulmonary veins, respectively → left atrium
  - root of the lung → Right bronchial veins and left bronchial vein
    - right bronchial veins → azygous vein → superior vena cava
    - left bronchial veins → accessory azygous vein

- Lymphatic:
  - lung parenchyma & visceral pleura → superficial lymphatic plexus → bronchopulmonary lymph nodes → superior & inferior tracheobronchial lymph nodes →right & left bronchomediastinal lymphatic trunks → right lymphatic duct & thoracic duct
  - root of the lung → deep lymphatic plexus → intrinsic pulmonary lymph nodes → bronchopulmonary lymph nodes → superior & inferior tracheobronchial lymph nodes → right & left bronchomediastinal lymphatic trunks → right lymphatic duct & thoracic duct

Diaphragm

- Arterial:
  - aorta → subclavian arteries → internal thoracic artery → pericardiophrenic artery and musculophrenic artery → superior surface of diaphragm
  - aorta → inferior phrenic arteries → inferior surface of diaphragm
- Venous:
  - superior surface of diaphragm → pericardiophrenic vein and musculophrenic vein → internal thoracic veins → IVC
  - inferior surface of diaphragm → inferior phrenic vein → IVC
- Lymphatic:
  - superior surface → diaphragmatic lymph nodes → phrenic lymph nodes → parasternal lymph nodes and posterior mediastinal lymph nodes
  - inferior surface → superior lumbar lymph nodes

Osteopathic Considerations in Circulation Related to Lower Respiratory System

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory systems (venous and lymphatic systems). These baffles include the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. For a more complete review, please see your first-year manual or any of the referenced materials.[2]

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the lower respiratory system. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the lower respiratory system. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the lower respiratory system. Next, biochemical and biophysical tests frequently used in the evaluation of the lower respiratory system are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.[2]

Osteopathic Exam:

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- OA, AA, C2 for the parasympathetic innervation from CN X
- Typical cervical vertebrae due to attachments for accessory muscles of respiration and influence on phrenic nerve (C3-5)
- T2-7 for the sympathetic innervation of the lower respiratory system
- Ribs, sternum and thoracic spine for biomechanical effects on respiration
- Diaphragm and accessory muscles of respiration for biomechanical forces of respiration
- L1-4 for attachment of diaphragmatic crura
- Evaluation of areas that may obstruct lymphatic flow
    - Thoracic inlet
    - Respiratory diaphragm

Testing

- CBC (WBC)
- Chest X-Ray (Non-invasive evaluation of pulmonary system's structure)
- CT of chest (Non-invasive evaluation of pulmonary system's structure and function)
- CTA of chest (visualization of pulmonary vasculature)
- Ventilation-perfusion (V/Q) scan (nuclear medicine test to determine blood flow and airflow distribution in the lungs)
- Pulse oximetry (Oxygen saturation)
- Spirometry (FEV1, FVC)
- Arterial Blood Gas (PaO_2, $PaCO_2$, SaO_2, pH, HCO_3)
- Bronchoscopy (Bronchial tree, obstructions, sampling)

Technique Contents:

Articulatory Technique

Supine Rib Raising

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

BLT/LAS for Rib Dysfunction

Muscle Energy Technique (ME)

Diaphragm Doming (Respiratory-assist ME)

ME for Structural 1st Rib Dysfunction

ME for Anterior Rib Subluxation

ME for Posterior Rib Subluxation

ME for Anterior Posterior Rib Compression

ME for Lateral Rib Compression

ARTICULATORY TECHNIQUE

Supine Rib Raising[7]

Mechanism: The sympathetic chain ganglia rest directly anterior to the rib heads. This relationship allows the operator an avenue to affect the autonomics. The goal of this technique is to balance sympathetic tone. While the ribs end at T12, the sympathetic chain continues to L2; therefore, this treatment can be used down to that level by placing hands along lumbar paraspinal musculature. Rib raising can also be used to improve respiration by freeing rib cage muscular, fascial, and boney restrictions.

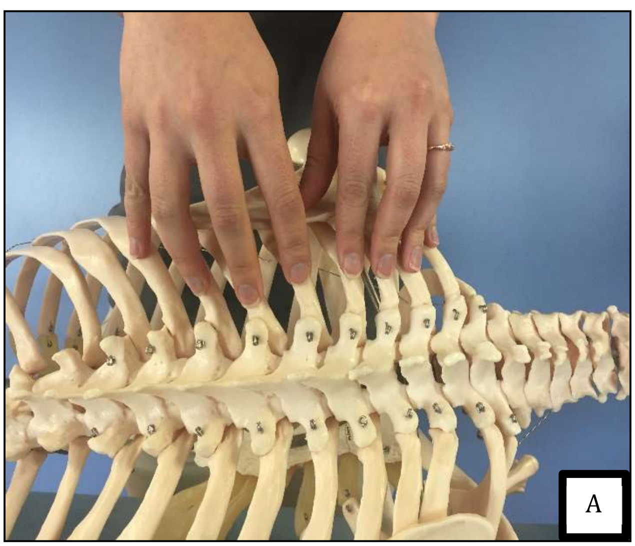
Example Diagnosis: Hypersympathetic tone of the thoracolumbar chain ganglia bilaterally

Physician Position: Seated at the side of the table

Patient Position: Supine (can be modified with patient on their side if needed)

Procedure:

1. Slide both hands underneath the patient's back at cervicothoracic junction and contact the rib angle with finger pads, lateral to the costotransverse articulation.
2. Apply a gentle anterolateral pressure with finger pads. This can be done by bracing the forearms on the table and using them as a lever while leaning back with the torso.
3. Maintain this pressure until a release is palpated.
4. Reposition the hands approximately 4-5 inches inferior and repeat the process.
5. Continue moving inferiorly to the level of L2.
6. Repeat on the contralateral side and then reassess.



A) Hand Position on Skeleton

B) Hand Position on Patient

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

BLT/LAS for Rib Dysfunctions[8]

Mechanism: This can be used for mechanical or respiratory rib dysfunctions. It can also be used for single or group dysfunctions.

Example Diagnosis: Right Rib 8 Posterior

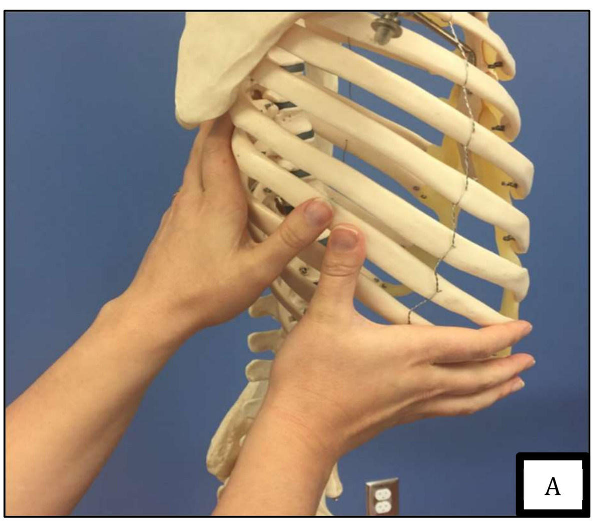
Physician Position: Standing or seated on the side of dysfunction

Patient Position: Seated or supine

Procedure:

1. Contact the right rib at its anterior and posterior attachments by placing the index finger of one hand over costovertebral junction and the index finger of other hand over costochondral junction with thumbs along lateral aspect of rib 8.
2. Using both hands, position the rib to reach a point of balance in relation to the surrounding tissues, where all tension is equal. Check the motion of the rib in all planes including respiratory (inhalation/exhalation) and mechanical (three planes). The balance point will be where the tension across rib 8 is symmetrically distributed.
3. Make minor adjustments in all planes until the position of best possible balance is achieved.
4. Wait for the release.* The release should be achieved relatively quickly. If not, repeat steps 2-3.
5. After a release is palpated, return the patient to neutral.
6. Reassess.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Hand Position for BLT/LAS for Rib Dysfunctions

B) Treatment Position for BLT/LAS for Rib Dysfunctions

MUSCLE ENERGY (ME)

Diaphragm Doming (Respiratory-assist ME)[7]

Example Diagnosis: Restriction in diaphragm excursion, inhalation or exhalation

Physician Position: Standing to the patient's side facing the patient's head

Patient Position: Supine

Procedure:

1. Contact just inferior to the costal margin using the thumbs and thenar eminences. The rest of the hand drapes over the inferior-lateral ribs.
2. Gently slip the thumbs under the costal margin and apply a slight superior and medially directed compression force to engage the diaphragmatic fascia.
3. Instruct the patient to take several slow and full breaths.
4. As the patient exhales, a gentle but firm compression is induced with a superomedial force vector, in the direction of the uppermost dome of the diaphragm.
5. As the patient inhales, the operator holds this compression, restricting inhalation.
6. Repeat this procedure for 2-3 breaths and then reassess.

Treatment Position for Diaphragm Doming

ME for Structural 1st Rib Dysfunction[5]

Mechanism: This technique is indicated for mechanical or structural rib dysfunctions. Patients frequently complain of neuralgic symptoms that can mimic those of a rib fracture. There may be altered chest wall contour anteriorly, posteriorly or laterally. This muscle energy treatment activates the contralateral scalenes, causing inhibition of the ipsilateral scalenes via the crossed extensor reflex and allowing the rib to descend into a normal physiologic position.

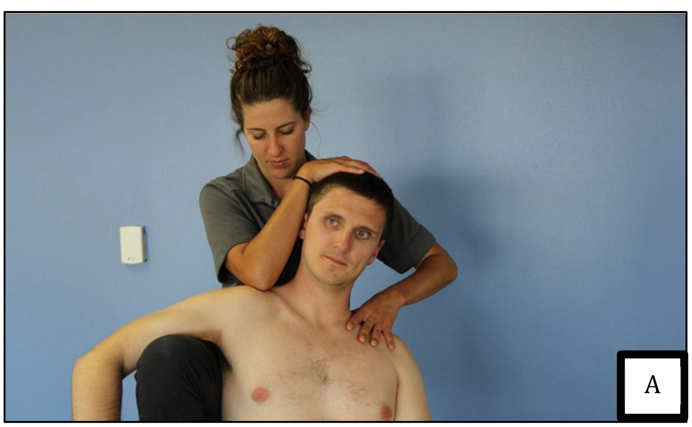
Example Diagnosis: Superior left 1st rib

Patient Position: Seated

Physician Position: Posterior to patient facing the patient's back

Procedure:

1. Stabilize the patient's trunk with the right knee.
2. Control the head and neck with the right forearm by placing the elbow on the patient's right shoulder and resting the hand over the patient's head.
3. Sidebend the patient's head to the left (toward the dysfunctional 1st rib).
4. With left thumb, contact the 1st rib and guide it anteriorly.
5. Place caudal pressure on the posterior rib shaft.
6. Instruct patient to sidebend the head and neck to the right (activating the right scalenes and inhibiting the left scalenes) against isometric counterforce for 2-5 seconds.
7. Have the patient relax and wait for tissues to soften for post-isometric relaxation.
8. Re-engage the feather edge of the new barrier by increasing left sidebending of the head and neck.
9. Repeat steps 6-8 until no further change is noted.
10. Return the patient to neutral, and then reassess.



A) Treatment Position of Left 1st Rib

B) Treatment Position. Hand contacting the superior posterior aspect of 1st rib, anterior to the upper trapezius.

ME for Anterior Rib Subluxation[5]

Mechanism: This technique is utilized for anteriorly subluxed ribs. Decreased prominence of the rib angle can be palpated posteriorly compared to the rib above or below. Respiratory restriction is often associated with these dysfunctions, along with noticeable tenderness along the rib shaft and intercostal muscles. This muscle energy treatment activates the rhomboids, which indirectly work through the scapula and anterior serratus to pull the underlying ribs back into a neutral position.

Example Diagnosis: Anteriorly subluxed right rib 5

Patient Position: Seated

Physician Position: Posterior to the patient

Procedure:

1. Patient's right-hand contacts their left shoulder.
2. Stand behind the patient with right thumb contacting the shaft of the 5th rib medial to the rib angle.
3. The physician's left-hand contacts the patient's right elbow and lifts with a cephalad force to localize motion at the dysfunctional rib.
4. Apply a posterolateral force on the rib shaft with the right thumb.
5. Instruct the patient to pull the right elbow laterally or caudally for 3-5 seconds against an isometric counterforce.
6. Have the patient relax and allow the tissue to soften for post isometric relaxation.
7. Re-engage the barrier by drawing the arm into further adduction and increasing posterolateral force on the rib shaft.
8. Repeat steps 5-8 until no further change is noted.
9. Return the patient to neutral, and then reassess.

A) Posterior view of treatment position. Contact the rib shaft medial to rib angle.

B) Anterolateral view of treatment position.

ME for Posterior Rib Subluxation[5]

Mechanism: This technique is utilized for posteriorly subluxed ribs. On osteopathic exam a prominent rib angle is palpated posteriorly. The anterior chest wall may exhibit a posterior translation of the rib shaft compared the rib above or below. Respiratory restriction with tenderness to rib shaft and intercostal muscles may be present. This muscle energy technique activates the serratus anterior to pull the posterior rib into a more anterior physiologic position. The serratus anterior originates at the anterior and medial border of the scapula and inserts on the lateral surface of ribs 2-8. By adducting the upper extremity, the scapula is protracted, and the posteriorly displaced rib is pulled anteriorly through the barrier with activation of the serratus anterior muscle.

Example Diagnosis: Posterior right rib 5

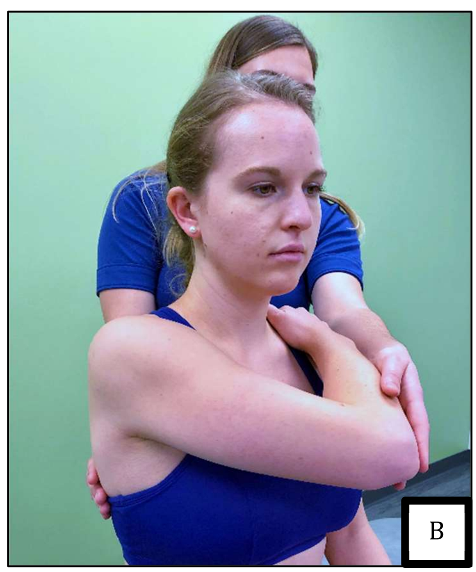
Patient Position: Seated

Physician Position: Posterior to patient

Procedure:

1. Patient's right-hand contacts their left shoulder.
2. Stand behind the patient with right thumb contacting the shaft of the 5th rib lateral to the rib angle.
3. With the left hand, contact the patient's right elbow.
4. Lift the patient's elbow with cephalad force to localize motion at the dysfunctional rib.
5. With the right thumb, apply anteromedial force on the rib shaft.
6. Instruct the patient to push the right elbow medially or cephalad for 3-5 seconds against an isometric counterforce.
7. Have the patient relax and allow the tissue to soften.
8. Re-engage the barrier by abducting the patient's elbow and increasing anteromedial force on the rib shaft.
9. Repeat steps 6-8 until no further change is felt, and then reassess.

A) Posterior view of the treatment position. Contact the rib shaft lateral to the rib angle.



B) Anterolateral view of treatment position.

ME for Anterior Posterior Rib Compression[5]

Mechanism: This technique is utilized for ribs with anterior posterior compression. These ribs have decreased rib angle posteriorly, decreased rib shaft prominence anteriorly, and more pronounced rib shaft laterally. These are commonly associated with a traumatic history.

Example Diagnosis: Left anterior posterior compressed rib 10

Patient Position: Seated

Physician Position: Standing on contralateral side of dysfunctional ribs

Procedure:

1. Patient sits on the edge of the table.
2. Stand on the opposite side of the dysfunction with the patient's right arm draped over the physician's left shoulder.
3. Place the middle fingers of both hands on the prominent lateral rib shaft in the midaxillary line.
4. Sidebend the patient toward the dysfunctional side, while applying a medial compressive force on the shaft of the dysfunctional rib.
5. Instruct the patient to sidebend to the right against an isometric counterforce for 3-5 seconds.
6. Have the patient relax and allow the tissue to soften.
7. Re-engage the barrier by engaging in further sidebending towards the dysfunction.
8. Repeat steps 5-7 until no further change is noted.
9. Return the patient to neutral and then reassess.

Treatment position for AP rib compression

ME for Lateral Rib Compression[5]

Mechanism: This technique can be utilized for ribs with lateral compression. A laterally compressed rib has a more prominent rib angle posteriorly, a more prominent rib shaft anteriorly, and a less prominent rib shaft laterally. This dysfunction is associated with trauma.

Example Diagnosis: Right 8^{th} rib lateral compression

Patient Position: Seated

Physician Position: Stand on the side of the dysfunction

Procedure:

1. Patient sits on the end of the table.
2. Stand on the side of the dysfunction with the patient's right arm draped over the physician's left shoulder.
3. Place thenar eminences of both hands on the anterior and posterior shaft of rib 8.
4. Sidebend the patient away from the dysfunction, while applying an anteroposterior compressive force on the dysfunctional rib.
5. Instruct the patient to sidebend towards the dysfunction against an isometric counterforce for 3-5 seconds.
6. Have the patient relax and allow the tissue to soften.
7. Re-engage the barrier by inducing more sidebending contralateral to the dysfunction.
8. Repeat steps 5-7 until no further change is noted.
9. Return the patient to neutral and then reassess.

A) Treatment position, anterior view

B) Treatment position, posterior view

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Chapter 6

Hematology, Oncology & Lymphatics

"We strike at the source of life and death when we go into the lymphatics."

-A.T. Still, M.D., D.O.

Contents:

NOTES

Introduction

There are many medical conditions for which the health of the lymphatic system must be considered. These conditions include, but are not limited to, congestive heart failure (CHF), pregnancy, pre- and post-operative status, prolonged immobilization, and lymphoma and other malignancies. These conditions must be fully evaluated and treated medically, either before or concurrently, with OMT. A patient with poorly controlled CHF could easily be volume over-loaded by over-treating the lymphatics with OMT, further exacerbating their cardiac condition. Cancer is considered a relative contraindication to lymphatic treatment. The literature does not support the theory that lymphatic techniques promote metastasis. In fact, a study in an animal model showed benefit in the setting of pulmonary neoplasm.[12] Still, in the absence of definitive evidence, "each patient should be assessed individually to determine if judicious use of lymphatic treatment would be appropriate for that patient's care."[13]

Breast, prostate, lung, kidney, and thyroid cancers are more likely to metastasize to bone compared with other types of cancer. While pain is the most common presenting symptom of bone cancer, it is important to note associated red-flag symptoms. This helps not only to diagnose bony metastasis, but also to differentiate it from other sources of back pain. In the general population, cancer causes less than 1% of back pain. Pay close attention to unexplained musculoskeletal pain, such as pain in the spine or proximal extremities (hips, thighs, shoulders) without a known injury, night pain, or pain at rest. Localized, constant bone pain is a hallmark of bone cancer. It begins as dull and intermittent but worsens steadily, often over several days or weeks. Commonly affected sites include the vertebral column (especially the thorax), skull, humerus, ribcage, pelvis, and femur.

Indications for osteopathic examination in the hematologic/oncologic patient include decreased functional reserve, pain (including post-surgical pain), prevention or treatment of immobility-related complications in a bed-bound patient (such as atelectasis or constipation), lymphedema, and unwanted medication side effects (including chemotherapy). For patients with malignancy, treatment in the immediate vicinity of cancer is contraindicated. HVLA of the involved area should be avoided due to the risk of pathologic fracture of weakened bone. OMT can be indicated at all stages of diagnosis and treatment, including late-stage cancer or cancer remission. The physician can provide not only pain reduction but also the comfort of touch to patients, greatly improving quality of life.

Think About It

What is your differential diagnosis (DDx)? Given that DDx, what questions do you need to ask? What physical exam do you need to perform to help decide which it is? What kinds of osteopathic structural findings might be seen in this patient?

Autonomics, Biomechanics, Circulation, and Screening

The ABCS of hematology, oncology, and lymphatics depend on the body parts involved. The spleen is particularly worth discussing when considering lymphatic flow, as it is the largest lymphoid organ found in the body. Its relevant autonomics, biomechanics, and circulation will be discussed here, as will considerations for the lymphatic system in general.

Autonomics[1,2,4]

Autonomic Spinal Levels for the Hematologic/Lymphatic System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Spleen	T5-9	CN X (Capsule Only)

Chapman's Reflex Points for the Hematologic/Lymphatic System

	Anterior Point Location	Posterior Point Location
Spleen	Left 7th intercostal space near costochondral junction	Left intertransverse space between T7 and T8, midway between the spinous process and the tip of the transverse process

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Spleen

The spleen is densely innervated by sympathetic nervous system fibers which modulate immune cell responses by inhibiting or enhancing the expression of various cytokines.[3] The vagus nerve supplies parasympathetic innervation to the splenic capsule only.

Osteopathic Considerations in Autonomics Related to Hematology, Oncology, and Lymphatics

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and hematologic/lymphatic systems manifest in the tissues. Alterations in sympathetic tone due to splenic dysfunction may present as paraspinal tissue texture changes and range of motion restrictions from T5-9. Alterations in parasympathetic tone may affect the suboccipital region, possibly manifesting as muscular hypertonicity and OA/upper cervical somatic dysfunction due to facilitation of CN X. Lymphatics, present in nearly all tissues, can affect various levels of the autonomic nervous system, depending on the tissues affected. Alterations in sympathetic tone due to lymphatic congestion in the lower extremities, for example, may present as somatic dysfunction from T10-L2.

Biomechanics

Spleen

The spleen has various articulations with other abdominal structures that have biomechanical influence. Posteriorly the spleen is associated with the left-sided ribs 9-11, separated by the diaphragm. While these ribs serve a protective role for the spleen, they can also cause splenic rupture when fractured due to their proximity. Anteriorly the spleen contacts the greater curvature of the stomach via the gastrosplenic ligament, inferiorly it rests on the left colic flexure, and medially it attaches to the left kidney via the splenorenal ligament. Due to its limited ligamentous attachments, the spleen is a relatively mobile organ, which may contribute to it being the most commonly injured organ in the abdomen.[1]

Baffles

The most common approach to treating the lymphatic system is through the respiratory-circulatory model, which was explained in Chapter 3 of the RVUCOM OPP I & II Technique Manual. The goal of treating through this model is to remove obstructions and optimize flow of lymphatic fluid to improve physiologic function. One way of accomplishing this is to reduce myofascial restriction of the transverse diaphragms starting from proximal (at the thoracic inlet) to distal in order to remove obstructions to flow. A useful analogy to understand this approach is to consider a tub full of water. If you increase the flow of water into the tub without unstopping the drain, the water will overflow all over the floor. When the obstruction (the stopper) is removed first, then flow in the proper direction is restored (down the drain). Therefore, lymphatic treatments should always start with assessment and treatment of the thoracic inlet, the location of a major "drain" for the lymphatic ductal system. Once the fascia of the thoracic inlet has been released, move distally toward the region needing treatment. For example, in the upper extremity, the baffles should again be addressed proximal to distal: thoracic inlet, axilla, antecubital fossa, and the carpal tunnel. In treating the lower extremity, the baffles impeding flow proximal to distal would include the thoracic inlet, respiratory diaphragm, inguinal ligament, popliteal fossa, and the area of the Achilles tendon.

> **Definition: Baffle**
> A baffle is a device used to restrain the flow of a fluid, gas, or loose material. In the context of this chapter, it refers to any myofascial structure that, when restricted, can obstruct flow of fluid through the vessels of this structure.

Once the baffles have been opened proximal to distal, lymphatic flow can be augmented in its physiologic direction, distal to proximal. Imagine a traffic jam: to augment the movement of traffic, the cars at the front of the line must move first, allowing the cars behind to move after them. Applying this to the upper extremity, once the baffles have been released, the flow of lymphatic fluid is augmented toward the thoracic inlet (distal to proximal). The first place to begin moving lymph is the shoulder, where one would augment the movement of fluid in a distal to proximal direction. Following this, augment the movement of fluid in the upper arm in a similar fashion, then the forearm, etc. The flow is always directed from distal to proximal, but the segments are treated from proximal to distal. To return to the traffic analogy, the cars at the front must move first; it is much less effective to push the entire column of cars (or fluid) from the back of the line.

Understanding the treatment approach allows the physician to create efficient whole–body treatment plans for the patient. It is important to remember that the midline baffles are more than just the diaphragms. They are directly affected by the surrounding structures; therefore, treating the surrounding boney or muscular dysfunctions is also beneficial. For example, when considering the pelvic diaphragm, the muscles of the diaphragm itself should be treated, and the lumbosacral junction, sacrum, and pelvic girdle should be assessed and treated if needed.

Osteopathic Considerations in Biomechanics Related to Hematology, Oncology, and Lymphatics

The physiological (or pathologic) functioning of the hematologic/lymphatic system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify local lymphatic function, the long fascial chains of the body can transmit forces from distal anatomic structures. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the hematologic/lymphatic system:

- Central Transverse Diaphragms/Baffles (see table below)
- Upper Extremity Baffles
    - Axillary Folds
    - Antecubital Fossa
    - Carpal Tunnel
- Lower Extremity Baffles
    - Inguinal Ligament
    - Popliteal Fossa
    - Achilles Tendon
- Respiratory Diaphragm due to baffle effect, pumping action on the lymphatic system, and biomechanical relationship to the spleen
- Left ribs 9-11 due to proximity to spleen
- Stomach and left kidney due to articulation with spleen

Major Anatomic Transition Zones and Associated Diaphragms

Transition Zone	Transverse Diaphragm (Baffle)
Craniocervical (OA joint)	Tentorium Cerebelli (above) Myofascial structures of OA
Cervicothoracic	Thoracic Inlet
Thoracolumbar	Thoracoabdominal (Respiratory) Diaphragm
Lumbopelvic	Pelvic Diaphragm

Circulation

Spleen

- Arterial: abdominal aorta → celiac trunk → splenic artery
- Venous: spleen → splenic vein → hepatic portal vein
- Lymphatic: spleen → pancreaticosplenic nodes → superior mesenteric nodes → pyloric nodes, hepatic nodes, and celiac nodes → cisterna chyli → thoracic duct

Screening

There is no single test to diagnose lymphatic stasis; rather, the diagnosis is made by observing the signs and symptoms that would indicate the need for lymphatic treatment. When lymph stasis is diagnosed or suspected, it is important to evaluate the areas likely contributing to the pathology. The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the spleen and the lymphatic system in general and are the best places to begin evaluation. Most importantly, the physician should evaluate the relevant baffles, or transverse diaphragms beginning with the thoracic inlet, associated groups of lymph nodes, and the local lymphatic channels. Biochemical and biophysical testing used in the evaluation of lymphatic, hematologic, and oncologic problems are listed below. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

Testing

- CBC, peripheral smear (cell line dyscrasias, cell morphology)
- Bone marrow biopsy (lymphoma, leukemia)
- CMP (liver function, renal function, protein loss)
- BNP and NT-proBNP (heart failure)
- UA (renal function, protein loss)
- Venous duplex ultrasound (deep vein thrombosis)
- Echocardiogram (heart failure)
- PET CT (malignancy localization)
- CT abdomen (splenic size, pathology)

Principles of Diagnosis and Treatment of Lymphatics[2]

Diagnosis

When evaluating a patient for somatic dysfunction related to lymphatics, keep the following principles in mind:

- Evaluate diaphragms and transverse myofascial structures that act as diaphragms or baffles, especially the thoracic inlet, as these may limit the flow of lymphatic vessels
- Evaluate for somatic dysfunction affecting any motion that would normally enhance lymphatic flow. For example, a posterior rib 10 may inhibit full respiratory diaphragm excursion.
- Palpate tissues to evaluate the presence of congestion or excess fluid in the interstitial tissues. Congestion may be present before frank edema.
- Consider the fascial model described by Dr. Zink, who identified four patterns of fascial rotation at the transition zones of the body: ideal, common compensatory, uncommon compensatory, and uncompensated. For more detail, see Chapter 13 of the RVUCOM OPP I & II OPP Manual.

Treatment

When using OMT to address the lymphatics, keep the following principles in mind:

- Impediments to lymphatic flow should be removed first, beginning centrally and moving peripherally. *Most often this means evaluating and treating dysfunction in the thoracic inlet first*, then in any distal diaphragms or baffles. To remove impediments to lymphatic flow from the distal upper extremity, one would first treat the thoracic inlet, then the axillary folds, then the antecubital fossa, and finally the carpal tunnel.
- Diaphragmatic motion should be maximized to ensure intrinsic lymphatic pumping. This includes the respiratory diaphragm, but also the pelvic diaphragm and the thoracic inlet.
- Augment lymphatic flow beyond resting levels by increasing pressure differentials or by transmitting motion. This is achieved through lymphatic pump techniques.
- Mobilize targeted tissue fluids into the lymphatic and venous systems. This may include effleurage or other soft tissue techniques to encourage the formation of lymph in congested tissues.

Technique Contents:

Treating Lymphatic Diaphragms:

Thoracic Inlet MFR

Diaphragm Doming (Respiratory-assist ME)- See Chapter 5

BLT/LAS for Respiratory Diaphragm Dysfunctions

Ischiorectal Fossa Release

Upper Extremity Lymphatic Sequence

Lower Extremity Lymphatic Sequence

Other Lymphatic Techniques:

Auricular Drainage- See Chapter 4

Submandibular MFR

Cervical Chain Drainage- See Chapter 4

Anterior Cervical Myofascial Release- See Chapter 4

Thoracic Pump

Epigastric and Omental Pump

Liver Pump

Splenic Pump

Pedal Pump

Sutherland’s Lymphatic Technique

LYMPHATIC DIAPHRAGM TECHNIQUES

Thoracic Inlet MFR "Steering Wheel Technique"[5]

> **Think About It** A traffic jam does not move until the first car in the line begins to move. Before it can move, all roadblocks must be cleared. With regards to the lymphatic system, the first impediment, myofascial restriction of the thoracic inlet, must be removed before the lymph can flow freely.

Mechanism: Utilizing the boundaries of the thoracic inlet, it is easy to treat the entire complex with MFR to release lymphatic obstruction and promote lymphatic flow throughout the body.

Example Diagnosis: Thoracic inlet flexed, rotated right and sidebent right

Physician Position: Standing behind patient or seated at head of table

Patient Position: Seated or supine

Procedure:

1. Anterior contact is made across sternoclavicular junction and ribs 1 and 2. Posterior contact is made with T1 and the costovertebral junction. Therefore, the physician places hands on either side of the base of the patient's neck with fingers overlying the thoracic inlet and clavicle, palms over the upper trapezius, and thumbs contacting the transverse processes of T1.
2. Apply slight compression to engage the thoracic inlet fascia, including Sibson's fascia.
3. Induce motion in anterior-posterior, medial-lateral, and rotational planes until the desired position is achieved.*
4. Hold 20-60 seconds until tissue creep indicates a release of tissue tension, follow the release until no further change is noted or until you feel the breath return to the tissues, and then reassess.

*If using indirect MFR, remain in whichever position allows the tissues to soften (direction of ease), then follow the release.

*If using direct MFR, remain in whichever position creates more tension (direct barrier) then follow the release.

A) Hand Position for Thoracic Inlet MFR

B) Treatment Position for Thoracic Inlet MFR

BLT/LAS for Respiratory Diaphragm Dysfunctions[6]

Mechanism: Using the ribs as levers to balance the diaphragm, the physician re-establishes equal tension across the ribs and the fascial/ligamentous structure of the diaphragm, allowing the body to restore freedom of motion.

Example Diagnosis: Inhalation dysfunction of the right hemi-diaphragm

Physician Position: Seated on the side of dysfunction

Patient Position: Supine

Procedure:

1. Place cephalad hand under the posterior, right hemi-diaphragm and caudal hand over the anterior, right hemi-diaphragm so fingers are parallel to the ribs.
2. Apply a gentle compression force with hands directed towards the xiphoid process to disengage the ribs from their attachments.
3. Find a point of equal tension among the ligamentous attachments of the lower rib cage and diaphragm in all three planes.
4. Hold this balanced position until a release is palpated.*
5. If no release is palpated, repeat steps 2-4.
6. Return to neutral and reassess.

*When using BLT, the release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Treatment Position of BLT/LAS for Respiratory Diaphragm Dysfunctions

Ischiorectal Fossa Release – Supine[9]

Mechanism: This is an inhibitory technique for the myofascial tissues of the pelvic diaphragm. During inhalation, the pelvic diaphragm moves inferiorly due to the increased positive pressure created by the respiratory diaphragm moving inferiorly. During exhalation, the pelvic diaphragm returns superiorly. This technique utilizes these movements of respiration to alleviate restriction in the pelvic diaphragm, which can improve lymphatic flow.

Think About It Clinical diagnoses associated with increased pelvic congestion include, but are not limited to hemorrhoids, dysmenorrhea, and constipation. Relieving lymphatic congestion can provide better clinical outcomes and improvement of symptoms.

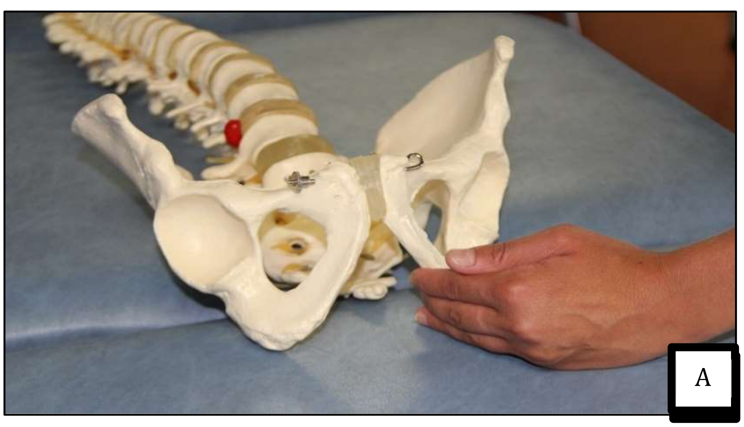
Example Diagnosis: Restricted left pelvic diaphragm

Physician Position: Seated on the side of dysfunction

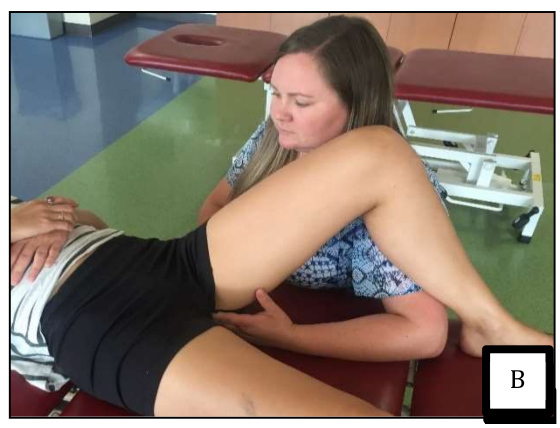
Patient Position: Supine with hips and knees flexed, feet on table

Procedure:

1. With the palm facing superiorly (relative to the patient, carefully find the inferior surface of the patient's left ischial tuberosity with left finger pads. Keeping contact with the medial aspect of the ischial tuberosity, turn the hand so fingertips pointing superiorly, and the palm is facing the physician.*
2. Apply gentle pressure superiorly, engaging the myofascial tissues until a restrictive barrier in the pelvic diaphragm is engaged.
3. As the patient exhales, follow the pelvic diaphragm cephalad by increasing superior pressure. As the patient inhales, resist the inferior motion of the pelvic diaphragm.
4. Repeat until no more change is palpated.
5. Return to neutral and reassess.
6. Treat contralateral side if necessary.



A) Hand position for Ischiorectal Fossa Release



B) Treatment position for Ischiorectal Fossa Release**

*To confirm that you are contacting the pelvic diaphragm, instruct the patient to cough or bear down; inferior pressure should be palpable at the fingertips.

**Patient's right leg extended for visualization only. When using this technique, keep both legs flexed.

Upper Extremity Lymphatic Sequence[14]

Mechanism: This sequence is an inhibitory technique directed at the tissues that cause lymphatic baffles. Always remember to release proximal baffles before distal, beginning with the thoracic inlet. Once the baffles have been released, lymphatic flow can be augmented in its physiologic direction. To accomplish this, one must treat segmentally from proximal to distal while augmenting the flow in a distal-to-proximal direction within each segment via effleurage soft tissue technique.

Example Diagnosis: Lymphatic congestion in right upper extremity

Physician Position: Seated or standing at patient's side

Patient Position: Supine

Procedure:

1. For the following locations, use gentle, increasing pressure to the congested lymphatics and fascia. Hold the pressure until a release is palpated. There may be multiple points of congestion within a given area which should be treated.
    a. <u>Anterior and Posterior Axillary Folds Release</u>
    Using a pincer grasp on the axillary folds, apply either traction or compression as described above. Hold until a release is felt, then reassess.
    b. <u>Antecubital Fossa Release</u>
    Apply a compressive force as described above with the thumbs engaging the fascia of the antecubital fossa and spreading laterally. Hold until a release is felt, then reassess.
    c. <u>Carpal Tunnel Release</u>
    Engage the transverse carpal ligament with thumbs and apply transverse distraction. Hold until a release is felt, then reassess.

A) Treatment Position for Anterior Axillary Fold Release

B) Treatment Position for Posterior Axillary Fold Release

C) Treatment Position for Antecubital Fossa Release

D) Treatment Position for Carpal Tunnel Release

Lower Extremity Lymphatic Sequence[14]

Mechanism: This sequence is an inhibitory technique directed at the tissues that cause lymphatic baffles. Always remember to release proximal baffles before distal, beginning with the thoracic inlet. Once the baffles have been released, lymphatic flow can be augmented in its physiologic direction. To accomplish this, one must treat segmentally from proximal to distal while augmenting the flow in a distal-to-proximal direction within each segment via effleurage soft tissue technique.

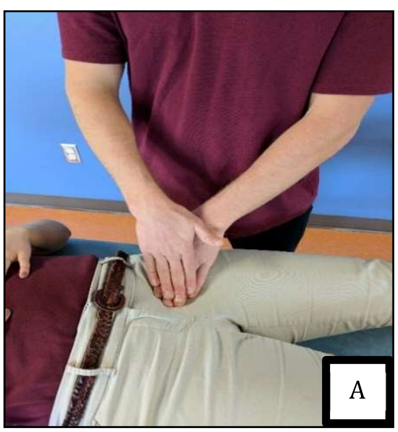
Example Diagnosis: Lymphatic congestion in left lower extremity

Physician Position: Seated or standing at patient's side

Patient Position: Supine

Procedure:

1. For the following locations, use gentle, increasing pressure to the congested lymphatics and fascia. Hold the pressure until a release is palpated. There may be multiple points of congestion within a given area which should be treated.
    a. <u>Inguinal ligament Release</u>
    Apply a compressive force as described above with the palpating (bottom) hand engaging the inguinal ligament perpendicularly. The top hand provides the compressive force into the ligament. Hold until a release is felt, then reassess.
    b. <u>Popliteal fossa Release</u>
    Apply a compressive force as described above with the fingers of both hands engaging deeply into the fascia of the popliteal fossa and providing a gentle, spreading force. Hold until a release is felt, then reassess.
    c. <u>Achilles tendon Release</u>
    Apply a compressive force as described above with the fingers and thumb of the right hand engaging the fascia of the space just anterior to the Achilles tendon at the level of the malleoli. Hold until a release is felt, then reassess.



A) Treatment Position for Inguinal Ligament Release

B) Treatment Position for Popliteal Fossa Release

C) Treatment Position for Achilles Tendon Release

OTHER LYMPHATIC TECHNIQUES

Submandibular MFR[7]

Mechanism: This is an inhibitory technique that eases the tension in the fascia in and around the submandibular lymph nodes, improving lymphatic flow and function.

Example Diagnosis: Myofascial restriction of the submandibular region with lymphatic congestion

Physician Position: Seated or Standing at the head of the table

Patient Position: Supine

Procedure:

1. Place finger pads of 2nd and 3rd digits (or as many as comfortably fit) medial to the inferior edge of the mandible bilaterally.
2. Gently apply a superior and lateral force into the mandibular fascia and motion test in all three planes until the desired position is achieved.*
3. Hold until tissue creep indicates a release of tissue tension, then follow the release until no further change is noted or until you feel the breath return to the tissues.
4. Return patient to neutral, then reassess.

*If using indirect MFR, remain in whichever position allows the tissues to soften (position of ease), then follow the release.
*If using direct MFR, remain in whichever position creates more tension (direct barrier), then follow the release.

Treatment Position for Submandibular MFR

Thoracic Pump/Miller Pump[7]

Mechanism: This technique increases the negative pressure within the thoracic cavity to create an exaggerated inhalation. This creates a stronger suction force, pulling lymph up from the abdominal cavity into the thoracic cavity and emptying it from the thoracic duct into the superior vena cava. **The modifications of this technique are relatively contraindicated in COPD patients,** as they may increase air trapping. This technique can cause hyperventilation and transient light-headedness or dizziness.

Example Diagnosis: Lymphatic congestion anywhere

Physician Position: Standing at patient's head

Patient Position: Supine

Procedure:

1. Place palms inferior to patient's clavicles with fingers overlying the anterior chest wall. For patients with breast tissue, rotate the fingers laterally and place more of the pressure on the hypothenar eminence to minimize pressure over breast tissue.
2. Instruct the patient to inhale and exhale deeply.
3. Introduce a rhythmic posterior/inferior motion at a rate of roughly 2 compressions per second. This rhythm is specific to each patient and should be comfortable for both the physician and patient.
4. Induce rhythmic motion for 30 seconds to 2 minutes until a release is palpated.
5. Return the patient to neutral and reassess.

Modification 1:

1. Follow steps 1-3 above.
2. During exhalation, increase pressure on rib cage by following the ribs' posterior/inferior motion—augmenting exhalation. During inhalation resist anterior/superior motion of the rib cage.
3. Follow steps 4-5 above.

Modification 2:

1. Follow steps for modification 1.
2. As the patient begins the last breathing cycle, abruptly release pressure just as they begin to inhale. Patients will often reflexively gasp for air, expanding the chest cavity.
3. Reassess.

Treatment position for Thoracic Pump

Epigastric and Omental Pump[9]

Mechanism: The omentum is visceral fascia containing arterial, venous, lymphatic, and nervous channels. This treatment is designed to simultaneously decrease restriction of omental fascial planes, as well as mobilize the fluids that course through them with the use of a rhythmic pumping motion.

Example Diagnosis: Lymphatic congestion

Physician Position: Standing at patient's side

Patient Position: Supine

Procedure:

1. Place the palm of your dominant hand on the patient's epigastrium with fingertips oriented superiorly. Be careful to avoid applying pressure directly over the xiphoid process.
2. Move your hand posteriorly and superiorly until the omentum is engaged. Alternately decrease and increase pressure in a rhythmic fashion at a rate of one pump every 2-3 seconds.
3. Continue pumping for 30 seconds to 2 minutes, or as tolerated by the patient.
4. Release the pressure to return the omentum back to neutral, then reassess.

Treatment Position for Epigastric and Omental Pump

Liver Pump[9,10]

Mechanism: This technique combines inhibition and oscillation to release the connective tissue around and within the liver, allowing for optimal function. Caution must be taken in patients with liver disease and acute disorders of the liver or gallbladder.

Example Diagnosis: Congestion of the liver

Physician Position: Standing or seated to the right of the patient

Patient Position: Supine

Procedure:

1. Place the left hand posteriorly on the lower ribs and the right hand anteriorly on the lower ribs, just superior to the costal margin; gently compress through the ribs to contact the liver.
2. Instruct the patient to inhale and exhale fully. As the patient exhales deeply, gently increase the compression and apply a medial, oscillatory motion at a rate of 2 compressions per second. Increase the pressure with subsequent breaths.
3. Repeat for 30 seconds to 2 minutes, or as tolerated by the patient.
4. Release the pressure, then reassess.

Treatment Position for Liver Pump

Splenic Pump/"Splenic Stimulation"[11]

Mechanism: The spleen is the largest lymphatic organ in the body and, therefore, a critical point of treatment. This technique combines inhibition and oscillation to release the connective tissue around and within the spleen, which allows for optimal lymphatic flow. This technique is contraindicated in a patient with acute splenomegaly, due to the risk of splenic rupture.

Example Diagnosis: Lymphatic congestion secondary to upper respiratory infection

Physician Position: Standing or seated to the left of the patient

Patient Position: Supine

Procedure:

1. Place one hand on the lower rib cage anteriorly and the other hand on the lower rib cage posteriorly, overlying the spleen; gently compress through the ribs to contact the spleen.
2. Carefully compress the spleen toward midline with both hands and apply a medial, oscillatory motion at a rate of 2 compressions per second.
3. Continue this oscillatory motion for 30 seconds to 2 minutes.
4. Release the pressure, then reassess.

Modification:

1. Follow steps 1-3 above.
2. After the last oscillatory compression is applied, release the pressure suddenly, then reassess. The recoil of the tissues provides a negative pressure to help move fluid through the spleen.

Treatment Position for Splenic Pump

Pedal Pump/Dalrymple Pump[7]

Mechanism: This technique increases pressure on the lymphatic fluid system, augmenting flow toward the thoracic duct. Before using this technique, the thoracic inlet, thoracic diaphragm, and lower extremity baffles should all be treated.

Example Diagnosis: Lower extremity lymphatic congestion

Physician Position: Standing at the foot of the table

Patient Position: Supine

Procedure:

1. Place palms over the plantar aspect of the patient's toes, wrapping your fingers anteriorly over the dorsum of the toes.
2. Dorsiflex the ankles.
3. While maintaining dorsiflexion, introduce a rhythmic motion (augmenting dorsiflexion) toward the patient's head at a rate of roughly 2 compressions per second. This rhythm is specific to each patient and should be comfortable for both the physician and patient. You should see motion from the top of the head to the bottom of the feet.
4. Continue this rhythmic motion for 30 seconds to 2 minutes, until the motion feels connected and free of restriction from the patient's head to the toes.
5. Return patient to neutral, then reassess.

Modification:

1. Place palms over the dorsal aspect of the patient's feet.
2. Carefully plantar flex the feet to their limit.
3. While maintaining plantar flexion, introduce a rhythmic motion (augmenting plantar flexion) superiorly at a rate of roughly 2 compressions per second. This rhythm is specific to each patient and should be comfortable for both the physician and patient. You should see motion from the top of the head to the bottom of the feet.
4. Continue inducing rhythmic motion for 30 seconds to 2 minutes until the motion feels freely connected from the patient's head to toe and free of restriction.
5. Return patient to neutral, then reassess.

Treatment Position for Pedal Pump

Sutherland's Lymphatic Technique[8]

Mechanism: By treating common areas of lymphatic constriction with an oscillatory technique, lymphatic flow can be improved.

Example diagnosis: Lymphatic stasis

Physician position: Standing at the head and side of the patient

Patient position: Supine

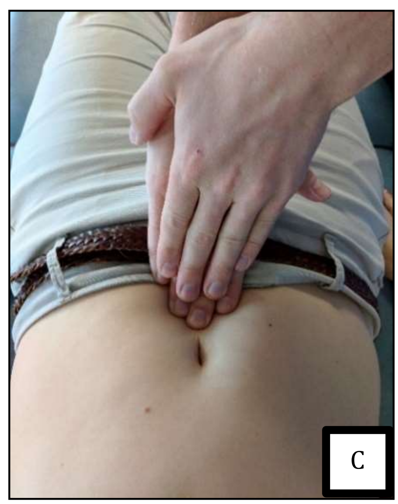
Procedure:

1. Place a sensing hand over the left* subclavicular area near the midclavicular line.
2. Place the treating hand over the sensing hand and induce rhythmic oscillations in a superior to inferior manner for 30-60 seconds.
3. Next, move to the epigastric area; stand on the patient's side and face cephalad.
4. Place a sensing hand so that the finger pads are just inferior to the xiphoid process pointed superiorly (over cisterna chyli).
5. Place a treating hand over the sensing hand and induce rhythmic oscillations in an inferior to superior manner for 30-60 seconds.
6. Next, move to the hypogastric area, stand on the patient's side facing cephalad.
7. Place a sensing hand with finger pads approximately two inches inferior to the naval pointed superiorly.
8. Place a treating hand over the sensing hand and induce rhythmic oscillations in an inferior to superior manner for 30-60 seconds.
9. Release the pressure, then reassess.

*__Note –__ If the desired area to be drained corresponds to the right thoracic inlet (head and right upper extremity), do this technique on the right side.

A) Treatment Position for Left Clavicular Pump

B) Treatment Position for Epigastric Pump



C) Treatment Position for Hypogastric Pump

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Chapter 7

Gastrointestinal System

"All disease begins in the gut."

-Hippocrates

Contents:

Notes

Autonomics[1-5]

Autonomic Spinal Levels for the Gastrointestinal System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Esophagus	T3-6	CN X
Stomach	T5-9	CN X
Liver	T5-9	CN X
Gallbladder	T5-9	CN X
Pancreas	T5-9	CN X
Duodenum (before Ligament of Treitz)	T5-9	CN X
Jejunum	T10-11	CN X
Ileum	T10-11	CN X
Ascending Colon and Proximal 2/3 of Transverse Colon (between Ligament of Treitz and Splenic Flexure) and Appendix	T10-11	CN X
Distal 1/3 of Transverse Colon	T12-L2	S2-4
Descending Colon and Sigmoid colon (after Splenic Flexure)	T12-L2	S2-4
Rectum	T12-L2	S2-4

Autonomic Ganglia Related to the Gastrointestinal System

Ganglia	Location	Preganglionic Fibers	Postganglionic Projections
Celiac Ganglia/Plexus	Anterior abdominal aorta near the origin of the celiac artery	Greater Splanchnic Nerves (T5-9)	Abdominal esophagus Stomach Proximal duodenum Dorsal pancreas Liver and gallbladder Spleen
Superior Mesenteric Ganglia/Plexus	Anterior abdominal aorta near the origin of the superior mesenteric artery	Lesser Splanchnic Nerves (T10-11)	Distal duodenum Jejunum Ileum Proximal colon
Inferior Mesenteric Ganglia/Plexus	Anterior abdominal aorta near the origin of the inferior mesenteric artery	Least and Lumbar Splanchnic Nerves (T12-L2)	Distal colon Rectum Pelvic viscera

The table above highlights the most significant pathways mediating sympathetic innervation of the abdominal viscera. Note that a full picture of the contribution of various spinal levels and splanchnic nerves to peripheral ganglia is more complex. There is significant communication among the ganglia and variability between individuals, such that in some cases the celiac and superior mesenteric ganglia coalesce into a single plexus. Similarly, the aorticorenal plexus is considered by some an extension of the celiac plexus, and by others a distinct plexus. The above should be understood as an anatomic framework upon which individual variations and complexities may be understood.[16]

Chapman's Reflex Points for the Gastrointestinal System

	Anterior Point Location	Posterior Point Location
Abdomen	Superior aspect of body and ramus of pubic bone near the pubic symphysis	Tip of the TP of L2
Appendix	Superior aspect, near the tip of right 12th rib	Intertransverse space between T11 and T12
Colon	An area 1-2 inches wide, extending from greater trochanter to within an inch of the patella on anterolateral aspect of femur: • Right superior 1/5th: cecum • Right middle 3/5th: ascending colon • Right inferior 1/5th: proximal 2/5th of transverse colon • Left inferior 1/5th: distal 3/5th of transverse colon • Left middle 3/5th: descending colon • Left superior 1/5th: sigmoid • Most superior aspect of left greater trochanter: rectosigmoid junction	Triangular space from the TP of L2 to the TP of L4 and along the iliac crest
Esophagus	2nd ICS close to the sternum	Posterior surface of the TP of T2, midway between the SP and the tip of the TP
Liver & Gallbladder	Right 6th ICS from mid-clavicular line to sternum	Intertransverse space between T6 and T7 on the right, midway between the SP and tip of the TP
Hemorrhoids	Just superior to ischial tuberosities	On sacrum on the inferior aspect of SI joint
Inguinal Lymph Nodes	Lowest 2/5 of the sartorius muscle and its attachment to the tibia, and just above the medial femoral condyle	On sacrum on the inferior aspect of SI joint
Intestinal Peristalsis	Midway between ASIS and greater trochanter	Costotransverse junction of right 11th rib
Liver	Right 5th and 6th ICS from mid-clavicular line to the sternum	Right intertransverse space between T5-T6, midway between the SP and the tip of the TP
Pancreas	Right 7th ICS close to costochondral junction	Right intertransverse space between T7 and T8, midway between the SP and the tip of the TP
Pylorus	Anterior aspect of the sternal body	Right 10th rib just lateral to the costotransverse joint
Rectum	Around the lesser trochanter	On sacrum at the inferior aspect of SI joint
Small Intestine	Bilateral 8th, 9th, and 10th ICS near cartilaginous attachments	Intertransverse spaces from T8-T11, midway between the SP and the tip of the TP
Stomach Acidity	Left 5th ICS from mid-clavicular line to sternum	Left intertransverse space between T5 and T6, midway between the SP and the tip of the TP
Stomach Peristalsis	Left 6th ICS from mid-clavicular line to sternum	Left intertransverse space between T6 and T7, midway between the SP and the tip of the TP
Tongue	Anterior aspect of 2nd rib cartilage ¾ inch lateral to sternum	Between the SP and the superior edge of the TP of C2

TP: Transverse Process; SP: Spinous Process; ASIS: Anterior Superior Iliac Spine; ICS: Intercostal Space; SI: Sacroiliac.
**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Esophagus

Sympathetic action on the esophagus decreases peristalsis and glandular secretion and increases vasomotor tone. Parasympathetic actions increase peristalsis and glandular secretion. Vagal fibers participate in reflex relaxation of the lower esophageal sphincter.

Stomach

Sympathetic effects include decreased peristalsis, closure of the pyloric sphincter, decreased glandular secretions, and increased vasomotor tone. Parasympathetic effects include increased peristalsis, relaxation of the pyloric sphincter, and increased HCl secretion.

Liver and Gallbladder

Sympathetic effect increases vasomotor tone. Parasympathetic effects on the liver are ill-defined. Parasympathetic effects on the gallbladder include secondary influence on contraction of the gallbladder and extra-hepatic biliary tree smooth muscle, and relaxation of the hepatopancreatic ampulla. Note that the primary influence on biliary vessel tone is hormonal via cholecystokinin (CCK).

Pancreas

Sympathetic and parasympathetic fibers are distributed to pancreatic acinar and islet cells. Additionally, sympathetic fibers innervate blood vessels. Parasympathetic effects are secretomotor, promoting secretion of pancreatic enzymes. Note that secretion of pancreatic enzymes is primarily hormonally controlled, specifically by cholecystokinin (CCK) and secretin formed by the epithelial cells of the duodenum and proximal intestinal mucosa in response to stimulus of acidic contents from the stomach. Sympathetic effects include vasoconstriction. Research on how sympathetic tone affects insulin secretion shows mixed results.[15]

Small Intestines

Sympathetic effects include decreased peristalsis, increased vasomotor tone, and decreased glandular secretion. Parasympathetic fibers mediate increased glandular secretion, increased peristalsis, and vagal afferent fibers activated by distension.

Ascending Colon and Transverse Colon

Sympathetic effects include decreased peristalsis, increased vasomotor tone, and decreased glandular secretion. Parasympathetic innervation originates from posterior vagal trunk and is distributed via the superior mesenteric plexus. Parasympathetic fibers mediate increased glandular secretion, increased peristalsis, and vagal afferent fibers activated by distension.

Descending Colon, Sigmoid Colon, and Rectum

Sympathetic effects include decreased peristalsis, increased vasomotor tone, and decreased glandular secretion. Parasympathetic effects include increased glandular secretion, increased peristalsis, and visceral afferents activated by distension.

Osteopathic Considerations for Autonomics Related to the Gastrointestinal System

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and gastrointestinal (GI) systems manifest in the tissues. Alterations in sympathetic tone due to GI dysfunction may present as paraspinal tissue texture changes and range of motion restrictions in various parts of the thoracic and lumbar spine, depending on the structures affected. Alterations in parasympathetic tone may affect the suboccipital region, possibly manifesting as muscular hypertonicity and OA/upper cervical somatic dysfunction due to facilitation of CN X. It may also present as dysfunction in the parasacral region due to facilitation of S2-4.

Biomechanics[2-14]

Diaphragm[2,3,6]

The diaphragm has attachments to the xiphoid, ribs, and lumbar spine. Ligamentous structures include the right crus, left crus, medial and lateral arcuate ligaments, and central tendon. The primary function of the diaphragm in the abdomen is to increase intra-abdominal pressure, which promotes venous and lymphatic return and visceral organ mobility. Three apertures in the diaphragm allow passage of crucial vessels between the thorax and the abdominal cavity. The caval foramen transmits the inferior vena cava and right phrenic nerve at the level of the eighth thoracic vertebra (T8). The esophageal hiatus transmits the esophagus, esophageal branches of the left gastric artery and the anterior and posterior vagal trunks which are located in the right crus at the level of the tenth thoracic vertebra (T10). The aortic hiatus transmits the aorta and the thoracic duct and is located at the level of the twelfth thoracic vertebra (T12). Excess diaphragm tension can reduce vasculolymphatic return and mobility of adjacent gastrointestinal viscera (liver, spleen, stomach, and intestines).

Costal Margin[3,6]

The costal cartilages of ribs 7-10 join anteriorly to form the costal margin. The costal margin serves as a landmark delineating the thoracic and abdominal walls. Anteriorly, the costal cartilage attaches to the inferolateral sternum bilaterally. The lower esophageal sphincter (LES) is found deep to the superior costal margin just left of the sternum. The costal margin also serves a protective role as it anchors ribs 7-10 anteriorly. These ribs protect organs such as the liver and gallbladder on the right side, and the stomach and spleen on the left side.

Abdominal Wall Musculature[2,7]

Abdominal muscle tone gives the visceral column its cohesion and shape. Abdominal muscle hypotonia can cause inferior slide of viscera and increased mesenteric pull possibly resulting in ligamentous laxity or fascial sag (e.g. ptosis), increased inflammation, muscular restriction (e.g. viscerospasm), circulatory problems (e.g. venous stasis), and transit problems (e.g. constipation, bowel occlusion).

Peritoneum[8]

The peritoneum is the largest and most complex serous membrane in the body consisting of parietal and visceral layers with serous fluid in between the layers. The transverse mesocolon separates the peritoneal cavity into two divisions: supracolic and infracolic. The abdominal contents can also be classified as intraperitoneal and retroperitoneal. Intraperitoneal organs are entirely encased in peritoneum and include the stomach, the ampulla of the duodenum, liver, spleen, jejunum, ileum, and transverse and sigmoid colon. Retroperitoneal organs touch the peritoneum only on one of their surfaces and include the pancreas, duodenum, and ascending and descending colon. Excess tension in the peritoneum (as found with somatic dysfunction) can negatively impact the intraperitoneal organs and compromise venous and lymphatic circulation.

Visceral Articulations[3,4,9-14]

Esophagus[9,11]

The thoracic portion of the esophagus resides along the left anterior bodies of the thoracic vertebrae and articulates with the arch of the aorta, the left main bronchus, and the diaphragm via the phrenicoesophageal ligaments. Because the esophagus is a smooth muscle tube, restriction of any of these structures can impair the esophagus' ability to appropriately accommodate a food bolus or perform peristalsis effectively, resulting in dysphagia. The lower esophageal sphincter (LES) is an abdominal landmark that is approximately the size of a dime and can be palpated just left of the sternum along the 7th costal cartilage at spinal levels T10/11.

Stomach[9,11]

The stomach connects with several gastrointestinal organs via the lesser and greater omentum. An omentum is a double fold of peritoneum that anchors organs and provides space for neurovasculature to travel to organs. The lesser omentum attaches the lesser curvature of the stomach and the duodenum to the liver and can be separated into hepatogastric and hepatoduodenal ligaments. The greater omentum attaches the greater curvature of the stomach to the spleen via the gastrosplenic ligament, to the diaphragm via the gastrophrenic ligament, and to the transverse colon via the gastrocolic ligament. Due to the highly distensible features of the stomach and its loose omental connections, these articulations are subject to change based on how full the stomach is. At maximum capacity, the stomach may extend into the major pelvis and articulate with different structures during its descent. In classical orientation, the body of the stomach articulates with the anterior abdominal wall, diaphragm, and left lobe of the liver anteriorly. Posteriorly and inferiorly, the stomach articulates with the left hemidiaphragm, spleen, body and tail of pancreas, superior pole of the left kidney, left suprarenal gland, splenic artery, transverse colon, transverse mesocolon, and left colic flexure.

Duodenum[9,12]

The duodenum is split into four parts which have different anatomical designations and physiologic purposes. The first part (superior) of the duodenum connects with the stomach via the pylorus and is called the ampulla of the duodenum. The pylorus, located around spinal level L1 (6-7 cm above umbilicus), is a quarter sized palpable sphincter. The neck of the gallbladder and the cystic duct articulate with the superior aspect of the first part of the duodenum. Anteriorly, the first part of the duodenum articulates with the gallbladder and quadrate lobe of the liver. Articulations along the posterior aspect of the first part of the duodenum include the common bile duct, gastroduodenal artery, and portal vein. Inferiorly, the first part of the duodenum articulates with the head of the pancreas.

The second part (descending) of the duodenum curves around the head of the pancreas. The head of the pancreas articulates with the medial aspect of the descending duodenum, along with the gastroduodenal artery, common bile duct, and main pancreatic duct. Posteromedially, the second part of the duodenum is connected to the bile duct and main pancreatic ducts via the Sphincter of Oddi which is pea sized and palpable at spinal level L2 (2-3 cm above umbilicus) at the right midclavicular-umbilical line. Along the anterior aspect of the descending duodenum, the right lobe of the liver, gallbladder, transverse colon, and various coils of other parts of the small intestine can be palpated. Posteriorly, the descending duodenum articulates with the right kidney, right renal vessels, right ureter, and the right psoas muscle.

The third part (horizontal) of the duodenum traverses deep to the superior mesenteric vessels, the root of the mesentery, and various coils of other parts of the small intestine. Posteriorly the horizontal duodenum articulates with the psoas major, aorta, inferior vena cava (IVC), right gonadal vessels, and right ureter. The superior articulation of the horizontal duodenum is with the head of the pancreas.

The fourth part (ascending) of the duodenum articulates anteriorly with the left side of the root of the mesentery and various coils of other parts of the small intestine. Posteriorly the ascending duodenum articulates with the aorta, left gonadal vessels, and left psoas muscle. The uncinate process of the head of the pancreas articulates with the medial ascending duodenum. The suspensory muscle of the duodenum (ligament of Treitz) is a fibromuscular band attaching the duodenal-jejunal flexure to the posterior body wall in the area of the right crus of the diaphragm near the esophageal hiatus. It is the anatomical and physiologic designation of the transition from duodenum to jejunum. The Duodenojejunal Junction (DJJ) created by the ligament of Treitz is quarter sized and palpable at spinal level L2 (2-3 cm above umbilicus) at the left midclavicular-umbilical line.

Pancreas[9]

Anteriorly, the pancreas articulates with the stomach and pylorus, superior mesenteric vessels, and transverse mesocolon. The posterior pancreatic articulations include the common bile duct, IVC, portal vein, aorta, right renal vessels, splenic vessels, and lumbar vertebrae 1and 2. The main pancreatic duct joins the common bile duct at the hepatopancreatic ampulla and empties into the second part (descending) duodenum to the right of the aorta and IVC.

Liver[9,14]

The liver and its articulations will be considered in the context of the peritoneal folds intimate with the liver. These folds are referred to as peritoneal ligaments. The coronary ligament attaches the posterior liver to diaphragm. The coronary ligament can be divided into the right triangular ligament and the left triangular ligament. The right triangular ligament attaches the liver to the diaphragm at the right anterior axillary line and the left triangular ligament attaches the liver to the diaphragm at the left mid-clavicular line. The falciform ligament connects the anterior and superior liver to the diaphragm and the anterior abdominal wall. This ligament divides the liver into right and left lobes. The hepatorenal ligament joins the liver to the right kidney. The hepatogastric and hepatoduodenal ligaments join to form the lesser omentum, a double layer of peritoneum, which encloses the portal triad. The lesser omentum also attaches the hilum of the liver to the esophagus, the lesser curvature of stomach, and the duodenum.

Gallbladder[9,14]

The gallbladder lies within the gallbladder fossa of the right lobe of the liver. The body of the gallbladder contacts the visceral surface of the liver and the first portion of the duodenum. The inferior-most portion of the gallbladder may contact the anterior abdominal wall near the junction of the mid-clavicular line and the 9th costal cartilage. The body of the gallbladder also articulates with the transverse colon inferiorly and the first and second portions of the duodenum posteriorly.

Small Intestine Mesentery[10,12]

Mesentery is a double layer of peritoneum formed via organ invagination that connects intraperitoneal organs to the abdominal wall. The small intestine mesentery attaches the jejunum and ileum to the posterior abdominal wall. The root of the mesentery is approximately 6-7 inches and extends in an inferior, oblique, left-to-right fashion, from distal duodenum to the ileocecal valve and right sacroiliac joint. It extends from the duodenojejunal junction (DJJ) on the left side of the vertebral body of L2 and crosses the following structures: third part of duodenum, aorta, IVC, right ureter, right gonadal vessels, and right psoas major. The ileocecal valve, which is approximately dime sized, lies 1-2 cm superior to McBurney's point (2/3 distance from umbilicus to ASIS) at the spinal level of L5.

Cecum[10,13]

The cecum is the proximal portion of the large intestine. Anteriorly, the cecum articulates with the abdominal wall including the inguinal ligament. Posterior articulations include parietal peritoneum, iliac fascia, psoas muscle, femoral nerve, and genitofemoral nerve. The appendix is a blind-ending diverticulum on the posteromedial surface of the cecum. Due to the appendix's proximity to the iliac fossa, psoas muscle, and parietal peritoneum, appendicitis can cause psoasitis and/or peritonitis at McBurney's point.

Ascending Colon[10,13]

The ascending colon extends from cecum to transverse colon, forming the right paracolic gutter. It is covered by peritoneum on the anterior and lateral surfaces, but not on the posterior or medial surfaces. Therefore, it is a retroperitoneal organ. Anteriorly the ascending colon articulates with the small intestine and greater omentum. Posterior articulations include the right iliac fossa, right lumbar fossa, right kidney, and right quadratus lumborum. Medial articulations of the ascending colon include the right ureter and the spermatic/utero-ovarian vessels. Laterally, the ascending colon articulates with the right transversus abdominis via the right paracolic gutter.

Transverse Colon[10,13]

The transverse colon is the most mobile segment of colon and can vary its position depending on abdominal cavity position. It runs from the hepatic flexure, where it meets the ascending colon, to the splenic flexure, where it meets the descending colon. In the most classic presentation, the transverse colon's superior articulations include the liver, gallbladder, stomach, and spleen. Anteriorly the transverse colon contacts the anterior body wall. Various portions of the small intestine articulate with the inferior transverse colon. Transverse mesocolon is attached to the posterior transverse colon and suspends the transverse colon at approximately L1-L2. The phrenicocolic ligament attaches the splenic flexure to the diaphragm.

Descending Colon[10,13]

The descending colon descends from the transverse colon to the sigmoid colon. It is covered by peritoneum on the anterior and lateral surfaces, making it retroperitoneal. Anteriorly, the descending colon contacts the jejunum and ileum. Laterally, the descending colon articulates with the left transversus abdominis at the left paracolic gutter. Medially, the descending colon contacts the jejunum, ileum and the left kidney. Posterior articulations of the descending colon include the left iliac fossa, left lumbar fossa, and left quadratus lumborum.

Sigmoid Colon[10,13]

The sigmoid colon connects the descending colon to rectum. It extends from the iliac fossa to S3 vertebral segment and typically has an S-shape. Due to the long sigmoid mesocolon, the middle and lower segments of the sigmoid colon are mobile whereas the upper part is fixed. Posteriorly the sigmoid colon contacts the left psoas muscle, left ureter, the division of left common iliac vessels, and the anterior aspect of the sacrum. Anteriorly, the sigmoid colon contacts the inguinal ligament. Inferior contacts of the sigmoid colon include the bladder and rectum.

Visceral Motion

Generally, each visceral organ has **motility** and **mobility,** which can be impaired and result in **visceral dysfunction.**[11-14] Motility is the inherent motion of the organ itself (e.g. opening and closing of sphincters). Mobility is the motion of the organ within the abdominal cavity governed by its fascial connections (e.g. motion of the liver in response to thoracic respirations). Dysfunctions in mobility or motility can cause or be caused by somatic dysfunction of related structures. Impaired visceral motility and mobility can also impair normal visceral organ functions. Therefore, understanding the articulations and relationships of each organ can help identify the root cause of a visceral disorder.

Osteopathic Considerations for Biomechanics of the Gastrointestinal System

The physiological (or pathologic) functioning of the gastrointestinal system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify an organ's function, the long fascial chains of the body can transmit forces from distal anatomic structures. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the gastrointestinal system:

- Respiratory diaphragm due to pumping action on intraabdominal organs and attachment to multiple viscera
- Lower ribs and costal margin due to proximity to organs and attachment for abdominal wall muscles and diaphragm
- Abdominal wall muscles due to containment of viscera and pressure on viscera during activation
- Quadratus lumborum and psoas muscles due to proximity to abdominal organs and contribution to structural integrity of abdominal cavity
- Lumbar spine due to attachment for abdominal musculature and proximity to viscera
- Pelvis and sacrum due to proximity to viscera and attachment to abdominal musculature

- Pelvic diaphragm due to compensation for movement of respiratory diaphragm within a closed system (the pelvic diaphragm should move in concert with the respiratory diaphragm to maintain a constant volume in the abdominal cavity as the pressure increases with the inferior movement of the respiratory diaphragm during inhalation)
- Thoracic spine due to proximity to esophagus
- Mobility and motility of viscera itself
- Visceral ligaments, peritoneal folds, mesentery, and omentum

Circulation[1,2,9,10]

Overview:

- Arterial: All branches of abdominal aorta:
  - Foregut is supplied by celiac trunk and its branches, midgut is supplied by superior mesenteric artery and its branches, hindgut is supplied by inferior mesenteric artery, and the middle and inferior portions of the rectum are supplied by branches of the internal iliac arteries.
- Venous: There are two venous drainages of the gastrointestinal tract. The Hepatic Portal Vein receives all venous blood from the foregut, midgut, and hind gut. This blood is filtered within venous plexuses in the liver parenchyma and then drains into the Inferior Vena Cava (IVC) via the hepatic vein. The systemic venous drainage (i.e., common iliac veins → IVC) receives tributaries from the middle and inferior rectum. Portocaval anastomosis exists within the portal and systemic venous drainage and multiple different liver pathologies can manifest as backflow in these vessels.
- Lymphatic: Most gastrointestinal lymphatic drainage finds its way to the cisterna chyli, the origin of the thoracic duct.

Abdominal esophagus

- Arterial: abdominal aorta → celiac trunk → left gastric artery → esophageal branch → esophagus
- Venous:
  - esophagus → left gastric vein → hepatic portal vein → IVC
  - esophagus → azygous vein → SVC
- Lymphatic: esophagus → left gastric nodes → celiac nodes → cisterna chyli → thoracic duct

Stomach

- Arterial: abdominal aorta → celiac trunk → splenic artery, left gastric artery and common hepatic artery → stomach
- Venous: stomach→ gastric veins → hepatic portal vein → IVC
- Lymphatic: stomach → gastric nodes, pancreaticoduodenal nodes, pancreaticosplenic nodes, and pyloric nodes → celiac nodes → cisterna chyli → thoracic duct

Gallbladder and cystic ducts

- Arterial: abdominal aorta → celiac trunk → common hepatic artery → right hepatic artery → cystic artery → gallbladder and cystic duct
- Venous: gallbladder and cystic duct → cystic veins → hepatic portal vein → IVC
- Lymphatic: gallbladder and cystic duct → hepatic nodes and cystic nodes → celiac nodes → cisterna chyli → thoracic duct

Liver

- Arterial: abdominal aorta → celiac trunk → common hepatic artery → liver
- Venous: liver → common hepatic veins → IVC
- Lymphatic:
    - anterior liver → hepatic lymph nodes → celiac lymph nodes → cisterna chyli → thoracic duct
    - posterior liver → phrenic lymph nodes → parasternal/mediastinal lymph nodes → thoracic duct

Pancreas

- Arterial:
    - abdominal aorta → celiac trunk → common hepatic artery → pancreas
    - abdominal aorta → superior mesenteric artery→ pancreas
- Venous: pancreas → pancreatic veins → splenic vein → hepatic portal vein → IVC
- Lymphatic: pancreas→ pancreaticosplenic nodes, superior mesenteric nodes → pyloric nodes, hepatic nodes, and celiac nodes → cisterna chyli → thoracic duct

Duodenum

- Arterial:
    - abdominal aorta → celiac trunk → common hepatic artery → gastroduodenal artery → duodenum
    - abdominal aorta → superior mesenteric artery → inferior pancreaticoduodenal → duodenum
- Venous: duodenum → superior mesenteric and splenic veins → hepatic portal vein → IVC
- Lymphatic: duodenum → pancreaticoduodenal nodes, pyloric nodes, and superior mesenteric nodes → cisterna chyli → thoracic duct

Jejunum and proximal ileum

- Arterial: abdominal aorta → superior mesenteric artery → jejunal and ileal arteries → jejunum and ileum
- Venous: jejunum and ileum → Superior mesenteric vein joins the splenic vein → hepatic portal vein → IVC
- Lymphatic: jejunal and ileal lacteals in intestinal villi → jejunal and ileal lymphatic plexuses → juxta-intestinal nodes → mesenteric nodes → superior mesenteric nodes → cisterna chyli → thoracic duct

Distal Ileum, cecum, appendix and ascending colon

- Arterial:
    - abdominal aorta → superior mesenteric artery → ileocolic and right colic artery → distal ileum, cecum, and ascending colon
    - abdominal aorta → superior mesenteric artery → ileocolic artery → appendicular artery → appendix
- Venous: distal ileum, cecum, appendix, and ascending colon → ileocolic and right colic veins → superior mesenteric vein → hepatic portal vein → IVC
- Lymphatic: distal ileum, cecum, appendix, and ascending colon → epicolic and paracolic nodes→ ileocolic and right colic nodes → superior mesenteric nodes→ cisterna chyli → thoracic duct

Transverse colon

- Arterial: abdominal aorta → superior mesenteric artery → middle colic artery, anastomotic arcade from right and left colic arteries → transverse colon
- Venous: transverse colon → superior mesenteric vein → hepatic portal vein → IVC
- Lymphatic: transverse colon → middle colic nodes → superior mesenteric node→ cisterna chyli → thoracic duct

Descending colon and sigmoid colon

- Arterial: abdominal aorta → inferior mesenteric artery → left colic artery and sigmoid artery→ descending colon and sigmoid colon
- Venous: descending colon and sigmoid colon → inferior mesenteric vein → splenic vein → hepatic portal vein → IVC
- Lymphatic: descending colon and sigmoid colon → inferior mesenteric nodes → cisterna chyli → thoracic duct

Superior part of rectum

- Arterial: abdominal aorta → inferior mesenteric artery → superior rectal artery → superior part of rectum
- Venous: superior rectum → inferior mesenteric vein → splenic vein → hepatic portal vein → IVC
- Lymphatic: superior rectum → pararectal nodes → lumbar lymph nodes→ inferior mesenteric nodes→ cisterna chyli → thoracic duct

Middle and Inferior parts of rectum

- Arterial: abdominal aorta → common iliac artery → internal iliac artery → anterior division of internal iliac artery → middle rectal and inferior rectal artery → middle and inferior parts of rectum
- Venous: middle and inferior parts of rectum → middle and inferior rectal veins → internal iliac veins → common iliac veins → IVC
- Lymphatic: middle and inferior rectum → sacral nodes → internal iliac nodes → common iliac nodes→ lumbar lymph nodes→ cisterna chyli → thoracic duct

Anal canal

- Arterial: abdominal aorta → common iliac artery → internal iliac artery → anterior division of internal iliac artery → internal pudendal artery → anal canal
- Venous: anal canal → internal rectal venous plexus → middle and inferior rectal veins → internal iliac veins → common iliac veins → IVC
- Lymphatic: anal canal above pectinate line → internal and external iliac nodes → common iliac nodes→ lumbar lymph nodes→ cisterna chyli → thoracic duct

Osteopathic Considerations for Circulation of the Gastrointestinal System[3]

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory systems (venous and lymphatic systems). All arterial flow to the gastrointestinal system, pelvic cavity, and lower extremity originates from the abdominal aorta that passes through the thoracoabdominal diaphragm at T12. Any impedance in arterial flow (such as aneurysm, atherosclerosis, stenosis, or dissection) through the abdominal aorta can lead to severe consequences in the vitality of the body. A significant proportion of the venous and lymphatic fluid in the body circulates through the hepatic portal venous and lymphatic system; therefore, restrictions in the gastrointestinal fluid flow can manifest as edema in any location. Conditions such as cirrhosis and portal hypertension highlight these imperative functions. The thoracic duct origin (cisterna chyli) is housed within the abdominal cavity and its patency is critical for proper lymphatic drainage of the abdominal cavity, pelvic cavity, and lower extremities. Any dysfunction along the path of the thoracic duct (such as thoracoabdominal diaphragm restriction) can impede lymph drainage inferior to the restriction.

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the GI system. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the GI system. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the GI system. Next, biochemical and biophysical tests frequently used in the evaluation of the GI system are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

Osteopathic Structural Exam

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- T5-L2 for the sympathetic innervation of the GI tract from stomach through rectum, T3-6 for esophagus
- OA, AA, C2 for the parasympathetic innervation from CN X
- Thoracic spine due to proximity to esophagus
- Lumbar spine due to proximity to abdominal viscera and attachment to abdominal musculature
- Abdominal musculature due to mechanical effects on GI tract, regulation of intraabdominal pressure
- Respiratory and Pelvic diaphragms due to proximity and attachment to viscera, effects on intraabdominal pressure, and relationship to low-pressure circulatory system
- Thoracic inlet due to baffle effect on lymphatic terminal drainage
- Abdominal fascia including peritoneum, mesentery, and omentum
- Pelvis and sacrum due to proximity to viscera and attachment to musculature, S2-4 for parasympathetic innervation
- Linea Alba: Muscular attachments of abdominal wall musculature, myofascial relationship to the pre-aortic ganglia.
- Abdominal Aorta: Preaortic ganglia lie deep to linea alba along the anterior abdominal aorta.
- Inguinal Ligament: Demarks inferior border of abdominal cavity and superior border of pelvic cavity, serves as muscular attachment of abdominal wall musculature.
- Lower Esophageal Sphincter (LES), Pylorus, Sphincter of Oddi, Ligament of Treitz, Ileocecal Valve (ICV): All assist in regulating transport of nutrients throughout the GI tract.

- Palpation of Right Upper Quadrant (Liver, Gallbladder, Stomach, Duodenum, Pancreas, Hepatic Flexure)
- Palpation of Left Upper Quadrant (Liver, Stomach, Duodenum, Pancreas, Small Intestine, Spleen, Splenic Flexure)
- Palpation of Right Lower Quadrant (Small Intestine, Cecum, Appendix, Mesentery, Mesocolon, Large Intestine)
- Palpation of Left Lower Quadrant (Mesocolon, Large Intestine)

Testing

- CBC: Hemoglobin, Hematocrit, Platelets, White Blood Cell count (splenic function)
- CMP: Glucose, Electrolytes, BUN, Calcium, ALT, AST, Bilirubin, Albumin, Triglycerides (liver and renal function)
- Pancreatic enzymes: Amylase, lipase
- Intolerance testing: Lactose Tolerance Test, Anti-Gliadin Ab (lactose intolerance and Celiac Disease, respectively)
- Bacterial Dysbiosis tests: Fecal cultures, Urea breath test (H. Pylori)
- Imaging: Endoscopy, Barium Swallow X-ray, Endoscopic retrograde cholangiopancreatography (ERCP), Ultrasound, Colonoscopy, Computed tomography (CT) scan, Magnetic resonance imaging (MRI): Visualize all structures or specific organs based on symptomology

Technique Contents :

Visceral Palpation

Sphincter Palpation

Visceral Techniques (in preferred order of treatment)

Linea Alba Release/Collateral Ganglia Inhibition

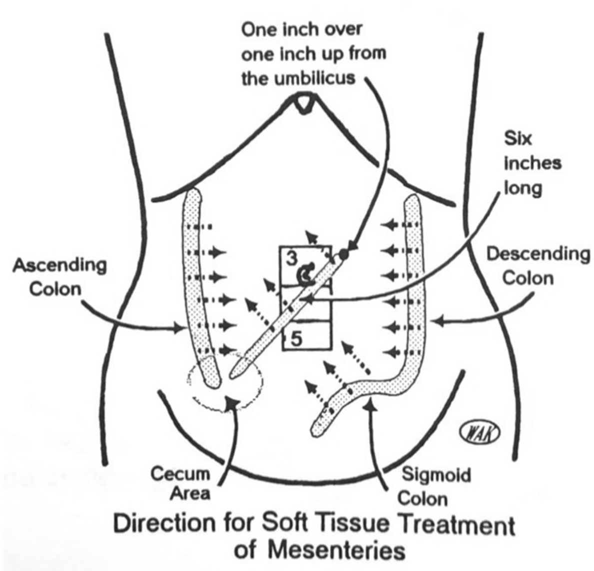
Sigmoid Colon Release

Cecal Release

Small Bowel Mesentery (Root of the Mesentery) Release

Colonic Milking

Liver/Gallbladder Release



Overview of directions of mesenteric releases in abdomen. Start treatment with sigmoid and work from distal to proximal along GI tract.[4]

VISCERAL PALPATION

Sphincter Palpation[11-13]

Lower esophageal sphincter (LES)

- approximately the size of a dime
- palpated just left of the sternum along the 7th costal cartilage at spinal levels T10/11

Pylorus

- approximately the size of a quarter
- palpated along the midline located around spinal level L1 (6-7 cm above umbilicus)

Sphincter of Oddi

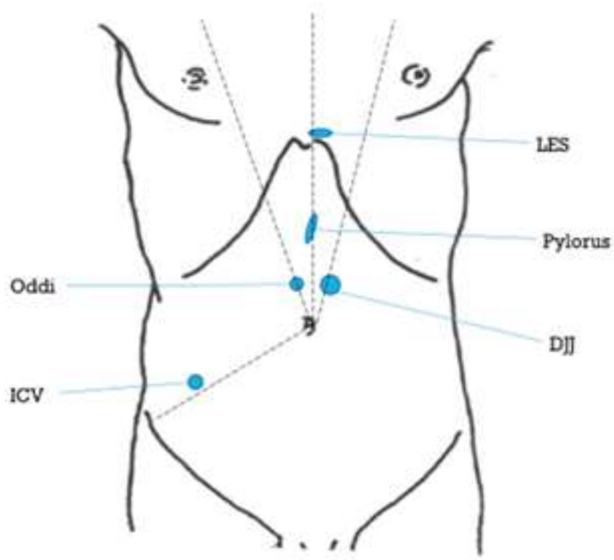
- approximately the size of a pea
- palpated at spinal level L2 (2-3 cm above umbilicus) at right midclavicular-umbilical line

Duodenojejunal Junction (DJJ) – Ligament of Treitz

- approximately the size of a quarter
- palpated at spinal level L2 (2-3 cm above umbilicus) at left midclavicular-umbilical line

Ileocecal Valve (ICV)

- approximately the size of a dime
- palpated at spinal level L5 1-2 cm **superior** to McBurney's point (2/3 distance from the umbilicus to the R ASIS)



VISCERAL TECHNIQUES

Linea Alba Release/Collateral Ganglia Inhibition[3]

Mechanism: As a general rule in Osteopathic Medicine, we look to balance the autonomic nervous system before treating the specific region itself. To address the parasympathetic nervous system serving the abdomen, treat the OA joint and sacrum. Also, treat somatic dysfunction of T5-L2 to decrease facilitation of the sympathetic nervous system. Next, because the sympathetic fibers to the abdominal cavity travel through the celiac, superior mesenteric, and inferior mesenteric ganglia the anterior midline of the abdomen should be treated when attempting to balance the autonomics. By diagnosing and treating areas of restrictions over the fascial line of the linea alba, one is attempting to address the anterior fascial projections of the ganglia where they lie anatomically along the anterior aspect of the abdominal aorta.

Example Diagnosis: Linea alba myofascial restriction, hypertonicity of the celiac ganglion

Physician position: Standing on either side of the patient

Patient position: Supine

Procedure:

1. Place finger pads along the midline of the abdomen over the linea alba. Ensure all fingers are the same length by bending some at the MCP/PIP joints. This decreases discomfort for the patient and ensures equal pressure distribution.
2. Apply a gentle, posteriorly directed pressure along the linea alba and assess for areas of restriction and/or tenderness as the fingers sink into the abdomen.
3. The linea alba can be addressed globally, or the specific areas of the fascial projections of the ganglia can be engaged. To locate the ganglia, palpate the linea alba from the xyphoid process to the umbilicus. The celiac ganglion can be located approximately one third of the distance from the xyphoid to the umbilicus. The superior mesenteric ganglion is located approximately half-way between the xyphoid and umbilicus. The inferior mesenteric ganglion is located approximately two-thirds of the distance from the xyphoid to the umbilicus.
4. Engage an area of restriction and instruct the patient to inhale and exhale deeply. Resist inhalation with a firm but gentle pressure. With exhalation, take up the fascial creep until the next area of restriction is engaged.
5. Repeat steps 3-4 until no further change is palpated.
6. Release pressure to bring the linea alba back to neutral, then reassess.

Treatment Position for Linea Alba Release

Sigmoid Colon Release[13]

Mechanism: If there are unbalanced autonomics to the sigmoid colon favoring sympathetic discharge, then there will be less motility and less peristalsis of the gut contents. If there is restriction within the mesentery, then there may be venous and lymphatic congestion inhibiting the transfer of water and electrolytes into the portal and lymphatic systems. Mesenteric restriction can also restrict arterial blood flow to some areas of gut lumen, denying those cells vital substances and freshly oxygenated blood. The sigmoid colon release is specifically aimed at treating the mesentery that connects the sigmoid colon to the posterior wall of the abdominal and pelvic cavities.

Example Diagnosis: Visceral dysfunction of the sigmoid colon; reduced motility and/or mobility of the sigmoid colon

Physician position: Standing to the right of the patient

Patient position: Supine, option to flex the patient's knees to decrease abdominal wall tension

Procedure:

1. Place finger pads medial to the left ASIS and gently advance them posteriorly along the iliac fossa until the lateral edge of the sigmoid colon is felt.
2. Gently draw the sigmoid and its mesocolon superior and medially (toward the umbilicus) with a slow, progressive, and painless pressure.
3. Hold this position until a release is obtained. The physician may have the patient inhale and exhale for respiratory assistance to aid with the release.
4. Release the pressure to return the sigmoid colon back to neutral, then reassess.

Treatment Position for Sigmoid Colon Release

Cecal Release[13]

Mechanism: The ileocecal valve serves as a transition area between the small intestines and the colon. Transition zones are often areas of restriction within the body and, therefore, are beneficial to treat to optimize motility of bowel contents. By treating the mesentery that serves the cecum, one works to the optimize flow of blood and lymph to an important area in the GI tract.

Example Diagnosis: Visceral dysfunction of the cecum; reduced motility and/or mobility of the cecum

Physician position: Standing on the left of the patient

Patient position: Supine, option to flex the patient's knees to decrease abdominal wall tension

Procedure:

1. Part 1:
    a. Place finger pads medial to the right ASIS and gradually advance them posteriorly along the iliac fossa until the lateral edge of the cecum is palpated.
    b. Gently draw the lateral aspect of the cecum superomedially with a slow, progressive, and painless pressure.
    c. Hold this pressure consistently until a release is felt. The physician may ask the patient to inhale and exhale deeply for a respiratory assist for the release.
    d. Release the pressure.
2. Part 2:
    a. With both thumbs, palpate the medial aspect of the cecum while applying a gentle inferior and lateral force.
    b. Maintain this pressure until a release is felt.
    c. Release the pressure to return the cecum back to neutral, then reassess.

Treatment Position for Cecal Release: Part 1

Treatment Position for Cecal Release: Part 2

Small Bowel Mesentery (Root of the Mesentery) Release[12]

Mechanism: The root of the mesentery for the small bowel runs diagonally from the ligament of Treitz at the level of the duodenojejunal junction (DJJ) at L2 on the left to the SI joint on the right. The goal of treatment of the mesenteric root is to address the neurovasculature of the bowel, thus decreasing lymphatic and venous stasis, optimizing arterial flow to the viscera, and further balancing the autonomic innervation.

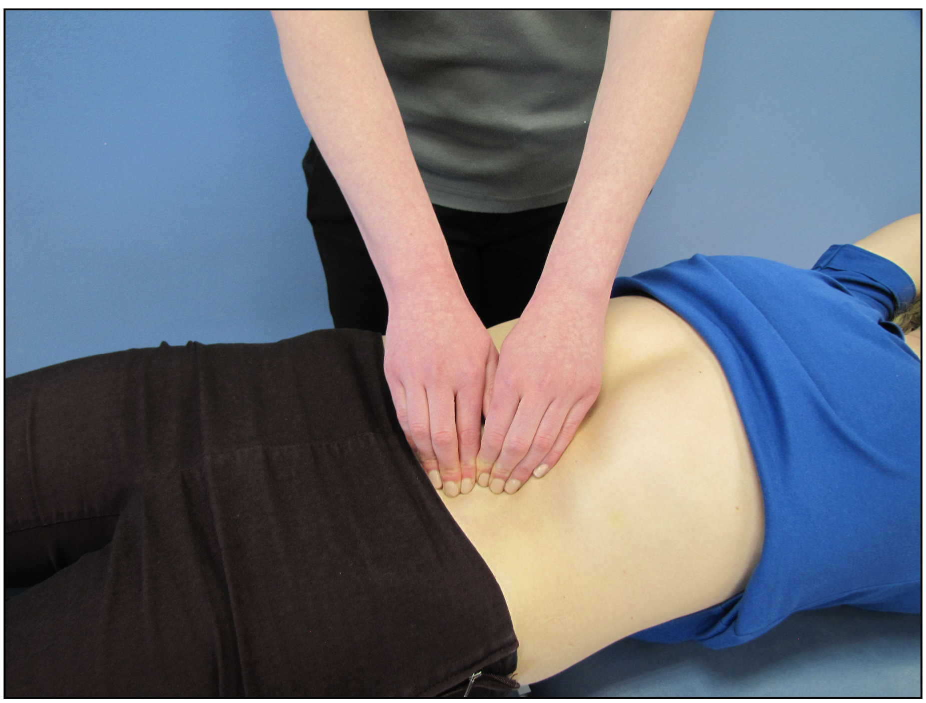
Example Diagnosis: Abdominal lymphatic congestion; decreased mobility of the mesenteric root

Physician position: Standing on the right side of the patient

Patient position: Supine or left lateral recumbent

Procedure:

1. Starting in the left lower quadrant (LLQ), using the medial edge of the hands, apply gentle pressure in a posterior direction, "collecting" the small bowel into one's hands. Use a slow, gentle, progressive, and painless pressure to draw the mesentery superiorly and medially towards the umbilicus.
2. Hold pressure until a release is obtained. Ask the patient to inhale and exhale for respiratory assistance to aid with the release.
3. Release the pressure to bring the root of the mesentery back to neutral, then reassess.



Treatment Position for Small Bowel Mesentery Release

Colonic Milking[13]

Mechanism: This technique is well described by the traffic jam analogy. When clearing a traffic jam, the car at the beginning of the traffic jam must move first before the cars at the back can move. With colonic milking, start distally at the sigmoid colon to release the "traffic jam" and work your way proximally. The objective of colonic milking is to stimulate function of the colon to improve defecation.

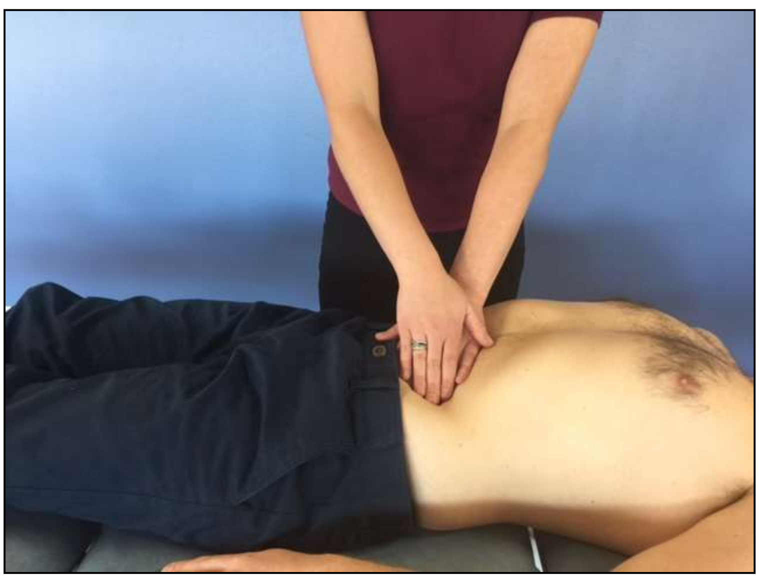
Example Diagnosis: Visceral dysfunction of the colon; decreased motility and/or mobility of the sigmoid, descending, transverse, and/or ascending colon

Physician position: Standing by the table on the right side of the patient

Patient position: Supine

Procedure:

1. Place hands on top of one another in the left lower quadrant (LLQ) and slowly advance the pads of the fingers deeply into the abdominal-pelvic area.
2. Once the colon is contacted, apply a mild oscillatory pressure.
3. Then proceed with a "milking" pressure directed from proximal to distal (in this case cephalad to caudad) along the accessible portion of the sigmoid colon.
4. Repeat this "milking" pressure in a stepwise fashion as the physician works more proximally along the length of the descending, transverse, and ascending colon, then reassess.



Treatment Position for Colonic Milking

Think About It: What is post-operative ileus? It is failure to pass flatus or stool for 3-6 days after surgery. It is the transient impairment of function and motility. Along with addressing the autonomics and lymphatics of the gut, treating the viscera with colonic milking will greatly improve the physiologic motion of the contents of the gut.

Liver/Gallbladder Release[14]

Mechanism: Restores normal motion of the liver/gallbladder by addressing tension in the coronary ligament and falciform ligaments. Decreased motion can be palpated in associated with diseases such as hepatitis, cirrhosis, cholelithiasis, and cholecystitis.

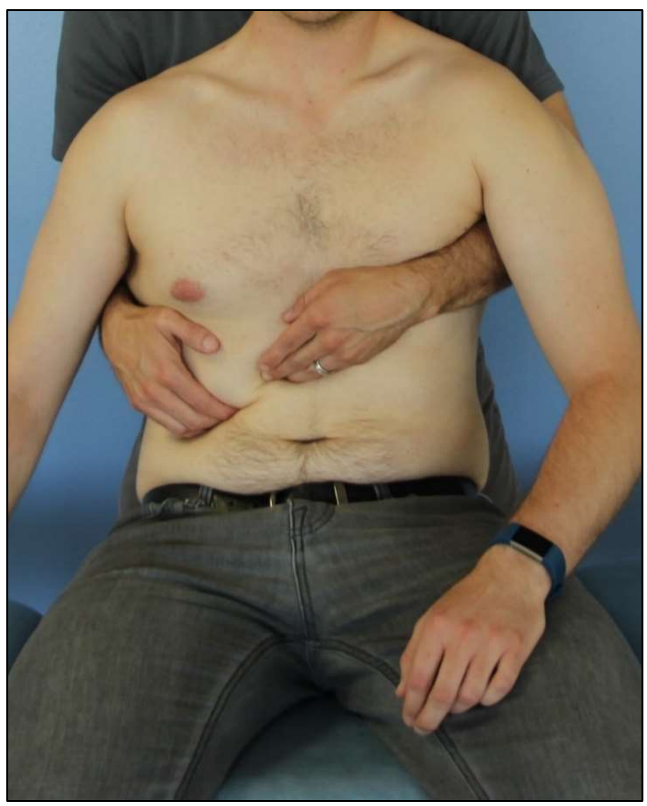
Example Diagnosis: Visceral dysfunction of the liver or gallbladder; decreased liver/gallbladder mobility and/or motility

Physician position: Standing posterior to the patient

Patient position: Seated

Procedure:

1. Place the left-hand fingertips inferior to xiphoid and slightly to the right of the patient's midline.
2. The right-hand fingertips are placed just inferior to the patient's subcostal margin, lateral of midline and to the right of the gallbladder.
3. Have the patient slump forward to reduce abdominal wall tension. Apply a gentle posterior-superior force along the inferior surface of the liver.
4. Test for ease-bind motions. On noting any asymmetries, maintain constant pressure at either ease (indirect) or bind (direct), depending on the patient's tolerance and comfort.
5. Follow the release. Have the patient inhale and exhale fully to augment the release.
6. Return to neutral, then reassess.



Treatment Position for Liver/Gallbladder Release

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Chapter 8
Osteopathic Cranial Manipulative Medicine

"It is necessary to develop fingers with brain cells in their tips, fingers capable of feeling, thinking, seeing. Therefore, first instruct his fingers how to feel, how to think, how to see, and then let him touch."

- William Sutherland, D.O.

Contents:

NOTES

Introduction

Osteopathic Cranial Manipulative Medicine (OCMM), previously called Osteopathy in the Cranial Field (OCF), applies osteopathic principles and philosophy to the dynamic and physiologic motions of cranial bones and intracranial structures. As a student at the American School of Osteopathy in 1899, William G. Sutherland, D.O., proposed an analogy between the gills of a fish and the beveled articulations of the sphenoid and temporal bones, that the complex architecture of this articulation suggested a mechanism of mobility. Sutherland theorized that the unique design of the cranial sutures was in fact not immovable lines of rigidity, but rather, evidence of the dynamic motion of the central nervous system, dural membranes, cerebrospinal fluid, and the cranial bones; a phenomenon that he would later describe as the primary respiratory mechanism. This realization sparked thirty years of study dedicated to the anatomy and physiologic motion of the skull. Through experimental research on himself and observation of his patients, Sutherland developed the palpation skills and treatments we now employ in OCMM.

Primary Respiratory Mechanism

Sutherland applied osteopathic principles to the cranium, demonstrating how the various components of the cranium move and create a dynamic, integrated system that drives all physiologic processes. This system he called the primary respiratory mechanism (PRM). It is **primary** because it influences essential physiologic control centers within the central nervous system (e.g., respiratory, cardiovascular and vasomotor centers) and thus takes precedence over thoracic respiration; **respiratory** because it involves the interchange of cellular nutrients and metabolites; and a **mechanism** because it involves multiple parts that work together as a unit. The PRM has two phases – inhalation (also called flexion) and exhalation (also called extension) – that form a single cycle. This cycle is subtle but palpable, with a rate slower than thoracic respiration, typically 10 to 14 cycles per minute. The PRM may be palpated not only at the cranium, but at any contact point on the body, evidencing its broad impact on health and disease. Because the rate, amplitude, and quality of motion in the PRM is usually measured at the cranium, the palpatory experience of the PRM is called the cranial rhythmic impulse (CRI).

The PRM includes the following five components or phenomena:

1. Inherent motility of the brain and the spinal cord
2. Fluctuation of cerebrospinal fluid
3. Mobility of intracranial and intraspinal membranes
4. Articular mobility of the cranial bones
5. Involuntary mobility of the sacrum between the ilia

Inherent Motility of the Brain and the Spinal Cord

The motility of the central nervous system (CNS; namely, the brain and spinal cord) follows the cycle of the PRM noted above. During inhalation (flexion), the CNS shortens from superior to inferior and widens laterally, increasing the coiling of the cerebrum. During exhalation (extension), it lengthens vertically and narrows laterally, uncoiling. This oscillatory motion of the CNS is best understood in the context of embryology. During embryologic development of the brain, the rapidly growing cerebral hemispheres adjust to the bounds of the developing cranium by growing posteriorly and laterally, successively covering the diencephalon, midbrain, and hindbrain. This curving backwards and laterally creates a coil like a ram's horn. The inherent motion of the fully developed CNS is a retracing or an echo of this primordial motion.

Fluctuation of Cerebrospinal Fluid

The choroid plexus forms and secretes cerebrospinal fluid (CSF) that flows within the ventricles and around the brain and spinal cord through subarachnoid spaces. The choroid plexus is comprised of specialized endothelial cells that filter the arterial capillary blood to produce CSF. This specialized fluid bathes the intracranial structures and spinal cord, serving as a mechanical shock absorber, source of nutrients, and site of metabolic waste removal. The innate motion of the CNS is transmitted through the cerebrospinal fluid resulting in "fluctuation of the fluids." Fluctuation is defined as a wavelike motion of fluid in a cavity of the body observed by palpation or percussion; it is a tidal motion and not the same as circulation. Ideally, this fluctuation is transmitted longitudinally along the long axis of the body with a steady rate and strong amplitude. As a result of CNS motility, the ventricles also rhythmically change shape and augment the movement of CSF. The combined forces of CNS motility and CSF fluctuation serve as a source of bioelectric energy throughout the body.

Mobility of Intracranial and Intraspinal Membranes

The meninges are comprised of three continuous fascial layers consisting of dura mater, arachnoid mater, and pia mater from outermost to innermost. The meninges surround, support, and protect the CNS. Dura mater is non-elastic, composed of thick collagenous sheets adherent to the surface of cranial bones. The outer layer of dura mater serves as the periosteal lining of the cranial cavity and is continuous with the periosteum of the external skull through the sutures of the skull. The inner layer of dura mater surrounds the arachnoid mater, pia mater, the brain, and spinal cord. Between the inner and outer layers in certain areas, venous sinuses form. These venous sinuses lack smooth muscle, elastic fibers, valves, and proximity to skeletal muscle. Therefore, venous sinuses depend on the mobility of the dural membranes to promote venous drainage. Along the straight sinus, specialized reduplications of dura form sickle-shaped structures called the falx cerebri (separates right and left sides of cerebrum), the falx cerebelli (separates right and left sides of cerebellum), and the tentorium cerebelli (separates cerebrum from cerebellum). The dura mater also extends caudally within the spinal canal with firm attachment sites at the foramen magnum, the posterior aspect of the bodies of C2 and C3, and the second sacral segment. Sutherland describes this functional anatomic unit of dura mater as the reciprocal tension membrane (RTM), also referred to as the "core link" as it transmits mechanical forces from the sacrum to the cranium and vice-versa. The reduplications of dura throughout the spinal canal and cranium contain constant tension that guides, limits, and responds to the inherent motion of the CNS and the fluctuation of CSF.

Articular Mobility of the Cranial Bones

Embryologically, the cranial bones form around the nervous system to provide support, protection, and adequate space for normal development. Cranial bones originate from centers of ossification in either cartilage or membrane, eventually forming smooth osseous plates. Osseous plates formed in cartilage – endochondral bone – develop into the base of the cranium through compressive forces. The cranial base is composed of the body of the occiput, body of the sphenoid, ethmoid bone, and petrous portions of the temporal bones. Bone formed from cartilage is resilient and provides support and shock absorption. Osseous plates formed from membrane – intramembranous bone – form the vault of the skull through stretching forces. The vault is composed of the squamous portions of the frontal bone, parietal bones, occiput, and temporal bones, and the tips of the greater wings of the sphenoid. Normal growth of intracranial structures promotes expansion of the osseous plates. Eventually, these plates come together at joint lines we call sutures. In the developing fetus, sutures are highly mobile to permit rapid intracranial growth and to accommodate cranial molding in the birth canal. Later in life, sutures allow much less motion, providing optimal protection of the brain, absorbing mechanical forces, and promoting osteogenesis during growth. The persistence of many sutures into early and late adulthood highlights their importance.[28] The articular mobility of the cranial bones is responsive to the motion of the CNS, CSF, and meninges. Unpaired bones (e.g., sphenoid, occiput, ethmoid) rotate around transverse axes into flexion and extension during inhalation and exhalation, respectively. Paired bones (e.g., temporal, zygoma, maxilla) rotate around various axes into external rotation and internal rotation during inhalation and exhalation, respectively.

Think About It: At birth, the cranial bones are composed of multiple parts. The sphenoid and temporal bones are both in three parts, and the occiput is in four parts. A cartilaginous matrix is located between osseous segments and serves to support development.

Involuntary Mobility of the Sacrum Between the Ilia

Motion at the sacrum occurs along three different transverse axes: "sacro-iliac axis" (also known as "middle transverse axis"), "ilio-sacral axis" (also known as "inferior transverse axis"), and "respiratory axis" (also known as "superior transverse axis"). The "sacro-iliac axis" is found transversely at the inferior aspect of the body of S2 and is responsible for the voluntary postural motion of the sacrum on the ilia. The "ilio-sacral axis" runs transversely through the body of S3 and is responsible for the voluntary motion of the ilium on the sacrum. The "respiratory axis" is a transverse axis posterior to the sacral canal at the level of S2 and responsible for the involuntary motion of the sacrum induced by the primary respiratory mechanism. This mechanism is a combination of the motion of the CNS, fluctuation of the CSF, and reciprocal tension membrane tension through dural attachments at foramen magnum of the occipital bone, C2, C3, and S2. Occiput motion leads to a rhythmic pull of the dural membranes resulting in a synchronous, involuntary motion of the sacrum. During inhalation (flexion), the sacrum moves slightly superiorly with the base moving posteriorly and the apex moving anteriorly (counternutation). During exhalation (extension), the sacrum moves slightly inferiorly with the base moving anteriorly and the apex moving posteriorly (nutation). Note that sacral movements during flexion and extension phases of the PRM are opposite of postural sacral flexion and extension. While flexion in the PRM causes the sacral base to move posteriorly, flexion of the sacrum in a postural model involves anterior motion of the base.

Autonomics[3]

Autonomic Spinal Levels for Cranial Structures

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Head and Neck	T1-4	CN III, VII, IX, X
Cerebral Vasculature, Meninges	T1-2	Sphenopalatine, otic, and internal carotid ganglia
Pupils	T1-2	CN III via ciliary ganglia

Chapman's Reflex Points for Cranial Structures

	Anterior Point Location	Posterior Point Location
Cerebellum	Tip of coracoid process	Just under skull midway between posterior midline and C1 transverse process
Cerebrum	Lateral from the spinous processes of C3-5	Intertransverse space between C1 and C2
Conjunctiva/ Retina	Anterolateral humerus, middle aspect of the surgical neck inferiorly	Around the suboccipital nerve

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Brain

T1-T2 are the preganglionic sympathetic input to the cranial vasculature and dura. These preganglionic neurons synapse in the superior cervical ganglia before innervating the dura and the intracranial vasculature before it enters the brain parenchyma. The innervation of vessels up to the Virchow-Robin space has been termed "extrinsic," while the innervation of vessels within the brain parenchyma has been termed "intrinsic."[22] The extrinsic, sympathetic innervation of cerebral vasculature has already been noted. The extrinsic, parasympathetic innervation include postganglionic fibers from the sphenopalatine, otic, and internal carotid ganglia.[25] It is unclear where the preganglionic fibers originate, though some studies have implicated the superior salivatory nucleus. Intrinsic, parasympathetic fibers arise from the nucleus basalis, locus coeruleus, and raphe nucleus. These parasympathetic fibers form a delicate plexus around the cerebral arteries and have vasodilatory effects when stimulated. Within the dura a dense plexus is formed in the connective tissue itself and the adrenergic component is thought to have a regulatory effect on the dural metabolic activity as well as a vasoconstrictive component. Sympathetic stimulation is thought to be related to migraine headaches.

Osteopathic Considerations in Autonomics Related to the Cranial System

From an osteopathic perspective, the autonomic nervous system (ANS) is fundamental to understanding how all bodily systems interact with each other. Central sensitization or facilitation of the ANS can result in somatic dysfunction, which can further augment autonomic facilitation. Facilitation of the ANS alters homeostasis and can contribute to a great variety of medical conditions. This is particularly significant in OCMM since cranial structures both receive autonomic innervation (just like the other systems covered in this manual) and provide autonomic innervation to the rest of the body. Indeed, the body's *entire* parasympathetic output arises from the cranium and the sacrum.

As with other systems in the body, sympathetic innervation arises from the thoracolumbar spine: T1-4 for the head and neck in general, and T1-2 for intracranial structures specifically. Somatic dysfunction of the upper thoracic region can facilitate abnormal sympathetic tone, which may alter cranial physiology. On the other hand, cranial somatic dysfunction can have deleterious effects on other systems in the body, due to the autonomic function of intracranial structures. For example, cranial and sacral nerve entrapment syndromes can be the cause of abnormal parasympathetic function that contributes to the altered autonomic balance seen in a great variety of pathologic conditions throughout the body (e.g., diseases of the cardiovascular, respiratory, and gastrointestinal systems). For example, somatic dysfunction of the occipitomastoid suture may impact the nervi nervorum and vasa nervorum of the vagus nerve. This can result in autonomic dysfunction of the heart or GI tract.

OCMM therapeutically impacts abnormal parasympathetic function contributing to a restoration of autonomic balance. Furthermore, OCMM relieves pain through a variety of mechanisms and contributes to decreasing or eliminating abnormal afferent signaling. This signaling may also contribute to segmental facilitation impacting the ANS more broadly with associated somatic dysfunction and TART changes in areas other than the cranium and sacrum.

Biomechanics

Brain

Motion is a manifestation of life, and the brain is no exception. The brain is constantly in motion. Besides the inherent motility noted during the discussion of the Primary Respiratory Mechanism, the brain and spinal cord also move in response to cardiac and respiratory influences.[13-20] Brain parenchyma has measurable viscoelastic properties that permit deformation during strain but also elastic return to neutral after the strain is removed.[19] This occurs at a cellular level in response to electrical activity and at a macroscopic level in response to motion of the cranium (e.g., head turning) or motion induced by other physiologic processes.[20] One of the most well-studied brain movements is the motion associated with the cardiac cycle. During systole, there is rapid displacement of brain parenchyma, followed by slow return to neutral during diastole. Radiographic studies agree that the most significant motion occurs in a caudal direction and at the base of the brain (i.e., basal ganglia and brain stem).[21] There are, however, minor motions in anterior/posterior and lateral/medial directions, with some data showing an overall posterior rotational movement of the cortex.[19] Overall, the brain has a “piston-like action” with cardiac systole, moving caudad toward the foramen magnum.[17]

Dural Membranes

As stated above, the dura mater is the outermost layer of the meninges composed of two layers of thick, fibrous tissue. The outer layer lines the inner aspect of the skull and is continuous with the periosteum of the cranial bones. The inner layer of dura mater envelopes the brain and spinal cord and contains sickle-shaped dural reflections we call the falx cerebri, falx cerebelli, and tentorium cerebelli. These dural reflections form the intradural venous sinuses. It is important to remember that though the reflections are named as individual structures, the dura is continuous – the two sides of the falx cerebri are continuous with the superior surface of the tentorium cerebelli; the inferior surfaces of the tentorium cerebelli are continuous with the falx cerebelli, which is continuous with the spinal dura at the foramen magnum. This single, functional unit of dura is the reciprocal tension membrane (RTM).

Dr. Sutherland saw the dural membranes as the ligaments of the cranium that played an integral role in the dynamic motion of cranial bones and the primary respiratory mechanism. "Look at the vertebral column to see the ligaments that hold the spinal articulations together and also allow a certain range of movement at these joints. Then look inside the skull to find what does the very same thing as those spinal ligaments. There is an interosseous membrane that holds the bones of the neurocranium together and allows a certain range of normal movement at the joints. The interosseous membrane inside the skull is called the dura mater."[1] Recent research has reinforced Dr. Sutherland's writings on the dural membranes. Researchers found that tensile stress patterns induced in the tentorium cerebelli and the falx cerebri from daily activities (e.g., postural changes, sneezing, head turning, running) closely align with anatomic fiber orientation, suggesting that the visible form (i.e., structure) of the RTM reflects its function. They also found that increased tension in the dural membranes induces compressive forces in the vault bones, affirming what Sutherland noted about the RTM limiting cranial bone motion.[26]

Falx Cerebri: The falx cerebri is the sickle-shaped dural reflection located midline, separating the cerebral hemispheres. The posterior pole of attachment is at the internal occipital protuberance. The falx continues vertically along the sagittal suture of the parietal bones and the metopic suture of the frontal bone and continues anteriorly to attach to the crista galli of the ethmoid bone. It arises from the straight sinus and creates the superior and inferior sagittal sinuses.

Tentorium Cerebelli: The tentorium cerebelli, or "tent," is a bilateral structure separating the occipital lobes of the cerebrum from the cerebellum. Like the falx cerebri, each side forms a sickle-shaped reflection of dura. The tent attaches to the occipital bone, the posterior angle of the parietal bone, the petrous portion of the temporal bone, and the anterior and posterior clinoid processes of the sphenoid bone. As the tentorium cerebelli crosses over the clinoid process, it twists, creating a thickening of the attached border called the petrosphenoid ligament. Along with the falx cerebri, it arises from the straight sinus and then creates the transverse sinuses and superior petrosal sinuses.

Falx Cerebelli: The falx cerebelli separates the two cerebellar lobes. Like the falx cerebri, it attaches to the internal occipital protuberance. It then courses down the midline of the occipital squama and attaches to the foramen magnum. It too originates from the straight sinus and creates the occipital sinus.

Diaphragma Sellae: The diaphragma sellae is a small dural fold that covers the sella turcica. It is bounded anteriorly by the tuberculum sellae and posteriorly by the dorsum sellae. It has a foramen that allows for passage of the pituitary gland infundibulum. The pituitary gland is seated in the sella turcica, inferior to the diaphragma sellae.

Cranial Bones

The bones of the skull are derived from either membrane or cartilage. The bones that make up the base of the skull have their origin in cartilage and undergo endochondral ossification. These undergo compressive forces and provide support to the neurocranium and viscerocranium structures. The bones that make up the cranial vault are formed in membrane and allow greater flexibility for the developing brain. The facial bones (maxillae, lacrimal bones, palatine bones, vomer, nasal bones, zygomata, and mandible) are mainly derived from the pharyngeal arches and neural crest cells and are influenced by the cranial base and vault.[27]

Sphenoid Bone: The sphenoid is an unpaired bone located in the middle of the skull and forms the shape of a bat with its wings extended. The body of the sphenoid contains sphenoidal sinuses and the sella turcica, which houses the pituitary gland.

Attaching to the anterior surface of the body are the lesser wings, while the greater wings attach to the lateral surface. The pterygoid processes project inferiorly from the junction of the body and greater wings. A portion of the greater wing of the sphenoid forms the posterior wall of the orbit and serves as the inferior boundary of the superior orbital fissure. It articulates with eight other bones including the frontals, parietals, ethmoid, temporals, zygomatic, palatine, vomer, and occiput. The articulation with the occipital bone is referred to as the sphenobasilar synchondrosis (SBS). As the SBS moves, tension is transferred through dural membranes and is transmitted to the sacrum. This plays an important role in the primary respiratory mechanism to facilitate the cranial rhythm in sync with the inherent motion of the brain and spinal cord, the fluctuation of the CSF, and the inherent motion of intracranial and spinal dural membranes. Interestingly, the superior surfaces of the greater wings articulate with L-shape articular surfaces of the frontal bones, suggesting similarities to the L-shape articulation between the sacrum and ilia. Likewise, the sphenoid bone is suspended by the frontal bones just as the sacrum is suspended by the ilia.

Occipital Bone: The occipital bone or occiput makes up the posteroinferior portion of the skull. The foramen magnum lies in the anterior occiput, and the cerebellum sits on the posterior squamous portion of the bone. It articulates with four other bones including the parietals, temporals, sphenoid, and atlas (C1). On the inferior surface of the occiput are the occipital condyles, convex oval surfaces that articulate with the concave superior facets of the atlas (C1). The anterolateral part of the occipital bone makes up the medial border of the jugular foramen. Cranial nerves IX, X, and XI as well as the internal jugular vein traverse through the jugular foramen, serving as a site of particular interest when deficits are present in these nerves. Mechanically the occiput is directly connected to the sacrum through the dural attachments at the foramen magnum.

Think About It

During the birthing process, cranial nerve X is commonly compressed as it passes through the jugular foramen between the occiput and temporal bones. This impingement can commonly result in impaired coordination of peristaltic waves of the gastrointestinal tract, or "colic" in newborn infants. Gentle OCMM can be applied to relieve this compression and restore the function of the vagus nerve.

Temporal Bones: Temporal Bones: The temporal bones are paired and positioned laterally, contributing to the base of the skull. The temporal bone has both cartilaginous and membranous origins and is comprised of four parts: squamous, mastoid, petrous, and tympanic. The squamous portion has a membranous origin, and thus, the bone is thinner. The squamous portion articulates with the parietal bone, greater wing of sphenoid, and the zygoma via an anteriorly projecting zygomatic process. It is convex in shape and serves as an attachment site for the temporalis muscle. The inferior part also has a synovial articulation with the mandible known as the temporomandibular joint (TMJ). The mastoid part of the temporal bone is on the posterior aspect and has a rough surface with muscular attachments of the sternocleidomastoid, longissimus capitis, and splenius capitis. It articulates with the occiput at the occipitomastoid suture, which terminates at the jugular foramen. The mastoid process also houses mastoid air cells that help balance pressure in the middle ear and, when dysfunctional, can harbor infections. The petrous part is located on the medial surface at the base of the

Think About It

The location of the Eustachian tube within the temporal bones has implications for treatment in patients with otitis media. The application of OCMM to the temporal bones has reported positive results in clinical trials, showing fewer ear tubes, improved tympanography, and reduced need for antibiotic treatment in children.[30-32]

skull between the sphenoid and occiput. The petrous portion houses and protects the middle and inner ear, the carotid canal, and internal auditory meatus. It also forms the lateral boundary of the jugular foramen. The tympanic part is horseshoe in shape and is located inferior to the squama and anterior to the mastoid process. It contains the external auditory meatus and is an attachment for the tympanic membrane. Beyond articulating with five other bones (occipital, parietal, sphenoid, mandible, and zygoma), the temporal bone serves as an attachment for various muscles (temporalis, sternocleidomastoid, stylohyoid, levator veli palatini, etc.), and houses the auditory meatus and ear. The temporal bone also has associations with nine cranial nerves (oculomotor, trochlear, abducens, trigeminal, facial, vestibulocochlear, glossopharyngeal, vagus, and spinal accessory). Because of its association with so many structures, Sutherland often emphasized the complexity and importance of this bone in the development of clinical symptoms, describing it as a "mischief maker" or "little clown."

Parietal Bones: The parietal bones are located bilaterally, forming the sides and roof of the cranium. Each parietal bone has four sides with four angles articulating with the frontal, sphenoid, temporal, and occiput. Formed from membrane, the parietal bone has interdigitations along the edges to allow motion and flexibility of the cranium. The interdigitations between the parietal bones and frontal bone forms the coronal suture. The sagittal suture is formed by interdigitations between each of the parietal bones. The internal surface of the sagittal suture is the attachment site of the falx cerebri. The interdigitations between the parietal bones and occiput form the lambdoidal suture. The superior sagittal sinus and transverse sinuses traverse across the parietal bones and rely on their motion for proper venous drainage and circulation.

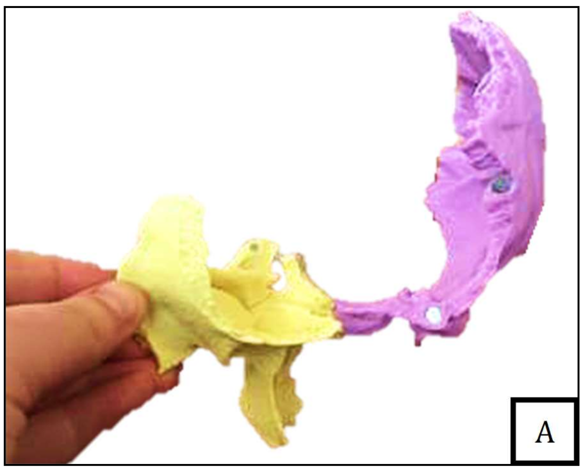
Frontal Bone(s): The frontal bone acts as a paired bone even without the persistence of the metopic suture. It is made up of three parts: squamous, orbital, and nasal. It articulates with the sphenoid, ethmoid, parietal bones, nasal bones, maxillae, lacrimal bones, and zygomata.

Cranial Nerves

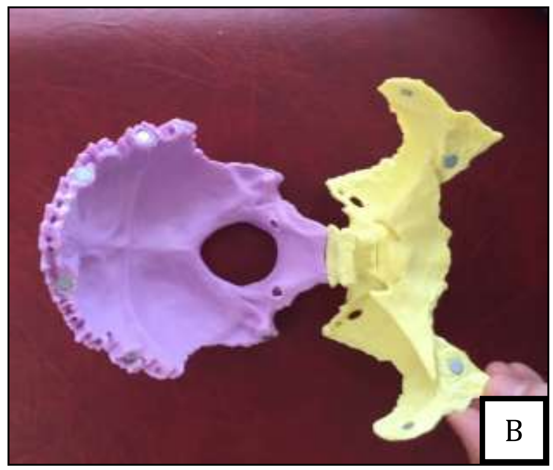
Suboptimal biomechanics of the cranial bone structures (including tension in the dura itself) can lead to impingement of cranial nerves with consequent negative effects. A salient example of this was given above with the vagus nerve passing through the jugular foramen, which can be negatively affected by somatic dysfunction of the occipitomastoid suture. A few other examples of this can be seen in cranial nerves I, VI, VII, VIII, and XII. Dysfunction in the ethmoid can lead to decreased or loss of smell because of its association with the olfactory nerve. CN VI travels underneath the petrosphenoidal ligament and excess tension of this ligament and resultant nerve impingement can lead to lateral gaze deficits like strabismus. Facial motor deficits can occur from impingement of CN VII in the stylomastoid foramen. CN VIII runs through the internal acoustic meatus and temporal bone dysfunction can lead to equilibrium issues. Occipital condylar compression can affect the hypoglossal canal leading to impaired function of the hypoglossal nerve, resulting in tongue muscle dysfunction.[11] OCMM can be used to improve the mechanics of the cranial structures and improve the function of the cranial nerves.

Cranial-Sacral Biomechanics

The cranial bones move through a biphasic cycle in response to the pull of dural membranes, which are influenced by the coiling and uncoiling of the CNS, and the fluctuation of the CSF. This motion, initiated from within the living body, is referred to as inherent motion or the PRM.[2] In response to the PRM, midline bones move through a flexion phase and an extension phase along a transverse axis. Simultaneously, paired bones move through an internal rotation phase and external rotation phase along various axes. The occipital and sphenoid bones form the key articulation of cranial bone motion at the SBS, where the basiocciput and basisphenoid (body of the sphenoid) meet.



A) Sagittal view of the sphenobasilar synchondrosis (SBS) in which the sphenoid bone (yellow) articulates with the occiput (purple)



B) Superior view of the SBS

Flexion of the SBS causes an increase in convexity of the superior surface of the joint. The basiocciput and basisphenoid move cephalad, while the wings of the sphenoid bone and the squamous portion of the occiput move caudally. This motion can also be described through anterior or posterior rotation of the sphenoid and occiput about transverse axes. The sphenoid rotates anteriorly about a transverse axis through the body of the sphenoid, while the occiput rotates posteriorly about a transverse axis just superior to the foramen magnum. This motion causes other midline cranial bones to flex and paired bones to externally rotate. As a result, the cranium widens, and the transverse diameter becomes longer. As the basiocciput moves into flexion, the dura is pulled, and tension is transferred to the sacrum. Consequently, the sacrum moves into counternutation (sacral base moves posteriorly) .

Extension of the SBS causes a decrease in the convexity of the superior surface of the joint. The basiocciput and basisphenoid move caudally, while the wings of the sphenoid bone and the squamous portion of the occiput move cephalad. This results in the sphenoid rotating posteriorly about the transverse axis through the body of the sphenoid, while the occiput rotates anteriorly about the transverse axis superior to the foramen magnum. This motion causes the midline cranial bones to extend and paired bones to internally rotate. The cranium narrows and the AP diameter becomes longer. Through dural connections, basiocciput extension causes the sacrum to nutate (sacral base moves anteriorly).[2]

Cranial Flexion	Cranial Extension
Inhalation	Exhalation
External rotation – paired bones	Internal rotation – paired bones
Increased transverse diameter	Increased AP diameter
Sacrum counternutates	Sacrum nutates
CNS coils	CNS uncoils
Feeling of "filling" in hands	Feeling of "emptying" in hands

Osteopathic Considerations in Biomechanics Related to the Cranial System

In addition to the biomechanical details of the cranium and sacrum as noted above, our osteopathic perspective requires that we take into consideration various other biomechanical factors that not only impact the function of the cranial-sacral mechanism, but that the function of the cranial-sacral mechanism will in turn affect. These include the following:

- Dentition and TMJ (structural and myofascial relationships effect on cranial mechanics and vice versa)
- OA and Cervical spine (dural relationship, suboccipital muscle attachments)
- Hyoid bone (muscular attachments to cranium via stylohyoid, mylohyoid, geniohyoid)
- Pelvic mechanics (cranial connection through sacrum)

Circulation[3]

Brain

- Arterial:
  - aorta → common carotid arteries → internal carotid arteries → anterior and middle cerebral arteries (supply anteromedial and lateral surfaces of the cerebrum respectively)
  - aorta → subclavian arteries → vertebral arteries → unite into basilar artery → posterior cerebral arteries (supplies posterior and inferior surfaces of brain)
- Venous:
  - Dural sinuses → internal jugular veins → brachiocephalic veins → superior vena cava

Lymphatic System

It was long thought that CNS was devoid of any elements of the lymphatic system. While the CNS seems to have no lymphatic vessels per se contributing to the removal of interstitial waste products, it is now known that there are vessels with structural and functional similarities to peripheral lymphatic vessels. These vessels are immediately adjacent to dural sinuses and run along the meningeal vascular supply. It is now recognized that a glial-dependent perivascular network exists, the *glymphatic system*, that also provides for the removal of interstitial waste products. The glymphatic pathway runs in parallel to the blood supply and spans the entirety of the CNS.[29]

The Ventricular System

The ventricles are cavities located within the brain parenchyma serving as channels for CSF flow throughout the brain. Modified ependymal cells within choroid plexus found in each ventricle produce CSF. Thus, the ventricular system is essential for nutrient and waste exchange in the central nervous system.

- Lateral ventricles → interventricular foramina (of Monro) → third ventricle → cerebral aqueduct (of Sylvius) → fourth ventricle → lateral apertures (foramina of Luschka) and median aperture (foramen of Magendie) to subarachnoid spaces → central canal of spinal cord

Osteopathic Considerations in Circulation Related to Cranial System

From an osteopathic perspective, remember that proper function of the transverse diaphragms of the thoracoabdominal cavity are critical for appropriate return of the fluids in the low-pressure circulatory system (venous and lymphatic systems). These diaphragms include the tentorium cerebelli, the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. Furthermore, somatic dysfunction of the cervical spine and its related myofascial structures, as well as cranial strain patterns affecting the cranial foramina, can have an adverse impact on head and neck arterial blood supply and venous blood and lymphatic fluid drainage. Given these considerations, appropriate OMT/OCMM to the involved structures can have a significant impact on improving the flow of fluids to and from the cranium.

Screening

As osteopathic physicians we must take into consideration factors influencing the patient outside of the obvious chief complaint and specific region of presumed dysfunction. We should assess the whole patient, recognizing that each patient is an individual with unique mental, physical, and spiritual factors impacting their health. In addition to screening the whole patient for somatic dysfunction that could be related to the patient's problem, we should also assess other potentially related issues including environmental, nutritional, psychological, or spiritual factors that must be addressed to help the patient attain a state of health and well-being.

Testing

- Non-contrast head CT (acute brain bleed)
- Complete Metabolic Panel (Electrolytes, glucose, calcium, renal function, liver function)
- Lumbar puncture with CSF analysis (pressure, color, turbidity, viscosity, glucose, protein, WBC diff, etc.)
- Brain MRI (tumor, chronic brain hemorrhage)
- PET scan (metabolic activity in brain)

Indications and Contraindications for OCMM

Indications[8]

OCMM is indicated for the treatment of somatic dysfunction. Below are examples of clinical presentations for which OCMM may be useful:

- Cranial neuropathy/nerve entrapment (e.g. trigeminal neuralgia, Bell's palsy)
- Colic
- Feeding difficulties in infants and in adult neurologic etiologies, e.g., post-CVA
- Headaches and orofacial pain
- Otitis media/Eustachian tube dysfunction
- Sinusitis
- TMJ dysfunction and malocclusion
- Vertigo
- Plagiocephaly
- Torticollis
- Mood disorders including depression and anxiety
- Nausea/vomiting
- Tinnitus
- Post-concussive syndromes/traumatic brain injury

Contraindications[8]

- Absolute
    - Acute or unstable fracture affected by application of treatment or treatment positioning
    - Manifestations of abnormal neurological and/or vascular symptoms brought on by and/or exacerbated by the treatment position
    - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
    - Hemodynamically or neurologically unstable patient
        - Unstable acute intracranial bleed
        - Unstable acute cerebrovascular accident
        - Unstable infectious process of the central nervous system
- Relative
    - Medically stable coagulopathies
    - Space occupying lesion in cranium
    - Medically stable increased intracranial pressure (ICP)
    - Stable skull fracture

- Seizure activity of unknown origin
- Cephalohematoma with hepatic or hematologic compromise
- Medically stable intracranial bleed
- Medically stable acute cerebrovascular accident

Note: As with any procedure, there are conditions in which the physician must proceed with caution in the application of OCMM procedures. In the case of the application of OCMM procedures, there are a number of relative contraindications based on the training and experience of the physician. Hemodynamic or neurologic stability are of significant concern, particularly in conditions such as acute intracranial bleed, skull fracture, and acute cerebrovascular accident. **If a patient is unstable, these conditions are absolute contraindications to OMT**. However, in the inpatient setting, the standard of practice in OCMM is to respond to an osteopathic consultation request by the surgeon or treating physician after the patient is initially evaluated, treated, and medically determined to be in a stable condition. **Once the patient is medically stable, these conditions would be considered relative contraindications to OCMM depending on the training and experience of the physician**.

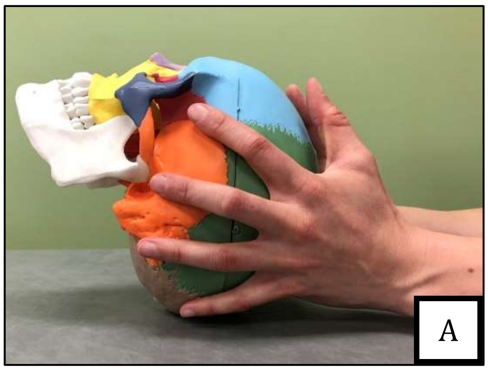
Osteopathic Screening and Evaluation of Somatic Dysfunction

Handholds for the Cranium and Sacrum

There are several hand placements that function well for palpation of the cranium and the craniosacral mechanism. The following hand holds are discussed below: vault hold, fronto-occipital hold, base (Becker) hold, sacrum hold, and temporal hold.

Vault Hold

The hands of the physician are lightly placed on either side of the patient's head. Thumbs should be hovering over, but not contacting the sagittal suture. Index fingers are placed over the greater wings of the sphenoid bone, middle and ring fingers on either side of the ear, and pinky fingers on the occiput. Therefore, the 4th and 5th digits will be posterior to the ear and the 1st, 2nd, and 3rd digits will be anterior to the ear.[6]



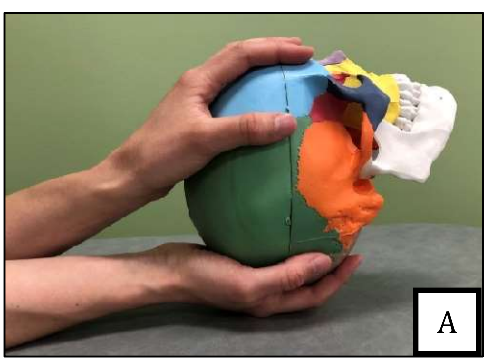
A) Lateral view of vault hold

B) Superior view of vault hold

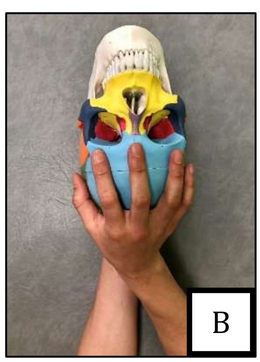
C) Lateral view of vault hold on patient

Fronto-Occipital Hold

The physician supports the head by cradling the occiput with one hand with fingers directed inferiorly. The physician's other hand is placed lightly on top of the head in the same orientation with fingers spread out to contact the entire width of the frontal bone. The middle finger should be aligned parallel with the metopic suture of the frontal bone.



A) Lateral view of fronto-occipital hold

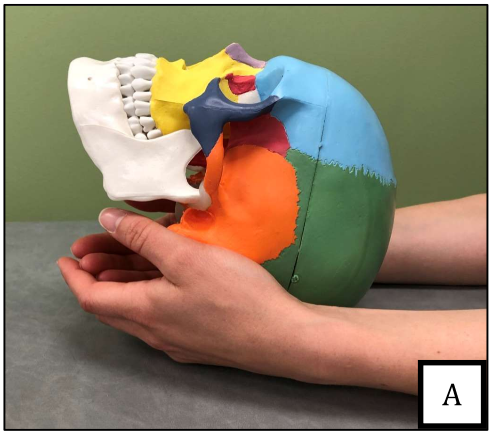


B) Superior view of fronto-occipital hold

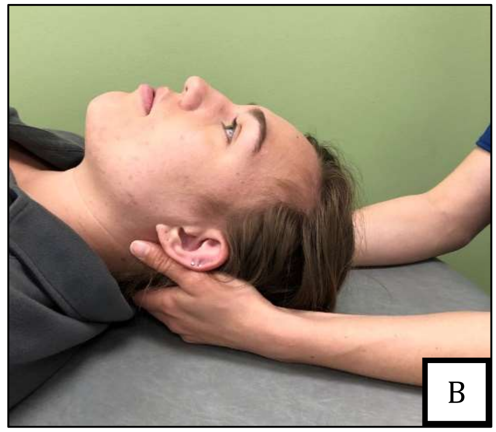
C) Fronto-occipital hold on patient

Base (Becker) Hold

The base hold is a relaxed alternative to the vault hold. The physician creates a bowl with the palms of his or her palms in which the patient's head rests. The weight of the head should allow the hands to slightly separate, such that the inferior portion of the patient's occiput rests on the table. The physician's first metacarpal-phalangeal joints should gently contact the mastoid processes with the distal thumbs contacting the tissues inferior. Alternatively, the pads of the thumbs may contact the greater wings of the sphenoid anterior to the ears. The physician's hands should be relaxed, as though the hands are a pillow for the patient's head.



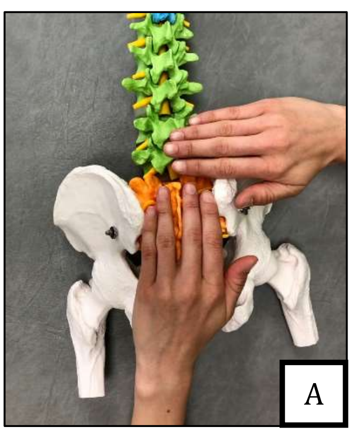
A) Lateral view of base (Becker) hold



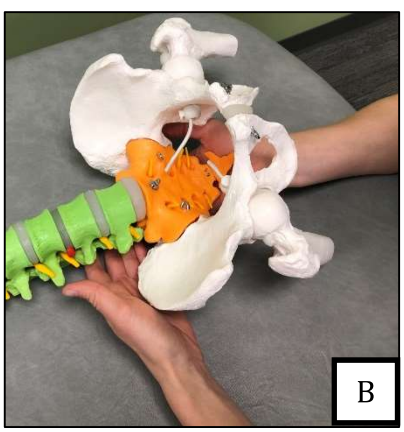
B) Lateral view of base (Becker) hold on patient.

Sacrum Hold

The physician places the caudal hand underneath the sacrum so that the coccyx lies between the thenar and hypothenar eminences and the 3rd and 4th digits contact the sacral base just below L5. The forearm may be placed between the patient's legs or underneath the leg closest to the physician. The physician places the cephalad hand under L5 perpendicular to the caudal hand, making firm contact with L5. The tips of the fingers of the caudal hand should barely touch the ulnar aspect of the cephalad hand. The physician's hands should form a "T".



A) Posterior view of sacrum hold

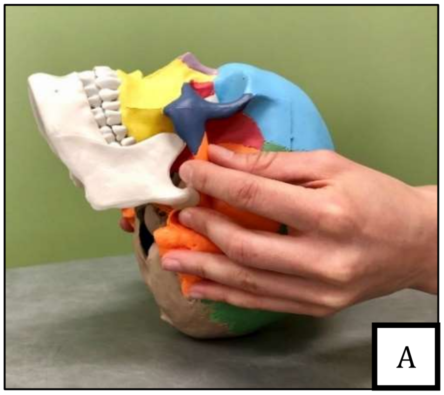


B) Anterior view of sacrum hold

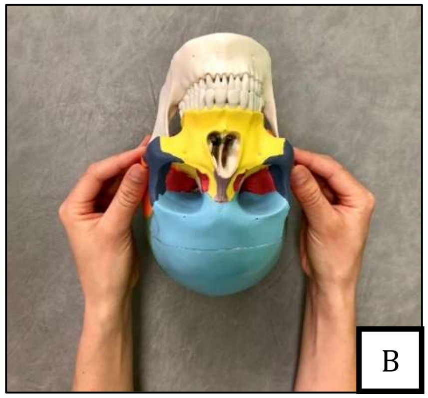
C) Superolateral view of sacrum hold on patient

Temporal (Unilateral and Bilateral) Hold

The physician contacts the opening of the external auditory meatus with the tip of the 3rd digit. The physician simultaneously contacts the mastoid process with the pads of the 4th and 5th digits and gently grasps the zygomatic arch of the temporal bone with the thumb and 2nd digit. For a unilateral hold, the other hand may gently cradle the occiput posteriorly or be used to apply force as part of a treatment (e.g., to the zygoma).



A) Lateral view of temporal hold



B) Anterior view of bilateral temporal hold

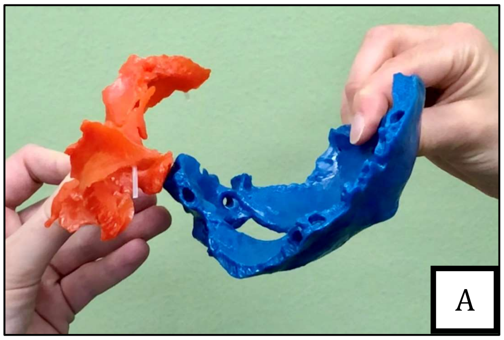
C) Temporal hold on patient

Cranial Base Strain Patterns

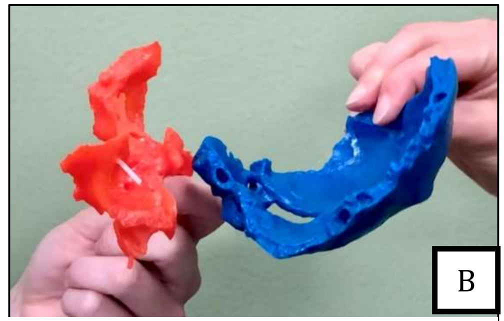
The normal, physiologic motions of the cranial mechanism involve flexion with external rotation and extension with internal rotation. The cranium, through a variety of etiologies, may develop a preference for one of these phases. This means that flexion and extension, while normal motions, can also be dysfunctions. Just as a fibular head normally moves anterior and posterior, but may become stuck in one of these positions, so with the cranium. In addition to flexion and extension, there are five common cranial strain patterns: torsions (right or left), sidebending rotations (right or left), vertical strains (superior or inferior), lateral strains (right or left), and SBS compression. Of these strain patterns, torsions and sidebending rotations are considered physiologic strains; vertical strains, lateral strains, and SBS compression are considered non-physiologic strains. Strains can also be superimposed on one another, resulting in a patient with multiple cranial strain patterns.

Flexion and Extension

As noted above, flexion and extension are the normal, physiologic motions of midline bones in the cranium, including the sphenoid and occiput at the SBS. During flexion, the sphenoid rotates about a transverse axis that runs through the body of the sphenoid just anterior and inferior to the sella turcica and through the sphenosquamous (SS) pivot (the point of change in bevel orientation in the sphenosquamous suture between the sphenoid and temporal bones). The occiput also rotates about its own transverse axis, located superior to the jugular processes of the occiput (more generally, superior to the foramen magnum) at the level of the SBS. During flexion, the SBS rises superiorly while the angle of the inferior aspect of the SBS decreases (i.e., becomes more concave). During extension, the SBS descends inferiorly while the angle of the inferior aspect of the SBS increases (i.e., becomes more convex). The sphenoid and occiput rotate in opposite directions during flexion and extension. Flexion and extension are named for the motion at the SBS. In the vault hold during flexion, the fingers spread apart (i.e., abduct) and move inferiorly and slightly laterally (as though the head is expanding laterally). Extension causes fingers to come together (adduct) and move superiorly and slightly medially (as though the head is deflating).



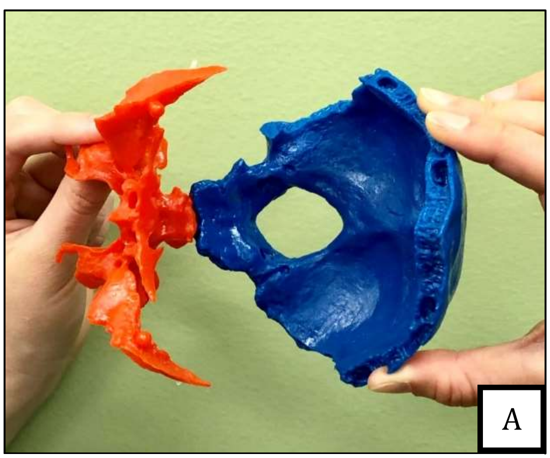
A) Lateral view of the SBS: Neutral



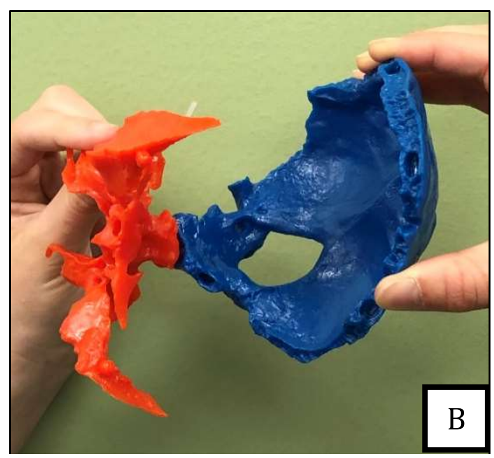
B) Lateral view of the SBS: Flexion

Torsion

During a torsion, the sphenoid and occiput rotate in opposite directions around a single anterior-posterior (AP) axis that runs from nasion, through the SBS, and through opisthion. It is named for the side with the superior greater wing of the sphenoid bone. For example, right torsions occur when sphenoid bone rotates left on the AP axis, causing the right greater wing to move superior. Simultaneously, the occiput rotates right on the same AP axis. Traumatic forces directed superiorly to the inferior surface of the zygoma can cause a torsion on the same side by moving the greater wing of the sphenoid superiorly on the affected side.[5,6] In the vault hold during a right torsion, the right index finger and left little finger will move superiorly, while the left index finger and right little finger move inferiorly. The overall motion feels like right hand radial deviation with left hand ulnar deviation. The opposite occurs with a left torsion.



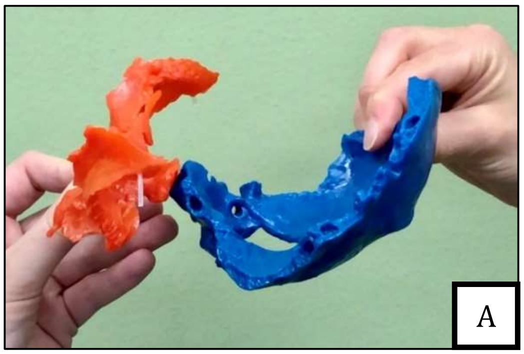
A) Superior view of the SBS: Neutral



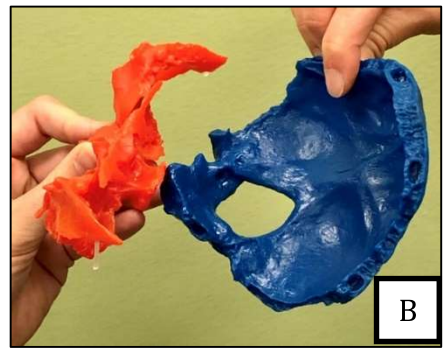
B) Superior view of the SBS: Right torsion

Sidebending Rotation

There are three axes of motion involved in sidebending-rotation strains. The sidebending component occurs around two parallel vertical axes; one that passes through the body of the sphenoid; and one that passes through the foramen magnum. The sphenoid and occiput rotate in opposite directions around their respective vertical axes, which brings the wings of the sphenoid farther away from the squama of the occiput on one side, and closer together on the other side. Simultaneously, both bones rotate in the same direction around a single AP axis (from nasion to opisthion, through SBS, like in torsions). On the AP axis, the occiput and sphenoid rotate to the side that has been widened from sidebending motion. The sidebending rotation strain is named for the wider, more inferior side, or the side of SBS convexity. For example, a left sidebending rotation results in the sphenoid rotating right on a vertical axis and the occiput rotating left on a parallel vertical axis, with widening of the left side of the cranium. Simultaneously, the sphenoid and occiput would have rotated to the left (towards the wider side) on the same AP axis, causing the sphenoid and occiput to move inferior on the left side.[2,5] In a vault hold during left sidebending rotation, the fingers of the left hand will spread apart (abduct) and move inferiorly, while the fingers of the right hand will come together (adduct) and move superiorly. The opposite occurs with a right sidebending rotation.



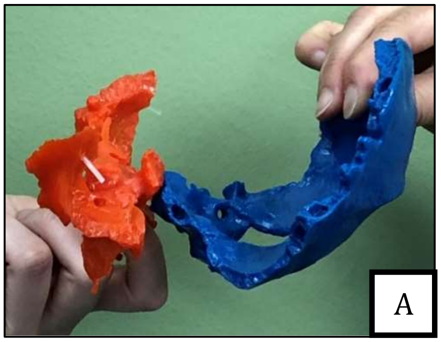
A) Lateral view of the SBS: Neutral



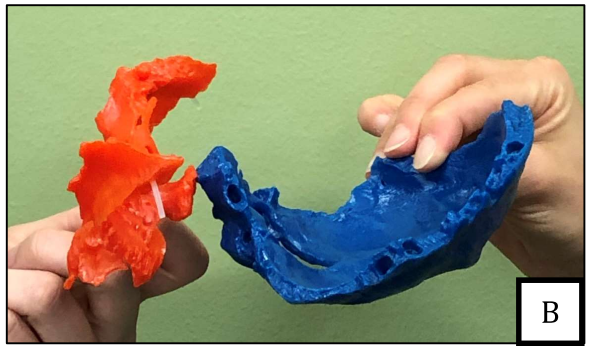
B) Lateral view of the SBS: Left sidebending rotation

Vertical Strain

In a vertical strain, the sphenoid and occiput rotate in the same direction around parallel transverse axes, creating a vertical shearing stress that can disrupt normal flexion and extension. The transverse axes are the same as flexion and extension. A vertical strain is named superior or inferior for the position of the basisphenoid in relation to the occiput. For example, a superior vertical strain occurs when the sphenoid rotates anteriorly around a transverse axis, causing the basisphenoid to move superior. At the same time, the occiput also rotates anteriorly around a transverse axis, moving the basiocciput inferior. The opposite (posterior rotation of both bones) occurs during an inferior strain. Superior vertical strains may be caused by an inferiorly directed force applied midline over the anterior-superior aspect of the frontal bone (anterior to the sphenoid transverse axis, causing anterior rotation), or an anteriorly directed force to the superior occiput (near lambda, superior to the occiput transverse axis, causing anterior rotation). A downward force transmitted to the basisphenoid (posterior to the axis) or an upward force on the basiocciput (posterior to the axis) can cause inferior vertical strains. A fall on the buttocks with a superior force transmitted up the spine can produce these mechanical changes by transmitting a superior force to the occiput posterior to the occiput's transverse axis, causing anterior rotation and a superior vertical strain.[2,5] In the vault hold, a superior vertical strain will feel like both hands ulnar deviating. An inferior vertical strain will feel like both hands radially deviating.



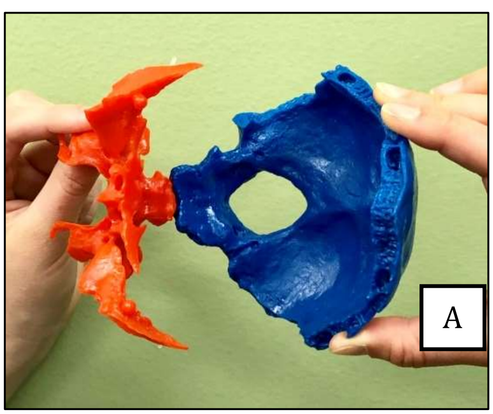
A) Lateral view of the SBS: Superior vertical strain



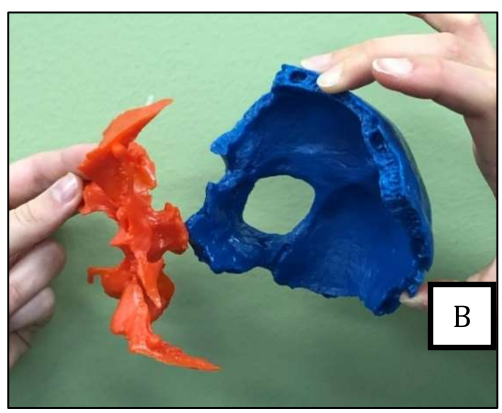
B) Lateral view of the SBS: Inferior vertical strain

Lateral Strain

In a lateral strain, the sphenoid and occiput rotate in the same direction around parallel vertical axes, creating a lateral shearing stress. The axes are the same as were used in the sidebending component of sidebending rotation. A lateral strain is named right or left for the position of the basisphenoid in relation to midline. For example, a right lateral strain occurs when the sphenoid and occiput rotate left around their respective vertical axes, moving the basisphenoid to the right. As the basisphenoid moves to the right, the wings of the sphenoid move to the left, while the basiocciput moves left and the inferior lateral angles of the occiput move to the right. A lateral-to-medial directed force applied over the right greater wing of the sphenoid would cause a right lateral strain. This force causes the greater wings to move left forcing the basisphenoid to rotate right. A lateral-to-medial directed force applied to the left posterior aspect of the occiput can cause a right lateral strain. This trauma forces the squama of the occiput to move right, causing the basiocciput to rotate left, resulting in the right rotation of the basisphenoid.[5] There are two accepted descriptions of what is felt in the vault hold during a right lateral strain. First, the index fingers will move to the left and little fingers will move to the right so as to form the corners of a parallelogram. This may feel like the right hand is pronating slightly while the left hand supinates slightly. Second, the right index and little fingers will move anteriorly as the left index and little fingers move posteriorly. The opposite of either occurs during a left lateral strain.



A) Superior view of SBS: Neutral



B) Superior view of SBS: Right lateral strain

SBS Compression

SBS compression will cause the most restriction in cranial motion. It occurs when the sphenoid and occiput are compressed together at the SBS along an AP axis, preventing normal flexion and extension. It is called simply “SBS compression” without any other variants. Palpation of the head is often described as feeling like a “bowling ball” with heaviness and minimal motion, if any. Vaginal birth is a common and frequent source of SBS compression.[5]

Evaluation of Cranial Somatic Dysfunction

Palpation of the cranial mechanism involves an understanding and assessment of the cranial bones, dura mater/intracranial membranes, and CSF fluctuation. The physician can evaluate whether there is an overall preference for flexion or extension, or if any cranial bone motion is particularly restricted. For instance, the right temporal bone could prefer internal rotation. By shifting awareness to include membrane along with bone, the physician can then diagnosis a cranial strain, what Sutherland called a “membranous articular strain.” The physician would also evaluate the health or amplitude of CSF fluctuation, often referred to as the “tide.” The physician should attempt to determine the frequency, amplitude, quality, and presence of turbulence in the tide while palpating. The PRM is most commonly palpated at a rate of 10-14 cycles per minute, slightly slower than thoracic respiration.[5] Overall, these are subtle motions that require significant practice to perceive. It is imperative that the physician be grounded and relaxed to listen to the subtleties of the body’s mechanism, as opposed to searching it out.

Sacral Strain Patterns

Sacral strains may accompany cranial strains and vice versa—recall the craniosacral biomechanical link. To review the discussion of common sacral somatic dysfunctions, please refer to “Chapter 8: Sacrum” in *RVUCOM OPP I & II Manual*.

Cranial Base Strains

	Flexion & Extension	**Torsion**	**Sidebending Rotation**	**Vertical Strain**	**Lateral Strain**	**SBS Compression**
Rotation & Axes	Opposite directions about 2 transverse axes (above foramen magnum & through sphenoid body)	Opposite directions on 1 AP axis (through SBS)	Opposite directions on 2 vertical axes (through foramen magnum & through sphenoid body); same direction on 1 AP axis (through SBS)	Same direction on 2 transverse axes (above foramen magnum & through sphenoid body)	Same direction on 2 vertical axes (through foramen magnum & through sphenoid body)	Compression on 1 AP axis (through SBS)
Naming Convention	Named for motion at SBS (flexion vs extension)	Named for superior greater wing of sphenoid (right vs left)	Named for side of convexity (right vs left)	Named for basisphenoid (superior vs inferior)	Named for basisphenoid (right vs left)	SBS compression

Cranial Base Strains – Practice!

Rotation & Axes						
Naming Convention						
Palpatory Findings (E.g., Shadow hand motions)						

Principles of Treatment

The goals of OCMM are several-fold beyond correcting somatic dysfunctions of the cranium and sacrum. OCMM can effectively normalize somatic and autonomic nerve function in addition to restoring circulatory function of arterial, venous, and lymphatic channels and normalizing fluctuation of the CSF.[2,11]

Just as balanced ligamentous tension (BLT) is used to treat articulations connected by ligaments, balanced membranous tension (BMT) is used to treat articulations connected by membranes. Such articulations include those of the cranium, face, and sacrum which are connected by the dura mater (recall, the reciprocal tension membrane (RTM)). Dr. Sutherland called dysfunctions of these structures “membranous articular strains” to illustrate the articular (bone-to-bone) nature of the dysfunction, as well as the RTM that guides and limits articular motion. BMT, like BLT, is a technique that utilizes the body’s inherent forces (i.e., the PRM) to address cranial and sacral somatic dysfunction by reaching a point of balance within the membranous system. This point of balanced membranous tension is the “point in the range of motion of an articulation where the membranes are poised between the normal tension present throughout the free range of motion and the increased tension preceding the strain or fixation which occurs as a joint is carried beyond its normal physiology. Thus it is the most ‘neutral’ position possible under the influence of all the factors responsible for the existing pattern – all attendant tensions have been reduced to an absolute minimum.”[5] It is at this point that the PRM, through the pull of the membranes and the potency in the CSF, can most effectively correct the dysfunction.[2,11]

Each dysfunction is unique in its characteristics; thus, the precise motions necessary to achieve a point of balanced membranous tension will vary. Several methods may be used, including exaggeration, direct action, disengagement, opposite physiologic motion, and molding.[5,10,11] Each of these are discussed below. Sometimes, a combination of methods is applied to secure a point of balance.

Exaggeration (Indirect Action)

Exaggeration is synonymous to indirect action. In this method, an articulation’s abnormal relationship is increased or “exaggerated” to arrive at the point of balanced tension. It is the preferred method for most dysfunctions in patients 6 years of age and older. It is not used in acute head trauma due to the increased risk of intracranial hemorrhage from exaggerating malalignment of an articulation, or in acute headache where exaggeration may exacerbate symptoms.[10,11]

Direct Action

Direct action is a method in which the path of the strain is retraced, bringing the parts as far as they can easily move toward the position they had before being strained. The articulation is brought back toward a normal position to achieve a point of balanced tension. This method is often utilized in acute head trauma and in children under 6 years of age, especially in the setting of overlapping sutures.[10,11]

Disengagement

Disengagement is a method to release locking between articulations that have been forcefully approximated. In this method, the physician applies either compression or traction to disengage articular surfaces. Disengagement often precedes exaggeration and direction action to achieve a point of balanced tension.[5,10,11]

Decompressions and lifts are common techniques used to release restricted articulations. Decompressions and lifts may be thought of as variations of balanced membranous/ligamentous tension techniques that primarily use the principle of disengagement. Decompression is used to release an articulation (e.g., OA joint) that has been compressed (often traumatically), while a lift is used to release a bone or bones (e.g., the cranial vault) from its articulations by drawing the bone(s) peripherally.[5,10,11] Lift techniques also engage the membranes (e.g., falx cerebri, tentorium cerebelli) allowing balancing of tension within the meninges.[12]

Opposite Physiological Motion

Opposite physiological motion is a combination of direct action and exaggeration. In this method, one part of an articulation is moved toward the physiological position (i.e., direct action) and the other part is held away from the physiological position (i.e., exaggeration). It is infrequently utilized, but in the hands of an experienced physician may be useful for traumatic dysfunctions where normal motion has been severely disrupted.[5]

Molding

Molding is "a form of direct action used to normalize the contours of bones when there has been an intraosseous warping."[5] Recall that intraosseous means within a given bone, not involving articulation between bones. Molding is most utilized in the infant cranium, where growing bones have the most potential to change shape. Vault bone changes seen in plagiocephaly are a common indication for molding.

Augmenting Treatment

While the above methods are used to secure the point of balanced membranous tension, there are several ways to augment the correction of a dysfunction that has been brought to a balance point. Two will be discussed below: fluid technique and respiratory assist.

Fluid Technique (Directing the Tide/Fluctuation of the Cerebrospinal Fluid)

Fluid technique, also called 'directing the tide' or 'fluctuation of the cerebrospinal fluid,' is an approach to treatment that can be applied anywhere in the body but is often utilized in treating the cranium. Fluid techniques are focused on the movement of the CSF and how this movement can be used therapeutically. The motion of the CSF may be used to augment or assist the release of an articulation or membrane (e.g., V-Spread for the occipitomastoid suture); in some techniques, influencing the motion of the CSF is the primary objective (e.g., compression of the 4th ventricle).[5,10,11]

Recall that the CSF fluctuates in a two-phase cycle, causing a tide-like phenomenon. Note that fluctuation of fluid is different from circulation, such as blood circulating through the vasculature. This fluctuation normally occurs between 10-14 times per minute. The fluctuant waves of the CSF can be directed and focused to any lesioned area in the cranium either to enhance a treatment's effectiveness or to serve as a main activating treatment force. When the point of BMT is reached in a treatment, gently touching a point on the head at the longest contralateral diameter across from the lesioned area will induce a fluid wave through the tissues and across the lesioned area. This focused fluid wave makes CSF fluctuations more available to the lesioned area to assist in correcting the lesion and restoring health in the tissues. A lesioned area will initially cause a rebound fluid wave back to the point of impulse, but with repeated oscillation of this fluid wave (i.e., back and forth across the diameter between the point of impulse and the lesioned area), the fluid wave will eventually travel freely through the lesioned area without rebound.[5,10]

Respiratory Assist

Respiratory assistance from the patient can help enhance the phases of the PRM (i.e., flexion and extension), thereby enhancing the overall effectiveness of a treatment. For example, holding inhalation (for as long as possible) can be used to enhance flexion and external rotation, while holding exhalation (for as long as possible) can be used to enhance extension and internal rotation. This enhances the PRM as cervical muscles of respiration apply distant, external forces to act upon on the cranial base and these forces are suddenly relaxed at the involuntary end of such sustained breath holding. Other involuntary breathing events such as coughing or sneezing also serve to enhance treatment.[5,10,11]

Technique Contents:

Decompression

- Occipital Condylar Parts
- Occipitoatlantal (OA) Joint
- Sacrum
- Temporomandibular Joint (TMJ)
- Occipitomastoid Suture Pressure Release

Fluid Technique

- Compression of the Fourth Ventricle (CV4)
- Venous Sinus Drainage
- V-Spread

Lift

- Frontal Bone(s)
- Parietal Bones

Balanced Membranous Tension (BMT)

- Cranial Base Strains
- Sacral Base Dysfunctions
- Temporal Bone Dysfunctions

Decompression of Occipital Condylar Parts[2,5,9]

Mechanism: Decompression of the occipital condylar parts resolves intraosseous dysfunction between the squamous, basilar, and lateral parts of the occiput. Compression of the condylar parts of the occiput often occurs following a blow to the head or during newborn delivery. Recall the occipital condyles glide within the superior articular facets of the atlas, which converge anterosuperiorly and diverge posteroinferiorly. The location and vector of the traumatic force determines where the occipital condyles can become compressed into the facets. Complications of condylar compression include narrowing of the vertebral canal and disturbance of the primary respiratory mechanism (PRM) and cerebrospinal fluid (CSF) fluctuation. The goal is to restore symmetric palpable intraosseous tension in the condylar parts. It is advisable to follow this technique with decompression for the occipitoatlantal (OA) joint.

Example Diagnosis: Compression of the occipital condylar parts

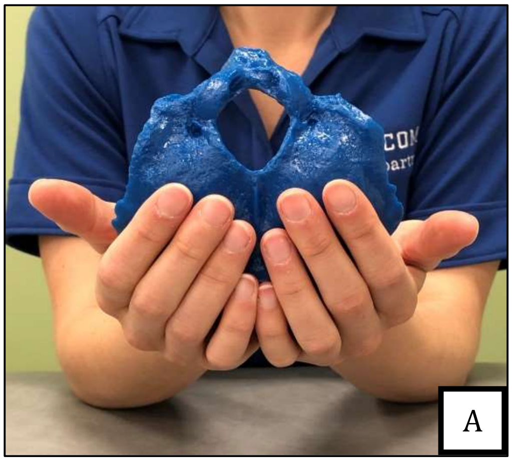
Physician Position: Sitting at the head of the table

Patient Position: Supine

Procedure:

1. Cradle the patient's head in the palms of both hands.
2. Place the fingers at the most inferior part of the occiput that is accessible with the wrists and elbows widely separated.
3. Flex the occiput on the atlas (C1) by drawing the hands slightly cephalad or, alternatively, by having the patient slightly tuck the chin. *Be careful not to flex the cervical spine past the OA joint*.
4. Flex the distal interphalangeal joints to apply superior and posterior traction on the condyles.
5. Gently, but firmly, separate the fingers while approximating the elbows, to create a posterior lateral force on the condyles.
6. Make minor adjustments to all planes until the position of best possible balance is achieved.
7. Wait for the release.* If a release is not palpated, repeat step 6.
8. After a release is palpated, return the occiput to neutral and reassess the condylar parts of the occiput.

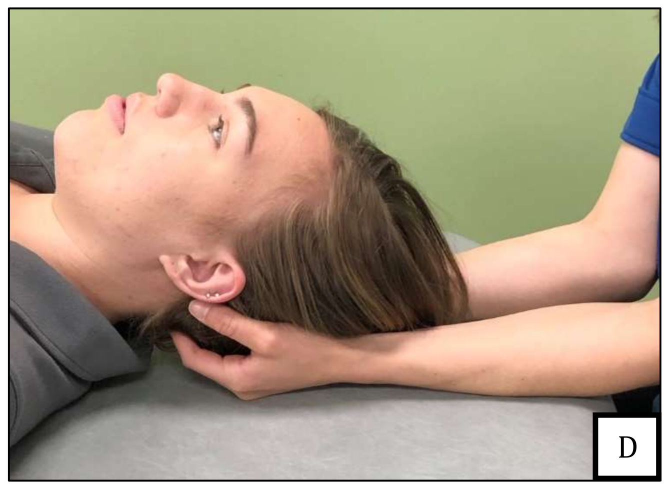
*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Inferior view of finger position for decompression of occipital condyles.

B) Inferolateral view of hand position for decompression of occipital condyles.

C) Lateral view of initial treatment position (elbows separated) for decompression of occipital condyles.



D) Lateral view of later treatment position (elbows together) for decompression of occipital condyles.

Decompression of Occipitoatlantal (OA) Joint[2,5]

Mechanism: Occipitoatlantal (OA) decompression serves to release compression in the OA joint. In a compressed OA joint, the occipital condyles are often found to be anterior on the atlas. Performing suboccipital release before performing this technique can help achieve optimal improvement at the OA joint. Additionally, this technique should be performed following decompression of the condylar parts.

Example Diagnosis: OA compression

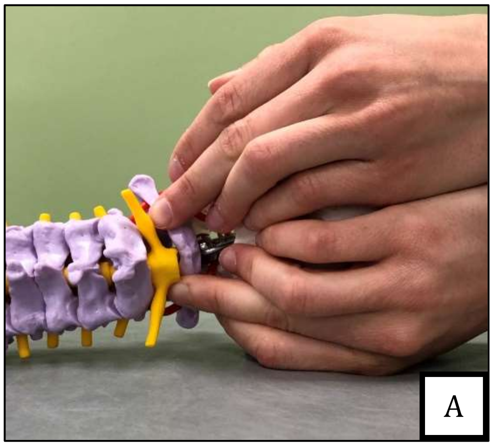
Physician Position: Sitting at the head of the table

Patient Position: Supine

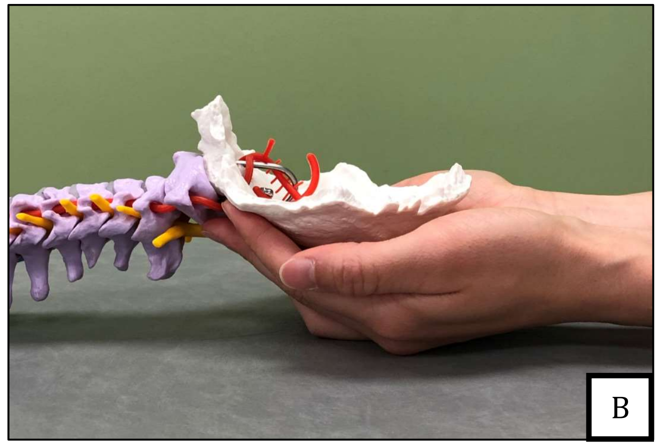
Procedure:

1. Cradle the patient's head in the palms of both hands.
2. Place the fingers at the most inferior part of the occiput that is accessible.
3. Place the pads of the middle fingers on the posterior arch of the atlas bilaterally, keeping the other fingers in place on the occiput. This contact serves to stabilize the atlas caudad, as the occiput is disengaged from the atlas as in *Step 4*.
4. While stabilizing the atlas caudad, flex the occiput on the atlas (C1) by drawing the hands slightly cephalad or, alternatively, by having the patient slightly tuck the chin. *Be careful not to flex the cervical spine past the OA joint.* This will bring the condyles more posterior and disengage the occiput from the articular facets of the atlas. This also creates a tensile force and stretch on the suboccipital ligaments and muscles.
5. Make minor adjustments to all planes until the position of best possible balance is achieved.
6. Wait for the release.* If a release is not palpated, repeat step 5.
7. After a release is palpated, return the occiput to neutral.
8. Gently return the OA joint to its neutral position, and then reassess the OA joint.

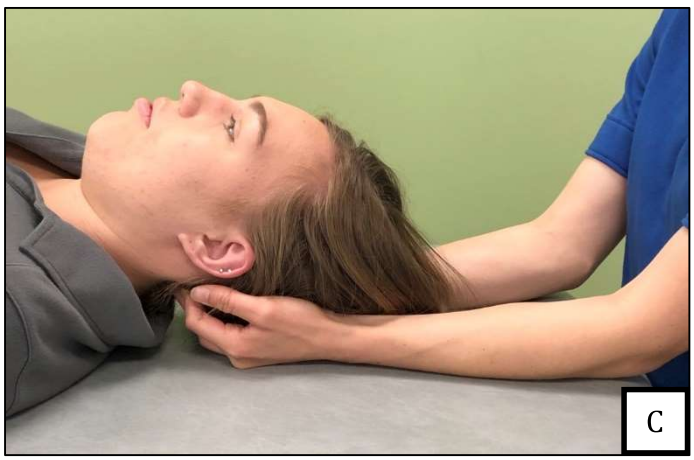
*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Inferior view of finger position for decompression of OA joint.



B) Lateral view of hand position for decompression of OA joint.



C) Lateral view of treatment position for decompression of OA joint.

Decompression of Sacrum[34]

Mechanism: Sacral decompression serves to release restrictions (e.g., compression) in the lumbosacral and/or SI joints by restoring balanced tension in the lumbosacral and/or sacroiliac ligaments and in the reciprocal tension membrane (RTM).

Example Diagnosis: Lumbosacral (L5-S1) compression

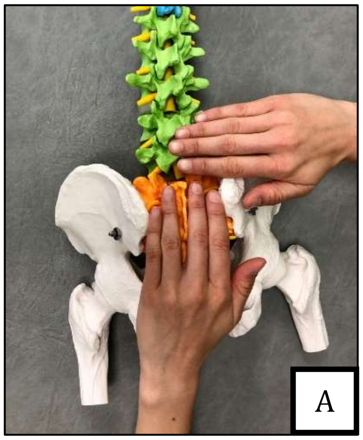
Physician Position: Seated at the side of the table

Patient Position: Supine

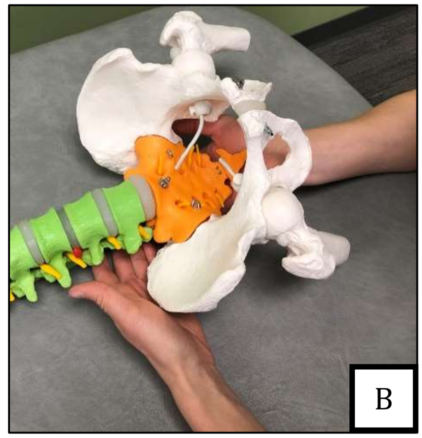
Procedure:

1. Contact the sacrum with the sacrum hold.
    a. Recall, the coccyx should lie between the thenar and hypothenar eminences of the caudad hand and the 3rd and 4th digits should contact the sacral base just below L5. The forearm may be placed between the patient's legs or underneath the leg closest to the operator. The cephalad hand should make firm contact with L5, perpendicular to the caudad hand. (The operator's hands should form a "T").
        i. *For a sacroiliac compression, place the cephalad hand underneath the ilium with fingers perpendicular to the dominant hand. Make firm contact on the medial border of the ilium with finger pads.*
2. Use the caudal elbow as a fulcrum to apply an anterior and superior force to the sacrum to disengage the ligamentous connections by shifting weight into the elbow on the table.
3. Simultaneously, use the cephalad hand to apply a slight anterior and inferior force to L5 to compress the ligamentous connections of the lumbosacral region.
    a. *For a sacroiliac compression, use the forearm as a fulcrum to apply a lateral traction on the ilium to disengage the ligamentous connections between the ilium and the sacrum.*
4. Make minor adjustments to all planes until the position of best possible balance is achieved.
5. Wait for the release* If a release is not palpated, repeat step 4.
6. After a release is palpated, return the sacrum to its neutral position and then reassess the sacrum.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Posterior view of hand position (i.e. sacrum hold) for decompression of sacrum.



B) Anterior view of hand position (i.e. sacrum hold) for decompression of sacrum.

C) Superolateral view of treatment position for decompression of sacrum.

Decompression of Temporomandibular Joint (TMJ)[35]

Mechanism: Decompression of the temporomandibular joint (TMJ) serves to release restrictions (e.g., compression) in the TMJ by restoring balanced tension in the ligamentous and membranous connections of the TMJ.

Example Diagnosis: Restricted right TMJ

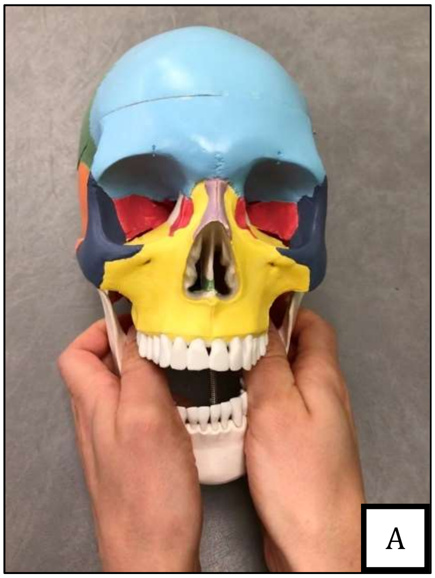
Physician Position: Standing at the side of the table (patient supine) or standing facing the patient (patient seated)

Patient Position: Supine or seated

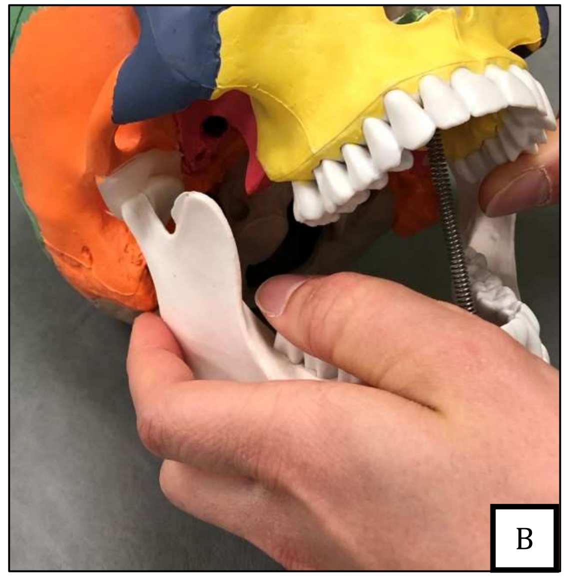
Procedure:

1. With gloved hands, gently place thumbs on occlusal surfaces of the lower molars bilaterally.
2. Wrap fingers around the ramus and angle of the mandible bilaterally.
3. Gently apply inferior traction to distract the mandibular heads from the articular facets of the temporal bones.
4. Make minor adjustments to all planes until the position of best possible balance is achieved.
5. Wait for the release.* If a release is not palpated, repeat step 4.
6. Gently return the mandible to its neutral position, and then reassess the TMJ joint.

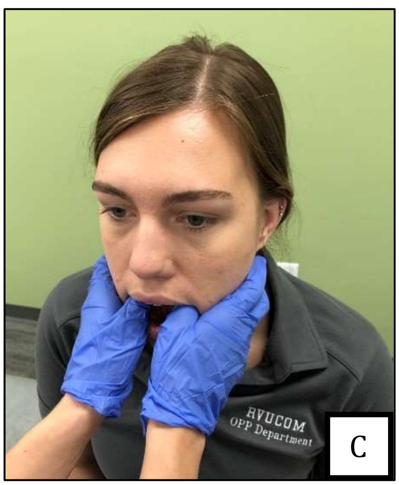
*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



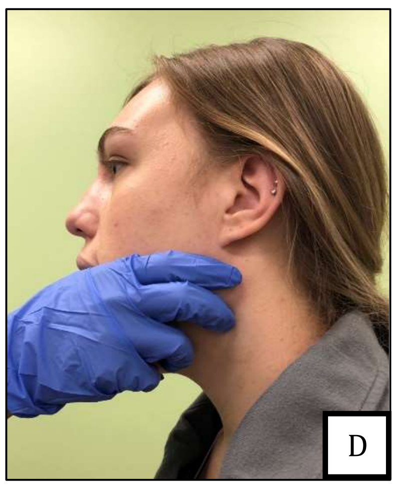
A) Anterior view of hand position for decompression of TMJ.



B) Anterolateral view of finger position for decompression of TMJ.



C) Anterosuperior view of treatment position for seated decompression of TMJ.



D) Lateral view of treatment position for seated decompression of TMJ.

E) Anterolateral view of treatment position for supine decompression of TMJ.

Occipitomastoid Suture Pressure Release[33]

Mechanism: The occipitomastoid (OM) suture pressure technique can be applied to release tension and increase mobility of the OM suture either unilaterally or bilaterally. This technique can be performed to address biomechanical somatic dysfunction of the OM suture but can also be used to influence the neurovascular structures associated with it. For example, the occipitomastoid suture forms the posterolateral wall of the jugular foramen, so decompression of the OM suture can help to release the jugular foramen and the cranial nerves that exit through it. This technique is particularly useful to address autonomic imbalance through its potential effect on the vagus nerve.

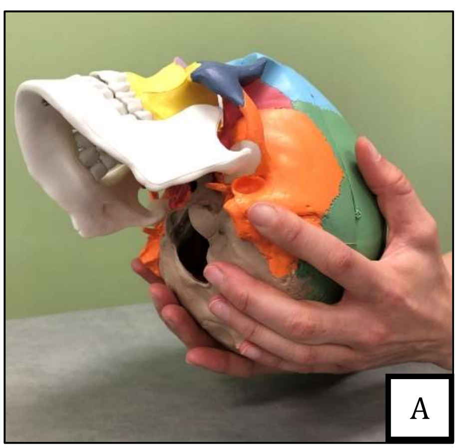
Example Diagnosis: Occipitomastoid suture restriction bilaterally

Physician Position: Sitting at the head of the table

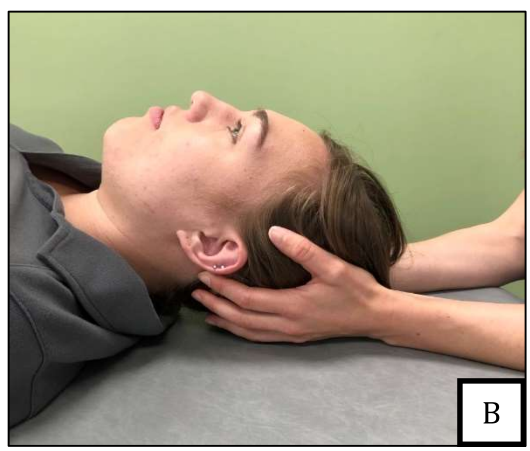
Patient Position: Supine

Procedure:

1. The physician's index finger is placed on the mastoid portion of the temporal bone just anterior to the OM suture. The third digit of the same hand is placed just posterior to the mastoid suture on the occipital bone. To treat bilaterally, this same hand placement can be replicated on the opposite OM suture.
2. The index and third fingers apply gentle pressure to engage the bones on either aspect of the OM suture.
3. The index and third fingers provide a gentle superior and opposing traction pressure to engage the areas along the OM suture where restriction is present.
4. Once the area of restriction is engaged, the principles of myofascial release, soft tissue, disengagement, or balanced membranous tension can be applied as indicated.
5. Once a release is palpated, return to neutral and reassess. Repeat as needed to achieve desired results.



A) Inferolateral view of hand position for OM Suture Pressure Release



B) Lateral view of treatment position for OM Suture Pressure Release

Compression of the Fourth Ventricle (CV4)[5,12]

Mechanism: The compression of the fourth ventricle (CV4) technique normalizes the fluctuation of the cerebrospinal fluid (CSF). Many of the body's physiologic centers are located near the floor of the fourth ventricle. Therefore, compressing the fourth ventricle and its surrounding structures restores balance in the autonomic and neuroendocrine systems. Since the fourth ventricle has a direct connection to the subarachnoid space, there is an essential interchange between fluids of the body, so improving motion of the fourth ventricle will affect the function of the entire system. The general concept in this technique is to increase tension on the tentorium cerebelli to draw it inferiorly, which then gently shifts the cerebellum towards the fourth ventricle, reducing the ventricle's volume. This, along with extension of the cranial mechanism, is applied until a still point is achieved and the primary respiratory mechanism (PRM) resets.[5,12]

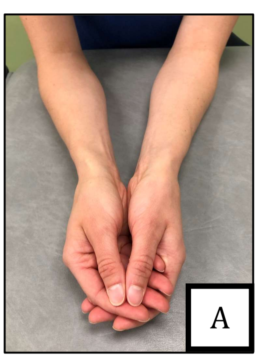
Example Diagnosis: Decreased cranial motion

Physician Position: Sitting at the head of the table

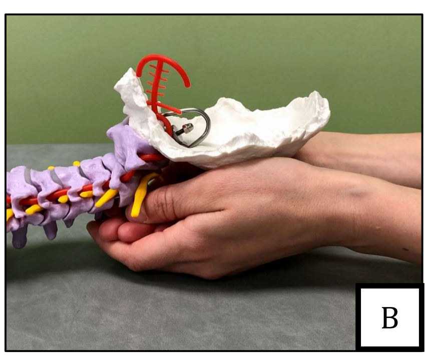
Patient Position: Supine

Procedure:

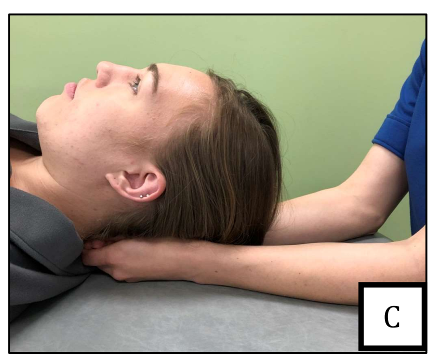
1. Overlap the fingers of both hands and slightly approximate the thenar eminences underneath the patient's head to cradle the head. The thenar eminences of both hands should contact the lateral angles of the occiput. Be sure that contact is made solely with the occipital squama and *not* the mastoid process or the occipitomastoid suture.
2. Maintaining this contact, gently squeeze the palms of the hands together, thereby approximating the thenar eminences. When doing this, consider the occiput as a saucer and attempt to "deepen the saucer."[5] This will induce the extension phase of the PRM.
3. Maintain this compression and the extension phase, even as the cranium moves through cycles of flexion and extension.
4. While maintaining compression and cranial extension, the rate of the PRM will slow down and the mechanism will reach a still point, where flexion and extension cease (usually after several minutes). Often, the still point is perceived as an idling in the mechanism—think of a quiet, idling engine.
5. Maintain extension through the still point until a release is palpated in the tissues (the occiput itself may become softer) and the PRM restarts with improved amplitude and motion. Then release compression. Sometimes, these changes are preceded by a noticeable sigh from the patient or a change in breathing pattern.
6. Reassess the PRM by waiting for several cycles of cranial flexion and extension to pass.
7. Return the occiput to neutral and reassess.



A) Superior view of hand position for CV4.



B) Lateral view of hand position for CV4.



C) Lateral view of treatment position for CV4.

Venous Sinus Drainage[10]

Mechanism: This technique consists of a sequence of techniques to release the dural venous sinuses to improve venous drainage from the cranium. The order of techniques is important—open the terminal drainage points before the more distal sinuses. Because the venous sinuses are formed within dural membrane, the goal is to engage the membranes as opposed to the bones. To facilitate venous drainage from the cranium to the thoracic cavity, before performing this series of techniques, it is advisable to remove somatic dysfunction at the thoracic outlet, cervical spine, and occipitoatlantal (OA) joint.

Example Diagnosis: Headache, sinus congestion, etc.

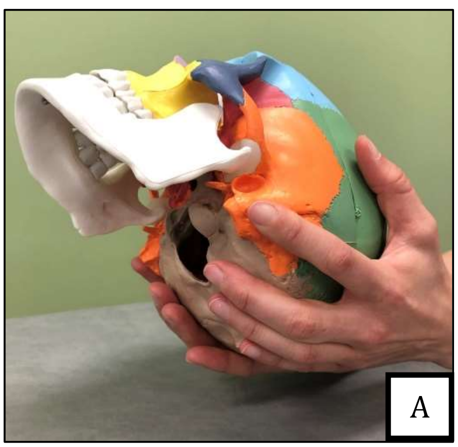
Physician Position: Sitting at the head of the table

Patient Position: Supine

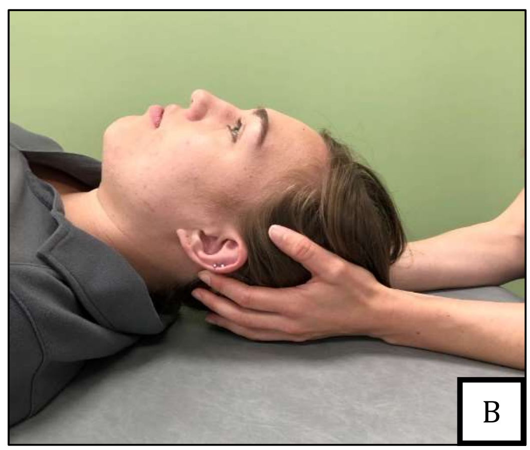
Procedure:

1. **Suboccipital release** (see "Chapter 4: Cervical Region" in *RVUCOM OPP I & II Manual*)

2. **Sigmoid sinus release** (Images A-B)
    a. Place index finger along the lateral border of the occipitomastoid (OM) suture on the temporal bone (the mastoid portion). Place the middle finger along the medial border of the OM suture on the occiput. Engage the membrane with a gentle lateral traction across the suture. Maintain engagement until a release and softening are palpated. Often, a softening of the bone will be appreciated with a release.

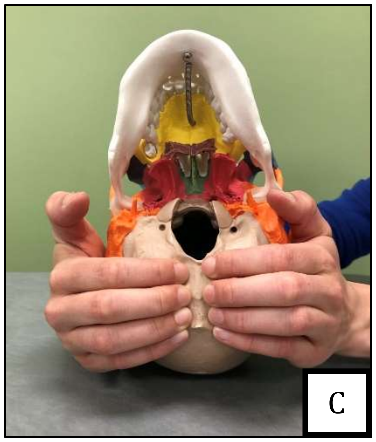


A) Inferolateral view of hand position for sigmoid sinus release.

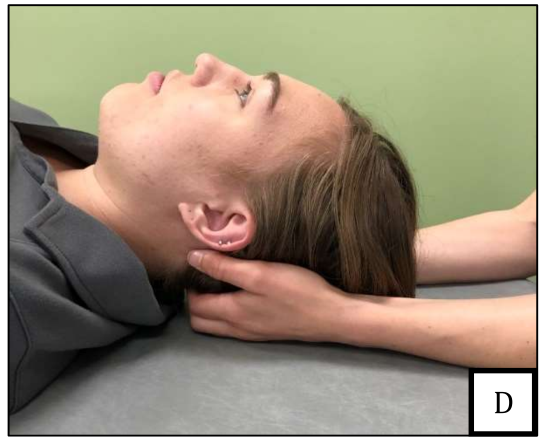


B) Lateral view of treatment position for sigmoid sinus release.

3. **Occipital sinus release** (Image C-D)
   a. Move fingers inferior to external occipital protuberance along the midline of occipital bone. Engage the membranes of the occipital sinus with all four finger pads by applying gentle distraction laterally and between each finger. Maintain engagement until a release and softening are palpated.

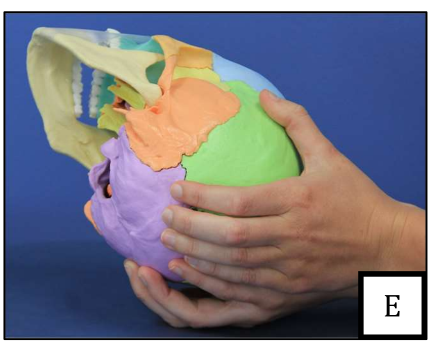


C) Inferior view of hand position for occipital sinus release.



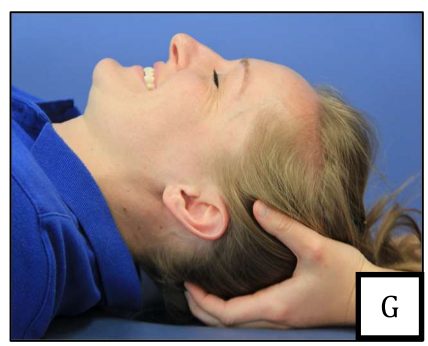
D) Lateral view of treatment position for occipital sinus release.

4. **Transverse sinus release** (Image E-G)
   a. Place fingertips just lateral to the external occipital protuberance and along the occipital ridge.
   b. Engage tentorium cerebelli membrane at the transverse sinus
   c. Hold until a release is palpated.



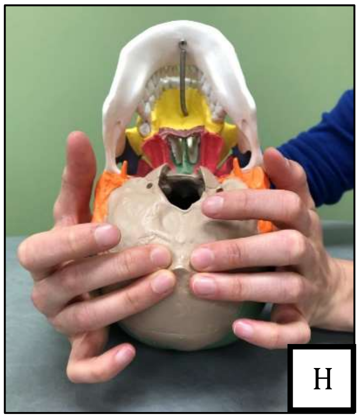
E) Inferior-oblique view of hand placement for transverse sinus palpation

F) Inferior-oblique view for hand placement during treatment of

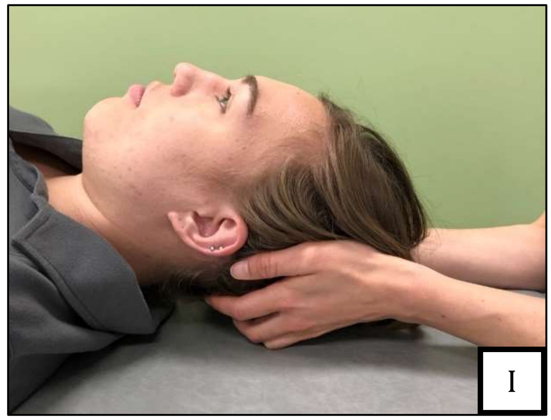


G) Lateral view of treatment of transverse sinus release

5. **Confluence of sinuses release** (Image H-I)
    a. Place pads of middle and fourth fingers above and below the external occipital protuberance on each side and support head with the rest of each hand. Engage the membrane at confluence of sinuses by applying gentle pressure perpendicular to the bone. Maintain engagement until a release and softening are palpated.

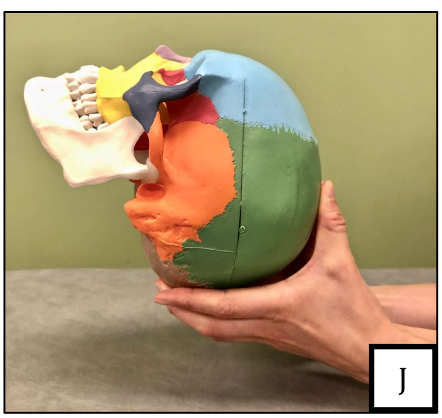


H) Inferior view of hand position for confluence of sinuses release.

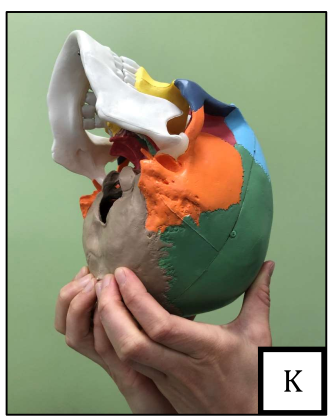


I) Lateral view of treatment position for confluence of sinuses release

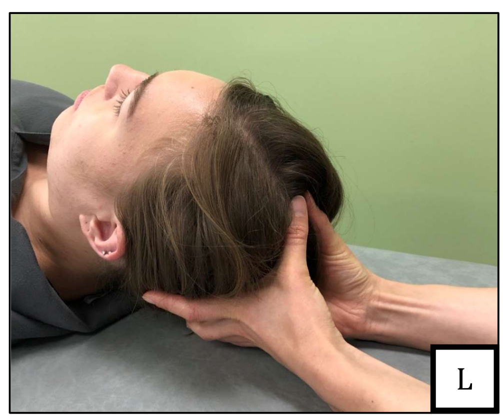
6. **Straight sinus release** (Image J-L)
    a. Places fingertips of both hands on either side of the occipital ridge and gently place thumbs on either side of the sagittal suture at the vertex of the skull. Apply gentle pressure from the fingers and thumbs towards each other along the direction of the straight sinus (from inion towards the vertex) in order to engage the dura of the straight sinus. Maintain engagement until a release and softening are palpated.



J) Lateral view of hand position for straight sinus release.

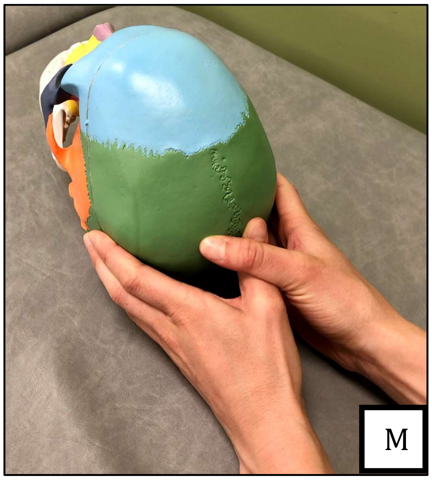


K) Inferolateral view of hand position for straight sinus release.



L) Superolateral view of treatment position for straight sinus release.

7. **Posterior sagittal sinus release** (Image M-O)
    a. Cross thumbs and place them on the external occipital protuberance while supporting the patient's head in a flexed position. Engage the membrane by applying gentle pressure perpendicular to the bone and in an inferolateral direction. Maintain until a release and softening are appreciated.
    b. Once a release is palpated, move thumbs anteriorly along the sagittal suture and re-engage barrier until a release and softening are palpated. Continue treatment until the coronal suture is reached.

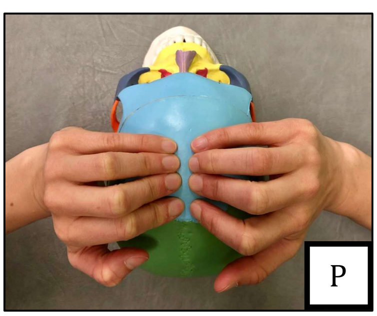


M) Superolateral view of hand position for posterior sagittal sinus

N) Superolateral view of treatment position for proximal posterior sagittal sinus release.

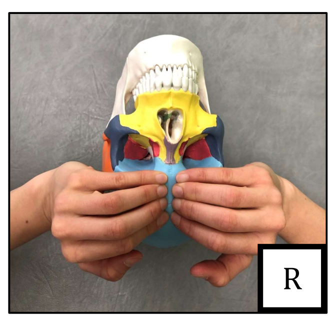
O) Superolateral view of treatment position for distal posterior sagittal sinus release.

8. **Anterior sagittal sinus release** (Image P-S)
    a. Place fingertips on either side of metopic suture of the frontal bone, beginning at the coronal suture. Engage the membrane by applying gentle pressure perpendicular to the bone and in a lateral direction. Maintain until a release and softening are palpated.
    b. Once a release is palpated, move fingers anteriorly along the metopic suture repeating the treatment until the frontonasal suture is reached.

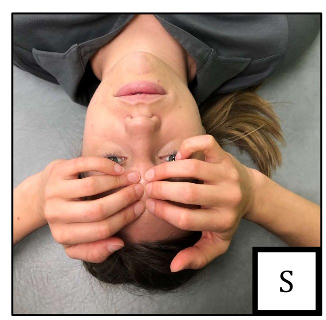


P) Superior view of hand position for proximal anterior sagittal sinus release.

Q) Anterior view of treatment position for proximal anterior sagittal sinus release.



R) Anterior view of hand position for distal anterior sagittal sinus release.



S) Anterior view of treatment position for distal anterior sagittal sinus release.

V-Spread[2,10]

Mechanism: The V-spread technique can be applied to any peripheral cranial suture to release tension and increase mobility. The V-spread is a type of fluid technique, which uses fluid fluctuation as the activating treatment force. Sutures commonly treated with this technique are the occipitomastoid, frontonasal and nasomaxillary. While one hand is used to disengage the restricted suture with traction, the other hand directs the tide (i.e., induces fluctuation of fluid) towards the suture from a contralateral point at greatest distance away from the suture.

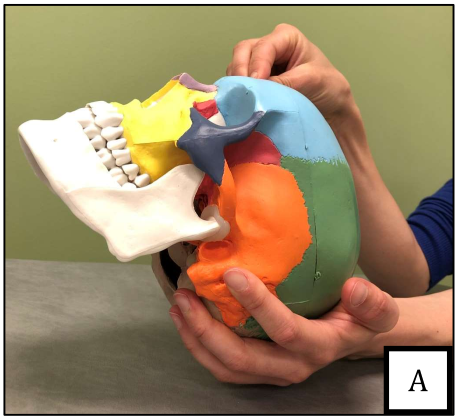
Example Diagnosis: Restricted left OM suture

Physician Position: Sitting at the head of the table

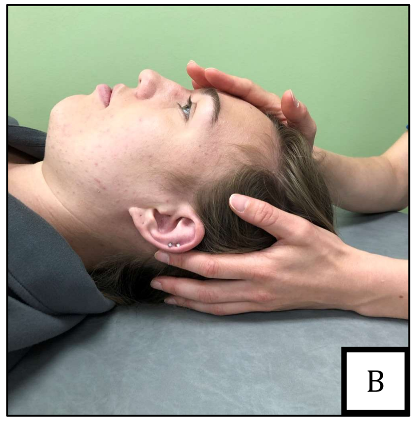
Patient Position: Supine

Procedure:

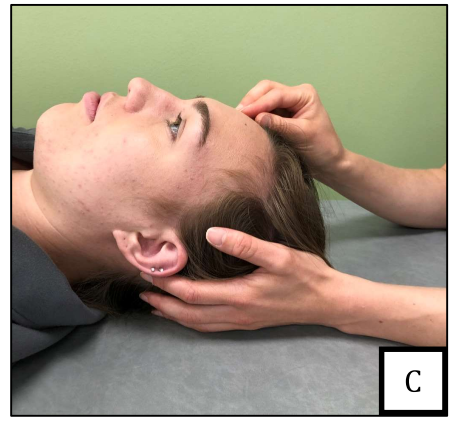
1. Place pads of index and middle fingers on either side of the occipitomastoid (OM) suture and support the head with the rest of the hand.
   a. *Since this technique can be applied to any peripheral suture, for longer sutures, use the palmar surface of these two fingers; for shorter sutures, use just the fingertips.*
2. With the contralateral palm, contact the area on the head that is longest in diameter from the suture.
3. With the finger pads at the OM suture, induce a gentle fluid wave by applying gentle pressure at the finger pads.
4. Once a gentle impulse is perceived in the contralateral palm, replace the palm with fingertips clustered at the point of maximal impulse. This location is called "the point of impulse." It is this point on the cranium at which a fluid wave will be best palpated and propagated as in *Steps 7-10*.
5. Gently spread the index and middle fingers to disengage OM suture, using just enough force to meet the tension within the suture.
6. Note the motion of the primary respiratory mechanism (PRM).
7. Now, induce a fluid wave from the clustered fingers at the point of impulse and direct it towards the left OM suture.
8. When the fluid wave reaches the OM suture, engage the new barrier across the OM suture with the index and middle fingers.
9. Induce another fluid wave but this time originating from the contact at the OM suture and direct it back towards the point of impulse. Note that this fluid wave will "bounce back" between the two finger contacts if restriction in the suture remains.
10. Continue this back-and-forth fluid wave motion at a rate that matches the patient's PRM until a melting or softening is palpated at the OM suture and the fluid wave seems to dissipate through the OM suture (i.e., the fluid wave no longer "bounces back" between your contacts). If the rate is too rapid, nausea or headache might ensue.
11. Return the OM suture to its neutral position and reassess.



A) Lateral view of hand position for V-spread.



B) Lateral view of treatment position for V-spread using palm.



C) Lateral view of treatment position for V-spread using cluster of fingers.

Lift for Frontal Bone(s)[12]

Mechanism: This technique applies the principle of disengagement to release the sutures of the frontal bone(s) from their articulations, in addition to releasing tension in the falx cerebri, allowing improvement in motion with the primary respiratory mechanism (PRM).[12]

Example Diagnosis: Internally rotated frontal bones

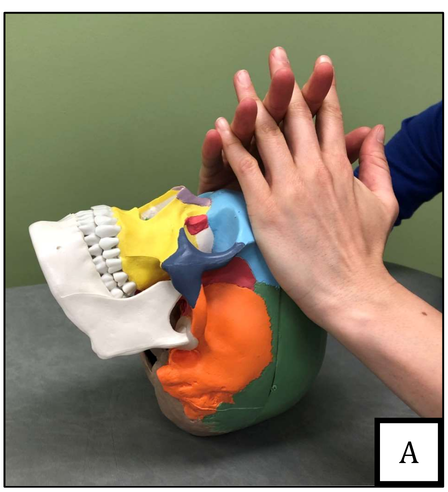
Physician Position: Sitting at the head of the table

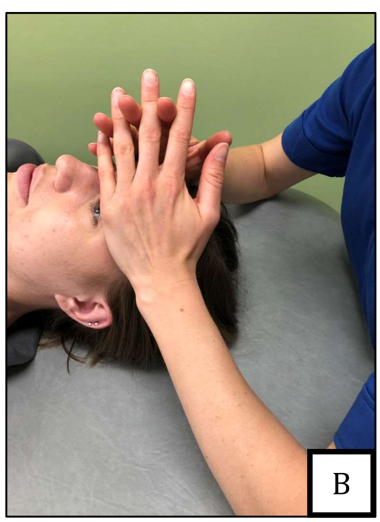
Patient Position: Supine

Procedure:

1. Rest elbows on the table; they will serve as the fulcrum to gain leverage to perform this technique.
2. Contact the lateral angles of the frontal bone with hypothenar eminences and interlace fingers above the metopic suture.
3. Palpate the primary respiratory mechanism (PRM). Note that during cranial flexion, the lateral angles of the frontal bone(s) will move laterally.
4. During cranial extension, gently pinch the interlaced fingers together (approximate the fingernails) to pull the palms together. Use the elbows on the table as a fulcrum to perform this action. This will apply a gentle medial, compressive force at the lateral angles to disengage the frontal bones from their adnexa.
5. During cranial flexion, maintain this medial force and gently lift the frontal bones anteriorly, lifting them off their adnexa. This puts traction on the falx cerebri along its attachments between the frontal bone and the sphenoid.[12]
6. Make minor adjustments to all planes until the position of best possible balance is achieved.
7. Wait for the release.* If a release is not palpated, repeat step 6.
8. During cranial extension, return the frontal bones to their neutral position, and then reassess the PRM by waiting for several cycles of cranial flexion and extension to pass.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.





A) Lateral view of hand position for lift for frontal bone.

B) Lateral view of treatment position for lift for frontal bone.

Lift for Parietal Bones[12]

Mechanism: This is technique applies the principle of disengagement to release the sutures of the parietal bones from their adnexa, in addition to releasing tension in the tentorium cerebelli, allowing improvement in motion with the primary respiratory mechanism (PRM).

Example Diagnosis: Internally rotated parietal bones

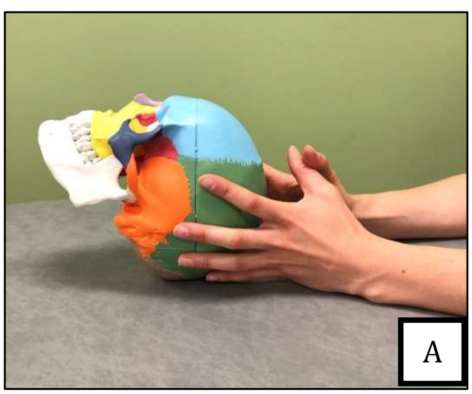
Physician Position: Sitting at the head of the table

Patient Position: Supine

Procedure:

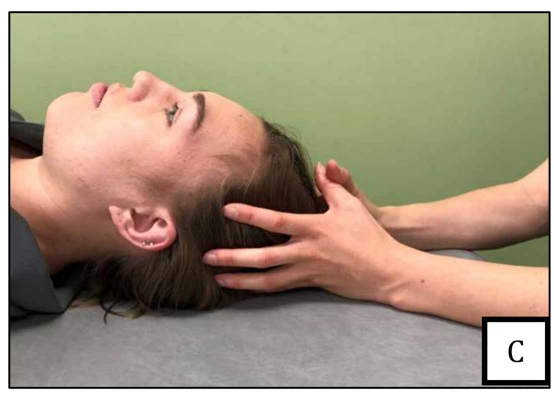
1. Place fingers over the inferolateral aspects of the parietal bones bilaterally and cross thumbs above the head.
2. Palpate the primary respiratory mechanism (PRM). Note that during cranial flexion, the inferolateral aspects of the parietal bones will move laterally.
3. During cranial extension, apply a gentle medial force from the fingers to disengage them from their adnexa.
4. Draw the parietal bones posteriorly to unlock the parietal notch from its articulation with the temporal bone. Unlocking this notch will allow the parietals to be successfully drawn superiorly, as in *Step 5*.
5. During cranial flexion, maintain this medial force and lean body back to draw the parietal bones superiorly, lifting them off their adnexa. This puts a transverse stress across the tentorium cerebellum.
6. Make minor adjustments to all planes until the position of best possible balance is achieved.
7. Wait for the release.* If a release is not palpated, repeat step 6.
8. During cranial extension, return the parietal bones to their neutral position, and then reassess the PRM by waiting for several cycles of cranial flexion and extension to pass.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Lateral view of hand position for lift for parietal bones.

B) Anterior view of hand position for lift for parietal bones.



C) Lateral view of treatment position for lift for parietal bones.

BMT for Cranial Base Strain[2,5,12]

Mechanism: Cranial strains are manifestations of a membranous strain or imbalance at the sphenobasilar synchondrosis (SBS). Treating cranial strains therefore involves correcting the lesion at the SBS. Balanced membranous tension (BMT) technique is an effective modality to address cranial base strains. The most common principles applied to treat cranial strains include direct or indirect (exaggeration) action, with indirect action being most commonly used.[12] In this technique, find the point of maximal ease in the range of motion of the cranial pattern (i.e., the balance point) and maintain this until a release is appreciated.

Example Diagnosis: Right sidebending-rotation

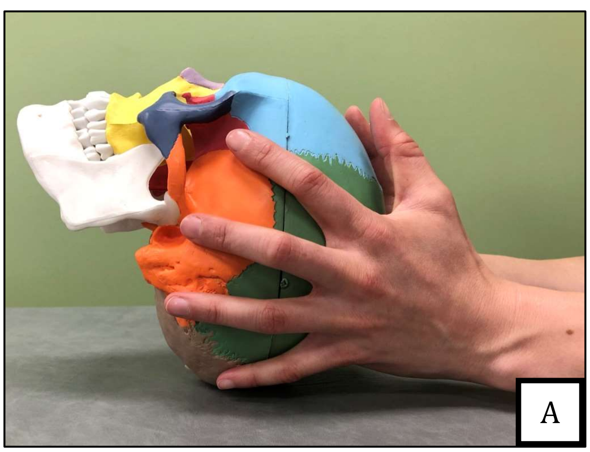
Physician Position: Sitting at the head of the table

Patient Position: Supine

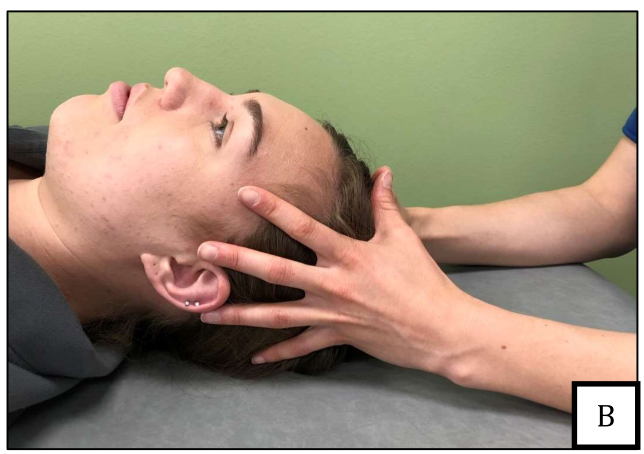
Procedure:

1. Contact the cranium with the vault hold.
2. Palpate the primary respiratory mechanism (PRM) and the reciprocal tension membrane (RTM).
3. Gently encourage the cranium into the direction of ease (i.e., the direction of the lesion).
    a. *For a right sidebending-rotation strain, gently spread the right index and the fifth fingers and move them caudad. Simultaneously, gently approximate the left index and fifth fingers and move them cephalad.*
4. Make minor adjustments to all planes until the position of best possible balance is achieved.
5. Wait for the release.* If a release is not palpated, repeat step 4.
6. Return the cranium to its neutral position and then reassess the PRM by waiting for several cycles of cranial flexion and extension to pass.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Lateral view of hand position (i.e. vault hold) for BMT for cranial base strains.



B) Lateral view of treatment position (i.e. vault hold) for BMT for cranial base strains.

BMT for Sacral Base Strain[2,34]

Mechanism: BMT technique for sacral base strains is an effective technique to resolve uncomplicated sacral strains with the ligamentous or membranous attachments. For example, if a traumatic sacral somatic dysfunction or compression of the SI joint(s) is present, this technique would likely be unsuccessful until these other dysfunctions are addressed. Sacral compressions are typically treated with the decompression technique included elsewhere in this chapter.

Example Diagnosis: Left on left sacral torsion

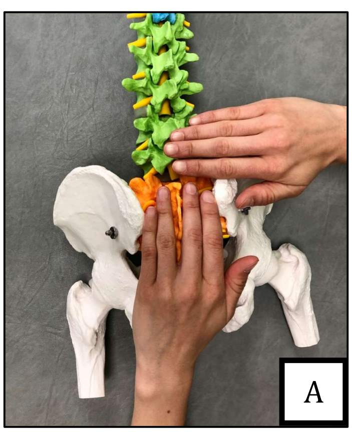
Physician Position: Seated at the side of the table

Patient Position: Supine

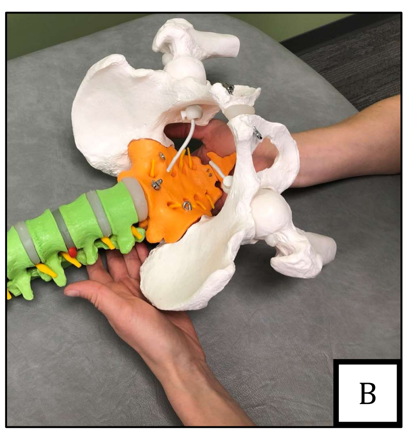
Procedure:

1. Contact the sacrum with the sacrum hold.
    a. Recall, the coccyx should lie between the thenar and hypothenar eminences of the caudad hand and the 3rd and 4th digits should contact the sacral base just below L5. The forearm may be placed between the patient's legs or underneath the leg closest to the operator. The cephalad hand should make firm contact with L5, perpendicular to the caudad hand. (The operator's hands should form a "T").
2. Use the caudal elbow as a fulcrum to apply an anterior and superior force to the sacrum to disengage the ligamentous connections by shifting weight into the elbow on the table.
3. Gently encourage the sacrum into the direction of ease (direction of the lesion) and slightly exaggerate this position.
4. Make minor adjustments to all planes until the position of best possible balance is achieved.
5. Wait for the release.* If a release is not palpated, repeat step 4.
6. Return the sacrum to its neutral position and then reassess the PRM by waiting for several cycles of cranial flexion and extension to pass.

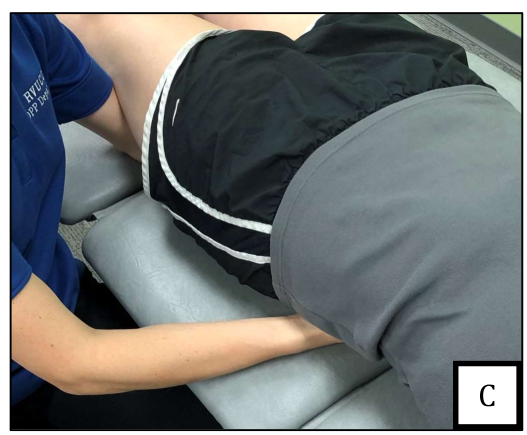
*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Posterior view of hand position (i.e. sacrum hold) for BMT for sacral base strains.



B) Anterior view of hand position (i.e. sacrum hold) for BMT for sacral base strains.



C) Superolateral view of treatment position for BMT for sacral base strains.

BMT for Temporal Bone Dysfunction[5]

Mechanism: BMT technique for temporal bone dysfunction is an effective technique to resolve temporal bone dysfunction caused by imbalances in membranous tension. Common dysfunctions of the temporal bone include either an internally or externally rotated temporal bone. Note that several attempts may be needed to correct a temporal bone dysfunction. This technique can treat either both temporal bones simultaneously or one at a time, in which the contralateral hand serves to stabilize the non-dysfunctional temporal bone.

Example Diagnosis: Internally rotated temporal bone(s)

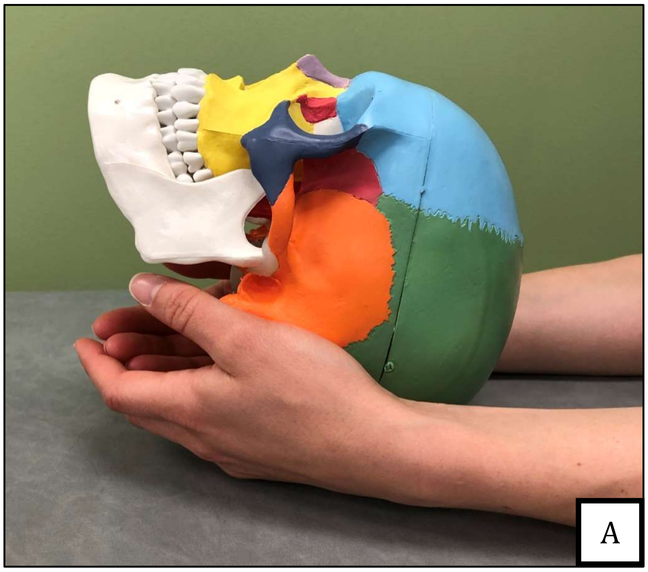
Physician Position: Sitting at the head of the table

Patient Position: Supine

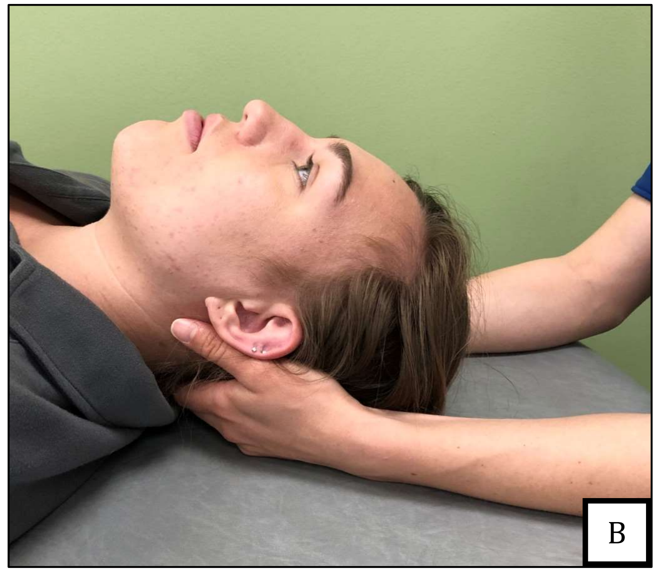
Procedure:

1. Contact the cranium with the base (Becker hold). Recall, the first metacarpal phalangeal (MCP) joints should contact the mastoid processes in a relaxed fashion.
2. Gently encourage the dysfunctional temporal bone into the direction of ease.
3. Slightly exaggerate this direction of motion either by contact and/or by rotation of the patient's head.
    a. For an externally rotated temporal bone, turn the patient's head slightly to the contralateral side.
    b. For an internally rotated temporal bone, turn the patient's head slightly to the ipsilateral side.
4. Find the point of balanced tension. It may be necessary to make minor adjustments in various planes of motion to best achieve this point. Note that manipulation of the occiput can be used to help achieve a balance point.
    a. For an externally rotated temporal bone(s), bring the occiput into flexion while drawing the mastoid tips posteromedially with the first MCP joints.
    b. For an internally rotated temporal bone(s), bring the occiput into extension and the mastoid tips anterolaterally with the first MCP joints.
5. Make minor adjustments to all planes until the position of best possible balance is achieved.
6. Wait for the release.* If a release is not palpated, repeat step 5.
7. Return the temporal bone(s) to its neutral position and reassess the PRM by waiting for several cycles of cranial flexion and extension to pass.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.



A) Lateral view of hand position (i.e. base hold) for BMT for temporal dysfunction.



B) Lateral view of treatment position (i.e. base hold) for BMT for temporal dysfunction.

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Chapter 9
Female Reproductive System

"And whatever the mother's state of health or illness be, such is also the state of the child. Just so, what grows in the soil is nourished from the soil and whatever the condition of the soil, so is the condition of what grows in that soil."

-Hippocrates

Contents:

NOTES

Autonomics[10]

Autonomic Spinal Levels for the Female Reproductive System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Gonads	T10-11	S2-4
Uterus and Cervix	T10-L2	S2-4
Erectile Tissue of Clitoris	T11-L2	S2-4
Fallopian Tubes	T10-11	S2-4

Chapman's Reflex Points for the Female Reproductive System[2]

	Anterior Point Location	Posterior Point Location
Clitoris/Vagina	Area on the superior, medial aspect of the posterior thigh 3-5 inches long and 1.5-2 inches wide	Articulation of the coccyx with the sacrum
Ovaries	Following the round ligament from superior to inferior border of pubic ramus	Intertransverse space between T9 and T10 and between T10 and T11
Uterus	On the superior aspect of the junction of the pubic ramus with the ischium	Between PSIS and spinous process of L5
Broad Ligament	From the greater trochanter inferiorly on the lateral aspect of the femur to within 2 inches of the knee joint	Between PSIS and spinous process of L5
Fallopian Tubes	Midway between the acetabulum and greater sciatic notch	Between PSIS and spinous process of L5

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Ovary

Sympathetic innervation to the ovary decreases ovulation. The role of parasympathetic innervation to the ovary is not well known; however, the autonomic nervous system regulates the vasculature to the organ.

Fallopian Tube

The role of sympathetic and parasympathetic innervation to the fallopian tube is not well known, however, the autonomic nervous system regulates the vasculature to the organ.

Uterus

Sympathetic and parasympathetic innervation regulates the vasculature supplying the uterus. Parasympathetic innervation relaxes the smooth muscle of the uterus. The number and size of adrenergic nerves appears to increase in the uterus during pregnancy suggesting that adrenergic input enhances the contraction of the myometrium. Nociception from the uterus (such as in uterine contractions) is transmitted via visceral afferent nerves which travel with sympathetic fibers retrograde to reach the cell bodies in the spinal ganglia. As part of the viscerosomatic reflex, pain can be referred to the lower back, abdomen, or into the inguinal and groin region.

Vagina and Cervix

Sympathetic innervation of the vagina causes constriction of the vaginal walls and vestibule of the vagina. The visceral afferent fibers conducting pain impulses from the cervix and superior vagina follow the parasympathetic fibers retrograde to reach cell bodies in the spinal sensory ganglia. These visceral afferent fibers send signals regarding the passage of a baby through the birth canal which manifests as referred pain to the perineal region.

The innervation of the inferior portion of the vagina and perineum are via somatic innervation, via the deep perineal nerve, which is a branch of the pudendal nerve. The somatic innervation conveys somatic afferent and efferent fibers, from S2-S4 spinal ganglia. Only this somatically innervated portion is sensitive to temperature and touch. This somatic component allows for the sensation of pain to be well-localized in this region.

Clitoris

Parasympathetic innervation to the clitoris stimulates the vasculature to increase perfusion. Sympathetic innervation causes the vaginal walls and vestibule to contract.

Osteopathic Considerations in Autonomics Related to the Female Reproductive System

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and female reproductive systems manifest in the tissues. Alterations in sympathetic tone due to gonad or reproductive tract dysfunction may present as paraspinal tissue texture changes and range of motion restrictions from T10-L2. Alterations in parasympathetic tone may affect the parasacral region due to facilitation of S2-4.[3]

Biomechanics

Ovary

The ovaries are located laterally within the pelvic cavity suspended by short mesenteric folds of the broad ligament, called the mesovarium. Ovarian vessels, lymphatics and nerves enter the pelvic cavity from the superolateral surface of the ovary within the suspensory ligament of the ovary and becomes the mesovarium. The ovary is attached to the uterus via the ovarian ligament. Dysfunction of the uterus can influence the ovary and vice versa through the broad ligament. The ovary is suspended within the pelvic cavity but is near the ilia and obturator internus muscle of the lateral pelvic wall. Hypertonicity of obturator internus muscle or increased tension in the broad ligament and mesovarium can negatively affect the ovary.

Fallopian Tube

The fallopian tubes extend laterally from the uterine horns and open laterally into the pelvic cavity near the ovaries. They lie within thin mesentery, called the mesosalpinx, of the broad ligament. The broad ligament envelops the round ligament which then traverses the inguinal canal and terminates within the labia majora. This relationship can allow pubic bone dysfunction to influence the fallopian tubes. The fallopian tubes are also suspended within the pelvic cavity but are near the ilia and obturator internus muscle of the lateral pelvic wall. Hypertonicity of obturator internus muscle or increased tension in the broad ligament and mesosalpinx can affect the fallopian tube.

Uterus (including cervix and superior ¾ of vagina)

The uterus lies within the pelvic bowl posterior to the bladder with the vesicouterine pouch in between, and anterior to the rectum with the rectouterine pouch in between. The pelvic girdle (composed of the ilium, ischium, and pubis) and the sacrum provide protection and support for the female reproductive organs. These bones also allow for attachment sites of the musculature and supportive connective tissue that surround the uterus, cervix, and vagina.

The uterus is supported inferiorly by the bladder, the parietal pelvic fascia, and the pelvic diaphragm which includes coccygeus muscle and levator ani muscle group (puborectalis, pubococcygeus, and iliococcygeus). The coccygeus muscle originates at the sacrum and coccyx and attaches to the sacrospinous ligament. The levator ani group originates at the pubic bone and attaches to the ischial spine and obturator fascia. Increased tension in the pelvic floor muscles can negatively affect the uterus, cervix, and vagina. If the pelvic floor muscles are weak, increased pelvic pressure may cause a prolapse.

The parietal pelvic fascia is contiguous with the visceral fascia of the uterus and thickens at the pelvic floor to form the tendinous arch of pelvic fascia which runs anterior to posterior from the pubic bones to the sacrum. Increased tension in the pelvic fascia can affect the female reproductive organs. The uterus, cervix and vagina are supported posteriorly by the uterosacral ligament. The uterosacral ligament is the most posterior portion of the tendinous arch and attaches the cervix to the body of the sacrum. Here, sacral dysfunctions can affect the uterus and cervix, or visceral-somatic reflexes can manifest in the sacrum.

The uterus, cervix, and vagina's visceral fascia expand laterally to connect to the tendinous arch of the pelvic fascia and is termed the paracolpium. If the paracolpium is weak, the vagina can become unstable during times of increased pelvic pressure. More lateral support for the cervix is provided by the cardinal ligament, or transverse cervical ligament, which attaches the cervix to the lateral pelvic wall via the obturator fascia. Hypertonicity of the obturator internus muscle can affect the cardinal ligament and the uterus.

The round ligament of the uterus anchors the uterus anteriorly by originating at the uterine horns, passing through the inguinal canal, and attaching to the labia majora. This relationship can permit pubic bone dysfunction to influence the uterus. Increased tension on the round ligament, or stretching during pregnancy, can affect the uterus and cause pain.

Osteopathic Considerations in Biomechanics Related to the Female Reproductive System

The physiological (or pathologic) functioning of the renal system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify an organ's function, the long fascial chains of the body can transmit forces from distal anatomic structures. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the female reproductive system:

- Lumbar Spine due to effects on sacrum (lumbosacral junction) and pelvis (quadratus lumborum, iliopsoas muscle, iliolumbar ligaments)

- Pelvis, especially:
  - Pubic bones and pubic symphysis due to their proximity to the uterus and site of ligamentous attachments
  - Ilia due to their proximity to female reproductive organs and contact with sacrum at SIJ
  - Ischia due to attachment site for supportive musculature and facial support of organs
  - Pelvic floor muscles, i.e. coccygeus, puborectalis, pubococcygeus, and iliococcygeus due to their support of the vagina and uterus
  - Tendinous arch of pelvic fascia, uterosacral ligament, paracolpium, and cardinal ligament due to their support of the uterus and vagina
  - Inguinal canal due to its proximity to the round ligament of the uterus
- Sacrum due to ligamentous and muscular attachments
- Psoas and iliacus muscles due to proximity to female reproductive organs

Osteopathic Considerations in Biomechanics Related to Obstetrics

The dynamic physiological functioning of the female reproductive system is directly affected by the anatomical adjustments necessary for the development and growth of a fetus during pregnancy. Dynamic changes that optimize space and functioning of the mother as well as the developing fetus can be observed in patients throughout pregnancy.

Musculoskeletal Changes in Pregnancy

There are several musculoskeletal changes that occur during the various stages of pregnancy. Early on there is often posterior rotation of the pelvis, flattening of the lumbar lordosis and contraction of the rectus abdominis. Later in pregnancy as the fetus continues to grow, the body begins to compensate. The center of gravity shifts more anteriorly, and the lordosis of the lumbar and cervical spine increases and the kyphosis of the thoracic spine increases. This increased lordosis results in a greater load on the facet joints, shearing of the intervertebral disc spaces, posterior paraspinal muscle contraction, an overstretched rectus abdominis muscle, and psoas muscle shortening. The pelvis begins to shift anteriorly causing strain on the SI joints, and the pubic symphysis begins to widen causing referred pain to the lower back and medial thighs that is worsened by walking. Lastly, there is reduced diaphragmatic excursion due to a lack of available space for the diaphragm to expand into.

The Role of Relaxin

Relaxin is a hormone produced by the ovary and placenta that mediates the hemodynamic changes seen in pregnancy. Production is significantly increased during the 1st trimester and peaks around 14 weeks and at delivery. As a result, the mother's cardiac output increases, renal blood flow increases, and arterial compliance increases. Additionally, relaxin widens and increases mobility of the SI joints and pubic symphysis. Over time, this may result in joint instability, leading to back pain due to compensation and muscle imbalances.

First Stage of Labor[6]

As labor begins, the body undergoes a series of musculoskeletal changes to allow for the passage of the fetus. During the first stage of labor, the sacrum counternutates and the lumbosacral joint moves into flexion while the iliac crests diverge, and the ischia converge. This allows for fetal descent into the true pelvis. The pain during this process is often located around the L1-L2 region, the lower abdomen and the groin.

During the second stage of labor the sacrum nutates and the lumbosacral joint moves into extension while the iliac crests converge, and the ischia diverge. This allows for parturition. The pain during this process is often located near the perineum due to the referred pain pattern of the S2-S4 innervation of the cervix and upper vagina (see vagina/cervix autonomics section above).

Circulation:

Ovary

- Arterial: aorta → ovarian artery → ovary
- Venous:
  - ovary → right ovarian vein → IVC
  - ovary → left ovarian vein → left renal vein → IVC
- Lymphatic: ovary → lumbar lymph nodes → cisterna chyli → thoracic duct

Fallopian Tube

- Arterial:
  - aorta → ovarian artery → fallopian tube
  - aorta → common iliac artery → internal iliac artery → uterine artery → fallopian tube
- Venous:
  - fallopian tube →
    - right ovarian vein → IVC
    - left ovarian vein → left renal vein → IVC
  - fallopian tube → uterine venous plexus → uterine vein → internal iliac vein → common iliac vein → IVC
- Lymphatic: fallopian Tube → lumbar lymph nodes → cisterna chyli → thoracic duct

Uterus, Cervix and Superior ¾ of Vagina

- Arterial: aorta → common iliac artery → internal iliac artery → uterine artery and vaginal artery → uterus, cervix, and superior ¾ of vagina.
- Venous: uterus, cervix and superior ¾ of vagina → uterine venous plexus → uterine vein → internal iliac vein → common iliac vein → IVC
- Lymphatic:
  - fundus of uterus → lumbar lymph nodes → cisterna chyli → thoracic duct
  - body of the uterus → external iliac lymph nodes → common iliac lymph nodes → lumbar lymph nodes → cisterna chyli → thoracic duct
  - cervix and upper ¾ of vagina → internal iliac nodes → common iliac lymph nodes → lumbar lymph nodes → cisterna chyli → thoracic duct

Breasts

- Arterial:
  - aorta → subclavian artery → internal thoracic artery → medial mammary branch and anterior intercostal branch of internal thoracic artery → breast
  - aorta → subclavian artery → axillary artery → lateral thoracic artery → lateral mammary branches of the lateral thoracic artery → breast
  - aorta → posterior intercostal artery → lateral cutaneous branches of posterior intercostal artery → lateral mammary branches of lateral cutaneous branches of posterior intercostal artery

- Venous:
  - breast → medially to the medial mammary vein → perforating branches of internal thoracic vein → internal thoracic vein → SVC
  - breast → laterally to lateral mammary vein → lateral thoracic vein → axillary vein → subclavian vein → SVC
- Lymphatic:
  - breast → laterally to axillary lymph nodes → supraclavicular lymph nodes → subclavian lymphatic trunk → right lymphatic duct or thoracic duct.
  - breast → medially to parasternal lymph nodes or opposite breast → bronchomediastinal lymphatic trunk → subclavian lymphatic trunk → right lymphatic duct or thoracic duct
  - breast → inferiorly to abdominal lymph nodes → thoracic duct

Glans Clitoris

- Lymphatics: clitoris → deep inguinal lymph nodes → external iliac lymph nodes → common iliac lymph nodes → lumbar lymph nodes → cisterna chyli → thoracic duct

Superficial Perineal structures

- Lymphatics: superficial structures → superficial inguinal lymph nodes → deep inguinal lymph nodes → external iliac lymph nodes → common iliac lymph nodes → lumbar lymph nodes → cisterna chyli → thoracic duct

Osteopathic Considerations in Circulation Related to the Female Reproductive System

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory system (venous and lymphatic systems). These baffles include the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. For a more complete review, please see your first-year manual or any of the referenced materials. It is particularly important to understand the normal systemic physiologic changes seen with circulation in pregnancy.[3]

Systemic Physiologic Changes in Pregnancy

There are many physiologic changes to be aware of that occur during pregnancy. Weight gain occurs as total body water increases and the fetus, placenta, and other tissues grow. To keep up with the increased blood supply demand to these growing tissues, the circulating blood volume increases by 50% which leads to physiologic anemia (due to greatly increased plasma with a lesser degree of increased red blood cells) and edema (due to extravasation into surrounding tissues). In order to help distribute this increased blood supply throughout the bodies of both the mother and the fetus, the heart increases cardiac output and the arteries undergo vasodilation (resulting in decreased systemic vascular resistance and decreased mean arterial pressure). The increased blood flow to the kidneys causes an increased GFR which leads to an increased basal metabolic rate, and therefore, a greater oxygen demand. Also, to increase the glucose in the blood supply to be made available to the fetus, the mother's insulin efficacy decreases.

There are also multiple changes that occur due to smooth muscle relaxation. The uterus expands to accommodate for the growth of the fetus, there is decreased GI motility to increase nutrient absorption (causing constipation), and the veins of the pelvis engorge which can cause varicosities, hemorrhoids or pelvic congestion syndrome. Due to the expansion of various organs, as well as the increased fluid volume in the body, some structures may become compressed. As the uterus expands it may compress the vena cava causing supine hypotension syndrome. The uterus may also compress other surrounding structures causing heartburn, constipation and decreased diaphragmatic excursion. Excess fluid retention may also cause compression of various structures such as the median nerve as it passes through the carpal tunnel, leading to carpal tunnel syndrome.

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the female reproductive system. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the reproductive system. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the reproductive system. Next, biochemical and biophysical tests frequently used in the evaluation of the reproductive system are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

History

- Gravidity and parity history
- Sexual history
- Urinary and bowel movement history

Osteopathic Structural Exam

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- T10-L2 for sympathetic innervation of the reproductive tract
- Pubic bones and pubic symphysis for biomechanical effects due to proximity and fascial, ligamentous, and muscular attachments of the uterus, cervix, and vagina
- Ilia and ischia for biomechanical effects due to proximity as well as facial, ligamentous, and muscular attachments of the uterus, cervix, and vagina
- Sacrum due to autonomic contributions from S2-4 to the reproductive tract, as well as biomechanical effects from proximity fascial, muscular and ligamentous attachments, including to the coccyx
- Pelvic Diaphragm for biomechanical effects due to proximity and support of the uterus, cervix, and vagina

Physical Exam

- Bimanual exam (cervical tenderness, ovary palpation)
- Speculum exam (cervix, vaginal canal)

Testing

- CBC (blood counts for potential anemia due to menstruation or pathology)
- Luteinizing hormone, follicle stimulating hormone, estrogen, progesterone (hormonal imbalances)
- Blood or urine beta-hCG (pregnancy)
- Papanicolaou test (Pap smear: cervical epithelial cell changes)
- Pelvic ultrasound (non-opaque structures, pregnancy, blood flow dynamics, cysts)
- Endovaginal ultrasound (pregnancy, non-opaque structures, blood flow dynamics, cysts)
- Pelvic CT (all structures, masses, fluid state)

Technique Contents:

Myofascial Release (MFR)

Presacral Release, Direct/Indirect Myofascial Release

Wrist, Carpal Tunnel Myofascial Release

Soft Tissue (ST)

Lateral Recumbent Scapulothoracic Soft Tissue

Pectoral Traction Soft Tissue

MYOFASCIAL RELEASE (MFR) TECHNIQUES

Presacral Release, Direct/Indirect MFR[9]

Example Diagnosis: Restricted presacral fascia.

Physician Position: Standing or seated at side of table

Patient Position: Supine

Procedure:

1. Physician makes a "C" shape with fingers and places fingers and thumb in lower abdominal region just superior to the pubic rami. Gently engage the tissues posteriorly to contact the presacral fascia.
2. Check for asymmetry in posterior, superior/inferior, clockwise/counterclockwise directions.
3. Apply force in either direct or indirect manner until meeting the barrier or ease respectively.*
4. Hold position until physician palpates a release.
5. Follow the movement of the release (fascial creep) to the new barrier and continue until no further improvement is detected.
6. Return the patient to neutral and reassess.

Treatment position for Presacral Release, Direct/Indirect

*For direct MFR, guide the structures from their position of ease into tension, and follow the direct barrier until no further change is noted or until you feel the breath (primary or thoracic respiration) return to the tissues.

Wrist, Carpal Tunnel MFR[9]

Example Diagnosis: Right flexor retinaculum restriction

Physician Position: Standing or seated anterior to or at side of patient

Patient Position: Seated or supine

Procedure:

1. Patient's forearm is supinated, hand facing in anatomical position.
2. Physician's thumb placed on medial and lateral attachments of the transverse carpal ligament. Thenar attachments: tubercles of the scaphoid and trapezium. Hypothenar attachments: pisiform and hook of hamate.
3. Physician wraps fingers around the dorsal surface of the wrist and presses thumbs laterally to exert tension on the flexor retinaculum, not sliding on skin.
4. Maintain pressure for 20-60 seconds or until a release is palpated.
5. Repeat if symptoms are improving, and relax tension if symptoms are exacerbated.
6. Return the patient to neutral and reassess.

Treatment position for Wrist/Carpal Tunnel MFR.

SOFT TISSUE (ST) TECHNIQUES

Lateral Recumbent Scapulothoracic ST[9]

Example Diagnosis: Right scapulothoracic muscular hypertonicity

Physician Position: Standing anterior to patient at side of table

Patient Position: Lateral recumbent, affected side up

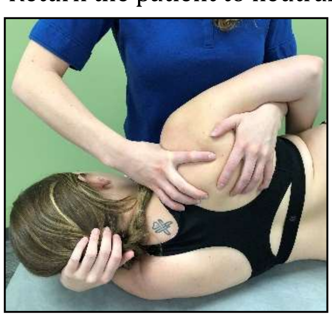
Procedure:

Part 1:

1. In the lateral recumbent position with the side of the restriction up towards the ceiling, the patient's top arm is draped over the physician's caudal forearm.
2. The physician's cephalad hand broadly grasps the superior portion of the scapula and shoulder girdle, spanning across the clavicle anteriorly and scapular spine and superomedial angle posteriorly.
3. The physician's caudal hand contacts the rhomboids and paraspinal muscles along the medial border of the scapula.
4. Soft tissue restrictions are then assessed in superior/inferior, medial/lateral, and clockwise/counterclockwise motions.
5. Using both the cephalad and caudal hand contacts, initiate movement of the scapula on the underlying thoracic ribcage soft tissues with a circular motion until a change in tissue texture is appreciated. Within the circular motion, focus on carrying the scapula laterally in a rhythmic fashion to release the medial scapulothoracic muscular attachment restrictions.
6. Return the patient to neutral and reassess.

Part 2:

1. Patient's top arm is moved to drape over the physician's cephalad forearm.
2. Physician's contact is broad over the superior aspect of the shoulder girdle with the cephalad hand. The caudal hand is placed so that the physician's fingers contact the medial border of the scapula with the physician's thenar eminence and thumb engaged in the musculature of the posterior axillary fold.
3. Soft tissue restrictions are assessed as above.
4. Using both the cephalad and caudal hand contacts, initiate a compressive force into the axillary and subscapular tissues in a rhythmic fashion until a change in tissue texture is felt. Focus on carrying the scapula medially and posteriorly to address the underlying lateral scapulothoracic muscular attachment restrictions.
5. Return the patient to neutral and reassess.



A) Treatment position for Lateral Recumbent Scapulothoracic ST: Part 1.

B) Treatment position for Lateral Recumbent Scapulothoracic ST: Part 2.

Pectoral Traction ST[9]

Mechanism: This technique utilizes direct stretching to decrease tension in the pectoralis muscles and augment lymphatic return to central circulation from the upper extremity.

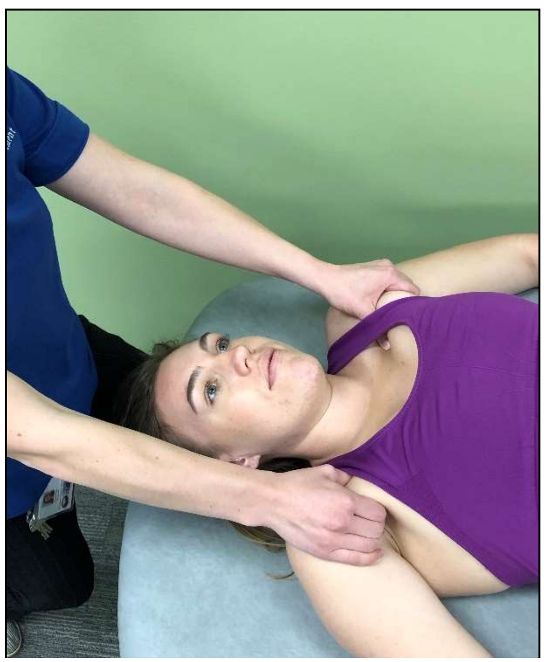
Example Diagnosis: Bilaterally tight pectoralis muscles

Physician Position: Standing or seated at the head of the table

Patient Position: Supine

Procedure:

1. Physician's contact is made with fingers hooked gently around the posterior aspect of the anterior axillary folds bilaterally, with the thumbs on the anterior aspect of the anterior axillary folds.
2. Gently lean backwards, allowing fingers to sink deeper into the patient's axillae until the restrictive barrier is engaged.
3. Apply further superior traction at the muscular barrier to produce a gentle stretch of the pectoralis muscles.
4. Instruct the patient to inhale and exhale deeply. Take up the slack during inhalation and resist motion during exhalation.
5. Continue until no further release in exhalation is palpated.
6. Return the patient to neutral and reassess.



Treatment position for Pectoral Traction ST

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Chapter 10

Male Reproductive System

"The osteopath must never fail to know the producing cause of all effects. He should seek to know the cause, remove it and give Nature a chance to repair."

A.T. Still, M.D, D.O.

Contents:

Notes

Autonomics[8]

Autonomic Spinal Levels for the Male Reproductive System

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Gonads	T10-11	S2-4
Erectile tissue of penis	T11-L2	S2-4
Vas deferens, seminal vesicles	T11-12	S2-4
Prostate	T11-L2	S2-4

Chapman's Reflex Points for the Male Reproductive System

	Anterior Point Location	Posterior Point Location
Testes	Superior, medial border of the pubic bone	Intertransverse space between T9 and T10 and between T10 and T11
Seminal vesicles	Midway between the acetabulum and greater sciatic notch	Between PSIS and spinous process of L5
Prostate	Laterally on either side of the pubic symphysis, and from the greater trochanter inferiorly to within 2 inches of the knee on lateral femur	Between PSIS and spinous process of L5

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Testes

Stimulation of the sympathetic system to the testes leads to the production of hormonal secretions.

Penis

Effects of sympathetic nerve stimulation to the penis include orgasm and ejaculation. *Increased* sympathetic tone can lead to premature ejaculation while a *decreased* sympathetic tone can lead to impotence. Stimulation of the parasympathetic system to the penis allows erection to occur.

Prostate

Stimulation of the sympathetic system to the prostate leads to glandular secretions and secretions out of the urethra.

Osteopathic Considerations for Autonomics related to the Male Reproductive System

From an osteopathic perspective, the interactions between the nervous, musculoskeletal, and renal systems manifest in the tissues. Alterations in sympathetic tone due to male reproductive dysfunction may present as paraspinal tissue texture changes and range of motion restrictions from T10-L2. Alterations in parasympathetic tone may present as dysfunction in the parasacral region due to facilitation of S2-4.

Biomechanics

Prostate

The prostate gland is located centrally in the pelvic cavity. Surrounding structures include the pubic symphysis anteriorly; the bladder superiorly; the rectum posteriorly; the perineal membrane inferiorly; and the levator ani muscles laterally. It is also near the ilia and the obturator internus muscle of the lateral pelvis. The levator ani group originates at the pubic bones and attaches to the ischial spine and obturator fascia. This muscle group maintains the viscera of the pelvic cavity. Hypertonicity of obturator internus muscle can affect the prostate. Dysfunction of the prostate can lead to congestion that can affect the surrounding structures resulting in somatic dysfunctions in the pelvic bones and surrounding muscles and fascia. In addition, restrictions in the sacrum can cause twisting at the coccyx which can lead to restrictions of the pelvic diaphragm. This can also cause congestion and can lead to prostate problems.

Penis

The shaft of the penis is located inferior to the pubic symphysis and consists of two corpora cavernosa columns and the corpus spongiosum. The corpora diverge at the base of the penis, which form the crura and attach at the ischiopubic rami. Compression at the pubic symphysis or pelvic dysfunctions can impede proper flow to the penis which can affect sexual function.

Ductus Deferens

From the testicle, the ductus (vas) deferens travels caudally and passes through the inguinal canal and deep inguinal ring to enter the pelvic cavity. It eventually crosses superior to the ureters at the posterolateral corner of the bladder. Medial to the ductus deferens are the seminal vesicles and they eventually join the seminal vesicle ducts to form the ejaculatory ducts. In the pelvis, it maintains contact with the peritoneum. Irritation of the peritoneum or restrictions at the inguinal ligament can cause dysfunction of the ductus deferens.

Pelvic Floor

The pelvic floor is formed by the bowl- or funnel-shaped pelvic diaphragm. It consists of the coccygeus muscle, levator ani muscles (pubococcygeus, iliococcygeus, puborectalis), and the pelvic fascia (parietal pelvic, visceral, endopelvic, superior and inferior fascia of the levator ani muscles). It maintains the structural integrity of the pelvic viscera and lower abdomen as well as addresses urination and defection by controlling the urethral meatus and anal canal. Tonicity of the pelvic floor may have implications in sexual function. Dysfunction of the pelvic bones which provide attachments for these muscles, or the pelvic floor itself, can lead to dysfunction of the visceral organs.

Osteopathic Considerations in Biomechanics of the Pelvis

The physiological (or pathologic) functioning of the male reproductive system affects the anatomy and biomechanics of the surrounding regions, and vice versa. While contiguous bony, muscular, and fascial structures can directly modify an organ's function, the long fascial chains of the body can transmit forces from distal anatomic structures. It is important to review the osteopathic diagnosis and treatment of the following areas when considering the biomechanics of the male reproductive system:

- Lumbar spine due to influence on sacral and pelvic mechanics
- Pelvic diaphragm including levator ani muscle group
- Pelvis including innominate and pubic dysfunctions
- Sacrum including coccyx
- Lower extremities, especially femoral-acetabular joints (obturator muscles, iliacus muscle)

Circulation

Testicle

- Arterial: abdominal aorta → testicular artery → testicle
- Venous:
  - R testicle → R testicular vein → inferior vena cava (IVC)
  - L testicle → L testicular vein → L renal vein → IVC
- Lymphatic: testicles → lumbar lymph nodes → cisterna chyli → thoracic duct

Ductus (vas) deferens, prostate, seminal vesicles

- Arterial: abdominal aorta → common iliac artery → internal iliac artery → anterior division of the internal iliac artery → superior and inferior vesicle artery (ductus deferens)/inferior and middle vesicle arteries (prostate)/middle rectal artery (seminal vesicles) → ductus deferens/prostate/seminal vesicles
- Venous: ductus deferens/prostate/seminal vesicles → pelvic venous plexus → internal iliac vein → common iliac vein → IVC
- Lymphatic: ductus deferens/prostate/seminal vesicles → external (ductus deferens)/internal iliac nodes (prostate) / both external and internal iliac nodes (seminal vesicles) → common iliac nodes/lumbar nodes → cisterna chyli → thoracic duct

Penis

- Arterial: abdominal aorta → common iliac artery → internal iliac artery → anterior division of the internal iliac artery→ internal pudendal artery → dorsal artery of the penis
- Venous:
  - corpora cavernosa and glans penis → circumflex veins → dorsal deep vein → prostatic venous plexus → internal iliac vein → common iliac vein → IVC
  - penile skin and prepuse → superficial dorsal vein → superficial external pudendal vein → external pudendal veins → great saphenous vein → femoral vein → external iliac veins → common iliac vein → IVC
- Lymphatic: glans of penis/distal spongy urethra → deep inguinal nodes → external iliac nodes → common iliac nodes/lumbar nodes → cisterna chyli → thoracic duct

Skin of perineum, scrotum, perianal skin, anal canal inferior to pectinate line

- Arterial: abdominal aorta → common iliac artery → internal iliac artery → anterior division of the internal iliac artery → internal pudendal artery
- Venous: skin of perineum, scrotum, perianal skin, anal canal inferior to pectinate line → external pudendal vein → internal iliac vein → common iliac vein → IVC
- Lymphatic: lymph from above structures → superficial inguinal nodes → deep inguinal nodes → external iliac nodes→ common iliac/lumbar nodes → cisterna chyli → thoracic duct

Osteopathic Considerations in Circulation of the Male Reproductive System

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory systems (venous and lymphatic systems). These baffles include the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. For a more complete review, please see your first-year manual or any of the referenced materials.

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the male reproductive system. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the reproductive system. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the reproductive system. Next, biochemical and biophysical tests frequently used in the evaluation of the reproductive system are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

History

- Social – puberty history, sexual history
- Lifestyle – diet, exercise, tobacco and substance use, allergies
- Trauma (physical, psychological)
- Current medication and supplement list

Osteopathic Structural Exam

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- T10-L2 for the sympathetic innervation of the male reproductive system
- Pubic bones and pubic symphysis for biomechanical effects due to proximity and attachment of pelvic floor structures
- Ilia and ischia for biomechanical effects

- Sacrum due to autonomic contributions from S2-4 to reproductive tract, as well as biomechanical effects from attachment of pelvic floor structures
- Pelvic diaphragm for biomechanical effects due to support of the prostate and other reproductive tract structures

Testing

- Urinalysis (blood, bacteria, glucose)
- STI testing (gonorrhea, chlamydia, HIV, herpes, syphilis, H. ducreyi, hepatitis B & C)
- Culture/smear (sample of suspicious lesions to ensure efficacy of treatment)
- Imaging: Abdominal US/CT, pelvic US/CT (visualize all structures, detect masses, assess fluid state)
- Complete blood count with differential (infections, primary or secondary neoplasms)
- Complete metabolic panel (low proteins can lead to low testosterone, LFTs for hepatitis, erectile dysfunction)
- Thyroid tests (hypothyroidism can lead to hypogonadism)
- Hormone levels (hypogonadism, low testosterone levels)
- PSA (to obtain baseline or monitor progression of BPH vs prostate cancer)
- Karyotyping (genetic etiologies to hypogonadism such as Klinefelter Syndrome)
- Semen analysis (infertility concerns)

Technique Contents:

Articulatory

Sacral Rocking

Lateral Recumbent Sacroiliac Articulation

Muscle Energy

ME for Sacral Dysfunctions/“Frog Leg”

Myofascial Release

Ischiorectal Fossa Release

Obturator Foramen Release

Articulatory

Sacral Rocking[2]

Mechanism: This oscillatory, direct articulatory technique augments the inherent motions of the sacrum allowing it to move freely without restriction. This technique can treat sacral extensions, flexions, and torsions** in addition to lumbosacral junction, pelvic diaphragm, and cranial strains.

Example Diagnosis: Somatic Dysfunction of sacrum, pelvis, or lumbosacral junction

Physician Position: Standing at the side of the table

Patient Position: Prone or lateral recumbent

Procedure:

1. Overlap palms on the sacrum with fingers pointing in opposite directions. The bottom hand should have digits pointing superiorly.
2. Palpate the sacral motion in response to primary or secondary (thoracic) respiration.
3. Gently augment the motion of the sacrum by alternating pressure on the sacral base and sacral apex, following and exaggerating the rhythm of the sacrum.
4. Continue for 30 seconds to 2 minutes or until no further change is palpated.
5. Return the patient to neutral and reassess.

Treatment position: Sacral Rocking

> **Think About It**
> Due to viscerosomatic reflexes, this technique is great for females with dysmenorrhea and pelvic congestion syndrome.

**When using Sacral rocking articulatory technique to treat sacral torsions, emphasis of force should be placed on whatever pole allows maximal movement of the dysfunctional base. For example, if a right-on-right sacral torsion is being treated (the left base is anterior/deep and the right ILA is posterior/shallow), the left base is likely to be the dysfunctional pole. Using an anterior articulating force on the posterior/shallow right ILA when the patient inhales will further facilitate the sacrum's posterior movement of the left base into its barrier.

Lateral Recumbent Sacroiliac Articulation[10]

Mechanism: This is an articulatory technique that dysfunction related to the SI joint. The lower extremity is used as a long lever to take the SI joint through its range of motion and release any restrictions in the process. The physician stabilizes the sacrum with the cephalad hand while the caudal hand brings the lower extremity through flexion, abduction, external rotation, and finally extension. This technique has the option to add an HVLA thrust to the final stage of the technique. A variety of SI joint dysfunctions can be addressed with this technique, including innominate dysfunctions and sacral dysfunctions.

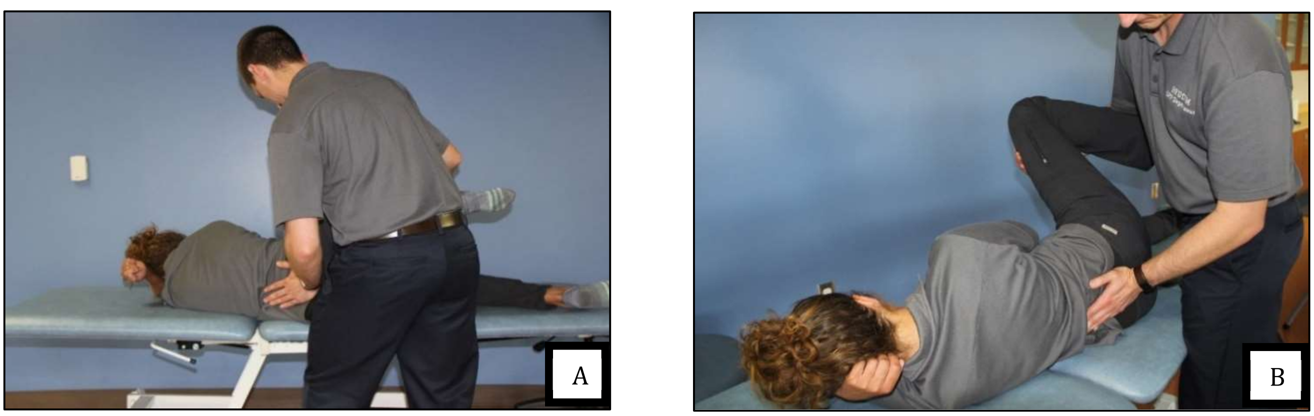
Example diagnosis: Right posterior innominate, Somatic dysfunction of SI joint

Physician position: Standing posterior to the patient

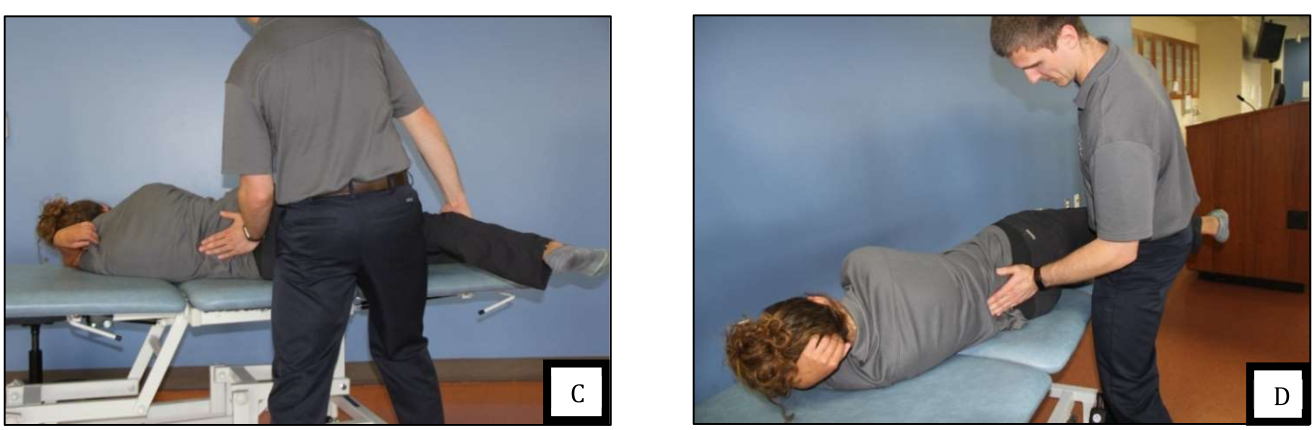
Patient position: Lateral recumbent, with affected side up

Procedure:

1. Place cephalad hand on the sacrum just medial to the right SI joint while the caudad hand grasps the patient's right leg distal to the knee.
2. Passively circumduct the thigh, bringing the hip into flexion, abduction, external rotation, and finally extension.
3. Repeat this circular motion for 3 cycles, and at the end of the third cycle, instruct the patient to kick the leg straight, positioning the hip and knee into extension.
4. Optional HVLA modification: While the kick is taking place, with the cephalad hand on the patient's sacrum deliver an impulse towards the patient's umbilicus.
5. Return the patient to neutral and reassess.



A & B) Initial Position



C & D) Final Position

Muscle Energy

ME for Sacral Dysfunctions/"Frog Leg"[1]

Mechanism: This ME utilizes the innate respiratory movement of the sacrum. The patient augments treatment with respiratory assistance by holding their breath in inhalation or exhalation to provide sacral extension or flexion, respectively. As the patient holds their breath, they steadily slide their feet inferiorly to the end of the table while keeping the soles of their feet together and their knees abducted as long as possible. This action gaps the SIJ allowing the treatment to be more effective. The physician applies a force vector into the restriction while the patient extends their legs.

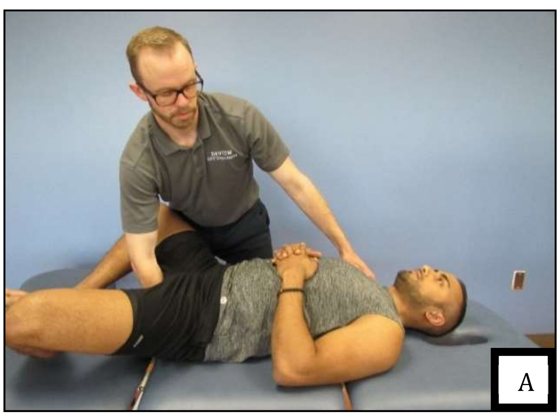
Example Diagnosis: Bilaterally flexed sacrum*

Physician Position: Standing at the side of the table

Patient Position: Supine with both legs flexed, knees abducted, and soles of feet together

Procedure:

1. Place caudal hand under the sacrum, contacting the lumbosacral junction with fingertips.
2. Apply a posterior and inferior traction on the sacrum to engage the restrictive barrier (inducing sacral extension).*
3. Instruct the patient to hold their breath in deep inhalation (further inducing sacral extension).*
4. While holding their breath, the patient steadily slides their feet inferiorly to the end of the table while keeping the soles of their feet together and their knees abducted as long as possible.
5. Instruct the patient to exhale while resisting sacral flexion with caudal hand.
6. Repeat steps 2-4 two to four more times or until no further change is noted.
7. Return the patient to neutral and reassess.



A) Initial treatment position

B) Final treatment position

* This technique can be modified for any sacral dysfunction by adjusting direction of force vector and adjusting respiratory assist. For example, for a bilaterally extended sacrum, the force vector would be anterior and superior while the patient holds their breath in exhalation. Remember that ME is a direct technique, so the force vector and respirations should always be into the barrier.

Myofascial Release

Ischiorectal Fossa Release – Prone[2]

Mechanism: Ischiorectal fossa release is a myofascial release technique that engages the pelvic floor myofascial tissues via the ischiorectal fossa. The ischiorectal fossa is a fat-filled space located inferior to the pelvic diaphragm and lateral to the anal canal. It contains, among other structures, pudendal neurovasculature. This technique engages first the superficial fascia, then the ischiorectal fossa, then the levator ani muscles as pressure is applied inferior to superior. Dysfunctions of the pelvic floor, obturator muscles, sacrum, and pelvis may be addressed with this technique.

Example Diagnosis: Somatic Dysfunction of pelvic diaphragm (restriction can be unilateral or bilateral)

Physician Position: Standing at side of table

Patient Position: Prone

Procedure:

1. Bilaterally place thumbs medial to the ischial tuberosities. Throughout the technique, palmar aspect of the thumb should maintain contact with the ischial tuberosity. Do not palpate midline.
2. Exert gentle, cephalad pressure into the ischiorectal fossa until resistance is met and then apply a lateral force. The side that shows the most resistance, or tissue texture changes, is most likely the dysfunctional side.
3. Instruct the patient to deeply inhale and exhale.
4. With each inhalation, resist the caudal motion of the pelvic diaphragm.
5. With each exhalation, gently exert increased cephalad pressure on the pelvic diaphragm until no further cephalad and lateral excursion is noted.
6. Return the patient to neutral and reassess.

A) Hand placement

B) Treatment position

Obturator Foramen Release[9]

Mechanism: The obturator foramen release is a myofascial release technique intended to engage the myofascial structures covering the obturator foramen, namely the obturator externus muscle, the obturator membrane, and the obturator internus muscle. The obturator foramen also allows for passage of the obturator neurovasculature. Patients with dysfunction in this area may complain of groin, hip, or pelvic pain, and may have a history of a "pulled groin." The approach for this technique is to engage the external aspect of the obturator foramen by palpating around or through the other myofascial structures of the anteromedial hip: pectineus and adductors will be encountered during the technique.

Example Diagnosis: Somatic Dysfunction of myofascial contents of obturator foramen

Physician position: Standing on the side of dysfunction

Patient Position: Supine

Procedure:

1. Flex the patient's hip, **abduct** and slightly **externally rotate** the leg on the dysfunctional side.
2. There are two ways to palpate and treat the obturator foramen:
   a. Place the thumb of the caudal hand just posterior to the medial border of the pectineus (inferior to the superior pubic ramus). The hand rests on the anteromedial thigh with digits pointing posteriorly, taking care not to contact the perineal structures. Use your cephalad hand to contact the ipsilateral knee to control leg movement outlined in steps 3 and 5.
   b. Place the thumb of the cephalad hand just posterior to the medial border of the pectineus (inferior to the superior pubic ramus). The hand rests on the anterolateral thigh with digits pointing posteriorly and laterally. Use your caudad hand to contact the ipsilateral knee to control leg movement outlined in steps 3 and 5.
3. As you **adduct** and **internally rotate** the leg, palpate around the adductors until the thumb contacts the contents of the obturator foramen (from superficial to deep: obturator externus muscle, obturator membrane, and obturator internus muscle).
4. Using motions of the thumb, translate, rotate, and apply more or less pressure to find the barrier.
5. If needed, hip flexion, extension, adduction and abduction can be used to gain deeper palpation of the obturator foramen.
6. Once a release is palpated, return the patient to neutral and reassess.

A) Caudad hand approach

B) Cephalad hand approach

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Chapter 11

Upper Extremity

"Extend the touch of the soft hand of human kindness to those in need."

-A.T. Still, M.D., D.O.

Contents:

NOTES

Autonomics[1-4]

Autonomic Spinal Levels for the Upper Extremity

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Upper Extremity	T2-7	None

Chapman's Reflex Points for the Upper Extremity[9]

	Anterior Point Location	Posterior Point Location
Arm Circulation	Muscular attachments of pectoralis minor to ribs 3-5	Superior angle of the scapula; ribs 1-3 along inner margin of scapula
Arm Innervation	3rd intercostal space close to the sternum	Intertransverse space between T3 and T4, midway between spinous process and the tip of transverse process

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Upper Extremity

Sympathetic innervation of the upper extremity is responsible for vasomotor, pilomotor and secretory functions. As such, the sympathetic nervous system serves to accomplish two major physiologic functions: thermoregulation and blood pressure regulation. Increased sympathetic input will lead to vasoconstriction, increased sweating, and piloerection of the hairs of the arm.

Osteopathic Considerations in Autonomics Related to the Upper Extremity

From an osteopathic perspective, the interactions between the nervous and musculoskeletal systems manifest in the tissues. Alterations in sympathetic tone due to pathology of the upper extremity will present as paraspinal tissue texture changes and range of motion restrictions from T2-7. Additionally, the sympathetic chain ganglia lie anterior to the head of the first rib, so dysfunction in the upper thoracic spine or upper ribs may manifest as increased sympathetic tone to the upper extremity causing altered motion, nerve dysfunction, and lymphatic or venous congestion as well decreased arterial blood flow to the structures of the arm. For this reason, special attention should be paid to the upper thoracic vertebrae and ribs in the setting of increased sympathetic tone to the upper extremity.

Biomechanics[2,4]

Myofascial Anatomy

In this section, you will learn the ways in which the myofascial networks of the body act as a model of tensegrity, working together to initiate movement, stabilize, and respond to stress. Through the weaving of interconnected structures, our myofascial networks are reinforced through interplay between compressive and tensile forces, thus creating an avenue for the dispersal of tension and strain on the system. Therefore, it becomes increasingly important to understand the described fascial lines in the setting of injury, as injury may occur at a distant "weak point" in the system from distributed strain, rather than direct injury. Understanding these fascial lines will aid in clinical decision making in the approach to injuries and strains along the myofascial networks.

The Superficial Front Arm Line (SFAL)

The SFAL begins with the pectoralis major (anteriorly), latissimus dorsi and teres major (posteriorly) → intermuscular septum → common flexor tendon at medial epicondyle → wrist flexors → transverse carpal ligament and palmar fascia

With its broad attachments and wide degree of surface area the SFAL helps to control the position of the arm in a wide range of motions, especially adduction and extension. It also participates with the deep front arm line in controlling the wrist and fingers in grip.

- Superficial Front Arm Line
  - Pectoralis Major
  - Latissimus dorsi
  - Intermuscular septum
  - Flexor muscles
    - Flexor carpi radialis
    - Palmaris longus
    - Flexor carpi ulnaris
    - Flexor digitorum superficialis
    - Flexor digitorum profundus
  - Carpal tunnel
  - Palmar surface of the fingers

The Deep Front Arm Line (DFAL)

The DFAL begins with the pectoralis minor and subclavius (both embedded in clavipectoral fascia) → coracoid process → short head of biceps brachii and coracobrachialis → periosteum of radius → radial collateral ligaments of wrist → transverse carpal ligament → thenar muscles

The DFAL acts primarily as a stabilizing line from the thumb to the front of the chest that functions to stabilize side-to-side movement and control the angle of the hand principally via the thumb.

- Deep Front Arm Line
  - Pectoralis minor, clavipectoral fascia
  - Biceps brachii
  - Supinator
  - Pronator teres
  - Radial collateral ligaments
  - Thenar muscles

        - Opponens pollicis
        - Abductor pollicis brevis
        - Flexor pollicis brevis

The Superficial Back Arm Line (SBAL)

The SBAL begins with the trapezius → spine of the scapula, acromion, lateral 1/3 of clavicle → deltoid → deltoid tubercle where it blends with fibers of intermuscular septum → common extensor tendon at lateral epicondyle of humerus → wrist extensors → dorsal fascia of the hand

The SBAL functions to control the arm when it is behind the lateral midline. It also controls abduction of the shoulder and arm and acts to limit the workload of the SFAL.

- Superficial Back Arm Line
    - Trapezius
    - Deltoid
    - Lateral intermuscular septum
    - Extensor Muscles
        - Extensor carpi radialis longus
        - Extensor carpi radialis brevis
        - Extensor digitorum
        - Extensor digiti minimi
        - Extensor carpi ulnaris
        - Abductor pollicis longus
        - Extensor pollicis brevis
        - Extensor pollicis longus
        - Extensor indicis
    - Dorsal Surface of Fingers

The Deep Back Arm Line (DBAL)

The DBAL begins with the rhomboids → medial border of scapula and subscapularis fascia → infraspinatus and teres minor → greater tubercle of humerus

Another branch of DBAL begins with rectus capitis lateralis → levator scapulae → superior angle of the scapula → supraspinatus → meets with other rotator cuff muscles at the greater tubercle of humerus

From the proximal humerus → triceps brachii → olecranon → periosteum of ulna and adjacent layers → ulnar styloid process → ulnar collateral ligaments → hypothenar muscles of distal muscular compartment

- Deep Back Arm Line
    - Levator scapula
    - Rhomboids
    - Rotator Cuff Muscles

        - Supraspinatus
        - Infraspinatus
        - Teres minor
        - Subscapularis
    - Triceps brachii
    - Ulnar periosteum
    - Ulnar collateral ligaments
    - Hypothenar Muscles
        - Abductor digiti minimi
        - Flexor digiti minimi brevis
        - Lumbar spine opponens digiti minimi

Osteopathic Considerations in Biomechanics Related to the Upper Extremity

As is clear from the above discussion on the long fascial lines, tensegrity is an important factor when evaluating the musculoskeletal system. Somatic dysfunctions in the upper extremity may have far-reaching consequences throughout the body. In any evaluation of the extremities, it is important to always evaluate the joint above and below the problem area. Focus should be aimed towards the biomechanical structures for somatic dysfunction, injury, or potential neurovascular compromise. For example, there are multiple regions in the upper extremity that are common sites for compression of the median, ulnar and radial nerves and should be appropriately evaluated for dysfunction. In addition, when there is dysfunction of the upper extremity, it is important to evaluate the following areas for somatic dysfunction: cervical spine, thoracic spine, and rib cage as somatic dysfunction in these areas may manifest as upper extremity pathology. Other anatomy to consider:

- Upper ribs and thoracic vertebrae due to scapulothoracic joint
- Clavicle as the upper extremity's connection to the thoracic cage
- Scapula as a site of myofascial restriction, particularly as it relates to the superficial and deep back arm lines
- Humerus and glenohumeral joint as a common site of upper extremity pathology
- Radial head, as it is adjacent to site of radial nerve entrapment in radial tunnel
- Ulna as it is site of common ligament injury, medial and lateral epicondylitis, and somatic dysfunction may be causative of transient radial nerve entrapment in radial tunnel
- Carpal bones, flexor retinaculum, metacarpals, phalanges (somatic dysfunction may be causative of transient median nerve entrapment in carpal tunnel, impaired mechanics)
- Median nerve (common areas of compression are pronator teres/ligament of Struthers, the anterior interosseus branch at the interosseus membrane, and carpal tunnel at the wrist)
- Ulnar nerve (common areas of compression are cubital tunnel at the elbow, Guyon cannel at the wrist)
- Radial nerve (common areas of compression are radial tunnel at the elbow and the thoracic outlet)

Circulation[2,3]

- Arterial:
  - Right: aorta → brachiocephalic trunk → subclavian artery → axillary artery (lateral border 1st rib) → brachial artery (inferior border teres major) → distal regions of UE (shoulder, arm, forearm, hand)
  - Left: aorta → subclavian artery → axillary artery (lateral border 1st rib) → brachial artery (inferior border teres major) → distal regions of UE (shoulder, arm, forearm, hand)
- Venous: UE → axillary vein → subclavian vein → brachiocephalic vein → SVC
- Lymphatic:
  - UE: distal UE → lateral axillary lymph nodes → central axillary lymph nodes → apical axillary lymph nodes → right lymphatic duct or thoracic duct
  - Anterior thoracic wall: anterior thoracic wall → central axillary lymph nodes → apical axillary lymph nodes → right lymphatic duct or thoracic duct
  - Posterior thoracic wall: posterior thoracic wall → central axillary lymph nodes → apical axillary lymph nodes → right lymphatic duct or thoracic duct

Osteopathic Considerations in Circulation Related to the Upper Extremities

It is important to remember that the neurovascular bundle (subclavian artery, subclavian vein, lymphatics and brachial plexus) is susceptible to compression as it courses through the neck and shoulder. Dysfunction of cervical ribs, clavicle, upper ribs, thoracic ribs, anterior and middle scalene muscles and pectoralis minor muscles can compromise blood flow and impair lymphatic return. The subclavian artery passes in between the anterior and middle scalene muscles, which is a common site of compression in thoracic inlet syndrome. In addition, proper function of the thoracic inlet and related Sibson's fascia is critical for appropriate return of the fluids in the low-pressure circulatory system (venous and lymphatic systems). Signs and symptoms of neurovascular compression in the upper extremity may include shoulder and arm pain, weakness, paresthesia, claudication, Raynaud phenomenon, swelling, ischemic tissue loss and gangrene. It is imperative that full medical consideration be given to the above symptoms prior to any OMT intervention so that no medical diagnoses are missed.

Screening

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the upper extremity. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the upper extremity. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the upper extremity. Next, biochemical and biophysical tests frequently used in the evaluation of the upper extremity are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

Osteopathic Structural Exam

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- T2-7 for the sympathetic innervation of the upper extremity
- Thoracic inlet and Sibson’s fascia to identify potential source of neurovascular compromise in UE
- Range of motion and special tests of shoulder to test for dysfunctional structures of the UE
- Neck special tests to identify neurologic compromise of the UE
- Clavicle to identify dysfunction contributing to impaired mechanics, neurovascular compression
- Radial head to identify dysfunction contributing to impaired mechanics
- Ulna to identify dysfunction contributing to impaired mechanics, neurovascular compression
- Carpals, metacarpals, phalanges to identify dysfunction contributing to impaired mechanics
- Flexor retinaculum to identify potential source of Median nerve compression
- Neurologic exam to assess UE motor and sensory function
- Epicondyles, varus/valgus stress to assess for presence of medial or lateral epicondylitis or ligament injury
- Wrist special tests to assess for neurologic entrapment or tenosynovitis of the wrist

Testing

- Doppler US to identify specific areas of vascular compromise
- Electromyography/Nerve Conduction Study to identify regions of neurological compromise
- MRI to assess for soft tissue pathology of the UE. When used with intra-articular contrast, this is an MR Arthrogram.
- Ankle-Brachial Index or Brachial-Brachial Index to assess for vascular compromise of UE
- XR/CT to assess structural pathology of the UE

Technique Contents:

Balance Ligamentous Tension (BLT)/ Ligamentous Articular Strain (LAS)/ Myofascial Release (MFR)

BLT/LAS/MFR for Restricted Clavicle[5]

Example Diagnosis: Restricted left clavicle

Physician Position: Standing or seated anterior to patient

Patient Position: Seated

Procedure:

1. Contact the proximal and distal ends of the left clavicle between the thumbs and index fingers.
2. Instruct the patient to place the left forearm across the physician's left forearm and to rotate the head to the right (away).
3. As the patient slowly brings the left shoulder posteriorly, motion test in multiple planes (lateral, superior, etc.) to find a point of equal tension among the ligamentous attachments.**
4. Hold this balanced position until a release is palpated.* It may be necessary to make minor adjustments in all planes until the position of best possible balance is achieved.**
5. Instruct the patient to return the arm and head to a neutral position while maintaining the balanced position of the clavicle.
6. Release the hold and reassess.

Think about it: The point to balance the clavicle around is the costoclavicular ligament. It is a firm attachment that will allow you to balance proximal and distal aspects of the clavicle.


Treatment position: BLT/LAS/MFR for Restricted Clavicle

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

**If using indirect MFR, remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

**If using direct MFR, remain in whichever position creates more tension and follow the direct barrier until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

BLT/LAS/MFR for Extrinsic Shoulder

Example Diagnosis: Restricted shoulder range of motion on the right

Physician Position: Seated on ipsilateral side

Patient Position: Supine

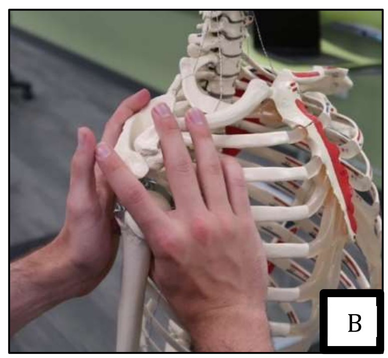
Think About It: The extrinsic components of the shoulder include everything that makes it move. Can you list all of those bones and muscles?

- Bones: Scapula, clavicle, ribs, thoracic, cervical, lumbar, sacrum, pelvis
- Muscles: Pectoralis major & minor, serratus anterior, teres major, levator scapulae, rhomboids, trapezius, latissimus dorsi

Procedure:

1. Cephalad hand contacts the scapula posteriorly.
2. Caudad hand gently places thumb in the axilla as posteriorly as possible, fingers contact anterior shoulder area: humerus, and clavicle if possible.
3. Gently engage the structures, beginning with the scapula. Carry the scapula into its position of ease while monitoring with anterior contact.
4. Allowing the tension of the ligaments to determine the direction, follow the direction of ease to the balance point—where all the forces are neutralized, and muscles relax.**
5. Hold this balanced position until a release is palpated.* It may be necessary to make minor adjustments to all planes until the position of best possible balance is achieved.**
6. Continue to repeat steps 3-5 as needed, monitoring both anteriorly and posteriorly. Adjust contact and pressure as necessary.
7. Return the patient to neutral and reassess.

A) Treatment position: Extrinsic shoulder BLT/LAS/MFR



B) Hand placement: Extrinsic shoulder BLT/LAS/MFR

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

**If using indirect MFR, remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

**If using direct MFR, remain in whichever position creates more tension and follow the direct barrier until no further change is noted or until you feel symmetric rhythmic motion return to the tissues.

BLT/LAS/MFR for Intrinsic Shoulder[5]

Think About It: The intrinsic components of the shoulder constitute the actual joint. Can you list all of those bones and muscles?

- Glenoid, humerus, capsule, rotator cuff muscles

Example Diagnosis: Restricted shoulder range of motion on the right

Physician Position: Seated on ipsilateral side

Patient Position: Supine

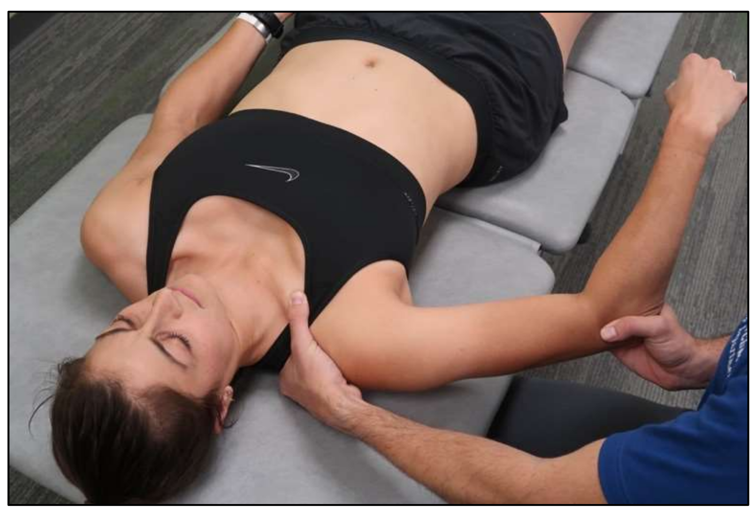
Procedure:

1. Cephalad hand stabilizes the scapula and clavicle—fingers posteriorly on scapula, thumb grasps the clavicle.
2. Caudad hand contacts the olecranon.
3. Gently engage the rotator cuff and glenohumeral joint capsule by compressing the humerus into the fossa (or distracting if needed).
4. Allowing the tension of the ligaments to determine the direction, follow the direction of ease to the balance point—where all the forces are neutralized, and muscles relax.**
5. Hold this balanced position until a release is palpated.* It may be necessary to make minor adjustments to all planes until the position of best possible balance is achieved.**
6. Continue to repeat steps 3-5 as needed for each individual muscle—Monitor both anteriorly and posteriorly. Adjust contact and pressure as necessary.
7. Next, slightly increase compression to engage the glenohumeral joint surface.
8. Repeat steps 4, 5 as needed to completely rebalance and reseat the glenohumeral joint.
9. Return the patient to neutral and reassess.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

**If using indirect MFR remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

**If using direct MFR remain in whichever position creates more tension and follow the direct barrier until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.



Treatment position for BLT/LAS/MFR intrinsic

BLT/LAS/MFR for Carpal/Metacarpal/Phalanx[1]

Example Diagnosis: Restricted right capitate

Physician Position: Seated or standing anterior to patient

Patient Position: Seated (or supine)

Procedure:

1. Grasp the affected bones with thumb and fingers.
2. Apply a gentle pressure to compress or distract the bones to find the point of disengagement.
3. Allowing the tension of the ligaments to determine the direction, follow the direction of ease to the balance point—where all the forces across the joint are neutralized.**
4. Hold this balanced position until a release is palpated.* It may be necessary to make minor adjustments to all planes until the position of best possible balance is achieved.**
5. Return the patient to neutral and reassess.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

**If using indirect MFR remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

**If using direct MFR remain in whichever position creates more tension and follow the direct barrier until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

A) Treatment position: BLT/LAS for carpal bones

B) Hand position: BLT/LAS for carpal bones

Upper Extremity "Long-lever" MFR[5]

Example Diagnosis: Restricted upper extremity fascia on the left

Physician Position: Standing on the left side of the table (side of dysfunction)

Patient Position: Supine

Procedure:

1. Flex and abduct the patient's left shoulder and extend the elbow.
2. Contact the patient's left forearm with both hands.
3. Apply a slight axial traction to engage the fascia of the upper extremity. Motion test the extremity in rotation, abduction/adduction, and flexion/extension to find the area of greatest restriction or ease.**
4. Hold the fascia in the position of greatest restriction or ease until a release is palpated* (respiratory assistance can be utilized to further enhance the release) and follow the release until there is no further change.**
5. Return the patient to neutral and reassess.

Treatment position: Upper extremity "long lever" MFR

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues

**If using indirect MFR remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.
**If using direct MFR remain in whichever position creates more tension and follow the direct barrier until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

Note: This can also be used to release the Sibson's fascia.

BLT/LAS/MFR for Upper Extremity Interosseous Membrane[5]

Mechanism: To make this a BLT technique for the interosseous membrane, expand awareness to the entire membrane between the ulna and radius.

Example Diagnosis: Restricted right interosseous membrane

Physician Position: Seated or standing anterior to patient or on the side of dysfunction

Patient Position: Seated or supine

Procedure:

1. Place thumbs on the anterior forearm, over the area of the interosseous membrane with the greatest restriction. The remaining fingers are wrapped around the posterior portion of the forearm.
2. Apply gentle pressure with thumbs to engage the interosseous membrane, then move it into a point of equal tension between both thumbs.**
3. Fine tuning can be accomplished by supinating/pronating the forearm.
4. Hold this balanced position until a release is palpated.* It may be necessary to make minor adjustments to all planes until the position of best possible balance is achieved.**
5. Return the patient to neutral and reassess.

Treatment position: BLT/LAS/MFR for Upper Extremity Interosseous

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

**If using indirect MFR remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

**If using direct MFR remain in whichever position creates more tension and follow the direct barrier until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

STILL

Still for Posterior Radial Head Dysfunction[6]

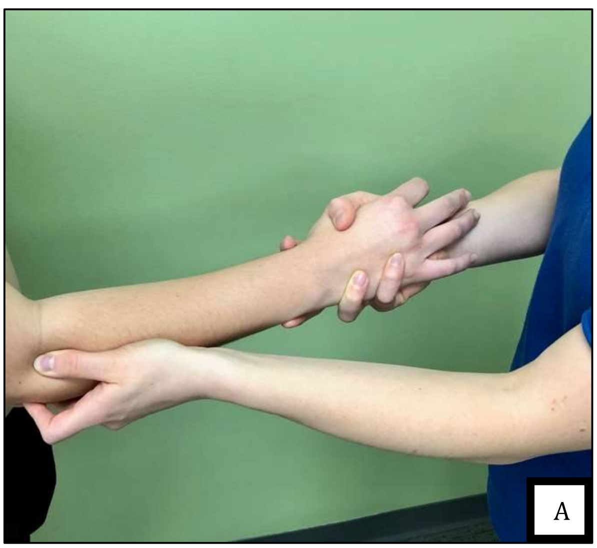
Example Diagnosis: Posterior left radial head

Physician Position: Seated or standing anterior to patient or on the side of the dysfunction

Patient Position: Seated or supine

Procedure:

1. The sensing hand gently contacts the radial head and supports the elbow. The patient's arm should be relaxed.
2. The operating hand encircles the patient's wrist. The forearm is brought into pronation until the radial head is brought into the direction of ease.
3. A gentle axial compressive force is applied through the distal radius to the radial head.
4. Maintaining that compression, the forearm is brought into supination.
5. Release the compression.
6. Return to neutral and reassess.



A) Initial treatment position: Still posterior radial head

B) Final treatment position: Still posterior radial head

Still for Anterior Radial Head Dysfunction[6]

Example Diagnosis: Anterior left radial head

Physician Position: Seated or standing next to patient (or on the side of the dysfunction)

Patient Position: Seated or supine

Procedure:

1. The sensing hand gently contacts the radial head and supports the elbow. The patient's arm should be relaxed.
2. The operating hand encircles the patient's wrist. The forearm is brought into supination until the radial head is brought into the direction of ease.
3. A gentle axial compressive force is applied through the distal radius to the radial head.
4. Maintaining that compression, the forearm is brought into pronation.
5. Release the compression.
6. Return to neutral and reassess.

A) Initial treatment position: Still anterior radial head

B) Final treatment position: Still anterior radial head

Still for Lateral Epicondylitis (Tennis Elbow)[6]

Example Diagnosis: Right lateral epicondylitis

Physician Position: Seated or standing next to patient (or on the side of the dysfunction)

Patient Position: Seated or supine

Procedure:

- The sensing hand gently grasps the affected elbow contacting the lateral epicondyle over the common extensor tendon of the wrist.
- The operating hand grasps the patient's hand palm to palm (like a handshake).
- The wrist is supinated and extended. The elbow should be partially flexed to encourage relaxation of the brachioradialis and extensor carpi radialis muscles. In this position, the tissue under the sensing finger (at the common extensor tendon) should feel relaxed or balanced. The patient may report a decrease in tenderness/pain in the area.
- Axial compression is then applied along the forearm until tissue response is felt at the lateral epicondyle.
- Maintaining the compression, the wrist is then moved into flexion and pronation concurrently.
- Release the compression.
- Return to neutral and reassess.

A) Initial treatment position: Still for lateral epicondylitis

B) Final treatment position: Still for lateral epicondylitis

Still for Medial Epicondylitis (Golfer's Elbow)[6]

Example Diagnosis: Right medial epicondylitis

Physician Position: Seated or standing next to patient (or on the side of the dysfunction)

Patient Position: Seated or supine

Procedure:

1. The sensing hand gently grasps the affected elbow, contacting the medial epicondyle over the common flexor tendon of the wrist.
2. The operating hand grasps the patient's hand (see photo below).
3. The wrist is pronated and flexed. The elbow should also be partially flexed to encourage relaxation of the brachioradialis and flexor carpi radialis muscles. In this position, the tissue under the sensing finger (at the common flexor tendon) should feel relaxed or balanced. The patient may report a decrease in tenderness/pain in the area.
4. Axial compression is then applied along the forearm until tissue response is felt at the medial epicondyle.
5. Maintaining the compression, the wrist is then moved into extension and supination concurrently.
6. Release the compression.
7. Return to neutral and reassess.

A) Initial treatment position: Still for medial epicondylitis

B) Final treatment position: Still for medial epicondylitis

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Chapter 12

Lower Extremity

"I have no desire to be a cat, which walks so lightly that it never creates a disturbance."

-A.T. Still, M.D., D.O.

Contents:

NOTES

Autonomics[1,12]

Autonomic Spinal Levels for the Lower Extremity

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Lower Extremity	T10-L2	None

Chapman's Reflex Points for the Lower Extremity

	Anterior Point Location	Posterior Point Location
Sciatic Nerve	1st: 1/5th of the length of the femur inferior to greater trochanter extending 2-3 inches inferiorly on the posterolateral aspect of the femur 2nd: 1/5th of the length of the femur superior to the knee extending 2 inches superiorly on the posterolateral aspect of the femur 3rd: 1/3 of the distance superior to the femoral condyles on the mid-posterior region of the femur	The superior portion of the sacrum, just medial to the SI joint

**Please see the Appendix for a visual aid and comprehensive list of Chapman's Reflex Points.*

Lower Extremity

Sympathetic innervation to the lower extremity affects the vasculature, sweat glands, and connective tissue. Sympathetic innervation to the vasculature controls the resistance to blood flow in the vessels. Mainly, sympathetic innervation constricts smooth muscle in the vasculature, increasing resistance. Sympathetic innervation to the sweat glands increases secretory activity of the gland. Sympathetic innervation to the connective tissue plays a role in modulating cellular components and maintenance of tissue integrity.

Osteopathic Considerations in Autonomics Related to the Lower Extremity

From an osteopathic perspective, the interactions between the nervous and musculoskeletal systems manifest in the tissues. Alterations in sympathetic tone due to lower extremity pathology may present as paraspinal tissue texture changes and range of motion restrictions from T10-L2. Additionally, the sympathetic chain ganglia lie anterior to the head of the ribs, so dysfunction in the lower thoracic spine, upper lumbar spine, or lower ribs may manifest as increased sympathetic tone to the lower extremity causing altered motion, nerve dysfunction, and lymphatic or venous congestion as well decreased arterial blood flow to the structures of the leg. For this reason, special attention should be paid to the lower thoracic vertebrae, upper lumbar, and ribs in the setting of increased sympathetic tone to the lower extremity.

Biomechanics[3-6]

Myofascial Anatomy

In this section, you will learn the ways in which the myofascial networks of the body act as a model of tensegrity, working together to initiate movement, stabilize, and respond to stress. Through the weaving of interconnected structures, our myofascial networks are reinforced through interplay between compressive and tensile forces, thus creating an avenue for the dispersal of tension and strain on the system. Therefore, it becomes increasingly important to understand the described fascial lines in the setting of injury, as injury may occur at a distant "weak point" in the system from distributed strain, rather than direct injury. Understanding these fascial lines will aid in clinical decision making in the approach to injuries and strains along the myofascial networks.

Superficial Back Line (SBL)

This line transmits force from the foot to the cranium. It is responsible for flexion of the knee and extension of the trunk. The SBL starts on the plantar surface of toes → plantar fascia → calcaneus → Achilles tendon → gastrocnemius → femoral condyles → hamstrings (biceps femoris, semitendinosus, semimembranosus) → ischial tuberosity →sacrotuberous ligament →sacrum → lumbosacral fascia → erector spinae (lumborum, thoracis, cervicis, capitis) → occipital ridge → galea aponeurotica

- Superficial Back Line
    - Plantar fascia
    - Gastrocnemius
    - Hamstrings
    - Sacrotuberous ligament
    - Erector spinae
    - Galea aponeurotica

Superficial Front Line (SFL)

This line transmits force from the top of the feet to the sides of the skull. It is responsible for flexion of the trunk and hips, as well as extension at the knee. Often, tension in the hamstrings is evidence of weakness in the quadriceps.

The SFL begins on the dorsal phalanges → tibialis anterior and extensor digitorum → patella → quadriceps (rectus femoris, vastus lateralis, vastus medialis, vastus intermedius) → anterior inferior iliac spine and pubic tubercle → rectus abdominis → 5th rib → sternalis → sternum → sternocleidomastoid → mastoid process

- Superficial Front Line
    - Tibialis anterior
    - Extensor digitorum
    - Patellar tendon
    - Rectus femoris/Quadriceps
    - Rectus abdominis
    - Sternalis
    - Sternocleidomastoid
    - Scalp fascia

Deep Front Line (DFL)

This line is an interior transmitter of force and incorporates what is considered the "core". The line does not have a single movement that solely requires engagement of the DFL, however, all movement is influenced by this line.

The DFL begins at the plantar tarsals and toes → posterior tibialis, flexor hallucis longus, and flexor digitorum longus → posterior-superior tibia → medial femoral condyle → hip adductors (adductor magnus, adductor brevis, pectineus, adductor longus) → lesser trochanter of femur, ischiopubic ramus, and sacrum → pelvic floor → iliacus → quadratus lumborum → psoas major → lumbar spine → thoracic spine → transversus abdominis → respiratory diaphragm → posterior sternum → hyoid bone → scaleni, hyoid muscles, longus colli and capitis → cervical spine → basal part of occiput → masseter → temporalis → cranium

- Deep Front Line
    - Tibialis posterior
    - Adductors
    - Anterior sacral fascia
    - Pelvic floor
    - Psoas and iliacus
    - Posterior diaphragm
    - Anterior diaphragm
    - Anterior longitudinal ligament
    - Pericardium
    - Infrahyoid muscles
    - Suprahyoid muscles
    - Masseter
    - Temporalis

Lateral Line (LL)

This line transmits force on each side of the body. It participates in translational and sidebending forces, abduction of the hip, and eversion of the foot. The LL can allow a respiratory rib dysfunction to cause dysfunction in the pelvis or lower extremity.

The LL starts at the 1st and 5th metatarsals → fibularis longus and brevis → fibular head and lateral tibial condyle → Iliotibial band → tensor fascia latae and gluteus maximus → iliac crest/ASIS/PSIS → external and internal abdominal obliques → ribs → external and internal intercostal muscles → 1st and 2nd ribs → splenius capitis and sternocleidomastoid → mastoid process and occipital ridge

- Lateral Line
    - Fibularis longus and brevis
    - Tensor fasciae latae
    - Gluteus maximus
    - Lateral abdominal obliques
    - Intercostals

 - Splenius capitis
 - Sternocleidomastoid

Spiral Line (SPL)

This line is actually two lines spanning from the occipital ridge to the first metatarsal then back up to the occiput, wrapping around the body in two helices, right and left, which intersect at the upper back. The SPL functions to balance out the other lines and compensates for motions between planes, such as twisting, and is responsible for the patterns seen with eversion ankle injuries and leads to the ipsilateral anterior innominate, exhaled ribs on the contralateral side, laterally rotated scapular angle, and OA dysfunction. The SPL starts at the occipital ridge → erector spinae/lumbosacral fascia → Sacrum → sacrotuberous ligament → ischial tuberosity → biceps femoris → fibular head → fibularis longus → 1st metatarsal → anterior tibialis → lateral tibial condyle → tensor fascia latae → iliac crest/anterior superior iliac spine → internal abdominal obliques → linea alba → external oblique → lateral ribs → serratus anterior → medial border of scapula → rhomboids → lower cervical/upper thoracic spine → splenius capitis and cervicis → occipital ridge

- Spiral Line
  - Erector spinae/lumbosacral fascia
  - Sacrotuberous ligament
  - Biceps femoris
  - Fibularis longus
  - Tibialis anterior
  - Tensor fasciae latae/Iliotibial band
  - Internal and external obliques
  - Serratus anterior
  - Rhomboids major and minor
  - Splenius capitis and cervicis

Osteopathic Considerations in Biomechanics related to the Lower Extremity

As is clear from the above discussion on the long fascial lines, tensegrity is an important factor when evaluating the musculoskeletal system. Somatic dysfunctions in the lower extremity may have far reaching consequences throughout the body. In any evaluation of the extremities, it is important to always evaluate the joint above and below the problem area. Focus should be aimed towards the biomechanical structures for somatic dysfunction, injury, or potential neurovascular compromise. For example, there are multiple regions in the lower extremity that are common sites for compression of the sciatic and common peroneal nerves and should be appropriately evaluated for dysfunction. In addition, when there is dysfunction of the lower extremity, it is important to evaluate the following areas for somatic dysfunction: thoracic spine, lumbar spine, pelvis, and sacrum. Somatic dysfunction in these areas may manifest as lower extremity pathology. Other anatomy to consider:

- Femur and femoral-acetabular joint (common site of LE pathology, muscle and ligamentous attachment site)
- Fibular head (adjacent to site of common peroneal nerve entrapment, muscle and ligamentous attachment site)
- Tibia (muscle attachments, ligamentous attachments, talocrural joint)

- Tarsal bones, metatarsals, phalanges (site of muscle and ligamentous attachment)
- Sciatic nerve (common area of compression is over, under, or through piriformis)
- Common peroneal nerve (common area of compression is posterior to the fibular head)

Circulation[5,8]

- Arterial: aorta → common iliac artery → external iliac artery → femoral artery (after inguinal ligament) → popliteal artery (after adductor hiatus) → distal structures of the leg, ankle, and foot
- Venous:
  - Superficial structures of the LE → great saphenous vein → femoral vein → external iliac vein (after inguinal ligament) → common iliac vein → IVC
  - Deep structures of the LE → popliteal vein → femoral vein (after adductor hiatus) → external iliac vein (after inguinal ligament) → common iliac vein → IVC
- Lymphatic:
  - Superficial structure of the LE → superficial inguinal lymph nodes → deep inguinal lymph nodes → external iliac lymph nodes → common iliac lymph nodes → lumbar lymph nodes → cisterna chyli → thoracic duct
  - Deep structures of the LE → popliteal lymph nodes → deep inguinal lymph nodes → external iliac lymph nodes → common iliac nodes → lumbar lymph nodes → cisterna chyli → thoracic duct

Osteopathic Considerations in Circulation related to the Lower Extremities

It is important to remember that proper function of the transverse diaphragms, or baffles, of the thoracoabdominal cavity is critical for appropriate return of the fluids in the low-pressure circulatory system (venous and lymphatic systems). These baffles include the thoracic inlet and related Sibson's fascia, the thoracoabdominal diaphragm, and the pelvic diaphragm. For a more complete review, please see your first-year manual or any of the referenced materials. Signs and symptoms of lymphatic congestion include swelling, edema and fullness of the lower extremities. It is imperative that full medical consideration be given to the reasons for the swelling prior to any OMT intervention so that no medical diagnoses are missed.

Screening[5,6]

The anatomic regions and structures provided above relate to the autonomic, biomechanic, and circulatory aspects of the lower extremity. Of all the parts of the musculoskeletal system, these are the most relevant to dysfunction of the lower extremity. An osteopathic screening exam or an area of greatest restriction (AGR) screen can help identify the most significant somatic dysfunction in the individual patient. Below are the most helpful screening exams and the areas most often found with somatic dysfunction in a patient with disease of the lower extremity. Next, biochemical and biophysical tests frequently used in the evaluation of the lower extremity are provided. Lastly, recall the importance of assessing the psychosocial aspects of the patient's health, details of which can be found in chapter 1.

Osteopathic Structural Exam

- AGR screen to identify key somatic dysfunction
- Chapman's screen to identify viscerosomatic reflexes
- Gait, including stance and swing phases for mobility of LE
- Squat to assess functional mobility of LE
- T10-L2 for the sympathetic innervation of the lower extremity
- Lumbar spine for contributions from SNS and site of muscular attachment
- Innominate to identify dysfunction contributing to impaired mechanics, site of muscular/ligamentous attachment
- Sacrum to identify dysfunction contributing to impaired mechanics, site of muscular/ligamentous attachment
- Pelvic diaphragm to identify potential source of neurovascular compromise in LE
- Femur to identify dysfunction contributing to impaired mechanics, site of muscular/ligamentous attachment
- Tibia to identify dysfunction contributing to impaired mechanics, site of muscular/ligamentous attachment
- Fibula to identify dysfunction contributing to impaired mechanics, neurovascular compression, site of muscular/ligamentous attachment
- Tarsals, metatarsals, phalanges to identify dysfunction contributing to impaired mechanics, site of muscular/ligamentous attachment
- Range of motion and special tests of hip
- Range of motion and special tests for the knee
- Range of motion and ankle special tests
- Flexor retinaculum to identify potential source of neurovascular compression
- Neurologic exam

Testing

- Doppler US to identify specific areas of vascular compromise
- Electromyography to identify peripheral nerve disorders
- MRI to assess for soft tissue pathology of the LE
- Ankle-Brachial Index to assess for arterial compromise of LE
- XR/CT to assess osseous structural pathology of the LE
- Joint aspiration to assess fluid for infection or inflammation

Technique Contents:

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)/Myofascial Release (MFR)

Long Lever BLT/LAS/MFR for Hip Dysfunctions[11]

Example Diagnosis: Abducted left hip

Physician Position: Standing at the foot of the table

Patient Position: Supine

Procedure:

1. Contact the patient's left ankle with both hands and lift it off the table.
2. Apply a slight axial traction to engage the ligaments of the hip.
3. Motion test until a position of balance is palpated with increasingly finer motion to fine-tune balance of tension within the ligaments.**
4. Wait for a release.* The release should be achieved relatively quickly. If not, repeat step 3.
5. After a release is palpated, return the patient to neutral and reassess.

Treatment position for Long Lever BLT for Hip Dysfunctions

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

**If using indirect MFR remain in whichever position allows the tissues to soften and follow the direction of ease until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

**If using direct MFR remain in whichever position creates more tension and follow the direct barrier until no further change is noted, or until you feel symmetric rhythmic motion return to the tissues.

BLT/LAS for Femorotibial Dysfunction[11]

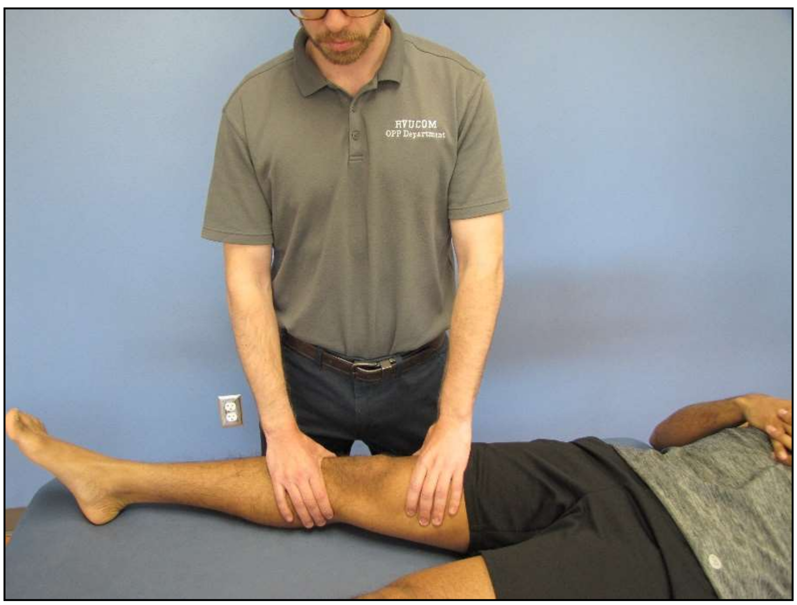
Example Diagnosis: Right anterior cruciate ligament sprain; right tibia external rotation

Physician Position: Standing on the side of dysfunction

Patient Position: Supine

Procedure:

1. With the caudal hand contact the proximal tibia, and with the cephalad hand contact the distal femur.
2. Apply a slight posterior force into the table with both hands to begin to localize the treatment to the ligaments in the knee.
3. To engage the structures for treatment, introduce a slight compressive force approximating the femur and tibia. A slight internal or external rotation of the tibia and femur can be used to fine-tune the positioning. Place the tissues in the position of the best possible balance.
4. Wait for a release.* The release should be achieved relatively quickly. If not, repeat step 3.
5. After a release is palpated, return the patient to neutral and reassess.



Treatment position for BLT for Femorotibial Dysfunctions.

Think About It

Multiple structures are being treated with this technique. ACL, PCL, MCL, and LCL are the most commonly thought of ligaments in this treatment. Additionally, other ligaments like the joint capsule, arcuate popliteal ligament, and the oblique popliteal ligament can be treated with this technique as well. Keep in mind the anatomy of any structure being treated!

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Note: To treat the collateral ligaments, a varus/valgus motion is also introduced to localize the treatment.

BLT/LAS for Fibular Head Dysfunctions[11]

Example Diagnosis: Right posterior fibular head (can be used for anterior fibular head as well)

Physician Position: Seated or standing on the side of dysfunction

Patient Position: Supine

Procedure:

1. Place cephalad thumb over the fibular head and caudal thumb over the lateral malleolus while using the caudal hand to control the foot and ankle.
2. Apply posterior and inferior pressure to the fibular head with the cephalad thumb while internally rotating the foot and ankle with the opposite hand.
3. Continue this compression and rotation (exaggerating the SD) until a position of equal tension among ligamentous attachments is felt.
4. Wait for a release.* The release should be achieved relatively quickly. If not, repeat step 3.
5. After a release is palpated, return the patient to neutral and reassess.

A) Treatment position for BLT for Fibular Head Dysfunctions

B) Modified treatment position for BLT of Fibular Head

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Note: This technique can also be modified by using index fingers to balance under the fibular head and lateral malleolus by bending the hip and knee to approx. 90° each, then balancing each end of the fibula on said index fingers.

Subtalar BLT/LAS "Bootjack Technique"[11]

Example Diagnosis: Compressed and restricted right subtalar joint; right calcaneus inversion

Physician Position: Standing on the side of dysfunction

Patient Position: Supine

Procedure:

1. Flex, abduct, and externally rotate the patient's right hip, and flex the right knee.
2. Place cephalad elbow into the patient's popliteal fossa, contacting their hamstrings.
3. Use the same cephalad hand to cradle the patient's proximal calcaneus.
4. With extension of the cephalad wrist and bracing the elbow against the patient's hamstring, distract the calcaneus from the talus. This can be exaggerated by bringing the patient's knee into further flexion.
5. Wrap the caudal hand around the metatarsals of the right foot.
6. A point of equal tension is found in the subtalar joint by plantar flexing the forefoot and supinating the foot with the caudal hand while further distracting the calcaneus from the talus.
7. Wait for a release.* The release should be achieved relatively quickly. If not, repeat step 6.
8. After a release is palpated, return the patient to neutral and reassess.

Treatment position for Subtalar BLT/ "Bootjack Technique"

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

BLT/LAS for Mid-foot and Forefoot Dysfunctions[11]

Example Diagnosis: Left inferior (dropped) navicular

Physician Position: Standing at the foot of the table

Patient Position: Supine

Procedure:

1. Place thumbs on the dorsal aspect of the navicular of the left foot wrapping the remaining fingers around to contact the plantar surface.
2. Take the patient's foot into slight plantar flexion and add compression toward the table and into the affected joint.
3. Find a point of equal tension within the joint by varying compression, traction, and motion in all planes.
4. Wait for a release.* The release should be achieved relatively quickly. If not, repeat step 3.
5. After a release is palpated, return the patient to neutral and reassess.

Treatment position for BLT for Mid-Foot and Forefoot Dysfunctions

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

BLT/LAS for Lower Extremity Interosseous Membrane Release

Example Diagnosis: Left restricted interosseous membrane

Physician Position: Seated or standing on the side of dysfunction

Patient Position: Supine

Procedure:

1. Place thumbs over the area of greatest restriction along the interosseous membrane wrapping fingers anteriorly and medially over the tibia.
2. Apply a gentle posterior pressure with thumbs to engage the interosseous membrane.
3. Motion test the membrane to find the balance point of equal tension in all planes.
4. With the cephalad or caudal hand, internally/externally rotate the leg to fine-tune the ligamentous balance point.
5. Wait for a release.* The release should be achieved relatively quickly. If not, repeat steps 2 and 3.
6. After a release is palpated, return the patient to neutral and reassess.

Treatment position for Lower Extremity Interosseous Membrane Release

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Myofascial Release (MFR)

MFR for Gastrocnemius[11]

Example Diagnosis: Restricted right gastrocnemius

Physician Position: Standing on the side of dysfunction

Patient Position: Supine with right knee bent so the right foot is flat on the table

Procedure:

1. Place both hands posteromedial to the right gastrocnemius so that the finger pads contact the origin of the muscle in the popliteal fossa and the thumbs wrap around the anterior aspect of the leg.
2. Apply a gentle anterior pressure with fingers sinking deeper into the gastrocnemius muscle.
3. Motion test until finding the desired position.*
4. Return the tissues to neutral and reassess.

Treatment position for MFR for Gastrocnemius

* If using direct MFR, place the tissues in the position that creates more tension and **follow** the barrier as it moves until the release. With indirect MFR, place the tissues in the direction(s) of ease and **follow** until palpating a release.

MFR for Plantar Fascia[11]

Example Diagnosis: Increased tension in the left plantar fascia

Physician Position: Seated at the foot of the table

Patient Position: Supine

Procedure:

1. Make an "X" with both thumbs and place over the area of greatest restriction in the plantar fascia.
2. Apply superior opposing force through both thumbs (moving thumbs away from each other) sinking deeper into the plantar fascia until finding the desired position.*
3. Hold this position until a release is palpated, following the fascial creep as necessary until no further release is palpated.
4. Repeat steps 2 and 3 with the foot in plantar flexion and dorsiflexion to engage the different planes of fascia.
5. Return the patient to neutral and reassess.

Treatment position MFR for Plantar Fascia

*If using <u>direct MFR,</u> place the tissues in the position that creates more tension and **follow** the barrier as it moves until the release. With <u>indirect MFR,</u> place the tissues in the direction(s) of ease and **follow** until palpating a release.

Still Technique

Still for Posterior Fibular Head Dysfunction[10]

Example Diagnosis: Left posterior fibular head

Physician Position: Seated or standing next to patient

Patient Position: Seated or supine

Procedure:

1. The cephalad hand fingers are placed around the fibular head.
2. The caudal hand grasps the foot gently, inducing supination (plantar flexion, inversion of the hindfoot, adduction of the forefoot) and internal tibial rotation in order to draw the fibular head posteriorly into the position of ease.
3. Gentle axial compression is applied through the caudal hand to the fibular head until a tissue response is felt under the cephalad hand fingers.
4. Maintaining compression, the foot is then dorsiflexed and pronated while concurrently inducing external rotation of the tibia. This will bring the fibular head anteriorly into the direct barrier.
5. Release compression and reassess.

A) Initial position for Still Posterior Fibular Head

B) Final position for Still Posterior Fibular Head

Still for Anterior Fibular Head Dysfunction[10]

Example Diagnosis: Left anterior fibular head

Physician Position: Seated or standing next to patient

Patient Position: Seated or supine

Procedure:

1. The cephalad hand fingers are placed around the fibular head.
2. The caudal hand grasps the foot gently inducing pronation (dorsiflexion, eversion of the hindfoot, abduction of the forefoot) and external tibial rotation in order to draw the fibular head anteriorly into the position of ease.
3. Gentle axial compression is applied through the caudal hand to the fibular head until a tissue response is felt under the cephalad hand fingers.
4. Maintaining compression, the foot is then plantar flexed and supinated while concurrently inducing internal rotation of the tibia. This will bring the fibular head posteriorly into the direct barrier.
5. Release compression and reassess.

A) Initial position for Still Anterior Fibular Head

B) Final position for Still Posterior Fibular Head

Still for Navicular Dysfunction[10]

Example Diagnosis: Right inferior (dropped) navicular bone

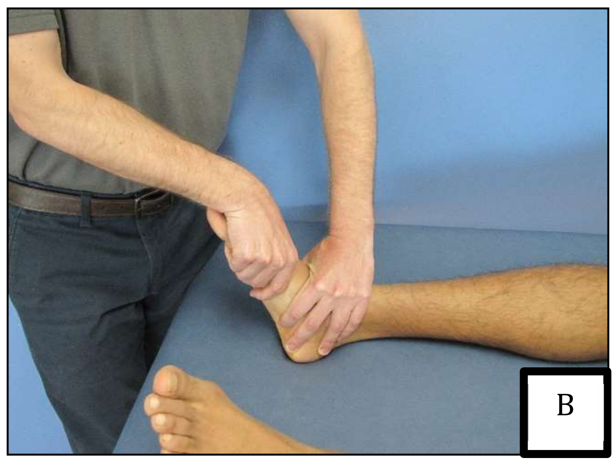
Physician Position: Seated or standing at the foot of the table

Patient Position: Supine

Procedure:

1. The cephalad hand grasps the ankle and as the fingers detect motion at the medial surface of the navicular.
2. The caudal hand grasps the forefoot and rotates it inward on the long axis of the foot, slight pronating and plantar flexing the foot. This will produce a palpable relaxation in the tissues overlying the bone.
3. A gentle axial compression is applied through the caudal hand to the navicular bone until a tissue response is felt under the cephalad hand.
4. Maintaining compression, the forefoot is rotated outward, specifically the medial plantar surface of the foot is rotated superiorly. This will bring the navicular superiorly into the direct barrier.
5. Release compression and reassess.

A) Initial position for Still Navicular Dysfunction



B) Final position for Still Navicular Dysfunction

Still for Cuboid Dysfunction[10]

Example Diagnosis: Left inferior (dropped) cuboid bone

Physician Position: Seated or standing next to patient

Patient Position: Supine

Procedure:

1. The cephalad hand grasps the foot with the sensing finger on the inferior surface of the cuboid bone.
2. The caudal hand grasps the fourth and fifth metatarsal bones to control motion of the forefoot
3. The caudal hand dorsiflexes the fourth and fifth metatarsals, reinforcing the inferior position of the cuboid and producing a palpable relaxation in the overlying tissues.
4. The caudal hand introduces gentle axial compression or traction from the metatarsals that is directed towards the cuboid.
5. Maintaining compression or traction, the metatarsals are then brought into plantar flexion. This will bring the cuboid superiorly into the direct barrier.
6. Compression is released and reassess.

A) Initial position for Still Cuboid Dysfunction

B) Final Position for Still Cuboid Dysfunction

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Chapter 13

Additional Techniques

"He [the osteopath] should never dally with effects but ever go back to the cause, which when corrected results in a disappearance of the effect."

-A.T. Still, M.D., D.O.

NOTES

1. Reiterate the principles of FPR, BLT and Still modalities and that they can be applied to any body region or patient case, even if they have not been explicitly demonstrated
2. Apply the principles of FPR, BLT and Still technique to specific somatic dysfunctions of the cervical spine
3. Practice each of the following techniques:
   A. FPR for OA Joint Dysfunctions
   B. FPR for AA Joint Dysfunctions
   C. FPR for Typical Cervical (C2-C7) Joint Dysfunctions
   D. Still for OA Joint Dysfunctions
   E. Still for AA Joint Dysfunctions
   F. Still for Typical Cervical (C2-C7) Joint Dysfunctions
   G. BLT/LAS for OA Joint Dysfunctions
   H. BLT/LAS for AA Joint Dysfunctions
   I. Short-lever BLT/LAS for Typical Cervical (C2-C7) Joint Dysfunctions
   J. Long-lever BLT/LAS for Typical Cervical (C2-C7) Joint Dysfunctions

LAB Attire: Shorts and T-shirt (no metal or plastic)

Technique Contents:

Cervical Spine

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

BLT/LAS for Occipitoatlantal (OA) Joint Dysfunctions

BLT/LAS for Atlantoaxial (AA) Joint Dysfunctions

Short-Lever BLT/LAS for Typical Cervical (C2-C7) Joint Dysfunctions

Long-Lever BLT/LAS for Typical Cervical (C2-C7) Joint Dysfunctions

Facilitated Positional Release

FPR for Occipitoatlantal (OA) Joint Dysfunctions

FPR for Atlantoaxial (AA) Joints Dysfunctions

FPR for Typical Cervical (C2-C7) Joint Dysfunctions

Still Technique

Still for Occipitoatlantal (OA) Joint Dysfunctions

Still for Atlantoaxial (AA) Joint Dysfunctions

Still for Typical Cervical (C2-C7) Joint Dysfunctions

Thoracic Spine

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Short-Lever BLT/LAS for Upper Thoracic (T1-T2) Joint Dysfunctions

Long-Lever BLT/LAS for Thoracic Joint Dysfunctions

Facilitated Positional Release

FPR for Upper Thoracic (T1-T4) Joint Dysfunctions

FPR for Lower (T5-T12) Type I Thoracic Joint Dysfunctions

FPR for Lower (T5-T12) Type II Thoracic Joint Dysfunctions

High Velocity Low Amplitude

Seated HVLA for Type II Thoracic Joint Dysfunctions/ “Epigastric Thrust”

Seated HVLA for Type II Extended Thoracic Joint Dysfunctions/“Knee in Back”

Seated HVLA for Type II Flexed Thoracic Joint Dysfunctions/“Knee in Back”

Prone HVLA for Lower (T5-T12) Thoracic Joint Dysfunctions/Cross Hand Pisiform Thrust/“Texas Twist”

Supine HVLA for Upper (T1-T5) Thoracic Joint Dysfunctions/“Watermelon”

Myofascial Release

Indirect MFR Upper Thoracic (T1-T2) Joint Dysfunctions

Still Technique

Seated Still for Upper Thoracic (T1-T4) Joint Dysfunctions

Seated Still for Lower (T5-T12) Type I Thoracic Joint Dysfunctions

Seated Still for Lower (T5-T12) Type II Thoracic Joint Dysfunctions

On-Side Still for Lower (T5-T12) Type I and Type II Thoracic Joint Dysfunctions

Lumbar Spine

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Short-Lever BLT/LAS for Lumbar Joint Dysfunctions

Long-Lever BLT/LAS for Lumbar Joint Dysfunctions

BLT/LAS for Lumbosacral Junction

Facilitated Positional Release

FPR for Type I Lumbar Joint Dysfunctions

FPR for Type II Lumbar Joint Dysfunctions

Still Technique

Supine Still for Type I Lumbar Joint Dysfunctions

Supine Still for Type II Flexed Lumbar Joint Dysfunctions

Supine Still for Type II Extended Lumbar Joint Dysfunctions

Pelvis

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Supine BLT/LAS for Innominate Dysfunctions

Seated BLT/LAS for Innominate Dysfunctions

Seated BLT/LAS for the Pelvic Diaphragm

Still Technique

Still for Anteriorly Rotated Innominate

Still for Posteriorly Rotated Innominate

Still for Superior Innominate Shears

Sacrum

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Four Pole BLT/LAS for Sacrum Dysfunctions

Miscellaneous Techniques

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Bilateral Shoulder Balancing

CERVICAL SPINE

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

BLT/LAS for Occipitoatlantal (OA) Joint Dysfunctions[1]

Example Diagnosis: OA ESLRR

Physician Position: Seated at the head of the table

Patient Position: Supine

Procedure:

1. Place index fingers posterior to the articular pillars of C1 and middle fingers over the inferior portion of the occiput with the palms cupping each side of the head.
2. Place the occiput into the position of balance with respect to the atlas.
    a. Extend the occiput by applying anterior pressure with both middle fingers.
    b. Rotate the occiput to the right by applying slightly more anterior pressure to the left side of the occiput with the left middle finger.
    c. Sidebend the occiput to the left by translating the occiput to the right using both middle fingers together.
    d. Remember, this position (OA ESLRR) is the left occipital condyle anterior. The balance point will be where the tension across the OA joint is in balance. So, instead of using the three separate motions above, the physician may gently advance the left condyle until the force is equalized.
3. Make minor adjustments to all planes until the position of best possible balance is achieved.
4. Wait for the release.* If a release is not palpated, repeat step 3.
5. After a release is palpated, return the occiput to neutral and reassess.

A) Treatment position: BLT/LAS OA

B) Angled view to show hand placement

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

BLT/LAS for Atlantoaxial (AA) Joint Dysfunctions[1]

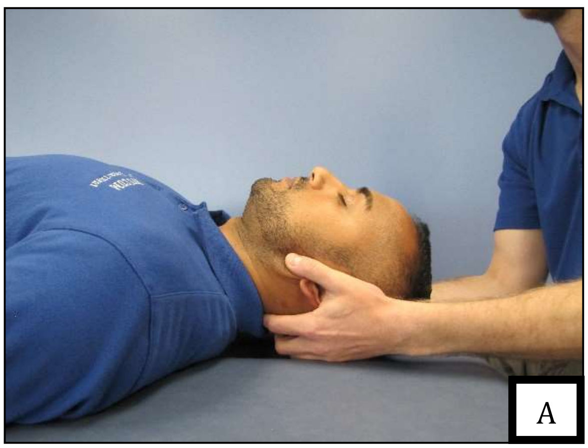
Example Diagnosis: AA RR

Physician Position: Seated at the head of the table

Patient Position: Supine

Procedure:

1. Place index fingers posterior to the articular pillars of C2 and middle fingers posterior to the articular pillars of C1.
2. Rotate C1 to the right by applying anterior pressure to the left articular pillar of C1 with the left middle finger.
3. Make minor adjustments to all planes until the desired position is achieved.
4. Wait for a release.* If a release is not palpated, repeat step 3.
5. After a release is palpated, return C1 to neutral and reassess.



A) Treatment position: BLT/LAS AA

B) Angled view to show hand placement

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Short-Lever BLT/LAS for Typical Cervical (C2-C7) Joint Dysfunctions[1]

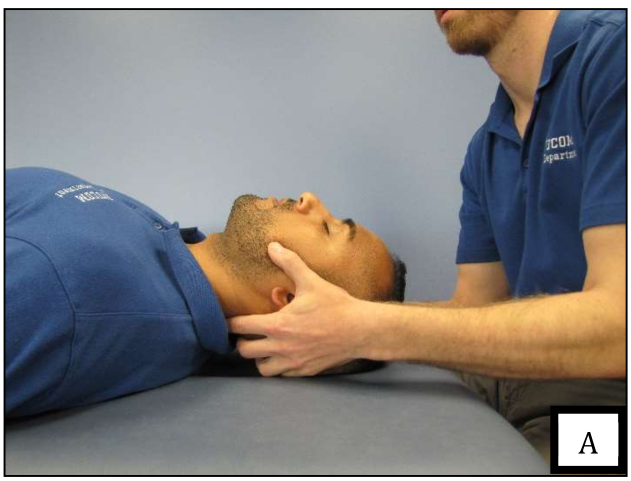
Example Diagnosis: C5 ERRSR

Physician Position: Seated at the head of the table

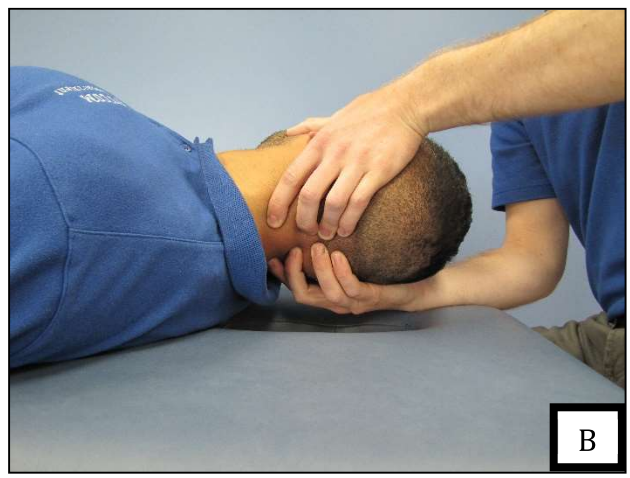
Patient Position: Supine

Procedure:

1. Place index fingers posterior to the articular pillars of C6 and middle fingers posterior to the articular pillars of C5.
2. Extend C5 by applying anterior and slightly superior pressure with both middle fingers on the inferior portion of the articular pillars.
3. Rotate C5 to the right by applying slightly more anterior pressure to the left articular pillar of C5 with the left middle finger.
4. Sidebend C5 to the right by translating C5 to the left using both middle fingers together.
5. Make minor adjustments to all planes until the desired position is achieved.
6. Wait for a release.* If a release is not palpated, repeat step 5.
7. After a release is palpated, return C5 to neutral and reassess.



A) Treatment position: Short-lever BLT/LAS for Typical Cervical



B) Angled view to show hand placement

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Long-Lever BLT/LAS for Typical Cervical (C2-C7) Joint Dysfunctions

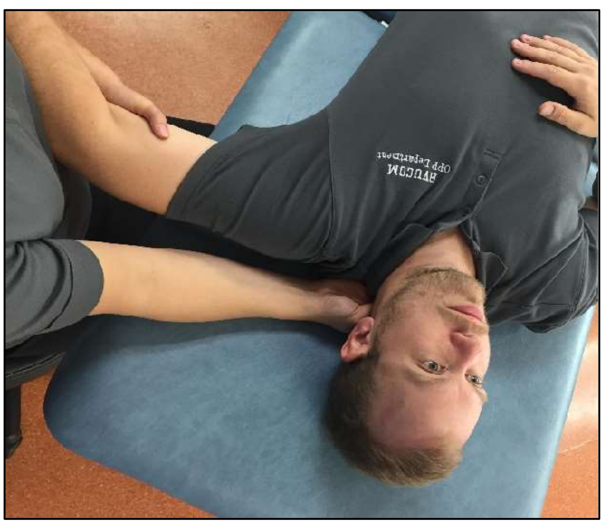
Example Diagnosis: C5 ERRSR

Physician Position: Seated at the side of the patient

Patient Position: Supine

Procedure:

1. Place cephalad hand under the articulation of C5 on C6, use caudal hand to grasp the patient's ipsilateral arm.
2. Apply abduction to the patient's arm to localize more inferiorly along the axial spine. Apply adduction to localize more superiorly along the axial spine. Localize to the level of C5.
3. Using the arm as a long lever, fine tune motion until a balance is felt at C5. Vertebral rotation is induced by protracting (pulling the arm) which creates contralateral vertebral rotation or by retracting (pushing the arm medially) which creates ipsilateral vertebral rotation of the arm. Side bending is induced by longitudinal force along the arm, with compression sidebending ipsilaterally and traction sidebending contralaterally. Flexion of the spine is induced by internal rotation of the arm and extension induced by external rotation of the arm.
4. Make minor adjustments to all planes until the desired position of ease is achieved.
5. Wait for a release (if a release is not palpated, repeat step 4).*
6. After a release is palpated, return to neutral and reassess.



Treatment position: Long-lever BLT/LAS for Typical Cervical Joint Dysfunctions

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

FACILITATED POSITIONAL RELEASE (FPR)

FPR for Occipitoatlantal (OA) Joint Dysfunctions

Example Diagnosis: OA ES_LR_R

Physician Position: Seated at the head of the table. Caudal hand is monitoring the somatic dysfunction at the OA, with the index finger on one transverse process of C1, and the thumb on the other transverse process of C1. The caudal hand is guiding the motion described below. The cephalad hand is the 'action' hand that is applying axial compression.

Patient Position: Supine

Procedure:

1. Gently traction the occiput superiorly to reduce the cervical lordosis. Neutralize curve
2. Apply axial compression (caudally, along the spine) with the cephalad hand, vectoring toward the OA. Use only enough force to disengage the OA joint. Excessive force will instead compress this joint and disengage joints more caudad.
3. Place the OA into the position of ease. For the above diagnosis, this is extension, left side-bending, and right rotation to the level of the OA.*
4. Hold this position until a release occurs (typically 3-5 seconds).
5. Return the patient to neutral while maintaining the axial compression. Then, release the compression and reassess.

Treatment Position: FPR OA Joint Dysfunctions

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

FPR for Atlantoaxial (AA) Joint Dysfunctions

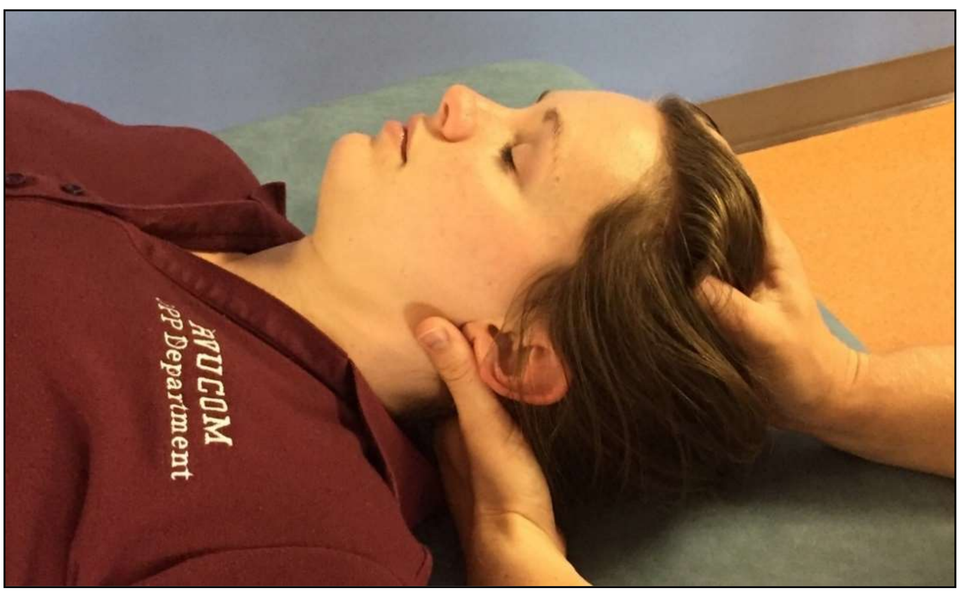
Example Diagnosis: AA R_R

Physician Position: Seated at the head of the table

Patient Position: Supine

Procedure:

1. Gently traction the occiput superiorly to reduce the cervical lordosis. neutralize
2. Place the index finger of the caudal hand over the right articular pillar of C1 with the palm cupping the occiput gently. This hand is used to monitor C1.
3. Place the cephalad hand on top of the head with a gentle contact. This hand introduces motion to the AA.
4. Apply axial compression (caudally, along the spine) with the cephalad hand, vectoring toward the AA until the tissue under the caudal hand relaxes. Use only enough force to disengage the AA joint. Excessive force will instead compress this joint.*
5. Using the head, place the AA into the position of ease. For the above diagnosis, this is right rotation to the level of the AA (until motion is felt with the caudad hand).
6. Hold this position until a release occurs (typically 3-5 seconds).
7. Return the patient to neutral while maintaining the axial compression. Then, release the compression and reassess.



Treatment Position: FPR for AA Joint Dysfunctions

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

FPR for Typical Cervical (C2-C7) Joint Dysfunctions[1]

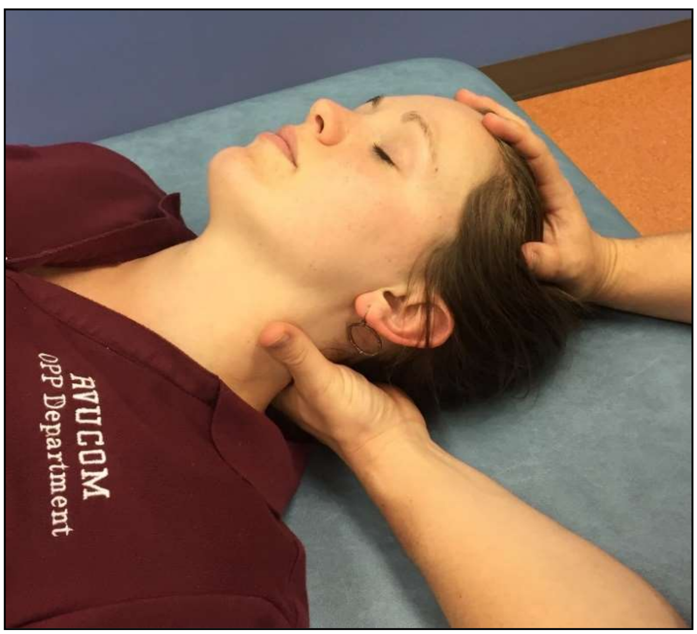
Example Diagnosis: C5 ERS_R

Physician Position: Seated at the head of the table

Patient Position: Supine

Procedure:

1. Gently traction the occiput superiorly to reduce the cervical lordosis.
2. Place the index finger of the caudal hand over the right articular pillar of C5 with the palm gently cupping the neck. This hand is used to monitor C5.
3. Place the cephalad hand on top of the head with a gentle contact. This hand is used to introduce motion to C5.
4. Apply axial compression (caudally, along the spine) with the cephalad hand, vectoring toward C5 until the tissue under the caudal hand softens. Use only enough force to disengage the C5/6 joint. Excessive force will instead compress this joint and disengage joints more caudal.
5. Using both hands, place C5 into the position of ease. For the above diagnosis, this is extension, right rotation and right side-bending to the level of C5.*
6. Hold this position until a release occurs (typically 3-5 seconds).
7. Return the patient to neutral while maintaining the axial compression. Then, release the compression and reassess.



Treatment position: FPR for Typical Cervical Joint Dysfunctions

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

STILL TECHNIQUE

Still for Occipitoatlantal (OA) Joint Dysfunctions[1,5]

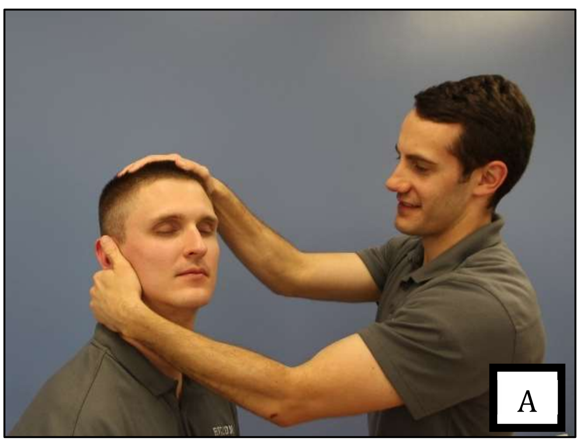
Example Diagnosis: OA ESLRR

Physician Position: Standing facing the patient

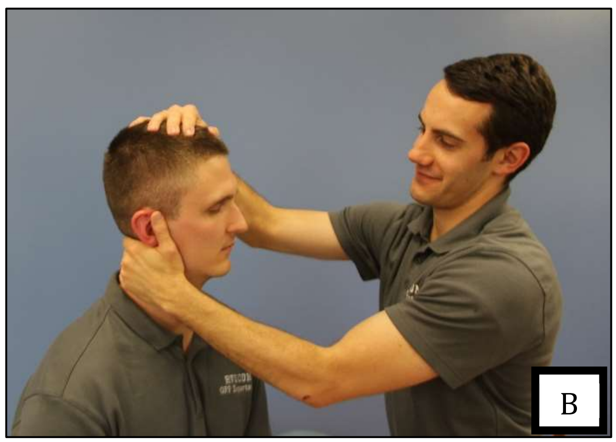
Patient Position: Seated facing the physician

Procedure:

1. Place the index finger of the caudal hand over the right inferior portion of the occiput with the palm cupping the mandible gently. This hand is used to monitor the occiput. The index finger should contact the OA joint that is being treated.
2. Place the cephalad hand on top of the head with a gentle grip. This hand is used to take the OA through its range of motion.
3. Place the OA into the position of ease. For the above diagnosis, this is extension, left sidebending and right rotation to the level of the OA.
4. Apply axial compression (caudally, along the spine) with the cephalad hand, vectoring toward the OA. Use only enough force to disengage the OA joint. Excessive force will instead compress this joint and disengage more distal joints.
5. While maintaining compression, move the OA through the barrier by moving it into flexion, right sidebending, and left rotation simultaneously, then back to neutral. It may be difficult to accomplish this motion in all planes. If so, focus on one plane at a time, and repeat the procedure as needed.
6. Release compression and reassess.



A) Initial patient position: Still for OA



B) Final patient position: Still for OA

Still for Atlantoaxial (AA) Joint Dysfunctions[1,5]

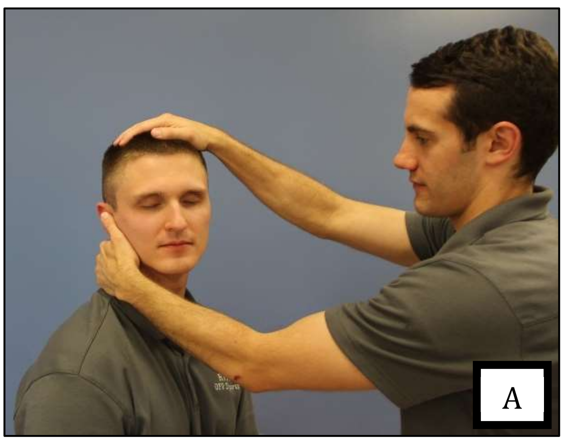
Example Diagnosis: AA RR

Physician Position: Standing facing the patient

Patient Position: Seated facing the physician

Procedure:

1. Place the index finger of the caudal hand over the right articular pillar of C1 with the palm cupping the mandible gently. This hand is used to monitor C1.
2. Place the cephalad hand on top of the head with a gentle grip. This hand is used to take the AA through its range of motion.
3. Place the AA into position of ease. For the above diagnosis, this is right rotation to the level of the AA.
4. Apply axial compression (caudally, along the spine) with the cephalad hand, vectoring toward the AA. Use only enough force to disengage the AA joint. Excessive force will instead compress this joint and disengage more distal joints. While maintaining compression, move the AA through the barrier by moving it into left rotation, and return to neutral.
5. Release compression and reassess.



A) Initial patient position: Still for AA

B) Final patient position: Still for AA

Still for Typical Cervical (C2-C7) Joint Dysfunctions[1,5]

Example Diagnosis: C5 ERRSR

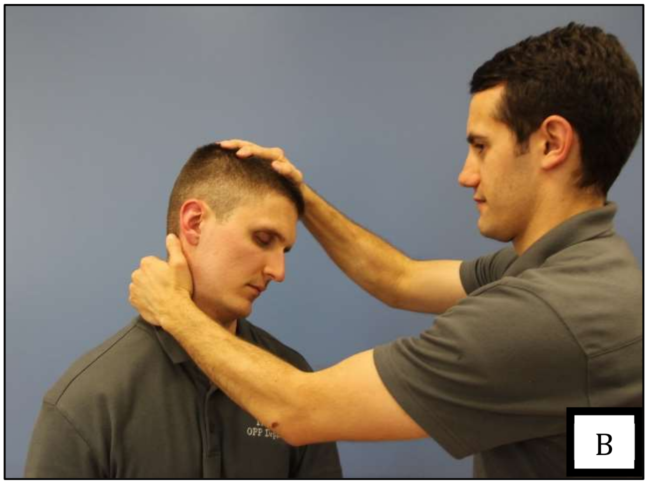
Physician Position: Standing facing the patient

Patient Position: Seated facing the physician

Procedure:

1. Place the index finger of the caudal hand over the right articular pillar of C5 with the palm cupping the neck gently. This hand is used to monitor C5.
2. Place the cephalad hand on top of the head with a gentle grip, to take C5 through its range of motion.
3. Place C5 into the position of ease. For the above diagnosis, this is extension, right rotation and right sidebending to the level of C5.
4. Apply axial compression (caudally, along the spine) with the cephalad hand, vectoring toward C5. Use only enough force to disengage the C5 joint. Excessive force will instead compress this joint and disengage joints more caudad.
5. While maintaining compression, move C5 through the barrier by moving it into flexion, left rotation, and left sidebending simultaneously, and return to neutral. It may be difficult to accomplish this motion in all planes. If so, focus on one plane at a time and repeat the procedure as needed.
6. Release compression and reassess.

A) Initial patient position: Still for typical cervical



B) Final patient position: Still for typical cervical

THORACIC SPINE

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

Short-Lever BLT/LAS for Upper Thoracic (T1-T2) Joint Dysfunctions[1]

Example Diagnosis: T1 ERRSR

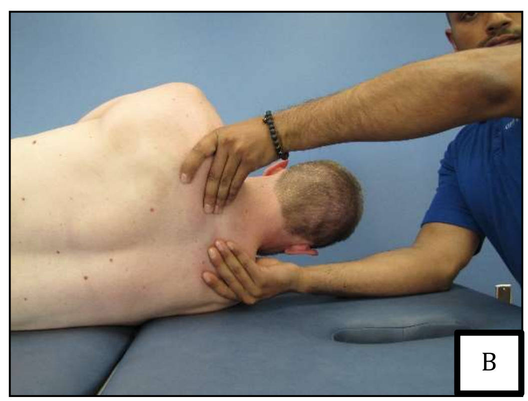
Physician Position: Seated at the head of the table

Patient Position: Supine

Procedure:

1. Place index fingers posterior to the transverse processes of T2 and middle fingers posterior to the transverse processes of T1.
2. Extend T1 by applying anterior pressure with both middle fingers until a position of equal tension between T1 and T2 is achieved.
3. Rotate T1 to the right by applying slightly more anterior pressure to the left transverse process of T1 with the left middle finger until a position of equal tension between T1 and T2 is achieved.
4. Sidebend T1 to the right by translating T1 to the left using both middle fingers together until a position of equal tension between T1 and T2 is achieved.
5. Make minor adjustments in all planes until the balance is achieved and equal pressure is felt under both fingers.
6. Wait for the release.* If a release is not palpated, repeat step 5.
7. After a release is palpated, return T1 to neutral and reassess.

A) Treatment position: Short-lever BLT/LAS upper thoracic joint dysfunction



B) Angled view to show hand placement.

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Long-Lever BLT/LAS for Thoracic Joint Dysfunctions

Example Diagnosis: T3 ERRSR

Physician Position: Seated at the side of the patient

Patient Position: Supine

Procedure:

1. Place cephalad hand under the articulation of T3 on T4, use caudal hand to grasp the patient's ipsilateral arm.
2. Apply abduction to the patient's arm to localize more inferiorly along the axial spine. Apply adduction to localize more superiorly along the axial spine. Localize to the level of T3.
3. Using the arm as a long lever, fine tune motion until a balance is felt at T3. Rotation is induced by protracting (contralateral rotation) or retracting (ipsilateral rotation) the arm. Side bending is induced by longitudinal force along the arm, with compression sidebending ipsilaterally and traction sidebending contralaterally. Flexion of the spine is induced by internal rotation of the arm and extension induced by external rotation of the arm.
4. Make minor adjustments to all planes until the desired position is achieved.
5. Wait for a release (if a release is not palpated, repeat step 4).*
6. After a release is palpated, return T3 to neutral and reassess.

Treatment position: Long-lever BLT/LAS for Thoracic Spine

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

FACILITATED POSITIONAL RELEASE (FPR) TECHNIQUES

FPR for Upper Thoracic (T1-T4) Joint Dysfunctions[1]

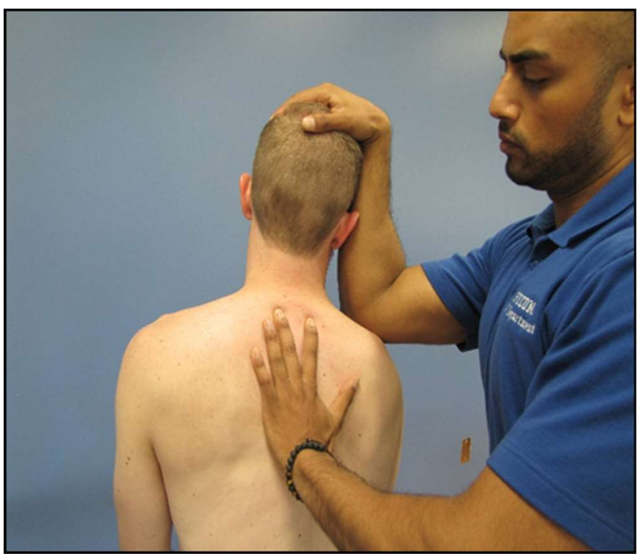
Example Diagnosis: T2 FRRSR

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index and middle fingers of the caudal hand over the transverse processes of T2. Apply gentle anterior translation to flatten the thoracic kyphotic curve.
2. Place the cephalad hand on top of the patient's head with a gentle contact.
3. Using the patient's head, place T2 into a neutral position.
4. Apply an activating force through the cephalad hand using axial compression, vectoring toward T2. Make sure that the forces are localized to the joint being treated.*
5. While maintaining the activating force, bring the area into ease. For the above diagnosis this means flexion, right rotation, and right sidebending to the level of T2.
6. Hold this position until a release occurs (typically 3-5 seconds).
7. Return the patient to neutral while maintaining the activating force. Release the activating force and reassess.



Treatment position: FPR for Upper thoracic joint dysfunctions

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

FPR for Lower (T5-T12) Type I Thoracic Joint Dysfunctions[1]

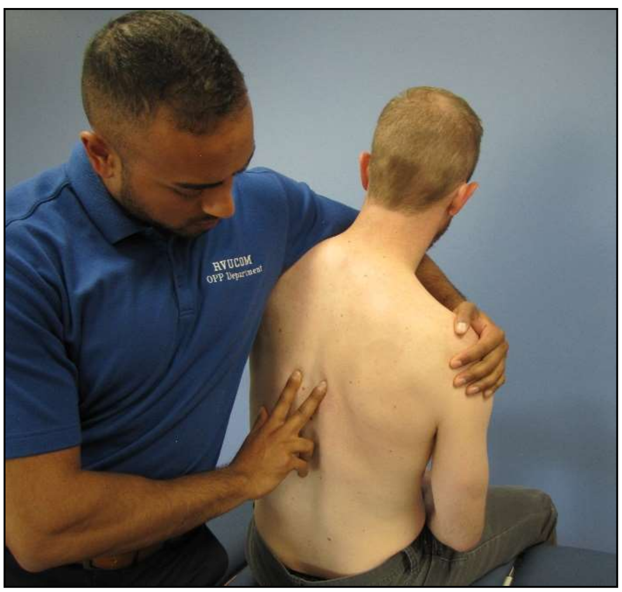
Example Diagnosis: T 6-8 NRLSR

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index and middle fingers of the caudal hand over the transverse processes of T7. Apply gentle anterior translation to flatten the thoracic kyphotic curve.
2. Contact the patient's shoulders by placing the left axilla over the patient's left shoulder and reaching across the chest to contact the patient's right shoulder with the cephalad hand.
3. Using the patient's shoulders, place T7 into a neutral position.
4. Apply an activating force through the cephalad arm, axial compression or traction, vectoring toward T7. Make sure that the forces are localized to the joint being treated.*
5. While maintaining the activating force, bring the area into ease. For the above diagnosis this means right sidebending and left rotation to the level of T7. T7 should remain neutral in the sagittal plane.
6. Hold this position until a release occurs (typically 3-5 seconds).
7. Return the patient to neutral while maintaining the activating force. Release the activating force and reassess.



Treatment position: FPR T 6-8 NRLSR

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

FPR for Lower (T5-T12) Type II Thoracic Joint Dysfunctions[1]

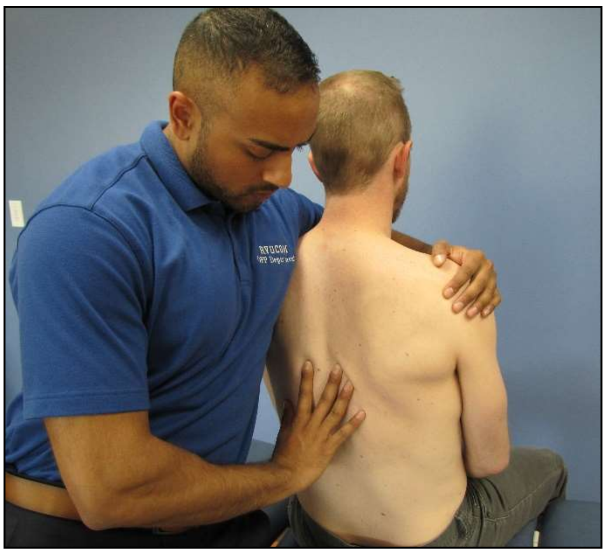
Example Diagnosis: T7 FRLSL

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index and middle fingers of the caudal hand over the transverse processes of T7. Apply gentle anterior translation to flatten the thoracic kyphotic curve.
2. Contact the patient's shoulders by placing the left axilla over the patient's left shoulder and reaching across the chest to contact the patient's right shoulder with the cephalad hand.
3. Using the patient's shoulders, place T7 into a neutral position.
4. Apply an activating force through the cephalad arm, axial compression or traction, vectoring toward T7. Make sure that the forces are localized to the joint being treated. *
5. While maintaining the activating force, bring the area into ease. For the above diagnosis, this means flexion, left rotation, and left sidebending to the level of T7.
6. Hold this position until a release occurs (typically 3-5 seconds).
7. Return the patient to neutral while maintaining the activating force. Release the activating force and reassess.



Treatment position: FPR T7 FRLSL

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

HIGH VELOCITY LOW AMPLITUDE (HVLA) TECHNIQUES

Seated HVLA for Type II Thoracic Joint Dysfunctions/"Epigastric Thrust"

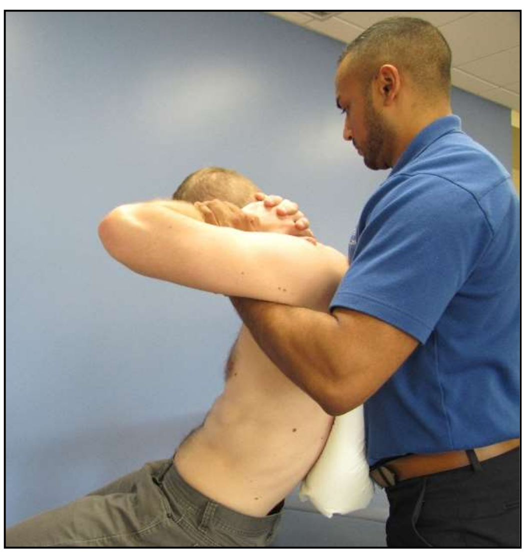
Example Diagnosis: T7 FRRSR

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Using a pillow, place epigastrium posterior to the right transverse process of T7.
2. Instruct the patient to clasp their hands behind their neck with fingers interlaced.
3. Gently grasp the back of the patient's forearms with both hands by reaching under the patient's axillae. At this point, the patient should be instructed to drop their elbows forward and relax, allowing the physician to take on their weight.
4. Extend T7 by translating the patient's shoulders and torso slightly posteriorly, using the epigastrium as a fulcrum.
5. Sidebend T7 to the left by translating the patient's torso to the right down to the level of T7.
6. Rotate T7 to the left slightly with anterior pressure from the epigastrium over the right transverse process of T7. Avoid over-rotating T7 to the left through the shoulder. A slight amount of superior traction through the axillae assists with force localization.
7. Once the barrier is fully engaged, instruct the patient to inhale and exhale. Take up any remaining slack in all planes during exhalation.
8. At the end of exhalation, apply the final corrective thrust. This will be a quick, anterior, and superior thrust from the epigastrium over the right transverse process of T7 combined with gentle superior traction of the patient's spine achieved by lifting the patient's shoulders. The superior traction is important as it helps to separate the facet joint surfaces.
9. Return the patient to neutral and reassess.



Treatment position: Epigastric thrust

*This technique can also be used for an extended segment. The patient is instructed to drop their elbows down and slump forward, introducing flexion to the dysfunctional segment. This flexion is maintained throughout the rest of the technique. For a neutral segment, a slight amount of flexion may also be utilized.

Seated HVLA for Type I or II Thoracic Joint Dysfunctions/ "Knee in Back"[1]

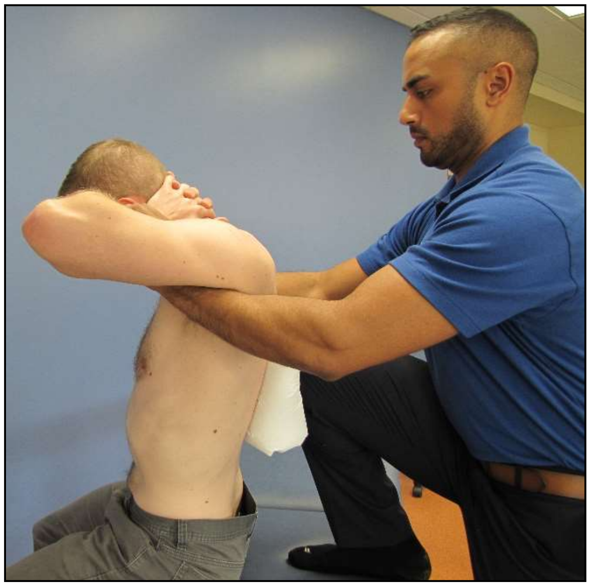
Example Diagnosis: T5 ERRSR

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place right foot on the table and using a pillow, place right knee posterior to the right transverse process of T5.
2. Instruct the patient to clasp their hands behind their neck with fingers interlaced.
3. Gently grasp the back of the patient's forearms with both hands by reaching under the patient's axillae.
4. While holding right knee firmly against the patient's back, instruct the patient to drop their elbows forward and relax. Flex the patient down to T5.
5. Sidebend T5 to the left by translating the patient's torso to the right down to the level of T5.
6. Rotate T5 to the left slightly with minimal rotation of the patient's torso down to the level of T5. Avoid over-rotation to the left.
7. Engage the barrier with the right knee by applying anterior and superior pressure over the right transverse process of T5.
8. Once the barrier is fully engaged, instruct the patient to inhale and exhale. Take up any remaining slack in all planes during exhalation.
9. At the end of exhalation, apply the final corrective thrust. This will be a quick, superior, anterior and slightly medial thrust from the right knee (accomplished by plantar flexing the ankle) over the right transverse process of T5, combined with gentle superior traction of the patient's spine achieved by lifting the patient's shoulders. The forces from above and below should meet at T5. *The emphasis is on superior motion of the knee (rather than anterior).
10. Return the patient to neutral and reassess.



Treatment position: Knee in the Back

*For flexed lesions, the patient is instructed to slump forward and relax. A fulcrum is created with the knee on the posterior transverse process. The physician induces extension by posteriorly translating the patient's shoulders over the fulcrum (Step 4). At the end of exhalation, apply the final corrective thrust. This will be a quick, anterior, superior, and slightly medial thrust from the right knee (accomplished by plantar flexing the ankle) over the right transverse process of T5, combined with gentle superior, posterior traction of the patient's spine achieved by lifting the patient's shoulders. The forces from above and below should meet at T5. Also for flexed lesions, the emphasis of thrust at the thoracic spine is an anterior motion of the knee (rather than superior) (step 9).

For neutral lesions, the patient is instructed to slump forward and relax. A fulcrum is created with the knee on the posterior transverse process, sidebending and rotation will be opposite (step 5-6). At the end of exhalation, apply the final corrective thrust. This will be a quick, anterior, superior, and slightly medial thrust from the right knee (accomplished by plantar flexing the ankle) over the right transverse process of T5, combined with gentle superior traction of the patient's spine achieved by lifting the patient's shoulders. The forces from above and below should meet at T5 (step 9).

***Variation: Using the concept of *Relative Motion*, the operator may stabilize the transverse process on the side opposite of the rotation one segment below the lesion (T6 on the left side in this example) with the knee, and instead of thrusting the knee forward, will instead pull the patient posteriorly over the knee. This will induce relative motion of T5 on a fixed T6. (Greenman's Principles of Manual Medicine. 5th Ed. Ch 14)

Supine HVLA for Upper (T1-T5) Thoracic Joint Dysfunctions/ "Watermelon"[1]

Example Diagnosis: T2 FRRSR

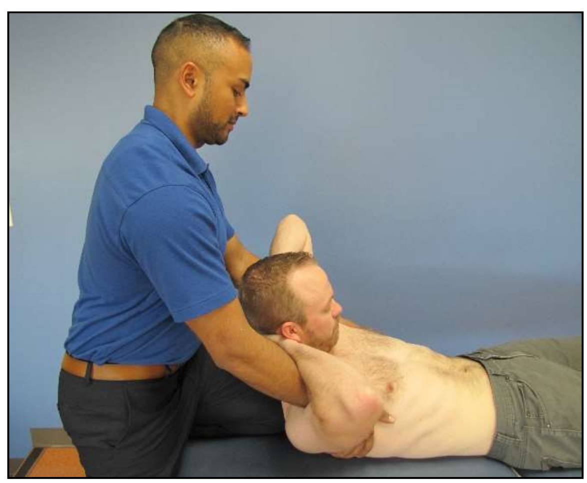
Physician Position: Standing at the head of the table

Patient Position: Supine

Procedure:

1. Start with the patient sitting, straddling the table, facing away from physician, and instruct them to clasp their hands behind their neck with fingers interlaced.
2. Physician bends the left knee and places the left leg on the table.
3. Gently lower the patient onto the left thigh so that the right paravertebral gutter and the right (posterior) transverse process of T2 rests upon the anterior aspect of the thigh.
4. Grasp the sides of the patient's thoracic cage posteriorly with both hands by reaching between the patient's arm and forearm.
5. Induce traction to the thoracic region by gently pulling the patient upward onto the left thigh as though extending the patient's thoracic region over a fulcrum.
6. Induce left rotation by pushing downward with both arms. Be sure that the arms are tightly (but gently) adhered to the patient's sides during this motion. Push the patient's torso down onto the physician's left thigh as a unit, taking care not to apply excessive force to the shoulders.
7. Engage the barrier by applying increased posterior pressure down toward the physician's left thigh, vectoring toward the right transverse process of T2.
8. Once the barrier is fully engaged, instruct the patient to inhale and exhale. Take up any remaining slack in all planes during exhalation.
9. At the end of exhalation, apply the final corrective thrust. This will be a quick, posterior thrust from the arms straight down onto the physician's left thigh and over the right transverse process of T2, which rests on the anterior aspect of the left thigh. This motion should bring the entire torso straight down without inducing any flexion or extension or applying excessive force over the shoulders.
10. Return the patient to neutral and reassess.

Note: This technique works best for flexed lesions. When performing this technique, try to be efficient. If the patient is extended over the physician's thigh, for a prolonged period of time, it can become uncomfortable.



Treatment position: "Watermelon"

Prone HVLA for Lower (T5-T12) Thoracic Joint Dysfunctions/ Cross Hand Pisiform Thrust/ "Texas Twist"[1]

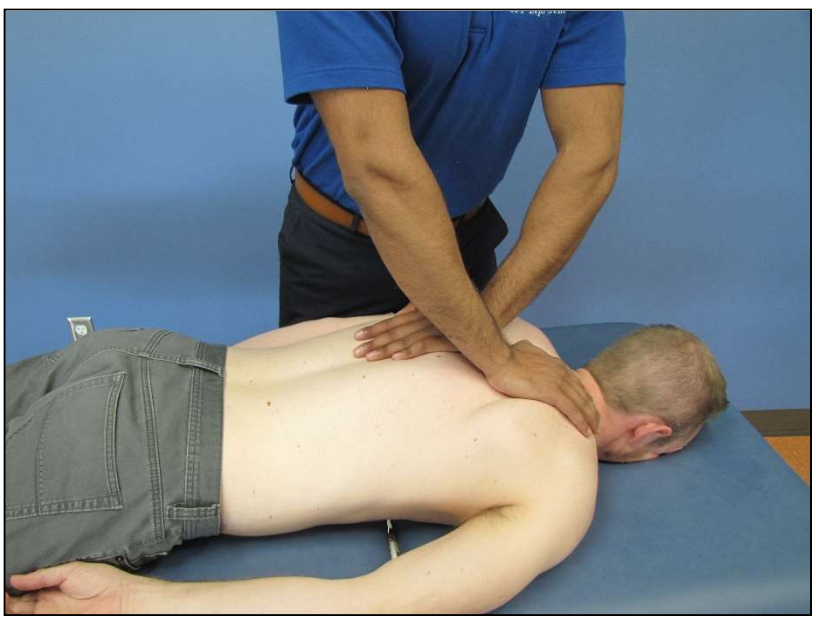
Example Diagnosis: T5 FRRSR

Physician Position: Standing to the left of the patient (opposite the posterior transverse process)

Patient Position: Prone

Procedure:

1. Place the thenar eminence of the right hand posterior and inferior to the right transverse process of T5. Place the hypothenar eminence of the left hand posterior and superior to the left transverse process of T5.
2. While maintaining firm contact over both transverse processes, simultaneously apply an anterior and superior force to the right transverse process of T5 while applying an inferior force to the left transverse process of T5. These actions combined should appear as a "twisting" motion of the hands.
3. Engage the barrier with the thenar eminence of the right hand by applying further anterior and superior force over the right transverse process of T5.
4. Once the barrier is fully engaged, instruct the patient to inhale and exhale. Take up any remaining slack in all planes during exhalation.
5. At the end of exhalation, apply the final corrective thrust. This will be a quick, predominantly anterior thrust from the thenar eminence of the right hand over the right transverse process of T5. During this procedure, keep elbows locked and use body weight to deliver the thrust.
6. Return the patient to neutral and reassess.



Treatment position: Texas twist

Note: The technique is easier for a flexed segment; for an extended segment, the vector is more superior.

MYOFASCIAL RELEASE (MFR) TECHNIQUES

Indirect MFR Upper Thoracic (T1-T2) Joint Dysfunctions

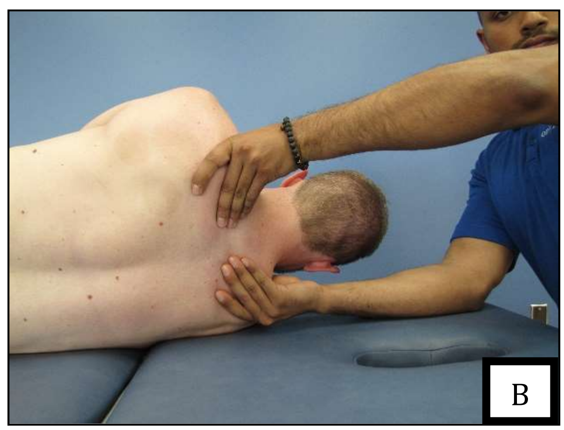
Example Diagnosis: T1 ERRSR

Physician Position: Seated at the head of the table

Patient Position: Supine

1. Place index fingers posterior to the transverse processes of T2 and middle fingers posterior to the transverse processes of T1.
2. Extend T1 by applying anterior pressure with both middle fingers until the tension in the myofascial structures between T1 and T2 is relieved in the sagittal plane.
3. Rotate T1 to the right by applying slightly more anterior pressure to the left transverse process of T1 with the left middle finger until the tension in the myofascial structures between T1 and T2 is relieved in the transverse plane.
4. Sidebend T1 to the right by translating T1 to the left using both middle fingers together until the tension in the myofascial structures between T1 and T2 is relieved in the coronal plane.
5. As the tension in the tissues change, follow the release in the direction of ease as the tissues "unwind" until there is no further change or until you feel the breath (primary or thoracic) return to the tissues.*
6. Return the patient to neutral and reassess.

A) Treatment position: MFR T1-2



B) Angled view to show hand placement

*For direct MFR, guide the structures from their position of ease into tension—toward neutral, and follow the direct barrier until no further change is noted or until you feel the breath (primary or thoracic respiration) return to the tissues.

STILL

Seated Still for Upper Thoracic (T1-T4) Joint Dysfunctions[1,5]

Example Diagnosis: T2 FRRSR

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index and middle fingers of the caudal hand over the transverse processes of T2.
2. Place the cephalad hand on top of the patient's head using a gentle contact.
3. Using the patient's head, place T2 into the position of ease. For the above diagnosis, this means flexion, right rotation, and right sidebending to the level of T2.
4. Apply a compression force vector with the cephalad hand, vectoring toward T2. Make sure that the forces are localized to the joint being treated.
5. While maintaining compression, use the head to move T2 through the barrier by introducing extension, left rotation, and left sidebending simultaneously. It may be difficult to accomplish this motion in all planes. If so, focus on one plane at a time, and repeat the procedure as needed.
6. Return the patient to neutral and reassess.

A) Initial patient position: Seated Still T1-T4

B) Final patient position: Seated Still T1-T4

Seated Still for Lower (T5-T12) Type I Thoracic Joint Dysfunctions[1,5]

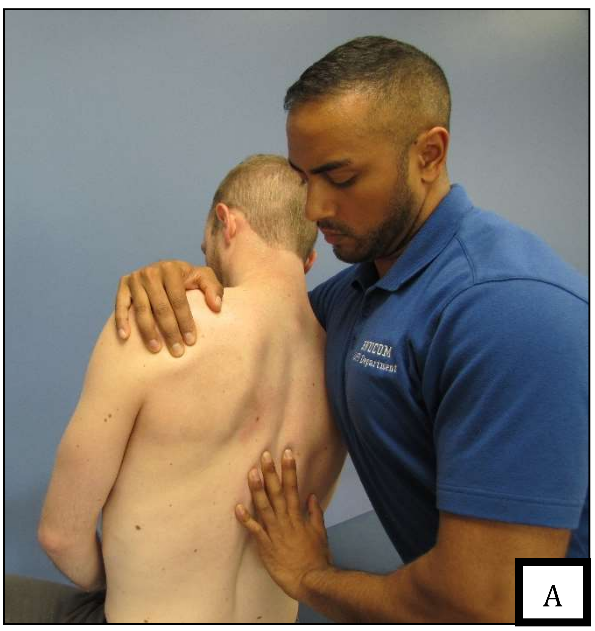
Example Diagnosis: T6-8 NRLSR

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index and middle fingers of the caudal hand over the transverse processes of T7.
2. Contact the patient's shoulders by placing the right axilla over the patient's right shoulder and reaching across the chest to contact the patient's left shoulder with the cephalad hand.
3. Using the patient's shoulders, place T7 into the position of ease. For the above diagnosis this means right sidebending and left rotation to the level of T7. T7 should remain neutral in the sagittal plane.
4. Apply a compression force vector with the cephalad hand and axilla equally, vectoring toward T7. Make sure that the forces are localized to the joint being treated.
5. While maintaining compression, move T7 through the barrier by moving the torso into left sidebending and right rotation simultaneously, taking care to keep the spine in neutral. It may be difficult to accomplish this motion in all planes. If so, focus on one plane at a time, and repeat the procedure as needed.
6. Return the patient to neutral and reassess.



A). Initial patient position: Seated Still T5-T12 Type I

B) Final patient position: Seated Still T5-T12 Type I

Seated Still for Lower (T5-T12) Type II Thoracic Joint Dysfunctions[1,5]

Example Diagnosis: T7 FRLSL

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index and middle fingers of the caudal hand over the transverse processes of T7.
2. Contact the patient's shoulders by placing the right axilla over the patient's right shoulder and reaching across the chest to contact the patient's left shoulder with the cephalad hand.
3. Using the patient's shoulders, place T7 into the position of ease. For the above diagnosis this means flexion, left rotation, and left sidebending to the level of T7.
4. Apply a compression force vector with the cephalad hand and axilla equally, vectoring toward T7. Make sure that the forces are localized to the joint being treated.
5. While maintaining compression, move T7 through the barrier by moving the torso into extension, right rotation, and right sidebending simultaneously. It may be difficult to accomplish this motion in all planes. If so, focus on one plane at a time, and repeat the procedure as needed.
6. Return the patient to neutral and reassess.

A) Initial patient position: Seated Still T5-T12 Type II

B) Final patient position: Seated Still T5-T12 Type II

On-Side Still for Lower (T5-T12) Type I and Type II Thoracic Joint Dysfunctions

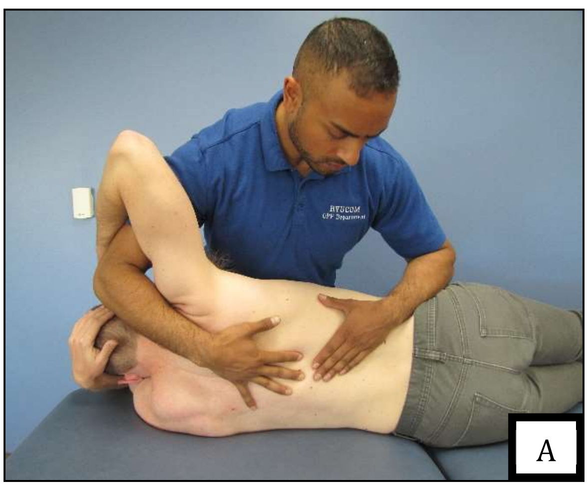
Example Diagnosis: T8-10 NRRSL

Physician Position: Standing in front of the patient

Patient Position: Lateral recumbent (posterior transverse process up)

Procedure:

1. Instruct the patient to place their right hand behind their neck.
2. Grasp the patient's right scapula by reaching cephalad hand through patient's arm.
3. Monitor the posterior transverse process of T9 with the caudal hand, resting caudal elbow on the patient's right iliac crest.
4. Using the cephalad hand, place T9 into the position of ease. For the above diagnosis, this means right rotation (rotate the patient's right shoulder posteriorly). In this example, T9 should remain neutral in the sagittal plane. (For Type II dysfunctions, translate shoulders anteriorly or posteriorly for flexion or extension respectively.)
5. Apply a compression force vector with the cephalad hand toward T9. Make sure that the forces are localized to the joint being treated.
6. While maintaining compression, move T9 through the barrier by moving the patient's right shoulder anteriorly with cephalad hand while pushing the patient's right hip posteriorly with caudal forearm (Note that for this technique, rotation is emphasized).
7. Return the patient to neutral and reassess.



A) Initial patient position: On-side Still T5-T12 Type I

B) Final patient position: On-side Still T5-T12 Type I

LUMBAR SPINE

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

Short-Lever BLT for Lumbar Joint Dysfunctions

Example Diagnosis: L4 ERRSR

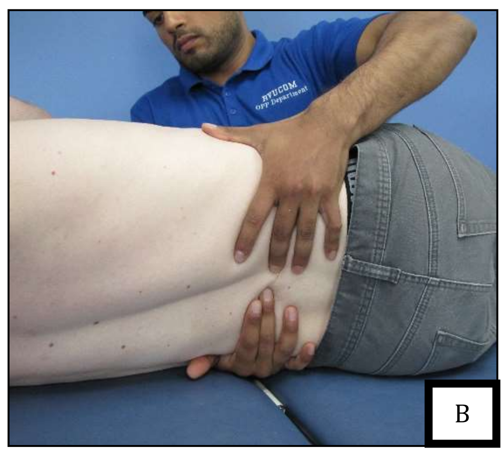
Physician Position: Seated at the side of the table, facing cephalad

Patient Position: Supine

Procedure:

1. Place index fingers posterior to the L4 transverse processes and middle fingers posterior to the L5 transverse processes.
2. Extend L4 by applying anterior pressure with both index fingers until the tension in the ligamentous structures between L4 and L5 is balanced in the sagittal plane.
3. Rotate L4 to the right by applying slightly more anterior pressure to the left transverse process of L4 with the right index finger until the tension in the ligamentous structures between L4 and L5 is balanced in the transverse plane.
4. Sidebend L4 to the right by translating L4 to the left using both index fingers together until the tension in the ligamentous structures between L4 and L5 is balanced in the coronal plane.
5. Make minor adjustments in all planes until the balance is achieved and equal pressure is felt under both fingers.
6. Wait for the release.* If a release is not palpated, repeat step 5.
7. Return patient to neutral and reassess.

A) Treatment position: BLT/LAS for lumbar dysfunctions



B) Angled view to show hand placement

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Long-Lever BLT for Lumbar Joint Dysfunctions

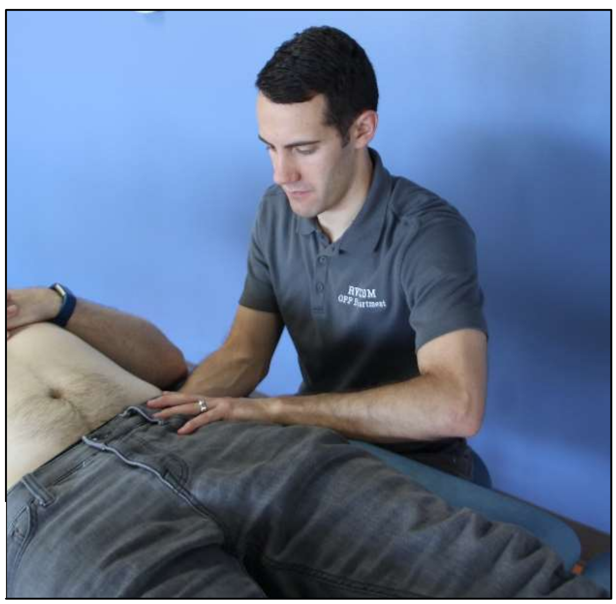
Diagnosis: L4 ERLSL

Physician Position: Seated at the side of the table (side where rotation is easiest)

Patient Position: Supine

Procedure:

1. Place the cephalad hand posterior to the lumbar spine to monitor the involved segment(s).
2. With the caudal hand, contact the ipsilateral hemipelvis.
3. Use the hemipelvis like a steering wheel to bring the lumbar segment into balance. (You may find that you need to use the leg to get more leverage.)
   a. Induce flexion by rotating the hemipelvis posteriorly (ASIS toward the head).
   b. Induce extension by rotating the hemipelvis anteriorly (ASIS toward the feet).
   c. Induce sidebending by bringing the hemipelvis either cephalad (closer to the shoulder) to induce ipsilateral sidebending, or caudad (closer to the feet) to induce contralateral sidebending.
   d. Induce rotation of the lumbar segment by pressing the hemipelvis into the table for ipsilateral rotation or lifting the hemipelvis up off the table for contralateral rotation. NOTE: This rotates the entire pelvis (and lumbar spine) on a vertical axis.
4. Make minor adjustments to all planes until the balance is achieved.
5. Wait for the release.* The release should be achieved relatively quickly—1-2 seconds. If not, repeat step 3-4.
6. Return the patient to neutral and reassess.



Treatment position: Long-lever BLT for Lumbar Joint Dysfunctions

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues

BLT for Lumbosacral Junction[6]

Example Diagnosis: Any L5 or sacral dysfunction

Physician Position: Standing or seated at side of table

Patient Position: Supine

Procedure:

1. Slide cephalad hand under patient’s lumbar spine with fingertips contacting spinous processes of L5 and above.
2. Slide caudal hand under patient’s sacrum with fingertips at sacral base and palm cupping the apex.
3. Motion test traction then compression by bringing caudal and cephalad hands further apart and closer together, respectively, until finding the position of ease across the lumbar junction. For indirect BLT, the position of ease is away from the restrictive barrier. For direct BLT, the position of ease is toward the restrictive barrier.
4. Holding current position, further induce motion in translation, rotation, flexion, or extension until tension across the lumbar junction is in balance. It may be necessary to make minor adjustments to all planes until the position of best possible balance is achieved.
5. Wait for the release.* The release should be achieved relatively quickly. If not, repeat step 4.
6. After a release is palpated, return to neutral and reassess.

A) Treatment position: BLT for lumbosacral junction

B) Hand placement

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

FACILITATED POSITIONAL RELEASE (FPR) TECHNIQUES

FPR for Type I Lumbar Joint Dysfunctions

Example Diagnosis: L 2-4 NRLSR

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index finger and middle finger of the caudal hand over the transverse processes of L3. Ask the patient to relax their back to reduce the lumbar lordotic curve.
2. Contact the patient's shoulders by placing the left axilla over the patient's left shoulder and reaching across the chest to contact the patient's right shoulder with the cephalad hand.
3. Using the patient's shoulders, place L3 into a neutral position.
4. Apply an activating force, axial compression or traction, vectoring towards L3. Make sure that the force is localized to the joint being treated.*
5. While maintaining the activating force, bring the area into ease. For the above diagnosis this means right sidebending and left rotation to the level of L3. L3 should remain neutral in the sagittal plane.
6. Hold this position until a release occurs (typically 3-5 seconds).
7. Return the patient to neutral while maintaining the activating force. Release the activating force and reassess.

Treatment position: FPR Type I Lumbar joint dysfunctions

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

FPR for Type II Lumbar Joint Dysfunctions

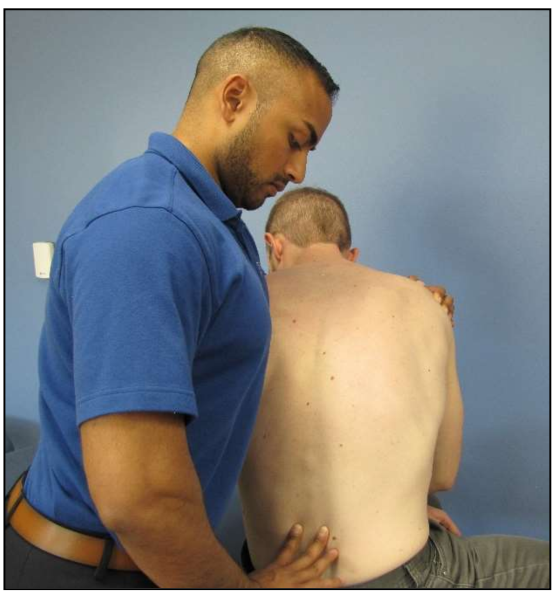
Example Diagnosis: L2 FRLSL

Physician Position: Standing behind the patient

Patient Position: Seated

Procedure:

1. Place the index finger and middle finger of the caudal hand over the transverse processes of L2. Ask the patient to relax their back to reduce the lumbar lordotic curve.
2. Contact the patient's shoulders by placing the left axilla over the patient's left shoulder and reaching across the chest to contact the patient's right shoulder with the cephalad hand.
3. Using the patient's shoulders, place L2 into a neutral position.
4. Apply an activating force, axial compression or traction, vectoring towards L2. Make sure that the force is localized to the joint being treated.*
5. While maintaining the activating force, bring the area into ease. For the above diagnosis, this means flexion, left rotation, and left sidebending to the level of L2.
6. Hold this position until a release occurs (typically 3-5 seconds).
7. Return the patient to neutral while maintaining the activating force. Release the activating force and reassess.



Treatment position: FPR Type II Lumbar joint dysfunctions

*When using FPR, the order of the steps for applying the activating force and the placement into the position of ease may vary, however, the sequence must always start with neutral positioning.

STILL

Supine Still for Type I Lumbar Joint Dysfunctions[5]

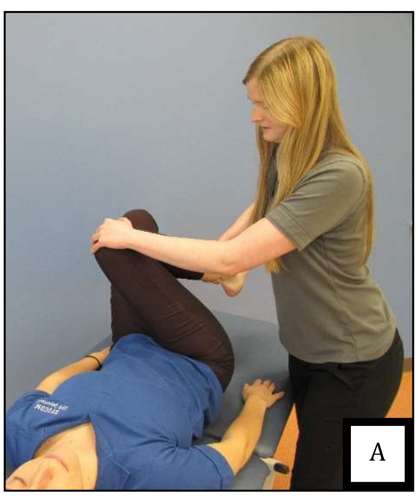
Example Diagnosis: L3-5 NRLSR

Physician Position: Standing to the right of the patient (same side as sidebending)

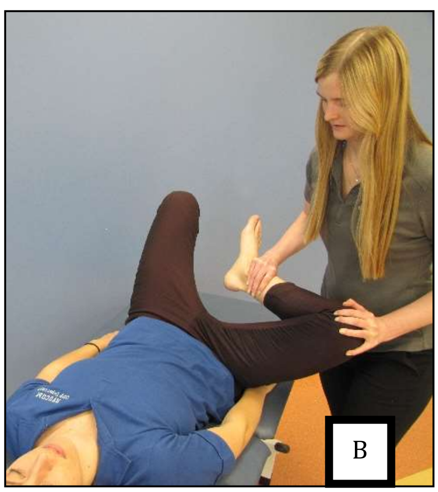
Patient Position: Supine

Procedure:

1. Monitor the posterior transverse process of L4 (the apex of the group curve) with cephalad hand.
2. Flex both of the patient's hips and knees so that the feet are resting on the table.
3. Further flex the ipsilateral hip to around 90 degrees or until motion is isolated to L4 and the surrounding tissues begin to relax.
4. Adduct the ipsilateral leg across the midline to produce the necessary initial rotational exaggeration.
5. Transfer the cephalad hand to the patient's ipsilateral flexed knee and grasp the ipsilateral ankle with the caudal hand.
6. Bring the patient's ipsilateral foot and lower leg toward the physician creating internal rotation of the thigh, swinging the hip superior, and producing right sidebending of the lumbar spine.
7. Introduce compression from the patient's ipsilateral knee vectoring toward L4.
8. Simultaneously swing the ankle inward (externally rotating the thigh) and abduct the leg at the hip, maintaining compression through the knee.
9. Finally, begin to extend the patient's leg. Release of the segmental restriction typically occurs during leg extension.
10. Return the patient to neutral and reassess.



A) Initial position



B) Intermediate position

C) Final position

Supine Still for Type II Flexed Lumbar Joint Dysfunctions[5]

Example Diagnosis: L2 FRRSR

Physician Position: Standing to the right of the patient (same side as rotation)

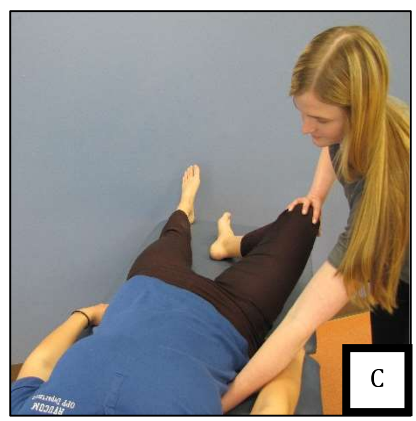
Patient Position: Supine

Procedure:

1. The patient is supine on a table. The physician stands at the patient's side, on the side of rotation and sidebending.
2. The physician's cephalad hand is inserted under the patient's lumbar spine and the sensing finger placed on the posterior transverse process of the dysfunctional segment (the side of ease).
3. The knee and hip on the side of ease are flexed until motion is felt at the segment to be treated, in this example L2. The physician's caudal hand is on the flexed knee.
4. The flexed knee is adducted until the affected segment flexes into its ease.
5. A compression force vector is then applied through the knee with the caudal hand in a vector toward the affected segment, until the segment further relaxes. Attention to muscle tone is important here, as too much pressure will cause the muscles to tense up again.
6. The leg is then circumducted, moving into abduction first, then straightening the leg, maintaining the compression vector throughout the motion.
7. Return the patient to neutral and reassess. Repeat process if needed.

A) Initial position

B) Intermediate position



C) Final position

Supine Still for Type II Extended Lumbar Joint Dysfunctions[5]

Example Diagnosis: L2 ERRSR

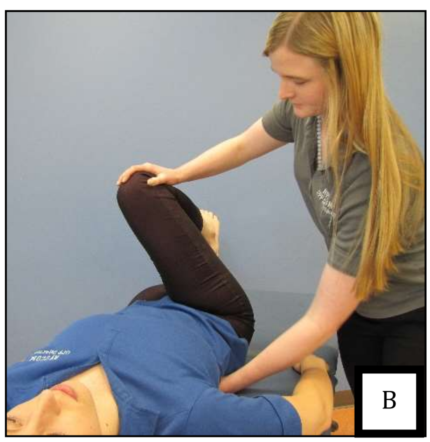
Physician Position: Standing to the right of the patient (same side as sidebending)

Patient Position: Supine

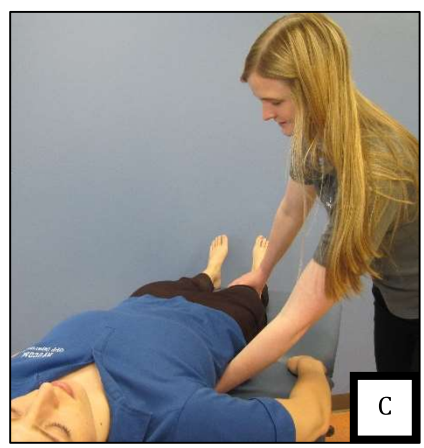
Procedure:

1. The patient is supine on a table. The physician stands at the patient's side, on the side of rotation and sidebending.
2. The physician's cephalad hand is inserted under the patient's lumbar spine and the sensing finger placed on the posterior transverse process of the dysfunctional segment (the side of ease).
3. The knee and hip on the side of ease are flexed until motion is felt at the segment to be treated, in this example L2. The physician's caudad hand is on the flexed knee.
4. The flexed knee is abducted until the affected segment palpably relaxes. Fine-tune the hip flexion to isolate the affected segment at ease.
5. Pressure is then put on the knee with the caudad hand in a vector toward the affected segment, until the segment further relaxes. Attention to muscle tone is important here, as too much pressure will cause the muscles to tense up again.
6. The leg is then circumducted, moving into adduction first, then straightening the leg, maintaining the compression vector throughout the motion.
7. Return the patient to neutral and reassess. Repeat process if needed.

A) Initial position



B) Intermediate position



C) Final position

PELVIS

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

Supine BLT for Innominate Dysfunctions

Physician Position: Standing on the side of the patient

Patient Position: Supine

Procedure:

1. Place palms of hands over patient's ASISs with fingers contacting the lateral pelvis.
2. Gently compress the ASISs medially and posteriorly to gap the SI joints.
3. Gently motion test to find the position of ease for each hemipelvis (anterior, posterior, inflare, outflare, upslip, downslip).
4. Take **both sides** into their respective positions of ease. This should neutralize all the forces in the pelvis—this is the balance point.
5. Make minor adjustments to all planes until the balance is achieved.
6. Wait for the release*. The release should be achieved relatively quickly—1-2 seconds. If not, repeat step 4-5.
7. Return the patient to neutral and reassess.

Treatment position: supine BLT for innominate dysfunction

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

Seated BLT for Innominate Dysfunctions

Example Diagnosis: Right anteriorly rotated innominate

Physician Position: Seated facing the patient

Patient Position: Seated

Procedure:

1. Take the patient's ankles, one in each hand, and lift their legs without destabilizing your patient.
2. Assess ligamentous tensions by compressing one leg into the pelvis and distracting the other, then reverse your compression and distraction.
3. Continue to assess ligamentous tension by having the patient rotate their torso to one side then the other.
4. Repeat steps 2 and 3 until a point of equal tension is palpated; generally, compressing the side that resists distraction and applying traction to the contralateral leg will accomplish this.
5. Observe the leg lengths, then instruct the patient to rotate their torso towards the shorter/compressed leg to fine-tune the balance.
6. Hold balanced position until palpating a release.
7. Return to neutral and reassess.

Treatment position: Seated BLT for innominate dysfunction

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues

Think about it: Why do we learn pelvic techniques seated? There are some situations where a patient cannot lie down. A patient with acute back pain, a pregnant patient in her third trimester uncomfortable lying down, a patient in the hospital who is sitting in a chair, or a patient in a wheelchair are all good candidates for treating the pelvis in a seated position. Avoid putting a hospitalized patient back in bed when they are already sitting to treat them with OMT. Sitting can be important for recovery.

Seated BLT for the Pelvic Diaphragm

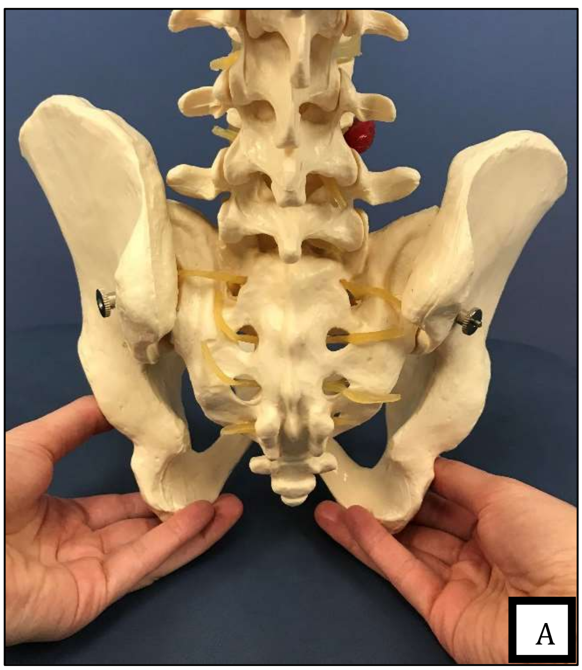
Example Diagnosis: Left inhalation dysfunction of pelvic diaphragm

Physician Position: Seated behind the patient

Patient Position: Seated

Procedure:

1. Slide both hands beneath the patient's ischial tuberosities (the "sit bones"), then slide your fingers medially keeping finger pads in contact with the ischium to contact the pelvic diaphragm with fingertips. It may be necessary to ask the patient to lift their hips up one at a time to position the physician's hands beneath the ischial tuberosities.
2. With the left hand, match the tension of the tissues of the inhaled pelvic diaphragm (stuck caudad).
3. With the right hand, find the right pelvic diaphragm and match the tension. Because the right side easily moves into exhalation, it will be more cephalad than the left pelvic diaphragm.
4. Once the tension is matched with both hands, hold the balanced position until palpating a shift in the tissues. As the tissues relax, continue to find the balance and match the tension.
5. Return to neutral and reassess. The treatment is finished when the pelvic diaphragm is moving easily and equally in both inhalation and exhalation.



A) Hand position: Seated BLT for pelvic diaphragm

B) Treatment position: Seated BLT for pelvic diaphragm

Think About It: The pelvic diaphragm is very important to maintain the intraabdominal pressure when we breathe. If a patient is having a hard time breathing and the thoracic diaphragm is moving well, check the pelvic diaphragm.

STILL

Still for Anteriorly Rotated Innominate[5]

Example Diagnosis: Left anteriorly rotated innominate

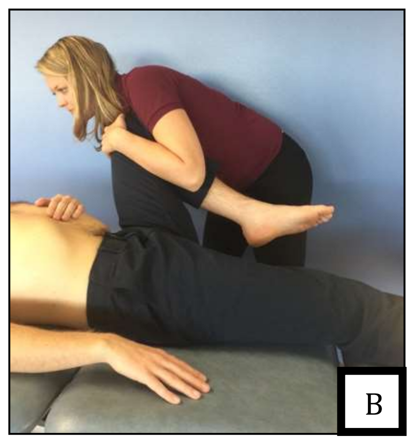
Physician Position: Standing to the left of the patient (dysfunctional side)

Patient Position: Supine

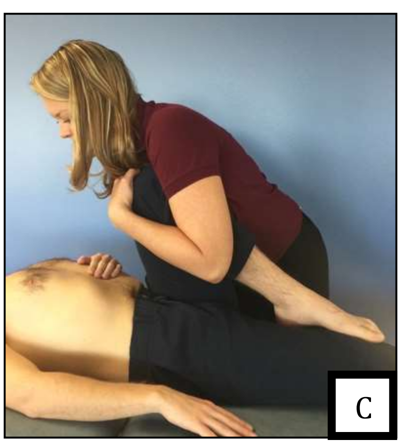
Procedure:

1. Place cephalad hand under the inferior aspect of the left SIJ to monitor motion.
2. Use caudal hand to flex the left knee and hip (no more than 60 degrees to maintain anterior rotation of the innominate) until motion is palpated by cephalad hand at the SIJ.
3. Add abduction until the position of greatest ease is palpated at the SIJ
4. Introduce compression with caudal hand from the knee to the SIJ. This vector may or may not align with the femur.
5. While maintaining compression, move knee in a circular motion through full hip flexion, then adduction, finally adding extension bringing the leg and foot back to the table.
6. Release compression and return the patient to neutral and reassess.

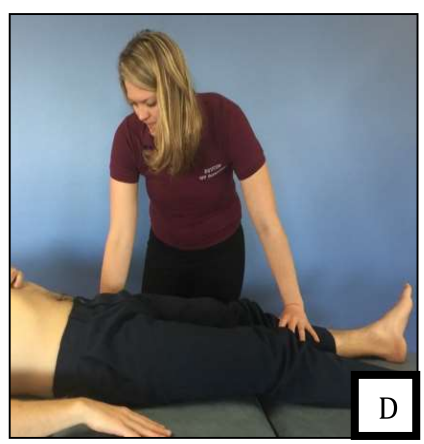
A) Initial treatment position (flexion)



B) Intermediate position (abduction)



C) Intermediate position (adduction)



D) Final position (extension)

Still for Posteriorly Rotated Innominate[5]

Example Diagnosis: Left posteriorly rotated innominate

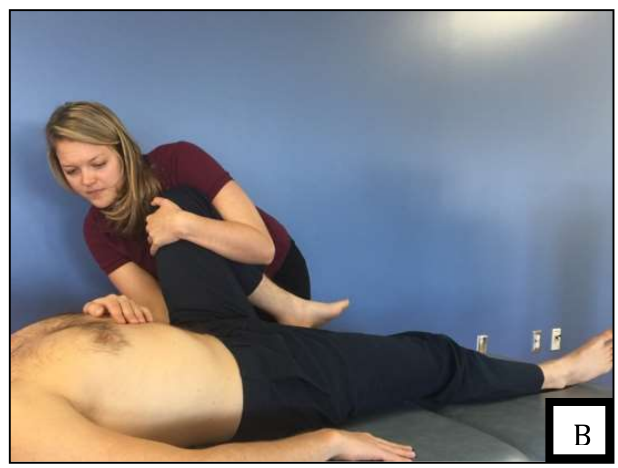
Physician Position: Standing to the left of the patient (dysfunctional side)

Patient Position: Supine

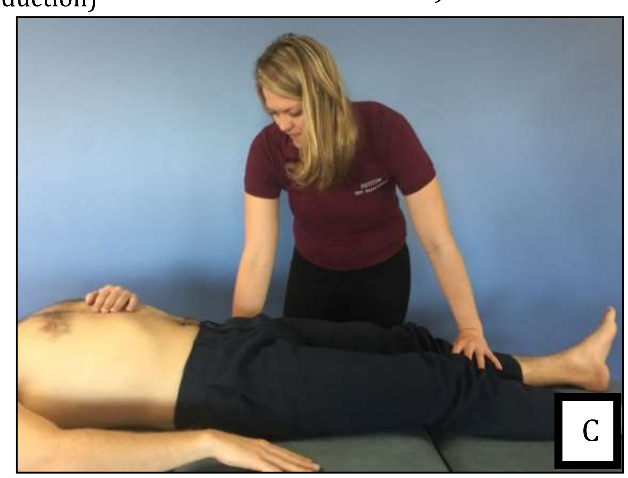
Procedure:

1. Place cephalad hand under the superior aspect of the SIJ to monitor motion.
2. Use caudal hand to flex left knee and hip (past 90° to induce posterior rotation of the innominate) until motion is palpated at SIJ.
3. Adduct further until the position of greatest ease is palpated at the SI joint.
4. Introduce compression with caudal hand from the knee to the SI joint. This vector may or may not align with the femur.
5. While maintaining compression, move knee in a circular motion through hip abduction, then extension bringing the leg and foot back to the table (physician may use abdomen to apply compression and use caudal hand to guide leg into extension if needed).
6. Release compression and return the patient to neutral and reassess.

A) Initial treatment position (adduction)



B) Intermediate treatment position



C) Final treatment position (extension)

Still for Superior Innominate Shears[5]

Example Diagnosis: Right superior innominate shear

Physician Position: Standing at the foot of the table

Patient Position: Supine

Procedure:

Step 1

1. Contact the right ankle with both hands.
2. Introduce external rotation to the ankle and leg, then add axial compression toward the SI joint.
3. While maintaining compression, gently internally rotate the ankle and the leg.
4. At the end of internal rotation, switch from compression to traction.
5. Return the leg to neutral.

Step 2

1. Use the Still for Posteriorly Rotated Innominate. See above.

Step 3

1. Use the Still for the Anteriorly Rotated Innominate. See above.

A) Initial treatment position: Step 1 of Still for superior innominate shear

B) Final treatment position: Step 1 of Still for superior innominate shear

SACRUM

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

Four Pole BLT for Sacrum Dysfunctions

Physician Position: Seated at the side of the table

Patient Position: Supine

Procedure:

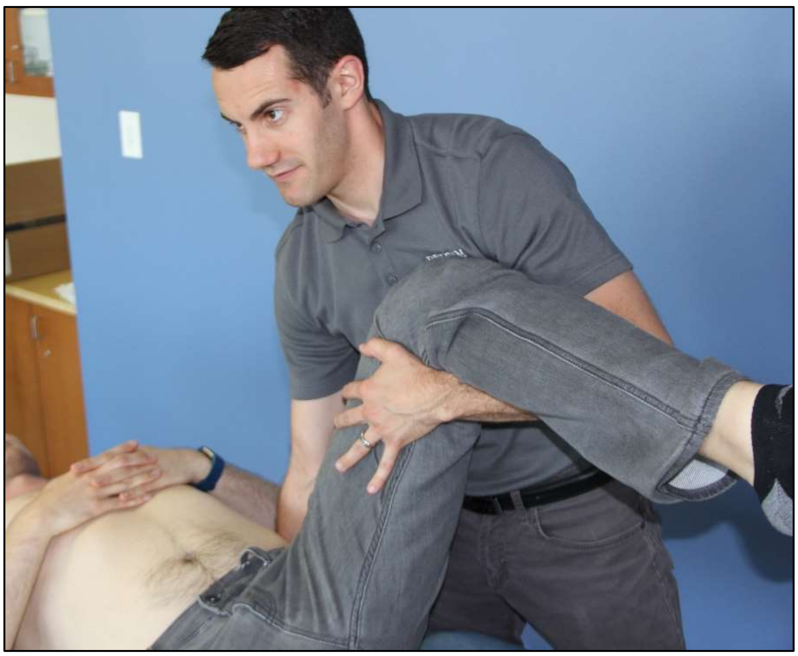
Upper limb of the SI joint

1. Place the cephalad hand posterior to the ipsilateral sacral sulcus.
2. Passively assess motion with respiration—does the base move fully anteriorly and posteriorly with each breath?
3. Actively assess anterior motion—introduce anterior motion to the base. Does it move freely in both directions?
4. With the caudal hand, flex the knee and hip to 90 degrees. Contact the lateral leg with the lateral forearm, and the medial thigh with the hand (forearm is posterior to popliteal fossa),
5. Gap the upper limb of the SI joint by externally rotating the hip (by internally rotating the physician's arm) until the upper part of the innominate flares laterally.
6. Using respiratory assist, bring the ipsilateral sacral base (upper limb of the SI joint) into anterior/posterior balance
    a. Instruct the patient to breathe deeply.
    b. Instruct the patient to hold the breath in the position that accentuates the indirect balance.
    c. Remember: sacral base travels posterior with inhalation, and anterior with exhalation.
7. You may need to fine-tune the balance by flexing or extending, internally or externally rotating the hip, and/or adding compression from the knee to the SI joint
8. Hold and wait for the release*
    a. If the release is not achieved before the patient must take a breath, make minor adjustments and repeat for 2-3 additional breath cycles if needed.
9. Repeat on the contralateral side if needed.
10. Return the patient to neutral and reassess.

Lower Limb of the SI joint

1. Place the cephalad hand posterior to the ipsilateral inferior lateral angle (ILA).
2. Passively assess motion with respiration—does the ILA move fully anteriorly and posteriorly with each breath?
3. Actively assess anterior motion—introduce anterior motion to the ILA. Does it move freely in both directions?
4. With the caudal hand, flex the knee and hip to 90 degrees. Contact the medial leg with the medial forearm, and the lateral thigh with the dorsum of the hand (forearm is posterior to popliteal fossa),
5. Gap the lower limb of the SI joint by internally rotating the hip (by externally rotating the physician's arm) until the lower part of the innominate flares laterally.
6. Using respiratory assist, bring the ipsilateral ILA (lower limb of the SI joint) into anterior/posterior balance

   a. Instruct the patient to breathe deeply.
   b. Instruct the patient to hold the breath in the position that accentuates the indirect balance.
   c. Remember: sacral ILA travels anterior with inhalation, and posterior with exhalation.
7. You may need to fine-tune the balance by flexing or extending, internally or externally rotating the hip, and/or adding compression from the knee to the SI joint
8. Hold and wait for the release*
   a. If the release is not achieved before the patient must take a breath, make minor adjustments and repeat for 2-3 additional breath cycles if needed.
9. Repeat on the contralateral side if needed.
10. Return the patient to neutral and reassess.



Treatment position: Four pole (indirect) BLT for sacrum dysfunctions

* The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues

MISCELLANEOUS TECHNIQUES

BALANCED LIGAMENTOUS TENSION (BLT)/LIGAMENTOUS ARTICULAR STRAIN (LAS)

Bilateral Shoulder Balancing

Example Diagnosis: Restricted right shoulder

Physician Position: Seated at the head of the table

Patient Position: Supine

Procedure:

1. Place hands over the bilateral AC joints with fingers overlying the proximal humeri.
2. Use both hands to motion test the shoulders in all planes (superior/inferior, clockwise/counterclockwise, and translation) to find a point of equal tension among the ligamentous attachments of the shoulders.
3. Hold this balanced position until a release is palpated.* It may be necessary to make minor adjustments in all planes until the position of best possible balance is achieved.
4. Return the patient to neutral and reassess.

Treatment position: Bilateral Shoulder Balancing

*The release occurs when there is a change in the tension of the tissues. Most often, this is perceived as a change (often a very subtle change) in the amount of force needed to maintain the balance point. This may also be perceived as the breath (either primary or thoracic) returning to the tissues.

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Chapter 14
Counterstrain

"Discovery of what appears to be a new principle of lesion production has resulted in a simple, easy method of correction without the use of force."

-Lawrence H. Jones, D.O.

Contents:

Notes

Introduction

Through experience and experimentation, Lawrence H. Jones, D.O. developed a novel system of diagnosis and treatment. He identified specific areas of tense, tender tissue that he initially called trigger points, and described a procedure for relieving these triggers: "spontaneous release by positioning."[6] Finding that these points represented a pathophysiologic process distinct from that identified by Dr. Janet Travell (the "myofascial trigger point"), he renamed his findings tender points, eventually shortened to tenderpoints.[1] He also changed the name of his technique to "strain-counterstrain." More recently, the technique has been shortened to "counterstrain" and the tenderpoints have been renamed "counterstrain points" to clarify their belonging to a distinct system of osteopathic diagnosis and treatment. This most recent terminology will be used throughout this manual.

Counterstrain (CS) is "an osteopathic method of diagnosis and indirect treatment in which the patient's somatic dysfunction, diagnosed by an associated myofascial counterstrain point, is treated by using a position of spontaneous tissue release while simultaneously monitoring the counterstrain point."[4] The key features of counterstrain technique are noted above: CS is an indirect technique; CS treats somatic dysfunction associated with a counterstrain point; CS uses patient positioning to induce a spontaneous release; and the counterstrain point is monitored during treatment to identify the release.

Counterstrain points (CP) are found in myofascial tissue such as muscle bellies, tendons, and ligaments and are associated with somatic dysfunction either of that specific structure or of a structure within the dermatomal, sclerotomal, or myotomal distribution related to the CP. For example, a T1 segmental (biomechanical) somatic dysfunction will frequently have an associated Anterior T1 CP or Posterior T1 Spinous Process CP. As evidence of this relationship, the positioning required to relieve a CP is usually the position of ease for the associated segmental somatic dysfunction, though variations do occur.

Counterstrain Physiology

To understand counterstrain technique is to understand neuromuscular physiology. Whenever there is rapid myofascial tissue lengthening (and thus the threat of tissue injury or strain), the body has an inherent reflex to stop the lengthening and prevent tissue damage via muscular contraction. Consider a muscle (the agonist) that is overstretched when one of its attachments (a vertebra, for example) is moved toward an extreme position, causing a strain. Meanwhile, the antagonist muscle is shortened. The body, in its attempt to relieve the strain on the agonist, causes contraction of the agonist and its synergistic muscles, which moves the vertebra back toward a neutral position. This relieves the strain on the agonist, but also results in rapid lengthening of the now-shortened antagonist muscle. The antagonist (which has adjusted its proprioception to the new position, see below) senses an imminent strain and contracts, maintaining the dysfunctional position of the vertebra (see Figure 1). This contraction persists, causing pain and somatic dysfunction.[3] While the strained agonist muscle may be painful and tender due to actual tissue damage, the muscle maintaining the somatic dysfunction is the antagonist, which holds the vertebra in a dysfunctional position. This antagonist was never lengthened to the point of tissue damage, but incorrectly sensed a strain and initiated a motor reflex.

This is an example of an inappropriate *proprioceptive reflex* associated with an increase in the discharge of the *gamma motor neurons.* When the antagonist was passively shortened, the discharge from its muscle spindle was decreased, such that the central nervous system (CNS) lost the proprioceptive monitoring of this muscle. In response, the CNS increased the firing of gamma motor neurons to increase tension on the muscle spindle and thus increase feedback from the spindle, a concept called *increased gamma gain*. Increased sensitivity of the muscle spindle means that a minor increase in muscle length will cause a larger response from the alpha motor neuron. Thus, a new (though dysfunctional) neutral position is established.[8]

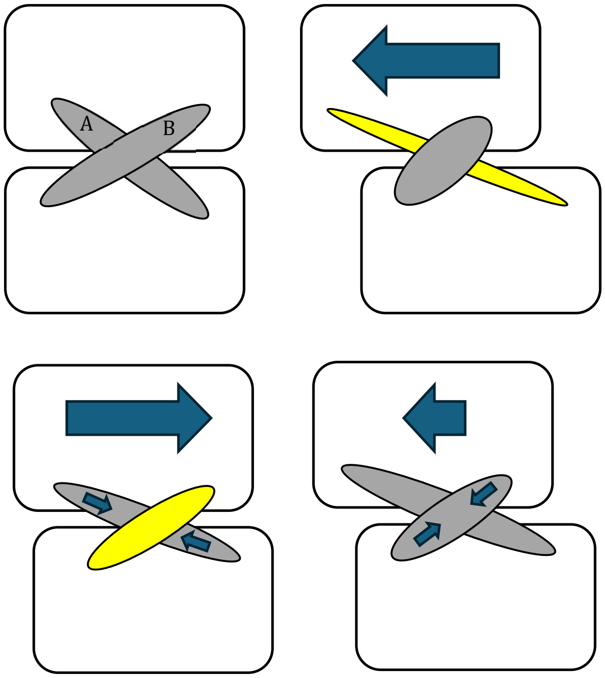


Figure 1: Schematic of the production of an inappropriate proprioceptive reflex. Top left: normal position of two vertebrae and two muscles, agonist A and antagonist B. Top right: The superior vertebra is put in extreme position, putting strain on A and shortening B. Muscle spindles in B reduce firing, gamma neurons increase firing to boost spindle sensitivity. Bottom left: the vertebra is rapidly moved back toward neutral to relieve the strain on A, which is shortened by this motion. B, now hypersensitive to change in length due to increased gamma gain, falsely perceived an impending strain. Bottom right: the body remains in a dysfunctional position to protect the supposed strain on B.

In addition to an inappropriate proprioceptive reflex, the nervous system also experiences increased signaling from *afferent nociceptive nerves*. Activated nociceptors alert the CNS and release neuropeptides into local tissues. Heightened sympathetic tone and local inflammation follow. Muscle contraction to splint the affected joint may be activated – a nocifensive reflex.[5] A specific type of nocifensive reflex is the *ligamento-muscular reflex*, wherein the body stabilizes a sprained ligament by activating muscles that reduce tension on the ligament and inhibiting the muscles that increase tension.[4]

The hypersympathetic tone and abnormal positioning mentioned above may result in the disruption of local microcirculation, leading to reduced nutrient supply and reduced waste clearance.[4] This causes the release of proinflammatory mediators, causing further activation and sensitization of nociceptors. More pain causes more muscle tension, further solidifying the somatic dysfunction. All these processes result in the findings of somatic dysfunction: tenderness, restricted motion, asymmetry, and tissue texture changes.

Counterstrain Technique Principles

Counterstrain technique interrupts the processes above by placing the affected tissue into a *position of ease.* To do this, a CP is identified through palpation and the affected tissue is shortened by approximating origin and insertion. In most cases, this position folds the patient around the CP. To be effective, the position of ease must adequately reduce nociceptive signaling, hence the goal for at least 70 percent reduction in pain. This position of ease has numerous therapeutic effects: reduced firing of the aberrant muscle spindle, reduced activity of nociceptors, decreased sympathetic tone, and improved microcirculation. This position is held until the body has adequately altered the tissue tension and local circulation, which is palpated as a release or *therapeutic pulse*. Dr. Jones found that *90 seconds* was the optimal time to hold the tissue in a position of ease for most CPs. While this time frame is the gold standard for testing situations, an experienced physician can palpate the tissue release and finish the technique irrespective of time elapsed. Once the release has occurred, the patient must return to neutral position. Muscle activation and rapid movement risk the reactivation of the inappropriate proprioceptive reflex. *Thus, the patient must be returned to neutral passively and slowly.*

Counterstrain Technique Procedure

1. **Locate a Counterstrain Point (CP) associated with the somatic dysfunction.** Scan for anterior and posterior CPs to determine the most significant point. If there are multiple CPs in an area, the most significant is usually the point that is the most tender. *The amount of pressure needed to test for tenderness is just enough to blanch the fingernail of the palpating finger.*
2. **Establish a tenderness scale** by informing the patient that the current CP discomfort is a 10 on a 0-10 point scale (this is not the same as a numerical pain scale).
3. **Maintain a monitoring finger contact** (minimal pressure) on the CP throughout the treatment.
4. **Find a position that reduces the tenderness**, preferably to zero, but **at least by 70 percent** to 3 or less. Most commonly this will be a position that will shorten the muscle or body region involved, but not always. While certain positions are recommended as starting positions for treatment of specific CPs, minor adjustments may be necessary to achieve the least amount of tenderness.
5. **The patient remains passive and relaxed throughout the treatment**. Note: If mechanically disadvantageous for the physician, the patient may assist the physician in getting into the initial treatment position, but the patient will then remain passive as the physician fine-tunes the treatment position to a 3 or less, as well as throughout the remainder of the treatment.
6. **Hold the final position for 90 seconds** while monitoring the CP. Only light pressure over the CP is required to monitor the tissue texture change. The tissues will slowly soften. *Do not lose contact with the CP.*
7. **Slowly and passively return the patient to neutral** while maintaining contact with the CP.
8. **Reassess the CP and somatic dysfunction.**

Indications[4]

- Acute or chronic somatic dysfunctions with an associated counterstrain point

Contraindications include but are not limited to:[4]

- Absolute
  - Acute or unstable fracture affected by application of treatment or treatment positioning
  - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
  - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
- Relative
  - Patient who cannot voluntarily relax or severely ill patient
  - Positioning that may involve upper cervical hyperrotation and hyperextension in patients with known vertebral artery disease and/or upper cervical ligamentous instability, dens malformation, or severe osteoporosis
  - Patient with severe acute rheumatological flare
  - Signs of apprehension while approaching the treatment position
  - Presence of a condition related to the site of treatment that could be negatively affected by the treatment position such as :
    - Comorbidities that place the patient at risk for fracture or tissue damage, e.g., malignancy, osteomyelitis, abscess, etc.
    - Moderate to severe join instability
    - Spinal stenosis/nerve root impingement
    - Severe osteoporosis

Considerations

Counterstrain is a gentle, well-tolerated treatment modality. It is especially useful for frail patients, patients in acute pain, and when myofascial tissue is so hypertonic and irritated that other modalities are difficult to perform. Its use may be limited by the patient's ability to rate pain and remain passive during the treatment. Therefore, infants and young children, as well as patients with psychosis or dementia, are not good candidates. It is also difficult to perform for patients who have neurologic conditions that prevent voluntary relaxation such as stroke, Huntington's Disease, Amyotrophic Lateral Sclerosis (ALS), etc.[1] Post-treatment reactions may include myalgia, arthralgia, and/or fatigue and are usually self-limited and well-tolerated by patients. Patients receiving counterstrain technique should be advised to maintain good hydration and nutrition in the 24-36 hours after treatment to mitigate post-treatment reactions.

Technique Contents:

Counterstrain Techniques by Region[1-5,7]

Cervical Region

CP	Location	Treatment Position	Acronym
	Anterior		
AC 1 TP AC 1 Mandible	Posterior aspect of ascending ramus of mandible at the level of the earlobe Lateral aspect of C1 TP	Marked rotation away with slight sidebending to fine tune	RA
AC 2-6 AC 8	On the anterolateral aspect of the anterior tubercle of the TP of corresponding vertebra At the sternal attachment of the SCM muscle on the medial end of the clavicle	Flexion, sidebending away, rotation away	F SA RA
AC 7	On clavicular attachment of the SCM muscle	Flexion, sidebending toward, rotation away	F ST RA
	Posterior		
PC 1 Inion	On the inferior nuchal line, lateral to the inion	Marked flexion of OA; fine tune with sidebending toward, rotation away	F
PC 1 Occiput PC 2 Occiput	On the inferior nuchal line at splenius capitis (between inion and mastoid) On the inferior nuchal line at the attachment of semispinalis capitis	Extension; fine tune with sidebending and rotation	E
PC 2 SP (Midline) PC 4-8 SP (Midline)	Superior or superolateral aspect of SP of C2 Inferior or inferolateral aspect of the SP of the vertebra above	Extension with minimal sidebending away, rotation away	E SA RA
PC 3 SP (Midline)	Inferior or inferolateral aspect of the SP of C2	Flexion, rotation away, sidebending away	F SA RA
PC 3-7 Articular Process (Lateral)	Posterolateral aspect of the articular process of the corresponding vertebra	Extension, sidebending away, and rotation away	E SA RA

AC: Anterior Cervical; PC: Posterior Cervical; SP: Spinous Process; TP: Transverse process; SCM: Sternocleidomastoid; OA: Occipitoatlantal Joint; F: Flexion; E: Extension; ST: Sidebending Toward; SA: Sidebending Away; RA: Rotation Away.

Anterior Cervical 1 Mandible & Anterior Cervical 1 Transverse Process

Location:

AC 1 Mandible: Posterior aspect of the ascending ramus of the mandible at the level of the earlobe

AC 1 Transverse Process: Lateral aspect of the transverse process of C1

Patient Position: Supine

Physician Position: Seated ipsilateral to CP

Initial Position:

AC 1 Mandible and Transverse Process: Marked rotation away with slight sidebending to fine tune

Involved Structures:

AC 1 Mandible: Rectus capitis anterior muscle

AC 1 Transverse Process: Rectus capitis lateralis muscle

Anterior Cervical 2-6 and Anterior Cervical 8

Location:

AC 2-6: On the anterolateral aspect of the anterior tubercle of the transverse process of the corresponding vertebra

AC 8: At the sternal attachment of the sternocleidomastoid muscle on the medial end of the clavicle

Patient Position: Supine

Physician Position: Seated at head of table

Initial Position: Flexion, sidebending away, rotation away (F SA RA)

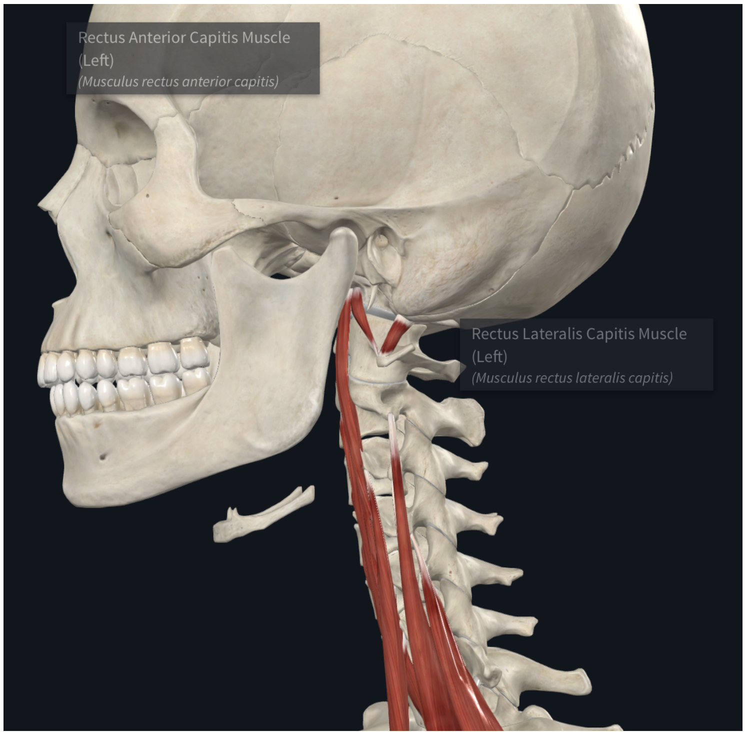
Involved Structures:

AC 2-6: Longus colli, middle scalene muscles

AC 3-4: Longus capitis, longus colli, anterior and middle scalene muscles

AC 5-6: Anterior, middle, posterior scalene; longus capitis and longus colli muscles

AC 8: Sternocleidomastoid muscle



Treatment position: Right AC 2-6 and AC 8

Anterior Cervical 7

Treatment position: Right AC 7

Location: On the clavicular attachment of the sternocleidomastoid muscle

Patient Position: Supine

Physician Position: Seated at head of table

Initial Position: Flexion, sidebending toward, rotation away (F ST AR)

Involved Structure: Sternocleidomastoid muscle

Posterior Cervical 1 Inion

Treatment position: Right PC 1 Inion

Location: On the inferior nuchal line, lateral to inion

Patient Position: Supine

Physician Position: Seated at head of table

Initial Position: Marked flexion of the OA; fine tune with sidebending and rotation

Involved Structures: Rectus capitis posterior minor and semispinalis capitis muscles

Posterior Cervical 1 Occiput and Posterior Cervical 2 Occiput

Location:

PC 1 Occiput: On the inferior nuchal line at the splenius capitis (midway between inion and mastoid)

PC 2 Occiput: On the inferior nuchal line at the attachment of semispinalis capitis

Patient Position: Supine

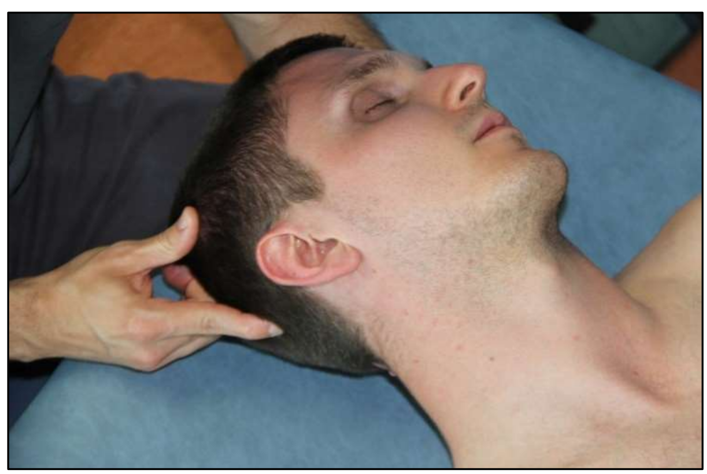
Physician Position: Seated at head of table

Initial Position: Extension; fine tune with sidebending and rotation

Involved Structures:

PC 1 Occiput: Obliquus capitis superior, rectus capitis posterior major/minor, semispinalis capitis muscles

PC 2 Occiput: Semispinalis capitis muscle, greater occipital nerve



Posterior Cervical 2 & 4-8 Spinous Process (Midline)

Location:

PC 2 SP (Midline): Superior or superolateral aspect of the spinous process of C2

PC 4-8 SP (Midline): Inferior or inferolateral aspect of the spinous process of the vertebra above (PC 4 is on the C3 spinous process; PC 5 is on the C4 spinous process, etc.)

Note that these midline points are usually more tender slightly to the right or left aspect of the spinous process; hence our discussion of sidebending and rotation away from the point.

Patient Position: Supine

Physician Position: Seated at head of table

Initial Position: Extension with minimal rotation away and sidebending away (E SA RA)

Involved Structures:

PC 2: Rectus capitis posterior major/minor and obliquus capitis inferior muscles

PC 4-8: Semispinalis capitis, multifidus, and rotatores muscles

Treatment position: Right PC 4 Midline (fingertip contacting right inferolateral aspect of C3 spinous process)

Posterior Cervical 3 Spinous Process (Midline)

Treatment Position: Right PC 3 Midline

Location: Inferior or inferolateral aspect of the spinous process of C2

Patient Position: Supine

Physician Position: Seated at head of table

Initial Position: Flexion, rotation away, and sidebending away (F SA RA)

Involved Structures: Greater occipital nerve or muscles innervated by C3 (middle scalene, longus capitis, longus colli muscles)

Posterior Cervical 3-7 Articular Process (Lateral)

Location: On the posterolateral aspect of the articular process

Patient Position: Supine

Physician Position: Seated at head of table

Initial Position: Extension, sidebending away, and rotation away (E SA RA)

Involved Structures: Transversospinalis muscle group (semispinalis cervicis and capitis, multifidus and rotatores)

Treatment position: Right PC 4 Articular Process (Lateral)

Thoracic Region

CP	Location	Treatment Position	Acronym
Anterior			
AT 1-6 Midline	AT1: Suprasternal notch AT2: From midpoint of the manubrium to the sternal angle AT3-6: Located on the sternum at corresponding costal level	Flexion, slight sidebending and/or rotation	F
AT 7-12 Bilateral	AT7: ¼ of the distance between xiphoid and umbilicus AT8: ½ of the distance between xiphoid and umbilicus AT9: ¾ of the distance between xiphoid and umbilicus AT10: ¼ of the distance between umbilicus and pubic symphysis, slightly more lateral than AT9 AT11: ½ of the distance between umbilicus and pubic symphysis, slightly more lateral than AT10 AT12: mid-axillary line on the inner surface of the iliac crest	Flexion, sidebending toward, rotation away	F ST RA
Posterior			
PT 1-12 TP	Lateral aspect of the transverse process of the corresponding vertebra	Extension, sidebending away, rotation toward	E SA RT
PT 1-12 SP	On the inferior midline or inferolateral aspect of the tip of the spinous process of the corresponding vertebra	Extension, sidebending away, rotation away	E SA RA

TP: Transverse process; AT: Anterior Thoracic; PT: Posterior Thoracic; SP: Spinous Process. F: Flexion; E: Extension; ST: Sidebending Toward; SA: Sidebending Away; RA: Rotation Away; RT: Rotation Toward.

Upper Anterior Thoracic (AT) 1-6 Midline

Location: *May have some degree of lateralization:*

AT1: Suprasternal notch

AT2: From midpoint of manubrium to sternal angle

AT3-6: Located on sternum at corresponding costal level

Patient Position: Supine or seated

Physician Position: Standing at head of table or behind patient

Initial Position: Flexion, slight sidebending and/or rotation

Involved Structures: Sternal fascia and pectoralis major muscle

Treatment position: AT 4 Midline

Lower Anterior Thoracic (AT) 7-12 Bilateral

Location: *Points are lateral to midline within the rectus abdominus (except AT12):*

AT7: ¼ of the distance between xiphoid and umbilicus

AT8: ½ of the distance between xiphoid and umbilicus

AT9: ¾ of the distance between xiphoid and umbilicus

AT10: ¼ of the distance between umbilicus and pubic symphysis, slightly more lateral than AT9

AT11: ½ of the distance between umbilicus and pubic symphysis, slightly more lateral than AT10

AT12: mid-axillary line on the inner surface of the iliac crest

Patient Position: Seated or supine

Physician Position: Standing ipsilateral to CP or behind patient

Initial Position: Move patient's torso into flexion, sidebending toward, and rotation away*

Involved Structure: Rectus abdominus muscle

*The lower anterior thoracic CP may be treated supine by positioning the patient's hips and knees in flexion as opposed to flexing the patient's torso. The pelvis is then rotated toward the CP by pulling the knees ipsilaterally, causing the torso to be rotated away from the CP. Sidebending toward the CP is induced by pulling the ankles ipsilaterally, causing ipsilateral sidebending. The physician may place their foot on the table and rest the patient's legs on their thigh. This supine position tends to be more effective for AT 10-12.

Treatment position: Right AT 8

Treatment position: Right AT 10

Posterior Thoracic (PT) 1-12 Transverse Process

Location: Lateral aspect of the transverse process of the corresponding vertebra

Patient Position: Prone with head rotated toward the CP

Physician Position: Standing contralateral to CP

Initial Position: The patient's shoulder (ipsilateral to CP) is lifted posterior and moved cephalad to produce spinal extension, sidebending away and rotating toward CP. (E SA RT) Fine tune with small arcs of motion of the shoulder.

Treatment position: Left PT 6 TP
Physician is standing contralateral to CP

Posterior Thoracic (PT) 1-12 Spinous Process

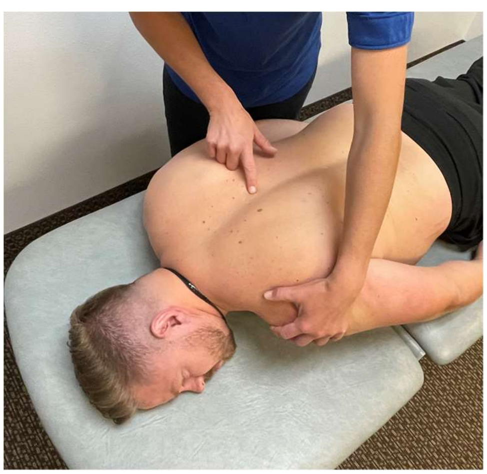
Location: Inferior midline or inferolateral aspect of the tip of the spinous process of the corresponding vertebra

Note that these points are usually worse slightly to the right or left aspect of the spinous process; hence our discussion of sidebending and rotation away from the point.

Patient Position: Prone with head rotated away from CP

Physician Position: Standing ipsilateral to CP (physician will grasp patient's contralateral shoulder to induce motion).

Initial Position: The patient's shoulder (contralateral to CP) is lifted posterior and caudad to produce spinal extension, sidebending away and rotation away. (E SA RA) Fine tune with small arcs of motion of the shoulder.

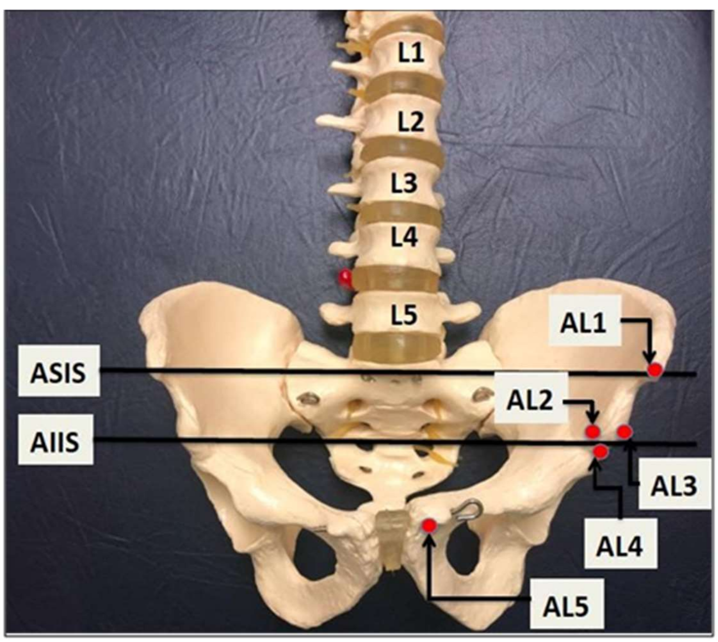


Treatment position: Right PT 6 SP
Physician is standing ipsilateral to the CP

Lumbar Region

CP	Location	Treatment Position	Acronym
Physician stands ipsilateral to CP for AL 1 and AL 5; contralateral for AL 2-4. Hips and knees are flexed for all CP, though the physician should flex the hips to the level of the dysfunction. The acronym is the lumbar vertebra (not the pelvis) relative to CP.			
AL 1	Medial aspect of ASIS	Flex, sidebend (ankles) toward, rotate knees/pelvis toward which rotates L1 away	F ST RA
AL 2 AL 3 AL 4	Medial aspect of AIIS Lateral aspect of AIIS Inferior aspect of AIIS	Flex, sidebend (ankles) away, rotate knees/pelvis away which rotates lumbar segment toward	F SA RT
AL 5	Anterior, superior aspect of pubic ramus just lateral to symphysis	Flex, sidebend (ankles) away, rotate knees/pelvis toward which rotates L5 away	F SA RA
The physician stands contralateral to the CP for all PL CPs. As with AL CPs, rotation of the pelvis is used to induce reciprocal motion in the vertebra below the segment being treated. The acronym reflects to position of the lumbar segment relative to CP.			
PL 1-5 SP PL 1-5 TP	Inferior midline or inferolateral aspect of the tip of the SP Lateral aspect of the TP	Extend to lumbar segment, sidebend toward, rotate pelvis toward (torso away)	E ST RA

AL: Anterior Lumbar; ASIS: Anterior Superior Iliac Spine; AIIS: Anterior Inferior Iliac Spine; F: Flexion; ST: Sidebending Toward; SA: Sidebending Away; RA: Rotation Away; RT: Rotation Toward; PL: Posterior Lumbar; SP: Spinous process; TP: Transverse process; E: Extension.



Anterior Lumbar Counterstrain Points

Anterior Lumbar (AL) 1

Treatment position: Right AL 1

Location: Medial aspect of ASIS

Patient Position: Supine

Physician Position: Standing ipsilateral to CP, foot on table

Initial Position: Flex hips and knees to the level L1. Pull the knees toward the side of the CP to rotate the pelvis and L2 segment towards the CP. This relatively rotates L1 away from the CP. Pull the ankles toward the CP, inducing ipsilateral sidebending. (F ST RA)

Involved Structures: Transversus abdominis, internal oblique, iliacus, and psoas muscles

Anterior Lumbar (AL) 2-4

Treatment position: Right AL 2

Location:

AL2: Medial aspect of AIIS

AL3: Lateral aspect of AIIS

AL4: Inferior aspect of AIIS

Patient Position: Supine

Physician Position: Standing contralateral to CP, foot on table

Initial Position: Flex hips and knees to the corresponding lumbar segment. Pull the knees away from the CP, rotating the pelvis and segment below away, relatively rotating the segment associated with the CP toward the CP. Pull ankles away from CP to induce sidebending away. (F SA RT)

Involved Structures: External oblique, iliacus, and psoas muscles

Anterior Lumbar (AL) 5

Location: Anterior, superior aspect of pubic ramus just lateral to symphysis

Patient Position: Supine

Physician Position: Standing ipsilateral to CP, foot on table

Initial Position: Flex hips and knees to engage the lumbosacral junction. Pull the knees toward the CP, inducing rotation of the pelvis and sacrum toward the CP. This induces relative rotation of L5 away from the CP. Push the ankles and feet away, thus inducing sidebending away from the CP. (F SA RA)

Involved Structure: Rectus abdominis muscle

Treatment position: Right AL 5

Posterior Lumbar (PL) 1-5 Spinous Process and PL 1-5 Transverse Process

Location:

PL1-5 SP: Inferior midline or inferolateral aspect of the tip of the SP of the corresponding vertebra

PL1-5 TP: Lateral aspect of the transverse process of the corresponding vertebra

Patient Position: Prone

Physician Position: Standing contralateral to CP

Initial Position: Grasp the ASIS ipsilateral to CP and lean back, inducing extension to level of CP, as well as pelvic rotation toward (rotation of torso away) and sidebending toward the CP.

Involved Structures: Multifidus and quadratus lumborum muscles

Treatment position: Right PL 3 SP

Sacral Region

CP	Location	Treatment Position
PS 1 Bilateral	Medial to PSIS at level of S1 (sacral base)	Apply posterior-to-anterior pressure on contralateral ILA (rotates about oblique axis)
PS 5 Bilateral	Medial and superior to ILA	Apply posterior-to-anterior pressure on contralateral sacral base (rotates about oblique axis)

PS: Posterior Sacrum; PSIS: Posterior Superior Iliac Spine; ILA: Inferior Lateral Angle.

Posterior Sacrum (PS) 1 and PS 5

Location:

PS 1: Medial to PSIS at level of S1 (sacral base)

PS 5: Medial and superior to ILA of sacrum

Patient Position: Prone

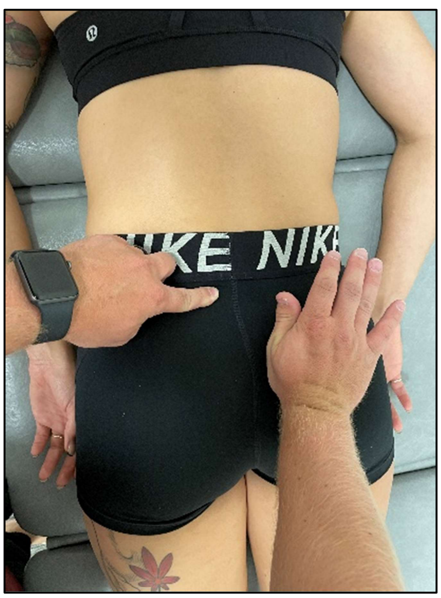
Physician Position: Standing ipsilateral to CP

Initial Position:

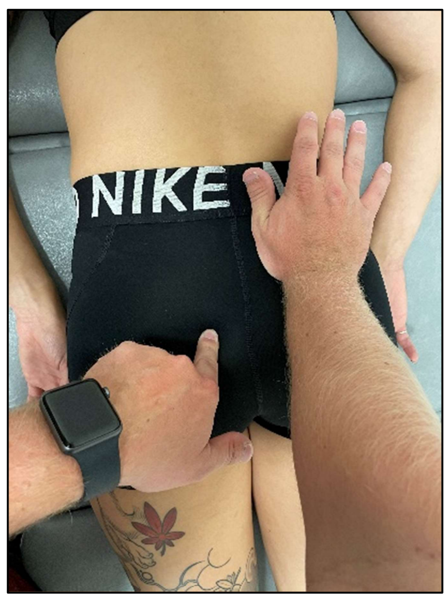
PS 1: Gentle, increasing anterior pressure on contralateral ILA (rotates sacrum about an oblique axis)

PS 5: Gentle, increasing anterior pressure on contralateral sacral base (rotates sacrum about an oblique axis)

Involved Structures: Multifidus, longissimus thoracis, iliocostalis lumborum muscles



Treatment position: Left PS 1



Treatment position: Left PS 5

Pelvic Region

Anterior Pelvis

CP	Location	Treatment Position	Acronym
Psoas Major	At the level of the ASIS, 2/3 of the distance toward midline, press deep posteriorly toward the psoas muscle belly	Bilateral hip flexion, hip external rotation, sidebend lumbar spine toward	F ST ER (hips)
Iliacus	At the level of the ASIS, 1/3 of the distance toward midline from the ASIS, pressing deep in a posterior and lateral direction toward the iliacus muscle	Bilateral hip flexion, external rotation	F ER (hips) ABD (knees)
Low Ilium/Psoas Minor	Superior surface of the iliopectineal (iliopubic) eminence associated with the attachment of psoas minor muscle	Ipsilateral hip and knee flexion	F
Inguinal Ligament/Pectineus	Lateral aspect of pubic tubercle associated with attachment of the inguinal ligament and/or pectineus muscle	Bilateral hip flexion with contralateral thigh crossed over ipsilateral thigh to create ipsilateral hip adduction and internal rotation	F ADD IR

ASIS: Anterior Superior Iliac Spine; F: Flexion; ST: Sidebending Toward; ER: External Rotation; ABD: Abduction; ADD: Adduction; IR: Internal Rotation.

Psoas Major

Treatment position: Psoas Major

Location: At the level of the ASIS, 2/3 of the distance toward midline from the ASIS, press deep posteriorly toward the psoas muscle belly

Patient Position: Supine

Physician Position: Standing ipsilateral to CP with caudal foot on the table to support patient's ankles

Initial Position: Patient's ankles rest on physician's caudal knee. Markedly flex hips, externally rotate hips. Pull ankles toward CP to sidebend the lumbar spine slightly toward the CP.

Involved Structure: Psoas major muscle

Iliacus

Location: At the level of the ASIS, 1/3 of the distance toward midline from the ASIS, pressing deep in a posterior and lateral direction toward the iliacus muscle

Patient Position: Supine

Physician Position: Standing ipsilateral to CP with caudal foot on table to support patient's ankles

Initial Position: Patient's crossed ankles rest over the physician's thigh. Marked flexion and external rotation of bilateral hips is achieved by allowing flexed knees to abduct and bringing the knees toward the chest.

Involved Structure: Iliacus muscle

Treatment position: Right Iliacus

Variation: Lateral Recumbent Psoas and Iliacus

Treatment position: Lateral Recumbent Left Iliacus/Psoas Major

Location: Psoas and Iliacus CPs, as above

Patient Position: Lateral Recumbent, affected side up

Physician Position: Standing posterior to patient

Initial Position: Both hips flexed to at least 90 degrees, or as much as is comfortable for the patient. Physician lifts the top leg while cradling the knee, externally rotates the hip. Fine tune with flexion, abduction, and external rotation.

Involved Structures: Psoas Major and/or iliacus muscles

Low Ilium/Psoas Minor

Treatment position: Right Low Ilium/Psoas Minor

Location: Superior surface of the iliopectineal (iliopubic) eminence associated with the attachment of psoas minor muscle

Patient Position: Supine

Physician Position: Standing ipsilateral to CP

Initial Position: Ipsilateral hip and knee are markedly flexed

Involved Structure: Psoas minor muscle

Inguinal Ligament/Pectineus

Location: Lateral aspect of pubic tubercle associated with attachment of the inguinal ligament and/or pectineus muscle

Treatment position: Right Inguinal Ligament/Pectineus

Patient Position: Supine

Physician Position: Standing ipsilateral to CP

Initial Position: Hips flexed with contralateral thigh crossed over the ipsilateral thigh to create adduction of hip. Ipsilateral lower leg pulled laterally (toward CP) to create slight internal rotation of the hip on the affected side.

Involved Structure: Pectineus muscle

Posterior Pelvis

CP	Location	Treatment Position	Acronym
Upper Pole L5	Superior medial aspect of PSIS	Extend and adduct ipsilateral hip, fine tune with internal or external rotation	E ADD
Lower Pole L5	On the ilium just inferior to PSIS pressing superiorly	Flexion of hip and knee, adduction and internal rotation of hip	F ADD IR
Piriformis	Within the muscle belly, midpoint between the lower half of the lateral aspect of the sacrum and ILA and the greater trochanter.	Marked hip flexion and abduction, fine tune with internal or external rotation	F ABD
High Ilium Sacroiliac (HISI)	About 1 inch superior and lateral to PSIS, pressing medially toward PSIS	Hip extension, abduction, and external rotation	E ABD ER
PL3 and PL4 Lateral/ Gluteus Medius	PL3 Lateral: Upper outer portion of the gluteus medius at the level of the PSIS, 2/3 distance from PSIS to TFL PL4 Lateral: Lateral portion of gluteus medius at level of PSIS near posterior edge of TFL	Hip extension, fine tune with abduction and external rotation	E ABD ER
High Ilium Flare Out (HIFO)/Coccygeus	Lateral aspect of the inferior lateral angle of the sacrum and/or the lateral aspect of the coccyx	Hip extension and adduction	E ADD

PSIS: Posterior Superior Sacroiliac Spine; PL: Posterior Lumbar; TFL; Tensor fascia latae; E: Extension; ADD: Adduction; ABD: Abduction; IR: Internal rotation; ER: External rotation.

Upper Pole L5

Location: Superior medial aspect of PSIS

Patient Position: Prone

Physician Position: Standing contralateral to CP

Initial Position: Extend and adduct ipsilateral hip, fine tune with internal or external rotation of hip.

Involved Structures: Multifidus, rotatores muscles and iliolumbar ligament

Treatment position: Right Upper Pole L5

Lower Pole L5

Location: On the ilium just inferior to PSIS pressing superiorly

Patient Position: Prone with ipsilateral leg off the table

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Flexion of the ipsilateral leg 90 degrees (at the hip and knee), adduction of hip, and slight internal rotation of hip

Involved Structures: Posterior sacroiliac ligaments, biceps femoris or erector spinae muscles, and pain referral region involving iliopsoas muscle

Treatment position: Right Lower Pole L5

Piriformis

Location: Within the muscle belly, midpoint between the lower half of the lateral aspect of the sacrum and ILA and the greater trochanter

Patient Position: Prone

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Thigh hanging off the table, hip markedly flexed and abducted, fine-tuned with external or internal rotation

Involved Structure: Piriformis muscle

Treatment position: Right Piriformis

High Ilium Sacroiliac (HISI)

Location: About 1 inch superior and lateral to PSIS, pressing medially toward PSIS

Patient Position: Prone

Physician Position: Standing ipsilateral to CP

Initial Position: Patient's ipsilateral hip is extended, abducted, and externally rotated

Involved Structures: Quadratus lumborum or gluteus maximus muscles, iliolumbar ligament

Treatment position: Left HISI

Posterior Lumbar (PL) 3 Lateral and PL 4 Lateral (Gluteus medius)

Location:

PL3 Lateral: Upper outer portion of the gluteus medius at the level of the PSIS, 2/3 distance from PSIS to tensor fasciae latae (TFL)

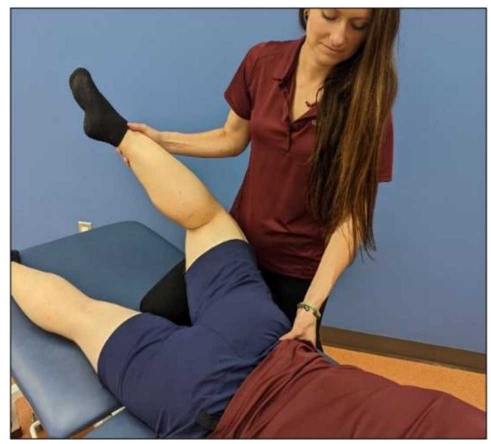
PL4 Lateral: Lateral portion of gluteus medius at level of PSIS near posterior edge of TFL

Patient Position: Prone.

Physician Position: Standing ipsilateral to CP

Initial Position: Hip extended with fine tuning in abduction and external rotation.

Involved Structure: Gluteus medius muscle



Treatment position: Left PL3 Lateral

High Ilium Flare Out (HIFO)/Coccygeus

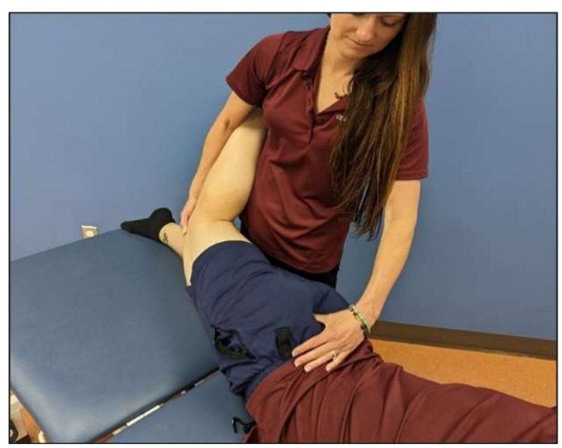
Location: Lateral aspect of the inferior lateral angle of the sacrum and/or the lateral aspect of the coccyx

Patient Position: Prone. Note use of table to induce hip extension.

Physician Position: Standing contralateral to CP

Initial Position: Extend and adduct thigh ipsilateral to the CP

Involved Structures: Coccygeus, Gluteus maximus, pelvic floor muscles



Treatment position: Right HIFO (Coccygeus)

Lower Extremity Region

CP	Location	Treatment Position	Acronym
Hip			
Lateral Trochanter	Along the ITB, distal to greater trochanter	Hip moderately abducted, hip and knee slightly flexed	F ABD
Knee			
Medial meniscus	Antero-medial aspect of the meniscus on the joint line	Knee flexion, tibia internal rotation and adduction	F IR ADD
Lateral meniscus/popliteus	Lateral aspect of the meniscus on the joint line	Knee flexion, tibia abduction, mild internal or external rotation	F ABD IR/ER
Medial hamstring (Semimembranosus)	Posterior thigh medial to midline approximately halfway down the shaft of the femur	Knee flexed, tibia internally rotated and slightly adducted, with ankle plantar flexed by compression on the calcaneus	F IR ADD
Lateral hamstring (Biceps femoris)	In the posterior thigh lateral to midline approximately halfway down the shaft of the femur	Knee flexed, tibia externally rotated and slightly abducted, with ankle plantar flexed by compression on the calcaneus.	F ER ABD
Ankle			
Medial ankle (Tibialis anterior)	Inferior to the medial malleolus along the deltoid ligament	Place a fulcrum on the medial aspect of the ankle. Apply an inversion force with slight shear.	INV
Lateral Ankle (Fibularis longus, brevis, and tertius)	Anterior and inferior to the lateral malleolus in the sinus tarsi (talocalcaneal sulcus)	Place a fulcrum on the lateral aspect of the ankle. Apply an eversion force with slight shear.	EV
Extension ankle (Gastrocnemius)	Within the proximal gastrocnemius muscles distal to the popliteal margin	Ankle markedly plantar flexed with knee flexed	F PF
Foot			
Flexion Calcaneus (Quadratus Plantae)	Anterior aspect of the calcaneus on the plantar surface of the foot at the attachment of the plantar fascia	Foot markedly plantarflexed approximating the forefoot to the calcaneus.	F
Navicular	Planter surface of the navicular bone	Plantar flexion, supination, and inversion of the foot	PF SUP INV

ITB: Iliotibial band; F: Flexion; ABD: Abduction; ADD: Adduction; ER: External Rotation; IR: Internal Rotation; INV: Inversion; EV: Eversion; PF: Plantar Flexion; SUP: Supination

Lateral Trochanter

Location: Along the ITB, distal to greater trochanter

Patient Position: Prone or supine

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Hip moderately abducted, hip and knee slightly flexed

Involved Structure: Iliotibial band

Treatment position: Right Iliotibial Band

Medial Meniscus

Location: Anteromedial aspect of meniscus on joint line

Patient Position: Supine

Physician Position: Standing or seated ipsilateral to CP

Initial Position: The knee is moderately flexed, and the tibia is internally rotated and slightly adducted

Involved Structures: Medial meniscus, medial collateral ligament, pes anserinus muscles

Treatment position: Left Medial Meniscus

Lateral Meniscus/Popliteus

Location: Lateral aspect of meniscus on joint line

Patient Position: Supine

Physician Position: Standing or seated ipsilateral to CP

Initial Position: The knee is moderately flexed, tibia slightly abducted. May require mild internal or external rotation

Involved Structures: Lateral meniscus, lateral collateral ligament, iliotibial band

Treatment position: Right Lateral Meniscus

Medial Hamstring (Semimembranosus)

Treatment position: Left Medial Hamstring

Location: Posterior thigh medial to midline approximately halfway down the shaft of the femur

Patient Position: Prone

Physician Position: Standing ipsilateral to CP

Initial Position: Knee flexed, tibia internally rotated and slightly adducted, with ankle plantar flexed by compression on the calcaneus

Involved Structures: Semitendinosus/Semimembranosus muscles

Lateral Hamstring (Biceps Femoris)

Location: In the posterior thigh lateral to midline approximately halfway down the shaft of the femur

Treatment position: Right Lateral Hamstring

Patient Position: Prone

Physician Position: Standing ipsilateral to CP

Initial Position: Knee flexed, tibia externally rotated and slightly abducted, with ankle plantar flexed by compression on the calcaneus. Note the physician's knee supporting the patient's knee to induce mild hip extension.

Involved Structure: Biceps femoris muscle

Medial Ankle (Tibialis Anterior)

Location: Inferior to the medial malleolus along the deltoid ligament

Patient Position: Supine, prone, or seated

Physician Position: Standing or seated at the foot of the table

Initial Position: Place a fulcrum on the medial aspect of the ankle. Apply an inversion force with slight shear.

Involved Structure: Tibialis anterior muscle

Right Medial Ankle CP Location

Treatment position: Right Medial Ankle CP
The physician monitors the point with either hand

Lateral Ankle (Fibularis or Peroneus longus and brevis)

Location: Anterior and inferior to the lateral malleolus in the sinus tarsi (talocalcaneal sulcus)

Patient Position: Supine, prone, or seated

Physician Position: Standing or seated at the foot of the table

Initial Position: Place a fulcrum on the lateral aspect of the ankle. Apply an eversion force with slight shear.

Involved Structures: Fibularis longus, brevis, or tertius muscles

Right Lateral Ankle CP Location

Treatment position: Right Lateral Ankle CP
The physician monitors the point with either hand

Gastrocnemius (Extension ankle)

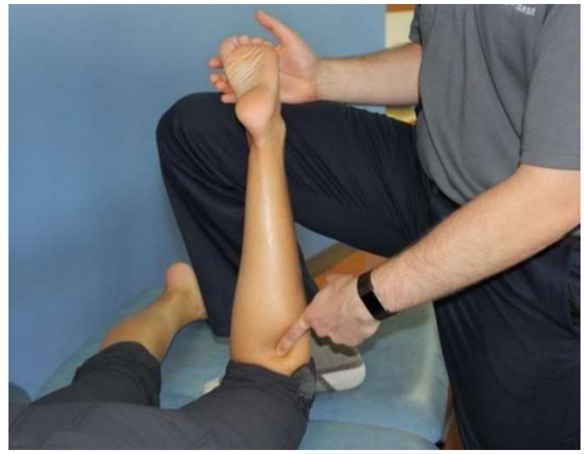
Location: Within the proximal gastrocnemius muscle distal to the popliteal margin

Patient Position: Prone

Physician Position: Standing ipsilateral to CP

Initial Position: Ankle markedly plantar flexed with knee flexed

Involved Structure: Gastrocnemius muscle



Treatment position: Left Extension Ankle (Gastrocnemius)

Flexion Calcaneus (Quadratus Plantae)

Location: Anterior aspect of the calcaneus on the plantar surface of the foot at the attachment of the plantar fascia

Patient Position: Supine or prone

Physician Position: Seated or standing at the foot of the table

Initial Position: Marked flexion of the forefoot approximating the forefoot to the calcaneus

Involved Structures: Quadratus plantae muscle, plantar fascia

Treatment Position: Right Flexion Calcaneus

Navicular

Location: Planter surface of the navicular bone

Patient Position: Prone

Physician Position: Standing ipsilateral to CP

Initial Position: Plantar flexion, supination, and inversion of the foot

Involved Structure: Tibialis posterior muscle

Treatment Position: Right Navicular

Upper Extremity Region

CP	Location	Treatment Position	Acronym
Shoulder			
Subscapularis	Anterolateral border of the scapula on subscapularis muscle pressing from anterior-lateral to posteromedial direction	Shoulder extended and internally rotated	E IR
Supraspinatus	In the belly of the supraspinatus muscle	Shoulder flexed, abducted, and markedly externally rotated	F ABD ER
Levator Scapulae	Superior medial border of the scapula at the attachment of the levator scapula	Marked internal rotation of the shoulder, with traction and slight abduction. Alternatively, glide scapula superiorly and medially	IR ABD Traction/ Glide Superior Medial
Long Head of Biceps	Over the tendon of the bicep muscle in the bicipital groove	Elbow flexed, shoulder flexed, abducted and internally rotated	F ABD IR
Short Head of Biceps/Coracobrachialis	At the inferolateral aspect of the coracoid process	Elbow flexed, shoulder flexed, adducted and internally rotated	F ADD IR
Rhomboid Major and Minor	Along the medial border of the scapula at the attachment of rhomboid muscles	Shoulder extension and adduction, pull arm/elbow posterior and medial	E ADD
Pec Minor	Inferior and medial to the coracoid process at the myotendinous junction or in the muscle belly	Arm adducted diagonally across the chest with shoulder/scapula pulled anterior, inferior, and medial	ADD
Elbow			
Radial Head – Lateral	Anterior lateral surface of the radial head at the attachment of the supinator	Full elbow extension, forearm supination, mild valgus force	E SUP VAL
Medial Epicondyle	At the medial epicondyle of the humerus at the common flexor tendon and the attachment of pronator teres	Elbow flexed, marked pronation and slight adduction of the forearm with the wrist slightly flexed	F PRON ADD
Wrist and Hand			
Dorsal Wrist	Surface of any of the proximal 2nd to 5th metacarpals and in the muscles of the extensor carpi radialis and ulnaris	Wrist extension, fine tune with radial/ulnar deviation	E
Palmar Wrist	Base of any of the proximal 2nd to 5th metacarpals and in the muscles of the flexor carpi radialis and ulnaris	Wrist flexion, fine tune with radial/ulnar deviation	F
Abductor Pollicis Brevis (First Carpometacarpal)	Anterioradial aspect of the base of the first metacarpal	Wrist flexed, thumb abducted	F ABD

E: Extension; F: Flexion; ABD: Abduction; ADD: Adduction; IR: Internal Rotation; ER: External Rotation; SUP: Supination; PRON: Pronation; VAL: Valgus force.

Subscapularis

Treatment position: Left Subscapularis

Location: Anterolateral border of the scapula on the subscapularis muscle, pressing from an anterolateral to posteromedial direction

Patient Position: Supine

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Shoulder extended and internally rotated

Involved Structure: Subscapularis muscle

Supraspinatus

Treatment position: Left Supraspinatus

Location: In the belly of the supraspinatus muscle

Patient Position: Supine

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Shoulder flexed, abducted, and markedly externally rotated

Involved Structure: Supraspinatus muscle

Levator Scapulae

Location: Superior medial border of the scapula at the attachment of the levator scapula

Patient Position: Prone, head turned away from CP

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Marked internal rotation of the shoulder, with traction and slight abduction. Alternatively, may glide scapula superiorly and medially to shorten the muscle.

Involved Structure: Levator scapulae muscle

Treatment position: Left Levator Scapulae

Long Head of Biceps Brachii

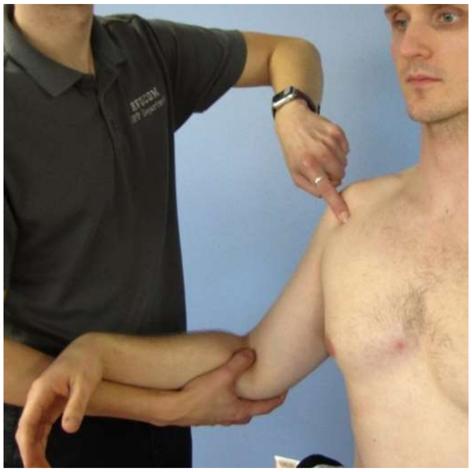
Location: Over the tendon of the bicep muscle in the bicipital groove

Patient Position: Supine or seated

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Elbow flexed, shoulder flexed, abducted and internally rotated

Involved Structure: Biceps brachii muscle



Treatment position: Right Biceps brachii Long Head

Short Head of Biceps Brachii/Coracobrachialis

Location: At the inferolateral aspect of the coracoid process

Patient Position: Supine or seated

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Elbow flexed, shoulder flexed, adducted and internally rotated

Involved Structures: Biceps brachii muscle, coracobrachialis muscle

Treatment position: Right Biceps brachii Short Head

Rhomboid Major/Minor

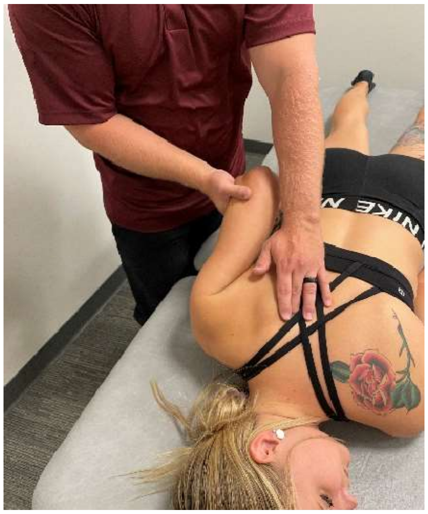
Location: Along the medial border of the scapula at the attachment of rhomboid muscles

Patient Position: Prone, arms at side

Physician Position: Standing ipsilateral to CP

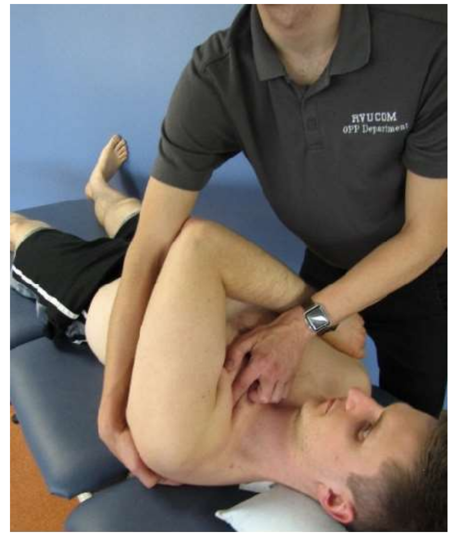
Initial Position: Shoulder extension and adduction by pulling the arm/elbow posterior and medial which approximates medial border of scapula to spine

Involved Structures: Rhomboid major/minor muscles



Treatment position: Right Rhomboid

Pectoralis Minor



Treatment position: Left Pectoralis Minor

Location: Inferior and medial to the coracoid process at the myotendinous junction or in the muscle belly

Patient Position: Supine

Physician Position: Standing contralateral to CP

Initial Position: Arm adducted diagonally across the chest with shoulder/scapula pulled anterior, inferior, and medial

Involved Structure: Pectoralis minor muscle

Radial Head-Lateral

Treatment position: Left Radial Head-Lateral

Location: Anterior lateral surface of the radial head at the attachment of the supinator

Patient Position: Supine or seated

Physician Position: Standing or seated, facing the patient

Initial Position: Full elbow extension, forearm supination, and mild valgus force

Involved Structures: Supinator muscle, radial head

Medial Epicondyle

Treatment position: Right Medial Epicondyle

Location: At the medial epicondyle of the humerus at the common flexor tendon and the attachment of pronator teres

Patient Position: Supine or seated

Physician Position: Standing or seated ipsilateral to CP

Initial Position: Elbow flexed, marked pronation and slight adduction of the forearm with the wrist slightly flexed

Involved Structures: Forearm flexor muscles, pronator teres

Dorsal Wrist

Location: Surface of any of the proximal 2nd to 5th metacarpals and in the muscles of the extensor carpi radialis and ulnaris

Patient Position: Supine or seated

Physician Position: Standing or seated, facing the patient

Initial Position: Wrist extension, fine tune with radial/ulnar deviation

Involved Structures: Wrist extensor muscles

Treatment position: Right Dorsal Wrist

Palmar Wrist

Location: Base of any of the proximal 2nd to 5th metacarpals and in the muscles of the flexor carpi radialis and ulnaris

Patient Position: Supine or seated

Physician Position: Standing or seated, facing the patient

Initial Position: Wrist flexion, fine tune with radial/ulnar deviation

Involved Structures: Wrist flexor muscles

Treatment Position: Right Palmar Wrist

Abductor Pollicis Brevis (First Carpometacarpal)

Location: Anterioradial aspect of the base of the first metacarpal bone

Patient Position: Seated or supine

Physician Position: Standing or seated, facing the patient or ipsilateral to CP

Initial Position: Wrist flexed, thumb abducted

Involved Structure: Abductor pollicis brevis muscle

Treatment Position: Right Abductor Pollicis Brevis

Rib Region

CP	Location	Treatment Position	Acronym
Anterior			
AR 1-10	AR 1: Inferior to clavicle on the first chondrosternal articulation AR 2: Superior aspect of rib 2 in midclavicular line AR 3-10: On the corresponding rib in anterior axillary line	Physician's foot (contralateral to CP) on table with patient's opposite side arm resting on physician's leg. Flexion, slight sidebending and rotation of torso toward affected rib are induced using the head and/or torso.	F ST RT
Anterior			
PR 1	PR 1: Posterior-superior part of rib 1, just lateral to the costotransverse articulation	Physician's foot (ipsilateral to CP) on table with patient's ipsilateral arm resting on the physician's leg. PR 1: Using the head, extend, sidebend away, and rotate toward CP	E SA RT
PR 2-10	PR 2-10: Superior aspect of corresponding rib angles	Physician's foot (ipsilateral to CP) on table with patient's ipsilateral arm resting on the physician's leg. PR 2-10: Using the head and torso, slightly flex, sidebend and rotate away from CP	F SA RA

AR: Anterior Rib; PR: Posterior Rib; F: Flexion; E: Extension; ST: Sidebending Toward; SA: Sidebending Away; RT: Rotation Toward; RA: Rotation Away.

Anterior Rib (AR) 1-10

Locations: AR 1: Inferior to clavicle on the first chondrosternal articulation

AR 2: Superior aspect of rib 2 in midclavicular line

AR 3-10: On the corresponding rib in anterior axillary line

Patient Position: Seated

Physician Position: Standing posterior to patient

Initial Position: Physician's foot (contralateral to CP) on table with patient's opposite side arm resting on physician's leg. Ribs 1 and 2 are positioned with motion of both the cervical and thoracic spine. Ribs 3-10 use the thoracic spine. Flexion, slight sidebending and rotation of torso toward affected rib (F ST RT) are induced using the head and/or torso.

Modifications: To achieve more sidebending and rotation, patient's ipsilateral arm may be extended and rest on the back of the table. The patient's legs and ankles may be brought up and rested on the table ipsilateral to the affected rib, inducing ipsilateral hip internal rotation and spinal sidebending.

Involved Structures: External/internal/innermost intercostal muscles, and serratus anterior muscles

Treatment position: Right Anterior Rib 2

Posterior Rib (PR) 1-10

Locations: PR 1: Posterior-superior part of rib 1, just lateral to the costotransverse articulation

PR 2-10: Superior aspect of corresponding rib angles

Patient Position: Seated

Physician Position: Standing posterior to patient

Initial Position: Physician's foot (ipsilateral to CP) on table with patient's ipsilateral arm resting on the physician's leg.

PR 1: Using the head, extend, sidebend away, and rotate towards the CP (E SA RT).

PR 2-10: Using the head and torso, slightly flex, sidebend and rotate away from affected rib (F SA RA).

Modifications: To achieve more sidebending and rotation, the patient's ipsilateral arm may be extended and rest on the back of the table. The patient's legs and ankles may be brought up and rested on the table ipsilateral to the affected rib, inducing ipsilateral hip internal rotation and spinal sidebending.

Involved Structures: External/internal/innermost intercostal, levatores costorum, and serratus posterior muscles

Treatment position: Right PR 1

Treatment position: Right PR 2 - 10

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Chapter 15

Mechanisms of Action

"Besides a philosophy, osteopathy is also an art. Art is the skill or power to perform certain actions. And osteopathy is a science. Science is a systematized knowledge of nature and the physical."

-Robert Fulford, D.O.

Contents:

NOTES

Introduction

Osteopathic Medicine uses a variety of modalities and techniques which all follow basic osteopathic principles. There is more than one "correct" approach to treatment. Deciding which modality to use should be based on the patient, the skill and comfort level of the physician, and the nature of the somatic dysfunction present. This chapter will introduce the most common modalities utilized; however, OMM should always be individualized to every physician and patient.

Modalities are often described as direct or indirect. **Direct** methods engage the restrictive barrier, apply a corrective force, and move through the barrier to restore physiologic motion.[1] Articulatory Technique, General Osteopathic Technique (GOT), High Velocity Low Amplitude (HVLA), Post-Isometric Relaxation Muscle Energy (ME), and Soft Tissue are often described as direct since they move the dysfunction through its restriction. This may also be described as moving away from the freedom, toward the barrier, or "where it does not want to go." **Indirect** methods, on the other hand, disengage from the restrictive barrier and move into the position of ease.[2] This allows the tissue to relax, and motion is restored. Counterstrain (CS) is considered an indirect modality. Indirect methods have been described as moving toward freedom, away from the barrier, or the "way it wants it to go." Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS), Myofascial Release (MFR), Osteopathic Cranial Manipulative Medicine (OCMM), and other approaches can be either direct and/or indirect depending on whether the restrictive barrier is engaged or disengaged. The directness or indirectness can also change throughout a treatment as the force changes from a position of ease to restriction and vice versa. Some techniques, such as Still technique and Facilitated Positional Release (FPR), are combined techniques in that they use both direct and indirect methods to achieve a change.

Most patients with a variety of presentations are responsive to OMT; however, there are some precautions or contraindications to certain techniques, which will be reviewed in this chapter. As with any procedure, a thorough history, physical examination, and astute clinical judgment are critical before utilizing OMT. For example, acute inflammation may be a contraindication for certain direct techniques in the area of concern, but that does not mean this technique cannot be used on the patient in another region. For instance, an acute ankle sprain would not be a contraindication for a direct treatment in the thoracic region. Also, assessing the severity of the complaint is crucial in determining whether treatment can be done in that specific area. For example, there may be acute inflammation associated with an ankle sprain, but if the ankle is stable, a direct modality could be used to treat the ankle somatic dysfunction present due to the sprain.

Clinical judgment is also essential when considering the dosage of OMT treatments. Dosage can be especially important when utilizing techniques such as OCMM and HVLA. Assessment should include the patient's age, the acuteness or chronicity of the pathology, state of health and vitality, medical history, previous treatment reactions, and overall disposition. Chronically ill patients, as well as the elderly, may respond more slowly, requiring a higher frequency (i.e., weekly to monthly) and a lower dose at any one time to prevent adverse effects. Acutely ill patients may tolerate only short treatment sessions, which may then be delivered more often (i.e. a patient hospitalized with pneumonia may require short, 5-minutes lymphatic treatments delivered once or twice daily during their hospitalization). Young pediatric patients, while generally healthy, may only tolerate being cooperative for a small amount of time.

Though results may often be immediate, the full results of a treatment may not reveal themselves for a few hours to a few days. Some patients may feel sore or fatigued for 24-48 hours following treatment. Patients should be informed that they may experience these symptoms after osteopathic treatment and that they are normal, expected therapeutic consequences.

Patients should be advised to hydrate to decrease the sensation of soreness. It is also reasonable to suggest abstaining from strenuous exercise and alcohol for 24 hours after a treatment. Topical ice packs and oral or topical NSAIDs can be recommended as well, depending on the reason for treatment. The patient should be instructed to contact the physician if the soreness persists more than two days, if they have significant pain, or proceed to the emergency department immediately with the onset of alarming symptoms such as loss of bladder or bowel control or other neurological symptoms.

Treatment Models

Before delving into the treatment modalities, it is prudent to note five different treatment models which provide different ways to approach patients and create treatment plans. All of the models have a singular goal of improving **homeostasis** by decreasing **allostatic load**. Allostatic load is the summative effect of internal and external stressors, which pull the body further away from homeostasis. The human body has an amazing ability to adapt and compensate with increasing allostatic load; however, each individual has limitations. While each of these models gives us a starting point, it is important to keep in mind that everything in the human body is interrelated. Therefore, most physicians will include multiple models in their treatment plan. The five models of care are biomechanical, respiratory-circulatory, neurological, metabolic-energy, and behavioral. For an in-depth discussion of these models, please see the *RVUCOM OPP I&II Manual*.

The Osteopathic Techniques[5]

Balanced Ligamentous Tension (BLT)/Ligamentous Articular Strain (LAS)

Dr. William G. Sutherland, D.O. described the concept of BLT/LAS along with osteopathy in the cranial field in the early 20th century. According to Sutherland's *reciprocal tension mechanism* theory, the ligaments of a joint will maintain a constant level of tension throughout physiologic range of motion. The ligaments of a joint can be viewed as a complicated set of levers, pulleys, and straps that maintain constant tension. Specific insertion sites of ligaments create fulcrums for movement as well as barriers to movement. In a functional joint, the tension distributed throughout the ligaments of a joint is balanced, and the system will shift its balance point or tensional distribution along with positional changes that occur with motion.[3]

When somatic dysfunction is present, tension becomes unbalanced which induces strain in a joint and alters proprioception. Sutherland described an alteration in balanced ligamentous tension as a ligamentous articular strain. Both "Balanced Ligamentous Tension" and "Ligamentous Articular Strain" are modalities based on interpretations of Sutherland's work. BLT and LAS were developed in different regions of the country by physicians who worked with Dr. Sutherland. Besides their historical origins, BLT and LAS have a few notable differences. However, they are largely similar and thus are discussed together. A physician can use the principles of BLT/LAS to influence a joint, fascial plane, and/or muscle. Strains are not limited to ligaments and can also be seen in fascia and connective tissue. The principles of BLT/LAS, despite the name, can be applied to any tissue of the body.

Principles of Treatment

BLT/LAS are primarily described as indirect, passive treatment methods. There are three basic components of BLT/LAS: disengagement, exaggeration, and balancing.

1. **Disengage**: Induce compression or decompression to the tension around the area of dysfunction to allow for repositioning of the dysfunctional structures.
2. **Exaggerate**: The dysfunctional structures are carried in the direction of least resistance, (sometimes referred to as the direction of original injury) toward a position where the tension of the tissues is symmetrically distributed (the balance point). This may be accomplished by providing motions in various planes (e.g., flexion, extension, rotation, sidebending) until that balance point is reached.
3. **Balance**: The point of balance is maintained until the strain within the connective tissues related to the dysfunction is resolved by inherent physiologic forces, typically leading to palpable tissue texture changes.

While these are the main components used in BLT/LAS techniques, there are other methods for obtaining a balance point, including respiratory and postural cooperation from the patient. Whatever the method, the goal of BLT/LAS is to place the somatic dysfunction in a position of balance relative to the surrounding tissue so that the body is allowed to return to its inherent reciprocal tension and full range of motion. This is a very subtle and gentle technique that is tolerated well by patients.

Technique Steps for BLT/LAS

1. Make a diagnosis of somatic dysfunction by assessing all planes of motion using passive motion testing for a region, tissue, or joint.
2. Disengage the tissues by inducing compression or decompression.
3. Maintaining this disengaging force, take involved tissues into the direction of least resistance in multiple various planes of motion (including those used in diagnosis) toward a position where the tension of the tissues is symmetrically distributed.
4. Maintain the balance point until the strain or somatic dysfunction resolves. This is usually felt as a notable tissue texture change, a significant shift in the balance point, or the breath returning to the region, related either to primary or secondary respiration.
5. Return the patient to neutral and reassess the somatic dysfunction.

Indications[5]

- Somatic dysfunctions that include ligamentous articular strains

Contraindications include but are not limited to the following:[5]

- **Absolute**
    - Acute or unstable fracture affected by application of treatment or treatment positioning
    - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
    - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient

- **Relative** (regionally or segmentally specific)
  - Fractures
  - Open wounds
  - Soft tissue or bony infections
  - Abscesses
  - Deep venous thrombosis (threat of embolism)
  - Recent post-operative conditions over the site of proposed treatment (wound dehiscence)
- **Relative** (General conditions)
  - Anticoagulation, disseminated or focal neoplasm
  - Aortic aneurysm
  - Hypermobility syndromes
  - Patient positioning that causes significant pain or discomfort

Facilitated Positional Release (FPR)

FPR was developed and introduced by Dr. Stanley Schiowitz, D.O. in the 1970s.[1] It emphasizes decreasing muscle hypertonicity involved in the maintenance of articular dysfunction. This modality should induce a relaxation of myofascial tissue, an unloading of the joint, and increased motion in the restricted articulation. Like Counterstrain and Muscle Energy, FPR is thought to decrease gamma gain caused by an inappropriate proprioceptive reflex and resets the gamma efferent system. Major benefits of this technique are that it treats both superficial and deep musculature and is time efficient.[1,2]

Principles of Treatment

FPR is primarily described as a combined (i.e., having elements of indirect and direct modalities) passive treatment method. The dysfunctional region is addressed with a combination of neutral positioning, application of an activating force, and placement into a position of ease.

Technique Steps for FPR

1. Monitor the area of somatic dysfunction.
2. Place the affected area in a neutral position (i.e., mechanically unloaded) to release tissue tension.
3. Apply an activating (also called facilitating) force (e.g., compression, traction, torsion, or a combination) until further relaxation is palpated.
4. While maintaining the activating force, bring the area into its greatest ease, generally into positional diagnosis.
5. Hold position for 3-5 seconds.
6. Passively return somatic dysfunction to neutral while maintaining the activating force.
7. Release the facilitating force.
8. Reassess the somatic dysfunction for improvement.
9. The treatment can be repeated several times if full motion is not restored.

Optional: Depending on the region, at the completion of holding the position for 3-5 seconds the structure is moved into the restrictive barrier(s) and an oscillatory component may be added if needed.

Indications[5]

- Myofascial or articular somatic dysfunction

Contraindications include but are not limited to the following:[5]

- **Absolute**
    - Acute or unstable fracture affected by application of treatment or treatment positioning
    - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
    - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
- **Relative**
    - Treatment is not well-tolerated or significant symptoms or signs occur during the process
    - Presence of a condition related to the site of treatment that could be negatively affected by the treatment position such as:
        - Comorbidities that place the patient at risk for fracture or tissue damage, e.g., malignancy, osteomyelitis, abscess, etc.
        - Moderate to severe joint instability
        - Spinal stenosis/nerve root impingement
        - Severe osteoporosis

Still Technique

The term "Still Technique" was coined by Richard Van Buskirk, D.O., Ph.D., but the technique is attributed to Dr. Still, "The Old Doctor." It is a method characterized as a specific, non-repetitive articulatory method that is a combined technique beginning with indirect and transitioning to direct.[1] Use of distant body parts as long-levers and vectors are common. By starting in the position of ease, the neural reflexes are disarmed, and the myofascial tissue is in a relaxed state. The force vector engages the tissue to allow re-patterning of the neuro-fascial-vascular complex. This is a relatively safe modality since it uses minimal force and can be used on any part of the body.[1] This can be done as quickly or slowly as the practitioner needs in order to maintain the activating force.

Principles of Treatment

Still technique is a combined, passive method utilizing both indirect and direct components. After making a diagnosis of somatic dysfunction, the physician places the structure into a position of ease in all planes of motion, applies a vector force (usually axial in direction), and then carries the structure through the restrictive barrier. In this way, Still technique may be thought of as "indirect, then direct."

Technique Steps for Still Technique[1]

1. Evaluate the affected tissue and, while monitoring, place it in a position of ease.
2. Introduce a force vector (usually compression or traction) from another part of the body. This must be sufficient to engage the affected tissues but is usually less than five pounds. The monitoring hand will feel a softening or relaxation of the tissues at the level of the dysfunction.
3. While maintaining the force vector, move the affected tissue into and through its restrictive barrier. A bump and/or click may be felt or heard as the tissue moves through its restriction, but neither is necessary for a successful treatment.
4. Passively move the body region back to neutral.
5. Reassess the somatic dysfunction.

Indications

- Articular or myofascial somatic dysfunction

Contraindications include but are not limited to the following:

- **Absolute**
  - Acute or unstable fracture affected by application of treatment or treatment positioning
  - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
  - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
  - Fracture/dislocation/spinal or joint instability that may be affected by treatment positioning
  - Severe loss of intersegmental motion secondary to conditions such as spondylosis, osteoarthritis, or rheumatoid arthritis in the area to be treated
  - Severe joint instability in the area to be treated
- **Relative**

  Presence of a condition related to the site of treatment that could be negatively affected by the treatment position such as:
  - Comorbidities that place the patient at risk for fracture or tissue damage, e.g., malignancy, osteomyelitis, ankylosis, abscess, etc.
  - Mild to moderate joint instability in the area to be treated
  - Spinal stenosis/nerve root impingement
  - Severe osteoporosis
  - Herniated disc
  - Severe sprain or strain
  - Congenital anomalies
  - Vertebrobasilar insufficiency and/or carotid pathology

Soft Tissue Method

In osteopathic practice, soft tissue method is defined as "a group of direct techniques that usually involve lateral stretching, linear stretching, deep pressure, traction and/or separation of muscle origin and insertion while monitoring tissue response and motion changes by palpation."[1] It is a modality most commonly used to address muscular and fascial structures as well as their associated neural and vascular elements. Soft tissue method enhances circulation, improves local tissue nutrition, oxygenation, and removal of metabolic wastes, and stimulates local and systemic immune responsiveness. It is also used before and after other techniques to facilitate treatment.[1] For example, if a patient has hypertonic musculature in the neck, soft tissue could be used to relax the muscles and fascia before HVLA is used on the cervical spine.

Principles of Treatment

Soft tissue method begins with identification of dysfunctional tissues through layer-by-layer palpation of the soft tissues of the body. The type of soft tissue dysfunction and the patient's clinical condition determine the type and duration of technique applied.

Technique Steps for Soft Tissue Method[1]

1. First, apply a gentle force of low amplitude.
2. While continually assessing the patient's response, the force can be increased for maximal tissue relaxation, but the rate of application should be 1-2 seconds of stretch followed by 1-2 seconds of stretch release.
3. The soft tissue application should continue until no further change is made.

There are a few things to remember about soft tissue technique. Throughout treatment, both patient and physician should be comfortable. There should not be pain, but the patient might describe a "good hurt" or "deep stretch," which is acceptable. This technique can also be uncomfortable if palpation is not at the intended level. Compressing the musculature into the bone or creating friction by sliding across or rubbing the skin should be avoided.[1]

Technique styles[1,2]

Parallel Traction

The musculature being treated is contacted at its origin and insertion. The treatment force is directed parallel to the musculotendinous axis, which induces a stretch or increase in length.

Perpendicular Traction (Kneading)

The musculature being treated is contacted at its midpoint, between the origin and insertion. The treatment force is directed perpendicular to the musculotendinous axis, similar to plucking a guitar string.

Direct Inhibitory Pressure

Contact is made over the musculotendinous portion of the muscle, and force is directed from superficial to deep in a sinking and firm fashion. To achieve results, the pressure may need to be quite deep, which is why the force should be placed on the musculotendinous portion; the technique is more painful in the muscle belly and can cause bruising.

Effleurage

A light stroking movement across superficial tissue from distal to proximal. Often used as a lymphatic treatment.

Petrissage and Skin Rolling

Deep pressure and lifting the skin and associated fascia away from deeper structures to break up adhesions such as scars.

Tapotement

Rapid and repeated striking of the body. Rhythmic percussion most frequently administered with the edge of the hand, cupped hand, or tips of fingers.

Indications[1, 4, 5]

- Somatic dysfunction characterized by
  - Hypertonic muscles
  - Excessive tension in fascial structures
- As an adjunct to additional manipulative treatment method in order to:
  - Prepare tissues for other types of manipulations
  - Identify areas of restricted motion, tissue texture changes and sensitivity
  - Address abnormal somatosomatic, viscerosomatic, and somatovisceral reflexes

Contraindications include but are not limited to the following:[1, 4, 5]

- **Absolute**
  - Acute or unstable fracture affected by application of treatment or treatment positioning
  - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
  - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
- **Relative** (regionally or segmentally specific)
  - Fractures
  - Open wounds
  - Soft tissue or bony infections
  - Abscesses
  - Deep vein thrombosis (DVT)
  - Neoplasm
  - Directly over the site of recent surgery
  - Hematoma
  - Traumatized or inflamed tissue

Myofascial Release (MFR)

To understand MFR, one must first understand fascia. Fascia is connective tissue made up of extracellular matrix that connects every cell, tissue, and organ. It is primarily made up of collagen and elastin with fibroblasts and white blood cells within the matrix. Fascia divides the body into compartments while encompassing all muscle types, arteries, veins, nerves, and lymphatics. Fascia also has a rich nervous supply which allows it to play a role in proprioception and position sense. In fact, 75% of proprioception occurs in fascial sheaths, with the other 25% occurring in ligaments, tendons, joint capsules, and muscle spindle activity. Anatomically, muscle and fascia are inseparable. Contraction and motion of the muscles are guided by fascia and this connective tissue is key for stability and effective force/load transfers. Fascia encases, tethers and limits motion and allows forces to be absorbed or redistributed. This connective tissue establishes a continuous network of balanced tension throughout the body, creating structural stability via **tensegrity**. It acts as the primary transmitter of inherent motion and adaptive communication throughout the body. Fascia is metabolically active and dynamic with mechanosensory, regulatory, and signaling functions; it is important to maintain homeostasis.[3] Additionally, *piezoelectricity* is a current produced by a substance that transforms mechanical stress to electrical energy, and collagen has been proven to have piezoelectric properties. Therefore, distortion of fascia will cause biochemical, immunologic, and electric changes. This is a direct representation of how structure and function are reciprocally interrelated. *Hooke's law* states that stress, either stretch or compression, is proportional to the strain or change in length so long as the limit of elasticity of the body (i.e., anatomical barrier) is not exceeded.[1] Due to these principles of physics and physiology, the fascia is crucial to our structure and function. Therefore, having access to and treating fascia can be very effective in alleviating both acute and chronic pain, as well as localized and systemic dysfunctions.

MFR is a safe and overall gentle technique that can be used for many somatic dysfunctions since fascia is present throughout the body. As Dr. A.T. Still said, "We see fascia as the framework of life, the dwelling place in which life sojourns."[8] MFR can normalize motion, decrease edema, reestablish symmetry, relieve pain, aid circulation and lymphatic flow, balance neuroreflexive activity, support visceral function, and maintain homeostasis.[1] MFR can be a direct, indirect, or combined technique. The key to MFR is continual engagement of the target tissue.

MFR can be completed through a direct or indirect approach. For direct approach, engage the restrictive barrier of the myofascial tissue being treated by applying a constant, directional force into the barrier. As the tissue releases, follow it by moving the tissue into the barrier. Continue doing this until no further release is felt and reassess. For an indirect approach, the tissue is engaged by applying pressure into the direction of least resistance and following tissue into ease as it releases. A combined approach uses both direct and indirect forces, either in combination or alternately, to achieve tissue balance. Treatment can also be augmented by using activating forces from the patient like inherent (intrinsic) forces, respiratory forces/assistance, patient cooperation, physician-guided force, or springing and vibration. Recognizing the best approach and moment of release requires palpatory skill and awareness. Keep in mind that fascial distortions are often described as torsion, pull, or strain and may be palpated from a more distal point due to the continuous tensegrity network.

Indications[1,4]

- Somatic dysfunctions involving myofascial or other connective tissues

Contraindications include but are not limited to the following:[1,4]

- **Absolute**
    - Acute or unstable fracture affected by application of treatment or treatment positioning
    - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
    - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
- **Relative** (general conditions)
    - Anticoagulation
- **Relative** (regionally or segmentally specific)
    - Fractures
    - Open wounds
    - Soft tissue or bony infections
    - Abscesses
    - Deep vein thrombosis (threat of embolism)
    - Disseminated or focal neoplasm
    - Recent post-operative conditions over the site of proposed treatment (wound dehiscence)
    - Aortic aneurysm

Articulatory Technique

This group of techniques is often referred to as low-velocity, high-amplitude, differentiating it from HVLA technique, which is described later in this chapter. The activating force is a gentle and repetitive movement through the restricted barrier, and long-lever vectors are commonly used to more efficiently achieve an increase in motion. When using articulatory techniques, the patient should be relaxed and comfortable. The physician should also be comfortable and use his or her body position to minimize muscular force. The goal of the treatment is to remove the pathologic barrier, returning to the physiologic barrier, thereby increasing and normalizing motion at the joint. The anatomic barrier should never be exceeded.[3]

Technique principles include[1]

1. Engage the restrictive barrier directly.
2. Bring the body part through its restrictive barrier with a gentle but firm force.
3. Return the body part to a point just short of the restrictive barrier (the restrictive barrier will shift as the treatment progresses and motion is restored).
4. Re-engage the new restrictive barrier and repeat motion through it.

5. Once no further progress is made, return to neutral.
6. Reassess.

Contraindications include but are not limited to the following:[1,4]

- Combination of repetitive rotation and extension in the upper cervical region (possible arterial or neurologic compromise)
- Fracture, dislocation, or joint instability
- Acute local inflammation (severe sprain or strain, local infection, etc.)
- Neurologic entrapment syndromes
- Serious vascular compromise
- Local malignancy
- Bleeding disorders

Muscle Energy (ME)

ME was developed by Fred Mitchell, Sr., D.O. in the 1940s and is defined as "a system of diagnosis and treatment in which the patient's muscles are actively used on request, from a precisely controlled position, in a specific direction, and against a distinctly executed physician counterforce."[1] It is considered a direct technique since the patient will be moved through his or her restrictive barrier. ME uses the understanding of muscle physiology to "reset" a muscle's proprioception and balance the muscle tone across joints. It can be utilized to lengthen hypertonic muscles, strengthen weak muscles, and/or improve motion in restricted joints. In order to understand muscle energy, we must first review muscle physiology and reflex pathways.

A reflex is a specific response to adequate stimuli and depends on neural input from sensory receptors. The bulk of a skeletal muscle is composed of *extrafusal fibers*, which make up contracting motor units; their efferent innervation is provided by *alpha-motorneurons*. The two major proprioceptive receptors in muscle are *muscle spindles* and *golgi tendon organs*. Muscle spindles, also known as *intrafusal fibers*, are located within striated muscles and lie parallel to *extrafusal fibers*. Muscle spindles provide afferent information about length and rate of change of the length of the muscle belly via afferent *group Ia* and *group II fibers*. Group Ia and group II fibers from muscle spindles work with the CNS to regulate alpha-motoneuron firing. This process is called the **stretch reflex** and maintains proper baseline muscle tone throughout the body: when a muscle begins to slacken or is stretched, the spindle fiber increases in length, causing increased spindle fiber firing and increased alpha-motorneuron stimulation, which will increase contraction of the extrafusal fibers. The reverse occurs while a muscle is contracting: it will decrease spindle fiber firing and decrease alpha-motor neuron stimulation, which will decrease contraction of the extrafusal fibers.

In order to fully understand this physiology, it is important to realize that the spindle fiber does not report the "absolute" extrafusal muscle length, but rather its length "relative to" the length of the intrafusal muscle fiber. Therefore, when the extrafusal fibers contract, the intrafusal fibers must also contract in order for the afferents to continue to report relative length. In order to accomplish this, *gamma-motorneurons* provide efferent innervation to the intrafusal muscle fibers and are regulated by the CNS. Increased activation of gamma-motor neurons leads to contraction of intrafusal muscle fibers, which increases the muscle spindle fiber's responsiveness to stretch by maintaining the relative relationship between the intrafusal and extrafusal fibers. If a muscle is contracted for too long, or contracting too often, the CNS will re-calibrate its "normal" innervation to the gamma-motorneurons—this process is called ***gamma-gain.***[5] Increased gamma-gain ultimately makes muscle spindle fibers more sensitive to stimuli; this leads to more constant firing of intrafusal afferents, which then increases alpha-motorneuron firing, increasing constant baseline tone of the extrafusal fibers. This physiologic protective reflex has now become pathologic and could cause or maintain hypertonic musculature.[6]

In addition to the stretch reflex, there is also an **autogenic reflex**. This involves the golgi tendon organs. The golgi tendon organs are proprioceptors found in tendons and along fascial coverings of muscle bellies, and they provide information about muscle tension to protect the muscle from over-contracting. This creates a protective mechanism to prevent pathologic stretching, i.e. tearing of a muscle. The afferent *group Ib fibers* originate in the golgi tendon organs and increase firing when the golgi tendon organ within the tendon is stretched during muscle contraction. This results in inhibition of the alpha-motorneurons innervating the involved agonist muscle and facilitating the alpha-motorneurons innervating the antagonist muscle. For example, contraction of the bicep muscle increases firing from the golgi tendon organ so that the bicep muscle would relax and the triceps muscle (its antagonist) would contract.[5]

Comparison of Intrafusal Fibers, Muscle Spindles, Golgi Tendon Organs, and Extrafusal Fibers

	Intrafusal Fiber	Golgi Tendon Organ	Extrafusal Fiber
Afferent (Proprioceptive)	Group Ia, Group II (Muscle Spindle)	Group Ib	
Efferent	Gamma-motorneuron		Alpha-motorneurons
During Contraction	Decreased length Decreased afferent firing Decreased alpha-motor neuron firing	Increased Length Increased afferent firing Agonist Inhibition Facilitate Antagonist	Decreased length

The final two reflexes to be considered in this text are **reciprocal inhibition** and **crossed extensor reflex**. When a muscle contracts, its antagonist must relax in order for the motion to be biomechanically efficient and smooth. The reciprocal inhibition reflex is the feedback loop that allows this basic motion to happen. But furthermore, when a muscle contracts, not only does its antagonist relax, but its contralateral counterpart relaxes and its contralateral antagonist counterpart contracts. This is the crossed extensor reflex, which contributes to biomechanical efficiency. Stepping on a sharp object with bare feet is an example of this reflex. If someone stepped on a nail with their left foot, reflexively their left flexors would contract, and left extensors would relax to raise their left leg. At the same time, their right extensors would contract, and right flexors would relax to ensure that their right foot was planted on the ground to hold their body weight as the left leg is raised.

A concept that is central to the muscle energy model is the post isometric relaxation phase of muscle physiology. After every muscle contraction type described above, there is a 1-2 second period during which the muscle is refractory to further stimulation. It is during this time that the muscle spindles and the central nervous system are communicating and "re-syncing" their respective information; the CNS is re-setting the perceived length and tone of the muscle, and the muscle spindles are reading the actual length and tone of myofibrils and fascia. It is during this time that the physician is most able to make changes in the resting tone and/or length of the muscle or area being treated.

Muscle Contraction Types

To complete the review of muscle physiology different types of muscle contraction must be addressed:

Isometric

The distance between the origin and insertion is maintained at a constant length. An example of an isometric contraction would be holding a weight in place. The muscle is contracting to hold the weight; however, the length of the muscle is not changing.

Concentric Isotonic

Origin and insertion approximate while maintaining constant tension. Force generated by the muscle is greater than the extrinsic force. An example of this would be lifting a heavy weight; the constant force generated by the muscle is greater than the force of the weight, and the muscle shortens.

Eccentric Isotonic

Origin and insertion separate while maintaining constant tension. Extrinsic force is greater than the force generated by the muscle. An example of this would be slowly letting a weight down. The force of the weight is overcoming the constant force generated by the contracting muscle, and the muscle is lengthening.

Isolytic

A rapid external force is applied to a contracting muscle forcing it to lengthen. An example of this would be if someone was handed a bag under the assumption that the bag weighed 5lbs, when it weighed 35lbs. Their muscles would be contracting; however, initially, the weight of the bag would overcome their force, extending and rapidly lengthening their arm.

Muscle Energy Types

Muscle energy can be used on a variety of somatic dysfunctions with the common goal of increasing range of motion and decreasing pain or limitation due to decreased range of motion and/or muscle weakness. It can be used to treat muscular dysfunctions, both hyper- and hypo-tonicity, while simultaneously addressing joint motion restriction. With an understanding of these principles of muscle physiology, we can look at how they specifically apply to different types of ME.

Isometric ME

This is indicated for hypertonic muscles and their associated structures with the goal of relaxation. This type of ME utilizes isometric muscle contraction and involves the proprioceptors of our stretch and autogenic reflexes. After an isometric contraction, the neuromuscular apparatus is in a refractory state and, therefore, will not have a strong reactive reflex. This is called the post-isometric relaxation (PIR) phase. By passively stretching the muscle during the refractory period, the physician can reset the proprioceptive sensory system; the muscle spindle fibers and golgi tendon organs are allowed to return to a more neutral state without counteracting reflexes. This can reset any "gamma-gain" in the system, decreasing the sensitivity of the spindle fibers. The step-by-step process for this modality is discussed later on.

Joint Mobilization Using Muscle Force

This type of ME is indicated for decreased ROM due to articular dysfunction, with the goal of increased joint range of motion. It utilizes any of the above types of muscle contraction and involves the proprioceptors of our stretch and autogenic reflexes. A dysfunctional joint will result in an imbalance in the muscles supporting that joint, usually hypertonicity of some, with paired hypotonicity of the antagonist muscle groups. A common example of this use of muscle energy would include using isotonic muscle energy to increase range of motion of the facet joints of the cervical spine.

Respiratory Assistance

This is indicated for hypertonic muscles and their associated structures with the goal of relaxation. This type of ME utilizes the inherent motion of respiration created by the diaphragm and other muscles of respiration, which then radiates throughout the entire body via tensegrity. The physician creates a fulcrum for motion within affected tissues, and then resists motion created by respiration and encourages motion into the barrier.

Oculocephalogyric/Oculocervical Reflex

This type of ME is indicated for hypertonic suboccipital muscles, OA and AA joint dysfunctions. It utilizes the oculocephalogyric, stretch, and autogenic reflexes. The oculocephalogyric reflex is a centrally mediated reflex that causes functional muscle groups in the upper cervical region to contract in response to eye movement so that the head moves in coordination with the eyes. This decreases eyestrain and keeps the eyes parallel to the horizon. Since the force used is from ocular motion, it is very minimal and gentle. This reflex can be utilized in acute cervical dysfunction or strain (whiplash injury) where activating the agonist or antagonist muscle may be too painful.

Reciprocal Inhibition

This type of ME has multiple indications. It can be used to lengthen a shortened/contracted muscle or to strengthen a weak/hypotonic muscle. It utilizes isotonic contraction in conjunction with the reciprocal inhibition reflex. It is particularly useful for patients with neuromuscular disease or dysfunction, such as muscular dystrophy, cerebral palsy and post-stroke muscular hyper- or hypo-tonicity. Any type of muscle contraction can be used, though isotonic eccentric and concentric are used most commonly in these situations. A hypertonic muscle can be relaxed and lengthened by contracting its antagonist muscle. These same principles can be applied by relaxing or lengthening a hypertonic agonist to tone a hypotonic muscle. For example, if the biceps are hypertonic, we can lengthen them by contracting the triceps. If the triceps are hypotonic, we can strengthen them by lengthening the biceps.

Crossed Extensor Reflex

This type of ME is indicated when the target muscle is so damaged or acutely tender that it cannot be directly manipulated (i.e., fracture, burn, etc.). Most commonly, this utilizes isotonic muscle contraction and the crossed extensor reflex. For example, a patient's right biceps brachii is hypotonic, but the patient has a cast on from a recent fracture. The physician can perform isometric ME on the left biceps. As a result of the crossed extensor reflex being activated, the left biceps relaxes and stretches while the right will contract, improving tone.

Isotonic Strengthening

This type of ME is indicated to reestablish tone and strength in a muscle that has become hypotonic by reflex hypertonicity of the opposing muscle group. It utilizes concentric isotonic contraction as well as stretching, and autogenic reflexes. The hypertonic muscle should be addressed first, typically using Isometric ME. Then, its weakened counterpart could further be strengthened using Isotonic Concentric ME. Using concentric isokinetic contraction, the weakened muscle shortens at a constant, slow rate against the counterforce created by the physician.

Isolytic Lengthening

This type of ME is indicated if a muscle is shortened due to fibrosis or contracture (i.e., upper motor lesion, or non-acute/chronic compartment syndromes). Using this type of ME requires that the patient contracts against a specific and targeted force of the physician, usually contracting the target muscle. The physician then gently overcomes the patient's resistance by rapidly stretching the muscle against the patient's force. This isolytic lengthening is essentially breaking, or lysing, the muscular contraction. This can happen just once or in a series of rhythmic contraction/isolytic stretch couplings.

One example of the application of this type of ME would be for the patient suffering from "shin splints." Shin splints is essentially a chronic compartment syndrome of the anterior compartment of the leg, involving the tibialis anterior muscle in particular. One of the physiological changes that occurs in chronic compartment syndrome is increased fibrosis, which exacerbates the problem, decreasing the muscles' ability to accommodate load during walking and running, furthering dysfunction and increasing pain. To treat this disorder with isolytic ME, the physician would ask the patient to contract the anterior flexor compartment of the leg by dorsiflexing the foot against the physician's resistance for several seconds. The physician would then gently "break" the muscle tensions by rapidly plantar flexing the patient's foot, creating an isolytic muscular stretch in the anterior compartment of the leg.

Post-Isometric Muscle Energy Technique Steps

1. Position the patient to where the restrictive barrier first begins to engage and restrict tissue motion (this is also known as the featheredge of the restrictive barrier)
2. Instruct the patient to move into the position of ease with intensity appropriate for the targeted muscle group while resisting the motion with an appropriate counterforce.
3. Maintain this force for 3-5 seconds.
4. Maintain the position but instruct the patient to relax, as does the physician.

5. After waiting for the post-isometric relaxation phase (1-2 sec), take up the slack until a new barrier is reached. It is important to pause for muscle relaxation/post-isometric-relaxation phase before forcefully stretching the muscle so that the stretch occurs during the refractory period with minimal proprioceptive response.
6. Repeat steps 1-5 until no further change is obtained (usually 3-5 times), then reassess.

Localization is key for a maximally effective ME. A correct diagnosis and knowledge of anatomy will allow activation of the correct muscle group and application of appropriate force. If excessive force is used, other muscle groups will be recruited, which will decrease the effectiveness of the treatment. Subtle adjustments should be made by the physician via palpation to achieve appropriate localization and engagement of tissues.[1] ME is often used along with other techniques such as HVLA. It is helpful to relax hypertonic musculature and strengthen reflexively weak muscles as well as improve asymmetry and enhance circulation. Since the patient needs to be actively involved in ME, patients who are unable to follow, or have difficulty following directions are not the best candidates for this modality.[1] As long as the force used is appropriate, this is a safe direct treatment.

Indications

- Myofascial or articular somatic dysfunction

Contraindications include but are not limited to the following:[1,4,5]

- **Absolute**
    - Acute or unstable fracture affected by application of treatment or treatment positioning
    - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
    - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
- **Relative** (regionally or segmentally specific)
    - Infection, hematoma or tear of the involved muscle
    - Fracture or dislocation of involved joint
    - Rheumatologic conditions causing instability of the cervical spine
    - Undiagnosed joint swelling or involved joint
    - Primary or secondary neoplastic process in the area to be treated
    - Patient unable to follow verbal directions (e.g., infants/young children, deaf patients, patients with severe mental illness, patients unable to speak the same language as the physician)
    - Presence of a condition related to the site of treatment that could be negatively affected by the treatment position such as:
        - Severe osteoporosis
        - Comorbidities that place the patient at risk for fracture or tissue damage, e.g., malignancy, osteomyelitis, abscess, etc.
        - Moderate to severe joint instability
        - Spinal stenosis/nerve root impingement

High-Velocity, Low-Amplitude (HVLA)

HVLA technique is a direct technique that uses a rapid (high velocity) therapeutic force of brief duration that travels a short distance (low amplitude) within the anatomic range of motion of a joint.[1] HVLA is unlike articulatory techniques, which use slower velocity over more distance. The somatic dysfunction is placed in its restrictive barrier, and a force vector is directed through the dysfunctional barrier, therefore classifying HVLA as a direct treatment method.

It is important that the restrictive barrier is localized, and the force directed is precise in order to remove the restrictive barrier while simultaneously protecting the anatomic barrier.[1] This means that an accurate intersegmental diagnosis is important. To assess if HVLA is an appropriate modality, each patient must be evaluated individually as well as every somatic dysfunction. It is generally accepted that restrictive barriers with a firm, distinctive, bony end feel respond well to HVLA. These specific palpatory findings tend to be associated with a mechanical-type dysfunction. In contrast, restrictions with a boggy, rubbery end-feel correspond to a reflex somatic dysfunction and generally do not respond well to HVLA.[1] If the positioning causes severe pain or the patient is extremely uncomfortable, a different modality should be used.

It is noteworthy that HVLA causes a transient, but significant, increase in sympathetic drive. This could have negative repercussions for an acutely ill or injured patient. In addition to these considerations, repeated thrusting on a joint is counterproductive and can result in hypermobility. Benefits of this modality include immediate relief of symptoms, decreased tenderness, and restored motion.[1] After a thorough evaluation and the correct diagnoses are established, this can be a time-efficient treatment for both physician and patient.

Technique principles include[1]

1. Position the patient to the restrictive barrier by stacking the planes of motion (flexion/extension, rotation, side-bending). The physician should be comfortable in order to maintain precision of treatment.
2. Allow the patient to relax. Hypertonic musculature may make the corrective force more difficult to achieve, less precise, and more painful for the patient.
3. Apply a short, rapid thrust in the direction of the barrier, making sure not to "wind up" or back off before the corrective force.
4. Return the patient to neutral and reassess the somatic dysfunction.

Indications[5]

- Articular somatic dysfunction (identified with TART) with a firm, distinct articular barrier

Contraindications include but are not limited to the following:[1,4,5]

- **Absolute (regionally or segmentally specific)**
    - Upper cervical pathology
        - Advanced rheumatoid arthritis
        - Down syndrome
        - Achondroplastic dwarfism

        - Chiari malformation
    - Fracture/dislocation/spinal or joint instability
    - Joint fusion: surgical, congenital, or pathologic
    - Klippel-Feil syndrome
    - Vertebrobasilar or carotid pathology
    - Acute, local, inflammatory arthritides (e.g., RA, SLE, IBD, Psoriatic, Still's, Scleroderma)
    - Joint infection
    - Malignancy involving bone and soft tissue
    - Myelopathy, cauda equina and other spinal cord pathology
- **Relative (regionally or segmentally specific)**
    - Acute herniated nucleus pulpous
    - Acute radiculopathy
    - Acute whiplash/severe muscle spasm/strain/sprain
    - Osteopenia/osteoporosis
    - Spondylolisthesis
    - Metabolic bone disease
    - Hypermobility syndromes
    - History of inflammatory arthritides (RA, SLE, IBD, Psoriatic, Still's, Scleroderma)
    - Regional implanted devices and joint replacements
        - Pacemaker/AICD
        - Spinal cord stimulator
        - Intrathecal pain pumps
        - Insulin pump
        - Breast implants
        - Orthopedic hardware

The "Crack"

One of the most rewarding aspects of HVLA is the sound of a "pop" or "crack" when the corrective force is applied –"Yes! I got it". This audible sound, though, does not always indicate a successful treatment, nor is it always necessary to achieve a successful treatment. The cause of the popping sound of a joint is actually still unknown though many hypotheses exist. As always, the evaluation of a successful treatment is based on restored motion and decreased tissue tension, which is evaluated by palpation and motion testing.[1]

Visceral Technique[5]

Visceral manipulation was first performed by Andrew Taylor Still. Since then, visceral manipulation has evolved into an important part of modern osteopathic treatment and practice. Visceral technique is similar in principle to BLT and MFR, with the goal of treating visceral dysfunction. This dysfunction can manifest as changes in organ motion that affects many other systems, such as neurologic, circulatory, and lymphatic. Additionally, visceral dysfunction can impact the entire body through the autonomic nervous system. Reflexes (somatovisceral, viscerosomatic and viscerovisceral) generated between the somatic system (muscles, bones, fascia, etc.) and the viscera (organs) contribute to dysfunction throughout the entire patient. These changes ultimately impact the health of the organ and the body, both of which can be addressed with visceral technique.

Each organ can develop somatic dysfunction, manifested as a loss of motion. Organs have two types of motion: mobility and motility. Mobility is passive motion of the organ secondary to direct interaction of the organ and structures it contacts. For example, respiratory activity of the diaphragm causes mobility of the liver. Motility is active, inherent motion the organ produces independent of the structures it contacts. Restriction in any type of motion is indicative of visceral dysfunction which can be treated with visceral technique.

The dysfunctional organ can be directly contacted for treatment, known as a short lever technique, or can be targeted through a body part, known as a long lever technique. In either case, the organ and associated tissues can be positioned directly (in the direction of tension and less motion) or indirectly (in the direction of ease or more motion). Then activating forces, like respiratory assistance, are employed to resolve the visceral dysfunction. This results in balanced tension, normalized organ mobility and motility, as well as normalization of the involved nervous system reflexes. Additionally, addressing the autonomic nervous system is an important consideration for any visceral dysfunction given the reflex patterns discussed. This includes treating vagus nerve, spinal sympathetic levels, sacrum, and pre-vertebral ganglion.

Technique principles include[13]

1. Diagnosis visceral dysfunction by evaluating organs for position, mobility, and motility
2. Treat visceral dysfunction with indirect or direct methodology
3. Consider addressing related structures, keeping in mind autonomic (somatovisceral, viscerosomatic and viscerovisceral reflexes), biomechanical, and circulatory considerations.

Technique styles[13]

Short Lever: The organ is contacted directly, through layer palpation, and direct or indirect treatment applied to restore motion to the organ. For example, the liver can be contacted through palpation through the abdomen. Respiratory assist, both inhalation and exhalation, can always be used to augment motion to the organ at any time during treatment.

Long Lever: The organ is contacted through a body part, and direct or indirect treatment applied to restore motion to the organ. For example, the liver can be contacted through the lower extremity using the muscular and fascial connections to the organ. Respiratory assist, both inhalation and exhalation, can always be used to augment motion to the organ at any time during treatment.

Indications[5]

- Visceral technique should be considered in the patient with a history and/or physical exam finding consistent with visceral dysfunction. This can include facilitated spinal levels, Chapman's points, and somatic dysfunction not responding to non-visceral treatment.
- Clinical conditions that should prompt an assessment for visceral dysfunction and somatic dysfunction related to visceral dysfunction include:
  - Constipation
  - Post-operative ileus
  - Gastroesophageal reflux disease
  - Irritable bowel syndrome
  - Cystitis

Contraindications include but are not limited to the following:[5]

- **Absolute**
  - Acute or unstable fracture affected by application of treatment or treatment positioning
  - Manifestation of abnormal neurological and/or vascular symptoms brought on and/or exacerbated by the treatment position
  - Exacerbation of potentially life-threatening symptomatology by treatment position (e.g., EKG changes, drop in oxygen saturation) in a monitored patient
- **Relative** (regionally or segmentally specific)
  - Aortic aneurysm
  - Splenomegaly
  - Gastrointestinal obstruction
  - Immediate post-abdominal/pelvic surgery/poster-operative period
  - Abdominal hernia
  - Diastasis recti
  - Complicated pregnancy
  - GI infection (colitis, duodenitis)
  - Ischemic bowel
- **Relative** (general)
  a. Undiagnosed abdominal pain
  b. Presence of cancer in a thoraco-abdominal organ
  c. Disproportionate pain with palpation

Counterstrain (CS)

For a discussion of Counterstrain technique, please see the counterstrain chapter in this manual.

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Appendix

"Osteopathy is only in its infancy, it is the great unknown sea just discovered, and as yet we are only acquainted with its shore tide."

–A.T. Still, M.D., D.O.

Contents:

NOTES

Basics of Sacral Diagnosis

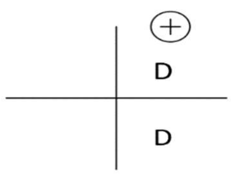
> **Pelvic Rock Test** is equivalent to the **ASIS compression test**. This test aims to assess sacral motion at the middle transverse axis.

These charts are helpful to understand sacral diagnoses.
Each quadrant represents the four landmarks for sacral diagnoses (L sacral sulcus, R sacral sulcus, L inferior lateral angle (ILA), R ILA) and the deep side is denoted with a “D”. The side of the positive seated flexion test or ASIS compression test is denoted with a “+”.

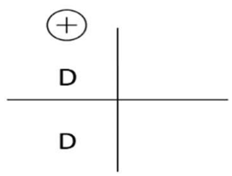
Step 1: Perform a lateralization test (seated flexion and/or ASIS compression test) and write “+” on the side of lateralization.
Step 2: Compare R and L sacral sulci, determine which landmark is deeper/anterior. Fill in the chart with a “D” for “deep”.
Step 3: Compare R and L ILAs, determine which landmark is deeper/anterior. Fill in the chart with a “D” for “deep”.

<u>Torsions</u>
In forward torsions, the sulci and ILA are deep on the same side of lateralization. The axis is opposite of the lateralization (i.e. a right positive seated flexion means the torsion is moving around a left axis). Forward torsions are named either “R on R” or “L on L”.

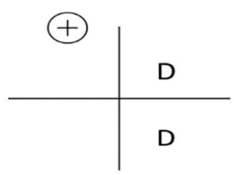
In backward torsions, the sulci and ILA are deep on the opposite side of lateralization. The axis is the opposite of the lateralization (i.e. a left positive seated flexion means the torsion is moving around a right axis). Backward torsions are named either “R on L” or “L on R”.



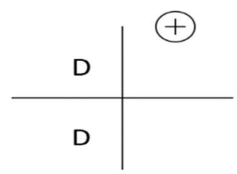
L on L torsion



R on R torsion



L on R torsion

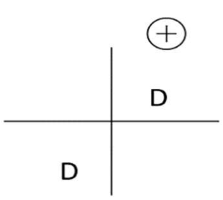


R on L torsion

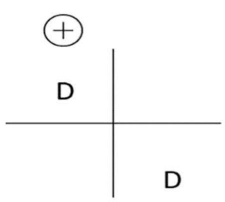
Forward torsions

Backward torsions

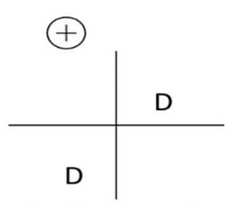
<u>Shears</u>
Unilateral shears are named as flexed or extended on the right or left. The lateralization test determines which side is dysfunctional. A shear is flexed or extended depending on if the deep sacral sulcus is on the same side of the lateralization test. (i.e. a deep sacral sulcus and lateralization test on the right is a right unilateral flexion)



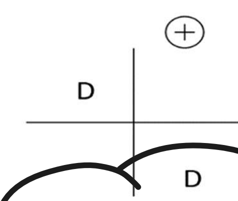
R unilateral flexion



L unilateral flexion

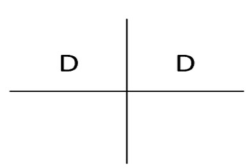


L unilateral extension

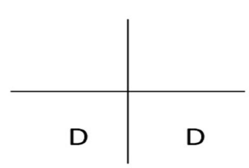


R unilateral extension

<u>Bilateral sacral flexion and extension</u>
The sacrum is in bilateral flexion when both sulci are deep, and the sacrum is in bilateral extension when both ILA are deep. The lateralization test is negative or equivocal.



Bilateral flexion



Bilateral extension

Sacral Algorithm

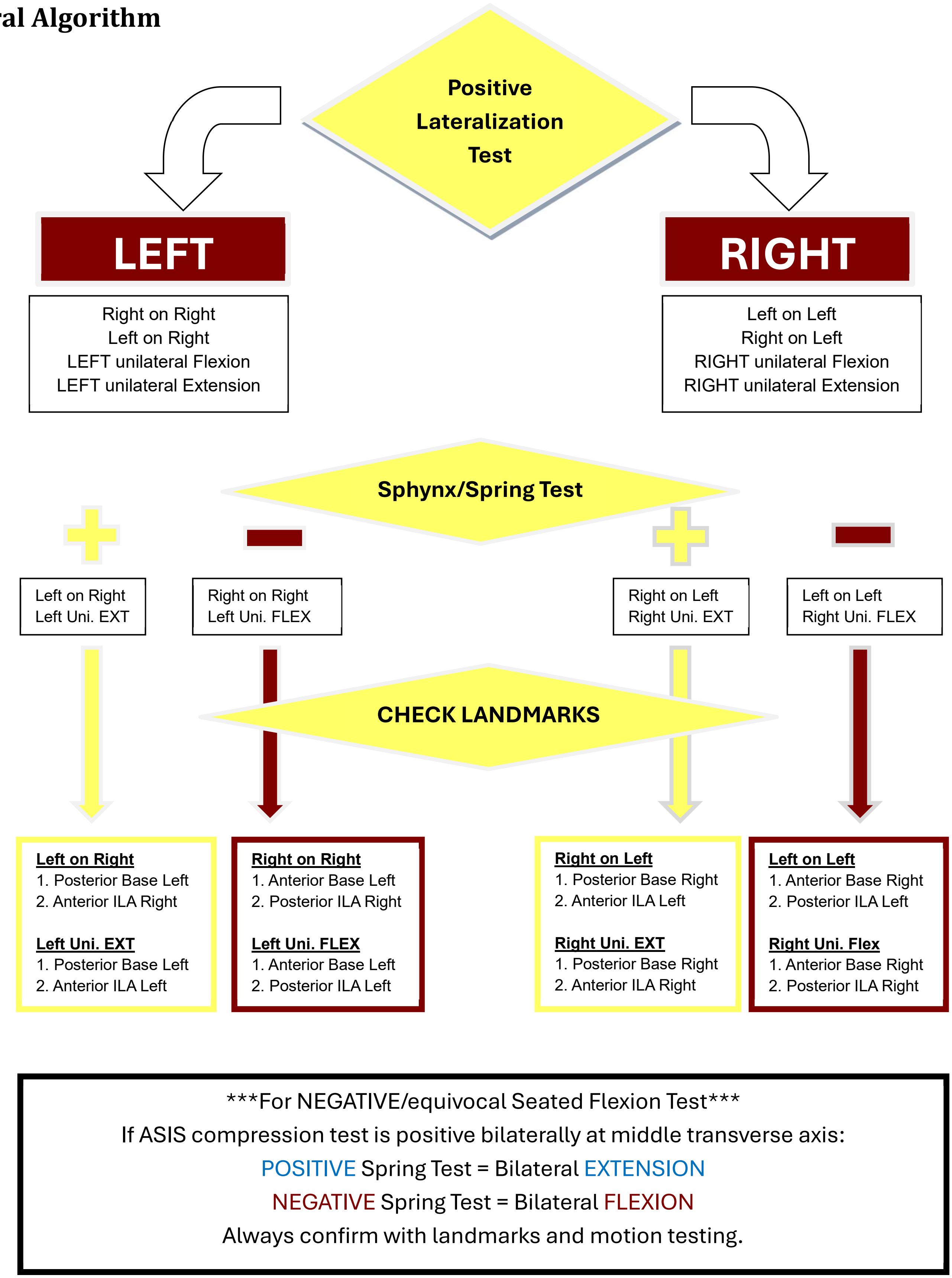
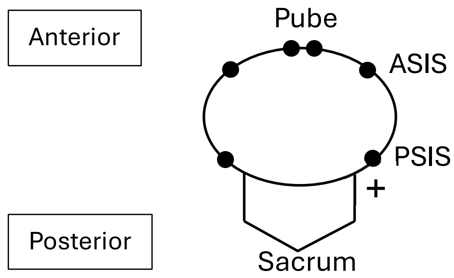


Figure 2. Sacral diagnosis algorithm.

Pelvic and Pubic Study Diagram

Pelvic Diagnosis Drawings (Posterior View)

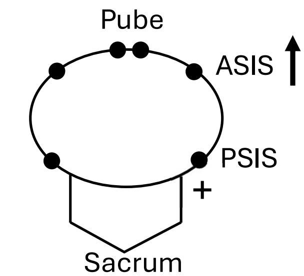
1. Mark the side of positive standing flexion test or pelvic compression test.



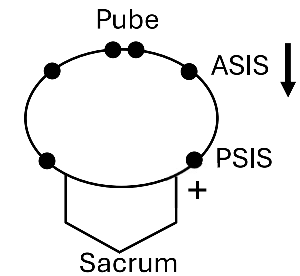
Right Innominate Dysfunction

KEY	
+	Side of lateralization (positive standing flexion/pelvic compression)
PSIS	Posterior superior iliac spine
ASIS	Anterior superior iliac spine

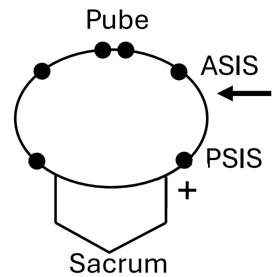
2. Mark the ASIS levels.



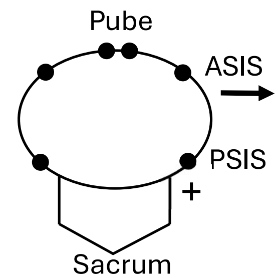
Right Posterior/Superior Innominate



Right Anterior/Inferior Innominate

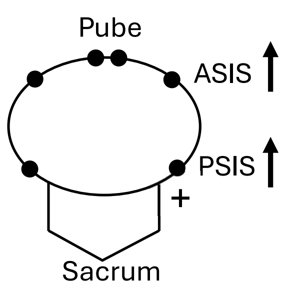


Right Innominate Inflare

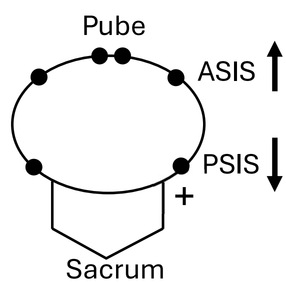


Right Innominate Outflare

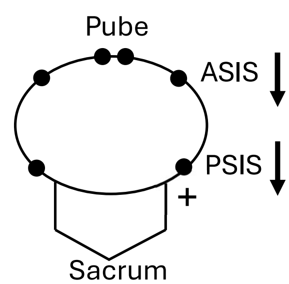
3. Mark the PSIS levels.



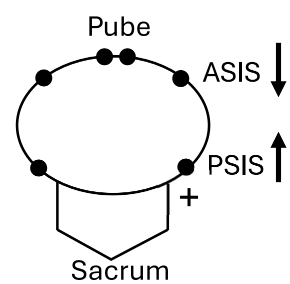
Right Superior Innominate Shear



Right Posterior Innominate

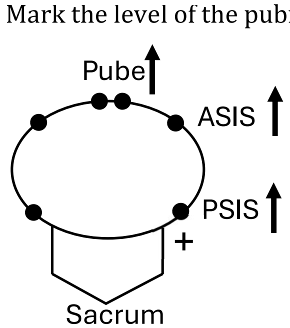


Right Inferior Innominate Shear

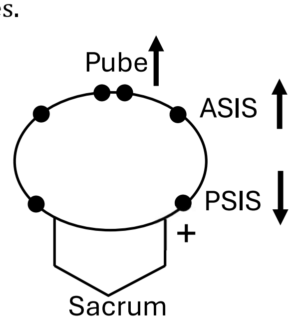


Right Anterior Innominate

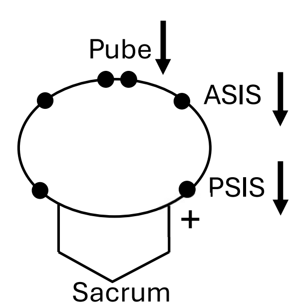
4. Mark the level of the pubic bones.



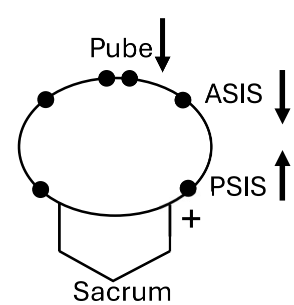
Right Superior Innominate Shear with Right Superior Pubic Shear



Right Posterior Innominate with Right Superior Pubic Shear



Right Inferior Innominate Sheer with Right Inferior Pubic Shear



Right Anterior Innominate with Right Inferior Pubic Shear

Chapman's Reflex Points[10]

	Anterior Point Location	Posterior Point Location
Abdomen	Superior aspect of body and ramus of pubic bone near the pubic symphysis	Tip of the TP of L2
Adrenals*	2-2.5 inches superior and 1 inch lateral to umbilicus on either side	Intertransverse space between T11 and T12, midway between SP and the tip of TP
Appendix*	Superior aspect, near the tip of right 12^{th} rib	Intertransverse space between T11 and T12
Arm Circulation	Muscular attachments of pectoralis minor to ribs 3-5	Superior angle of the scapula; ribs 1-3 along inner margin of scapula
Arm Innervation	3^{rd} ICS close to the sternum	Intertransverse space between T3 and T4, midway between SP and the tip of TP
Bladder*	Around the umbilicus	Superior aspect of TP of L2
Broad Ligament*	From GT inferiorly on the lateral aspect of the femur to within 2 inches of the knee joint	Between PSIS and SP of L5
Bronchus*	2^{nd} ICS close to the sternum	Posterior surface of TP of T2, midway between SP and the tip of TP
Cerebellum	Tip of coracoid process	Just under skull midway between posterior midline and C1 TP
Cerebrum	Lateral from the SP of C3-5	Intertransverse space between C1 and C2
Clitoris/ Vagina	Area on the superior, medial aspect of posterior thigh 3-5 inches long and 1.5-2 inches wide	Articulation of the coccyx with the sacrum
Colon*	An area 1-2 inches wide, extending from GT to within an inch of the patella on anterolateral aspect of femur: • Right superior $1/5^{th}$: cecum • Right middle $3/5^{th}$: ascending colon • Right inferior $1/5^{th}$: proximal $2/5^{th}$ of transverse colon • Left inferior $1/5^{th}$: distal $3/5^{th}$ of transverse colon • Left middle $3/5^{th}$: descending colon • Left superior $1/5^{th}$: sigmoid • Most superior aspect of left GT: rectosigmoid junction	Triangular space from TP of L2 to TP of L4 and along the iliac crest
Conjunctiva/ Retina	Anterolateral humerus, middle aspect of the surgical neck inferiorly	Around the suboccipital nerve
Esophagus*	2^{nd} ICS close to the sternum	Posterior surface of the TP of T2, midway between the SP and the tip of the TP
Fallopian Tubes/ Seminal Vesicles	Midway between the acetabulum and greater sciatic notch	Between PSIS and SP of L5
Liver & Gallbladder*	Right 6^{th} ICS from mid-clavicular line to sternum	Intertransverse space between T6 and T7 on the right, midway between SP and tip of TP
Hemorrhoids	Just superior to ischial tuberosities	On sacrum on the inferior aspect of SI joint
Inguinal Lymph Nodes	Lowest 2/5 of the sartorius muscle and its attachment to the tibia, and just above the medial femoral condyle	On sacrum on the inferior aspect of SI joint
Intestinal Peristalsis	Midway between ASIS and GT	Costotransverse junction of right 11^{th} rib

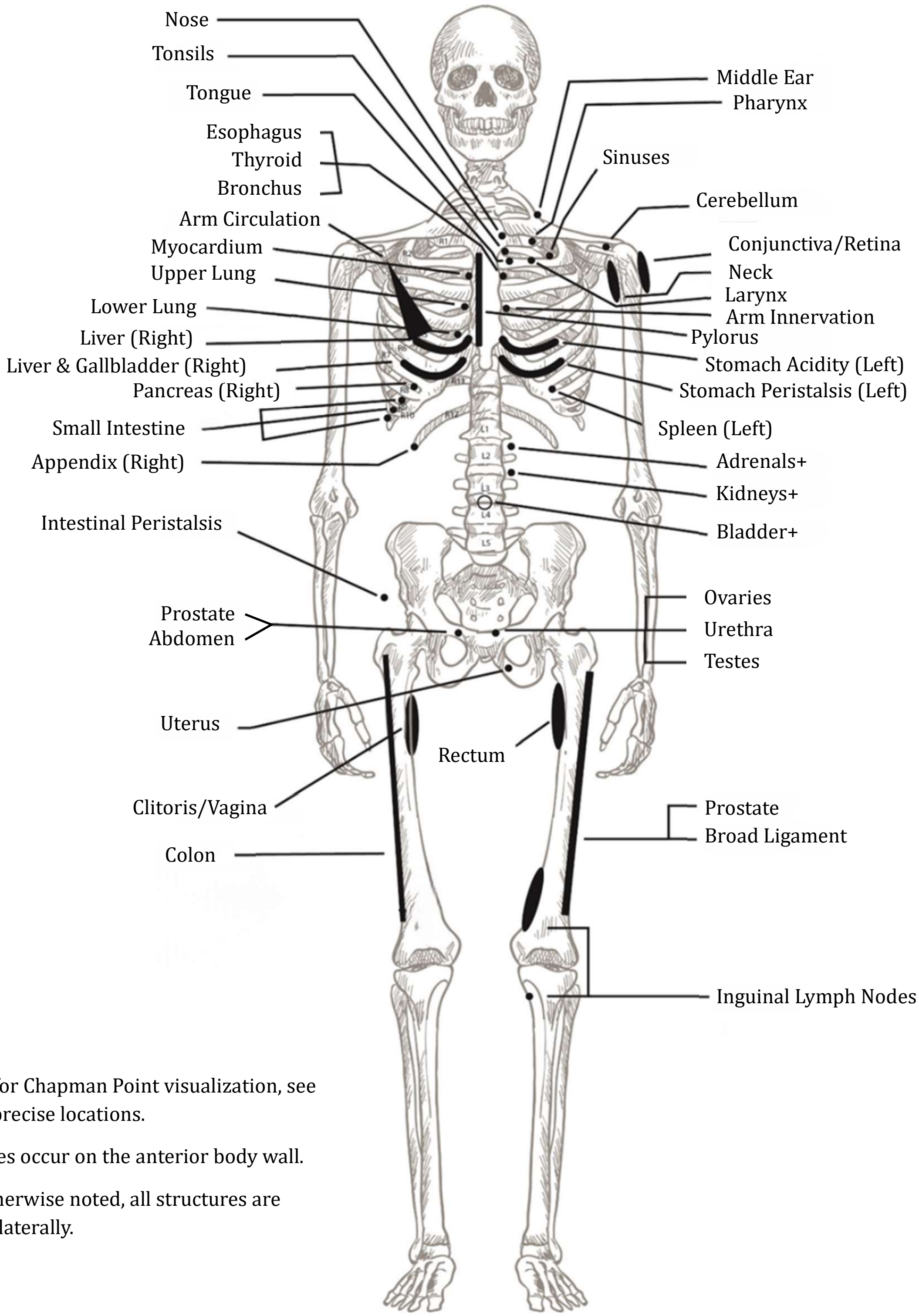
Kidneys*	1 inch superior and 1 inch lateral to umbilicus	Intertransverse space between T12 and L1, midway between SP and the tip of TP
Larynx*	Superior aspect of 2nd rib, 2-3 inches lateral from the sternum	Posterior aspect of TP of C2, midway between tip of TP and SP
Liver*	Right 5th and 6th ICS from mid-clavicular line to the sternum	Right intertransverse space between T5-T6, midway between SP and tip of TP
Lung, Lower*	4th ICS close to the sternum	Intertransverse space between T4 and T5, midway between SP and the tip of TP
Lung, Upper*	3rd ICS close to the sternum	Intertransverse space between T3 and T4, midway between SP and the tip of TP
Middle Ear*	Superior aspect of the clavicle, just lateral to where it crosses the 1st rib	Superior, posterior aspect of C1 TP
Myocardium*	2nd ICS close to the sternum	Intertransverse space between T2 and T3, midway between SP and the tip of TP
Neck	Medial aspect of proximal humerus from the surgical neck inferiorly	Across the TP of C3-C7
Nose	Costochondral junction of 1st rib	Lateral aspect of TP of C1
Ovaries*	Following the round ligament from superior to inferior border of pubic ramus	Intertransverse space between T9 and T10 and between T10 and T11
Pancreas*	Right 7th ICS close to costochondral junction	Right intertransverse space between T7 and T8, midway between SP and the tip of TP
Pharynx*	Anterior 1st rib for ¾ inch medial to where clavicle crosses the 1st rib	Posterior aspect of C2 TP, midway between SP and the tip of TP
Prostate*	Laterally on either side of pubic symphysis, and from the GT inferiorly to within 2 inches of knee on lateral femur	Between PSIS and SP of L5
Pylorus*	Anterior aspect of the sternal body	Right 10th rib just lateral to the costotransverse joint
Rectum*	Around the lesser trochanter	On sacrum at the inferior aspect of SI joint
Sciatic Nerve	• 1/5th of the length of the femur inferior to GT extending 2-3 inches inferiorly on posterolateral femur • 1/5th of the length of the femur superior to knee extending 2 inches superiorly on posterolateral femur • 1/3rd of the distance superior to the femoral condyles on the mid-posterior region of the femur	The superior portion of the sacrum, just medial to the SI joint
Sinuses*	3.5 inches from sternum on superior aspect of rib 2 and in the 1st ICS; 1st rib at costochondral junction	Posterior aspect of C2 TP, midway between SP and the tip of TP; under angle of jaw, parallel with line of mouth back to C1 TP
Small Intestine*	Bilateral 8th, 9th, and 10th ICS near cartilaginous attachments	Intertransverse spaces from T8-T11, midway between SP and the tip of TP
Spleen*	Left 7th ICS near costochondral junction	Left intertransverse space between T7 and T8, midway between SP and the tip of TP
Stomach Acidity*	Left 5th ICS from mid-clavicular line to sternum	Left intertransverse space between T5 and T6, midway between SP and the tip of TP

Stomach Peristalsis*	Left 6th ICS from mid-clavicular line to sternum	Left intertransverse space between T6 and T7, midway between SP and the tip of TP
Testes	Superior, medial border of pubic bone	Intertransverse space between T9 and T10 and between T10 and T11
Thyroid*	2nd ICS close to the sternum	Posterior surface of TP of T2, midway between SP and the tip of TP of T2
Tongue	Anterior aspect of 2nd rib cartilage ¾ inch lateral to sternum	Between SP and the superior edge of C2 TP
Tonsils*	1st ICS close to the sternum	Posterior surface of C1 TP, midway between median line of neck and the tip of TP
Urethra*	Medial aspect of pubic ramus near the superior aspect of pubic symphysis	Superior aspect of TP of L2
Uterus*	Superior aspect of junction of pubic ramus with ischium	Between PSIS and SP of L5

Abbreviations: ASIS, anterior superior iliac spine; GT, Greater Trochanter; ICS, intercostal space; PSIS, posterior superior iliac spine; SI, sacroiliac; SP, spinous process; TP, transverse process.

*Points marked with an asterisk are most commonly tested in national standardized osteopathic exams.

Chapman's Reflex Points, Anterior View



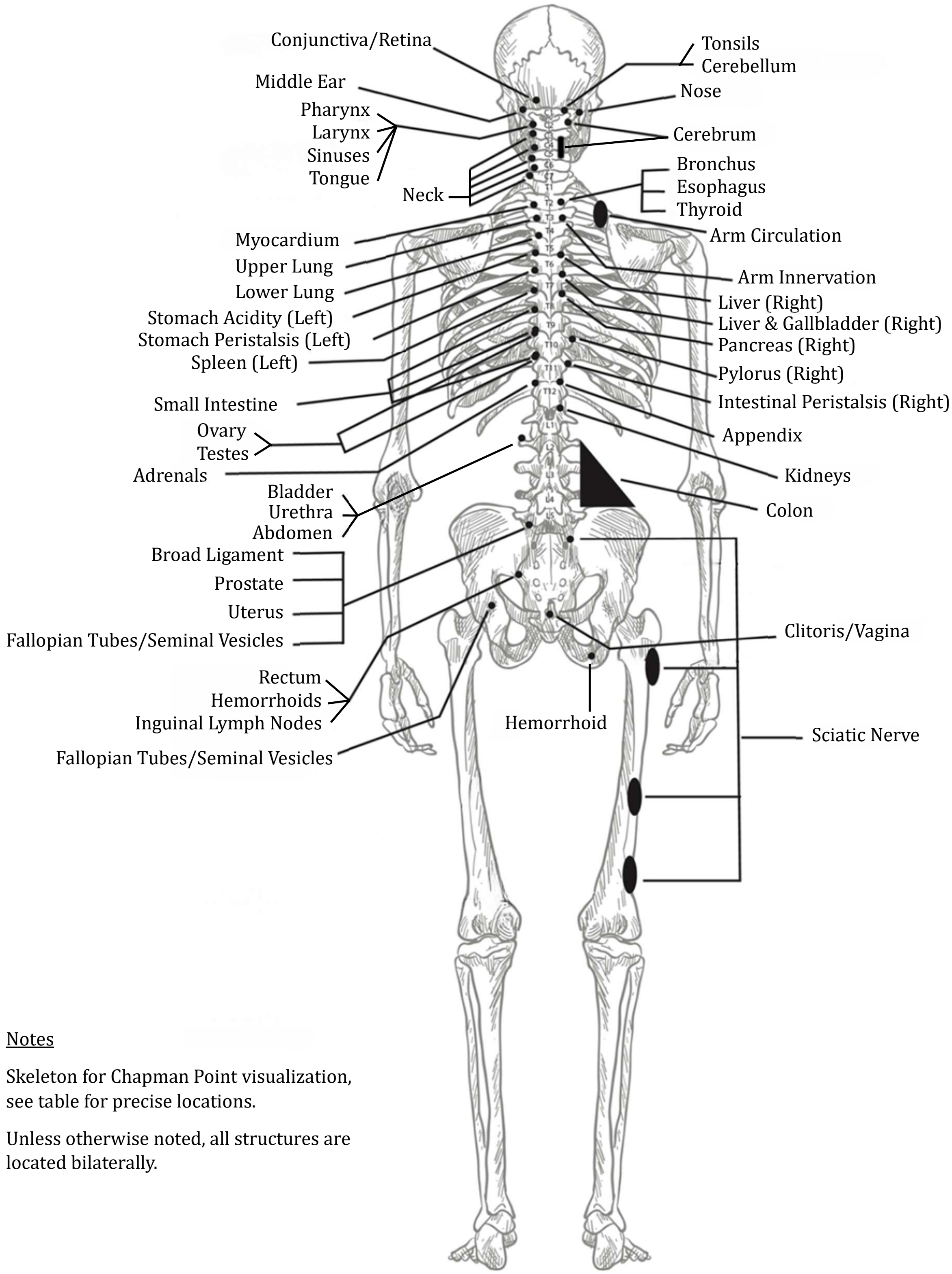
Notes

Skeleton for Chapman Point visualization, see table for precise locations.

+Structures occur on the anterior body wall.

Unless otherwise noted, all structures are located bilaterally.

Chapman's Reflex Points, Posterior View



Notes

Skeleton for Chapman Point visualization, see table for precise locations.

Unless otherwise noted, all structures are located bilaterally.

Comparison of Counterstrain points, Chapman's Reflex points & trigger points

	Counterstrain (CS) Point	Chapman's Reflex (CR) Point	Myofascial Trigger Point (MFTrP)
Location	Tendinous attachments, belly of muscle, ligaments	Subcutaneous tissue, fascia, muscle, ligament, perichondral/periosteal tissue	Fibers in mid-portion of muscle, myotendinous junction
Palpatory Quality	Discrete, small, tense, edematous Size of a fingertip	Gangliform, granular, contracted, edematous, ropy, fibrospongy Size varies from the size of a pinhead to an almond. Often described as the size of a pea	Distinct nodules ("knots") in the muscle or rope-like "taut band" Size similar to Chapman's point
Pain Characteristic	Very tender, localized, without radiation	May or may not be tender, well-localized, without radiation	Tender, localized, radiates distinct and reproducible pain based on myofascial anatomy
Association	Somatic dysfunction	Viscerosomatic reflex, somatic dysfunction, visceral dysfunction	Local pathophysiology within the muscle, can be associated with somatic dysfunction and muscle imbalance
Classic Treatment	Counterstrain (CS)	Rotatory stimulation for 20-60 seconds	Injection, dry needling, ischemic compression, post-isometric relaxation muscle energy technique (MET), spray and stretch

Autonomic Innervation Levels[10]

Structure	Sympathetic Spinal Level	Parasympathetic Spinal Level
Head and Neck*	**T1-4**	**CN III, VII, IX, X**
Cerebral Vasculature, Meninges	T1-2	Sphenopalatine, otic, and internal carotid ganglia
Pupils	T1-2	CN III via ciliary ganglia
Sinuses, Middle Ear, Lacrimal Glands, Submandibular and Sublingual Salivary Glands	T1-4	CN VII and CN IX via sphenopalatine and otic ganglia
Parotid Glands	T1-4	CN IX via otic ganglia
Carotid Body/Sinus	T1-4	CN IX, X
Trachea	T1-4	CN X
Thoracic Viscera		
Heart*	T1-5	CN X
Lung*	T2-7	CN X
Esophagus*	T3-6	CN X
Abdominal Gastrointestinal Viscera		
Stomach*	T5-9	CN X
Liver*	T5-9	CN X
Gallbladder*	T5-9	CN X
Spleen*	T5-9	CN X (Capsule Only)
Pancreas*	T5-9	CN X
Duodenum (before Ligament of Treitz)*	T5-9	CN X
Jejunum*	T10-11	CN X
Ileum*	T10-11	CN X
Ascending Colon and Proximal 2/3 of Transverse Colon (between Ligament of Treitz and Splenic Flexure) and Appendix*	T10-11	CN X
Distal 1/3 of Transverse Colon*	T12-L2	S2-4
Descending Colon and Sigmoid Colon (after Splenic Flexure)*	T12-L2	S2-4
Rectum*	T12-L2	S2-4
Adrenal and Renal Viscera		
Adrenal Medulla*	T10-11	CN X
Kidneys*	T10-L1	CN X (Capsule Only)
Upper Ureters*	T10-11	CN X
Lower Ureters*	T12-L1	S2-4

Urinary Bladder*	T11- L2	S2-4
Urethra	T10-L2	S2-4
Reproductive Viscera		
Gonads*	T10-11	S2-4
Uterus and Cervix*	T10-L2	S2-4
Erectile Tissue of Penis and Clitoris*	T11-L2	S2-4
Prostate*	T11-L2	S2-4
Fallopian Tubes	T10-11	S2-4
Vas Deferens, Seminal Vesicles	T11-12	S2-4
Extremities		
Upper Extremity*	T2-7	None
Lower Extremity*	T10-L2	None

*Structures marked with an asterisk are most commonly tested in national standardized osteopathic exams.

NOTE: Skin only has a localized sympathetic supply and no parasympathetic supply.

Select Sympathetic Ganglia[2]

Ganglia	Location	Preganglionic Fibers	Postganglionic Projections
Superior Cervical Ganglia	Adjacent to C2-3	T1-5	Head and neck via "hitchhiking" on the carotid arteries; heart via cardiac nerves
Middle Cervical Ganglia	Adjacent to C5-6	T1-5	Heart and neck
Inferior Cervical Ganglia	Adjacent to C7	T1-5	Fuse with first thoracic ganglia to form the cervicothoracic (stellate) ganglia; heart posterior cranial arteries; lower neck; arm
Cardiac Plexus	Around the Aortic Arch	Cardiac Nerves (T1-5 via cervical and thoracic sympathetic ganglia)	Heart structures including coronary vessels
Celiac Ganglia/Plexus	Anterior abdominal aorta near the origin of the celiac artery	Greater Splanchnic Nerves (T5-9)	Abdominal esophagus Stomach Proximal duodenum Dorsal pancreas Liver and gallbladder Spleen
Superior Mesenteric Ganglia/Plexus	Anterior abdominal aorta near the origin of the superior mesenteric artery	Lesser Splanchnic Nerves (T10-11)	Distal duodenum Jejunum Ileum Proximal colon
Inferior Mesenteric Ganglia/Plexus	Anterior abdominal aorta near the origin of the inferior mesenteric artery	Least and Lumbar Splanchnic Nerves (T12-L2)	Distal colon Rectum Pelvic viscera

Joint Ranges of Motion[4]

Cervical Spine	
Flexion	50°
Extension	80°
Sidebending	45°
Rotation	80°
Thoracic Spine	
Flexion	45°
Extension	0°
Sidebending	45°
Rotation	30°
Lumbar Spine	
Flexion	60+°
Extension	25°
Sidebending	25°
Rotation	--
Shoulder	
Abduction	180°
Adduction	45°
Flexion	90°
Extension	45°
Internal rotation	55°
External rotation	40-45°
Elbow	
Flexion	135+°
Extension	0-(-5)°
Supination	90°
Pronation	90°
Wrist	
Flexion	80°
Extension	70°
Ulnar deviation	30°
Radial deviation	20°
MCP Joint	
Abduction	20°
Adduction	0°
Flexion	90°
Extension	30-45°
Finger PIP Joint	
Flexion	100°
Extension	0°
Finger DIP Joint	
Flexion	90°
Extension	20°

Thumb	
Abduction	70°
Adduction	0°
Thumb MCP Joint	
Flexion	50°
Extension	0°
Thumb IP Joint	
Flexion	90°
Extension	20°
Hip	
Flexion	120°
Extension	30°
Abduction	45-50°
Adduction	20-30°
Internal rotation	35°
External rotation	45°
Knee	
Flexion	135°
Extension	0°
Internal Rotation	10°
External Rotation	10°
Ankle	
Dorsiflexion	20°
Plantar flexion	50°
Subtalar Joint	
Inversion	5°
Eversion	5°
Forefoot	
Adduction	20°
Abduction	10°
First MTP Joint	
Extension	70-90°
Flexion	45°

Example Soap Note

Writing an Osteopathic Note:

When taking an osteopathic history, all the skills obtained in PCM must be applied, especially being very thorough. There are a few extra questions that should be routinely asked when thinking critically as an osteopathic physician. These include:

1. Dental/orthodontia history
    a. Including retainers, braces, filings
    b. Wisdom teeth/ other extraction
    c. Oral surgeries
    d. Complications with any of the above
2. Birth History
    a. Vaginal vs. C-section
    b. Complications
3. Sports played, both currently and in the past as well as any sports-related injuries.

The Objective physical exam section of the note is where the structural findings are documented. List the actual physical exam findings here (e.g., OA ERrSl and T4 FRrSr). Remember to evaluate the entire individual, not just the area of injury. At a minimum, assess one joint above and one joint below the area of injury or complaint of pain. However, performing a complete structural exam or whole body screening exam will give a much clearer picture of the whole patient and help identify areas of compensation that may hinder the speed of healing through increased allostatic load.

Next, in the Assessment section, list the primary medical diagnosis first, then the regions with somatic dysfunction. For example, the primary medical diagnoses may be migraine headaches and cervicalgia and the osteopathic diagnoses would be somatic dysfunction (SD) of the head and thoracic regions. List every region where somatic dysfunction is found, even if you did not treat it with OMM, as it is part of the diagnosis. Under the current ICD-10 diagnostic framework, there are 10 body regions that can have somatic dysfunction, each with its own code: Head, Cervical, Thoracic, Lumbar, Sacral, Pelvic, Lower Extremity, Upper Extremity, Ribs, and Abdomen/Other.

In the Plan section, include tests (diagnostic studies), treatment (treatment other than OMT), OMT (including statement of verbal consent obtained), patient education/counseling and document when the patient should follow up (both scheduled and acute follow up indications).

Finally, OMM is a procedure, so a procedure note should be written once it’s been performed. A procedure note needs to be clearly and separately identifiable within the SOAP note. It should be a “stand alone” document. Because OMM is a procedure, verbal consent needs to be obtained and documented. Clearly document which regions were treated and what modalities were used on each corresponding region, including a statement of verbal consent obtained. Remember, OMM is used to treat somatic dysfunction, so you need to have at least one somatic dysfunction listed in the osteopathic structural exam section (PE) for each region that you treat.

Example Soap Note

Subjective:

CC: "left ankle pain"

HPI:

TG is a 21 y/o male who slipped on the ice at home and fell down the bottom two stairs three days ago, inverting his left ankle. He felt a sharp pain and was immediately able to walk. No pop was noted. Approximately two hours later, he noticed some slight swelling over the lateral aspect of the ankle. At this time, the pain is localized over the lateral side of ankle and is described as sharp, intermittent and rated a 6/10 in severity. It is mildly worse with walking and better with rest. No radiation is noted. He has been using the "RICE method" since the accident and thinks it has helped. He has also been taking Ibuprofen 800mg po TID since the accident with some relief and denies GI upset. He denies prior ankle injuries and denies other complaints.

ROS:

General: denies fever, chills, fatigue, weight loss or night sweats
Cardiovascular: denies chest pain or palpitations
Respiratory: denies SOB
Neuro: denies dizziness, numbness, weakness or tingling in his upper and lower extremities bilaterally
MSK: denies foot, knee, hip or low back pain

Allergies:

NKDA

Meds:

Rx: none

OTC: Ibuprofen 800 mg po TID

Supplements: daily multivitamin

Past Medical and Surgical Hx:

Hospitalizations- none

Surgeries- None

Traumatic injuries- MVA at age 19, Fx right distal radius

Dental/Orthodontia- Braces from 10-12 yo and wisdom teeth removed at 16 yo with no complications

Birth Hx- uncomplicated C-section d/t mom's previous C-section history

Family Hx: Unremarkable

Social Hx:

Lives with three friends and attends college. Has smoked cigarettes 1 PPD for 2 years. Drinks 2-6 beers/day. Drinks 5-10 cups of coffee/day. Denies marijuana or other drug use. Played competitive soccer from 5th-11th grade, now plays on club team at school for fun.

Objective:

Vitals: HR 95, RR 12, BP 130/89, Temp 98.8, Ht 6'1", Wt 190 lbs, SaO2 98% on RA

General: WDWN, active body habitus, NAD

Cardio: RRR S1 and S2 present, no S3 or S4, no murmurs, rubs, clicks, or gallops

Resp: No dyspnea noted. Lungs clear to auscultation b/l, no rhonchi, rales or wheezes

Neuro: Light touch sensation is intact in the upper and lower extremities bilaterally. Strength +5/5 in the upper and lower extremities bilaterally. DTR's +2/4 in the upper and lower extremities bilaterally

MSK: He ambulates with a left-sided limp and his left lower extremity proprioception is poor. Mild swelling is noted over the left lateral ankle. No change in the left arch is noted. Pulses are intact in the lower extremities bilaterally. No point bony tenderness is noted. No ligament laxity is noted. ROM – decreased eversion of the left ankle is noted, all other planes of motion intact. Tenderness to palpation is noted over the left anterior talofibular ligament. External rotation stress test is negative.

Osteopathic structural examination: Tenderness, asymmetry, restriction of motion and tissue texture changes were assessed in the head, cervical, thoracic, lumbar, sacrum, pelvis, lower extremity, upper extremity, rib cage and abdominal regions. The following areas of somatic dysfunction were noted. Head - R torsion; Cervical - C5 ERSL, C1 RR; Thoracic T2-6 NSRRL; Lumbar - L2 ERSL; Sacrum - L on L; Pelvis - L anterior; Lower Extremity - L posterior fibular head, L anterior lateral malleolus and L anterior talus

Assessment:

- Grade I sprain of the left anterior talofibular ligament, s/p ground level fall
- Somatic dysfunction: cranial, cervical, thoracic, lumbar, sacrum, pelvis and lower extremity regions

Plan:

1. Diagnostic Work up: Unnecessary—may consider MRI if no improvement
2. Medications: Continue Ibuprofen 800 mg po TID prn, take with food.
3. Osteopathic manipulative treatment as detailed in Procedure Note.
4. Patient Education/Instruction:
    a. Call office immediately if symptoms worsen.
    b. Apply icepack to sore areas 20 minutes every 2 hours while awake prn.
    c. Begin ankle ROM and proprioceptive exercises and progress as tolerated. Proper form demonstrated and taught.
    d. Wear ace wrap on left ankle until swelling subsides.
    e. Activity to tolerance.
    f. Decrease alcohol and caffeine intake.
    g. The patient will consider smoking cessation at a later visit.
    h. The risks of smoking were discussed.
5. Follow Up: RTC 1 week, sooner PRN

OMT Procedure Note

Chief Complaint: "Left ankle pain"

Indications: Somatic dysfunction: cranial, cervical, thoracic, lumbar, sacrum, pelvis and lower extremity regions

Procedure: The procedure of osteopathic manipulative medicine was discussed with the patient. Risks, benefits and alternatives were discussed. Questions were answered to the patient's satisfaction and verbal consent was obtained. The following areas of somatic dysfunction were treated: head – OCMM, cervical – HVLA, thoracic – HVLA, lumbar – ME, sacrum – ME, pelvis – ME and lower extremity – BLT. The patient tolerated the procedure well.

Patient perception of treatment: Reduced pain.

Physician perception of treatment: Increased symmetry and PROM

Complications: None

Patient Instructions:

1. Call office immediately if symptoms worsen.
2. Apply icepack to sore areas 20 minutes every 2 hours while awake prn.
3. Begin ankle ROM and proprioceptive exercises and progress as tolerated. Proper form demonstrated and taught.
4. Wear ace wrap on left ankle until swelling subsides.
5. Activity to tolerance.
6. RTC 1 week.

The Hospitalized Patient

"Remember that little things are big things in Osteopathy."

- William Sutherland, D.O.

Contents:

Introduction[9,10]

When planning to treat a hospitalized patient with OMM, the goal is to support and maximize the health and healing in the whole organism. To accomplish this, the main focus is on two primary systems: **autonomics** and **lymphatics**. These are inevitably two systems in the body that are strained in an acutely ill patient. Whether it is healing from surgery that requires increased immune cell concentration to the incision/excision site, or a patient with congestive heart failure that has blockages at one or many of the diaphragms of the body that is ultimately preventing return of lymphatic fluid into the vascular system, all patients will benefit from mobilization of lymphatic fluid. While more aggressive techniques like lymphatic pumps have extreme power, do not underestimate equally effective techniques of removing restrictions in the horizontal baffles of the body such as the thoracic and pelvic diaphragms.

Similarly, if a patient is ill enough to be hospitalized, then inescapably, their sympathetic nervous system is upregulated. Addressing autonomic imbalance can be the **single most effective** treatment to help to decrease the infection rate, length of hospital stay, and ultimately, the need for medication in hospitalized patients. The sympathetic nervous system innervates both the arterioles as well as the lymphatics. When the sympathetic nervous system is over stimulated, blood and lymphatic flow are decreased. Thus, nutrients required for the healing process are not received by the damaged tissue. Treating the spine and associated dorsal root ganglion, located lateral to the spine bilaterally, will reduce sympathetic outflow leading to profound changes globally in the body. In order to bring balance to the autonomic nervous system, the parasympathetic nervous system should also be addressed. Since the vagus nerve is responsible for all parasympathetic signaling in the thorax and the majority of the abdominal cavity, treating the OA joint and upper cervical spine will have profound effects within the body: decreased bronchoconstriction and mucous production, improved cardiac function, improved GI peristalsis, and decreased nausea and vomiting. By addressing sacral dysfunction, the physician can optimize parasympathetic output to the lower GI system as well as to the pelvic organs, thereby decreasing pelvic congestion and improving excretory function. In summary, if time is limited, diagnosing and treating the viscerosomatic reflexes in the thoracic and upper lumbar spine in addition to the OA joint and sacrum will have profound effects on the patient.

Considerations

When treating a hospitalized patient with OMM, there are some special considerations to always keep in mind. The first thing to consider, as with any treatment, is the primary goal of care. In contrast to a non-hospitalized patient, the treatment is not intended to address the accumulation of dysfunction acquired over a lifetime. Rather, the goal is to support the patient's healing at least to a level that would no longer require hospital-level care, and to achieve this goal as quickly as possible, thus decreasing the length of hospital stay. When a patient is hospitalized, they either have an acute condition or an acute-on-chronic condition. When the problem is acute-on-chronic, it is not a goal to work on the chronic dysfunction, but rather address the structural dysfunction most likely contributing to the acute problem.

Another important factor to consider is that healthier people can handle more vigorous OMM than someone who is acutely or chronically ill. Remember, an OMM treatment does not end once the physician takes their hands off the patient. The treatment continues for days afterwards, as the physician merely helped to integrate the area of dysfunction back into the whole health of the body. What happens next with the treatment is ultimately up to the inherent wisdom of the body. Therefore, while there may still be significant dysfunction remaining in the hospitalized patient, it is important not to do too much because then the body will be over-taxed. Put another way, the body is meant to find health, but the more disease that is present, the harder it is for the body to find health, so only guide the body in a few areas at once so as not to overwhelm the system.

Next, the hospitalized patient may need gentler techniques, indirect techniques, or techniques that require less from the body, with some techniques omitted depending on the severity of his or her current and/or chronic state. Often, they will respond better to MFR, BLT, Counterstrain, and OCMM type techniques because they are gentle and do not require assistance from the patient. However, because these techniques require the body to make even the initial changes, the patient may not tolerate more than one or two dysfunctions being treated at a time. In severely debilitated patients, these techniques, though seemingly gentle, may be too taxing for the system. Muscle energy and HVLA can also be difficult for the hospitalized patient, as they have a harder time moving and have less energy to cooperate. However, do not underestimate the effect of a single technique. Even though the patient might not feel as if a change is being made, profound changes often occur. Therefore, it's pertinent to use the structural exam, rather than the patient's subjective opinion, to determine if there is improvement in the dysfunction.

It's important to always tailor the frequency and length of the OMM treatment to each individual patient. However, there are general guidelines that typically work for most hospitalized patients. Use OMM at least daily while they are hospitalized. These treatments should be short, so as not to induce too much change into the body at once, with the average time being 5-20 minutes for a treatment, not going over 20 minutes of treatment at any one time. If time permits, and the patient's system allows, it may be a good idea to treat the patient several times a day, just doing a small amount of work at each session. Please keep in mind, though, that if you treat several times in one day, this all counts as "one visit" from a billing perspective and cannot be billed as three separate encounters in one day.

The final consideration to make is logistics, which is anything but simple when working in a hospital setting on an acutely ill patient. First, the equipment found in the room can make it exceedingly difficult to treat a patient in the preferred or most comfortable position for the physician. It only becomes more difficult the more serious the patient's condition (e.g., attached to a ventilator). Be flexible, but do not sacrifice good body mechanics. A treatment that is very uncomfortable for the physician, though brief, can lead to serious problems for the physician if it is performed every day on every patient. Take time to find the most advantageous set-up possible; whether this is dropping the bed rail or sitting down, make sure the set-up is optimized before continuing. Also, be aware of tubes and lines that may be attached to the patient. When using one's hands to diagnose/treat regions of the body, it is quite easy to get one's hands stuck on something, and when removing one's hands, to pull out a tube or a line. This could have profound consequences, but at the very least, will add more work for others, so move slowly and carefully. Remember always to follow protocol for personal protective equipment, and wear gloves.

Osteopathic Screening and Evaluation of Somatic Dysfunction

When planning to treat a patient with OMM, the first step is always a good structural exam. In a hospitalized patient specifically, diagnose restriction in the transition areas as these serve as baffles, which can restrict lymphatic flow. Also, always diagnose the thoracic spine, as identifying viscerosomatic reflexes helps to monitor the status of specific visceral organs. It's also important to ensure that any rib or thoracic dysfunction is identified, since a primary goal is to decrease sympathetic tone. Although these are the primary areas for diagnosis, it's essential to look at the entire body to make sure not to miss a significant restriction elsewhere in the body. Also, just as it is required to listen to a patient's heart and lungs during each exam in the hospital, an osteopathic structural exam should be performed daily. It helps to assess the progress of the patient from an osteopathic perspective. For example, a recurrent restriction could be a clue that something else in the body is maintaining the dysfunction.

A structural exam in a hospitalized patient can be quite different from the type of exam that is performed in an outpatient setting. The patient may be bed-bound, and testing range of motion may not be feasible. It is appropriate to complete as much of the osteopathic structural exam as possible, determined by the limitations of the patient, on the first day. More focused exams can be prudent for follow up exams. Do not forget to look for muscle hypertonicity because this can lead to decreased lymphatic flow in the corresponding area. Each day that a structural exam is performed, focus not only on the area of greatest restriction, but also continue to monitor the baffles of the body. Specifically, identify the somatic dysfunction of the OA, and the CT, TL, and LS junctions. Additionally, assess the sacrum to address the parasympathetic innervation and the thoracic and lumbar spine to determine the state of the sympathetic nervous system. Look for Type II dysfunction, as these tend to demonstrate viscerosomatic reflexes. General paraspinal hypertonicity is an indication of increased sympathetic outflow.

Often it can be difficult to diagnose spinal somatic dysfunction when the patient is bed-bound. If a complete exam of the spine is difficult to perform due to patient positioning or body habitus, you still may be able to note specific areas of restriction or decreased motion in at least one plane. You may also use Chapman's points to determine the status of visceral organs, as these points are located anteriorly and give important information regarding underlying physiology.

Formulating a Treatment Plan

Out of every aspect of planning and treating a hospitalized patient with OMM, the easiest part should be the treatment itself. As discussed above, keep it simple, and focus primarily on autonomics and lymphatics. Follow the sequence below with adjustments as necessary based on the patient's individual needs as an example of an effective and efficient OMM treatment.

1. OA release
2. Soft tissue for cervical spine
3. Thoracic inlet release
4. Thoracic soft tissue
5. Rib raising
6. Lumbar soft tissue
7. Thoracolumbar junction release
8. Diaphragm release
9. Lumbosacral junction release
10. Pelvic balance and pelvic floor release

Try to perform at least an OA release on each patient. This is an extremely high-yield area to treat because it addresses parasympathetic innervation and is an important baffle in the body. Also, by releasing tension in this area, the cardiac and respiratory centers of the brain will have less fluid congestion and increased function. Depending on the base state of health, any given patient may be able to tolerate more, such as rib raising, diaphragm releases, lymphatic pumps, treatment of Chapman's points, viscerosomatic reflexes, area of greatest restriction, etc.

Example of How to Communicate with the Patient Regarding OMT

For the Structural Exam
As part of your physical examination, I would like to look a bit further to aid me with my diagnosis. This will require me to examine many areas of your body and have you move in different ways. Let me know if anything is tender to touch. Do you have any questions?

Explaining OMM and Obtaining Consent
After performing my physical exam, I found there were some areas of your body that weren't moving as well as other areas. If it's okay with you, I would like to perform Osteopathic Manual Treatment, which involves using my hands to perform some gentle techniques to get these areas moving better so that your body can heal faster. After the treatment, I want you to keep hydrated (or we will keep you extra hydrated with fluids). During the treatment, please feel welcome to provide me with feedback of how you are feeling, and if anything becomes more than minimally uncomfortable, we can stop. Do you have any questions or concerns?

Approaching the Attending Physician

Whenever a student wants to perform OMT they need to get permission, not only from the patient, but also from their supervising physician. Often, students feel it is more intimidating to approach the topic of OMM with the attending than the patient. There is typically even more anxiety when speaking with an attending who does not perform OMM. However, do not avoid including OMM in your treatment plan, if you feel it is beneficial to the patient. Be aware that your precepting physician may not agree to allow OMM for various reasons.

The biggest key to success for any student wanting to perform OMM is to do a comprehensive structural exam and be able to explain how addressing somatic dysfunction can **improve the patient's physiology**. Keep it simple, and don't use too many osteopathic terms if he or she is not an osteopathic physician. For example, instead of using the term "somatic dysfunction", use the word "restricted". When a preceptor is new to OMM, it is important to address the goals of the treatment, any relative contraindications, and explain the risks (increased soreness or fatigue). Also, it is beneficial to keep the description based in anatomy and biomechanics and how it relates to function of the body.

As a student, the attending physician should always be present in the room when performing OMM. Even if they don't understand what is happening, it is a procedure and should be supervised. This is a great time to showcase the benefits of OMM, as most of the time, the patient will feel noticeably better after treatment and demonstrate this to the attending physician. Finally, it is a good idea not to perform high-velocity or direct articulatory techniques if the attending is not well-versed and proficient themselves.

Example of How to Talk with an Attending Regarding OMT

I am interested in performing Osteopathic Manual Medicine on our patient with pneumonia, if is okay with you. I performed a structural examination on him and realized that his diaphragm and a group of ribs were restricted, which is inevitably inhibiting optimal breathing mechanics. I feel comfortable performing some simple and gentle techniques given in short bursts over the course of his hospitalization to improve his ability to take a deep breath. Also, due to his acute illness, the sympathetic nervous system is in overdrive. I would like to perform a technique called rib raising, which is a very gentle technique that helps to decrease sympathetic tone. By decreasing sympathetic tone, there will be increased blood flow to the region that will ultimately help the antibiotics given reach the infiltrate in greater concentrations. I am hoping that by performing OMM, the patient will be able to breathe more easily and will feel less uncomfortable in general.

The risks involved may be some more discomfort during or post-treatment, in which case the technique will be modified or stopped.

Charting OMT

To document OMT adequately, the note must contain an OMT/musculoskeletal portion in the physical examination correlating with the assessment and plan sections. In the assessment section, there must be an SD of each region of the body that is treated using OMM, which comes after the non-osteopathic diagnosis (e.g., right lower lobe pneumonia followed by SD of the ribs). Finally, in the plan, make sure to include how often OMM should be performed and for what duration, as well as detailing the procedure, which includes which modalities were utilized for each body region.

OMT is a procedure and must be documented as such. Within the procedure section of the SOAP note, always write that verbal consent was obtained and how the patient tolerated the procedure. As with any procedure, note that questions/concerns were addressed. Explain the patient's subjective and the physician's objective perception of the success of the treatment.

Example Initial SOAP Note and Discussion of OMT Protocol in the Hospitalized Patient

Subjective:

CC: "Difficulty breathing"

HPI: FJ is a 69 y/o M with a history of COPD presenting to the ED with increased cough and SOB for approximately one day. He experienced fatigue and muscle aches earlier this week, which has since resolved. He thinks he may have had a fever. Last night he could not sleep due to a persistent cough and this morning felt anxious after walking to his kitchen, as he was not able to catch his breath. Usually he is able to walk around the block without problems. He had symptoms similar to this about a year ago and was hospitalized for a COPD exacerbation. His cough is dry without sputum production.

ROS:
General: (+) fever, fatigue (-) chills, wt loss, night sweats
HEENT: (-) sore throat, nasal congestion/discharge, ear pain
Cardiovascular: (-) chest pain, swelling in arms or legs, palpitations
Respiratory: (+) cough, SOB, (-) hemoptysis
Abdominal: (-) abdominal pain, nausea, vomiting, diarrhea, constipation
Neuro: (-) dizziness, paresthesia in arms or legs, weakness in arms or legs
Allergies:

NKDA, no food or environmental allergies

Meds:

O2 2L nasal cannula at night and PRN

Ipratropium inhaler QD

PMHx:

COPD for 10 years

PSHx:

None

FH:
Parents deceased from old age, sister is 71 and healthy, 2 kids ages: 35 and 38 both healthy.

SH:

Lives with wife; retired engineer. Smokes 1 PPD for 35 years. 1-2 cups of coffee a day. No history of alcohol or illicit drug use.

Objective:

Vitals: 88 HR, 20 RR, BP 145/89, Temp 101.9, Ht 5'9", Wt 190 lbs, SaO_2 85% on RA

General: WDWN tripod position in respiratory distress with 3-word dyspnea

HEENT: Normocephalic, atraumatic cranium, PERRLA with EOMI b/l, nares clear b/l, TM well-visualized and clear, throat without pharyngeal erythema or tonsillar exudates, thyroid without goiter, trachea midline

Cardio: RRR, S1 and S2 present, no S3 or S4, no murmurs, rubs, clicks, or gallops

Resp: Decreased breath sounds globally, wheezes present in all lung fields, increased tactile fremitus at left lower lung base, no rhonchi or rales

Abdomen: Bowel sounds present x4 quadrants, no HSM, no masses, aorta palpated at 2 cm, no tenderness to light or deep palpation

Extremities: No edema present, 2+ pulses bilaterally in UE and LE

Osteopathic: AGR T8-12 b/l, R cranial torsion, OA FRRSL, C5 ERSL, T4ERSL, T9-T12 NRRSL, Hypertonic paravertebral musculature in mid-thoracic region b/l, Ribs 7-10 on left exhaled, diaphragm restriction b/l L>R, L3 ERSR, L on L sacrum, L anterior innominate

Assessment:

- COPD exacerbation –given history, constellation of symptoms, decreased SaO_2 and wheezing
- Probable Pneumonia- increased tactile fremitus of LLL base
- Influenza- history of muscle aches, fatigue and fever
- SD of cranium, cervical, thoracic and lumbar spine, sacrum, innominate, ribs, and abdomen

Plan:

- Admit to inpatient floor
- CXR, sputum cultures x2, CBC with differential, electrolyte panel, PFTs
- Continuous 2 L of nasal cannula, monitor pulse ox, keep sats >90%
- Empiric antibiotics: Levofloxacin 750mg IV q24 hours
- 5-day course of corticosteroids with taper
- Incentive spirometer TID
- OMM QD for duration of hospitalization

OMM Procedure:

OMM was discussed with the patient and verbal consent was obtained before procedure. All questions were answered to satisfaction. Gentle BLT technique was applied to the cervical and thoracic spine as well as to the ribs and diaphragm. Rib raising was performed b/l. No adverse reactions were noted during the treatment. The patient stated that they could breathe easier. Increased ROM was noted in the areas addressed post-treatment. Will follow up tomorrow.

Discussion

There are many learning points demonstrated in this encounter. The first important point is to be able to decide which areas should be treated and why. In the outpatient setting, the patient would likely tolerate addressing each significant dysfunction, but in an acutely ill patient, focusing the treatment is paramount. The first step is to decide which somatic dysfunctions are clinically significant, and the next is to decide which areas should be focused on at which times for the hospitalized patient specifically.

Let's start by correlating this patient's somatic dysfunctions to their current complaint. The OA dysfunction can be significant due to the proximity of the OA joint to the vagus nerve, which supplies parasympathetic innervation to the lungs. The C5 dysfunction is significant because C3-C5 forms the phrenic nerve as it leaves the cervical spine. Decreasing tension and, thus, facilitation on the phrenic nerve will help to optimize diaphragmatic motion. The T4 type II dysfunction is significant because this corresponds with a viscerosomatic reflex that may correlate to the lung. There was decreased rib motion over the same area that had increased tactile fremitus. It is the tactile fremitus that suggests denser or inflamed lung tissue (pneumonia), but it is the decreased rib motion that contributes to the condition due to altered breathing mechanics. If the ribs are not moving adequately, then it is more difficult to move air, respiratory secretions, and lymphatic fluid, thus creating stasis, which is an ideal breeding ground for infection. The bilateral diaphragm restriction is the most intuitive dysfunction since, if the diaphragm cannot expand adequately, there will be decreased breathing volumes as well as decreased lymphatic flow. Finally, the Type II dysfunction in the lumbar spine is significant because of the attachment of the crura of the diaphragm to the lumbar vertebra.

Knowing what not to treat is just as important as knowing what to treat in the hospitalized patient. Some key examples are demonstrated in this patient's structural exam. Ultimately, deciding what to treat and what not to treat comes down to the difference between physiological versus pathological dysfunction. A left-on-left sacrum and a left anterior innominate are considered physiological dysfunctions; so, in other words, dysfunction that can be explained by a normal walking pattern, which got slightly stuck in one direction. In contrast, a R on L sacrum and a L superior innominate shear are pathological dysfunctions because these are significantly different positions of those bones than what would be found during normal physiological motion. Additionally, group I curves are considered physiological because they are result of muscular tension, versus a Type II dysfunction, which is typically caused by a viscerosomatic reflex. Cranial torsions and side-bending and rotation dysfunctions are deemed physiological as well, since these are the normal axis of rotation of the cranium. The list goes on and on, exemplifying the importance of knowing normal functional anatomy so as to better identify what is pathological somatic dysfunction. Therefore, while it may be indicated to treat physiological dysfunction in an outpatient setting, concentrating on the pathologic dysfunctions may be more prudent in the inpatient setting. Completing an AGR screening may help narrow down areas that need to be treated first.

In summary, the clinically significant pathological somatic dysfunctions present in this patient are in the OA, cervical, thoracic, lumbar, rib, and abdominal (the diaphragm) regions. However, if the physician performed corrective techniques to all of these regions in an acutely ill patient, it may be over-treating, and they may end up feeling worse instead of better. More importantly, overtreatment may cause the patient to acutely decompensate, worsening the clinical condition. Therefore, it is a good idea to focus on the area of greatest restriction or just a few key areas to start. On subsequent hospitalized days, a new structural exam should be performed, and the same or different areas can be addressed. Determining a treatment protocol is where the art of medicine comes into play and would be a good discussion topic to have with the attending physician.

The first area to address in a hospitalized patient is the autonomic nervous system because it is inevitably imbalanced in an acutely ill patient. Rib raising is a great initial treatment, as it is relatively safe, gentle and makes profound changes in the body. Next, one might want to treat the OA joint, to further balance the autonomic system by decreasing facilitation of the vagus nerve. The physician then could decide to treat the thoracic inlet and diaphragm to optimize breathing mechanics and lymphatic flow. This might be all the patient can tolerate for the day. Remember, even by treating these three areas, the physician has already made profound changes in the patient's physiology. Communicate with the patient during the treatment about how they are feeling. Use this information, as well as their general health status, to evaluate if they seem healthy enough to tolerate more. If not, return the next day or later in the day, time permitting, to continue OMT.

The next day, ask the patient how they feel and what, if any, changes they notice. Re-check all the areas that were previously diagnosed. Some dysfunctions may have returned, but other dysfunctions that were not even treated may have disappeared. For example, after the diaphragm was released, the type II lumbar dysfunction might have resolved itself. At this point, the physician could decide to treat the same high-yield areas again, if the dysfunction persisted, or choose to address other clinically significant somatic dysfunction, like the segmental dysfunctions in the axial spine. Also, keep an eye on how the ribs are moving, and address this somatic dysfunction if the problem persists. Remember, while the goal is eventually to get all ribs moving equally in inhalation and exhalation, it might only be possible to get a small amount of motion in the restricted ribs initially. Instead of using a technique requiring large amounts of patient input, like muscle energy, perform a gentle technique and then come back the next day and assess the progress.

The key to treating the hospitalized patient is that "less is more." And when it comes to being in the hospital, the less time a patient must spend there, the better. Every technique, no matter how simple or fast, can greatly improve the patient's physiology, so never take these techniques for granted. Ultimately, performing OMT as an adjunct to standard medical care will help the inherent wisdom of the body to find health and assist the patient on their path to getting well enough to be discharged from the hospital.

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