FIRST AID FOR THE® COMLEX

AN OSTEOPATHIC MANIPULATIVE MEDICINE REVIEW

A STUDENT-TO-STUDENT GUIDE

- Must-know, frequently tested facts and mnemonics for the OMT portion of the COMLEX
- Comprehensive review of OMM techniques and orthopedic musculoskeletal tests with accompanying photographs and illustrations
- Includes Q&A for exam-day practice
- Written by OMM fellows who aced the OMM portion of the COMLEX

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DEDICATION

To Dawn, Jonathan, Rebecca, Kirsten, Jack, Kathleen, and the rest of our friends, families, and teachers, without whom this venture would not have been possible. We also dedicate this book to the past, present, and future OMM Fellows.

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PREFACE

The idea behind this book came from the need for a high yield board review book of OMT questions on the Comprehensive Osteopathic Medical Licensing Examination (COMLEX). When the opportunity presented itself to create a board review book in the First Aid format, we were delighted to fill what we knew was a void in osteopathic literature. However, when researching information for the content, we came to realize the many different frameworks in which osteopathic concepts are taught among various institutions. The challenge became creating a high yield text in which the majority of this information could be included. To accomplish this, only widely accepted osteopathic texts were used as sources.

Our focus was to emphasize the material most commonly encountered on the COMLEX. Nevertheless, we make no guarantees that this text covers every single osteopathic question that may be presented. With that in mind, we strongly encourage your feedback regarding not only the content within the book itself, but also how helpful the book was in preparing you for the exam. Should you wish to share this feedback with us, you can do so by sending an e-mail to *firstaidforthecomlex@yahoo.com*.

This book was designed to be used as a review guide for the COMLEX. In no way is it meant to be used as an all inclusive reference source. Therefore, the authors take no responsibility for consequences of the applications of information within this text including but not limited to technique descriptions.

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This project came to fruition with the help of many individuals whom we would like to thank. Our appreciation extends to Aaron Bruce, whose tireless efforts helped to initiate this process. For greatly contributing to this book we thank Terry Pexton. For additional contributions we thank Dawn Nye and Melissa Novak. For taking the time to review our works, we thank Daniel Davison, DO, Mark McKeigue, DO, Charles Mok, Jr., DO, Kenneth Nelson, DO, Mark Robinson, DO, and Melicien Tettambel, DO. For use of the Yogatrek Center and endless support, we thank Ben and Joan Taylor. For current and future revisions, we are grateful to Elise Halajian for taking on this project. For last-minute phone calls, questions, and for always being available, we thank Marsha Loeb. And finally, we extend gratitude to our editor, Catherine Johnson, for guiding us through these uncharted waters.

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SECTION I

Guide to Efficient Examination Preparation

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CHAPTER 1

Introduction

▶ HOW TO USE THIS BOOK

This book was developed after realizing the need for a high yield board review book for the osteopathic manipulative techniques (OMT) portion of the COMLEX. When the opportunity presented itself to create a board review book in the First-Aid format, we were delighted to fill what we knew was a void in osteopathic literature.

There are four main sections. The first section gives an overview of the general types of techniques used in OMM without getting into specific technique descriptions. The second section looks at diagnosis and treatment of each region of the body. This section focuses on relevant anatomy and the main issues in diagnosis for a particular body region. Also found in this section is information regarding OMM for particular clinical areas, such as obstetrics/ gynecology, pediatrics, the hospitalized patient, cardiac, gastrointestinal (GI), and the like. We found these topics to be particularly relevant to board questions, as the majority of OMM questions on the COMLEX are in the setting of these types of clinical scenarios. The third section contains various high yield tables for viscerosomatic/Chapman's reflexes, Jones' counterstrain tenderpoints, and tables summarizing major historical dates and musculoskeletal tests. The fourth section involves a brief overview of commonly encountered techniques, including a brief description and indications. Finally, this book contains a section on the COMLEX PE, with particular emphasis on how OMM is related to the examination including what techniques are allowable and how OMM performed on the examination is graded.

The difficulty with creating a board review book involving OMM is the vast differences in terminology and techniques used between the different osteopathic schools. We tried our best to describe techniques that are common on board questions. The description of techniques in this book is given with the intent to provide information about the techniques relevant to written board questions. For example, the indications for a technique, patient positioning, and the predominant final corrective force, and so forth. This is *not* intended to be a technique manual. The technique descriptions only cover general material relevant to a written question; very little detail is given on successfully performing a technique clinically. As there is great variation between schools with how techniques are performed, each technique described in this book is referenced from a major osteopathic source. Again, the point is not to describe a technique to help you pass your practical examination, but to describe the relevant information about techniques that are commonly asked on the board's questions.

▶ COMLEX LEVELS 1, 2, AND 3

Description of the COMLEX

The COMLEX is designed to assess both medical knowledge and clinical skills. In order to accomplish this, the National Board of Osteopathic Medical Examiners (NBOME) has developed an overall blueprint for the examination covering two main areas. The first (Dimension I) is known as *the clinical presentation*. This involves health topics frequently encountered by general practice osteopathic physicians. The second area (Dimension II) is known as *the physician task*. This involves the decision-making abilities that physicians

TABLE 1-1. The COMLEX Examination Blueprint

Dimension I: Patient Presentation	Level 1, Level 2 CE, Level 3
Asymptomatic and general symptoms	8–16%
Symptoms and disorders of digestion and metabolism	4–10%
Symptoms and disorders of sensory alternations	28–38%
Symptoms and disorders of motor alternations	6–12%
Symptoms and disorders related to human sexuality and urination	3–8%
Symptoms and disorders of respiration and circulation	8–16%
Symptoms and disorders of thermoregulation	2–6%
Symptoms and disorders of the tissues and trauma	8–16%
Symptoms and disorders of human development	3–8%

Dimension II: Physician Tasks	Level 1	Level 2 CE	Level 3
Health promotion and disease prevention	1–5%	15–20%	15–20%
History and physical	5–15%	30–40%	10–20%
Diagnostic technologies	1–5%	10–20%	15–25%
Management	2–7%	10–20%	25–40%
Scientific understanding of mechanisms	70–85%	5–15%	5–10%
Health-care delivery	1–3%	5–0%	5–10%

use to problem-solve a particular medical issue. This general blueprint is used for each step of the COMLEX examination (see Table 1–1); however, the content of each examination is tailored to the knowledge level of the test taker. OMT topics are dispersed throughout this blueprint, covering all areas within these two sections.

Level 1

COMLEX Level 1 is created using the COMLEX examination blueprint. The emphasis of this examination is placed on utilizing basic science knowledge in the areas of anatomy, behavioral science, biochemistry, microbiology, osteopathic principles, pathology, pharmacology, and physiology.

Level 2

COMLEX Level 2-CE is also created using the COMLEX-USA blueprint; however, there is greater emphasis placed on topics found in the second area of the blueprint (Dimension II). These topics involve arriving at medical diagnoses using history and physical examination information. Disciplines in this examination include emergency medicine, family medicine, internal medicine, obstetrics and gynecology, osteopathic principles, pediatrics, psychiatry, and surgery.

Level 3

As with Levels 1 and 2, Level 3 is created using the COMLEX-USA blueprint. In this examination, the emphasis is shifted toward patient management. The test requires the examinee to solve the types of medical problems similar to what a general practice osteopathic physician would encounter. The disciplines involved in the examination are the same as those found in Level 2.

In 1995, the NBOME changed the delivery method of the COMLEX from a 2-day written examination containing 750 questions to a 1-day computer-based examination containing 400 questions. The last written examination available was the Level 1 examination in October 1995. The new computer-based examination is delivered throughout the year at more than 300 locations throughout the country.

The computer-based examination contains eight blocks of 50 questions each. Once the examinee has left a particular block, they may not return to that block and modify their answers. There are two types of breaks during the examination. After completion of sections two and six, there will be an optional 10-minute break. This break will count against the total time the examinee has to take the entire examination. After completion of block four, there will be an optional 40-minute lunch break. This time is not counted against the total time allotted to complete the examination. If the examinee returns to take block five after the 40 minutes has ended, any remaining time over 40 minutes will count against the total time allowed to complete the examination.

Registration, payment, scheduling, canceling, rescheduling, and withdrawing are all completed through an online system. This system is also used to receive available testing dates and locations. For more information on registration, visit *www.nbome.org*.

Grading of the Examination

The number of correct items is converted to both a 3-digit and 2-digit score. The mean 3-digit score is 500, for all steps of the examination. The minimal score needed to pass Levels 1 and 2 is 400; for Level 3 the minimum passing score is 350. The standard deviation of the 3-digit score depends on the year taken. For example, the standard deviation for Level 1 from 2002 to 2005 was 79, for Level 2 from 2001 to 2005 was 73, for Level 3 from 2000 to 2005 was 120.

The minimal 2-digit score needed to pass is 75 for all levels of the examination. Like the 3-digit score, the standard deviation depends on the year taken. For Level 1 the standard deviation from 2002 to 2005 was 3.95. For Level 2 the standard deviation between 2001 and 2005 was 3.65, and for Level 3 the standard deviation from 2000 to 2005 was 4.00.

The number of examinees that pass or fail the test depends on their performance in the examination and is not determined prior. A passing score is based on the overall examination, not on specific areas. The COMLEX score report does however provide graphic information regarding how well a particular test taker performed on specific areas of the examination. Students can typically expect their scores 4 weeks after the exam. However, the scores cannot be released until a reasonable number of examinees have taken a given test. Therefore, examinees who take the test earlier may have to wait longer to receive their results.

OMT ON THE COMLEX

Roughly 20% of the total questions in the examination for all three levels involve OMT. These questions are typically straightforward. Therefore, these are questions you do not want to miss. Commonly, people omit studying for the OMT questions on the COMLEX, thinking there are not that many of them. However, 20% is a significant amount, so acing those questions can really help elevate one's overall score. Not to mention, the majority of these questions are relatively easy compared to the other questions you'll get on the COMLEX examination. Traditionally, people tend to feel there are OMT topics that are overrepresented on the COMLEX. However, there really is a great deal of variation from test-to-test and year-to-year. In our collective experience, we have noticed certain topics tend to be favorites for this exam. These include cranial, sacrum, and viscerosomatic reflexes.

There tend to be two major forms of OMT questions on the COMLEX: block questions and stand-alone questions. Stand-alone questions are just that, individual questions with one-question stem. Block questions typically start out with a question stem, then ask 2-5 questions pertaining to that stem. Some blocks are all OMT, meaning the question stem is related to an OMT case and each question pertaining to the stem asks OMT questions. Some blocks deal with a particular case and only one of the questions pertains to OMT. For example, the case may deal with a patient with appendicitis. Most of the questions will ask about appendicitis, with one question asking about where you would find a viscerosomatic response in this patient. In addition, there may be a smaller number of matching questions.

► PE EXAMINATION

The Performance Evaluation/Clinical Skills examination of the COMLEX-USA Level 2 is intended to assess the medical student's knowledge of focused physical examinations, as well as evaluate their interpersonal and communication skills. This is a requirement for all osteopathic medical students. Scheduling for this examination should be done as early as possible during the fourth year. Spots fill up very quickly and it's better to reserve yours early. As the testing date comes closer, it is highly recommended that the medical student refers to the Orientation Guide for COMLEX-USA Level 2-PE on the NBOME Web site at *www.nbome.org*. There is also a 27-minute informational program video on the Web site that shows the actual testing center, the documents used throughout the test, and a few examples of mock examinations. The following information is a summary of what you will find on the Web site, in the video, and some personal insights as well.

Outline of Examination

There are 12 clinical encounters involving standardized patients (SPs) that have been trained to play the role of a patient. About 14 minutes are allotted for reading the doorway information sheet (patient's name, type of clinical setting, chief complaint, and vital signs) performing the history and physical, and doing any OMT treatment deemed necessary. Around 9 minutes will then be allotted for the completion of a subjective, objective, assessment, plan (SOAP) note. If the medical student finishes the encounter prior to the 14 minutes, he or she can begin writing the SOAP note. However, additional discussion or examination of the SP is prohibited at that time.

Walk Through of Test Day

On the day of the examination, remember to dress professionally, wear your white coat, and bring your own stethoscope. Aside from a pen, these are the only items permitted in the testing area itself. The NBOME recommends arriving at the testing center 30 minutes prior to the start of the examination. You should still leave ample travel time from wherever you're staying, seeing that there are often delays due to traffic. Be aware that the clinical encounters do not begin for at least an hour and a half after arriving at the testing center.

First, there is an official sign in and an opportunity for the NBOME to take your picture for security purposes. Next, the group of 12 medical students is led into a conference room which acts as the "home-base" throughout the day. At this time, all personal belongings are placed into lockers, which are then inaccessible *at all times* until the examination is completed. This means that *anything* you need during the day needs to stay in the conference room, *not* your locker.

A 50-minute orientation is provided, which consists of a video presentation very similar to the one on the Web site and an oral presentation with an accompanying PowerPoint. It essentially covers the same things that are on the Web site and in the informational video. Following the orientation there is a 15-20-minute break which can be used to get familiarized with the power tables and the equipment in the testing rooms. This time is also for bathroom breaks and any last minute fidgeting.

The medical students are then led into the main testing facility. This room is the starting point for all clinical encounters and leads to each of the 12 testing rooms. The 12 clinical encounters are broken down into 3 sets. Following the first set of four encounters, a 30-minute break is given at which time a small meal is provided. Feel free to bring your own food but refrigeration is not available. Bring some extra snacks in case the box lunches don't suffice. Following the second set of four encounters, a 15-minute break is given. The final set of four encounters is followed by an opportunity to fill out an evaluation of the testing experience. Medical students are free to go upon completion of the evaluation. The orientation, the lunch break, and the 15-minute break are all taken in the conference room. There is a proctor present at all times when the students are in the conference room to monitor any discussion that could pertain to the examination. Any such discussion is strictly prohibited at all times throughout the day.

Content of Clinical Encounters and OMT

The clinical encounters range from family practice settings to the emergency room, from pediatrics to geriatrics, and from the common cold to a specific musculoskeletal injury. The patients may have specific complaints or they may be there for a well-patient visit. These can include prenatal visits, preparticipation sports physicals, well-woman examinations, and school physicals. The patients are already gowned when you enter the room. The female breast and pelvic examination along with a rectal or genitalia examination of either sex is absolutely not allowed during the examination. It is appropriate to suggest a rectal examination for occult blood in your plan, but do not perform one. Remember, the overall goal of this examination is for the NBOME to determine if you've got the basic skills necessary to begin a residency training program. They are not looking to find who can do manipulation the best. That being said, manipulation may not be necessary for all cases but osteopathic principles should be applied in *every* case. For example, make sure to palpate for viscerosomatic reflexes if the patient has GI complaints. You may choose not to perform OMT but documentation of the viscerosomatic reflexes shows your understanding of the osteopathic philosophy.

Only about 25% of the encounters involve evaluation of OMT specifically. If OMT is warranted, it is recommended that only 3–4 minutes of the total encounter be spent on treatment. High velocity, low amplitude (HVLA) is the only type of manipulation that is absolutely not allowed during the entire examination. Soft tissue techniques, deep articulation, counterstrain, muscle energy, myofascial release, and facilitated positional release are some examples of appropriate techniques to use. The following are some ideas for specific techniques that can be used for possible cases.

Chronic headaches—cervical soft tissue, "killer fingers" (myofascial release of the OA junction), cervical muscle energy, counterstrain of upper thoracics or rib tenderpoints that could be contributing to the headaches

URI—myofascial release of thoracic inlet (to allow for increased lymphatic drainage from the head), sinus techniques (percussion of frontal and maxillary sinuses, inhibitory pressure of the three branches of the trigeminal nerve where they exit the cranium, nasal bone articulation), frontal lift, venous sinus drainage

Shoulder complaints (not caused by referred pain)—*treat the upper thoracics*, Spencer's technique, counterstrain for anterior and posterior rib tenderpoints,

Forearm/wrist complaints—*treat the upper thoracics*, direct/indirect myofascial release of the forearm, carpal bone articulation, counterstrain of forearm tenderpoints

Cough/shortness of breath (SOB)—thoracic soft tissue, myofascial release of the thoracic inlet, doming of the diaphragm, thoracic pump, rib raising

Chronic abdominal pain—thoracolumbar junction soft tissue or muscle energy, indirect techniques of the sacrum, rib raising

Low back pain—lumbar soft tissue, lumbar muscle energy, counterstrain of anterior lumbar tenderpoints (great place to start), psoas muscle energy, balanced ligamentous tension of the pelvis, indirect techniques of the sacrum, piriformis counterstrain, muscle energy of the ilium

Don't Forget To

- Introduce yourself upon entering the room.
- Wash your hands before examining the patient.
- Drape the patient appropriately during the physical examination.
- Perform OMT.

- Perform a structural examination if necessary.
- Check viscerosomatic reflexes.
- Perform a thorough neurological examination for cases involving radiculopathies.
- Appropriately close the encounter.

SOAP Note

The official SOAP note used during the examination can be found on the NBOME Web site as well. The SOAP note is not available to write on during the encounter so taking notes on the doorway information sheet is perfectly acceptable. Like all SOAP notes, there is an area for the subjective and objective findings. Under the assessment, there will be five different lines, which are your differential diagnoses. It is not necessary to always come up with five diagnoses but do your best. Your first assessment should be the most likely one. Under the plan, there will also be five lines for which you can list several things that should be done for the patient. This may include giving an antibiotic (you do not need to specify which one), ordering an x-ray, or doing a rectal examination for occult blood (which you would not do during the encounter.) This concludes your SOAP note. A signature is *not* necessary because anonymity must be kept at all times.

Scoring and Evaluation

The overall examination score will be reported as either pass or fail. Each encounter is evaluated based on two different domains. The first is the humanistic domain, which encompasses doctor-patient communication, interpersonal skills, and professionalism. The SPs themselves are responsible for this part of the evaluation, and will immediately fill out evaluations following the encounter assessing each of these areas. The second domain is the biomedical/biomechanical domain. History and physical (H&P) skills, OMT principles and skills, and written SOAP notes are the basis for evaluation of this domain and will be rated by certified osteopathic physician examiners. An overall passing score for *both* domains is necessary to receive a pass for the COMLEX-USA Level 2-PE. Results are typically mailed out 10–12 weeks following the examination. This time frame may decrease as more and more osteopathic students take the examination.

Preparation for the Examination

The preparation for this examination essentially takes place during your third and fourth year as a medical student. Remember, the purpose of this examination is to make sure you are ready to begin residency. It is not intended to determine if you can diagnose every problem or fix all somatic dysfunction with OMT. Communication with patients is just as important as writing a concise, informative SOAP note. If anything, review common medical problems and be able to come up with a differential diagnosis for each one. To prepare for the OMT aspect, pick a few techniques for each major area of the body and be able to demonstrate them effectively. Practice giving instructions in layman's terms so the SPs will understand you.

Finally, get a good night's rest before the examination. This means arriving in Philadelphia at a reasonable hour and settling in to your hotel. Do not take the last flight out for the evening in case there are unforeseen problems with the flight. Most importantly, relax and good luck!

SECTION II

Database of High Yield Facts

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CHAPTER 2

Somatic Dysfunction

▶ SOMATIC DYSFUNCTION

Definition

- Impaired or altered function of related components of the somatic (body framework) system: skeletal, arthrodial, and myofascial structures; and related vascular, lymphatic, and neural elements

Characteristics

- A disturbance of the normal function of somatic structures
- Possesses the characteristics of TART
- Based on a neurophysiological phenomenon
- Can result in compromised health
- Responds appropriately to osteopathic manipulative techniques (OMT)

Think TART

- **T**issue texture change
- **A**symmetry
- **R**estriction of motion
- **T**enderness

Components of TART

- **T**: Tissue Texture Change (see Table 2-1.)
  - Palpable changes within the somatic tissues indicative of physiological dysfunction
  - Changes found in skin, fascia, and muscle
  - Acute versus chronic palpatory findings
- **A**: Asymmetry
  - A visual or palpatory difference in the bony or soft tissue alignment when compared to similar structures in the same area
  - Example: A flexed spinal segment will produce a "speed bump" (spinous process will stick out farther) as compared to the other spinous processes in the same area.
- **R**: Restriction of motion
  - There will be a decreased range of motion in one or several directions of the affected joint.
  - Pay attention to the **quantity** of motion as well as the **quality** (end feel) of motion.
  - **Active motion** may be affected (ability of the patient to move the joint with his/her own force); this type of motion engages the **physiological barrier**.
  - **Passive motion** may be affected (motion produced by the force of the examiner exerted on the patient); this type of motion engages the **anatomical barrier**.
  - When somatic dysfunction is present, the **restrictive barrier** will be engaged (see Barrier Concept).
- **T**: Tenderness
  - This is a subjective finding upon palpation of the affected area; look at the patient for a change in facial expression.
  - The degree of pain reported is disproportionate to the amount of force applied by the examiner.
  - Response to pain is often involuntary.

Some schools discuss the components of STAR, substituting sensitivity for tenderness.

TABLE 2-1. Acute Versus Chronic Tissue Texture Change

Elements	Acute Palpatory Findings	Chronic Palpatory Findings
Texture	Boggy, rough	Thin, smooth
Temperature	Warm	Cool
Moisture	Increased	Dry
Tenderness	Significant	Present, but less significant
Edema	Present	Absent

Barrier Concept

- Describes the limitations of motion in one plane or several planes of motion.
- All motion has a **neutral point** for which the characteristics of motion (quantity and quality) are equal on both sides.
- Absence of somatic dysfunction (see Figure 2-1.)
  - Neutral point exists for which motion away from that point is equal toward either side.
  - The active range of motion engages the **physiological barrier** (soft tissue restrictions).
  - The passive range of motion engages the **anatomical barrier** (bony restrictions).
- Somatic dysfunction will alter the neutral point and change both characteristics of motion (see Figure 2-2.)
  - The neutral point shifts and now motion away from the original point is greater to one side than the other (in quality and quantity).
  - This type of motion now engages the **restrictive barrier** (a functional restriction that limits the range of motion to even less than the physiological range of motion).
  - The **pathological neutral** is formed, which brings back equal motion to both sides.
- A **pathological barrier** may also be present, which is a permanent restriction of joint motion due to pathological changes of the somatic system (i.e., osteoarthritis of the hip limits range of motion due to joint space narrowing and bony changes).
- These concepts are important when determining what type of OMT to use.
  - Direct techniques engage the restrictive barrier.
  - Indirect techniques move toward the pathological neutral.

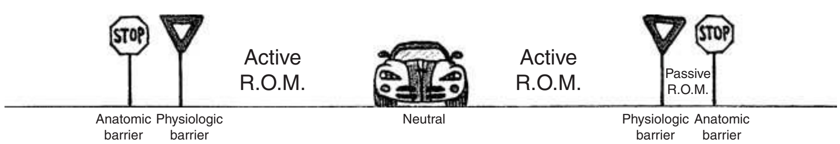


FIGURE 2–1. Range of motion in the absence of somatic dysfunction. The neutral point is exactly in the middle of the anatomical barriers.

DATABASE OF HIGH YIELD FACTS
SOMATIC DYSFUNCTION

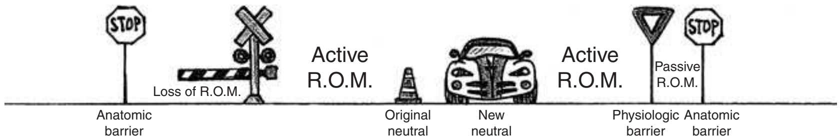
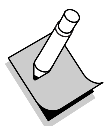


FIGURE 2–2. Range of motion in the presence of somatic dysfunction. The neutral point has been moved to accommodate for the lack of motion to one side.

Terminology of Spinal Motion and Somatic Dysfunction

If T3 is rotated to the right, the right transverse process is called the posterior component and the left transverse process is called the anterior component.



Concavity and convexity are used when discussing group curves (involving three or more vertebral segments), scoliosis, and certain cranial strain patterns.

- **Vertebral segment**—a single vertebra
- **Vertebral unit**—two adjacent vertebrae and all of their associated components (i.e., arthrodial, ligamentous, muscular, neural, lymphatic)
- **Group curve**—consisting of at least three vertebral segments
- **Posterior component**
  - Describes the position of the vertebra when it is rotated
  - Typically referring to a prominent transverse process
- **Anterior component**
  - Also describes the position of the vertebra when it is rotated
  - Typically referring to the less prominent transverse process
  - This term is used less frequently
- **Concavity**
  - The inside of a curve (forms a **CAVE**)
  - The side to which sidebending occurs
- **Convexity**
  - The outside of a curve
  - The opposite side to which sidebending occurs
- **Facilitation**—the maintenance of a pool of neurons in a state of partial or subthreshold excitation
  - Refers to a spinal segment, which is being overloaded by input from somatic or visceral structures.
  - Takes the VS reflex to a new level.
  - The spinal segment remains hyperexcitable and leads to hypertonicity of the adjacent somatic structures.

Fryette's Principles

History

- H.H. Fryette, D.O., first described the principles of physiological spinal motion in 1918. These principles describe typical spinal motion of a vertebral segment and groups of segments.
- These principles were applied only to typical vertebral segments—those which have articular facets and an intervertebral disc.

Simple versus Compound Motion

- Motion can be described as simple or compound
  - Simple—single motion of the spine that occurs in a sagittal plane about a transverse axis; either **flexion** or **extension**
  - Compound—motion that links multiple movements to each other
    - Addresses the sidebending and rotational components of a vertebral segment and its relationship with the simple motion of that same segment (flexion, extension, neutral)

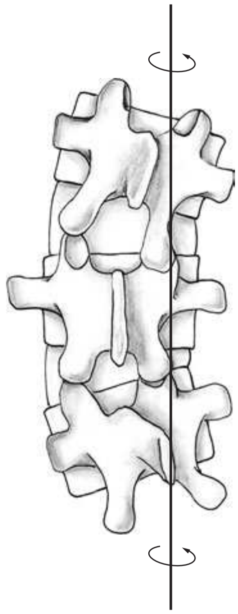


FIGURE 2–3. **Fryette's Principle I. The spine is in neutral; rotation and sidebending occur to opposite sides.**

FRYETTE'S PRINCIPLE I

(See Figure 2-3 and Table 2-2.)

- A subset of compound motion
- Type I motion = neutral mechanics = group mechanics
- Typically refers to a group curve in the thoracic and/or lumbar regions of the spine
- The neutral spine does *not* engage the articular facets
- Rotation occurs into the convexity (which is produced by the sidebending)
- Maximum rotation will be at the apex of the group curve

Fryette's Principle I: When the spine is in neutral (neither flexed nor extended), a group of vertebral segments will rotate and sidebend in opposite directions.

FRYETTE'S PRINCIPLE II

(See Figure 2-4 and Table 2-2.)

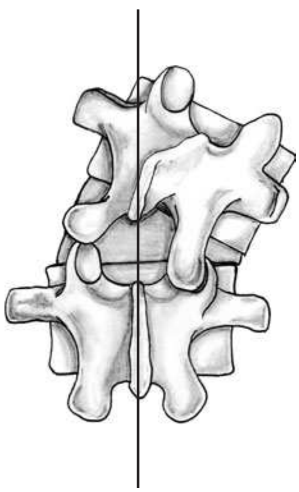


FIGURE 2–4. **Fryette's Principle II. The spine is in nonneutral; rotation and sidebending occur to the same side.**

Fryette's Principle II: When a spinal segment is engaged in either flexion or extension, the same segment will rotate and sidebend in the same direction.

TABLE 2-2. **Comparison of Fryette's Principles**

Characteristics	Principle I	Principle II
Naming	Type I motion	Type II motion
	Neutral mechanics	Nonneutral mechanics
	Group mechanics	Single segment mechanics
Flexion/Extension component	Absent (neutral)	Present
Relationship of sidebending and rotation	Occurs to opposite sides	Occurs to the same side
Direction of rotation	Into the convexity	Into the concavity
Clinical findings	Lateral curve	Speed bumps—flexed segments causing the spinous process to stick out
		Pot holes—extended segments causing the spinous process to sink in

- A subset of compound motion
- Type II motion = nonneutral mechanics = single segment mechanics
- Typically refers to a single vertebral segment in the thoracic and/or lumbar regions of the spine
- The flexion or extension of the segment engages the articular facets
- Rotation occurs to the side of the concavity (which is produced by the sidebending)

Areas of the spine that do not follow Fryette's Principles I and II:

- Occiput
- Atlas
- Sacrum
- Cervical Spine

Exceptions to the Rule

- Occiput—rotates and sidebends to opposite sides
- Atlas—no significant sidebending component
- Sacrum—sidebending and rotation are coupled causing the sacrum to move about an oblique axis
- Cervical spine (C2–C7)—typically rotate and sidebend to the same side

Typically movement in one plane will decrease movements in the other planes.

Physiological Principle III (Developed at a Later Point in Time)

Movement of a vertebral segment in any one plane will affect the motion of that same segment in other planes of motion.

Example: When setting up high velocity, low amplitude (HVLA) techniques, one plane of motion is engaged first (i.e., sidebending in the frontal plane). This will then decrease the amount of rotation possible in that same joint (within the transverse plane).

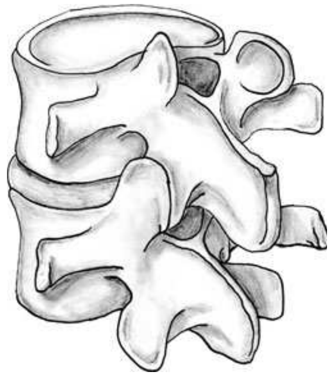


FIGURE 2–5. Frame of reference.

Naming Somatic Dysfunction

FRAME OF REFERENCE

- The anterior superior aspect of the vertebral body is used as the frame of reference (see Figure 2-5).
- Segmental motion is described by comparing the vertebral segment to the one below it.

Example: The motion of T5 is described by using the anterior superior aspect of the vertebral body of T5 in relation to T6.

- Group mechanics (three or more segments) are described relative to the anatomical position.

Example: T2–T7 as a group are sidebent right, rotated left in relation to the anatomical position.

WHO?

Which segment or group of segments has the dysfunction?

WHAT?

What will it do? This is usually how we write our findings.
What won't it do? This is usually how we find our findings.

Somatic dysfunction is most commonly named for the direction of FREER motion.

NAMING TYPE I SOMATIC DYSFUNCTION

- Identify the segment.
- Acknowledge that the segment is neutral.
- Describe the way in which the group moves more freely in rotation and sidebending (in opposite directions, of course).

Example: $T5NR_RS_L$—identifies which segment has the somatic dysfunction, acknowledges the neutral (N) component of a Type I dysfunction, and describes the direction of rotation and sidebending to which it moves more freely.

It is not necessary to write the direction of both rotation and sidebending in a Type II dysfunction since it is always to the same side.

Naming Type II Somatic Dysfunction

- Identify the segment.
- Acknowledge the flexion or extension component.
- Describe the way in which the segment moves more freely in rotation and sidebending (in the same direction, of course).

Example: $L1FRS_L$—identifies which segment has the somatic dysfunction, acknowledges the flexion component of a Type II dysfunction, and describes the direction of rotation and sidebending to which it moves more freely.

CHAPTER 3

Overview of Techniques

This chapter provides a review of the major techniques that have been developed. While there are many others being developed and used, only those most commonly taught have been included. Osteopathy in the cranial field is covered in its own chapter (see Chapter 4). Most of the information in this chapter is distilled from the second edition of *Foundations for Osteopathic Medicine;* however, the organization and classification differ slightly. A description of specific techniques can be found in Chapter 7. This chapter is divided into four sections:

- Overview of techniques—categories and comparisons
- Summary table of techniques
- Details of techniques
- Review questions

▶ OVERVIEW OF TECHNIQUES—CATEGORIES AND COMPARISONS

Given all of the techniques that exist, it can be confusing to sort them out and keep them straight. Much of the confusion arises from the similarities that exist among many of the techniques. One helpful way of categorizing techniques is dividing them between **direct** and **indirect**. A **direct** action technique is one that engages a physiologically restricted barrier and attempts to "break through" the barrier by directly engaging it. With **indirect** technique, the body is positioned away from the barrier to allow restrictive tissues to release inherently (see Barrier Concept in Chapter 2). With the tissues released, there is no longer a restrictive barrier. Not all indirect techniques deal with barriers, however. They may also be used to release reactive tissues in the absence of joint dysfunction. Table 3-1 summarizes techniques by direct and indirect.

Below are some of the features that differentiate the techniques. As with any brief comparison, these are generalizations and not absolutes.

Direct Techniques

- High velocity, low amplitude **(HVLA)** and **articulation** are entirely passive—the physician does all the work.
- **Muscle energy (ME)** is both active and passive—the physician and patient both work.
- **HVLA** requires firm barrier engagement.
- **Muscle energy** engages initial barrier resistance—the feather edge.

TABLE 3-1 Technique Classifications

Direct	Indirect	Both
High velocity–low amplitude (HVLA)	Strain and counterstrain (CS)	Myofascial release (MFR)
Muscle energy (ME)	Functional positional release (FPR)	
Deep articulation (ART)	Balanced ligamentous tension (BLT)	

- All of the techniques may use multiple planes to engage the barrier. In **muscle energy** and **articulation**, the barriers in the three cardinal planes may be engaged either individually or in combination.

Indirect Techniques

- All techniques may address tenderness, but **counterstrain** has specific tenderpoints.
- Myofascial release (**MFR**) releases soft tissues; this may or may not be with the intention of freeing up a specific joint.
- Facilitated positional release (**FPR**) is very similar to **MFR**, but adds a facilitating force to expedite the process.
- Balanced ligamentous tension (**BLT**) specifically deals with balancing the ligamentous tissues of a joint.

Active motion is motion carried out by the patient. Passive motion is motion carried out by the physician.

▶ SUMMARY OF TECHNIQUES

Technique	Summary
High velocity, low amplitude (HVLA)	■ Also known as **thrust technique.** ■ Used to remove articular restriction to motion—static asymmetry alone, is not a sufficient indication. ■ Patient is positioned such that the dysfunctional joint is into the restricted barrier and a quick thrust—**high velocity**—over a very short distance—**low amplitude**—is applied by the practitioner.
Muscle energy (ME)	■ A direct technique in which the physician engages the initial resistance to a barrier—**the feather edge**—and asks the patient to provide a counterforce away from the barrier. ■ Forces are generally light—excessive force is a common error. ■ The active contraction by the patient acts to mobilize a joint directly or by providing a postisometric relaxation period whereby tissues can be further stretched.
Articulation (ART)	■ Gentle, repetitive, and passive motion of a joint into its restricted barrier to "loosen" the joint. ■ Spencer technique for the shoulder and rib raising are examples.
Myofascial release (MFR)	■ A direct or indirect approach to releasing tension in muscles **(myo)** and fascia **(fascial).** ■ With a direct approach, tissues barriers are engaged rhythmically, or engaged and held. ■ With an indirect approach, tissues are taken to a place where the least amount of tension exists and held until an inherent release occurs.

Technique	Summary
Strain and counterstrain (CS)	■ Treatment consists of positioning the patient to eliminate the tenderness and tension—position of ease—and holding this for 90 seconds. ■ Over 200 points found anteriorly and posteriorly. Usually discrete, fingertip size, tense, and edematous. Patient will typically wince due to exquisite tenderness of significant points. ■ Tenderpoints typically in tendons or muscle belly. They may also be found in other myofascial tissues. ■ If multiple tenderpoints are found, treat the tenderest point first. ■ Points are often away from a point of trauma. For example: tenderpoints on the chest wall with back pain, or points in the antagonist muscle of a traumatized muscle. ■ If pain is associated with trauma, position of treatment matches the position of trauma and is associated with maximal comfort.
Balanced ligamentous tension (BLT)	■ An indirect approach where tensions of the ligaments and membranous structures are balanced by joint positioning. This allows an inherent release in the tissues. ■ Active movement by the patient—often breath—is commonly used to assist with the release.
Facilitated positional release (FPR)	■ A form of indirect treatment—**positional release**—in which a **facilitating** force is added to decrease the amount of treatment time needed. ■ Facilitating force is compression and/or torsion. ■ Used for both tissue texture change and joint restriction secondary to myofascial tension. ■ Treatment always begins with putting joint into a neutral position then adding a facilitating force.

▶ DETAILS OF TECHNIQUES

High Velocity Low Amplitude

- **Description**: A direct technique, which moves a joint through a restricted barrier with **h**igh **v**elocity—a quick, sudden impulse, and **l**ow **a**mplitude—the extent of movement is very small. The technique is used to remove articular restrictions to motion.
- **Indications**: Restriction of a joint to active and/or passive motion testing. Static asymmetry alone is not a sufficient indication for HVLA.
- **Contraindications/precautions**:
  - Hypermobile joints (the technique may work, but it may contribute to joint instability which accompanies hypermobility).
  - Traumatic muscle contracture.
  - Bone fracture.
  - Advanced degenerative joint disease (DJD) and/or ankylosis.
  - A rubbery or indistinct barrier is usually an indication that a thrust will be ineffective.
  - A patient who is unable to relax the muscles around the joint.
  - Osteoporosis and disks are not necessarily absolute contraindications, but are indications for trying other approaches first.

- **Typical sequence**:
  1. Position patient such that the restricted joint is into the restricted barrier. It is important that the barrier is firmly engaged so there is no windup preceding the thrust.
  2. Practitioner performs a quick thrust over a short distance into the restricted barrier forcing the joint through the restriction. This may or may not be accompanied by a pop.
  3. Reassess for increased joint mobility and decreased TART.
- **Final activating force:** Practitioner force into the restricted barrier
- **Examples:**
  - Kirksville krunch
  - Crosshand pisiform
  - Talar tug
  - Hiss plantar whip

An indistinct or rubbery end feel may indicate muscle hypertonicity. Other techniques such as MFR, ME, or articulation may be needed to prepare the joint for HVLA. An indistinct or rubbery end feel may indicate a viscerosomatic reflex.

Muscle Energy

- **Description:** A direct technique in which a patient's active muscle force is used to affect somatic change in a desired way. This technique requires very specific positioning of the patient, and a physician counterforce to the patient's muscle force. The technique is used to
  - Decrease joint restriction
  - Decrease muscle hypertonicity and lengthen muscle fibers
  - Reduce restrictions to respiratory inhalation/exhalation
  - Strengthen weaknesses that produce asymmetry
- **Categories (amount of force to be used):**
  - **Joint mobilization** (30–50 lb)—patient's muscle contraction mobilizes joint
  - **Postisometric relaxation** (10–20 lb)—following contraction, muscles are relaxed and can be further stretched
  - **Respiratory assistance**—exaggerated breathing as a muscle force
  - **Oculocephalogyric reflex** (ounces)—eye movements reflexively affect muscles of neck and trunk
  - **Reciprocal inhibition** (ounces)—agonist contraction produces reflex relaxation of the antagonist group
  - **Crossed extensor reflex** (ounces)—contraction of flexor in an extremity produces relaxation of flexor and contraction of extensor in contralateral extremity
- **Indications**: Asymmetry of joint motion and/or muscle hypertonicity
- **Contraindications/precautions:**
  - Acute injury*
  - Pain in muscle*
  - Patient too young to cooperate
  - Patient unresponsive
  - Patient cannot understand or follow instructions
- **Typical sequence**:
  1. Position body part to position of initial resistance (**feather edge**).
  2. Instruct patient to contract against the physician force.
  3. Maintain force for 3–5 seconds.

***Feather edge** is a term often applied to muscle energy. It is defined as the point where the physician first feels restriction to motion. This restriction is due to soft-tissue restriction and has a different end feeling than that felt with HVLA in which a distinct articular barrier is felt. Excessive force is a common error made when employing this technique.*

*May still be able to use reciprocal inhibition or crossed extensor reflex techniques.

4. Patient instructed to release force of contraction slowly. Physician releases force along with patient.
5. Wait several seconds for the tissues to relax. The physician then takes up the slack into a new barrier of initial resistance.
6. Repeat steps two through five, three to five times.
7. Reassess for increased joint motion or decreased muscle tension.

- **Final activating force**: Contraction of patient's muscles either moves a joint or provides for a postisometric relaxation period whereby tissues can be further stretched.

Articulation

- **Description**: Gentle, repetitive, and passive motion of a joint into its restricted barrier to "loosen" the joint. The goal is to reduce the resistance to motion (usually tight connective tissue), and improve or restore normal physiological motion. It may also be used simultaneously, or as a stand-alone diagnostic tool.
- **Indications**: Restriction to articular movement. Good for postoperative or older, immobile patients when tolerated
- **Contraindications/precautions:**
  - Generally a safe technique
  - Pain (other than mild soreness or mild discomfort) with technique
  - Sutures, burns, infections, or other acute injury in area of treatment
  - Traumatic muscle contracture or bone fracture
  - Advanced DJD and/or ankylosis—use with caution
- **Typical sequence**:
  1. With the patient in a comfortable position, the physician gently moves the joint to the restricted barrier or to the limit of the patient's tolerance.
  2. The joint is then returned to neutral and this whole process is repeated in a rhythmic pattern.
  3. With each repetition, the range of motion should increase. Once there is no further increase in motion the treatment is finished.

Very young and very old respond well. Usually less posttreatment reaction than with HVLA.

- **Final activating force**: Direct and repetitive stretching of restrictive tissues by the physician
- **Examples:**
  - Rib raising
  - Spencer technique for the shoulder
  - Thoracic lymphatic pump

Myofascial Release

- **Description**: Strictly speaking, it is the release of tension in muscles (myo) and fascia. This is achieved by applying a direct force to stretch tissues or an indirect force to allow an inherent release of the tissues. Also included in this category is **inhibition** that works by maintaining deep pressure over an area of hypertonicity.
- **Indications**: Muscular and/or fascial restrictions. This may include joint restrictions, which are caused by or held by hypertonic tissues. It can be used to "prepare" a joint for HVLA or as a stand-alone technique.

- **Contraindications/precautions**:
  - Generally a safe technique.
  - Pain (other than mild soreness or mild discomfort) with technique.
  - Sutures, burns, infections, or other acute injury in area of treatment.
- **Typical sequence:**
  - **Direct**
    1. Engage tissues with pressure appropriate to depth of interest.
    2. Move them into a restricted barrier and hold the stretch or allow tissues to relax and repeat stretching in a rhythmic manner. The barrier may be engaged with any of the following motions: translation, rotation, distraction, compression.
  - **Indirect**
    1. Engage tissues with pressure appropriate to depth of interest.
    2. Move tissues to a point of least resistance. This may include any of the following: translation, rotation, distraction, compression.
    3. Wait for an inherent release in the tissues.
- **Final activating force:**
  - **Direct**—stretching from the force of physician's manipulation.
  - **Indirect**—an inherent release of the patient's tissues.

Often direct and indirect approaches are used together to maximize the release.

Strain and Counterstrain

(See also Chapter 6 for Jone's Counterstrain Tenderpoints.)

- **Description**: The use of gentle positioning to maximally decrease tenderness of specific tenderpoints in order to restore normal somatic function. There are over 200 discrete anatomical points, anteriorly and posteriorly, which can be found in muscles, tendons, and ligaments.
- **Indications:** Presence of a tenderpoint
- **Contraindications/precautions**:
  - Generally a safe technique
  - Pain (other than mild soreness or mild discomfort) with technique
  - Sutures, burns, infections, or other acute injury in area of treatment
- **Typical sequence**:
  1. Slowly move patient to position of comfort while monitoring for tissue relaxation. Monitoring should be done with a light touch.
  2. Determine degree of tenderness by pressing the tenderpoint and asking patient for the level of tenderness still present. **On a 0–10 scale, tenderness should reduce from an initial value of 10, to a 3 or less.** If greater than a 3, fine-tune until tenderness decreases.*
  3. Maintain position for 90 seconds and monitor tissues for a sensation of release.
  4. Following **90 seconds** and/or release, slowly return patient to neutral. It is important that the patient remains passive during this return.
  5. Recheck tenderpoint for tenderness. **A successful treatment leaves no more than 30% of the original tenderness.**
- **Final activating force**: An inherent release of patient's tissues

Light contact throughout treatment sequence should be maintained. Pressure is used only to determine the degree of tenderness.
Midline points generally require more flexion/extension.
Lateral points generally require more sidebending/rotation.

* If fine-tuning is not working, one can treat the paired point (i.e., if you are treating an anterior point without success, treat its corresponding posterior point) and then return to treating the original point.

Balanced Ligamentous Tension

- **Description**: Indirect positioning of a dysfunctional joint to a place of balanced ligamentous and membranous tensions. In practice this means that when a balance point is achieved, any additional motion will create an imbalance of tension around the joint. Finding this point of balance will allow inherent forces to correct the dysfunction and the tissues will return to a physiologically correct balance point. Active movement from the patient (especially breath) is often used to achieve this balance and help with the release.
- **Indications**: Restriction or asymmetry of motion in any articulation
- **Contraindications/precautions:**
  - Generally a safe technique
  - Pain (other than mild soreness or mild discomfort) with technique
  - Sutures, burns, infections, or other acute injury in area of treatment
- **Typical sequence**:
  1. After finding a restriction in movement of a joint, the patient's body is positioned to find a point of balance in the ligamentous tensions.
     - This may include active motion by the patient to tune the balance. As the patient returns to neutral, the joint is held in position by the physician until a release occurs.
     - Alternatively, breathing may be used to tune the balance. For example, an inhale flattens spinal curves (in AP direction) and can be used to extend upper thoracics (above T8) or flex lower thoracics. Once balance is achieved, the balance point is held for several respiratory cycles until it self-corrects.
  2. Correction of the dysfunction is sensed when the point of balance shifts back toward the normal physiological neutral.
  3. Reassess joint movement and symmetry.
- **Final activating force:** Inherent physiological forces. Often this is breathing.

> ***Notes:***
>
> - Respiratory assistance
> - Inhalation flattens the spine in the AP direction (i.e., thoracic kyphosis and lumbar lordosis decrease).
> - Exhalation increases anteroposterior (AP) spinal curves.
> - In this model, ligaments of a joint neither stretch nor go lax as long as the joint stays within physiological limits.
> - The degree of motion required is very small for diagnosis and treatment.
> - First described by W.G. Sutherland, DO, in the 1940s.

Facilitated Positional Release

- **Description**: A specific form of indirect treatment in which a facilitating force (usually compression or torsion) is used to reduce the time needed for the tissues to release. It can be used to resolve tissue texture changes as well as joint dysfunction resulting from muscle hypertonicity.
- **Indications**: Tissue texture change and joint dysfunction secondary to tissue hypertonicity
- **Contraindications/precautions:**
  - Generally a safe technique
  - Pain (other than mild soreness or mild discomfort) with technique
  - Sutures, burns, infections, or other acute injury in area of treatment
- **Typical sequence**:
  1. The dysfunctional joint is placed into a neutral position to unload articular surfaces. For vertebra, neutral relates to a position between flexed and extended.
  2. A facilitating force (compression and/or torsion) is applied.
  3. The tissues are further placed in a position of relative freedom to allow them to "relax".
  4. In a matter of several seconds, the dysfunction resolves and the joint can be returned to the original position.
  5. Reassess for resolution of dysfunction.
- **Final activating force:** An inherent release of patient's tissues.

▶ REVIEW QUESTIONS

Name the technique associated with each of the following descriptions.

A. Compression or torsion added to expedite the release
B. Articular barrier firmly engaged
C. Hold for 90 seconds
D. Active movement by patient (often breath) to find a balance point
E. Feather edge of a barrier engaged

▶ ANSWERS

A. FPR, **B**. HVLA or articulation, **C**. Counterstrain, **D**. BLT, **E**. Muscle energy

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CHAPTER 4

Regional Diagnosis

Osteopathic manipulative medicine (OMM) questions on the COMLEX often reveal findings of a structural examination or present different restrictions in the various regions of the body. It is your job to determine what the true diagnosis is. This next section will review the principles and guidelines for diagnosing somatic dysfunction (SD) and other structural abnormalities throughout the body.

▶ CRANIAL DIAGNOSIS

Primary respiratory mechanism (PRM) first described by William G. Sutherland, DO

- Primary = vegetative center of the brain
- Respiratory = metabolic exchange at the cellular level
- Mechanism = an integrated machine

The five components of the PRM

- Inherent motility of the brain considered to be the driving force.
- Cerebrospinal fluid (CSF) is the hydraulic aspect, moving in a concurrent fashion.
- Articular motility of the bones of the skull.
- Mobility of the membranes and the reciprocal tension membrane (RTM).
- Involuntary motion of the sacrum.

Relevant Anatomy

(See Figures 4-1, 4-2, 4-3, 4-4.)

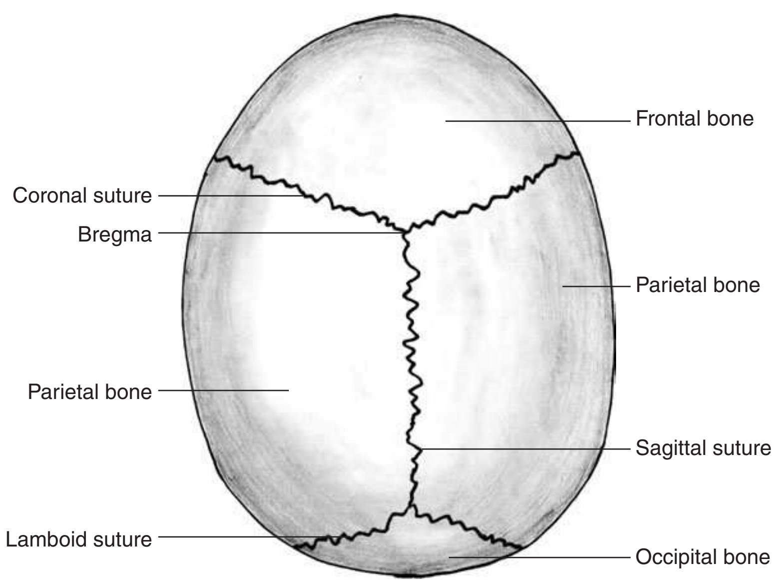


FIGURE 4-1. Cranium—superior view.

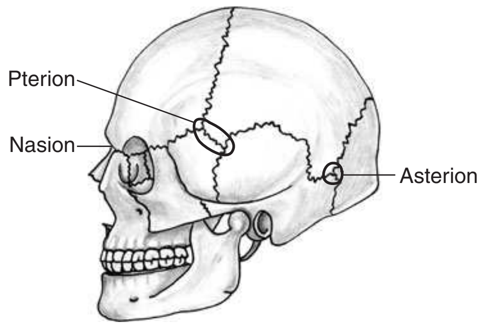


FIGURE 4-2. Cranium—lateral view.

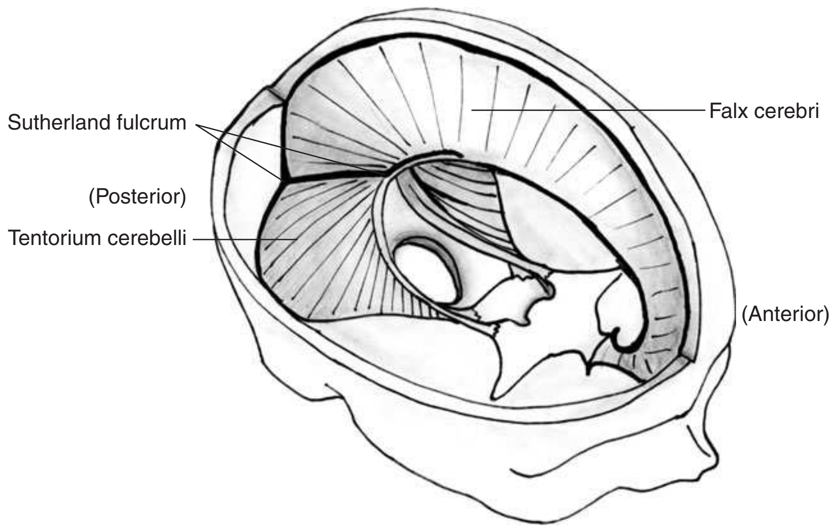


FIGURE 4-3. The Dural septa.

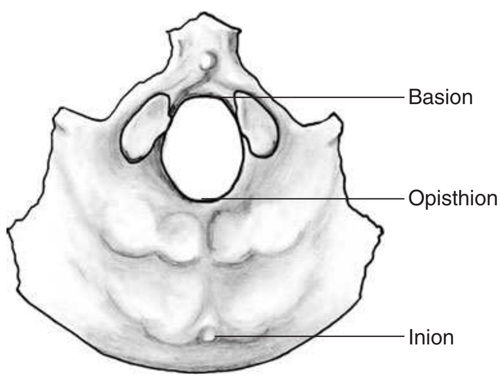


FIGURE 4-4. Occiput.

Bony

- Midline bones = sphenoid, occiput, sacrum
- Paired bones = frontal, parietal, temporal, nasal, zygoma, maxilla

Connective Tissue

- Falx cerebri, tentorium cerebelli, and spinal dura form RTM.
- Falx cerebri and tentorium cerebelli arise from common origin at the straight sinus known as the *Sutherland fulcrum*. This point is not actually a detectable structure. An analogy would be the "center of gravity" in the body.
- Dura continues down the spinal canal and attaches to the sacrum at the level of S2.
- RTM attaches anteriorly at the cribriform plate and crista galli of the ethmoid bone, as well as the clinoid processes of the sphenoid, posteriorly at the occiput, and laterally at the petrous portion of the temporal bones.

Landmarks

- Sphenobasilar synchondrosis (SBS)—junction of body of sphenoid and body of occiput point about which flexion and extension occurs
- Pterion—junction of frontal, sphenoid, parietal, and temporal bones
- Asterion—junction of occiput, parietal, temporal bones
- Basion—ventral aspect of foramen magnum
- Opisthion—dorsal aspect of foramen magnum
- Inion—occipital protuberance
- Nasion—junction of nasal and frontal bones
- Bregma—junction of coronal and sagittal sutures

Cranial Motion

- Primary movements of SBS are flexion and extension.
- During flexion, SBS rises; during extension, SBS falls (see Figure 4-5).
- In flexion, the body of the sphenoid rises and moves slightly anterior. The wings move anterior and laterally, while moving slightly inferior.
- In flexion, the base of the occiput rises and moves slightly posterior. The squamous portion of the occiput moves inferior and laterally.
- Sphenoid and occiput circumduct in opposite directions about two transverse axes (see Figure 4-5).

*Occipital landmarks = **BOIL B**asion, **O**pisthion, **I**nion, **L**ambdoidal suture.*

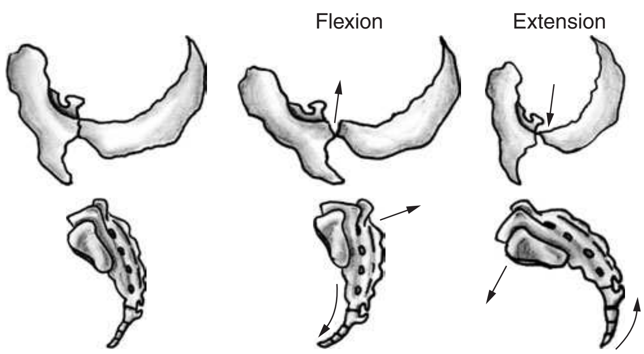


FIGURE 4-5. Flexion and extension of the SBS.

- Paired bones externally rotate (lateral aspect of bones move away from the midline) in flexion and internally rotate (lateral aspect of bones move toward the midline) in extension.
- Occiput influences motion and direction of temporals, mandible, and sacrum.
- Sphenoid influences motion and direction of anterior cranium including frontals, ethmoid, maxilla, zygoma, vomer, and palatine bone.

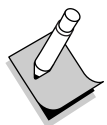
SACRAL MOTION

- Sacrum = midline bone. It moves on a transverse axis located at the level of S2 (in the area where the lamina might be if the sacrum had lamina).
- In flexion, the sacral base rises posteriorly and superiorly.
- In extension, the sacral base moves anteriorly and inferiorly.
- The base of the sacrum and base of the occiput move in the same direction. (See Figure 4-5.)

SPECIFIC BONE DYSFUNCTION

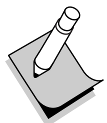
- Frontal bone dysfunction may often cause sinus congestion.
- Temporal bone dysfunction may cause tinnitus, vertigo, otitis, and migraines.
- Nine pairs of cranial nerves (CNs) are potentially influenced by temporal bone motion (CN III, IV, V, VI, VII, VIII, IX, X, and XI).
- Compression of condylar components in a newborn may cause feeding difficulties due to compression of CN XII.

Cranial Strain Patterns



***T**ight **S**kull **B**ones **R**eally **L**ike **V-S**pread techniques.*

- Types of strain patterns are **T**orsion, **S**idebending **R**otation, **L**ateral, **V**ertical, **S**BS compression.
- Strains can be palpated with either vault or anteroposterior (AP) contact.
- Two types of strain patterns: Physiological and nonphysiological.



When palpating strain patterns, do you note "healthy" flexion and extension? If yes, the strain pattern is probably physiological. If no, strain pattern is probably nonphysiological.

SPHENOBASILAR TORSION STRAIN PATTERN

(See Figure 4-6.)

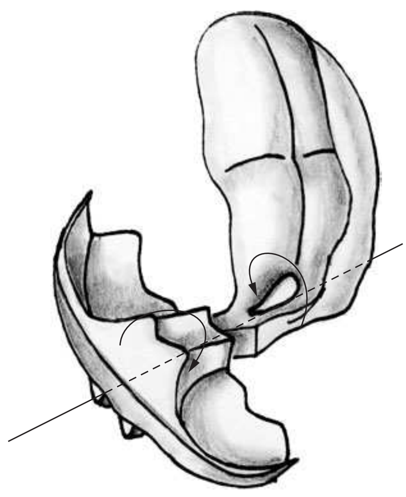


FIGURE 4-6. Torsion strain pattern.

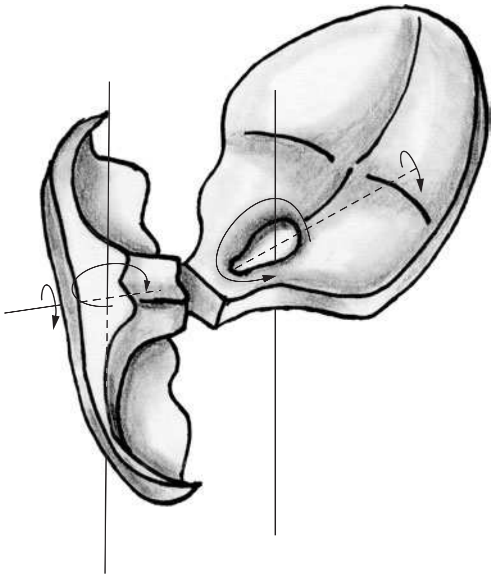


FIGURE 4-7. Sidebending-rotation strain pattern.

- Physiological strain pattern.
- Result in rotation of the sphenoid and occiput in opposite directions about a relative AP axis.
- Named for the "high" greater wing of the sphenoid.
- While palpating a right torsion using vault contact you will notice your right index finger is more superior (closer toward you) than your left. Your left 5th digit will be more superior (closer toward you) than your right.
- In the AP hold, you will appreciate a twisting in the flax such that one hand rotates one direction and the other hand rotates in the opposite direction.
- *Torsion = twisting* of dural membranes.

SIDEBENDING-ROTATION STRAIN PATTERNS

(See Figure 4-7.)

- Physiological strain pattern.
- Involve two main motions.
- Motion 1: Sphenoid and occiput rotate in same direction about one AP axis
- Motion 2: Sphenoid and occiput sidebend away from each other, such that "low" side forms a convexity and high side forms a concavity.
- Using vault contact to palpate a right sidebending rotation (SBR), the operator will note the fingers on the right hand separating from each other, while sensing a convexity or fullness on the right side. The left fingers will approximate and the left side of the head may feel "flat".
- Named for whichever side is low (down) and convex (out).

SBR strain patterns are named for whichever side is "down and out."

LATERAL STRAIN PATTERNS

(See Figure 4-8.)

- Nonphysiological (traumatic) strain pattern.
- Result when a force (e.g., a blow to the temples) causes a translatory motion of the body of the sphenoid in relation to the body of the occiput.
- Cause rotation of the sphenoid and occiput in the same direction on two vertical axes, after this translatory motion has occurred.

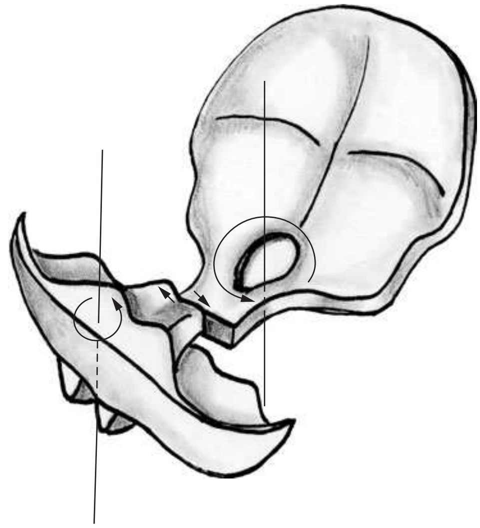


FIGURE 4-8. Lateral strain pattern.

- Named for the relationship of the base of the sphenoid in relation to the base of the occiput.

 Example: Your attending becomes upset and throws a chart at you, which hits you square in your left temple. The base of your sphenoid will be displaced to the right. When you have a fellow student work on your head later, they will appreciate the sphenoid being "carried" to right relative to the position of the occiput. This would be diagnosed as a right lateral strain.

The greater wings of the sphenoid may rotate in slightly different directions depending on the vector of the force causing the lateral strain. However, on board questions just worry about the base of the sphenoid in relation to the base of the occiput.

- This pattern may give a palpatory impression of a "parallelogram" head. In addition, these strains may result in the appearance of a parallelogram-shaped head in the newborn.
- May be difficult to detect flexion and extension of the cranial rhythmic impulse (CRI).

VERTICAL STRAIN PATTERNS

(See Figures 4-9 and 4-10.)

- Nonphysiological (traumatic) strain patterns.
- Result when a force causes a vertical (superior or inferior) displacement of the base of the sphenoid relative to the base of the occiput.

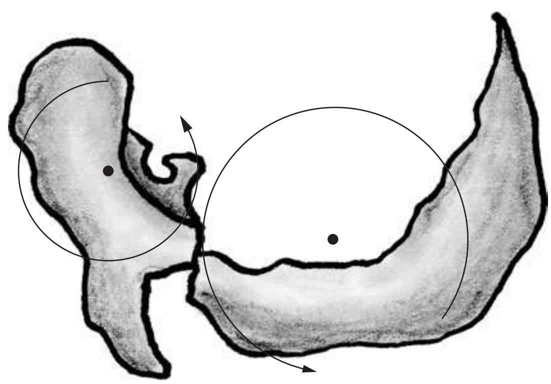


FIGURE 4-9. Vertical strain pattern.

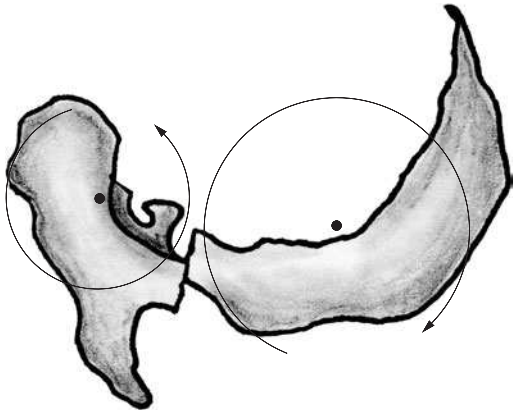


FIGURE 4-10. Vertical strain pattern.

- Cause rotation of the sphenoid and occiput in the same direction about two transverse axes.
- Named for position of the base of the sphenoid in relation to the base of the occiput.

Superior Vertical Strain

- Base of the sphenoid is superior to the base of the occiput (e.g., falling on the back of your head driving your occiput anterior and inferior).
- While palpating the patient using vault contact, the wings of the sphenoid will move forward and lateral, as if the sphenoid were in flexion, while the occiput is in extension.

Inferior Vertical Strain

- Base of the sphenoid is inferior to the base of the occiput (e.g., from standing up and hitting an open cupboard door after treating a patient in a tiny examination room).
- While palpating the patient using vault contact, the wings of the sphenoid will move superiorly and medial, as if the sphenoid were in extension, while the occiput is in flexion.

Sphenobasilar Synchondrosis (SBS) Compression

(See Figure 4-11.)

- Nonphysiological (traumatic) strain pattern.
- Results from the base of the sphenoid becoming compressed into the base of the occiput as a result of birth (i.e., face presentation), trauma (i.e., head on windshield), or sacral dysfunction (i.e., falling on sacrum).
- Flexion and extension are limited.
- Rate and amplitude will be decreased.
- On palpation using vault or AP contact, operator will note extremely restricted motion of the SBS. The operator may note no motion at all, suggesting a “bowling ball head.”
- Can be common in newborns due to compression of the head through the birth canal.
- CV4 may be useful treatment for this strain pattern.

Table 4-1 provides a summary of the various strain patterns.

Name vertical strains for the base of the sphenoid in relation to the base of the occiput, not the wings.

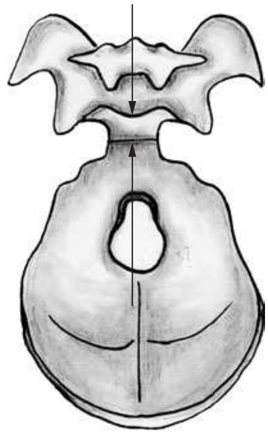


FIGURE 4-11. SBS compression.

TABLE 4-1. Strain Patterns

Pattern	Torsion	Sidebending rotation (SBR)	Lateral	Vertical	Sphenobasilar synchondrosis (SBS) compression
Physiological/ Nonphysiological	Physiological	Physiological	Nonphysiological	Nonphysiological	Nonphysiological
Sphenoid and occiput motion	Opposite directions about AP axis	Rotate same direction about AP axis, opposite directions about two transverse axes	Same direction about two vertical axes	Same direction about two transverse axes	Severely restricted motion
Named for	High greater wing of sphenoid (right or left)	Which side is convex and inferior (down and out), (full side of head) (right or left)	Base of sphenoid in relation to base of occiput (right or left)	Base of sphenoid in relation to base of occiput (superior or inferior)	Lack of motion
What you palpate using vault contact	R-torsion = R 1st and L 5th digits move freely superiorly. L 1st and R 5th digits move freely inferiorly. Twisted falx.	R SBR = R 1st and 5th digits spread and move inferior, (fullness)L 1st and 5th digits move closer and superior	R Lateral = Sphenoid translates freely R, base of sphenoid carried right in relation in occiput.	Superior = sphenoid in flex., occiput in ext.Greater wings move anteriorly and inferiorly. Inferior = sphenoid in ext., occiput in flex. Greater wings move superiorly and posteriorly	Limited motion, decreased amplitude and rate of CRI

Techniques

The following techniques are discussed in detail in Chapter 9:

Vault contact
AP contact
Sacral contact
V-spread
CV4 technique
Frontal lift

▶ REVIEW QUESTIONS: CRANIAL DIAGNOSIS

Questions 1–2

A 33-year-old patient comes to see you for osteopathic manipulative techniques (OMT). During your treatment, the patient tells you he has been feeling generally tired and fatigued recently. He has no previous trauma history, except a recent fall on the ice, but he didn't hit his head. You check his cranial motion and note a dramatic decrease in amplitude and rate of the CRI.

1. Which bone(s) involved in cranial motion may be responsible for these findings?
   A. Occiput
   B. Temporal bones
   C. Parietal bones
   D. Frontal bones
   E. Sacrum
2. What may be an appropriate treatment for this strain pattern?
   A. Frontal lift
   B. CV4
   C. V-spread
   D. Temporal balancing
   E. No treatment is necessary

Questions 3–4

A 28-year-old patient comes to see you after a several year history of indigestion, gas, and intermittent diarrhea. In addition to a thorough workup, you decide to examine the patient's cranial motion.

3. You are concerned that the _______ may be compressing CN _______.
   A. jugular foramen, IX
   B. jugular foramen, X
   C. jugular foramen, XI
   D. stylomastoid foramen, VII
   E. stylomastoid foramen, VIII
4. During normal flexion and extension, the occiput and sphenoid usually
   A. Rotate in the same direction about two transverse axes
   B. Rotate in the same direction about two vertical axes
   C. Rotate in the same direction about one AP axis
   D. Rotate in opposite directions about two vertical axes
   E. Rotate in opposite directions about two transverse axes

5. A patient comes to see you after having a cold for several days. During your examination, she mentions she has been very dizzy lately. What might you expect to find on cranial palpation?
   A. CRI rate of 26 per minute
   B. Internally rotated temporal bone
   C. Flexed parietal bone
   D. Externally rotated ethmoid bone
   E. Internally rotated sacrum
6. In motion testing your patient's head, you note the following findings: Your left index finger and pinky come together and move toward you, while your right index finger and pinky spread apart and move away from you. What strain pattern are you palpating?
   A. SBS compression
   B. Right torsion strain
   C. Right sidebending-rotation strain
   D. Superior vertical strain
   E. Right lateral strain
7. A patient comes to see you after complaining of headaches. While palpating the patient's cranium, you notice your left pinky and right index finger move superiorly. Which is true regarding this strain pattern?
   A. It involves rotation in opposite directions about two superior axes.
   B. It involves rotation in opposite directions about an AP axis.
   C. It is nonphysiological (traumatic).
   D. It is named for the relationship of the base of the sphenoid in relationship to the base of the occiput.
   E. It often results from a blow to the top of the head or under the chin.
8. Your classmate finds you at the hospital you both are rotating at after a demented patient gave him an uppercut to the chin. While palpating you note both wings of the sphenoid move freely inferiorly. Which statement is true regarding this strain pattern?
   A. It is named for the free motion of the wings of the sphenoid.
   B. The occiput and sphenoid rotate in the same direction about an AP axis
   C. This is a physiological strain.
   D. As the sphenoid flexes, the sacral base moves posterior.
   E. The occiput moves in the same direction as the sphenoid about two transverse axes.

▶ ANSWERS

1. **E**

Judging from the history and the presentation, a locked sacrum is most likely at the root of this patient's compression.

2. **B**

CV4 is a useful technique for increasing the overall rate and amplitude of the CRI.

3. **B**

The jugular foramen houses many structures, including CN IX, X, and XI. Judging from this person's complaints, the vagus nerve appears to be involved.

4. **E**

During flexion and extension, the sphenoid and occiput rotate in opposite directions about two transverse axes. If rotation about an AP or superior axis occurs, there is usually a strain pattern present. In vertical strain patterns, the sphenoid and occiput rotate in the same direction about two transverse axes.

5. **B**

Whenever you see tinnitus on a question involving cranial, the first bone that comes to mind should be the temporal bone.

6. **C**

This type of question is very common on boards. The question gives you information about what you are feeling using vault contact, and you must determine the strain pattern. Given the description of your fingers spreading and moving away from you on one side and approximating and moving toward you on the other, this sounds like a sidebending-rotation strain pattern.

7. **B**

This is a two-step question. First, you must determine the strain pattern based on the information given. Second, you must remember the motion and axes involved in this strain pattern. The description of one index finger and one pinky both moving superiorly should make you think of a torsion. Then, you must remember that torsions involve the sphenoid and occiput rotating in opposite directions about a relative AP axis. Choice A describes a sidebending-rotation pattern. We know a torsion is a physiological strain pattern, so we can rule out choice C. Choice D describes lateral and vertical strain patterns. Choice E describes vertical strain patterns.

8. **E**

This is another two-step question. We know from the history and examination that this is a superior vertical strain. Choice E is the only answer that fits this strain pattern. Choice A is incorrect, as these patterns are named for the base of the sphenoid. Choice B describes a sidebending-rotation strain pattern. We know a vertical strain is a nonphysiological strain pattern so we can rule out choice C. Choice D is incorrect because the sacrum follows the occiput, and we know that a superior vertical strain involves a flexed sphenoid with an extended occiput. Therefore, as the sphenoid flexes, the occiput extends. As the occiput extends, the sacral base moves anterior.

▶ CERVICAL DIAGNOSIS

Relevant Anatomy

BONY

OCCIPUT

(See Figure 4-4.)

- Occipital condyles are convex and converge anteriorly.
- Condyles glide anteriorly and posteriorly in the superior articulations of the atlas causing flexion and extension of the joint.

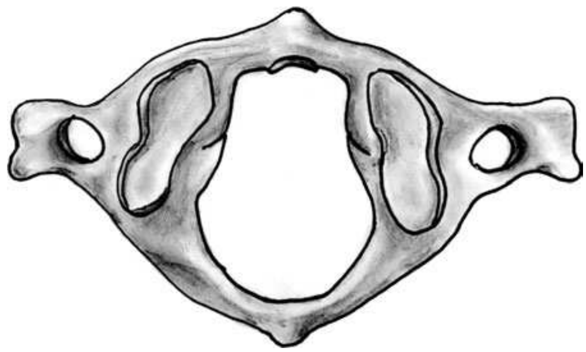


FIGURE 4-12. Atlas.

ATLAS

(See Figure 4-12.)

- Atypical cervical segment that lacks a body and spinous process.
- Superior articulations are concave to receive occipital condyles.

C2–C7

(See Figure 4-13.)

- Bodies contain uncinate processes—bodies appear concave in the coronal plane.
- Vertebral artery travels through transverse foramina.

MUSCULAR

POSTERIOR

Trapezius

- Originates on the occipital bone and all cervical and thoracic spinous processes.
- Inserts on the clavicle and scapula.

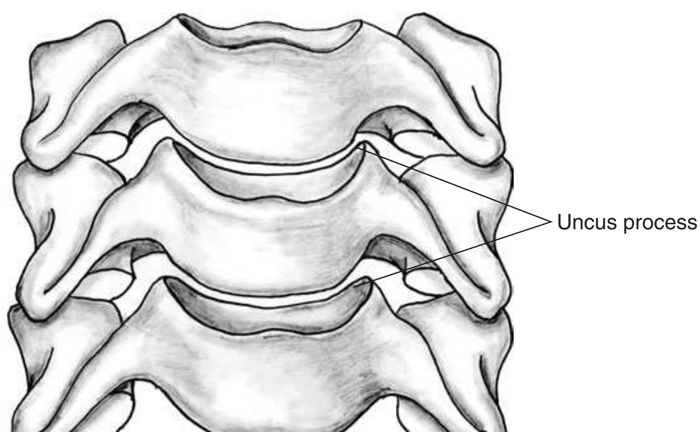


FIGURE 4-13. C2–C7.

Levator Scapulae

- Originates on the transverse process of upper cervical vertebrae.
- Inserts on superior, medial aspect of scapula.

Splenius

- Originates from upper thoracic and lower cervical spinous processes.
- Inserts on upper cervical transverse processes and the mastoid process of the skull.
- Extends, rotates, and sidebends to the same side.

Deep Muscles of the Neck (i.e., Erector Spinae, Semispinalis, and Multifidus)

- Have slips that run from the thoracic spine and rib angles to the cervical spine, occiput, and mastoid process.
- Mainly extend, but also rotate and sidebend the cervical spine.

Suboccipital Muscles

- Rectus capitus posterior major and minor
- Obliquus capitus superior and inferior
- Extend and rotate occipito-atlanto and atlanto-axial joints.

ANTERIOR

Sternocleidomastoid

- Originates on the sternum and clavicle.
- Inserts on the mastoid process of the skull.
- Flexes, sidebends, and rotates the head in opposite directions.

Scalenes

- Anterior, middle, and posterior
- Originate on transverse processes of cervical vertebrae.
- Insert on first (anterior and middle) and second (posterior) ribs.
- Flex and sidebend the neck.
- Brachial plexus and subclavian artery pass between anterior and middle scalenes.

The majority of the muscular anatomy in the neck has extensive thoracic as well as cervical attachments. Therefore, clinical treatment of the neck typically involves both the cervical and thoracic spine.

Prevertebral Muscles

- Longus capitis, longus coli, rectus capitus anterior, and lateralis
- Main action is flexion of the neck.
- May become strained in whiplash injury.

FASCIA

- Superficial cervical fascia—lymphatics must penetrate this fascia.
- Deep cervical fascia = investing, prevertebral, pretracheal.
- Pretracheal fascia is continuous with the carotid sheaths. Prevertebral fascia is continuous with the axillary sheaths (which surround the brachial plexus).

Treatment of this fascia is important in maintaining appropriate neurovascular flow of the neck.

NERVOUS

- There are eight cervical nerves.
- Nerves exit above the vertebrae, the eighth nerve exits below C7.

Active Range of Motion

- Flexion: 90°
- Extension: 70°
- Sidebending: 35° to 45°
- Rotation: 90°

Diagnosis

The cervical spine contains three major anatomical areas that each possesses different motion characteristics. Each area involves atypical Fryette mechanics, as traditional Type I and Type II motion are not found in the cervical spine.

Occiput on Atlas (C1)

This joint does not follow Type I Fryette's principles, as it rotates and sidebends in opposite directions whether in neutral, flexion, or extension.

- Major motion is flexion/extension
- Fifty percent of cervical flexion occurs at this joint
- Minor motion is sidebending and rotation

Diagnosis of the occiput on the atlas can be obtained using a simple set of steps.

- Step one: Motion test the occiput
  - This step lets you know how the occiput is moving as a whole, which helps narrow down your diagnosis.
  - Questions will typically give you some information about the motion of the occiput. Since you know the occiput rotates and sidebends in opposite directions, knowing one of these motions allows you determine the other.
- Step two: Determine area of greatest tissue texture change
  - Once you know the overall motion of the occiput, determining the side of greatest tissue texture change helps determine which side of the occiput is dysfunctional.

Example: If the occiput is rotated right, sidebent left, the dysfunction will either be a posterior (flexed) occiput on the right, or an anterior(extended) occiput on the left (one of these must be occurring to cause the occiput to rotate right and sidebend left).

- To help visualize this concept, think of a patient's head sidebent left and rotated right. The right part of the occiput is closer to the treatment table (posterior), while the left side of the occiput is closer to the ceiling (anterior). For boards, those are the only two diagnostic possibilities if the occiput is sidebent left and rotated right. The opposite would be true if the occiput is sidebent right and rotated left (i.e., left posterior or right anterior).
- If the tissue texture change is greatest on the right, we most likely have a posterior right occiput.
- If the tissue texture change is greatest on the left, we most likely have an anterior left occiput.

- Step three: Motion test each condyle individually
  - Determining the motion of each condyle helps confirm which side of the occiput is dysfunctional. In addition, if no information about tissue texture change is given, this may be the only way to determine the dysfunctional condyle.
  - Again, if we assume the occiput is rotated right and sidebent left, we will either have a posterior (flexed) occiput on the right or an anterior(extended) occiput on the left.
  - If the right condyle moves freely in flexion and extension, but the left condyle is restricted in flexion, we know, we have an anterior (extended) occiput on the left.
  - If the left condyle moves freely in flexion and extension, but the right condyle is restricted in extension, we know, we have a posterior (flexed) occiput on the right.

EXAMPLE 1

- The occiput is freer in left sidebending. This tells you the occiput is sidebent left and rotated right (the occiput always rotates and sidebends in opposite directions). This narrows the possible dysfunctions to two: posterior (flexed) right occiput or anterior (extended) left occiput.
- There is increased tissue texture change and tenderness on the right. This tells us the dysfunction is on the right, and since the only possible dysfunction we can have on the right given the motion of the occiput is a posterior (flexed) occiput, we know we have a posterior (flexed) occiput on the right.
- The left condyle moves freely in flexion and extension. The right condyle moves freely in flexion but resists extension. This confirms our diagnosis of a posterior (flexed) occiput.

EXAMPLE 2

- The occiput is freer in left rotation. This tells you the occiput is sidebent right and rotated left. This narrows the possible dysfunctions to two: posterior (flexed) left occiput or anterior (extended) right occiput.
- There is increased tissue texture change on the right. This tells us the dysfunction is on the right, and since the only possible dysfunction, we can have on the right given the motion of the occiput is an anterior (extended) occiput, we know we have an anterior (extended) occiput on the right.
- The left condyle moves freely in both directions. The right condyle moves freely in extension but resists flexion. This confirms our diagnosis of an anterior (extended) occiput.

TREATMENT TECHNIQUES

(See Chapter 9.)

- High velocity, low amplitude (HVLA): Occiput posterior (flexed)
- Muscle energy (ME): Occiput posterior (flexed)
- Indirect: Occiput posterior (flexed)

ATLAS (C1) ON AXIS (C2)

This joint does not have typical Fryette mechanics, as the majority of motion that occurs at this joint is rotation—very little sidebending occurs here.

- Major motion is rotation.
- Fifty percent of cervical rotation occurs at this joint.
- Minor motion is flexion and extension.

Diagnosis

- Since the primary motion at the atlas is rotation, diagnosis of the atlas involves flexion of the neck to "lock out" C2–C7, thus isolating the rotation of the neck to the atlas.
- The patient's head is rotated to the left and to the right. Freedom of motion is noted.
- If rotation to the right is greater than rotation to the left, the atlas is rotated to the right.

Treatment Techniques

- HVLA: Posterior atlas
- ME: Posterior atlas
- Indirect: Posterior atlas
- Facilitated positional release (FPR): Posterior atlas

C2–C7

- Rotation and sidebending occur to the same side regardless of whether the spine is in neutral, flexion, or extension.

Diagnosis

- Diagnosis of this region is determined by assessing motion in all three planes (i.e., flexion, extension, sidebending, and rotation).

Treatment Techniques

- HVLA: Dysfunction $C4FRS_R$
- ME: Dysfunction $C4FRSR_R$
- Indirect: Dysfunction $C4FRS_R$
- FPR: Dysfunction $C4FRS_R$

▶ REVIEW QUESTIONS: CERVICAL DIAGNOSIS

Questions 1–3

A 22-year-old female presents to the clinic with a complaint of headaches. After a negative workup, you diagnose her with tension headaches, and decide to use OMT as an adjunctive treatment.

1. While diagnosing her occiput, you notice it sidebends freely to the right. Both condyles move freely in flexion. You diagnose
   A. Right posterior (flexed) occiput
   B. Left posterior (flexed) occiput
   C. Right anterior (extended) occiput
   D. Left anterior (extended) occiput
   E. None of the above

2. What percentage of cervical flexion occurs at the occipito-atlanto joint?
   A. 10%
   B. 25%
   C. 50%
   D. 75%
   E. 100%
3. The major motion of the atlas is
   A. Flexion
   B. Extension
   C. Sidebending
   D. Rotation
   E. Nutation

Questions 4–5

A 45-year-old male presents to the clinic with history of migraines. After a negative workup, you decide to treat him using a combination of medication and OMT.

4. While palpating his occiput, you notice it rotates freely to the right. There is increased tissue texture change and tenderness over the left condyle. You diagnose
   A. Right posterior (flexed) occiput
   B. Left posterior (flexed) occiput
   C. Right anterior (extended) occiput
   D. Left anterior (extended) occiput
   E. None of the above
5. C2–C7 rotate and sidebend to the same side in which position(s).
   A. Flexion
   B. Extension
   C. Neutral
   D. All of the above
   E. None of the above

▶ ANSWERS

1. **B**

This question gives us little information, but enough to make the correct diagnosis. The occiput is sidebent to the right, therefore, it is rotated to the left. This gives us two choices, B and C. Since both condyles move freely in flexion, we can rule out choice C. An anterior occiput on the right would be restricted in flexion on the right, but free in extension. A left posterior occiput is free in flexion, but resists extension on the left.

2. **C**

Fifty percent of cervical flexion occurs at the occipitoatlantal (OA) joint.

3. **D**

The major motion of the atlas is rotation. The minor motions of the atlas are flexion and extension. Very little sidebending occurs at the atlas. **Nutation** refers to the forward nodding of the sacrum during craniosacral extension.

4. **D**

Again, the question is not exactly forthcoming, however, we have what we need to answer it correctly. If the occiput rotates to the right, it sidebends to the left. This narrows the choices down to A and D. If we have tissue texture changes over the left aspect of the occiput, we can rule out a right sided problem, leaving us with our answer. (Note: In reality, one cannot rule out a right-sided problem based on tissue texture changes alone. However, board questions tend to be straightforward in this manner.)

5. **D**

C2–C7 rotate and sidebend to the same side in flexion, extension, and neutral positions.

▶ THORACIC, RIB, AND DIAPHRAGM DIAGNOSIS

The thoracic region is integral to most SD. Problems in the upper thoracics can create or maintain dysfunction in the head, neck, and upper extremities. Problems in the lower thoracics can contribute to low back pain and even lower extremity complaints. Breathing and thus many lymphatic issues are centered here. Finally, given that sympathetic dorsal root ganglion are primarily located in the thoracic spine, viscerosomatic reflexes are an important consideration in this location. (See Chapter 6 for a review of viscerosomatic reflexes.)

Landmarks

Posterior

- C7—vertebra prominens
- T3—spine of scapula
- T7—inferior angle of scapula

Anterior

- Sternal notch at level of T2
- Sternal angle at level of T4
- Xyphoid process at level of T9

Rule of 3s

- **T1–T3**—spinous processes lie at level of same vertebral body
- **T4–T6**—spinous processes lie at level between associated vertebral body and one segment below
- **T7–T9**—spinous processes lie at level of the vertebral body one segment below
- **T10**—same as T7–T9, **T11**—same as T4–T6, **T12**—same as T1–T3

Diagnosis and Treatment

This section will be divided into three areas:

1. Thoracic spine
2. Ribs
3. Diaphragm

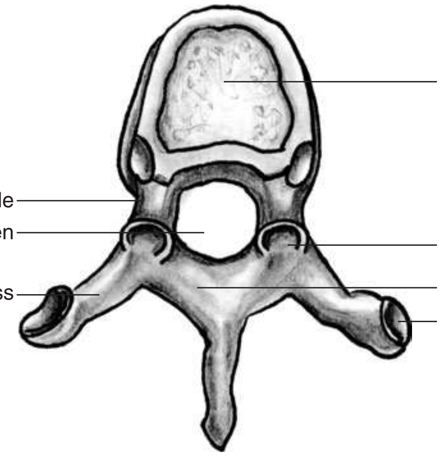


FIGURE 4-14. Anatomy of a thoracic vertebral segment.

THORACIC SPINE

RELEVANT ANATOMY

Bony

Twelve vertebrae

- All vertebral segments have the same basic architecture, which consists of a body, pedicles, laminae, transverse processes, superior and inferior facets, and a spinous process. (See Figure 4-14.)
- The orientations of the facet joints remain constant. The inferior articular facet of the vertebra above lies over the superior articular facet of the vertebra below (as viewed from behind) in the same way that roof shingles lie.

ACTIVE RANGE OF MOTION

- Flexion 20° to 45°
- Extension 25° to 45°
- Sidebending 20° to 40°
- Rotation 35° to 50°

DIAGNOSIS

When diagnosing the thoracic spine, any of the following may be observed:

- AP curves—**kyphosis**
  - An increased kyphosis is generally the result of poor posture or osteoporosis. The approach to this dysfunction would include prescribed exercises or PT to decrease progression of the curve. This may include activity to decrease shoulder protraction such as scapular retractions.
  - A flattened thoracic kyphosis generally leads to extension dysfunctions.
  - Kyphosis flattens with inhalation and increases with exhalation.
  - In general:
    - Flattened kyphosis → inhaled ribs
    - Increased kyphosis → exhaled ribs
- Lateral curves—Group dysfunction—Freyette's Type I—Neutral
  - Freyette's Type I: Sidebent and rotated to opposite sides. Neutral with regard to flexion/extension.

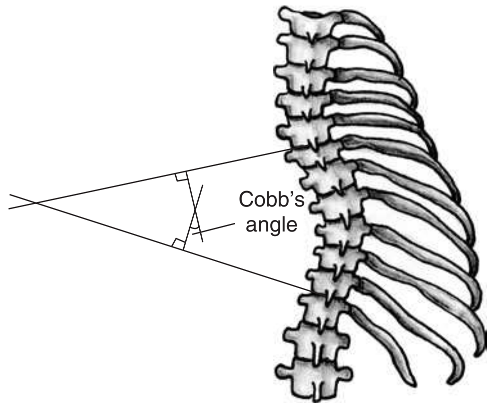


FIGURE 4-15. Cobb's method for determining the degree of scoliosis.

  - A lateral curve is often first detected on a standing structural exam. As the patient bends forward at the waist, a curve may be detected by finding asymmetric **paravertebral humping**. This humping may be due to the rotation of vertebral segments in a group curve. For instance, if one finds paravertebral humping in the right lower thoracic region, this may indicate a group curve, convex right. The vertebral segments are sidebent left, and rotated right. The right rotation causes the humping. Alternatively, paravertebral humping may be the result of muscle hypertrophy from a dominant hand and may not be associated with a lateral curve. Motion testing the area would help differentiate these two processes.
  - **Scoliosis**: By definition a curve is scoliotic if greater than 10°. Measurement of the curve is often done by Cobb's method. (See Figure 4-15.)
  - Scoliosis is named for the side of the convexity of the curve. In the example above, it would be named right thoracic scoliosis (dextroscoliosis) if it were greater than 10°.
  - Etiology of scoliosis:
    - Idiopathic (majority)
    - Congenital
    - Acquired (short leg and prosthesis)
  - Severity: Surgical intervention is generally indicated in thoracic curves of greater than 50°. Curves greater than this can compromise respiratory and eventually cardiovascular function.
  - Structural versus Functional: A functional curve is not yet fixed in place. A heel lift may immediately correct a functional curve, but will not correct a structural curve. As the patient is bent over, humping may decrease in a functional curve as the patient also sidebends. Humping will not decrease in a structural curve with this maneuver.
  - Treatment for scoliosis (especially in adults) is generally directed at reducing symptoms created by the curve. Most curves at this age are fixed. The main goal is often to stretch the concave side and to strengthen the convex side to help prevent worsening of the curve. From a segmental standpoint, the apex of the curve and crossover regions can be addressed with segmental techniques such as HVLA, ME, and FPR.
- Segmental dysfunction—Freyette's Type II—Nonneutral
  - Freyette's Type II—one vertebral segment involved, sidebent and rotated to the same side. Nonneutral, meaning there is a component of flexion or extension.

- Diagnosis of Type II lesions is determined by assessing motion in all three planes (i.e., flexion, extension, sidebending, and rotation). A multitude of various approaches to diagnosis exists. Use any that you are comfortable with.

TREATMENT TECHNIQUES

(See Chapter 10.)

ME for thoracic curve, convex left, T3–T7
HVLA (Kirksville krunch) for T4 extended, rotated left, sidebent left—$T4ER_LS_L$
Counterstrain for anterior and posterior thoracic tenderpoints

RIBS

RELEVANT ANATOMY

(See Figure 4-16.)

- Head—articulates with corresponding vertebra and vertebra above it. For example, rib 2 articulates with the superior part of the second vertebral body and the inferior portion of the first vertebral body.
- Neck—flattened portion between the head and the tuberosity.
- Tubercle—articulates with transverse process of corresponding vertebra – costotransverse articulation.
- Body or shaft—portion, which extends beyond the tubercle and articulates with the costal cartilage anterior.

EXCEPTIONS

- Ribs **1** and **10**—articulate with corresponding vertebra only
- Ribs **11** and **12**—articulate with corresponding vertebra only. In addition, they have no neck or tubercle and thus no costotransverse articulations.

CLASSIFICATION

- **True ribs** (1–7)—attached to sternum by their costal cartilage
- **False ribs** (8–10)—attached to costal cartilage of ribs above forming anterior costal margin
- **Floating ribs** (11 and 12)—no anterior connection, also considered **false ribs** by definition

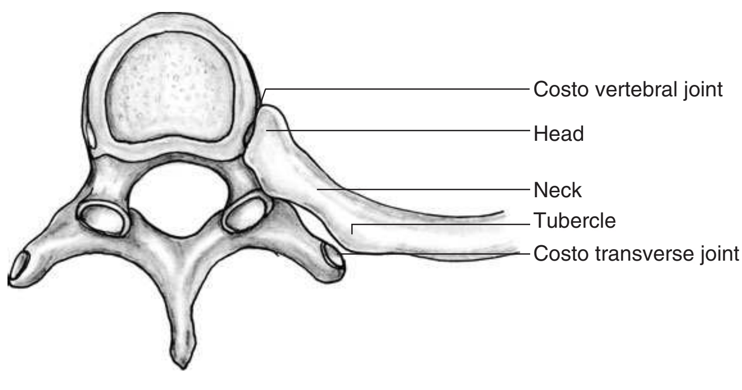


FIGURE 4-16. Anatomy of a typical rib.

DATABASE OF HIGH YIELD FACTS
REGIONAL DIAGNOSIS

Rib Motions

Pump Handle Motion

- Predominantly found in upper ribs.
- Anterior aspects of ribs move upward during inspiration.
- Increases anterior-posterior diameter of thorax.

Bucket Handle Motion

- Predominantly found in lower ribs.
- Lateral aspects of the ribs move upward with inspiration.
- Increases transverse diameter of thorax.

Caliper (Pincer Motion)

- Ribs 11 and 12
- External rotation with inspiration

Diagnosis

SD of ribs is typically classified into two groups:

1. Respiratory restrictions
2. Structural dysfunctions

Respiratory Restrictions

- **Inhaled ribs**—stuck in inhalation, do not move freely into exhalation (Figure 4-17)
- **Exhaled ribs**—stuck in exhalation, do not move freely into inhalation (Figure 4-18)
- **Key rib**—Often a group of inhaled or exhaled ribs are held restricted by one key rib.

You can think of the key rib as acting like a dam—it restrains the ribs behind it. So for a group of inhaled ribs 4–6, the bottom rib, sixth, is the key rib. It is stuck in inhalation and doesn't let the ones above it (4 and 5) move

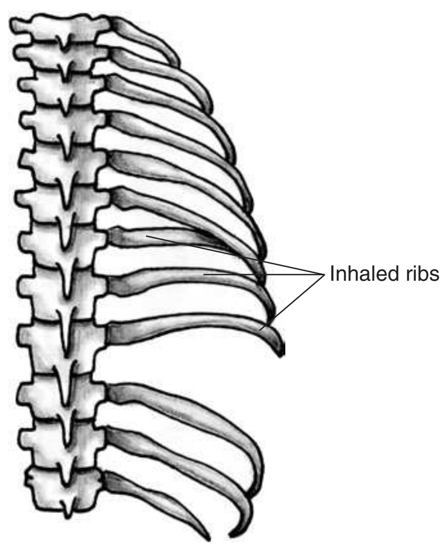


FIGURE 4-17. Inhaled ribs.

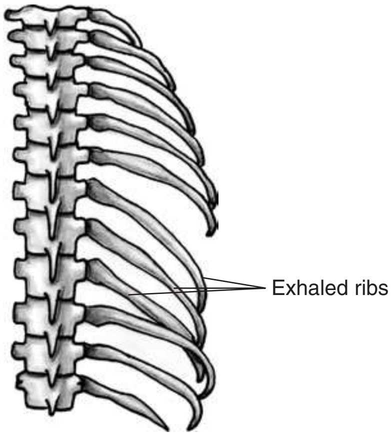


FIGURE 4-18. Exhaled ribs.

into exhalation. Conversely, for a group of exhaled ribs 7–10, the top rib, seventh, is the key rib. It stops the ones below it from going into inhalation. Another way to remember the position of the key rib is the mnemonic

BITE: Bottom Inhaled, Top Exhaled.

Structural Dysfunction

- **Anterior ribs—**prominence and tenderness of rib anteriorly
- **Posterior ribs—**prominence of rib angle posteriorly, tenderness and restriction of rib rotation to opposite side
- **Elevated first rib—**restriction to inferior motion and when pressing on the posterior aspect of the shaft of the rib. Often very tender

Rib angles are often a place where the tenderness and tissue texture change associated with viscerosomatic reflexes are found. To determine if the tissue texture change is due to a dysfunctional rib or a viscerosomatic may be difficult. Restriction to motion testing of the rib is evidence for a structural rib dysfunction.

TREATMENT

Respiratory Restrictions

- ME for exhaled ribs 1 or 2 on the left

Structural Dysfunction

- FPR for elevated 1st rib on the left

RESPIRATORY DIAPHRAGM

RELEVANT ANATOMY

(See Figure 4-19.)

ATTACHMENTS

- Sternal part—attached to xyphoid (inner surface)
- Costal part—attached to ribs 7–12
- Lumbar part—attached to medial and lateral arcuate ligaments (see below)
- Right crus—attached to bodies of L1–L3
- Left crus—attached to bodies of L1–L2

  All of the above insert into the central tendon

- Medial arcuate ligament—spans from body of L1 to transverse process of L1
- Lateral arcuate ligament—spans from transverse process of L1 to rib 12

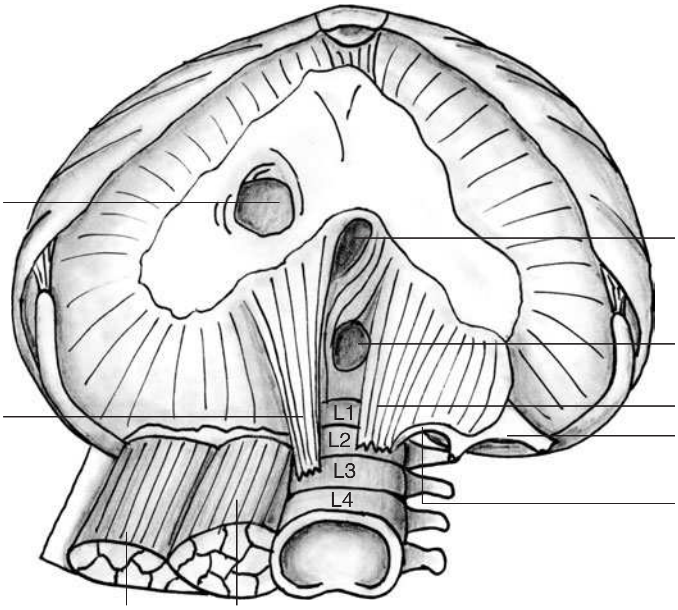


FIGURE 4-19. Anatomy of the respiratory diaphragm.

APERTURES

- T8—vena caval hiatus in central tendon → IVC and right phrenic nerve
  Dilates with inspiration allowing venous return
- T10—esophageal hiatus in muscular part → esophagus and vagus nerves
  Contracts with inspiration to prevent gastric reflux
- T12—aortic hiatus between crura → aorta, thoracic duct, azygos vein
  Not affected by inspiration

In addition to its role for lung inflation, the diaphragm also provides a very important pump for venous and lymphatic return. Contraction of the diaphragm during inhalation leads to the descent of the dome. This creates more space in the thoracic region, leading to a negative pressure or vacuum. The contraction also adds pressure to the abdominal cavity. A favorable pressure gradient for fluid return to the thoracic cavity is thus created with each inspiration.

DIAGNOSIS

Diagnosis of the diaphragm can be accomplished in many ways. Three common steps are listed:

- *Step one: Motion test diaphragm*
  - Patient seated. Physician behind patient (see Figure 4-20).
  - Physician passes his/her arms under patient's arms and around thorax to place fingers under subcostal margin anteriorly.
  - Fingers are slowly advanced up and under ribs as patient leans back into physician and slumps forward.
  - With the patient taking deep breaths, diaphragmatic tension is assessed as the fingers are further advanced up and under the rib cage.
- *Step two: Check for tight accessory muscles of respiration (scalenes, sternocleidomastoid).*

Normally these muscles are recruited for breathing with exertion only. Tightness in these muscles may be a result of poor diaphragmatic involvement. Some patients simply do not use their diaphragms well. Often this is secondary to stress.

- *Step three: Check for a flattening of the upper lumbar lordosis.*

FIGURE 4-20. Diaphragm diagnosis.

Due to its lumbar attachments, a contracted diaphragm will flatten this curve. This may be assessed visually, by palpation, or by a loss of spring in this region.

Treatment

- Address a flattened lumbar lordosis if it exists.
- Address myofascial restrictions in chest wall and abdomen.
- Teach the patient abdominal breathing in contrast to accessory muscle use.

(See Chapter 5.)

▶ REVIEW QUESTIONS: THORACIC/RIBS/DIAPHRAGM DIAGNOSIS

Questions 1–5

A 43-year-old female comes to your office with a complaint of diffuse "back pain," which is mostly in the "middle of the back." She denies any history of trauma. She denies radicular symptoms. You have seen her several times for urinary tract infections (UTI), and during this visit, she states that she has again had some pain with urination. She denies any flank pain or history of kidney stones. On physical examination, she is negative for costovertebral angle tenderness.

1. Based on her history where is the most likely place to find a sympathetic viscerosomatic reflex?
   A. S1–S2
   B. S2–S4
   C. C2
   D. T5–T9
   E. Thoracolumbar region
2. You have found an anterior counterstrain tenderpoint on the left at T10. Which of the following setups is most likely to work?
   A. Extension of the spine, rotation to the right with no sidebending
   B. Extension of the spine, no rotation and side bending to the right
   C. Flexion of the spine, rotation to the right with no sidebending
   D. Flexion of the spine, sidebending to the left
   E. Spine in neutral, sidebending to the left and rotation to the right
3. You have found a dysfunction in a group of ribs, 7–10, on the right. Compared to the left side, these ribs move well with exhalation, but not so well with inhalation. Which of the following best describes this situation?
   A. Inhaled ribs right, 7th rib is the key rib, primarily restricted in bucket handle motion
   B. Exhaled ribs right, 7th rib is the key rib, primarily restricted in bucket handle motion
   C. Exhaled ribs right, 10th rib is the key rib, primarily restricted in pump handle motion
   D. Inhaled ribs right, 10th rib is the key rib, primarily restricted in pump handle motion
   E. Exhaled ribs right, 10th rib is the key rib, primarily restricted in bucket handle motion
4. What additional SD might you expect to find in the region of T7–T10 for the above patient?
   A. Flattened kyphosis with extended thoracic dysfunctions
   B. Flattened kyphosis with flexed thoracic dysfunctions
   C. Increased kyphosis with extended thoracic dysfunctions
   D. Increased kyphosis with flexed thoracic dysfunctions
   E. Flattened kyphosis with flattened diaphragm
5. You find a dysfunction at the level of T7. The spinous process of T7 can be found at the level of which vertebra?
   A. T5
   B. T6
   C. T7
   D. T8
   E. T9

Questions 6–8

You are performing a standing structural examination on a 24-year-old female who comes to your office with a complaint of back pain and headaches, which she has had intermittently for a number of years. You notice that she has distinct paravertebral humping in the left thoracic region from T3 to T7. Motion testing confirms that a group curve exists, which corresponds to this paravertebral humping.

6. Which of the following best describes the expected findings at T4?
   A. Extended, sidebent right, rotated right
   B. Extended, sidebent left, rotated left
   C. Flexed, sidebent right, rotated right
   D. Flexed, sidebent left, rotated left
   E. Neutral, sidebent right, rotated left
7. The most common measurement or method to determine the degree of curvature on a plain x-ray is by which of the following?
   A. Ferguson angle
   B. Cobb method
   C. Q-angle
   D. Parallax method
   E. Pelvivertebral angle
8. By definition a curve is considered scoliosis if it has a curvature of at least how many degrees?
   A. 5°
   B. 10°
   C. 15°
   D. 20°
   E. 30°

▶ ANSWERS

Questions 1–5

1. **E**, 2. **D**, 3. **B**, 4. **D**, 5. **D**.

Based on her history of UTI, it is reasonable that she has some persistent viscerosomatic reflexes from the bladder. These reflexes may be sympathetic and/or parasympathetic. Parasympathetic reflexes for the bladder are found S2–S4, but the question asked specifically for sympathetic reflexes; this is the thoracolumbar region for the bladder, answer E. While C2 is a reflex for kidneys and ureters, this again is parasympathetic. Also, her history is more consistent with a UTI than with pyelonephritis or stones; she has no flank pain or costovertebral tenderness and a history of UTIs. For the counterstrain question you only need to know the general rule that for anterior points it takes flexion and sidebending to the same side (if it is not a midline point), answer D. An exhaled rib is one that goes easily into exhalation. Using the mnemonic BITE, the key rib is the top rib with exhaled ribs, which, in this case, is rib 7. These are lower ribs so they move in a primarily bucket handle motion. In addition, exhaled ribs are often found with an increased kyphosis and flexed thoracic dysfunctions in the area of the exhaled ribs. The spinous process of T7 can be found at the level of T8.

Questions 6–8

6. **E**, 7. **B**, 8. **B**.

T4 is part of the group curve. A group curve follows Freyette's Type I mechanics and so is neutral with respect to flexion and extension. It is also sidebent and rotated to opposite sides. In this case, humping is found on the left, so this is the side of rotation. Only one answer fits this description, answer E. All the other choices follow Type II mechanics. The degree of scoliosis is measured by Cobb's method, answer B. The Ferguson angle is also known as the lumbrosacral angle—answer A. The Q-angle deals with knee mechanics, answer C. The parallax method is used by radiologists to determine the depth of objects on films, answer D. The pelvivertebral angle measures the tilt of the pelvis with respect to the spinal column, answer E. And finally, scoliosis is defined by a curve of at least 10°, answer B.

▶ LUMBAR DIAGNOSIS

Relevant Anatomy

BONY

(See Figure 4-21.)

- Five lumbar vertebrae.
- Facets angled toward the sagittal plane, allows for maximum flexion and extension.
- Normal lumbar curve is lordotic.
- Large vertebral bodies. Long, slender transverse processes point laterally. Round, blunted, spinous processes point posteriorly.

MUSCULAR

ERECTOR SPINAE

- **I**liocostalis, **l**ongissimus, and **s**pinalis (I Like Spaghetti).
- Primarily extend spine.
- Also sidebend and rotate to ipsilateral side.

MULTIFIDUS

- Predominant in the lumbar region.
- Extend and sidebend to the ipsilateral side.
- Rotate to the opposite side.

The deep back muscles contain more muscle spindles (which sense stretch) and sensory innervation than the larger, superficial back muscles. In addition, they are more likely to become strained. With this combination they are likely a significant cause of musculoskeletal back pain.

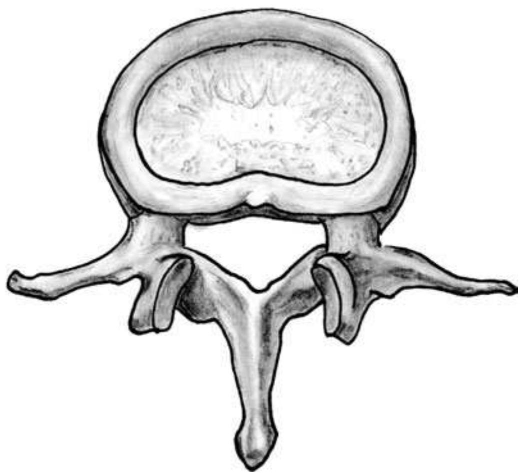


FIGURE 4-21. Lumbar vertebrae.

PSOAS

- Attaches to the anterior aspect of vertebrae T12–L5.
- Combines with the iliacus.
- Inserts on lesser trochanter of the femur.
- Flexes hip. If feet are fixed, flexes trunk. Also laterally flexes vertebral column to the ipsilateral side.
- Major pelvic stabilizer, tonically contracted while standing.
- Extremely common source of low back pain.

QUADRATES LUMBORUM

- Attaches to the iliac crest and iliolumbar ligament.
- Inserts on inferior aspect of the 12th rib, as well as transverse processes of vertebrae 1–4.
- Flexes vertebral column to the ipsilateral side, also fixes 12th rib during inspiration.
- Major stabilizer of the pelvic girdle.

RESPIRATORY DIAPHRAGM

(See Thoracic Diagnosis.)

LIGAMENTOUS

- The iliolumbar ligament attaches to the iliac crest and the transverse processes of L4–L5.
- Results in decreased mobility of L4 and L5 compared to the upper three lumbar vertebrae.
- Dysfunction of the iliolumbar ligament can produce a wide array of referred pain patterns.

NERVOUS

- Spinal cord typically ends near the L2 level.
- Preganglionic sympathetic cell bodies are found in upper lumbar segments of the spinal cord (L1–L2).
- Pain stimulus travels along sympathetic fibers to spinal cord via white rami communicantes, which begin in the upper thoracic levels and terminate at the upper lumbar levels.
- Several nerves of the lumbar plexus pass in close proximity to the Iliopsoas complex.
- The genitofemoral nerve passes directly through psoas major muscle; therefore, psoas tension can cause anterior thigh or groin symptoms.

Diagnosis

Low back pain can be caused by several different mechanisms. The history and physical examination should clue you in as to whether the pain is neurological, musculoskeletal, arthritic, inflammatory, and so on. Diagnosis of the lumbar spine involves active and passive range of motion, a standing structural examination including screening for group curves, single segment motion, psoas evaluation, and a seated flexion test. If sacroiliac dysfunction is present, chances are good lumbar SD is present as well.

(See section on sacral diagnosis for more on lumbosacral junction.)

The lumbar spine may exhibit either Type I or II mechanics.

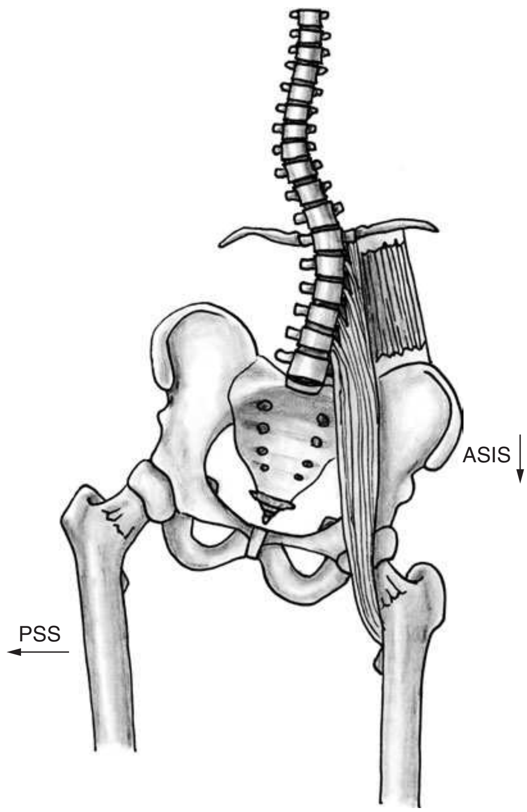


FIGURE 4-22. Functional short leg.

TYPE I MECHANICS

- Often due to short leg or scoliosis.

(See Thoracic Diagnosis for more on scoliosis.)

SHORT LEG MECHANICS

- Two types: anatomical and functional
- Functional short leg is commonly a result of trauma (usually a myofascial problem).
- Anatomical short leg is typically congenital (usually a bony problem).

FUNCTIONAL SHORT LEG

(See Figure 4-22.)

- Length discrepancy causes sacral base unleveling and pelvic sideshift to the long leg side, allowing the long leg to burden the added weight of the trunk.
- A lumbar group curve develops convex to the short leg side.
- The sacrum sidebends to the short leg side. Since the sacrum rotates and sidebends in opposite directions, the sacrum will rotate away from the short leg leaving a deep sulcus on the short leg side.
- Seated flexion test will be positive on the short leg side.

(See Table 4-2 for further anatomic findings related to a short leg.)

TABLE 4-2. Manifestations of a Short Leg

STRUCTURE	MANIFESTATION
Lumbar spine	Convex on short leg side
Sacral sulcus	Deep on short leg side
Sacral ILA	Posterior on short leg side
Innominate	Anterior on short leg side
Psoas	Hypertonic on short leg side
Quadratus	Hypertonic on short leg side
Piriformis	Hypertonic on long leg side
Gluteus medius	Hypertonic on short leg side

STRUCTURAL SHORT LEG

- This dysfunction causes a similar pattern as described above for functional short leg. However, it is due to an inequality in the leg length of either the femur or tibia. It is usually congenital; therefore, if the problem is diagnosed early in life, a heel lift can help alleviate the development of these symptoms. However, if the inequality is left undiagnosed for years, these dysfunctions can become chronic and difficult to resolve.

  Type II mechanics related to single segment dysfunction

- Flexed, sidebent, and rotated to the same side. Often found with a decreased lordosis of the lumbar spine.
- Flexed upper lumbar dysfunctions are associated with a hypertonic psoas. You may find a flexed lumbar segment rotated and sidebent to side of the hypertonic psoas.
- Extended, sidebent, and rotated to the same side. Common with an increased lumbar lordosis.

In addition to SD, there are several anatomic variations that, when present, can produce low back pain.

SACRALIZATION OF L5

- L5 fuses either partially or completely with the sacrum. This causes limited motion at the lumbosacral junction.

LUMBARIZATION OF S1

- S1 fails to fuse with the remainder of the sacrum. This results in greater mobility at the lumbosacral junction, which may lead to instability in this region.

BAT WING DEFORMITY

- Results from enlargement of the transverse processes of L5. This may lead to limited motion at the lumbosacral junction.

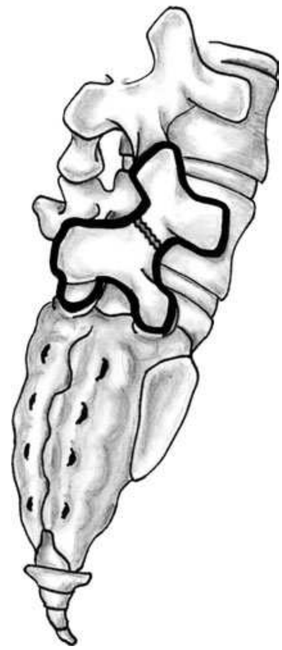


FIGURE 4-23. **The Scottie dog.**

On x-ray this appears as a "collar" on a "Scottie dog."

SPONDYLOLYSIS

- Fracture of the pars interarticularis. May happen unilaterally or bilaterally. If bilateral, results in forward slippage of the anterior aspect of the vertebrae. (See Figure 4-23.)

SPONDYLOLISTHESIS

- Anterior slippage of one vertebra in relation to the vertebrae below (often occurs at L5 on S1). Graded according to the percentage of slippage (see Figure 4-24).
  - Grade 1 1–25%
  - Grade 2 26–50%
  - Grade 3 51–75%
  - Grade 4 76–100%

SPINAL STENOSIS

- Narrowing of the intervertebral foramina causes nerve root irritation and radicular symptoms.

HERNIATED DISC

- Caused by a tear in the annulosis fibrosis. Irritation to the nerve root exiting below the disc is caused by mechanical compression or chemical irritation from the nucleus pulposis. Example: An L4 nerve root is irritated by the L3 disc.

Treatment Techniques

(See Chapter 10.)

- HVLA lateral recumbent for Type II dysfunction, T10–L5
- Counterstrain, anterior L1–L5 (AL1–AL5)

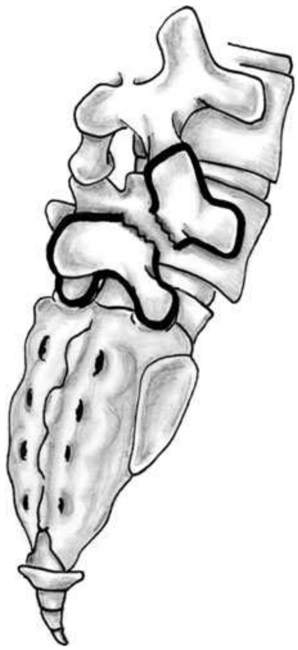


FIGURE 4-24. Spondylolisthesis.

- Counterstrain, posterior L1–L5 (PL1–PL5)
- Facilitated positional release, extended SD
- Facilitated positional release, extended SD
- HVLA: Leg pull dysfunction: Short leg
- ME: Psoas muscle spasm

▶ REVIEW QUESTIONS: LUMBAR

A 34-year-old male presents to the clinic with a 2-day history of low back pain after traveling 8 hours in the car recently. The pain is focal, bilateral, dull, and constant. After a negative workup, you decide to treat this patient using OMT.

1. On examination, you notice the seated flexion test is positive on the right, pelvic sideshift is positive left, and the lumbar spine has a decreased lordosis. The sacrum is rotated to the left on a left oblique axis. What muscle do you suspect is contributing to these findings?
   A. Hypertonic psoas on the right
   B. Hypertonic psoas on the left
   C. Hypertonic iliocostalis on the right
   D. Hypertonic iliocostalis on the left
   E. Hypertonic multifidus on the left

2. What other SD might you expect to find in the upper lumbar segments?
   A. Extended, rotated right, sidebent right
   B. Extended, rotated left, sidebent left
   C. Flexed, rotated right, sidebent right
   D. Flexed, rotated left, sidebent left
   E. Flexed, rotated left, sidebent right

3. You note the patient has an anterior counterstrain tenderpoint at the area corresponding to L1. Where would you monitor this point when treating with counterstrain?
   A. Over the anterior superior iliac spine (ASIS)
   B. Over the medial aspect of the anterior inferior iliac spine (AIIS)
   C. Over the lateral aspect of the AIIS
   D. Over the umbilicus
   E. Over the pubic tubercle
4. To treat the above point using counterstrain, how is the patient positioned?
   A. Prone
   B. Supine
   C. On the left side
   D. On the right side
   E. Seated
5. The patient also complains of anterior thigh and groin pain. What nerve would you suspect is irritated?
   A. Iliohypogastric
   B. Ilioinguinal
   C. Subcostal
   D. Genitofemoral
   E. Obturator

▶ ANSWERS

1. **A**

Given the sideshift, sacral motion, and decreased lordosis you should suspect a psoas issue on the right side as a contributing factor. Remember, a tight psoas compresses the SI joint and lumbar spine on that side. Therefore, you may get a lumbar convexity on that side. If the convexity is on the right, the sacrum will sidebend to the right to accommodate the curve. The sacrum rotates and sidebends to opposite sides, therefore, it will rotate to the left on a left oblique axis. Regardless, neither a tight iliocostalis nor multifidus should produce this constellation of findings.

2. **C**

A tight psoas may result in a flexed upper lumbar Type II lesion. Typically, you will find a flexed segment rotated and sidebent to the side of the tight psoas.

3. **A**

According to *Foundations of Osteopathic Medicine*, the anterior lumbar tenderpoints are located as follows: **AL1**: medial side of ASIS, press laterally, **AL2**: medial side of AIIS, press laterally, **AL3**: lateral side of AIIS, press medially, **AL4**: inferior side of AIIS, press cephalad, **AL5**: anterior surface of pubic rami approximately 1 cm lateral to pubic symphysis and inferior to tubercle, press posteriorly.

4. **B**

Treatment of anterior lumbar tenderpoints occurs with the patient supine.

5. **D**

While several nerves from the lumbar plexus pass in close proximity to the psoas muscle, the genitofemoral nerve actually passes through the belly of the muscle itself. Therefore, of the above nerves, the genitofemoral is the most likely to cause this patient's symptoms.

▶ SACRUM AND PELVIS DIAGNOSIS

Sacrum

Relevant Anatomy

- Formed from five fused vertebrae.
- The sacrum has two L-shaped articulations it shares with the ilium.
- The sacrum glides along this L-shaped articulation. (See Figures 4-25, 4-26, 4-27, 4-28.)

Unique Terminology

- Nutation—a forward nodding of the sacrum with the sacral base moving anteriorly and inferiorly and the sacral apex moving posteriorly and superiorly.
- **Counternutation**—the sacral base moves posteriorly and superiorly and the sacral apex moves anteriorly and inferiorly.

Sacral Motion

- The sacrum moves about three transverse axes: superior, middle, and inferior.
- Superior transverse axis: site of respiratory or craniosacral flexion or extension of the sacrum
- Middle transverse axis: site of anatomical sacral flexion and extension
- Inferior transverse axis: site of innominate motion on the sacrum
- Oblique Axes: Physiological axes created as a result of changes in weight bearing. Run from the superior articular surface on one side of the sacrum

***CRAIN**—from superior to inferior—**C**ranial/**R**espiratory **A**natomical **I**nnominate.*

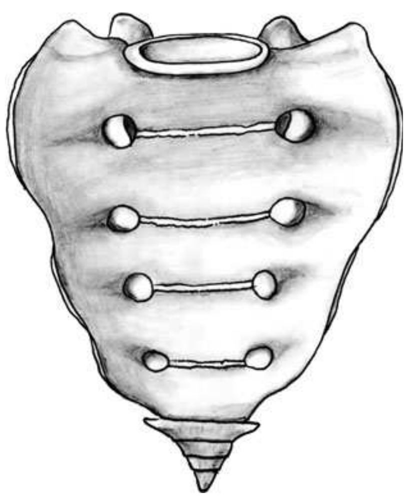


FIGURE 4-25. Sacrum—anterior view.

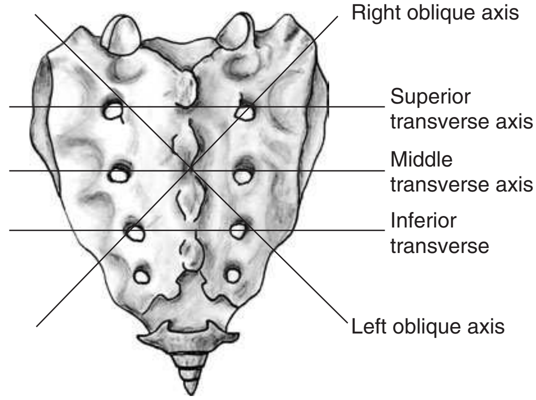


FIGURE 4-26. Sacrum—posterior view.

FIGURE 4-27. Sacrum—lateral view.

FIGURE 4-28. Sacrum—sagital view.

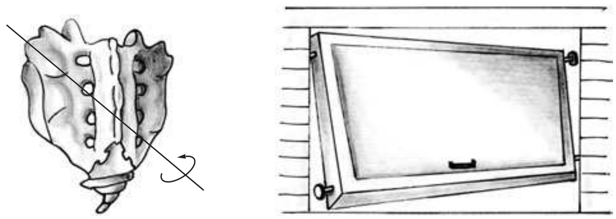


FIGURE 4-29. Sacral motion.

to the inferior pole on the opposite side of the sacrum. There are two oblique axes: Right and left. The oblique axis is named for the superior aspect of the sacrum of which the axis travels.

- To get a better handle on sacral rotation about the oblique axes, think of the sacrum like a garage door. The two superior corners of the garage door are the sacral sulci, while the two inferior corners of the garage door are the ILA of the sacrum. (See Figure 4-29.)
- The garage door glides in two tracks on either side, just like the sacrum glides in two L-shaped articulations.
- Now, think of a garage door that gets jammed such that the superior left and the inferior right corner of the garage door get stuck. Meanwhile, the superior right corner and inferior left corner come off the tracks.
- Since the superior left and inferior right corners cannot move, if the door starts to fall forward at the top, the superior right corner falls forward, while the inferior left corner moves toward you. The "jammed" aspects of the garage door equal the "engaged" axis of the sacrum.
- Now replace the garage door with a sacrum. The right sulcus is deep or anterior (away from you), while the left ILA is posterior (toward you). The sacrum is named for the anterior superior aspect of the bone (as is any vertebrae); therefore, the sacrum is rotated to the left.

Remember, the oblique axis is named for the superior aspect of the sacrum through which it travels—in this case the left oblique axis.

DIAGNOSIS

Diagnosis and treatment of the sacrum is a favorite topic on boards. One difficulty with this area is the different terminologies used to describe sacral dysfunction at different osteopathic medical schools. Two main types of frameworks exist to describe sacral mechanics: sacral torsions and the anterior/ posterior sacrum model. The majority of osteopathic schools teach the torsion model; however, the anterior/posterior sacral model is the primary model for a minority of osteopathic schools, therefore it is included here. The main point to keep in mind is not to confuse the two models. They are separate because the reference point is different for each of them.

One way questions on boards avoid this issue is by focusing on sacral motion about the oblique axes, which is common to both frameworks. Therefore, the goal with any sacral question should be to establish which direction the sacrum is moving about which oblique axis, that is, rotated right about a right oblique axis, and the like. From there, any further information needed to answer a sacrum board question can usually be obtained easily.

Once you figured out which way the sacrum rotates around which axis, you should be able to answer almost any sacrum question regardless of which model you learned.

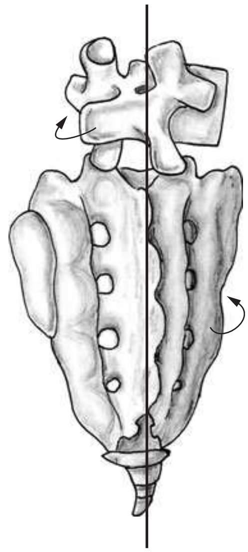


FIGURE 4-30. Torsion.

SACRAL TORSION MODEL

- The most common model used to describe sacral mechanics.
- The point of reference for this model is the sacrum in relation to L5. Therefore, all sacral diagnoses are named in reference to L5.
- Torsion means twisting. In a sacral torsion, the sacrum is *always* rotated in the opposite direction of L5. (See Figure 4-30.)
- It is helpful to think about diagnosis of the sacrum in this model following a specific set of steps. The typical test question will provide information about some of these steps, then require you fill in the remaining blanks in order to answer the question.
- Step one: Diagnose L5
  - This is a crucial step for diagnosing sacral torsions. The diagnosis of L5 will determine whether you have a forward or backward torsion.
  - If L5 is in neutral mechanics, you will have a forward torsion.
  - If L5 is in nonneutral mechanics, you will have a backward torsion.
  - The side to which L5 is sidebent determines the axis about which the sacrum rotates. For example, if L5 is sidebent left, the left oblique axis is engaged (the garage door is jammed on the superior left side) (see Figure 4-31).
- Step two: Seated flexion test
  - The seated flexion test indicates there is sacroiliac dysfunction on the side of a positive test.
  - A negative test indicates two things: (1) There is no sacroiliac dysfunction. (2) The test is actually falsely negative, meaning the SI joints are restricted bilaterally. This happens with bilateral sacral flexions and extensions.
  - With a torsion, the seated flexion test will be positive on the side *opposite* the engaged oblique axis. For example, in a forward torsion rotated right on a right oblique axis, the seated flexion test will be positive on the left.
- Step three: Check sulcus depth
  - Determine which sulcus is deeper. Remember, forward torsions result in a deep sulcus on one side. Backward torsions result in a shallow sulcus on one side. Sulcus asymmetry rules out a bilateral sacral flexion or

*One **N** Forward, Two **N**s Back*
***N**eutral = forward torsion*
***n**on**n**eutral = backward torsion*

The sidebending of L5 determines the oblique axis.

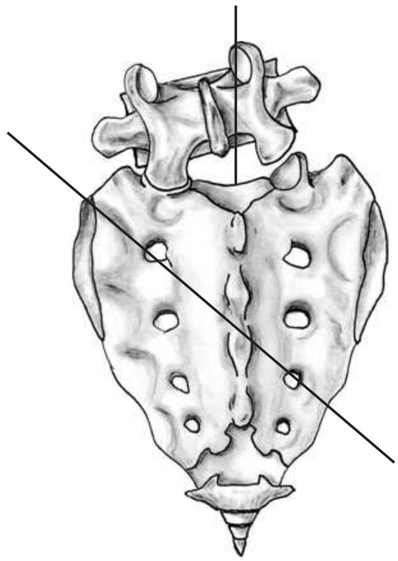


FIGURE 4-31. Torsion.

extension. In addition, forward torsions are typically symptomatic (increased tissue texture change and tenderness) over the deep sulcus, while backward torsions are typically symptomatic over the shallow sulcus.

- Step four: Check for posterior ILA
  - This step rules in or out the less common sacral dysfunctions, like sacral flexions and extensions. For example, if the posterior ILA is on the *same* side as a deep sulcus, you have a unilateral sacral dysfunction. If the posterior ILA is on the *opposite* side of the deep sulcus, you know you will have a forward or backward torsion. See below for more on other sacral diagnoses.
- Finally: Determine type of sacral rotation and oblique axis
  - This should be the goal of each sacral board question. Using the above four steps, you should be able to come up with a diagnosis. However, it is critical to think about the diagnosis in terms of rotation about an oblique axis, as this is what board questions commonly ask.
  - Knowing if you have a forward or backward torsion helps determine the type of rotation and axis.
  - Forward torsions are *always* rotated right about a right axis or rotated left about a left axis.
  - Backward torsions are *always* rotated right about a left axis or rotated left about a right axis.
  - Remember, the *sidebending* of L5 determines the *axis*.
  - The *rotation* of L5 determines the *rotation* of the sacrum (opposite).

Two additional tests you may see on boards are the lumbosacral spring test and the backward bending (or sphinx) test.

LUMBOSACRAL SPRING TEST

- This information helps confirm whether you are dealing with a forward or backward torsion. In the absence of information regarding L5, this can be the only information you receive about the lumbar spine.
- A positive test indicates *no* spring. This means the sacrum is in relative extension while L5 is in relative flexion. This is suggestive of a backward torsion, unilateral sacral extension, or bilateral sacral extension.

WARNING: Some test questions will not describe a shallow sulcus. Instead, they will describe the sulcus opposite a shallow sulcus as being "deep." For example, a shallow sulcus on the right will be described as a deep sulcus on the left. The left sulcus is not necessarily deep, it is just deep relative to the right sulcus.

For example, if L5 is sidebent left and rotated right, you suspect you have a forward torsion (neutral mechanics), the left oblique axis is engaged (sidebent left) and the sacrum is rotated to the left (L5 is rotated right); therefore, the sacrum is rotated left on a left oblique axis.

*Remember the steps involved with diagnosing torsions: **D**iagnosing **S**acral **T**orsions **S**ucks **I**mmensely. **D**iagnose L5, **S**eated flexion **T**est, **S**ulcus depth, **IL**A.*

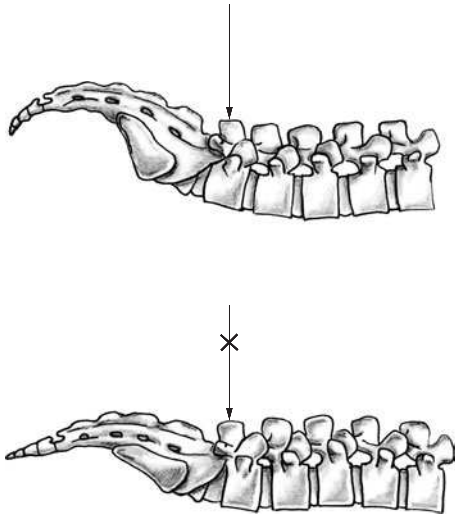


FIGURE 4-32. Lumbosacral spring test.

A positive lumbosacral spring test is abnormal. Normally, the lumbar spine is lordotic, and pressing on the lumbosacral junction should provide some "give." If the sacrum is extended and L5 is flexed, this lordotic curve is reversed. Therefore, pressing on the lumbosacral junction provides no give. (See Figure 4-32.)

*Remember: **N**egative = **n**ormal (normal lordotic curve) **P**ositive = **p**athology (reversed lordotic curve).*

- A negative test indicates there *is* spring at the lumbosacral junction. Therefore, the sacrum is in relative flexion. This is a normal finding but may also be suggestive of a forward torsion, unilateral sacral flexion, or bilateral sacral flexion.
- If you are given information about L5 and the lumbosacral spring test, you should already suspect, whether or not, you are dealing with a forward or backward torsion. The remaining steps help determine which type of rotation and axis you are dealing with, as well as rule out the other sacral problems such as sacral flexions and extensions.

Backward Bending/Sphinx Test

- A patient lying prone is asked to extend their back and rest on their elbows (see Figure 4-33). In a forward torsion, the sulcus asymmetry improves (more symmetrical). In a backward torsion, the sulcus asymmetry worsens (less symmetrical).

FIGURE 4-33. Backward bending/sphinx test.

EXAMPLE 1

- L5 is sidebent right and rotated left. This gives you a lot of information. You suspect a forward torsion, the right oblique axis should be engaged, and the sacrum should be rotated to the right.
- Seated flexion test is positive on the left. This goes along with a forward torsion rotated right on a right oblique axis. A positive test also rules out a bilateral sacral dysfunction.
- There is a deep sulcus on the left. This helps confirm the sacrum is rotated to the right, although there could still be a unilateral sacral dysfunction. The sulcus asymmetry also rules out a bilateral sacral dysfunction.
- The right inferior lateral angle (ILA) is posterior. This rules out a unilateral sacral dysfunction and confirms the sacrum is rotated to the right on a right oblique axis.

EXAMPLE 2

- L5 is sidebent and rotated to the right. This tells us we most likely have a backward torsion, the right oblique axis is engaged, and the sacrum is rotated to the left.
- Seated flexion test is positive on the left. This fits with a backward torsion rotated left on a right oblique axis.
- Lumbosacral spring test is positive. This helps to confirm we're dealing with a backward torsion and rules out a unilateral/bilateral sacral flexion.
- The right sulcus is deep. Keep in mind, all this means is the right sulcus is deeper than the left. Therefore, we could interpret this to mean the left sulcus is shallow. This fits with our presumptive diagnosis of a backward torsion, rotated to the left on a right oblique axis. Additionally, the sulcus asymmetry rules out a bilateral sacral dysfunction.
- The left ILA is posterior. This rules out a unilateral sacral dysfunction, as the deeper sulcus and posterior ILA are on opposite sides.
- As we suspected, we have a backward torsion, rotated to the left on a right oblique axis.

ANTERIOR/POSTERIOR SACRUM MODEL

- The point of reference for this model is the sacrum in relation to the *innominate*. Therefore, all sacral diagnoses are named in reference to the innominate. An anterior sacrum is *anterior* to the innominate. A posterior sacrum is *posterior* to the innominate. (See Figure 4-34.)
- As with the torsion model, diagnosis of the sacrum in this model follows a specific set of steps. Some of this information will be given in the questions. You must then determine the diagnosis and motion about the oblique axis.
- Step one: Seated flexion test
  - This test is the *first* step to diagnose the sacrum in this model. This tells you which side of the sacrum the dysfunction is on. Period. It tells you *nothing* about the type of dysfunction.

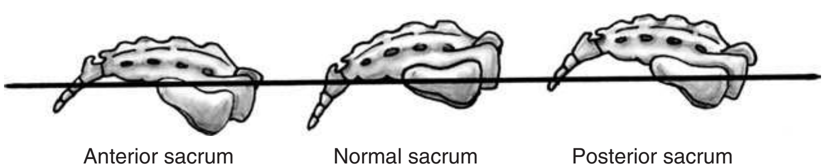


FIGURE 4-34. Anterior, normal, and posterior sacrum.

- Step two: Check sulcus depth
  - Determine which sulcus is deeper. Sulcus asymmetry also rules out bilateral sacral flexions and extensions.
- Step three: Check for posterior ILA
  - This step rules in or out unilateral sacral flexions and extensions. For example, if the posterior ILA is on the *same* side as a deep sulcus, you have a unilateral dysfunction. If the ILA is on the *opposite* side of the deep sulcus, you know you have an anterior or posterior sacrum.
- Step four: Determine area of greatest tissue texture change
  - If the greatest area of tissue texture change is over the deep sulcus, you have an anterior sacrum on that side. If there is tissue texture change over the posterior ILA, you have a posterior sacrum on that side.
  - "What if the seated flexion test is positive right, there is a deep sulcus on the right, but the area of tissue texture change is over the posterior ILA on the left?" This could happen clinically, but is avoided on boards, as it would confuse everyone.
  - In bilateral sacral flexions and extension, there will be tissue texture changes bilaterally.

One difference between this model and the torsion model is once you know the rotation and axis of the sacrum there are two possible diagnoses. For example, if the sacrum is rotated right on a right oblique axis, you either have an anterior left or posterior right dysfunction. Use the seated flexion test to determine which one is present.

- Finally: Determine type of sacral rotation and oblique axis
  - Again, using the above four steps, you should be able to come up with a diagnosis. However, it is critical to think about the diagnosis in terms of rotation about an oblique axis, as this is what board questions commonly ask.
  - In the anterior/posterior sacrum model, this step is actually quite easy. Since backward torsions are not described in this model, there is *never* right rotation about a left oblique axis or left rotation about a right oblique axis.

*Remember the steps involved with diagnosing anterior/posterior sacrums, use the mnemonic **SSIT**. You **SSIT** on your sacrum. **S**eated flexion test, **S**ulcus depth, **I**LA, **T**issue texture change.*

EXAMPLE 1

- Seated flexion test is positive on the *right*. This tells you the problem is on the right, nothing else. It could be an anterior sacrum on the right, a posterior sacrum on the right, or a unilateral dysfunction on the right.
- The right sulcus is deeper. This tells you that you either have an anterior sacrum on the right or a unilateral dysfunction on the right. The asymmetrical sulcus rules out a bilateral sacral dysfunction.
- The left ILA is posterior. This rules out a unilateral dysfunction.
- There is increased tissue texture change over the deep sulcus on the right. This determines our diagnosis—anterior sacrum on the right.
- Finally, if we have an anterior sacrum on the right, we know the sacrum is rotated to the left about a left oblique axis.

The main component that differentiates the two models is information about L5. If diagnostic information about L5 is given in the question stem, it will usually be a question pertaining to torsions. Confused? Use the questions at the end of the chapter to help clarify these concepts.

EXAMPLE 2

- Seated flexion test is positive on the *right*. Again, this tells you the problem is on the right, nothing else. It could be an anterior sacrum on the right, a posterior sacrum on the right, or a unilateral dysfunction on the right.
- The left sulcus is deeper. This tells you there is either a posterior sacrum on the right or a unilateral dysfunction on the right. The sulcus asymmetry rules out a bilateral sacral dysfunction.
- The right ILA is posterior. This rules out a unilateral dysfunction.
- There is tissue texture change over the right ILA. This determines our diagnosis—posterior sacrum on the right.
- Finally, if we have a posterior sacrum on the right, we know the sacrum is rotated right on a right oblique axis.

Other Sacral Diagnoses

- Not as commonly emphasized on boards.
- Occur when either one or both sides of the sacrum anatomically flex or extend along the L-shaped articulation about the superior (unilateral) or middle (bilateral) transverse axes and get stuck that way. Therefore, no oblique axes are engaged in these dysfunctions.
- Four types: Unilateral sacral flexion, bilateral sacral flexion, unilateral sacral extension, bilateral sacral extension.
- Negative spring test (good spring) = unilateral/bilateral sacral flexion.
- Positive spring test (no spring) = unilateral/bilateral sacral extension.
- Unilateral sacral flexion/extension = seated flexion test is positive on side of dysfunction.
- Bilateral sacral flexion/extension = seated flexion test is falsely negative (actually positive bilaterally, so both posterior superior iliac spines (PSIS) rise symmetrically).
- Unilateral sacral flexion/extension = tissue texture changes on side of dysfunction.
- Bilateral sacral flexion/extension = tissue texture changes bilaterally.
- Diagnosis of unilateral dysfunctions is made when posterior ILA is on the *same* side as the deep sulcus.
- Bilateral sacral flexion = ILAs will be posterior bilaterally.
- Bilateral sacral extension = ILAs will be anterior bilaterally.
- If no information about the lumbosacral spring test is given, differentiation between bilateral sacral flexion and extension is made by motion testing sacrum in flexion and extension. Bilateral sacral flexion will resist extension of the sacrum, while bilateral sacral extension will resist sacral flexion. Either the lumbosacral spring test or sacral motion testing must be given in a question in order to differentiate between these two types of dysfunctions. Remember, in a bilateral sacral dysfunction, the seated flexion test will be equal bilaterally, sulcus depth will be equal bilaterally, ILA position will be equal bilaterally, and tissue texture change will be equal bilaterally.

Example 1

- Seated flexion test is positive on the *right*. Again, this tells you the problem is on the right, nothing else.
- The right sulcus is deeper. With no further information, this could be a left on left forward torsion, a left on right backward torsion, or a unilateral flexion on the right.
- There is tissue texture change on the right. Again, this goes along with either a left on left forward torsion or a unilateral flexion on the right.
- The right ILA is posterior. At this point we have our diagnosis—right unilateral flexion. As both the deep sulcus and posterior ILA are on the same side, we know we don't have a typical torsion. Therefore, we know the sacrum is not engaged about an oblique axis.

Example 2

- Seated flexion test is positive on the *right*. Again, this tells you the problem is on the right, nothing else.
- The left sulcus is deeper. This tells you either have a right on right forward torsion, a right on left backward torsion, or a unilateral extension on the right. Remember, the seated flexion test is positive on the right; therefore, the dysfunction is on the right.
- There is tissue texture change on the right. This goes along with a right on left backward torsion or a unilateral extension on the right.

- The left ILA is posterior. At this point we have our diagnosis—right unilateral extension. As both the deep sulcus and posterior ILA are on the left, and the seated flexion test is on the right, we know we have a right-sided problem, which would rule out a unilateral flexion on the left. Therefore the right sulcus is shallow compared to the left, and the right ILA is anterior compared to the left ILA.

EXAMPLE 3

- Seated flexion test symmetrical. This tells us either the seated flexion test is negative (unlikely on a board question) or the test is positive bilaterally, strongly suggestive of a bilateral sacral dysfunction.
- Sulci are symmetrical. This is also strongly suggestive of a bilateral sacral dysfunction, but doesn't tell us what type.
- There are tissue texture changes bilaterally. This again strongly suggests a bilateral sacral dysfunction.
- Lumbosacral spring test is negative. This rules out a bilateral sacral extension, leaving us with our diagnosis of a bilateral sacral flexion.
- Sacral motion testing reveals the sacrum moves freely in flexion and resists extension. This confirms our diagnosis.

TREATMENT

(See Chapter 11.)

ME for forward torsion
ME technique for backward torsion
HVLA technique for anterior sacrum
HVLA technique for posterior sacrum

Pelvis

RELEVANT ANATOMY

(See Figure 4-35.)

- Formed from three fused bones: ilium, ischium, and pubic bone.
- ASIS, PSIS, pubic tubercle, ischial tuberosity are major bony landmarks.
- In standing position, ASIS and pubic tubercle are in one frontal plane.

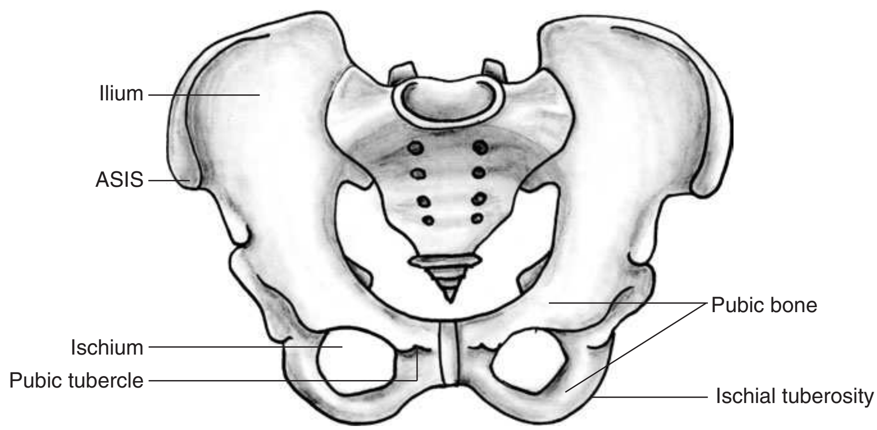


FIGURE 4-35. Pelvic anatomy.

MOTION

- Rotation about the inferior sacral axis
- Also has some caliper motion, torsional motion, and superior/inferior translatory motion

DIAGNOSIS

- There are six main types of pelvic dysfunctions: anterior innominate, posterior innominate, superior innominate (up-slip), inferior innominate (down-slip), externally rotated (out-flared) innominate, internally rotated (in-flared) innominate.
- Innominate diagnosis involves five steps.
- Step one: Standing flexion test
  - Tests iliosacral dysfunction. Tells you which side dysfunction is on, nothing more
- Step two: Check position of ASIS
- Step three: Check position of PSIS
- Step four: Check pubic tubercles
- Step five: Check ischial tuberosities

ANTERIOR INNOMINATE

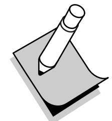
- Standing flexion test is positive on side of anterior innominate.
- ASIS is inferior on affected side.
- PSIS is superior on affected side.
- Pubic tubercle is inferior on affected side.
- Ischial tuberosity is superior on affected side.
- Can result in an apparent long leg on affected side.

POSTERIOR INNOMINATE

- Standing flexion test is positive on side of posterior innominate.
- ASIS is superior on affected side.
- PSIS is inferior on affected side.
- Pubic tubercle is superior on affected side.
- Ischial tuberosity is inferior on affected side.
- Can result in an apparent short leg on affected side.

SUPERIOR INNOMINATE (AKA UP-SLIP OR SUPERIOR SHEAR)

- Standing flexion test is positive on side of superior innominate.
- ASIS is superior on affected side.
- PSIS is superior on affected side.
- Pubic tubercle is superior on affected side.
- Ischial tuberosity is superior on affected side.
- Can result in an apparent short (aka superior) leg on affected side.



Superior innominate = everything superior on affected side! Inferior innominate = everything inferior on affected side!

INFERIOR INNOMINATE (AKA DOWN-SLIP OR INFERIOR SHEAR)

- Standing flexion test is positive on side of inferior innominate.
- ASIS is inferior on affected side.
- PSIS is inferior on affected side.
- Pubic tubercle is inferior on affected side.
- Ischial tuberosity is inferior on affected side.
- Can result in an apparent long (aka inferior) leg on affected side.

EXTERNALLY ROTATED INNOMINATE (AKA OUT-FLARE)

- Standing flexion test is positive on side of externally rotated innominate.
- ASIS is lateral (relatively further from the midline) on affected side.
- PSIS is medial (relatively closer to the midline) on affected side, resulting in a narrowed sacral sulcus on that side.
- Pubic tubercle is lateral on affected side.
- Ischial tuberosity is medial on affected side.
- Can result in an externally rotated leg on affected side.

INTERNALLY ROTATED INNOMINATE (AKA IN-FLARE)

- Standing flexion test is positive on side of internally rotated innominate.
- ASIS is medial on affected side.
- PSIS is lateral on affected side, causing a widened sacral sulcus on that side.
- Pubic tubercle is medial on affected side.
- Ischial tuberosity is lateral on affected side.
- Can result in an internally rotated leg on affected side.

TREATMENT

ME technique for anterior innominate
ME technique for posterior innominate
HVLA technique for innominate up-slip

► REVIEW QUESTIONS: SACRUM AND PELVIS DIAGNOSIS

Questions 1–2

A 42-year-old male presents to the clinic with low back pain. The patient states the pain started while he was shoveling snow yesterday. The pain is focal, with no radiation to the extremities. There is acute tenderness over the right sacroiliac (SI) joint. The lumbosacral spring test is positive. L5 is sidebent and rotated to the left. The left sacral sulcus is deep.

1. What is the diagnosis?
   A. Right on right forward torsion
   B. Left on left forward torsion
   C. Left on right forward torsion
   D. Left on right backward torsion
   E. Right on left backward torsion

2. To treat this dysfunction using ME, the patient should be positioned
   A. Supine
   B. Prone
   C. On the left side
   D. On the right side
   E. Seated

Questions 3–4

A 32-year-old female presents to the clinic with a 1-week history of low back pain. Seated flexion test is positive on the right. Lumbosacral spring test is negative. The right sulcus is deep.

3. You suspect a
   A. Left on left forward torsion
   B. Right on right forward torsion
   C. Left unilateral sacral flexion
   D. Right unilateral sacral extension
   E. Bilateral sacral flexion
4. You would expect L5 to be
   A. Flexed, sidebent left, rotated left
   B. Flexed, sidebent right, rotated right
   C. Neutral, rotated left, sidebent right
   D. Neutral, rotated right, sidebent left
   E. Extended, sidebent right, rotated left

Questions 5–6

A 45-year-old male presents to the clinic with low back pain ever since he moved last month. He describes focal pain over the left SI joint. The seated flexion test is positive on the left. There is tissue texture change over the left sacral sulcus, which is deeper than the right.

5. The sacrum is rotated _____ about a ______ oblique axis.
   A. Left, left
   B. Right, right
   C. Left, right
   D. Right, left
   E. All of the above
6. After treating his sacral dysfunction, you palpate his sacrum to determine the rate of his CRI. Cranial flexion and extension of the sacrum occurs about which axis?
   A. Superior transverse axis
   B. Middle transverse axis
   C. Inferior transverse axis
   D. Right oblique axis
   E. Left oblique axis

Questions 7–8

A 35-year-old male presents to the clinic with low back pain after cleaning his garage. The seated flexion test is positive on the right. The left sacral sulcus is deeper than the right. The right ILA is posterior.

7. You suspect
   A. Right unilateral flexion
   B. Right unilateral extension
   C. Right anterior sacrum
   D. Right posterior sacrum
   E. Bilateral sacral flexion
8. In order to treat this dysfunction using HVLA, the patient is positioned
   A. Prone, physician standing on patient's left
   B. Prone, physician standing on patient's right

   C. Supine, physician standing on patient's left
   D. Supine, physician standing on patient's right
   E. Laterally, on the side of the engaged oblique axis

Questions 9–10

A 63-year-old female presents to your office with severe right hip pain after walking to the grocery store yesterday. After a negative x-ray you decide to treat her using OMT. On examination, the standing flexion test is positive on the right. You notice her right ASIS is higher than her left. Her right PSIS is higher than her left, and her right pubic tubercle is higher than her left.

9. You diagnose
   A. Right anterior innominate
   B. Right posterior innominate
   C. Right up-slip
   D. Right down-slip
   E. Right innominate out-flare

10. To treat this patient using HVLA, you would
   A. Extend and abduct the patient's leg
   B. Flex and internally rotate the patient's leg
   C. Extend and adduct the patient's leg
   D. Flex and abduct the patient's leg
   E. Extend and externally rotate the patient's leg

▶ ANSWERS

1. **E**

This is a typical question you will see on boards. It contains more than enough information to make the diagnosis. First, we are given information about L5, which probably means the question is dealing with a torsion. Second, L5 is sidebent and rotated to the left. This tells us that we most likely have a backward torsion, the left oblique axis is engaged, and the sacrum is rotated to the right. The positive lumbosacral spring test helps confirm our suspicion. Finally, the left sulcus is deep (really deeper than the right), which would give us a shallow sulcus on the right. If we know nothing else, we know L5 is sidebent left so the left oblique axis will be engaged. Looking at our answer choices, only B and E involve the left oblique axis. Of those two, only E is a backward torsion.

2. **C**

When treating either a forward or backward torsion using ME, the patient lays on the side of the involved oblique axis, in this case the left side.

3. **A**

This is a difficult question as it gives you very little information. However, only one answer choice fits with the information given. A right on right forward torsion would have a deep sulcus on the left. With a unilateral sacral flexion on the left, one would expect a deep sulcus on the left. In addition, the seated flexion test is positive on the right. With a unilateral sacral extension on the right, one would expect to see a deeper sulcus on the left. In addition, the lumbosacral spring test is negative, ruling out a sacral extension.

The sulcus asymmetry and positive seated flexion test rule out a bilateral sacral dysfunction. Therefore, the only choice that potentially works is choice A, left on left forward torsion.

4. **D**

This question requires you to use the information in question three and work backward to come up with a diagnosis of L5. If we suspect a forward torsion, we know L5 will have Type I mechanics, ruling out A, B, and E. If the sacrum is rotated left, we know L5 *always* rotates in the opposite direction of the sacrum, so the only answer choice that fits is D. Also, since the left oblique axis is engaged, we know L5 must be sidebent left, as the sidebending of L5 determines which axis is engaged.

5. **B**

This question gives us no information about L5 or the lumbosacral spring test; therefore, we suspect the question is not dealing with a torsion. However, we're not being asked to diagnose a torsion or anterior/posterior sacrum. We're only being asked to diagnose sacral motion about an oblique axis. Looking at the answer choices, we know we're not dealing with a unilateral/bilateral sacral dysfunction. Choice E can be ruled out immediately, as the sacrum does not simultaneously rotate about multiple oblique axes. Since it appears we're not dealing with the torsion model, choices C and D can be ruled out. In addition, we have tissue texture change over a deep sulcus. In a backward torsion, we would expect to have tissue texture change over a shallow sulcus. Since the seated flexion test, tissue texture changes, and sulcus depth all point to an anterior sacrum on the left, choice B becomes the best option. Even if we decided to call this a forward torsion (difficult to do since we have no information about L5), we would still come up with choice B, as a left on left forward torsion would present with a deep sulcus on the right.

6. **A**

This is a straightforward question asking about which axis cranial-sacral flexion and extension occurs. Anatomic flexion and extension occurs about the middle transverse axis. Innominate rotation occurs about the inferior transverse axis. Cranial-sacral flexion and extension does not occur about the oblique axes.

7. **D**

This is another question that gives us no information about the lumbar spine, so we suspect we're not dealing with a torsion question. In addition, looking at the answer choices, we know that a torsion is not an option. The seated flexion test is positive on the right. This rules out choice E, as a bilateral sacral dysfunction would give us an equal-seated flexion test, equal sulcus depth, and equal ILA position. The remainder of the choices are on the right, so we cannot rule any of these out based on the seated flexion test alone. The left sulcus is deeper. This rules out choices A and C, which would have a deep sulcus on the right. Since the ILA is posterior on the opposite side of the deep sulcus, we know we are not dealing with a unilateral sacral dysfunction, leaving us with choice D.

8. **C**

The technique for treating a posterior sacrum using HVLA requires the patient to be supine. The physician stands on the opposite side of the dysfunction. Choice E would be correct for treating a forward or backward torsion using ME.

9. **C**

Since the standing flexion test is positive on the right, we know we have a right-sided problem. All the involved landmarks are higher on the right, giving us our diagnosis of an up-slip.

10. **B**

To treat this using HVLA, we would use the leg pull technique. This involves slight flexion and internal rotation of the patient's leg.

▶ EXTREMITY DIAGNOSIS

Upper Extremity

RELEVANT ANATOMY

BONY

Scapula

- A triangular bone lying posterior to the rib cage, protected by strong muscular coverings.
- Winging of the scapula may occur with damage to the long thoracic nerve.

Clavicle

- A long bone that articulates medially with the manubrium and laterally with the acromion.
- Rarely, fragments from a clavicular fracture may damage the brachial vessels.

Humerus

- A long bone that articulates proximally with the glenoid fossa of the scapula and laterally with the radius and ulna.
- A sharp blow to the posterior aspect of the humerus's medial epicondyle may irritate the ulnar nerve.

Radius

- With pronation and supination, the radial head rotates around the radial notch of the ulna and the distal radius rotates on the head of the ulna.
- In the elderly, a fall on the hand produces a radial fracture 1 in proximal to the wrist joint known as a Colles' fracture.

Ulna

- The proximal portion of the ulna contains the olecranon. The trochlear fossa articulates with the humerus.
- Repeated trauma to the subcutaneous bursa overlying the olecranon causes an inflammation known as miners' elbow.

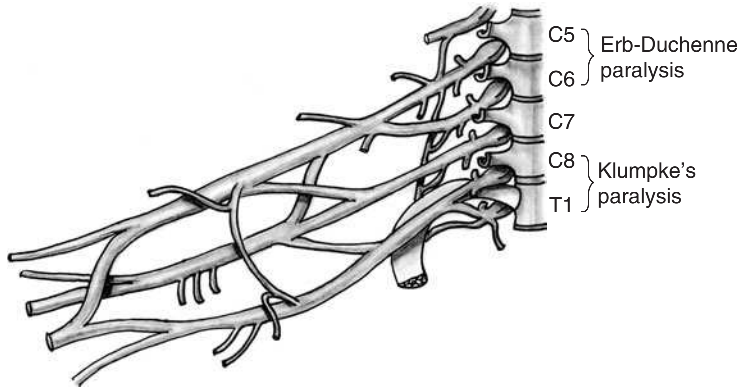


FIGURE 4-36. Brachial plexus.

Carpal Bones

- The *carpus* is made of two rows: the proximal row and distal row.
- Proximal row consists of (from lateral to medial) the *scaphoid*, *lunate*, *triquetral, and pisiform*.
- Distal row consists of (from lateral to medial) the *trapezium*, *trapezoid*, *capitate, and hamate*.
- A fall on the palm with the hand abducted may cause a scaphoid fracture with resultant tenderness in the anatomic snuffbox and risk for potential avascular necrosis.

NERVOUS

- The brachial plexus (see Figure 4-36).
- Supplies the nerves of the upper extremity.
- Formed by nerve roots C5, C6, C7, C8, and T1.
- Erb-Duchenne paralysis: A brachial plexus injury, which can occur during birth. A downward traction force can affect roots C5 and C6, causing the arm to hang limp at the patient's side with the forearm pronated and the palm facing backwards.
- Klumpke's paralysis: Upward traction on the arm, during a forceful breech delivery, may tear roots C8 and T1, causing the hand to assume a clawed appearance.

SPECIFIC JOINTS

The Glenohumeral (Shoulder) Joint

(See Table 4-3).

- Defined as the articulation between the head of the humerus and the glenoid fossa of the scapula.

Rotator Cuff

- The sheath of muscle tendons that aid in holding the head of the humerus in the glenoid cavity of the scapula during movements of the shoulder joint (see Figure 4-37)
- Supraspinatus, infraspinatus, teres minor, subscapularis

TABLE 4-3. Upper Extremity Actions and Related Muscles. Bolded Muscles Represent the Primary Muscles Involved in the Action

Action	Muscle
Abduction	Supraspinatus, **deltoid (middle portion)**
Adduction	**Pectoralis major, latissimus dorsi**
Flexion	Pectoralis major, coraco-brachialis, **deltoid (anterior portion) biceps brachii**
Extension	**Teres major, latissimus dorsi, deltoid triceps brachii**
Internal rotation	Pectoralis major, latissimus dorsi, teres major, deltoid, **subscapularis**
External rotation	**Infraspinatus, teres minor**, deltoid

Diagnosis

Articular SD of the shoulder—most often occurs at the sternoclavicular or acromioclavicular joints

- Dysfunction is characterized by pain at the involved joint and restriction of motion in one or more of the planes of joint motion

  Restriction of motion in shoulder SD

- Most common—restriction in internal and external rotation
- Least common—restriction in extension

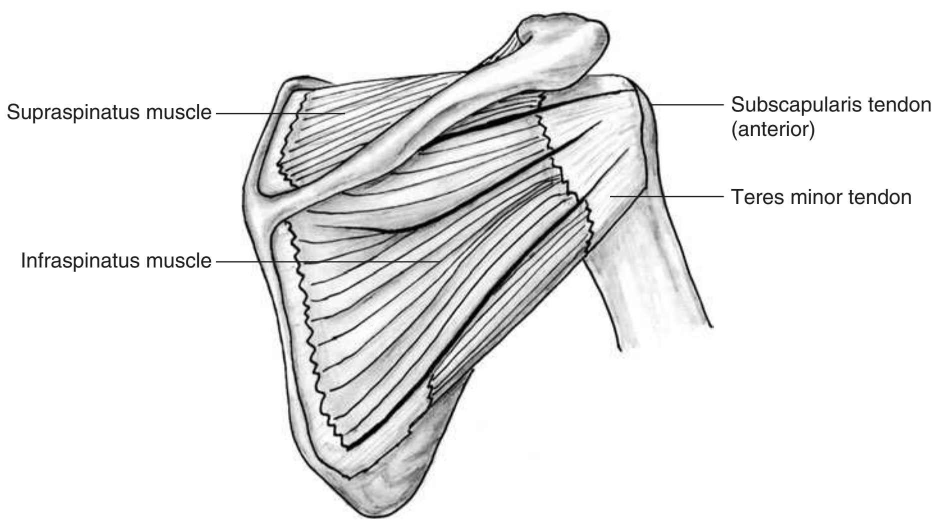


FIGURE 4-37. Rotator cuff.

Additional Shoulder Pathology

Shoulder Dislocation

- A traumatic repositioning of the humeral head outside the glenoid fossa of the scapula.
- The majority of shoulder dislocations occur anteriorly. Traumatic forces usually involve abduction and external rotation.

Rotator Cuff Tear

- Long-standing inflammation of the rotator cuff tendons caused by overuse, aging, a fall on an outstretched hand, or a collision may lead to a disruption in one of the rotator cuff muscles.
- May also be caused by a mechanical impingement in an overhead position.
- The most common muscle involved in rotator cuff injury is the supraspinatus.

Frozen Shoulder (Adhesive Capsulitis)

- Constant limitation of the range of motion of the shoulder due to scarring around the shoulder joint.
- May be a consequence of rotator cuff disease and/or associated with diabetes.

Impingement Syndrome

- Pain caused with elevation and internal rotation of the arm as the greater tuberosity of the humerus (with the supraspinatus riding on top) presses against the underside of the acromion.
- The Hawkins test assesses impingement syndrome by placing overhead pressure on an arm that is forward flexed to 90° and then internally rotated (see Chapter 6).

Treatment Techniques

(See Chapter 13.)

- Manipulation for the shoulder with ME
- Articulatory—Spencer seven-step technique
- Counterstrain—coracoid tenderpoint counterstrain technique

The Elbow Joint

- True elbow joint is considered the ulnohumeral joint.
- The elbow is capable of 160° of flexion and 0° of extension around a transverse axis.
- Collateral ligaments stabilize the elbow laterally and medially. The musculature passing anterior and posterior to the elbow stabilize it anteroposteriorly.
- The **carrying angle** is defined as the angle formed by the intersection of two lines: one that passes down the long axis of the humerus, the other that starts at the proximal radial ulna joint and passes through the distal radial ulna joint (see Figure 4-38).
- Men typically have a normal carrying angle of 5°.
- Women typically have a carrying angle between 10° and 12°.

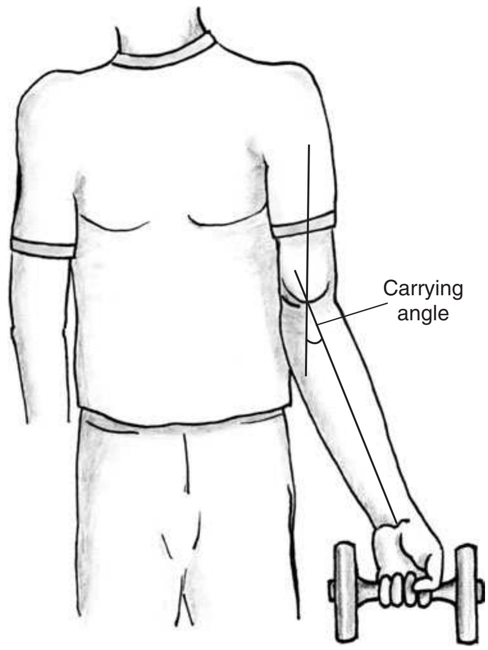


FIGURE 4-38. Carrying angle.

Diagnosis

- Primary SD of the elbow is found in the ulnohumeral joint.
- Secondary SD is found at the radioulnar joint.
- During abduction of the ulna, the wrist is pushed into increased **adduction**.
- During adduction of the ulna, the wrist is pulled into **abduction**.
- An abduction SD (adduction restriction) increases the carrying angle and causes the olecranon process to glide more freely medially. In an abducted SD, the wrist will be adducted.
- An adduction SD (abduction restriction) decreases the carrying angle and causes the olecranon process to glide more freely laterally.

In an abducted SD, the wrist will be adducted.
In an adducted SD, the wrist will be abducted.

Additional Elbow Pathology

Lateral Epicondylitis (Tennis Elbow)

- Often used as a blanket description for any soft tissue pain between the shoulder and wrist.
- Best defined as an inflammation to the common extensor origin.
- Extensor carpi radialis brevis is the muscle most predisposed to irritation.
- Activities that combine repeated wrist extension with supination (tennis backhand, hammering, painting) are often responsible for the inflammation.

Medial Epicondylitis (Golfer's Elbow)

- Inflammation at the common flexor origin, affecting primarily the pronator teres muscle and the flexor carpi radialis muscle.
- Inflammation is provoked by activites involving powerful snapping of the wrist and pronation of the forearm.

Olecranon Bursitis

- Inflammation of the olecranon bursa located over the olecranon, subcutaneously.
- The bursa can become inflamed by leaning on the elbow for a prolonged period (aka student's elbow), or from a direct fall onto the point of the elbow.
- Impaired function of any joint of the arm produces compensatory changes in all other joints. If total functional demand overtaxes any one of the other joints, secondary SD is also produced in those joints.

TREATMENT TECHNIQUES

- HVLA—thrust technique for anterior radial head and posterior radial head
- ME—supination and pronation dysfunction
- Counterstrain—lateral epicondyle tenderpoints

THE WRIST AND HAND

- The **true wrist** is defined as the ellipsoid radiocarpal joint formed by the distal end of the radius and the carpal bones: scaphoid, lunate, and triquetral.
- The wrist has two axis of motion: the transverse axis and the AP axis.

The wrist flexes and extends around the transverse axis. It adducts and abducts around the AP axis.

DIAGNOSIS

Somatic Dysfunction of the Wrist

- Is related to the slight gliding motions of the carpal bones on the radius as the wrist is moved.
- Is named according to the direction of freedom of motion.
- Is determined by comparing flexion to extension or abduction to adduction on both hands.
- Is usually caused by trauma if there is a flexion/extension SD. The trauma overcomes the ligamentous restrains and the opposing muscle pull.

Somatic Dysfunction of the Hand

- Intercarpal SD usually occurs due to a fall on an outstretched hand.
- In the carpometacarpal joints (with the exception of the thumb), SD is primarily a dorsal glide with restriction of ventral glide.
- The metacarpophalangeal joints and interphalangeal joints may develop SD in the following:
  - AP glide
  - mediolateral glide
  - internal-external rotational glide

Don't forget to rule out a scaphoid fracture.

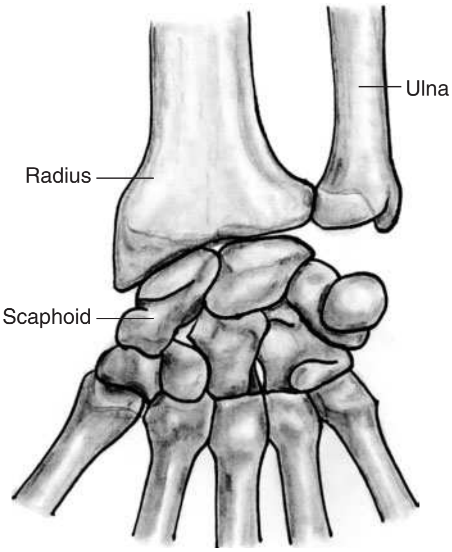


FIGURE 4-39. The wrist and carpal bones.

ADDITIONAL WRIST AND HAND PATHOLOGY

Scaphoid Fracture

(See Figure 4-39.)

- A fracture of the scaphoid bone in the hand that occurs most commonly with a fall on an outstretched hand with the wrist fully extended.
- Fractures to the waist of the scaphoid bone may sever blood supply to the proximal portion of the bone leading to avascular necrosis.

Carpal Tunnel Syndrome

- A compression neuropathy of the median nerve as it passes beneath the flexor retinaculum and into the carpal tunnel.
- Carpal tunnel syndrome is more common in women and typically occurs between the ages of 40 and 60.

De Quervain's Syndrome

- An inflammation and thickening of the synovial lining of the common sheath of the abductor pollicis longus and extensor pollicis brevis tendons.
- Thickening occurs at the point where the tendon passes over the distal aspect of the radius.

TREATMENT

- ME—wrist restriction in radial deviation
- Counterstrain—to treat wrist tenderpoints
- Metacarpal articulatory technique

Lower Extremity

Relevant Anatomy

Bony

Femur

- Largest bone in the body.
- Consists of head, neck, shaft, and medial and lateral condyles.
- Fractures of the femoral neck (subcapital fractures) interrupt retinacular blood supply to the femoral head causing avascular necrosis.

Patella

- Sesamoid bone in the expansion of the quadriceps tendon.
- Continues from the apex of the bone as the ligamentum patellae.
- Lateral dislocation of the patella is resisted by the prominent articular surface of the lateral condyle and the medial pull of the vastus medialis oblique muscle.

Tibia

- Long bone that expands proximally into the medial and lateral condyles.
- Triangular shaft, which projects medially from the distal extremity of the bone as the medial malleolus.
- Most common long bone to be fractured and to suffer compound injury.

The Q-Angle

(See Figure 4-40.)

- Angle formed by the intersection of the longitudinal axis of the femur (a line drawn from the ASIS to the midpoint of the patella) and the longitudinal axis of the tibia (a line drawn through the midpoint of the patella and the tibial tubercle).

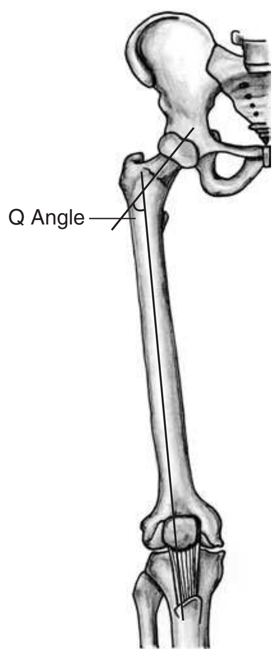


FIGURE 4-40. The Q-angle.

- A normal Q-angle = 10° to 12°
- An abnormal Q-angle is >20°
- An increased Q-angle causes genu valgus (knock kneed)
- A decreased Q-angle causes genu varum (bowlegged)

Fibula

- Serves as an origin for muscles, a part of the ankle joint, and a pulley for peroneus longus and brevis.
- The bone consists of a head to which the fibularis longus and brevis attach, a neck, a shaft, and a lateral protuberance known as the lateral malleolus.

Tarsal Bones

- Defined as the group of seven bones proximal to the metatarsal bones and phalanges.
- Seven tarsal bones are the talus, calcaneus, navicular, cuboid, and three cuneiforms.
- The bones of the foot also include 5 metatarsal bones and 14 phalanges.

NERVOUS

The Lumbar Plexus

(See Figure 4-41.)

- Originates from the anterior primary rami of L1 through L4.
- The principle branches of the lumbar plexus are the femoral nerve and obturator nerve.

The Sciatic Nerve

- Largest nerve in the body.
- Branches of the sciatic nerve supply the hamstring muscles (biceps femoris, semimembranosus, and semitendinosus) and the adductor magnus.
- **Sciatica** is defined as irritation of the sciatic nerve resulting in pain or tingling running down the leg and is often caused by a herniated lumber disk.

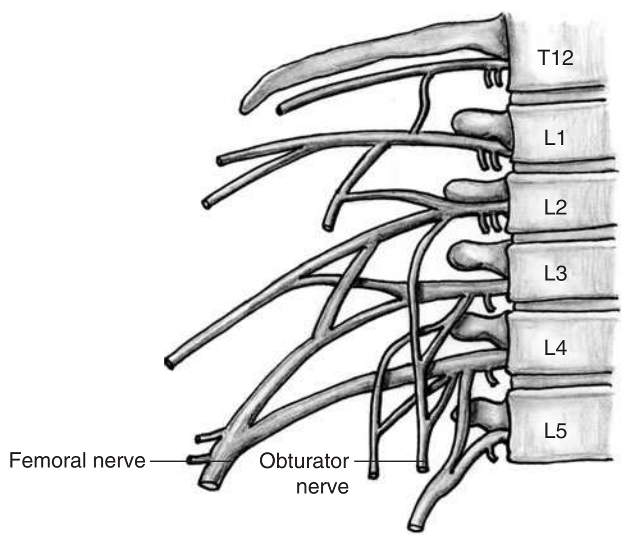


FIGURE 4-41. The lumbar plexus.

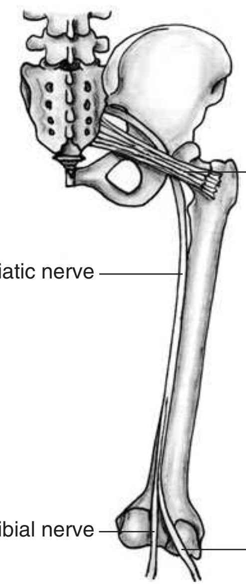


FIGURE 4-42. Sciatic nerve.

The sciatic nerve branches to form:

- The tibial nerve—ends as the medial and lateral plantar nerves.
- The common peroneal nerve—divides to form the deep peroneal and superficial peroneal nerves. (See Figure 4-42.)

SPECIFIC JOINTS

The Hip Joint

(See Table 4-4.)

- Largest joint in the body.
- Characterized as a ball and socket joint.
- Joint is deepened by a structure known as the acetabular labrum.

TABLE 4-4. Upper Extremity Actions and Related Muscles. Bolded Muscles Represent the Primary Muscles Involved in the Action

ACTION	MUSCLE
Abduction	Gluteus medius, gluteus minimus, tensor fasciae latae
Adduction	**Adductor longus, brevis, and magnus, gracilis**, pectineus
Flexion	**Iliacus and psoas**, rectus femoris, sartorius, and ectineus
Extension	**Gluteus maximus, the hamstrings**
Lateral rotation	**Gluteus maximus**, the obturators, gemelli, and quadratus femoris
Medial rotation	Tensor fasciae latae and anterior fibers of gluteus medius and minimus

DIAGNOSIS

Hip Somatic Dysfunction

- Characterized by a decrease in typical range of motion.
- Gait may appear abnormal.
- Muscles surrounding the hip joint demonstrate tenderpoints at the muscle origin and insertion.

Psoasitis Somatic Dysfunction

- Patient typically presents with flexion at the waist and slightly bent to the side of the aggravated psoas.
- Leg extension is restricted.

  (See Chapter 4 for more on psoas SD.)

Gluteus Maximus Somatic Dysfunction

- SD of gluteus maximus leads to restriction of hip flexion and internal rotation.
- Dysfunction of gluteus medius and minimus may decrease leg abduction.

Piriformis Somatic Dysfunction

- Restriction of leg internal rotation.
- Possible numbness, tingling, paresthesias in the back of the leg.

LEG radiculopathies are due to spasm of the piriformis muscle, which lies in close proximity to the sciatic nerve.

ADDITIONAL HIP PATHOLOGY

Legg-Calvé-Perthes Disease

- Avascular necrosis of the femoral head causing the bony nucleus of the epiphysis to become necrosed.
- May be caused by joint effusion at the hip following trauma.

Slipped Capital Femoral Epiphysis

(See Figure 4-43.)

- A posterior and inferior slippage of the proximal femoral epiphysis on the femoral neck occurring through the physeal plate during the early adolescent growth spurt.
- The most common hip disorder in adolescents.

Clicking Hip Syndrome

- Snapping in the hip that can be painful or not painful.
- Common in dancers and young athletes.
- External hip click is usually due to the movement of the gluteus maximus tendon or ilio-tibial band clicking over the greater trochanter.
- Internal hip click caused by movement of the iliopsoas over its bursae.

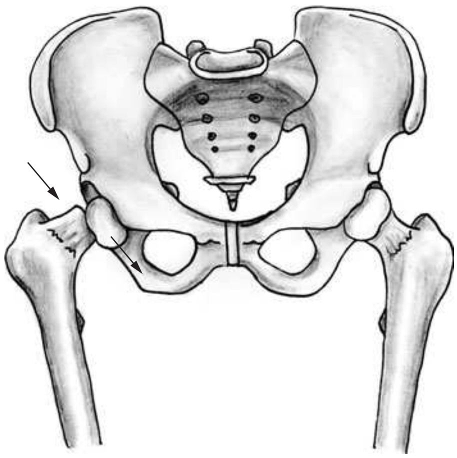


FIGURE 4-43. Slipped capital femoral epiphysis.

TREATMENT

ME—psoas muscle spasm
Counterstrain—piriformis

THE KNEE JOINT

- Most complicated articulation in the body.
- Consists of a medial and lateral femoral-tibial articulation and a patella-femoral articulation, all within one joint capsule.
- One of the few joints with menisci.
- The quadriceps muscles, the quadriceps tendon, and the patellar tendon maintain the stability of the patellofemoral joint.

DIAGNOSIS

Adduction Dysfunction—Tibia on Femur

- A condition of **varus** stress of the tibia on the femur.

Abduction Dysfunction—Tibia on Femur

- A condition of valgus stress of the tibia on the femur.

Anterior-Posterior Glide Dysfunction

- The tibia is restricted in anterior or posterior glide. The initial patient complaints are restrictions of flexion or extension movements.

A blow to the medial knee joint or a twisting motion that produces lateral ligamentous sprain may result in an adduction dysfunction.

ADDITIONAL KNEE PATHOLOGY

Meniscal Tears

- Tear in the shock-absorbing fibrocartilage of the knee.
- Most common reason for arthroscopy of the knee.
- Most frequently occurs in the medial meniscus, which is securely attached around the entire periphery of the joint capsule.

A blow to the lateral knee joint or a twisting motion that produces medial ligamentous sprain may result in an abduction dysfunction.

Anterior Cruciate Ligament Tear

- Tear of the ligament that prevents anterior translation of the tibia on the femur or posterior translation of the femur on a fixed tibia.
- Most common knee ligament injury.

Posterior Cruciate Ligament Tear

- Tear of the ligament that prevents posterior translation of the tibia on the femur (or anterior translation of femur on fixed tibia).
- Much less common than a tear to the anterior cruciate ligament.

Patellofemoral Pain Syndrome

- Pain to the undersurface of the patella, attributed to cartilage damage on the posterior surface of the patella.
- Damage results from the patella not riding within the femoral groove.

TREATMENT

- HVLA—anterior fibular head dysfunction
- Counterstrain—patellar tenderpoint

THE ANKLE AND FOOT

- The distal end of the tibia, the medial malleoli, and the lateral malleoli make up the crural arch (also known as the ankle mortise), which snuggly holds the talus.
- The joint capsule, the deltoid ligaments, the ATL, the PFL, the anterior and posterior tibiofibular ligaments, and the CFL connect the above bones.
- The ankle joint is most stable in dorsiflexion (due to the anterior aspect of the talus wedging between the malleoli).

DIAGNOSIS

- SD of the ankle often follows immobilization.
- Talar dysfunction at the tibiotalar joint is a common lower extremity dysfunction. The talus is often restricted in dorsiflexion.
- Restriction at the tarsal and metatarsal joints is most effectively diagnosed with dorsal and plantar motion testing.

Distal tibiofibular dysfunction often resolves with treatment of the proximal tibiofibular articulation.

ADDITIONAL ANKLE AND FOOT PATHOLOGY

Ankle Inversion Sprain

- Sprain or tear of the lateral ligamentous structures surrounding the ankle joint.
- Anterior talofibular ligament (ATF) is most commonly affected (ATF>CFL [calcaneofibular ligament]>PTF [posterior talofibular ligament]).
- Can also cause lateral malleolus SD as well as a "dropped" cuboid.

Medial Ankle Sprain

- Sprain or tear of the deltoid complex induced by pathological abduction and pronation of the foot.

Plantar Fasciitis

- Chronic irritation of the plantar fascia, usually a result of biomechanical imbalances.

TREATMENT

- Counterstrain—medial ankle tenderpoint
- HVLA—cuboid and navicular SD
- Articulation—metatarsal heads

▶ REVIEW QUESTIONS: EXTREMITY DIAGNOSIS

1. Upon motion testing the elbow joint, you notice that the olecranon process glides more freely, medially. Consequently, you notice that the wrist moves further into
   A. Pronation
   B. Supination
   C. Adduction
   D. Abduction
   E. Flexion
2. Upon physical examination of a 30-year-old female, you note that her carrying angle measures approximately 15°. The normal carrying angle for a woman is between
   A. 10° and 12°
   B. 5° and 10°
   C. 15° and 18°
   D. 8° and 10°
   E. 18° and 20°
3. A 40-year-old carpenter enters the clinic complaining of tenderness on the lateral aspect of his forearm, just distal to the elbow. He states that the pain is particularly severe when he uses a screwdriver, and that ibuprofen helps his discomfort minimally. You suspect that his pain results from repetitive overuse and you tell him that his condition is most commonly known as
   A. Miners' elbow
   B. Nursemaids' elbow
   C. Olecranon bursitis
   D. Tennis elbow
   E. Washwoman's elbow
4. A 35-year-old female presents to the clinic with low back pain and muscle spasm. You note that she is flexed at the waist but also slightly bent to the right side. She refuses to lie prone on the table and, instead, prefers to lie on her back with her knees pulled to her chest. What is the most likely etiology of her pain?
   A. Right quadratus lumborum spasm
   B. Right piriformis spasm
   C. Left piriformis spasm
   D. L4–L5 disk herniation
   E. Right psoas spasm

5. A 25-year-old male presents to the clinic after "twisting" his knee during a basketball game. He states that he has experienced several episodes of sharp, shooting pain on the medial aspect of his knee since the accident and that he hears an occasional "click" when he's walking. The patient states that yesterday, while walking down the stairs, his knee "gave out." The most likely structure injured is the
   A. Anterior cruciate ligament
   B. Posterior cruciate ligament
   C. Medial meniscus
   D. Lateral meniscus
   E. Patella

6. A 15-year-old girl presents to the ER after hurting her ankle during a soccer game. She says that she stepped on an opponent's foot, inverting her foot. The ankle demonstrates inflammation over the lateral malleolus and slight discoloration. The x-ray is negative. You suspect an inversion sprain and assess for which SD?
   A. A dropped cuboid
   B. A dropped navicular
   C. An anterior fibular head
   D. A posterior fibular head
   E. A tibial torsion

▶ ANSWERS

1. **C**

During abduction of the ulna, the radius glides distally and the wrist is pushed into increased adduction. During adduction of the ulna, the wrist glides proximally. The wrist is pulled into abduction. An abduction SD increases abduction of the ulna and further wrist *adduction*.

2. **A**

The normal carrying angle for women is between 10° and 12°.

3. **D**

Lateral epicondylitis is most commonly known as tennis elbow.

4. **E**

The patient most likely suffers from a right psoas spasm. Patients with acute psoas spasm typically present with flexion at the waist and slightly bent to the side of the dysfunctional psoas.

5. **C**

The patient in this question presents with signs and symptoms consistent with a meniscal tear. As the symptoms are on the medial side, we would suspect the medial meniscus as the probable structure injured.

6. **A**

A dropped cuboid commonly accompanies an inversion sprain.

CHAPTER 5

Osteopathic Principles and Considerations of Clinical Medicine: A Systems-Based Approach

Often osteopathic manipulative medicine (OMM) questions on the boards are part of a much bigger clinical scenario. They can catch you off guard if you don't keep the basic principles in the back of your head while taking the test. One of the more high yield areas of OMM and the systemic systems is the principle of the normalization of the autonomic nervous system (ANS). Understanding the sympathetic and parasympathetic effects on each system is imperative. In addition, the viscerosomatic reflex(es) (VSR) must be reviewed. Remember, the autonomic innervation of the organs does not always correlate with the VSR. They are extremely similar but keep the differences in mind when differentiating questions regarding the ANS and questions regarding the VSR. Another high yield topic tends to focus on appropriate techniques for specific pathology. This section discusses OMM within each system of the body. The relevant anatomy, VSR, osteopathic considerations, and treatment guidelines will all be reviewed. This is *not* intended to be any sort of medicine review but, rather, an organized approach to incorporating OMM into your clinical problem-solving skills.

▶ HEENT

Introduction

Head, ears, eyes, nose, throat (HEENT) complaints are some of the most common complaints in the primary care setting ranging from headaches (HAs) and sinusitis to ear infections and sore throats. As usual, OMM questions on the boards will focus on VSR as well as appropriate techniques. A few key points to remember include normalizing the sympathetics to the head (T1–T4); when in doubt, pick a lymphatic technique for treatment, if possible, and focus on techniques that will indirectly affect the head (i.e., cervical and thoracic techniques). Rarely will you see something specific about facial techniques.

Relevant Anatomy

- Internal carotid arteries pass through the carotid canal in the petrous portion of the temporal bone.
- Vertebral arteries enter through the foramen magnum.
- Internal jugular veins pass through the jugular foramina.
- Deep cervical lymph nodes are located along the internal jugular veins.
- Cranial Nerve (CN) V—trigeminal nerve
  - V1 (ophthalmic division)—passes through the cavernous sinus and enters the orbit through the superior orbital fissure (treatment at the superior orbital foramina affects this division).
  - V2 (maxially division)—passes through the foramen rotundum of the sphenoid and enters the orbit through the inferior orbital fissure (treatment at the inferior orbital foramina affects this division).
  - V3 (mandibular division)—passes through the foramen ovale of the sphenoid (treatment at the mental foramina affects this division).
- CN VII—facial nerve
  - Enters the internal acoustic meatus of the temporal bone and exits at the stylomastoid foramina of the temporal bone.
- CN VIII—vestibulocochlear nerve
  - Enters the internal acoustic meatus with CN VII.

Generalized VSR for HEENT

SYMPATHETICS—T1–T4

- Increased sympathetic tone leads to photophobia, tinnitus, unsteady gait.
- Prolonged sympathetic tone leads to thick and sticky nasal and pharyngeal secretions.

PARASYMPATHETICS—CN V, OCCIPUT, C1 AND C2

- Increased parasympathetic activity leads to excessive tear production and profuse, thin nasopharyngeal and sinus secretions.

(For a more specific listing, please refer to VSR, Chapter 6.)

Osteopathic Considerations and Treatment Guidelines for HEENT Pathology

DYSFUNCTION AFFECTING RELEVANT ANATOMIC STRUCTURES

ARTERIAL

- Cranial dysfunction of temporals, occiput or sphenoid can affect the internal carotid arteries; signs and symptoms include weakness and altered sensation on the contralateral side.
- Cervical dysfunction from C2 to C6 can affect the vertebral arteries; signs and symptoms include dizziness and visual abnormalities.

VENOUS

- Cranial dysfunction of the temporals, specifically occipitomastoid compression, can affect the venous drainage (internal jugular veins); signs and symptoms include head congestion.

LYMPHATICS

- SD of the upper thoracic spine, upper ribs, and clavicle can affect the lymphatic system; signs and symptoms include head congestion, which may be more specifically due to decreased drainage through the thoracic inlet.

CRANIAL NERVES

- Cranial dysfunction of the temporals can affect V1 leading to problems in the distribution of V4.
- Cranial dysfunction of the temporals, sphenoid, maxillae, and mandible can affect V2 leading to problems in the distribution of V2 and more specifically, Tic douloureux (intense paroxysmal neuralgia along the trigeminal nerve).
- Dysfunction of the temporal mandibular joint (TMJ) and other problems with the mouth and teeth (poorly fitted dentures) can affect V3 leading to HAs.
- Dysfunction of the sphenoid, occiput, temporals, and cervical fascia can affect CN VII; signs and symptoms include eyelid spasms and Bell's palsy (facial nerve paralysis).
- Dysfunction of the sphenoid, occiput, and temporals can affect CN VIII; signs and symptoms include hearing impairment and vertigo.

Other Common HEENT Pathology

Attention: Causes are defined by osteopathic parameters.

Sinusitis

- Cause: Cranial dysfunction preventing adequate drainage of the paranasal sinuses
- Treatment guidelines: Remove the dysfunctional cranial motion patterns
  - Frontal sinuses—use frontal lift
  - Ethmoid sinus—use frontal lift, volmer pump, facial articulatory techniques
  - Sphenoid sinuses—correct cranial strain patterns
  - Maxillary sinuses—use frontal lift or facial articulatory techniques

All treatment for the above mentioned manifestations should focus on treating the cranial dysfunctions that are causing the problem.

Otitis Media

- Cause: Internal rotation of the temporal bone may result in partial or complete closure of the eustachian tube leading to impaired drainage.
- Treatment guidelines: The Galbreath technique.

Vertigo

- Cause: Temporal bone dysfunction (internal or external rotation) can alter the normal position and function of the vestibular apparatus.
- Treatment guidelines: Cranial techniques affecting the temporal bone.

Common Cold

- Cause: No specific osteopathic consideration.
- Treatment guidelines: Support the body and establish an environment for healing to occur.
  - Improve arterial supply to, and venous/lymphatic drainage away from, the head and neck (treat the neck, upper back, and ribs; use lymphatic techniques).
  - Facilitate breathing (treat the diaphragm and ribs).

Headaches

Tension Type Headaches

- Cause: Can be due to somatic dysfunction (SD) in the upper thoracics, cervical region, and cranium; also consider poor posture or poor work setup.
- Treatment guidelines:
  - Address postural issues with exercises.
  - Address work environment issues (i.e., raising computer screen, changing chair height).
  - Use high velocity, low amplitude (HVLA), muscle energy (ME), soft tissue (ST), counterstrain (CS), myofascial release (MFR) where appropriate.

Migraine Headaches

- Cause: Can be triggered by stress, odors, foods, alcohol, and menstruation.
- Treatment guidelines:
  - Reduce tension in the body via treatment to the upper thoracics, head and neck.
  - Exercise and stretching programs target tension reduction throughout the body.
  - Treatment is best applied between headaches but can be beneficial during the migraine episode.

Cluster Headaches

- Cause and treatments are similar to migraine HAs.

▶ REVIEW QUESTIONS: HEENT

1. A 35-year-old male presents to his primary care physician with complaints of vision abnormalities and dizziness for the past 2 weeks. The patient's physical examination was unremarkable except for tissue texture change and motion restriction in the area of C5 and throughout the thoracic spine. The patient's lesion at C5 may contribute to his dizziness and vision changes by affecting the
   A. Vagal nerve
   B. Brachial plexus
   C. Anterior scalenes
   D. Vertebral artery
   E. Spinal cord

2. A 44-year-old female presents to her primary care physician complaining of a noticeable droop on the right side of her face and inability to close her right eye. She states that she has been drooling and having trouble speaking. The cranial nerve responsible for the patient's symptoms is cranial nerve
   A. V1
   B. VIII
   C. VII
   D. VIII
   E. IX

3. (Referring to the above patient.) The physician suspects a cranial dysfunction is responsible for the patient's symptoms. Dysfunction of which cranial bone will most likely cause the above patient's symptoms?
   A. The parietal bone
   B. The temporal bone
   C. The frontal bone
   D. The lacrimal bone
   E. The maxilla

4. A 4-year-old child presents to his primary care physician with recurrent otitis media of his right ear. Upon evaluating the child's cranial motion, the physician notices that the child's right temporal bone is

A. Externally rotated
B Flexed
C Extended
D Torsioned
E Internally rotated

5. A 55-year-old male presents to the emergency room with a headache that he describes as "stabbing," and "excruciating," behind his right eye. The pain began 2 hours ago. The patient states that he has had similar headaches in the past and that they usually go away after 3 hours. The most likely diagnosis is
   A. Cluster headache
   B. Meningioma
   C. Migraine headache
   D. Tension headache
   E. Epidural hematoma

▶ ANSWERS

1. **D**

The vertebral arteries pass through the transverse foramen in the cervical spine. SD in the cervical spine, particularly levels C2–C6, may affect the vertebral arteries causing dizziness and vision changes.

2. **C**
3. **B**

Bell's palsy is a condition associated with the facial nerve, CN VII. Cranial dysfunction associated with Bell's palsy can occur with dysfunction of the temporals, sphenoid, or occiput.

4. **E**

Internal rotation on the temporal bone may result in partial or complete closure of the eustachian tube, inhibiting drainage of the middle ear, and establishing an appropriate medium for otitis media.

5. **E**

Cluster headaches are characterized by stabbing, retro-orbital pain that lasts between 15 minutes and 3 hours. Attacks may be seasonal and followed by months of remission.

▶ CARDIOLOGY

Introduction

Many cardiac conditions are not caused by dysfunction of the musculoskeletal system but may result in dysfunction of the somatic system. The acute cardiac conditions obviously need to be dealt with medically first, and osteopathic manipulative techniques (OMT) may not be a first line of treatment. However, most conditions will be associated with particular VSR and many conditions will respond to OMT in the later stages or chronic disease states. Treatment guidelines will be given when appropriate.

Relevant Anatomy

- Sympathetic innervation
  - T1–T4
  - Accelerates the heart
- Parasympathetic innervation
  - CN X (vagus)
  - Decelerates the heart
- Both divisions of the ANS come together at the cardiac plexus.

Generalized Viscerosomatic Reflex(es) for the Cardiac System

- Sympathetics—T1–T5 (left > right)
- Parasympathetics—C0, C1, mainly C2 (vagus)

(For a more specific listing, please refer to VSR, Chapter 6.)

Osteopathic Considerations and Treatment Guidelines for Cardiac Pathology

Myocardial Infarction

- Acute phase
- Stabilize the patient. Now is not the time to work on your Kirksville krunch.
  - Use VSR to help with diagnosis.
    - Changes may be found over the rib angles and at T2 on the left.
  - Any direct OMT and lymphatic pump techniques are contraindicated.
- Post-MI Treatment guidelines:
  - Restore motion to the thoracic spine (ST, deep articulation [DA]).
  - Normalize autonomics (treat occipitoatlantal [OA] and C2 to restore parasympathetic tone).
  - Consider diaphragm release techniques.
  - Apply thoracic inlet and fascial release techniques.

Congestive Heart Failure

- Musculoskeletal manifestations:
  - Swelling in the lower extremities (may complain of recent weight gain).
  - Dyspnea on exertion (DOE) or difficulty breathing at rest.
  - SD—tissue texture change in the upper thoracics (VSR) and in the upper cervical (parasympathetic innervation to the heart, specifically C2, vagus).
- Treatment guidelines: Improve venous and lymphatic return (be careful not to overtax the cardiovascular (CV) system during an acute attack).
  - Treat the respiratory diaphragm (indirect balancing).
  - Treat the pelvic diaphragm.
  - Treat the thoracic cage and outlet (MFR, ST, DA, ME).
  - Treat the VSR (T1–T5 for the head, T9–L1 for the kidneys).

Hypertension

- Treatment guidelines:
  - Lower thoracic treatment to affect facilitation to the adrenals/renals.
  - Cervical/upper thoracic treatment to affect facilitation to the heart.
  - OA and C2 treatment to affect parasympathetic innervation to the heart.
  - Rib treatment to affect the sympathetic chain.

▶ REVIEW QUESTIONS: CARDIOLOGY

1. A 66-year-old male presents to the emergency room (ER) with “crushing” pain beneath his sternum that radiates to his jaw and left arm. He is diaphoretic and appears ashen. You suspect a myocardial infarction. Palpation may reveal tissue texture change
   A. In the thoracic spine, T2, left
   B. In the thoracic spine, T6, right
   C. In the cervical spine, C1, right
   D. In the thoracic spine, T12, left
   E. Over the 10th rib, right
2. The anterior Chapman’s reflex points for a myocardial infarction appears
   A. Between the second and third transverse processes
   B. At the fifth intercostal space
   C. Along the midline of the sternum
   D. At the second intercostal space, next to the sternum
   E. Immediately below the xyphoid process
3. A physician suspects kidney involvement in a patient’s sudden-onset hypertension. To help confirm his suspicions, he may look for a Chapman’s reflex point
   A. At a distance of 2.5 in above the umbilicus, on either side of the median line
   B. One in above the umbilicus, on either side of the median line
   C. On either side of the lumbar spinous processes
   D. At the angle of the 12th rib
   E. Immediately below the costal margin, anteriorly

Questions 4–5

A patient presents to the ER with a headache, sweating, palpitations, chest pain, and abdominal pain. On physical examination, you note a hand tremor. His blood pressure is 180/90. The abdominal computerized tomography (CT) scan shows a small adrenal mass that you suspect to be a pheochromocytoma.

4. When palpating for Chapman’s reflex points, you expect to find one
   A. At a distance of 2.5 in above, and 1 in on either side of the umbilicus
   B. One in above the umbilicus, on either side of the median line
   C. On either side of the lumbar spinous processes
   D. At the angle of the 12th rib
   E. Immediately below the costal margin, anteriorly
5. In addition to medical treatment for this patient, you decide to use OMT to help normalize sympathetic tone. Which technique would be most appropriate?
   A. Cervical soft tissue
   B. Muscle energy to the atlas
   C. Rib raising
   D. MFR of the diaphragm
   E. Pedal pump

▶ ANSWERS

1. **A**

Viscerosomatic change related to myocardial infarction generally appears in the thoracic spine, in the areas of T1–T5. Findings are more commonly on the left than on the right.

2. **D**

The anterior Chapman's reflex points, generally associated with a myocardial infarction, are located at the second intercostal space, next to the sternum.

3. **B**

The Chapman's reflex points for the kidney appear on either side of the median line, 1 in above the umbilicus.

4. **A**

Chapman's reflex points, associated with the adrenal glands, appear 2.5 in above and 1 in on either side of the umbilicus.

5. **C**

While each of these techniques may be of benefit, rib raising acts on the sympathetic chain aiding in normalization of sympathetic tone.

▶ PULMONOLOGY

Introduction

Pulmonary complaints are almost always associated with SD. Common diseases such as asthma, bronchitis, and pneumonia all have related SD anywhere from the diaphragm on up to the head. Board questions will focus on VSR and appropriate treatment techniques. These techniques typically focus on mobilization of the related somatic components. Many of the same techniques can be used for different pulmonary problems.

Relevant Anatomy

Thoracic Cage

- Bony components: cervical and thoracic vertebrae, ribs, sternum, manubrium
- Muscles: paraspinals, intercostals, diaphragm (some people use accessory muscles for respiration, i.e., SCM and scalenes)
- Joints: costovertebral, costotransverse, costochondral, costosternal

Thoracic Outlet

- Posteriorly—superior border of the scapula
- Anteriorly—clavicle
- Medially—1st and 2nd ribs

Generalized Viscerosomatic Reflex(es) for the Pulmonary System

- Sympathetics—T1–T4, bilateral
- Parasympathetics—C0, C1, C2 (vagus), C3–C5 (phrenic)

(For a more specific listing, please refer to VSR, Chapter 6.)

Osteopathic Considerations and Treatment Guidelines for Pulmonary Pathology

DYSFUNTION AFFECTING RELEVANT ANATOMIC STRUCTURES

THORACIC OUTLET

- Various nerves, arteries, and lymphatics, such as the brachial plexus trunks and subclabian vessels which supply the arms, travel through this passage.
- Restrictions lead to decreased lymphatic flow, increased congestion, decreased arterial flow due to sympathetic arterial vasospasm, nerve impingements, and decreased respiration due to thoracic cage restrictions.

CERVICAL VERTEBRAE

- C0, C1, mainly C2 (vagus)—provide parasympathetic innervation to the lower respiratory tract
  - Dysfunction may lead to bronchospasm
- C3-C5—phrenic nerve originates here
  - Dysfunction may lead to restrictions within the diaphragm

OTHER COMMON PULMONARY PATHOLOGY

COUGH

- Excessive coughing leads to upper thoracic and rib complaints.
- Related SD:
  - Upper thoracic segmental restrictions secondary to VSR
  - Rib dysfunction
    - Positional—posterior rib
    - Functional—inhaled or exhaled
  - Muscle spasm—intercostals, paraspinals
- Treatment guidelines:
  - Treat the upper thoracics—HVLA, ME, CS
  - Treat the ribs—HVLA, ME, CS
  - Take care of the VSR (upper cervicals)—indirect balancing of C2, FPR

ASTHMA

- Caused by bronchospasm of the airways.
- Treat the acute patient with the appropriate medical means.
- Treatment guidelines for the chronic asthmatic (treat between attacks)
  - Treat the VSR

BRONCHITIS AND PNEUMONIA

- Leads to a buildup of mucus within the bronchioles.
- Patients have difficulty with inhalation and exhalation.
- Movement of thoracic cage decreases.
- Treatment guidelines:
  - Improve lymphatic and venous flow—lymphatic pump, MFR of thoracic outlet.
  - Decrease bronchial secretions—rib raising.
  - Decrease the work load of breathing—indirect balancing of the diaphragm.
  - Treat the upper thoracics, ribs, and cervicals (VSR)—HVLA, ME, CS.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

- Musculoskeletal changes—barrel chest, anteroposterior (AP) diameter equals transverse diameter, hypertrophy of accessory muscles of respiration (sternocleidomastoid [SCM], scalenes), restriction of rib motion, increased kyphosis of thoracic spine, restriction of the diaphragm

- Treatment guidelines:
  - Mobilization of the thoracic spine and ribs—ST, DA, ME, CS.
  - Mobilization of the diaphragm—indirect balancing.
  - Improve lymphatic and venous flow—lymphatic pump, MFR of thoracic outlet.
  - Treat the VSR.

▶ REVIEW QUESTIONS: PULMONARY

Questions 1–5

An 88-year-old male presents to the clinic for evaluation of long-standing emphysema. In addition to standard therapy for this condition, you have been treating him using OMT.

1. Which of the following would *not* be an appropriate treatment to use on this patient?
   A. Indirect treatment of the atlas
   B. Thoracic outlet MFR
   C. Diaphragm release
   D. Thoracic lymphatic pump
   E. Pedal lymphatic pump

2. The patient states he has been coughing recently. What SD findings might you expect to find on this patient?
   A. Hypertonic scalenes
   B. Extended upper thoracic lesions
   C. Inhaled rib dysfunction
   D. Restricted diaphragm
   E. All of the above

3. Which region of the spine would you focus on to normalize parasympathetic tone to the diaphragm in this patient?
   A. C2
   B. T2
   C. T12
   D. L2
   E. Sacrum

4. The diaphragm is innervated by which cervical roots?
   A. C1–C3
   B. C2–C4
   C. C3–C5
   D. C4–C6
   E. C5–C7

5. The patient thanks you for your treatment and wants to know if there is anything he can do himself while at home to help his SD. Which would be the most appropriate treatment to recommend?
   A. CV4
   B. Scalene muscle energy

C. MFR of the diaphragm
D. Thoracic HVLA
E. ME for a forward torsion

▶ ANSWERS

1. **D**

The thoracic lymphatic pump technique may rupture blebs present in a patient with emphysema. Therefore, if lymph flow needs to be addressed, it is best done using a pedal lymphatic pump technique. The remainder of the choices would be appropriate for this patient.

2. **E**

One would expect to find all of the above SDs in a patient with emphysema who has been coughing recently.

3. **A**

Treatment of C2 may help influence the vagus nerve, which supplies parasympathetic innervation to the diaphragm. Treatment of the thoracic and lumbar spine would be appropriate for normalizing sympathetic tone. The sacrum may affect parasympathetic tone, however, not to the diaphragm.

4. **C**

There will commonly be a straightforward anatomy question integrated into an OMT question set. Typically, these are not difficult, but you should be prepared for them as these are questions you definitely do not want to miss. The diaphragm is innervated by cervical roots C3, C4, and C5.

5. **B**

ME for the scalenes is a simple and effective treatment that this patient could do himself while at home. The rest of the answer choices may be difficult or impossible for patients to learn to do on themselves.

▶ GASTROENTEROLOGY

Introduction

OMT questions regarding the gastrointestinal (GI) tract typically focus on treating the ANS associated with a given anatomic area. Therefore, it is helpful to think about autonomic distribution of the GI tract. While we may think of the GI system as being under predominantly parasympathetic control, there is a balance between the sympathetic and parasympathetic nervous system. In order to treat the GI tract using OMT, both systems may need to be addressed. Instead of thinking about treatment of the GI tract in terms of *increasing* or *decreasing* either sympathetic or parasympathetic drive, the goal of treatment should be *normalization* of the ANS. Treatment using OMT is thought to aid in this normalization. For example, treating the vagus nerve using OMT on C2 may increase parasympathetic drive to the constipated patient, or decrease it in a patient with diarrhea. In other words, when taking boards, don't get too preoccupied with whether a specific technique will increase or decrease a particular autonomic response. Rather, think about what area of the body will affect the particular nerves in question. For example, in a patient with either diarrhea or constipation, treatment of the vagus nerve would be appropriate.

Relevant Anatomy

- Foregut—structures up to the duodenum
  - Nerve supply—greater splanchnics (T5–T9)
  - Arterial supply—celiac artery
- Midgut—structures from the duodenum to the proximal two-thirds of the transverse colon
  - Nerve supply—lesser splanchnics (T10–T11)
  - Arterial supply—superior mesenteric artery
- Hindgut—structures from the distal one-third of the colon to the anus
  - Nerve supply—least and lumbar splanchnics (T12–L2)
  - Arterial supply—inferior mesenteric arteryn
- Lymphatics—lymphatic drainage of the GI tract is from abdominal trunks that converge to form the cisterna chyli, which then drains to the venous system via the thoracic duct.

Generalized Viscerosomatic Reflex(es) for the Gastrointestinal System

- Sympathetics—T5–L2
- Parasympathetics—occiput, C1, mainly C2 up to the left colic flexure; S2–S4 from the left colic flexure to the anus

(For a more specific listing, please refer to VSR, Chapter 6.)

Osteopathic Considerations and Treatment Guidelines for Gastrointestinal Pathology

Boards' questions involving treating GI disease generally focus on two types of questions.

- What general area of the spine should be the focus of treatment?
- What GI specific techniques would be appropriate for a given problem?

Example: Diarrhea

- Increased parasympathetic tone
- Increased sympathetic tone secondary to pain
- Treatment guidelines:
  - Treat the VSR (normalize autonomic tone).
    - Treat C2 (vagus), pelvic splanchnics (S2–S4) – indirect balancing of C2, sacral rocking
    - Treat the thoracolumbar (TL) junction (T10–L2)—HVLA, ME, CS, ST, DA
  - Chapman's reflex points (see Chapter 6)

These treatment guidelines can be used to answer the majority of board questions dealing with the GI tract. Board questions on this topic tend to be relatively straightforward. Usually, there won't be two answer choices involving treating the parasympathetics to the appropriate area *and* treating sympathetics to the appropriate area as one could argue that both choices may be appropriate. Other anatomical areas of focus for treating the GI tract should include occiput, atlas, C2, thoracic spine-higher levels for proximal GI tract, lower levels for distal GI tract, lumbar spine at the level of L1–L2, sacrum.

Questions 1–2

A 23-year-old male presents to your clinic after an episode of "food poisoning" 2 weeks ago. He states he recovered without any problem, but has had severe, constant nausea since the episode. After a negative workup you decide to use OMT as an adjunct treatment.

1. Which of the following treatments would you use for this patient?
   A. Indirect balancing to the upper cervical spine
   B. HVLA–T2
   C. Sternal articulation
   D. Indirect balancing of the sacrum
   E. ME to the fibular head

2. Where would you expect to find tissue texture changes in this patient?
   A. C2 on the left
   B. C7 on the right
   C. T2 on the right
   D. T3 on the left
   E. Right sacroiliac (SI) joint

Questions 3–5

A 68-year-old female presents to your office 1-year status postpartial colectomy (a portion of the sigmoid colon was removed, specifically) for recurrent diverticulitis. She complains of slight, but uncomfortable, abdominal pain that occurs with certain movements. She saw her surgeon who did a thorough workup, but found nothing abnormal.

3. Where would you expect to find tissue texture changes on this patient?
   A. T4 on the right
   B. T7 on the left
   C. T12 on the right
   D. L2 on the left
   E. Over the right ischial tuberosity

4. You decide to try OMT as an adjunct treatment. Which of the following techniques would be appropriate for this patient?
   A. Cervical HVLA
   B. ME for T2
   C. General lower abdominal/pelvic lift
   D. ME for a forward torsion
   E. Ischiotuberosity spread

5. She also complains of constipation. You decide to treat the parasympathetic autonomics to her affected area. To which region would you direct your treatment?
   A. Occipitomastoid suture
   B. Upper cervical spine
   C. Upper thoracic spine from T1–T4
   D. Upper lumbar spine
   E. Sacrum

▶ ANSWERS

1. **A**

Once you hear nausea, you want to think about the vagus nerve. Treating the upper cervical segments, specifically the occiput, atlas, and C2, will be of benefit to this patient. While she could theoretically benefit from any of the above treatments, especially choices A and E, only choice A has an association with the vagus nerve.

2. **A**

Vagus irritability may produce tissue texture changes at the level of C2. While the upper thoracics are thought to produce tissue texture changes in response to cardiac and pulmonary issues, they are not thought to react from issues to the vagus nerve. Nothing in the question stem leaves us to believe this patient is having SI joint problems.

3. **D**

We know this patient had her colon surgically manipulated. Since the highest percentage of diverticula is found in the distal colon, we would expect to find tissue texture changes at the level of L2.

4. **C**

Since this patient has had prior surgery, she may have adhesions or other fascial restrictions in her abdomen. Treating these with an abdominal technique may help free some of these fascial restrictions. Cervical HVLA is probably not a good answer in this case due to the age of the patient. Even if it is completely safe, it is still not addressing her main issue, which is her colon. The same could be said for choices B and D. Choice E may be beneficial but is typically used for lower pelvic organs such as the bladder or prostate. Therefore, the best answer is C.

5. **E**

Again, knowing the anatomic location of this patient's issue and the nervous system that supplies this area gives us our answer. Both the occipitomastoid suture and the upper cervical spine are associated with the vagus nerve; however, the vagus nerve does not innervate the descending and sigmoid colon, where this patient likely had her surgery. The upper thoracic and lumbar spine would be beneficial for modulating sympathetic tone, not parasympathetic tone.

▶ UROLOGY AND GYNECOLOGY

Introduction to the Urinary System

Urological dysfunctions can affect all patient populations including men, women, and children. Acute processes must always be assessed before OMT can be used; however, VSR can be used for diagnostic purposes and OMT can be used to treat chronic diseases. As always, board questions tend to focus on the VSR and appropriate treatment techniques.

Relevant Anatomy

- Sympathetic innervation of the urinary system
  - Kidneys, ureters, bladder: T10–L1
  - Prostate: L1–L2

- Parasympathetic innervation of the urinary system
  - Kidneys, ureters: very little input to the kidney; the distal ureters get input from S2–S4
  - Bladder and prostate: S2–S4

Generalized Viscerosomatic Reflex(es) of the Urinary System

- Sympathetics—T9–L2 (think TL junction)
- Parasympathetics—occiput, C1, C2 up to the proximal ureter; S2–S4 the rest of the way

Sympathetic VSR for urinary system is at TL junction.

Osteopathic Considerations and Treatment Guidelines for Urologic Pathology

Examples: Pyelonephritis, renal lithiasis, urinary tract infection (UTI), benign prostatic hypertrophy (BPH)

- Treat the acute infection with the appropriate medical attention.
- Give pain medication if necessary.
- Use VSR to help with diagnosis.
- Treatment guidelines (when possible):
  - Treat the VSR—ST, Still technique, sacral balancing
  - Treat the pelvic fascia—indirect MFR

Introduction to Gynecology

Most women throughout their lifetime deal with some sort of pelvic pain. This may be as simple as dysmenorrhea or it may be related to a more complex disease process such as a gynecological neoplasm. Successful treatment of pelvic pain comes with a thorough understanding of the relevant anatomy and physiology of the pelvis as well as the innervations of the structures within.

One approach to diagnosing pelvic pain is to discern which function of the pelvic floor is being compromised. The pelvic floor has three main functions: to support the pelvic organs, to act as a sphincter for perineal openings, and to maintain sexual functions. Pelvic complaints relating to any one of those three functions can guide an osteopathic physician in terms of treatment. Knowledge of VSR of the pelvis is also imperative.

Gynecological questions on the boards involving OMM focus on VSR and treatment for common gynecological pathology. A brief overview of pelvic and other gynecological complaints will be discussed as well as their associated SD and appropriate treatment guidelines.

Relevant Anatomy

- Pelvic floor
  - Muscles: levator ani muscles and pelvic diaphragm complex
  - Contains: visceral pelvic fascia, pelvic diaphragm, deep genital muscles, sphincter muscles
- Autonomic innervation of pelvic organs (ovaries, fallopian tubes, uterus, cervix, vagina)
  - Sympathetic—T9–L1
  - Parasympathetic—S2–S4

Generalized Viscerosomatic Reflex(es) for the Pelvic Organs

- Sympathetics—T9–L1
- Parasympathetics—S2–S4

(For a more specific list, please refer to Chapter 6.)

Osteopathic Considerations and Treatment Guidelines for Gynecological Pathology

Dysmenorrhea

Think outside the pelvis–treat the thoracics too!

- Causes: uterine contractions, ischemia, chronic pain syndromes or other psychological disorders affecting pain perception, cervical pathology (cervical stenosis).
  - Determine whether it's primary or secondary.
- Manifestations: painful menstruation, cramping, nausea, fatigue, headache
- VSR: T10–L1, S2–S4
- Treatment guidelines:
  - Chapman points within the iliotibial band (ITB) may be present; treatment of these points may be beneficial.
  - Lymphatic techniques—edema and bloating can be associated with dysmenorrhea; focus on treating the upper thoracics and the thoracic outlet (may alleviate breast tenderness as well)
  - Sacral techniques—inhibitory pressure can decrease uterine contractions and is well-tolerated.

Premenstrual Syndrome

Sacral rocking inhibits parasympathetics to the pelvic organs.

- Causes: (not limited to) hormonal imbalances, psychological, social, or genetic factors, vitamin deficiencies
- Manifestations: bloating, weight gain, irritability, mood changes, fatigue
- VSR: T9–L1, S2–S4, C2 (vagus) may be present
- Treatment guidelines:
  - Treat the VSR
  - Treat lymphatics
  - Check for OA dysfunction
  - Lumbosacral decompression
  - Sacral techniques—rocking of the sacral base helps to inhibit the parasympathetics

Pelvic Floor Dysfunction

- Causes: (not limited to) pregnancy, labor trauma, weakness of muscular structures, previous sexual abuse, pelvic structural trauma
- Manifestations: incontinence (fecal and urinary), sexual dysfunction, prolapse of pelvic organs, dyspareunia
- VSR: T9–L1, S2–S4
- Treatment guidelines:
  - Trigger points (not tenderpoints) are found in many of the muscular structures including coccygeus, levator ani, obturator internus, adductor magnus, and piriformis.
  - CS and MFR techniques can be very beneficial.
  - Direct inhibitory pressure of intravaginal structures.
  - Pelvic diaphragm release.

► REVIEW QUESTIONS: UROLOGY

1. A 26-year-old female complains of burning with urination and urgency. You start her on Cipro 250 mg twice a day for 3 days. You also assess and treat the VSR at the level of
   A. C2
   B. T1–T3
   C. T6–T8
   D. T12–L1
   E. L4–L5
2. A 77-year-old female presents with severe low back pain, fever/chills, and dysuria for the past week. You order a urine culture that shows *Escherichia coli* and a urine sample that shows leukocyte casts with hematuria. You also note tissue texture change at which level?
   A. C2
   B. T1–T3
   C. T6–T8
   D. T12–L1
   E. L4–L5
3. A 62-year-old healthy male complains of difficulty maintaining a steady stream of urine for the past few months. He denies dysuria and fevers. The urinalysis is negative. You find tissue texture change at the level of T12–L2. What should be at the top of your differential diagnosis?
   A. Pyelonephritis
   B. BPH
   C. UTI
   D. Renal lithiasis
   E. Cystitis

► ANSWERS

1. **D**, 2. **D**, 3. **B**.

All of these questions refer to the VSR for the urinary system. Question 1 addresses the bladder affected by a UTI. Question 2 addresses the kidneys affected by pyelonephritis. Question 3 addresses the prostate affected by BPH.

► REVIEW QUESTIONS: GYNECOLOGY

Questions 1-2

A 32-year-old female, G2P2002, presents to her gynecologist and states that her husband requested that she do something about her premenstrual syndrome (PMS). She states that her symptoms of irritability and mood changes are "getting worse" throughout the past few years and she would like some relief.

1. Which areas do you expect to find viscerosomatic reflexes?
   A. C2 and T1–T4
   B. C2 and T5–T9

C. C2 and L3–L5
D. S2–S4 and T9–L1
E. S2–S4 and L3–L5

2. The gynecologist starts the patient on oral contraceptive pills (OCPs) and decides to do OMT. Which of the following techniques is most appropriate for relieving symptoms of PMS?
   A. Sacral rocking
   B. Indirect balancing of the diaphragm
   C. Rib raising
   D. ME for a rotated ilium
   E. Frontal lift

Questions 3-4

A 19-year-old female, G0P0, complains of painful cramping associated with every menstrual cycle. She began her menses at age 12; her cycles are every 32 days, and they last for 7 days. A Pap smear was done and her pelvic examination is normal.

3. What area of the body do you expect to find Chapman's reflex points.?
   A. The posterior cervical spine
   B. The costosternal joints
   C. The medial border of the scapula
   D. The TL junction
   E. The ITB

4. You decide to treat the patient with inhibitory pressure of the sacrum. This technique most improves dysmenorrhea by?
   A. Affecting the sympathetics to the pelvic organs
   B. Decreasing uterine contractions
   C. Increasing levels of circulating estrogen
   D. Affecting the Jones' CS tenderpoint of the iliolumbar ligament
   E. Leveling the sacral base

5. A 56-year-old female, with four previous NSVD's presents to your office with complaints of incontinence. Her symptoms started about a year ago, but she now admits that she has recently started using absorbent pads. You diagnose her with a prolapsed bladder. The patient wants to avoid surgery. Aside from medical treatment, what OMT can be used to help with her symptoms?
   A. ME of the TL junction
   B. Indirect balancing of C2
   C. Cervical soft tissue
   D. CS of anterior L5 tenderpoint
   E. ME of psoas

▶ ANSWERS

1. **D**

Sometimes OMM questions on the boards do not directly address musculoskeletal issues. When presented with a gynecology case, regardless of the signs and symptoms, think VSR. For the pelvic organs, the sympathetics are at the TL junction (T9–L1). The parasympathetics are at S2–S4. Specifically for PMS, the vagus reflex at C2 may be present secondary to manifestations of abdominal complaints such as cramping and diarrhea.

2. **A**

Sacral rocking is a technique, that affects the pelvic splanchnics (S2–S4). These are the VSR for parasympathetic innervation of the pelvic organs. Balancing the diaphragm helps with respiratory complaints. Rib raising helps to decrease sympathetic tone. The patient may have some unrelated ilium dysfunction, which may respond to ME, but this technique would not specifically help with the symptoms of PMS. Frontal lift primarily affects the sinuses.

3. **E**

Patients with dysmenorrhea have pelvic visceral irritation, which can manifest in CRP in the ITB. All the other regions listed are not associated with pelvic complaints. Posterior cervical spine—HEENT; the costosternal joints—respiratory pathology; medial border of the scapula—upper extremity complaints; TL junction—adrenal pathology.

4. **B**

Inhibitory pressure of the sacrum directly affects the parasympathetics to the pelvic organs, specifically the uterus. This results in a decrease of uterine contractions, which can improve dysmenorrhea. None of the sympathetic innervation of any organ comes from the sacrum. This technique plays no role in the hormonal regulation of estrogen nor does it treat the iliolumbar ligament, which doesn't contribute to dysmenorrhea regardless. Leveling the sacral base alone will not improve dysmenorrhea.

5. **A**

This patient has pelvic floor dysfunction most likely due to her four vaginal deliveries. Treating the TL junction will directly affect the sympathetics not only to the pelvic organs but also to the organs of the urinary system (kidneys, bladder). Normalizing autonomic tone to this region will not fix her prolapsed bladder, but may allow for better control of her urine. Treating C2 or the other cervical vertebrae have no effect on this area. This patient may have an anterior L5 tenderpoint or a tight psoas, but treating neither will help to balance the ANS.

▶ OBSTETRICS

Introduction

The obstetrics patient is a unique patient in the osteopathic setting. The types of SD that arise can change dramatically over the 40 weeks of pregnancy. They may be present for a short period of time, may last the entire pregnancy, and may completely resolve following the delivery. Therefore, it is very important to do a screening structural examination early on in the pregnancy to establish what the patient's current anatomy, physiology, and SD is. It is also a great time to address existing chronic SD because pregnancy may often times exacerbate these dysfunctions. As the patient progresses throughout the pregnancy, so must the clinician's mind-set in terms of diagnosis and treatment. Different problems present during all three trimesters and types of treatment can change too. OMM can assist in diagnosing and treating the obstetrics patient but fetal well-being and maternal well-being are the most important considerations. All developmental problems of the fetus and any medical problems of the mother must be assessed before treatment using OMT can begin. Obstetrics questions on the boards involving OMM tend to focus on VSR and treatment guidelines throughout the different trimesters.

Relevant Anatomy and Overview of Changes During Pregnancy

Musculoskeletal

- Increased lordosis and change in the center of gravity.
- Compensatory increase in the thoracic kyphosis.
- Abdominal muscles become overstretched while the paraspinal muscles become shortened and tight.
- Possible exacerbation of scoliosis.
- Changes in contour of the rib cage affecting respiration.
- Radicular symptoms of extremities secondary to the uterus placing pressure on the nerve roots of the lumbosacral spine.

Lymphatics and Other Fluids

Lymphatics may be at the root of many manifestations of pregnancy.

- Circulation to the pelvis increases in order to support the existing pregnancy.
- An imbalance exists between the increased fluid in the pelvis and the decrease in return of the fluid to the systemic circulation leading to pelvic floor congestion.
- Decreased fluid return also results in upper and lower extremity congestion and edema, which in turn may cause problems in the extremities.

Hormonal

- Relaxin is released, which allows the maternal pelvic ligaments to accommodate the growing fetus.
- Ligamentous laxity is present throughout the whole body, but can lead to hypermobility, especially in the SI joints, pubic symphysis, and hips.
- Increased levels of progesterone can cause headaches, nausea, decreased peristalsis of the GI tract, and can affect the thoracic cage leading to an increase in tidal volume.

Generalized Viscerosomatic Reflex(es) for the Pelvic Organs

There are additional VSR that come late with specific manifestations of pregnancy.

- Sympathetics—T9–L2
- Parasympathetics—S2–S4

(For a complete listing, see Chapter 6.)

Osteopathic Considerations and Treatment Guidelines for the Pregnant Patient

First Trimester

During the first trimester, it is important to normalize the sacrum as much as possible. Check for sacral unleveling. The less SD at this point during the pregnancy, the easier new onset SD will be to treat. Both indirect and direct techniques can be used and any position of treatment for which the patient is comfortable is appropriate. This includes lying prone.

Manifestations of First-Trimester Pregnancy and Related Somatic Dysfunction

Hyperemesis

- Cause: Not exactly understood
- VSR: C2 on the left (vagus reflex), T5–T9 (additional GI discomfort)

- Treatment guidelines: Decrease suboccipital tension with MFR (Killer Fingers); treat C2 with indirect balancing; treat C3–C5 (phrenic nerve); treat the upper thoracics with ST, HVLA, ME, CS

Pelvic Floor Congestion

- Cause: Increased circulation to the pelvic organs and decreased venous return to the systemic circulation
- Treatment guidelines: Ischial tuberosity spread; lymphatic pedal pump; range of motion (ROM) exercises of the lower extremities

Sacral Dysfunction

- At this time in the pregnancy, any sacral dysfunction is fair game. Try to normalize sacral function as much as possible. All sacral techniques can be used.

SECOND TRIMESTER

During the second trimester, hyperemesis often resolves but other conditions may present. Treating with indirect and direct techniques is appropriate and the patient can still be treated in any position including lying prone. Treating SD that may not be related to the pregnancy is just as important.

MANIFESTATIONS OF SECOND-TRIMESTER PREGNANCY AND RELATED SOMATIC DYSFUNCTION

Round Ligament Pain

- Cause: As the gravid uterus becomes larger, there is increased tension of the round ligaments, which can cause pain, cramping, and discomfort in the lower abdominal area.
- VSR: T10-L1.
- Treatment guidelines: Direct or indirect MFR of the abdominal fascia; anterior lumbar CS tenderpoints L3–L5 (correlates with round ligament pain).

Carpal Tunnel

A tender point in pronator teres muscle is often present in carpal tunnel.

- Cause: Increased localized edema and swelling in the carpal tunnel; can be due to breast congestion, axillary congestion, and changes in the postural mechanics of the head and neck
- Treatment guidelines: MFR of the thoracic outlet; treat the axial component in the upper thoracics; CS in the forearm (median nerve travels through pronator teres where a tenderpoint may be present); MFR of the carpel tunnel
- Night splints may be necessary
- Often resolves after delivery

THIRD TRIMESTER

During the third trimester, the body is stressed to its maximum. The lumbar lordosis is the greatest, the venous congestion is the greatest, the reflux is the worst, and the patient can become structurally fatigued. It is more important than ever to be able to modify techniques used to treat these symptoms during this time. Again, depending on the situation, direct and indirect techniques can still be used. Most techniques should be done with the patient seated or lying on her side. Prone techniques are obviously off-limits. Remember to limit the sidelying techniques especially on the right side so the fetus does not compress the inferior vena cava (IVC) even further. Continue treating the general VSR.

MANIFESTATIONS OF THIRD-TIMESTER PREGNANCY AND RELATED SOMATIC DYSFUNCTION

Lower Extremity Edema and Hemorrhoids

- Cause: As the pelvic contents continue to enlarge and gravity takes an effect, more and more pressure is placed on the venous and lymphatic return from the lower extremities as well as the IVC, which leads to increased venous congestion.
- Treatment guidelines: Any type of myofascial technique used to increase lymphatic flow; treat the SD that corresponds with the VS reflexes; treat the pelvic diaphragm to lift pelvic contents.

Remember the common G.I. pattern for reflux:
- C2L
- T3R
- T5L
- T7R

Reflux

- Cause: Can be structural (i.e., compression of the abdominal contents), or hormonal (i.e., relaxation of the lower esophageal sphincter)
- VSR: G.I. pattern (C2 left, T3 right, T5 left, T7 right); in general, focus on T5–T9 and C2 (vagus)
- Treatment guidelines: HVLA to midthoracics (i.e., epigastric thrust), indirect balancing of C2; treatment of the respiratory diaphragm

CONSIDERATIONS OF OSTEOPATHIC MANIPULATIVE TECHNIQUES DURING LABOR

OMT can still be used throughout labor. This will largely depend on the condition of the patient.

- Gentle techniques are tolerated well, especially in early labor
- Treating the sympathetic can induce labor, while treating the parasympathetic can induce cervical dilation
- Cranial techniques have been shown to influence contractions
- Absolutely no direct or otherwise aggressive treatments; fetal well-being must always be kept in mind

SOMATIC DYSFUNCTION DIRECTLY RELATED TO TRAUMA OF DELIVERY

Most of the structural trauma is related to the way in which the fetus travels through the birth canal. Significant strain is placed upon the pelvis and soft tissue, which can persist after delivery.

- Iliac dysfunction—up-slip or down-slip of the ilium; anterior or posterior ilium; pubic symphysis dysfunction/separation
- Sacral base restriction—either torsions or shears
- Lumbosacral junction dysfunction—disc pathology
- Lower extremity neuropathy associated with lower back trauma

CONTRAINDICATIONS OF OSTEOPATHIC MANIPULATIVE TECHNIQUES IN THE PREGNANT PATIENT

Table 5-1 outlines contraindications by trimester.

POSTPARTUM CONSIDERATIONS

The goal of treating the patient during the postpartum period is to return her to her pregravid state. Breast-feeding mothers may also have continued complaints of upper thoracic pain as well as a continuation of the carpal tunnel symptoms. Techniques used to address these problems during pregnancy can absolutely be used during the postpartum time.

TABLE 5-1. Contraindications of OMT in the Pregnant Patient Divided by Trimester

Pathology	First Trimester	Second Trimester	Third Trimester
Vaginal bleeding of unknown etiology	X	X	X
History of recent abdominal trauma	X	X	X
Ectopic pregnancy	X		
Possibility of threatened or incomplete abortion	X	X	
Placenta previa		X	X
Abruption		X	X
Premature rupture of membranes (PROM)		X	X
Preterm labor (PTL)		X	X
Prolapsed umbilical cord			X
Pre-eclampsia/ eclampsia/ pregnancy-induced hypertension		X	X

▶ REVIEW QUESTIONS: OBSTETRICS

Questions 1–3

A 27-year-old female, G1P0 at 9 and 3/7 weeks, presents for an initial prenatal visit. A ultrasound confirms an IUP and the patient has an enlarged uterus upon palpation.

1. The patient is complaining of morning sickness. Where are you most likely to palpate VSR?
   A. C2
   B. T1–T3
   C. T11–T12
   D. L3–L5
   E. S2–S4
2. Which technique is most appropriate to treat her symptoms of nausea?
   A. Sacral inhibitory pressure
   B. CS of iliolumbar ligament
   C. Direct treatment of inhaled ribs
   D. ST of the upper thoracics
   E. ME of the mid to lower thoracics

3. The structural examination reveals a low anterior superior iliac spine (ASIS) on the right, a low PSIS on the left, and restriction of motion of the right ilium. Standing flexion test is positive on the right. What type of SD does she most likely have?
   A. Posterior ilium on the right
   B. Left innominate up-slip
   C. Posterior sacrum on the left
   D. Anterior ilium on the right
   E. Unilaterally extended sacrum on the left

Questions 4–5

A 31-year-old female, G2P1 at 22 and 1/7 weeks, presents to the OB clinic with complaints of numbness and tingling in her right hand. She has never had this before, and her symptoms only started a few weeks ago. Upon examination, her uterus is measuring at 21 cm and FHT are in the 130s. The upper extremity examination reveals a positive Phalen's test and a positive Tinel's sign of the right hand. You diagnose carpal tunnel.

4. What is the most likely cause of carpal tunnel in the second trimester of pregnancy?
   A. Compression of the IVC by the fetus
   B. Breast and axillary congestion
   C. Increased lumbar lordosis
   D. Flexed dysfunctions in the TL junction
   E. Restriction of the hemidiaphragm

5. Aside from utilizing night splints to relieve the symptoms, what osteopathic technique would be most appropriate to treat the patient?
   A. HVLA of the upper cervicals
   B. CS of levator scapulae
   C. MFR of the thoracic outlet
   D. CS of the biceps tendon
   E. ME of the TL junction

► ANSWERS

1. **A**

Hyperemesis in the first trimester is a very common problem of pregnancy. The nausea associated with it will cause a VSR of the vagus nerve (parasympathetic innervation to the gut) resulting in SD of C2. Other VSR: T1–T3 – cardiac or pulmonary, T11–T12 – genitourinary (GU), L3–L5 – no VSR, S2–S4 – parasympathetics of lower GI and GU.

2. **E**

The sympathetic innervation of the gut comes from T5 to T9. ME is an appropriate technique to treat this area. All of the other areas of treatment do not have an effect on nausea or other GI symptoms.

3. **D**

A standing structural examination is very important to do as early on in the pregnancy as possible. The positive standing flexion test on the right immediately clues you in to a problem with the ilium on the right. The low ASIS on the right and restriction of motion on the right confirms your diagnosis of an anterior ilium on the right.

4. **B**

During the second trimester, increased breast and axillary congestion lead to localized edema and swelling throughout the upper extremity. Compression of the IVC typically does not occur until later pregnancy (third trimester). Structural changes of the TL junction and lumbar spine may be present, but do not contribute directly to carpal tunnel.

5. **C**

MFR of the thoracic outlet will facilitate drainage of the venous and lymphatic systems of the upper extremity. While SD may be present in many other areas of the body, treatment of these areas will not directly affect the thoracic outlet.

▶ PEDIATRICS

Introduction

The pediatric patient can frequently present to the physician's office with complaints that go undiagnosed. Many dysfunctions are related to trauma from birth. Other dysfunctions occur from injuries secondary to repetitive postural patterns. The musculoskeletal system of the pediatric patient is more flexible than that of the adult due to the greater ratio of cartilage to bone. This allows for more frequent dysfunctions because the skeletal system is not rigid. However, it allows techniques like cranial manipulation, indirect balancing, ME, and FPR to work well in resolving SD. For all pediatric dysfunctions, HVLA is contraindicated. The skeletal system has yet to develop fully. Using a strong force can be detrimental.

Relevant Anatomy

CRANIAL

(See Figure 5-1.)

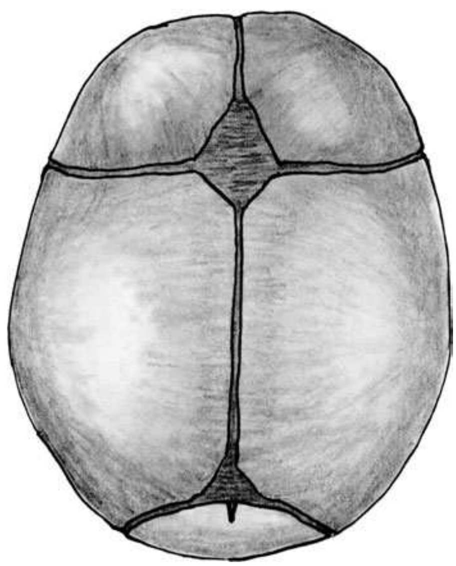


FIGURE 5-1. Pediatric cranium.

- Made up of the cranial base and vault
  - The vault has areas of ossification within membranous areas.
  - The base is made up of fibrocartilaginous articulations.
  - The cartilaginous and membranous portions, which permit maximum compressibility, allow the fetus' head to move through the birth canal.

Osteopathic Considerations and Treatment Guidelines for the Pediatric Patient

CRANIAL DYSFUNCTIONS

The following cranial dysfunctions are typically due to birth trauma. Most dysfunctions can be treated in similar ways using various craniosacral techniques (please refer to Chapter 8).

ANTERIOR OCCIPUT

- Results in compression of the twelfth cranial nerve (hypoglossal nerve).
- Manifestations: problems with the suckling mechanism.
- Can also occur after birth if the baby is constantly held in the same position while feeding (slight left lateral decubitus position with the head turned left and flexed).
- Treatment guidelines: craniosacral techniques.

MISSHAPED HEAD

- Cause: Sphenobasilar lateral strain as the baby is moving through the mother's pelvic girdle (birth canal).
- Manifestations:
  - Parallelogram-shaped head
  - Entrapment of the CN III, IV, and VI, which can cause eye dysfunction
- Treatment guidelines: Craniosacral techniques

CONE-SHAPED HEAD

- Cause: Increased time in the birth canal or vacuum extraction
- Manifestations: The entire cranial vault become disproportionate
- Treatment guidelines: Craniosacral techniques

OTHER COMMON PEDIATRIC PATHOLOGY

TORTICOLLIS

- Cause: Unilateral contraction of the SCM
- Manifestations:
  - The infant's neck is sidebent and rotated in opposite directions.
  - Temporal dysfunction secondary to attachments of SCM.
    - The SCM originates from the manubrium (sternal head) and medial portion of the clavicle (clavicular head) and inserts on the mastoid process of the temporal bone.
- Treatment guidelines:
  - Craniosacral techniques
  - Indirect techniques of the cervical spine and clavicle
  - CS of SCM

Pelvic Girdle Dysfunction

- Cause: Strain during birth or growth plate development
- Manifestations: Craniosacral dysfunction, asymmetric rotation of the innominates, genu varus/valgus, short leg syndrome, scoliosis
- Treatment guidelines:
  - Craniosacral techniques
  - Treatment of the ilium—ME, indirect balancing of the pelvis

▶ REVIEW QUESTIONS: PEDIATRICS

Questions 1–5

A concerned mother brings her 8-week-old infant in to the clinic. She would like to know if there is anything else that can be done to improve the overall health of her child. In addition to counseling on diet and safety, you decide to treat the infant using OMT.

1. The mother states that her previous child had trouble with suckling as an infant, even though his appetite was good. You explain to her that a possible cause for this may have been ______ compressing the _____.
   A. Condylar compression, twelfth nerve
   B. Diaphragm restriction, esophagus
   C. Inguinal hernia, genitofemoral nerve
   D. Umbilical hernia, small intestine
   E. Psoas hypertrophy, SI joint
2. The mother then tells you this child had a “parallelogram-shaped” head when she was born. What cranial strain pattern would you suspect?
   A. Torsion
   B. Sidebending rotation
   C. Lateral strain
   D. Vertical strain
   E. Sphenobasilar synchondrosis (SBS) compression
3. While treating the infant, the mother tells you about a friend of hers who had a child with torticollis. What cranial nerve would you suspect was involved?
   A. III
   B. IV
   C. VII
   D. IX
   E. XI
4. Which cranial bone may become dysfunctional as a result of torticollis?
   A. Frontal
   B. Sphenoid
   C. Parietal
   D. Temporal
   E. Occiput
5. While palpating the infant in the vault hold, you note the rate and amplitude of the cranial rhythmic impulse (CRI) seem decreased. What other anatomic region would be helpful in addressing the CRI?
   A. C2
   B. Upper thoracic spine

C. Lumbar spine
D. Sacrum
E. Fibular head

▶ ANSWERS

1. **A**

Condylar compression is the most likely of the above choices given the anatomy of the occiput at birth. Compression of the twelfth nerve could have produced difficulty with suckling. The remainder of the choices would have produced additional symptoms in addition to suckling difficulties.

2. **C**

Whenever you see "parallelogram" in a question pertaining to cranial strain patterns, you should immediately think of lateral strains. None of the other choices would produce a parallelogram-shaped head.

3. **E**

CN XI is typically the culprit in torticollis, causing dysfunction of the SCM. The remaining CN may produce other systemic dysfunctions if irritated, but would not affect the SCM muscle.

4. **D**

Tension on the mastoid process as a result from a hypertonic SCM may produce temporal bone dysfunction. This could lead to dysfunction of the remainder of the cranial bones, however the temporal bone would be the primary bone affected in torticollis.

5. **D**

Pelvic girdle dysfunction is common after birth. Sacral dysfunction may be responsible for the decreased rate and amplitude of the CRI. Therefore, treatment of the sacrum may help improve the cranial mechanism.

▶ THE HOSPITALIZED AND POSTSURGICAL PATIENT

Introduction

Patients that have been hospitalized, and more specifically, those that are postsurgical are compromised in some way. It may be decreased lung function due to a recent coronary artery bypass graft (CABG) or decreased ROM secondary to immobilization of a fracture. Regardless of the situation, certain concepts need to be kept in mind when using OMT. Determining a goal of treatment helps to decipher which techniques are appropriate. The different types of treatment tend to be a focus on the boards.

Osteopathic Considerations and Treatment Guidelines for the Hospitalized or Postoperative Patient

Goals of Treatment and Examples of Specific Techniques

(Not all-inclusive)

- Increase venous and lymphatic return/decrease edema and congestion
  - Extremity ROM exercises
  - Lymphatic techniques—pedal pump, lymphatic pump
  - MFR of the thoracic outle

- Increase ROM (muscles and joints)/decrease edema
  - ROM exercises
- Normalize the ANS
  - Treat VSR
  - Rib raising
  - Sacral rocking
- Normalize the CRI
  - Craniosacral techniques
- Increase lung function
  - Treat the VSR—indirect techniques of the upper thoracics, ST, CS
  - Indirect balancing of the diaphragm
  - Rib techniques—CS, balancing
- Stimulate the bowels
  - Rib raising
  - Treat the mid-lower thoracics

EXAMPLE OF POSTOPERATIVE SURGICAL CASE WITH APPROPRIATE TECHNIQUES

CORONARY ARTERY BYPASS GRAFT

- Early stages—*no* high velocity, low amplitude (HVLA); rib raising, cervical soft tissue (focus on C2—vagus), early mobilization (walking)
- Later stages—sternal articulation, rib walking, treat the upper thoracics (ME, CS, DA)

▶ REVIEW QUESTIONS: THE HOSPITALIZED PATIENT/ POSTSURGICAL PATIENT

1. A 55-year-old female presents to her primary care physician for the first time in several years. She has smoked 1 pack of cigarettes a day for 35 years. She now complains of an intermittent, productive cough and dyspnea that has bothered her for the last 2 years. The physician suspects chronic obstructive pulmonary disease (COPD). On the musculoskeletal examination of the thoracic cage, he expects to find
   A. T5, sidebent right, rotated right, and flexed
   B. Decreased thoracic motion in exhalation
   C. An elevated 1st rib on the left side
   D. Increased compliance of the thoracic cage
   E. Decreased thoracic motion in inhalation
2. A 75-year-old male is hospitalized for an acute exacerbation of congestive heart failure (CHF). After a thorough evaluation, you and your attending think that OMT might be beneficial to the patient. Your first step before performing OMT is to
   A. Place the patient in a completely supine position
   B. Call the patient's family to request consent
   C. Determine which techniques may be most appropriate
   D. Perform a complete physical examination
   E. Determine the patient's urine output
3. Release of the respiratory diaphragm and employment of the pedal pump technique both serve to
   A. Increase fluid movement throughout the body
   B. Quiet viscerosomatic reflexes
   C. Mobilize the thoracic cage

D. Exacerbate cardiac arrhythmias
E. Increase the likelihood of a local inflammatory reaction

4. While on your surgery rotation, you round on a patient who is 48 hours post-CABG. Your attending would like you to perform OMT to help aid in his recovery. What technique would be most appropriate?
   A. MFR to the thoracic inlet
   B. Articulation to the thoracic cage
   C. Thoracic pump
   D. Rib raising
   E. All of the above

5. The above patient is now 2 months post-CABG. Which OMT technique would be most appropriate at this time?
   A. MFR to the thoracic inlet
   B. Articulation to the thoracic cage
   C. Thoracic pump
   D. Rib raising
   E. All of the above

▶ ANSWERS

1. **B**

COPD is considered an obstructive lung disease. As a result, patients will generally present with limited thoracic cage motion during exhalation. Limited motion may be palpated on the musculoskeletal examination.

2. **C**

OMT for the hospitalized patient must be individualized to the patient's illness and needs. Of paramount importance is determining which techniques will be most appropriate for this patient.

3. **C**

OMT for the hospitalized patient must be individualized to the patient's illness and needs. Of paramount importance is determining which techniques will be most appropriate for this patient.

4. **A**

In someone who is 48 hours postoperative, only very gentle techniques would be appropriate. While the rest of the techniques would help mobilize lymph and normalize sympathetic tone, they may also inhibit healing by placing undo strain on a fragile thoracic cage, which has been recently been opened and is now reconnected with wires.

5. **E**

Enough time has now passed to give the thoracic cage a chance to heal; therefore, any of the above techniques would be appropriate and helpful to this patient.

CHAPTER 6

High Yield Topics for the COMLEX

Occasionally, questions about the history of osteopathy will be asked on the COMLEX. Included in this section is a time line of important historical events. Other high yield topics on the COMLEX are often times questions that are easy to write. Viscerosomatic reflexes (VSR), Chapman's reflex points (CRP), and Jones' counterstrain tenderpoints are commonly included as adjunct questions to clinical scenarios. The following section contains this information in a table format as a quick reference guide. It may be a good idea to look these tables over the night or two before taking the examination.

▶ HISTORY OF OSTEOPATHY

- **1828:** A.T. Still was born in Virginia.
- **1874:** A.T. Still "flung to the breeze the banner of osteopathy."
- **1892:** American School of Osteopathy (ASO) opens in Kirksville, MO.
- **1893:** Nettie Bolles is the first woman to serve on an Osteopathic Faculty—an example of A.T. Still's commitment to women's rights.
- **1896:** Vermont is the first state to recognize osteopathy.
- **1897:** American Osteopathic Association (AOA) is founded—originally the American Association for the Advancement of Osteopathy.
- **1898:** Second college founded—Philadelphia College and Infirmary of Osteopathy (will become PCOM).
- **1899:** William Smith, MD, ASO faculty, first to delineate the arterial system with x-rays. First and only x-ray west of Mississippi. Mark Twain testifies on behalf of osteopathy to help obtain practice rights in New York.
- **1900:** J. Martin Littlejohn, MD, DO, founded the American College of Osteopathic Medicine and Surgery in Chicago.
- **1905:** Des Moines College founded.
- **1916:** Kansas City College founded. No new colleges until 1966.
- **1917:** The profession mounts an effort to gain federal recognition and the right to serve in the uniformed services.
- **1910:** The Flexner report. A scathing report on medical and osteopathic education by Abraham Flexner of the Rockefeller Institute. As a result of this report, many allopathic and osteopathic colleges were closed. This report forced the AOA to develop standards for teaching osteopathy in colleges and lead to AOA accreditation.
- **1918:** H.H. Fryette, DO, introduces his concepts of spinal motion. He gives to the profession the development of the articulated spine and the principles of spinal motion (Principle I and II).
- **1936:** The Applied Academy of Osteopathy (AAO) is formed from the Osteopathic Manipulative Therapeutic and Clinical Research Association.
- **1939:** William G. Sutherland, DO, DSc (hon), proposed the cranial concept.
- **1944:** AAO name is changed to American Academy of Osteopathy. H.H. Fryette, DO, publishes his text *Principles of Osteopathic Technique*.
- **1950:** Dr. Angus Cathie forms the first Undergraduate American Academy of Osteopathy (UAAO) at PCOM.
- **1950s:** Lawrence Jones, DO, develops his technique known as strain/counterstrain.
- **1955:** Fred Mitchell, Sr., DO, introduces his muscle energy technique.
- **1962:** Licensing of osteopathic physicians in California is halted. MD degrees are granted to DOs for the fee of $65. Nearly 2000 of California's 2400 DOs become MDs. The Los Angeles College of Osteopathic Physicians and Surgeons becomes an allopathic medical school.

- **1963:** DOs are accepted by the civil service as medical officers on equal footing with MDs.
- **1966:** Robert McNamara, Secretary of Defense, directs the Army, Navy, and Air Force to accept qualified DOs as medical officers.
- **1970:** Most colleges changed names to "college of osteopathic medicine." Allopathic postdoctoral training opens to DOs.
- **1971:** Michigan State University College of Osteopathic Medicine founded-first university affiliated and state funded college. The California State Supreme Court restores licensure of osteopathic physicians.
- **1994:** Judith O'Connell, DO, represents the osteopathic profession before the AMA's committee on CPT codes. She successfully argues to have specific procedure codes for osteopathic manipulative treatment accepted and included in the national coding manual.
- **2004:** Twenty-two colleges of osteopathic medicine.

▶ VISCEROSOMATIC REFLEXES

The COMLEX loves to write questions about VSR. They're easy to write and they're easy to throw in at the end of a case. A complete list of VSR is listed in the table at the back of this section (see Table 6-1). For high yield study purposes, it's best to come up with generalizations. Following the table are groupings of VSR for the different systems in the body, focusing on the sympathetic reflexes. If you can remember approximately what area of the body you should be focusing on for a particular system, you can easily rule out several of the distracters. These groupings are what you should look over the night before the examination, not the complete table.

Introduction

VSR are a type of somatic dysfunction (SD) caused by changes in the autonomic nervous system (ANS) (see Figure 6-1). They can be acute or chronic and can result from problems in the viscera that are affected by either the sympathetic or parasympathetic nervous systems. When a particular viscera continues to be overstimulated by either branch of the ANS, the soma at the associated spinal level of innervation of that viscera takes on characteristics of SD (**T**issue texture change **A**symmetry **R**estriction of motion **T**enderness [TART]). The degree of SD is directly related to the degree of visceral pathology.

- Sympathetic Nervous System
  - Enhances or accelerates the activity of organs.
  - Arises from the **thoracolumbar spinal segments.**
- Parasympathetic Nervous System
  - Inhibits or decelerates the activity of organs.
  - Arises from the **craniosacral area of the spine.**
  - **High cervicals (C0–C2)** are also included, **particularly C2 on the left, which is specific for cranial nerve (CN) X, vagus (Know this vagus reflex. It's one of the most common parasympathetic reflexes.)**
- SD from VSR have some of the same components as SD caused by other reasons (i.e., structural changes, trauma).
  - Tissue texture changes of chronic VSR—atrophied, firm, dry, cool, rubbery.

Sympathetic nervous system–think thoracolumbar. Parasympathetic nervous system–think craniosacral.

When in doubt, the vagus nerve shouts.

TABLE 6-1. Viscerosomatic Reflexes

System	Sympathetic (Thoracolumbar)		Parasympathetic (Craniosacral)	Comments
HEENT/Neck	T1–T4 bilateral		CN V, C0, C1, C2	
Cardiac	T1–T5 (left > right)		C0, C1, C2	T2 on the L is specific for an MI
Pulmonary	T1–T4 bilateral		C0, C1, C2	The "asthma reflex" is T2 L Vagal stimulation can exacerbate bronchospasm; don't treat C2 during an acute asthma attack
GI	Esophagus	T3–T6 R	C0, C1, C2—up to transverse colon	Common GI pattern: C2 L, T3 R, T5 L, T7 R
	Stomach	T5–T10 L		
	Duodenum	T6–T8 R	S2–S4 (pelvic splanchnics)—transverse colon to anus	Ascending colon is right-sided; descending colon is left-sided
	Appendix	T9–T12 R		
	Liver and gall bladder	T6–T9 R		
	Pancreas	T5–T9 bilateral		
	Spleen	T7–T9 L		
	Small intestine	T8–T10 bilateral		
	Colon and rectum	T10–L2		
GU (think thoracolumbar junction)	Kidneys	T9–L1 bilateral	C0, C1, C2	
	Ureters and bladder	T10–L2	S2–S4	
	Prostate	T10–L2	S2–S4	
	Ovaries (testes) and fallopian tubes	T9–T11	S2–S4 (for fallopian tubes)	
	Uterus and cervix	T10–L1	S2–S4	

  - Tissue texture changes of acute VSR—boggy, moist, warm.
  - Restriction of motion tends to have a rubbery end-feel, versus the firm end-feel of structural SD.
- When treated with OMT, SD of VSR origin may resolve for a short time. Unless the visceral problem is addressed, the SD will keep coming back.

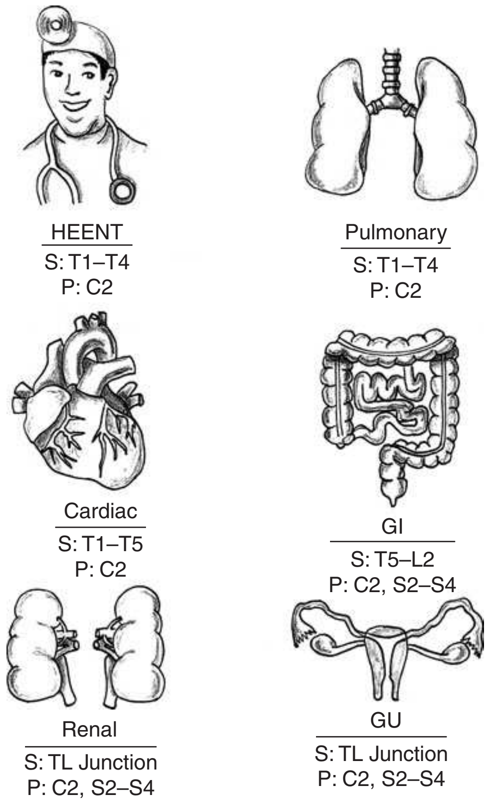


FIGURE 6-1. Groupings for VSR (sympathetic and parasympathetic).

LOCATIONS OF VISCEROSOMATIC REFLEXES

Table 6-1 lists the locations of specific VSR. Several sources were used to comprise this list. Keep in mind that for board purposes, VSR can be ± one to two segments.

▶ CHAPMAN'S REFLEX POINTS

This is another area of commonly asked questions on the boards. Again, these are easy to write and easy to add to a case. Just like VSR, try and focus on groups of points. Do not memorize each individual point. The CRP have been drawn out by different regions of the body. This may help with high yield studying as well.

History

- Frank Chapman, a student of A.T. Still, determined these points in the 1920s.
- Anterior and posterior points were used for diagnosis and treatment, respectively.
- Today these points are used more as diagnostic indicators for dysfunction of a particular organ.

Definition

- Small points of increased tenderness and sensitivity found in the deep fascial layers that correlate with increased sympathetic tone to a particular area of the body.
- They are a type of VSR.

Physiology

- Increased sympathetic tone as well as blockages in the lymphatic system lead to myofascial nodules.
- These points are less specific due to the fact that one spinal segment innervates several organs, not just one.

Physical Findings

- Location: deep in the fascia
- Palpation: small, smooth, firm, 2–3 mm, "string of pearls"
- Tissue texture change (just like VSR)
  - Acute reflexes: boggy, edematous
  - Chronic reflexes: ropy, thickened, feels like a pea
- Very sensitive and very tender but does not radiate away from the specific point.
- Not necessarily associated with SD.

Location of Points

(See Figures 6-2, 6-3, 6-4, 6-5, 6-6, and 6-7.)

- About 50 from head to toe.
- Bilateral on anterior and posterior surface of body.

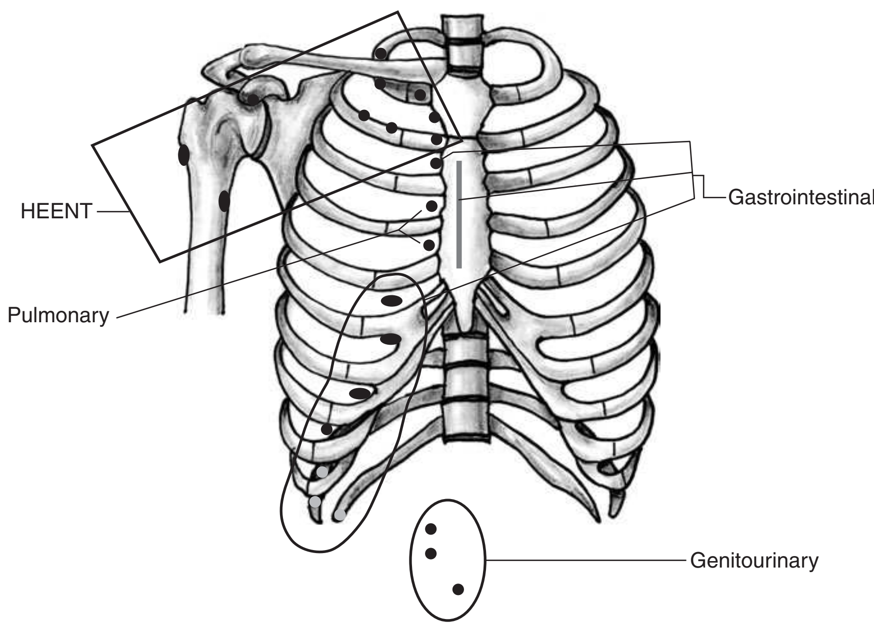


FIGURE 6-2. Anterior, upper quarter of CRP.

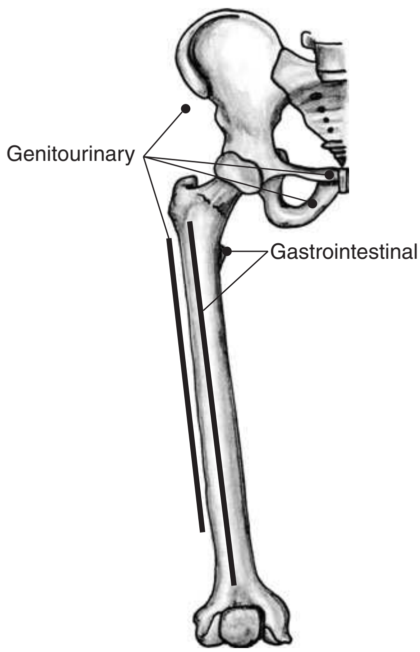


FIGURE 6-3. Anterior, lower quarter of CRP.

- Anterior—located about the intercostal spaces near the sternum.
  - Level of rib segment correlates with sympathetic outflow from that same segment to the corresponding viscera.
- Posterior—located at the paraspinal areas near the transverse processes.
  - Points feel more like VSR.
- If an anterior point is present, the corresponding posterior point is present too.

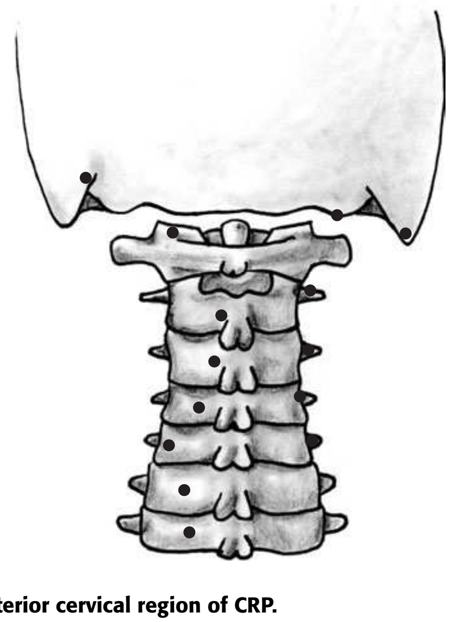


FIGURE 6-4. Posterior cervical region of CRP.

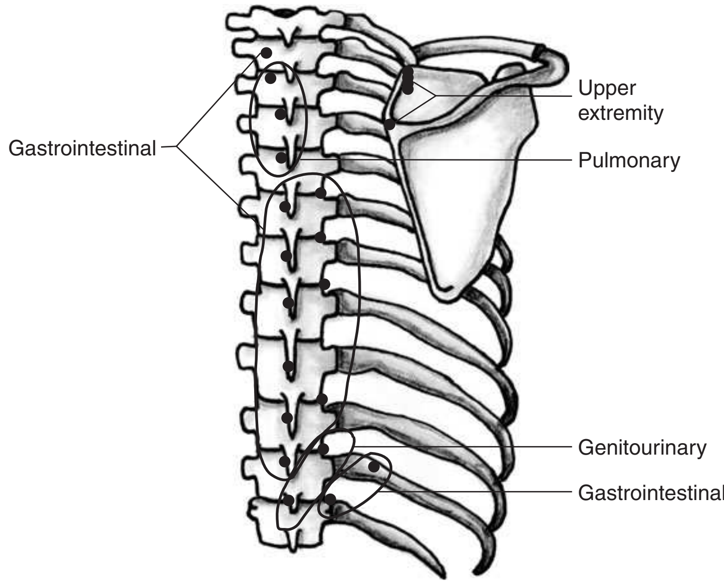


FIGURE 6-5. Posterior thoracic region of CRP.

- Lower extremity points
  - Located on the anterior aspect of the iliotibial band extending from just below the greater trochanter to just above the knee, bilaterally.
  - Correlate to the mirror image of the abdominal contents.
- If an anterior point is present, the corresponding posterior point is present too.
- Findings can help in determining a differential diagnosis (i.e., visceral pathology versus musculoskeletal pathology).

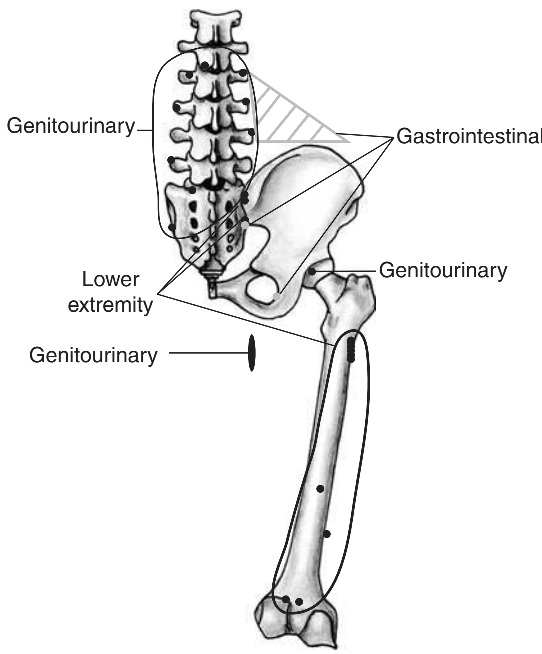


FIGURE 6-6. Posterior lumbar/pelvis region of CRP.

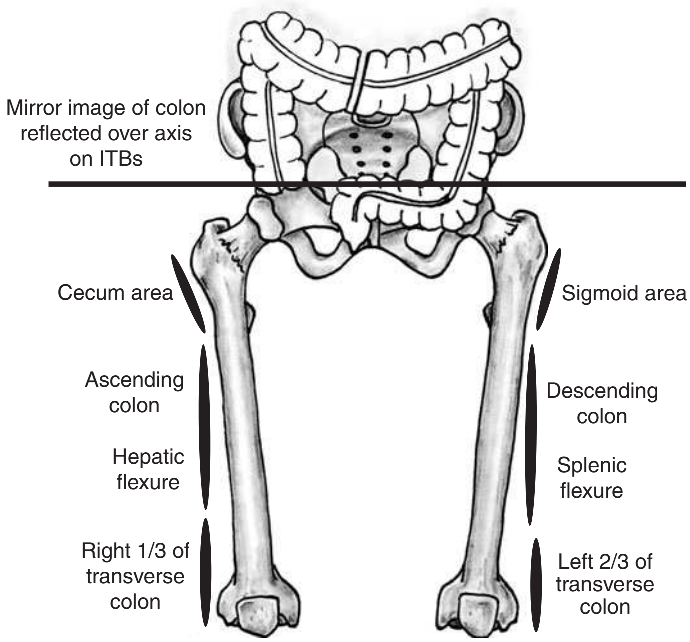


FIGURE 6-7. Anterior CRP for the colon.

Treatment

- Purpose: To decrease sympathetic tone.
- Any point whether anterior or posterior may be used for diagnosis *and* treatment.
- Technique: Contact point with pad of finger and apply a circular motion with firm pressure for 15 seconds to 2 minutes.
- Release: Felt when there is a softening of tension in the fascia.

Clinical Examples and Frequently Treated Points

- Appendicitis—CRP found at the **tip of the right 12th rib.**
- Irritable Bowel syndrome—CRP found along the iliotibial band.

▶ JONES' COUNTERSTRAIN TENDERPOINTS

The Jones' counterstrain tenderpoints are the points that are used for the indirect technique of counterstrain. Table 6-2 and Figures 6-8 through 6-15 illustrate the location of these points. As always, do *not* memorize every single point but rather the generalizations for each area of the body. The points found within the axial skeleton tend to be higher yield than the extremity points.

History

- Dr. Lawrence H. Jones, DO, determined these points in 1955.
- His paper, titled *Spontaneous Release of Positioning*, was published in 1964.

TABLE 6-2. Location of Jones' Tenderpoints; Not All-Inclusive

Area	Anterior Points		Posterior Points	Comments
Cervical spine	Anterior surface of transverse processes of vertebrae; *not* on the SCM but the SCM crosses this line of these points		On the spinous processes of the vertebrae	
Thoracic spine	T1	Apex of sternal notch	T1–T12—inferolateral aspect of spinous process of vertebra, bilaterally	The anterior points from T1–T6 are all midline; T7–T12 are all bilateral
	T2	Middle of manubrium		
	T3–T6	On sternum at rib level		
	T7	Under costochondral margin, lateral and inferior to xiphoid		
	T8	3 cm below xiphoid		
	T9	1–2 cm above umbilicus, 2–3 cm lateral to midline		
	T10	1–2 cm below umbilicus laterally		
	T11	5–6 cm below umbilicus and laterally		
	T12	Inner surface of iliac crest at midaxillary line		
Ribs	R1	At point of articulation with manubrium	R2–R6—posterior aspect of ribs at rib angles	
	R2	Second rib midclavicular		
	R3–R6	On rib at anterior axillary line		
	R7–R12	Uncommon		
Lumbar	L1	Medial side of ASIS	L1–L5—inferolateral side of spinous process, bilaterally; can also be midline directly on the spinous process	
	L2	Medial side of AIIS		
	L3	Lateral side of AIIS		
	L4	Inferior side of AIIS		
	L5	Pubic rami, 1 cm lateral to pubic symphysis		
Pelvis				
Iliacus	Halfway between the midline and the ASIS at the level of the ilium			
Lower pole fifth lumbar	2 cm below PSIS of ilium			
Piriformis	Within the muscle belly, half way between the attachments (greater trochanter and anterior aspect of ILA of sacrum)			

TABLE 6-2. Location of Jones' Tenderpoints; Not All-Inclusive (Continued)

AREA	ANTERIOR POINTS	POSTERIOR POINTS	COMMENTS
Extremities			
Supraspinatus	Within the muscle belly		
Subscapularis	Anterolateral surface of scapula		
Biceps brachii	Tendon of long head of biceps in the bicipital groove		
Rectus femoris	Musculotendinous region at distal end, above patella		
Gastrocnemius	Muscle bellies of both heads of the muscle		

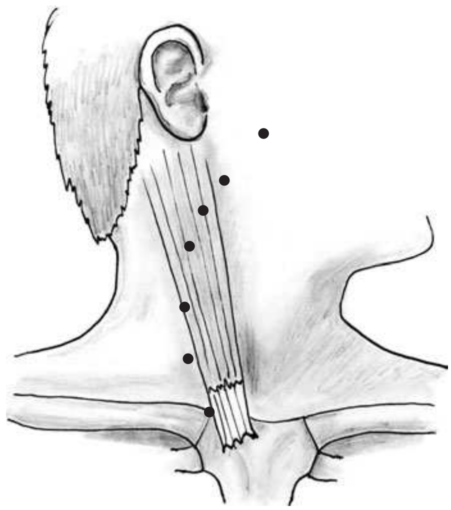


FIGURE 6-8. Anterior cervical tenderpoints.

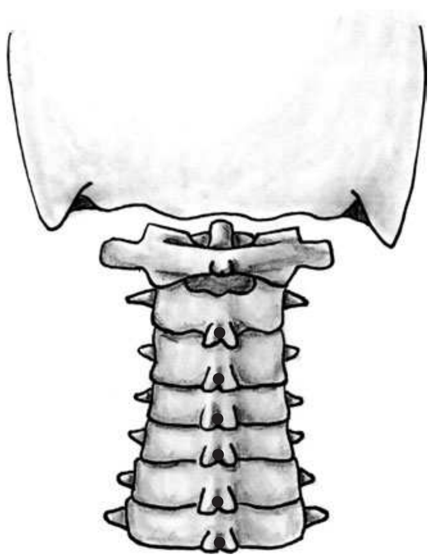


FIGURE 6-9. Posterior cervical tenderpoints.

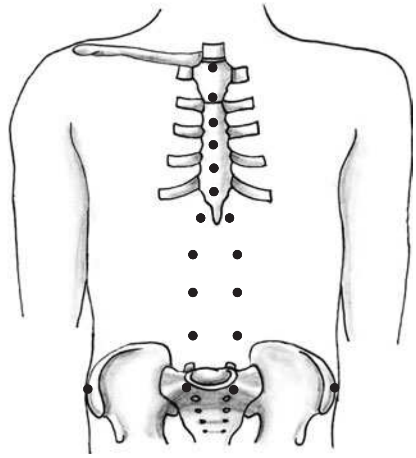


FIGURE 6-10. **Anterior thoracic tenderpoints.**

FIGURE 6-11. **Posterior thoracic tenderpoints.**

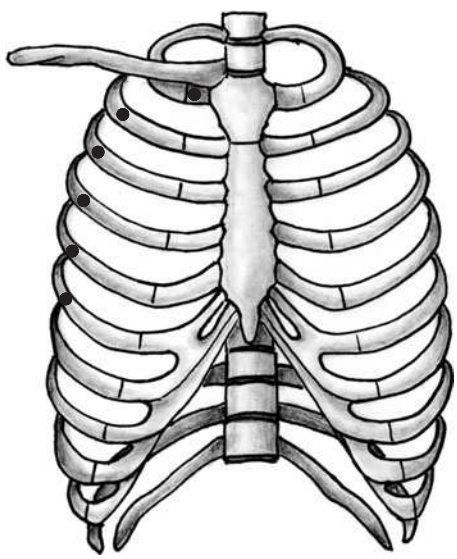


FIGURE 6-12. **Anterior rib tenderpoints.**

FIGURE 6-13. Posterior rib tenderpoints.

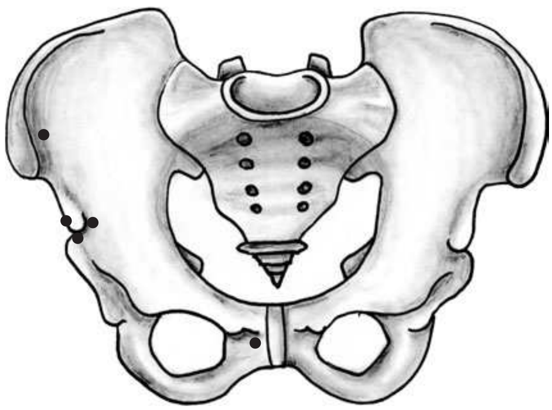


FIGURE 6-14. Anterior lumbar tenderpoints.

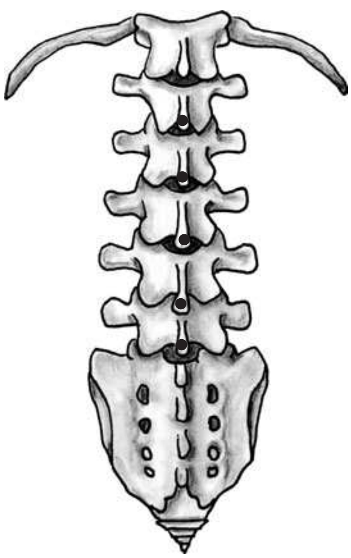


FIGURE 6-15. Posterior lumbar tenderpoints.

Jone's CS tenderpoints are directly related to SD.

Definition

- An area of tenderness or hypersensitivity that has a direct relationship to SD of an adjacent area.
- Based on the neuromuscular basis of SD.

Physiology

- An inappropriate amount of proprioceptor activity to a given area leading to a reflex tenderpoint and subsequent SD.

Physical Findings

- Tense, fibrotic, dime sized
- The amount of tenderness perceived by the patient is inappropriate for the amount of pressure being used by the examiner.
- Location of tenderpoints are consistent from one person to the next.
- Similar to CRP in that the pain doesn't radiate.

Location of Points

(See Table 6-2.)

Treatment

- Purpose: To place the body into a position of maximum comfort.
- The position of comfort is almost always held for 90 seconds.
- Tenderness should be decreased by about two-thirds.

▶ MUSCULOSKELETAL TESTS

Musculoskeletal medicine and osteopathic manipulative medicine (OMM) are integrated throughout the COMLEX. Common orthopedic tests used in specific musculoskeletal medicine situations are reviewed below.

Common Upper and Lower Extremity Musculoskeletal Tests

Region	Name of Test	Description	+ Findings
Neck	Adson's test (Figure 6-16)	The radial pulse is palpated and the patient is directed to rotate and extend the head away from the side of the complaint; the patient inhales and holds the breath; this is repeated again with the patient rotating and extending the head toward the side of the complaint	The radial pulse decreases or disappears; **indicates thoracic outlet syndrome**
	Spurling's test (Figures 6-17 A and B)	A compressive force is transmitted down the axial spine through the top of the head; compression is given with the neck in neutral, sidebent left, and sidebent right	Patient will have radiating symptoms down the arms into the hands; **indicates a cervical nerve root impingement**

Common Upper and Lower Extremity Musculoskeletal Tests (Continued)

Region	Name of Test	Description	+ Findings
Shoulder	Apley scratch test (Figures 6-18 A and B)	Patient reaches behind back to touch opposite shoulder blade; patient reaches above and behind head toward the shoulder blades	Determines **ranges of motion of internal rotation, and abduction and adduction;** if these motions are limited, there will be asymmetry from one side to the other
	Apprehension/ relocation test (Figures 6-19 A and B)	With the elbow flexed to 90° and the humerus abducted to 90°, the glenohumeral joint is brought into passive external rotation	Pain is elicited and the patient becomes apprehensive with increased external rotation; when **relocated** by stabilizing the humeral head, the patient gets relief; **indicates anterior glenohumeral laxity**
	Empty can test (Jobe's test) (Figure 6-20)	The GH joint is abducted to 90°, horizontally flexed to 30°, and internally rotated 90° (thumb points downward); the patient resists a downward force exerted at the forearms by the examiner, while the examiner stabilizes the GH joint.	One arm will demonstrate an inability to resist the downward force and may drop more quickly than the other arm; pain is also elicited at the greater tuberosity of the humerus; **indicates a supraspinatus tendonitis or tear**
	Hawkins'-Kennedy impingement test (Figure 6-21)	The GH joint is at 90° of abduction and 30° of forward flexion; the elbow is flexed to 90°; the humerus is then internally rotated	Pain; **indicates impingement of the rotator cuff tendons** (usually **supraspinatus**)
	Neer's sign (Figure 6-22)	With the elbow extended and the GH joint internally rotated, the GH joint is passively brought into forward flexion	Pain; **indicates impingement of the rotator cuff tendons** (usually **supraspinatus**)

Common Upper and Lower Extremity Musculoskeletal Tests (Continued)

Region	Name of Test	Description	+ Findings
	Speed's test (Figure 6-23)	The elbow is extended with the palm facing up; the patient resists flexion of the glenohumeral joint	Pain occurs with resisted flexion; **indicates tendonitis of the long head of the biceps or a possible labral injury**
	Sulcus sign (Figure 6-24)	While holding the patient's arm at the elbow, downward traction is applied by the examiner	A sulcus (depression) appears below the glenoid; **indicates inferior glenohumeral laxity**
	Yergason's test (Figure 6-25)	The elbow is flexed to 90° and the patient resists while the examiner brings the GH joint into external rotation and pulls the elbow inferiorly	Popping or snapping at the bicipital groove; **indicates laxity of the transverse humeral ligament; pain without popping or snapping indicates bicipital tendonitis**
Elbow, wrist, hand	Finkelstein's test (Figure 6-26)	The patients makes a fist, tucking the thumb inside the fingers; the wrist is actively moved into ulnar deviation	Pain on the radial side; **indicates tenosynovitis of the extensor pollicis brevis and abductor pollicis longus tendons (deQuervain's syndrome)**
	Phalen's test (Figures 6-27 A and B)	Patient places the dorsal aspect of both wrists together causing excessive flexion at the wrists; the position is held for 1 minute	Tingling will occur in the distribution of the median nerve; **indicates carpal tunnel;** Reverse Phalen's (placing palmar aspect together) will alleviate symptoms
	Tinel's sign (Figure 6-28)	Tapping over the median nerve at the transverse carpal ligament	Pain and tingling radiating into the fingers of the distribution of the median nerve; **indicates carpal tunnel**

Common Upper and Lower Extremity Musculoskeletal Tests (Continued)

Region	Name of Test	Description	+ Findings
Low back, hips, SI	FABERE sign (Patrick's test) (Figure 6-29)	The patient is lying supine with the foot of the involved side resting on the opposite thigh; this position brings the hip into **f**lexion, **a**bduction, **e**xternal **r**otation, and **e**xtension; the examiner stabilizes the opposite ASIS while pushing downward on the knee of the involved side	Pain in the SI joint **indicates sacroiliac (SI) pathology;** pain in the anterior aspect of the femur **indicates hip pathology**
	Iliac compression/ distraction test (Figures 6-30 A and B)	The patient is lying supine; the examiner exerts a force laterally at the ASIS bilaterally which causes compression of the SI joints; the examiner then exerts a force medially at the ilium bilaterally which causes gapping of the SI joints	Pain with compression of the SI joints and relief of pain with spreading of the SI joints; **indicates SI pathology**
	Backward bending test (single leg-stance test) (Figure 6-31)	While standing, the patient lifts one leg and extends at the waist; this same motion is repeated while standing on the opposite side	Pain in the lumbar spine area; **indicates pathology of a posterior element (i.e., spondylolysis, spondylolisthesis, or facet degenerative joint disease** [**DJD**])
	Straight leg-raise test (Figure 6-32)	The patient is lying supine with the involved leg extended; the examiner grasps the heel with one hand while keeping the knee in full extension with the other hand; the examiner begins to lift the leg causing flexion of the hip	Pain, parasthesias radiating down the leg between 30° and 70° of hip flexion; **indicates irritation of the sciatic nerve or lumbar nerve root;** pathology could stem from a bulging/ herniated disc OR piriformis syndrome where the tightened piriformis is clamping down on the sciatic nerve leading to symptoms
	Thomas test (Figures 6-33 A and B)	The patient is lying supine with the buttocks at the end of the table; one knee is drawn up to the chest while the other leg (the one being tested) remains passive	The knee of the tested leg is unable to flex to 90°; **indicates a tight rectus femoris**. The thigh of the tested leg raises off the table; **indicates a tight iliopsoas**

Common Upper and Lower Extremity Musculoskeletal Tests (Continued)

Region	Name of Test	Description	+ Findings
	Trendelenburg's test (Figures 6-34 A and B)	While standing, the patient raises the leg opposite the side being tested	The iliac crest of the non-weight bearing side falls below the level of the iliac crest on the standing leg; **indicates weakness of the gluteus medius**
	Valsalva test (Figure 6-35)	While seated, the patient bears down on a closed glottis causing an increase in intrathecal pressure	Pain in the spine; **indicates a herniated disc at the level of the pain**
Knee	Anterior drawer test (Figure 6-36)	The patient is lying supine with the hip flexed to 45° and the knee to 90°; the examiner sits on the foot of the patient to fix the distal tibia; the proximal tibia is pulled forward by grasping the lower leg posteriorly, just below the joint line of the knee; this should be done with the hip in neutral, at 20° of internal rotation, and at 15° to 20° of external rotation	Increased anterior tibial translation when compared to the opposite side; **indicates a tear of the anterior cruciate ligament** (ACL)
	Apley's compression test (Figure 6-37)	The patient is lying prone with the knee flexed to 90°; the examiner contacts the calcaneous and exerts an axial load through the tibia while simultaneously flexing and extending the knee, first in internal rotation and then in external rotation	Joint line pain with compression; **indicates a tear of the meniscus and/or collateral ligaments**
	Apley's distraction test (Figure 6-38)	The patient is lying prone with the knee flexed to 90°; the examiner grasps the ankle with one hand while stabilizing the femur on the table with the other; a distraction force is applied through the ankle to affect the knee	Pain with distraction; consistent with **a tear of the collateral ligaments;** alleviation of pain following Apley's Compression is indicative of **meniscal pathology**
	Lachman's test (Figure 6-39)	The patient is lying supine with the knee passively flexed to 20°; the examiner grasps the tibia with one hand and stabilizes the femur with the other hand; the tibia is anteriorly translated while the femur is pushed posteriorly; the motion is then reversed by pushing the tibia posteriorly and drawing the femur anteriorly	Increased anterior tibial translation when compared to the opposite side; **Indicates a tear of the ACL**

Common Upper and Lower Extremity Musculoskeletal Tests (Continued)

Region	Name of Test	Description	+ Findings
	McMurray's test (Figures 6-40 A and B)	The patient is lying supine; the examiner monitors the joint line with one hand while contacting the patient's foot with the other; the examiner passively flexes and extends the knee while simultaneously internally and externally rotating the tibia	Popping, clicking, or locking of the knee and pain in the joint line; **indicates a tear of the meniscus (either medial, lateral, or both, depending on location of symptoms)**
	Ober's test (Figures 6-41 A and B)	The patient is sidelying with the affected side up and both knees and hips flexed to 90°; the examiner stabilizes the pelvis with one hand while lifting the affected hip and returning it to neutral; the hip is then allowed to drop (adduct) to the table	The knee does not drop to the table; **indicates a tight iliotibial band (ITB)**
	Posterior drawer test (Figure 6-42)	The patient and examiner are set up in the exact same way as with the Anterior Drawer Test; the tibia is pushed posteriorly	Increased posterior tibial translation when compared to the opposite side; **indicates a tear of the posterior cruciate ligament (PCL)**
	Valgus stress test (Figure 6-43)	The patient is lying supine; the examiner grasps the distal tibia with one hand while exerting a valgus (medial) force with the other hand at the level of the joint line of the knee; performed at complete extension and at 20° to 30° of knee flexion	Increased laxity at the medial knee when compared to the opposite side; **indicates a tear of the medial collateral ligament (MCL)**
	Varus stress test (Figure 6-44)	The patient is lying supine; the examiner stands between the table and the leg; the examiner grasps the distal tibia with one hand while exerting a varus (lateral) force with the other hand at the level of the joint line of the knee; performed at complete extension and at 20° to 30° of knee flexion	Increased laxity at the lateral knee when compared to the opposite side; **indicates a tear of the lateral collateral ligament (LCL)**
Lower leg, ankle, foot	Anterior drawer test (Figure 6-45)	With the lower leg dangling off the table and the foot in slight plantar flexion, the examiner pulls the calcaneus and talus forward while stabilizing the a distal tibia	Increased laxity compared to the other side, pain, or clunk; **indicates a tear of the anterior talofibular (ATF) ligament. This is the most commonly injured ligament in ankle sprains.**

Common Upper and Lower Extremity Musculoskeletal Tests (Continued)

Region	Name of Test	Description	+ Findings
	Bump test (Figure 6-46)	The patient is seated with the foot off the table; the examiner uses the palm of the hand to bump the calcaneus with increasing force	Pain in the area of the calcaneus, talus, tibia or fibula; **indicates an advanced stress fracture**
	Kleiger's test (Figure 6-47)	With the lower leg dangling off the table, the foot is rotated laterally (not inverted or everted) while the tibia is stabilized	Pain on the medial aspect; **indicates a sprain of the deltoid ligament;** pain superior to the lateral malleolus; **indicates a sprain of the syndesmosis**
	Squeeze test (Figure 6-48)	The examiner squeezes the proximal tibia and fibula together with increasing pressure	Pain in the distal leg; **indicates a fracture of the tibia, fibula, or a sprain of the syndesmosis**
	Thompson test (simmonds test) (Figure 6-49)	With the patient prone or seated with the foot off the table, the examiner squeezes the calf	No plantar flexion of the foot; **indicates a tear of the Achilles tendon**
	Talar tilt test (inversion/eversion stress test) (Figures 6-50 A and B)	With the lower leg dangling off the table, the examiner grasps the calcaneus and brings it into inversion and eversion	Increased tilting compared to the other side; **indicates a sprain of the calcaneofibular** (CF) **ligament and the deltoid ligament, respectively**

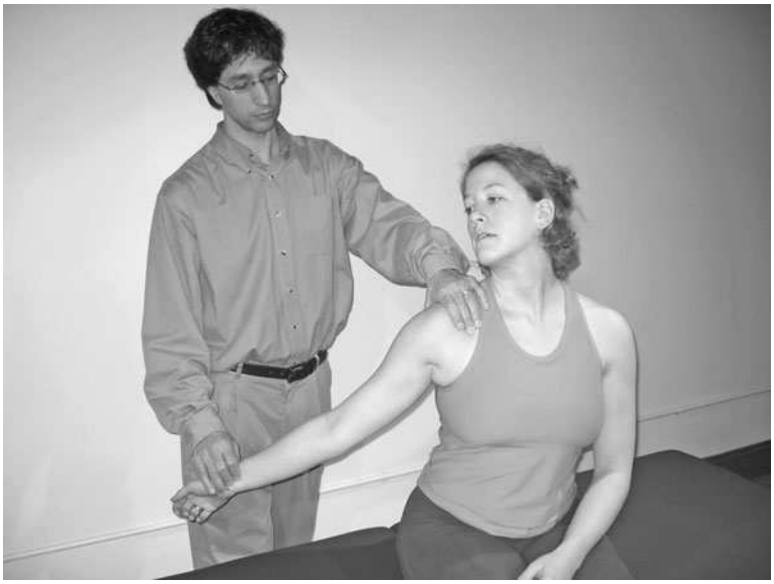


FIGURE 6-16. Adson's test.

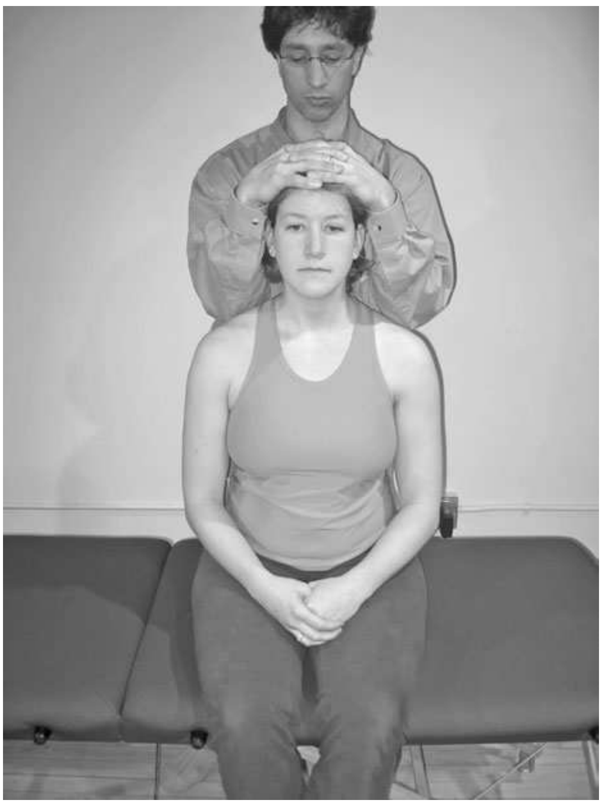


FIGURE 6-17(A). Spurling's test in neutral.

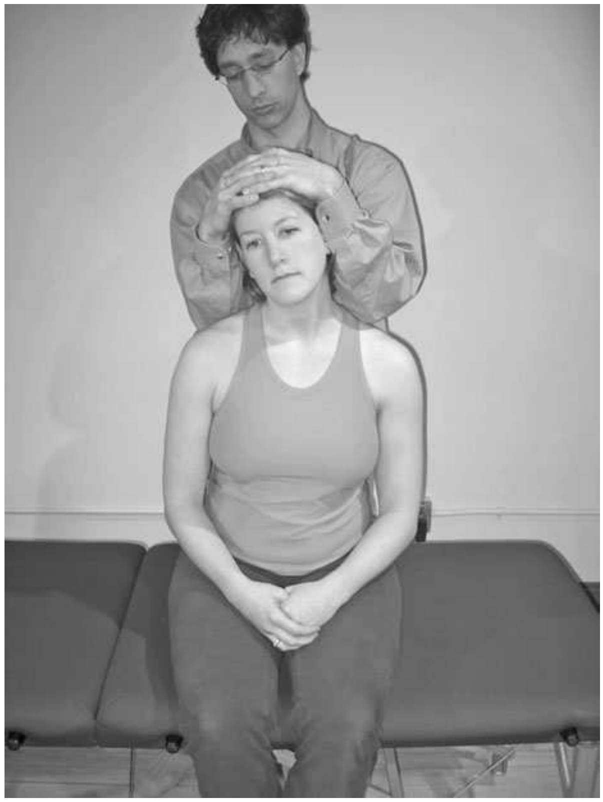


FIGURE 6-17(B). **Spurling's test with neck sidebent to one side.**

FIGURE 6-18(A). **Apley scratch test. Testing internal rotation and adduction.**

FIGURE 6-18(B). Apley scratch test. Testing abduction.

FIGURE 6-19(A). Apprehension test.

FIGURE 6-19(B). Relocation test.

FIGURE 6-20. **Empty can test.**

FIGURE 6-21. **Hawkins'-Kennedy impingement test.**

FIGURE 6-22. **Neer's sign.**

FIGURE 6-23. **Speed's test.**

FIGURE 6-24. Sulcus sign. Positive findings; notice depression.

FIGURE 6-25. Yergason's test.

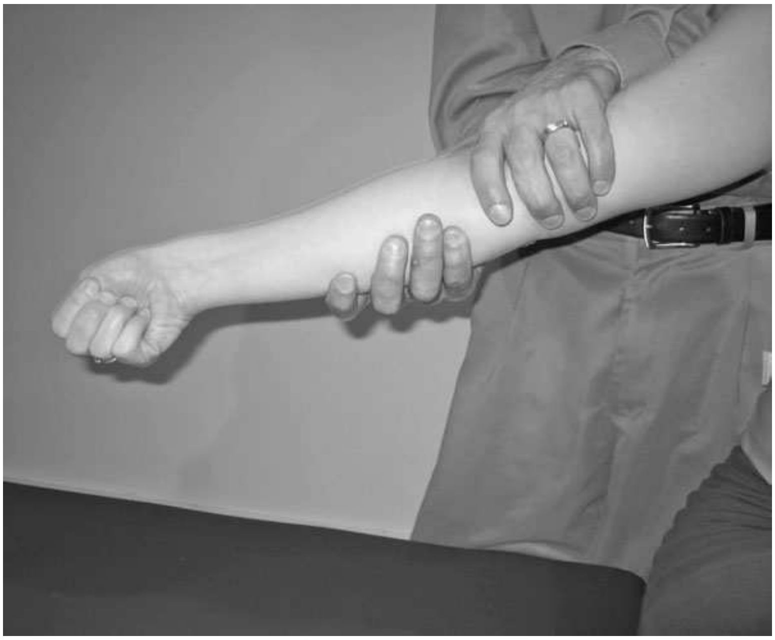


FIGURE 6-26. Finkelstein's test.

FIGURE 6-27(A). Phalen's test.

FIGURE 6-27(B). **Reverse Phalen's test.**

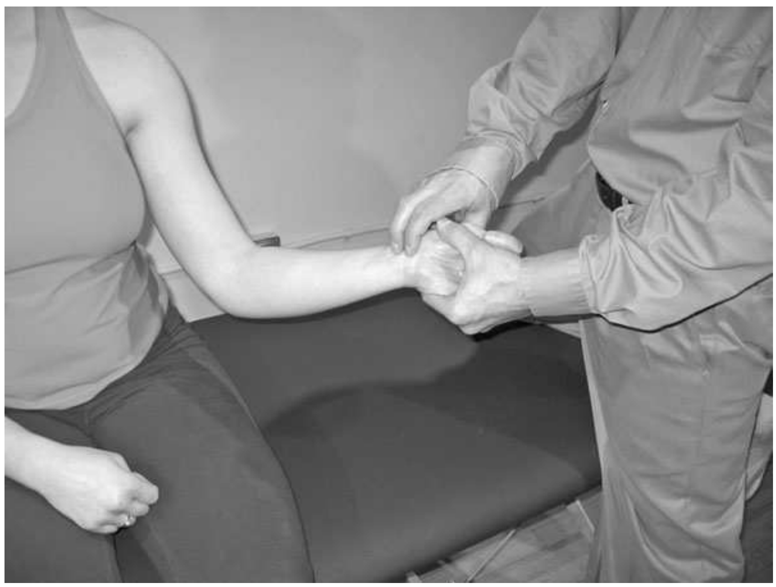


FIGURE 6-28. **Tinel's sign.**

FIGURE 6-29. **FABERE sign (Patrick test).**

FIGURE 6-30(A). **Iliac compression test.**

FIGURE 6-30(B). **Iliac distraction test.**

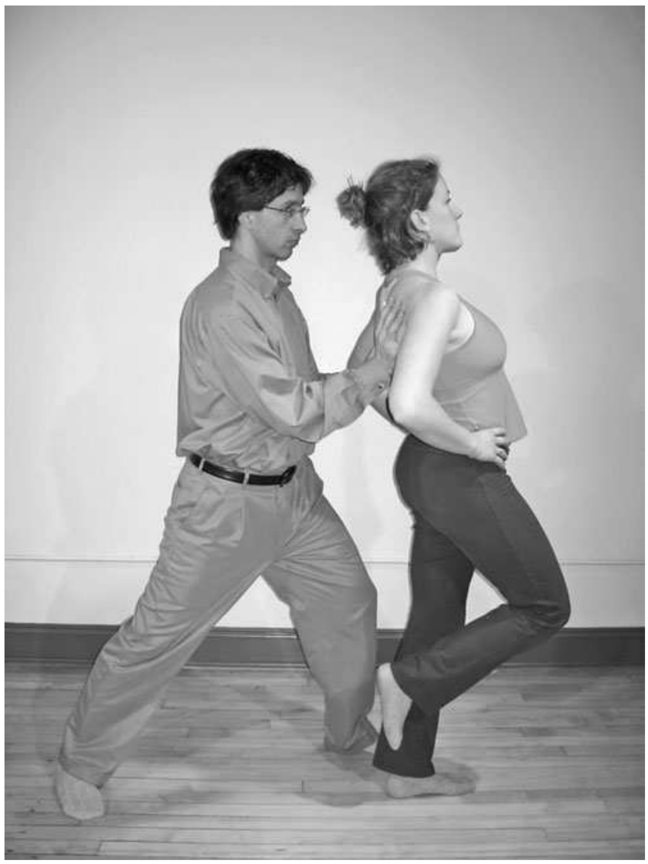


FIGURE 6-31. **Backward bending test (single-leg stance test).**

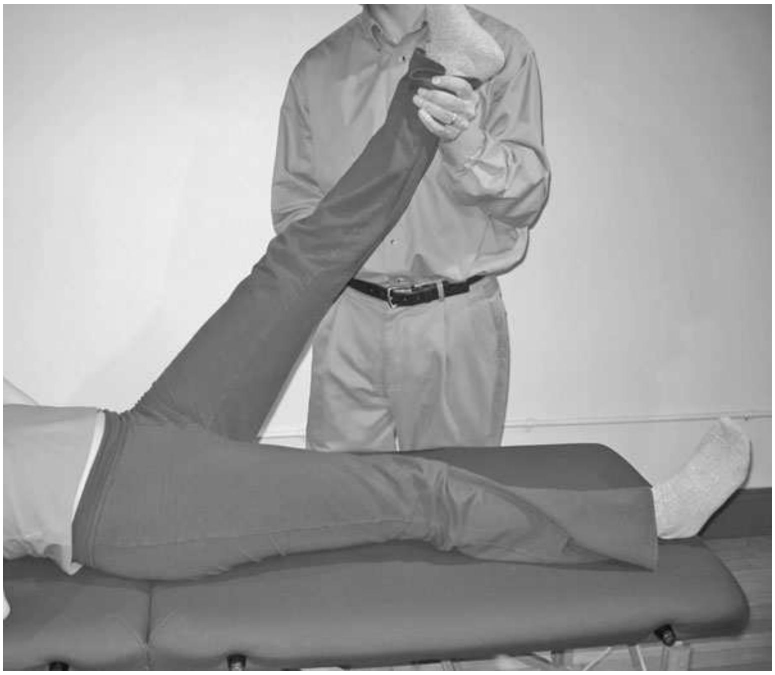


FIGURE 6-32. Straight leg-raise test.

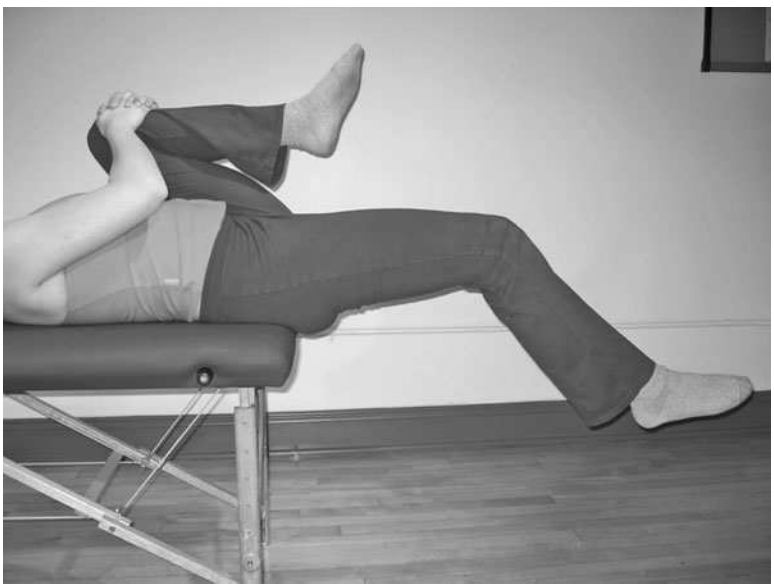


FIGURE 6-33(A). Thomas test. Positive for tight rectus femoris.

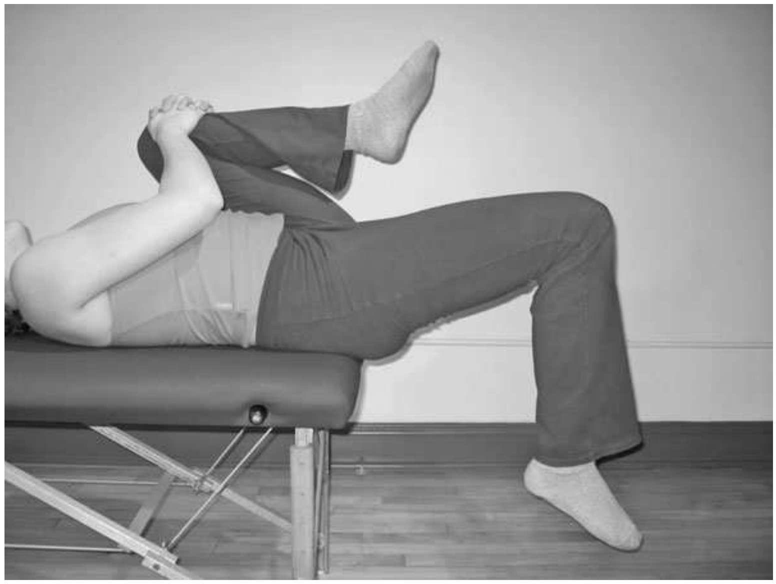


FIGURE 6-33(B). **Thomas test. Positive for tight iliopsoas.**

FIGURE 6-34(A). **Trendelenburg's test. Negative.**

FIGURE 6-34(B). Trendelenburg's test. Positive.

FIGURE 6-35. Valsalva test.

FIGURE 6-36. Anterior drawer test of knee.

FIGURE 6-37. Apley's compression test.

FIGURE 6-38. Apley's distraction test.

FIGURE 6-39. Lachman's test.

FIGURE 6-40(A). McMurray's test. Foot in internal rotation.

FIGURE 6-40(B). McMurray's test. Foot in external rotation.

FIGURE 6-41(A). **Ober's test. Negative; knee falls into table.**

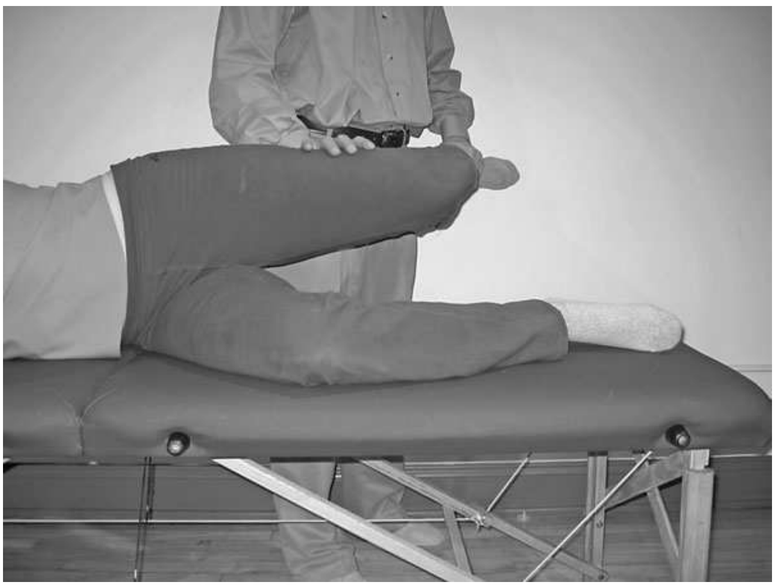


FIGURE 6-41(B). **Ober's test. Positive.**

FIGURE 6-42. **Posterior drawer test.**

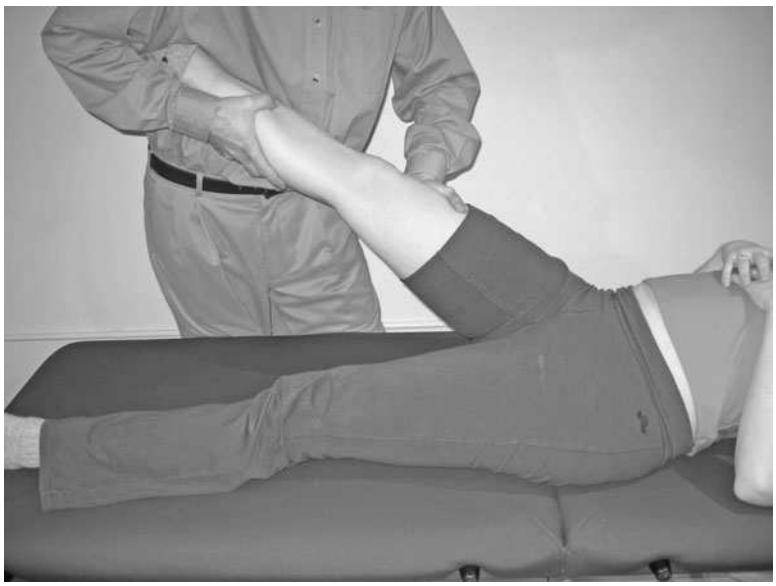


FIGURE 6-43. **Valgus stress test.**

FIGURE 6-44. **Varus stress test.**

FIGURE 6-45. **Anterior drawer test of ankle.**

FIGURE 6-46. Bump test.

FIGURE 6-47. Kleiger's test.

FIGURE 6-48. Squeeze test.

FIGURE 6-49. Thompson test (Simmonds test).

FIGURE 6-50(A). **Talar tilt test (inversion).**

FIGURE 6-50(B). **Talar tilt test (eversion).**

SECTION III

Osteopathic Treatments and Techniques

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CHAPTER 7

Cranial Treatment

Vault Contact

(See Figure 7-1.)

Indications

- Used to diagnose cranial strain patterns.
- Patient is in supine position.
- Commonly used to count cranial rhythmic impulse (CRI), observe flexion and extension of sphenobasilar synchondrosis (SBS).

Technique

- Index fingers are placed in area of the greater wings of the sphenoid.
- Middle fingers are placed on the temporal bones anterior to the external auditory meatus.
- Ring fingers are placed on the temporal bones posterior to the external auditory meatus, above the mastoid process.
- Fifth fingers are placed near lateral angle of occiput.
- From this hold, it may be convenient to diagnose cranial strain patterns.

Anteroposterior Contact

(See Figure 7-2.)

- Can be used seated or supine.
- The operator sits at side of table.
- The operator's posterior hand is placed under patient's head such that physician's palm contacts the squamous portion of occiput.

FIGURE 7-1. **Vault contact.**

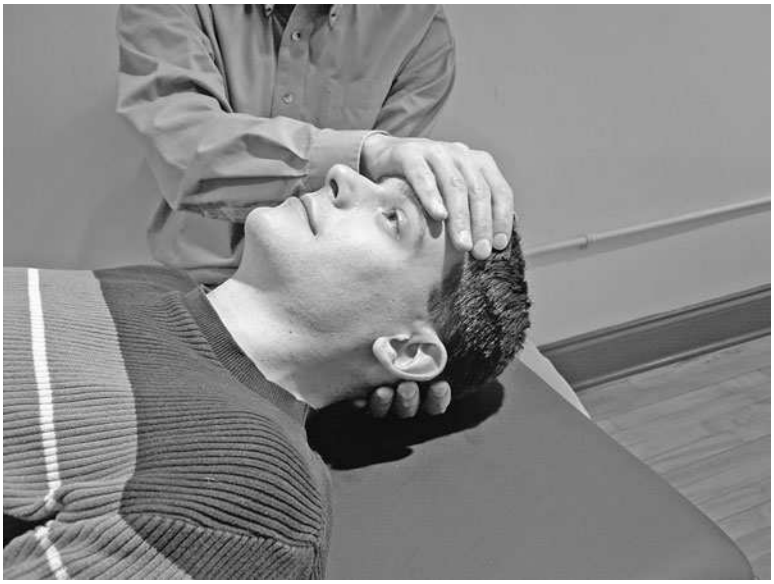


FIGURE 7-2. AP contact.

- The physician's thumbs are pointed toward the patient's head.
- Superior hand contacts sphenoid such that the physician's thumb is in the area of the greater wing and the 4th and 5th digits are across the forehead contacting the opposite greater wing of sphenoid.
- This contact allows appreciation of dural membrane motion as well as bony articular motion.

Sacral Contact

- Can be palpated either supine or prone position.

Patient Prone

- The base of physician's hand is placed in area of base of the patient's sacrum. The other hand is placed on top of the palpating hand.

Patient Supine 1

(See Figure 7-3.)

- The physician sits at the side of the table facing the head of the patient.
- The patient's hips and knees are flexed. Physician's hand is placed in the area of the patient's sacrum such that the operator's fingertips are inferior to L5.
- The physician's hand, wrist, and forearm should all be straight, with minimal weight placed on the physician's elbow.

Patient Supine 2

(See Figure 7-4.)

- Physician sits at the side of the table, facing the head of the patient.
- The patient rolls toward operator, while the physician's hand is placed between the patient's legs, contacting the sacrum.

FIGURE 7-3. Sacral hold 1.

- The patient is then instructed to return to supine position. Again, the physician's hand, wrist, and forearm should all be straight, with minimal weight placed on the table.
- For infants or obese patients, the patient can be supine while the physician uses two fingers in a "V" position to palpate the sacrum. In larger patients, the physician can palpate the sacrococcygeal angle.
- The sacrum follows the occiput, therefore, one can palpate the reciprocal tension membrane (RTM) via the sacrum.

FIGURE 7-4. Sacral hold 2.

V-Spread Technique

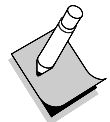
INDICATIONS

- Used for compression of any suture, but often used for the occipitomastoid suture.
- Ninety percent of the venous drainage from the head occurs through the internal jugular vein, which courses through the jugular foramen in close proximity to the occipitomastoid suture.
- Compression of the occipitomastoid suture can reduce drainage from the head and affect cranial nerves IX–XI via the jugular foramen.
- Useful for any pathology associated with the above nerves.

CV4 Technique

INDICATIONS

- Used to stimulate the inherent therapeutic force of the body by compressing the fourth ventricle.
- Useful for increasing overall motion, rate, and amplitude.
- Useful for achieving a balanced autonomic nervous system.



On boards, often the treatment of choice when patient is described as having low rate and amplitude of the cranial rhythmic impulse (CRI).

Frontal and Parietal Lift

INDICATIONS

- Lifts are used to balance membranous tension.
- Frontal lift is particularly useful in treating sinus dysfunction.

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CHAPTER 8

Cervical Treatment

High Velocity, Low Amplitude: Occiput Posterior (Flexed)

(See Figure 8-1.)

- With the patient supine and physician at the head of the table, the physician contacts the posterior (flexed) occipital condyle with the metacarpal-phalangeal joint (MCP) joint of their index finger. The physician's opposite hand cradles the patient's head while introducing sidebending to the side of the dysfunction.
- The physician applies a force through the MCP joint of their index finger through the posterior (flexed) occipital condyle, inducing rotation away from the dysfunction.
- When the restrictive barrier is reached, the corrective force is with the MCP joint through the posterior (flexed) occipital condyle causing further rotation.
- Reassess.

Muscle Energy: Occiput Posterior (Flexed)

- The same position as above is achieved.
- When the restrictive barrier is reached, the physician asks the patient to rotate his/her head against resistance of the physician's hold. This is held for 3–5 seconds, then released. After waiting for 3 seconds, the physician introduces further rotation to engage the new restrictive barrier.
- Repeat three to four times, until normal range of motion is restored to the occiput on the atlas.
- Reassess.

FIGURE 8-1. **HVLA—occiput posterior left (flexed left).**

Indirect: Occiput Posterior (Flexed)

- With the patient lying supine and the physician at the head of the table, the physician contacts the nondysfunctional occipital condyle with the MCP joint of their index finger. With the pads of their opposite index and middle fingertips, contact the dysfunctional occipital condyle.
- The physician applies a force through the MCP joint of his/her hand contacting the nondysfunctional occipital condyle, inducing rotation toward the dysfunction. With the opposite hand, he/she applies about 10% of the force by pulling the posterior (flexed) occipital condyle further posteriorly, assisting rotation of the occiput.
- This position is held until a release is felt.
- Reassess.

High Velocity, Low Amplitude: Posterior Atlas

(See Figure 8-2.)

- With the patient supine and physician at the head of the table, the physician places the MCP joint against the posterior aspect of the atlas (the lateral mass). The opposite hand is placed on the parietal bone of the cranium.
- The physician applies pressure with his/her hand against the posterior aspect of the atlas on the dysfunctional side and rotates the head away from the dysfunction. The opposite hand is used as a support to guide the head.
- The head is rotated, until the restrictive barrier is met. At this point, a quick thrust through the physician's hand is applied to rotate the patient's atlas further into the restrictive barrier. The patient's head is then brought back to neutral.
- Reassess the rotation of the atlas on the axis.

FIGURE 8-2. HVLA—dysfunction posterior left atlas.

Muscle Energy: Posterior Atlas

- With the patient supine and physician at the head of the table, the physician places the MCP joint of their index finger contacting the posterior aspect of the atlas (the lateral mass). The opposite hand is placed on the parietal bone of the cranium.
- The physician applies pressure with their hand to rotate the atlas into the restrictive barrier. The opposite hand is used as a support to guide the head.
- The head is rotated, until the restrictive barrier is met. At this point, the patient is asked to rotate his/her head away from the restrictive barrier. This is held for 3–5 seconds, then released. After waiting for 3 seconds, the physician introduces further rotation to engage the new restrictive barrier.
- This is repeated three to four times, until normal range of motion is restored.
- Reassess.

Indirect: Posterior Atlas

- With the patient supine and physician at the head of the table, the physician places the pad of their index finger on the posterior aspect of atlas (lateral mass). The pad of their opposite index finger is on the anterior aspect of the atlas (opposite lateral mass). The palms of each hand lie on the respective parietal bones of the cranium.
- The physician rotates the head of the patient away from the restrictive barrier until a balance point is reached.
- This position is held, until a release is felt.
- Reassess.

Facilitated Positional Release: Posterior Atlas

(See Figure 8-3.)

FIGURE 8-3. Facilitated positional release (FPR)—posterior left atlas.

FIGURE 8-4. HVLA—dysfunction: $C4FRS_R$.

- The same position of the physician and the patient is achieved as above; however, a compression force is applied through the head down the spine to the level of the atlas, then the indirect positioning of the head is achieved.
- Release is typically achieved in about 3–5 seconds.
- Reassess.

High Velocity, Low Amplitude: Dysfunction: $C4FRS_R$

(See Figure 8-4.)

- With the patient lying supine and physician at the head of the table, the physician places his/her right hand under the patient's neck. The MC joint of the physician's right index finger contacts the posterior aspect of C4 (the right lateral mass).The patient's head is allowed to fall posteriorly and rest on the table over the physician's right hand. This allows for the extension of C4. The physician's right thumb will be resting on the patient's right cheek, pointing toward the patient's right eye. The physician's left hand contacts the patient's forehead, with the palm of their left hand contacting the frontal bone, fingers pointing to the left.
- The physician applies a force upward toward the patient's eyes at a 45° angle, through their right MC joint of their right index finger into the right lateral mass, causing rotation left. The left hand guides this motion. The patient's head remains on the table to ensure left sidebending.
- When the restrictive barrier is met, the final force is a gentle thrust upward and to the left, at a 45°angle through the patient's eyes.
- Return to neutral position.
- Reassess.

Muscle Energy: Dysfunction $C4FRS_R$

- The same position as above is achieved.
- With the patient's head rotated and sidebent left, the physician asks the patient to gently return their head to a neutral position.

- This is held for 3–5 seconds, then released.
- After waiting for 3 seconds, the physician introduces further right rotation to engage the new restrictive barrier.
- Step 2 is repeated three to four times.
- Reassess.

Indirect: Dysfunction $C4FRS_R$

- With the patient lying supine and physician at the head of the table, the physician places the pad of their right index finger on the posterior aspect of C4 (lateral mass). The pad of the left index finger is on the opposite lateral mass. The palms of each hand lie on the respective parietal bones of the cranium.
- The physician slowly flexes the patient's head until flexion at the level of C4 is achieved, straigthening the cervical lordosis.
- The physician laterally translates his/her right index finger to the left causing sidebending right.
- The physician applies a superior force with his/her left index finger to the left lateral mass causing right rotation of the vertebra.
- This position is held until a release is felt.
- Reassess.

Facilitated Positional Release: Dysfunction $C4FRS_R$

- The same position of the physician and patient is achieved as above; however, a compression force is applied through the head down the spine to the level of C4, once indirect positioning of the vertebra is achieved.
- This position is held until a release is felt.
- Reassess.

CHAPTER 9

Thoracic, Rib, and Diaphragm Techniques

Muscle Energy for Thoracic Curve, Convex Left, T3–T7

(See Figure 9-1.)

The apex of this curve is at T5 so this will be the focus of the treatment. T5 is rotated left, sidebent right.

- Patient seated, physician standing on side of concavity.
- Physician palpates interspinous space of T5–T6 with middle finger. Other fingers are placed interspinous above and below this.
- Physician flexes patient's trunk minimally until gapping is felt at the T5–T6 space.
- Physician then rotates and sidebends patient's trunk into the "featheredge" of the barrier, rotating right and sidebending left.
- Patient is instructed to counteract these forces for 3–5 seconds.
- Forces are gently relaxed. Wait 3–5 seconds, and engage new barrier.
- Repeat three to five times.

High Velocity, Low Amplitude (Kirksville Krunch) for T4 Extended, Rotated Right, Sidebent Right—$T4ER_RS_R$

(See Figure 9-2.)

- Patient supine with arms hugging upper chest. Physician on side opposite of the lesion.
- Physician cradles patients head and neck with left arm, while right thenar eminence is placed under the transverse process of T4. The physician's epigastrium is placed over the patient's elbows. A pillow can be placed over the patient's elbows for the physician's comfort.

FIGURE 9-1. Muscle energy treatment of a group curve.

FIGURE 9-2. Kirksville krunch of a segmental dysfunction.

- Patient's head and neck are flexed to T4–T5. Left sidebending is induced from above. A small amount of left rotation can be induced to localize all planes to the barrier.
- Final corrective force is a quick thrust through the epigastric contact in the direction of the posterior component, T4.

Strain and Counterstrain for the Thoracic Region

(See Chapter 6 for more detail.)

Key Points

- **Anterior points**—treat with **flexion** and sidebending **toward** lesion
- **Posterior points**—treat with **extension** and sidebending **away** from lesion
    - Anterior—three groups divided by treatment position
        - AT1–AT6 (anterior tenderpoints 1–6)—midline on the sternum. Treat with flexion and arms internally rotated
        - AT7–AT9—abdominal wall, 1–2 in lateral to midline between xyphoid and umbilicus. Treat with flexion, sidebending toward and rotation away from lesion
        - AT10–AT11—abdominal wall below umbilicus. AT12 – inner surface of iliac crest at midaxillary line. Treat with flexion, sidebending and minimal rotation toward lesion
    - Posterior—points can be found on the spinous process (usually the sides) or on the transverse process
        - PT1–PT9 (posterior tenderpoints 1–9)—spinous process of corresponding vertebra. Treat with extension, sidebending and rotation away from lesion
        - PT10–PT12—spinous process of corresponding vertebra. Treat with extension, and rotation toward lesion
        - LPT1–LP12—(lateral posterior tenderpoint)—transverse process of corresponding vertebra. Treat primarily with sidebending away from lesion

Muscle Energy for Exhaled Ribs 1 or 2 on the Left

(See Figure 9-3.)

- Patient supine, head rotated to the right approximately 30°, with left wrist over forehead. Physician opposite dysfunctional ribs. Top hand is placed over patient's wrist (over the forehead). Bottom hand is placed under angle of dysfunctional rib and continuously exerts an inferior and lateral force.
- Patient is instructed to lift head toward ceiling while the physician resists.
- This is held for 3–5 seconds.
- Tissues are then allowed to relax for several seconds, a new barrier engaged and the process repeated three to five times.

Muscle energy (ME) uses respiratory assistance—directly pushing the ribs into exhalation—for inhaled ribs. Ribs can also be balanced indirectly to release myofascial restrictions. Elevated 1st ribs and posterior ribs can be 'put back in place' with high velocity, low amplitude (HVLA) and ME techniques. Alternatively, they can be balanced by any of the indirect techniques.

Facilitated Positional Release for Elevated 1st Rib on the Left

(See Figure 9-4.)

- Patient supine. Physician on side of dysfunction.
- Physician's left hand monitors the patient's rib at its area of greatest tension over the posterior, superior aspect. Physician's right hand manipulates patient's ipsilateral elbow.
- Physician places patient's arm into flexion and internal rotation until tissues around the rib are maximally softened.
- Compression is then added through the elbow in the direction of the monitoring fingers.

FIGURE 9-3. ME of exhaled ribs 1–2.

FIGURE 9-4. Facilitated positional release for an elevated 1st rib.

- Position is held for 3–5 seconds.
- While maintaining the current forces, the arm is adducted across the chest and then brought inferiorly and back into neutral in a continuous arc.

In addition, all ribs can be assessed for myofascial restrictions and direct and indirect MFR techniques used to reduce strain patterns.

Rib Raising

(See Figures 9-5 A and B.)

- Patient lies supine.
- Physician stands to the side of the patient.

FIGURE 9-5(A). Rib raising.

FIGURE 9-5(B). Rib raising.

- Physician slides his/her hands, palms up, so the finger pads contact the rib angles (posterior aspect of the ribs).
- The physician flexes his/her fingers holding them firmly in place. By using the physician's arms and body as a unit, an upward springing force is applied to the rib cage to exaggerate the patient's inhalation. This is accomplished by the physician locking his/her fingers, wrists, arms, and shoulders in place with his/her elbows extended. The physician bends their knees lowering their trunk causing their hands to move upward, articulating the patient's rib cage.
- As the patient exhales, the physician stands up to exaggerate exhalation.
- This cycle is repeated, until motion in the rib cage is improved.
- Reassess, and repeat on opposite side.

FIGURE 9-6(A). Indirect balancing of the diaphragm.

FIGURE 9-6(B). **Indirect balancing of the diaphragm.**

Indirect Balancing of the Diaphragm

(See Figures 9-6 A and B.)

- The patient is seated or in supine position.
- Physician stands to the side of the patient.
- The physician places one hand under the lower ribs with their fingers between the spinous process of the upper lumbar vertebra. The other hand is placed with the middle finger on the xiphoid process. The rest of the fingers lie inferiorly.
- As the patient breathes, the physician assesses the motion of the hemidiaphragm.
- The physician moves his/her hands as to follow the direction of least tension of the diaphragm exaggerating this position.
- This position is held through three breathing cycles. After each exhalation, the physician readjusts his/her hands into the direction of least tension. After three cycles, reassess.
- Repeat this process on the opposite hemidiaphragm.

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CHAPTER 10

Lumbar Techniques

High Velocity, Low Amplitude Lateral Recumbent (Posterior Transverse Process Down-Lumbar Low) for a Type II, Flexed Dysfunction, T10–L5

(See Figure 10-1.)

- Patient is positioned in the **lateral recumbent position** with the side of the dysfunction down (lumbar low).
- Physician stands facing the patient.
- Patient's legs are flexed until motion is palpated at the joint space of the dysfunction.
- Inferior leg is straightened.
- Patient's inferior arm is pulled cephalad and upward to increase rotation of the dysfunctional segment.
- Physician places his/her caudad forearm over the patient's ilium.
- Physician's cephalad hand monitors the dysfunctional segment.
- Ask patient to inhale/exhale. Physician monitors motion at the dysfunction, while taking up tissue slack.
- A high-velocity low-amplitude thrust directed through the physician's caudad forearm toward the patient's head and downward to encourage sidebending.
- Physician's cephalad forearm stabilizes patient's upper torso during the thrust.

For an extended dysfunction, follow the procedure as outlined above. If flexion of the lumbar spine is desired, this can be accomplished by pulling the patient's shoulders anteriorly.

When performed with the posterior transverse process down, this technique addresses the sidebending component of the dysfunction. For example, if L1 is flexed, rotated and sidebent to the right, placing the patient on the right side with the patient's left ankle tucked behind their right knee causes left sidebending of the lumbar spine. The final corrective force is an increase in this left sidebending (along with rotation) of the lumbar spine. This technique can be performed with the posterior component up; however, this only addresses the rotational component of the dysfunction.

FIGURE 10-1. HVLA lateral recumbent (posterior transverse process down-lumbar low) for a Type II, flexed dysfunction, T10–L5.

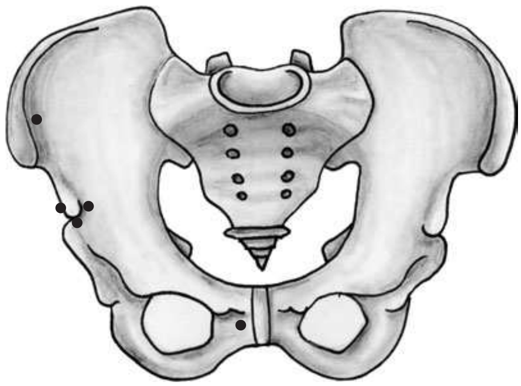

FIGURE 10-2. Anterior lumbar counterstrain tenderpoints.

Counterstrain, Anterior L1–L5 (AL1–AL5)

Tenderpoint Location

(See Figure 10-2.)

- **AL1**: medial side of anterior superior iliac spine (ASIS), press laterally
- **AL2**: medial side of anterior inferior iliac spine (AIIS), press laterally
- **AL3**: lateral side of AIIS, press medially
- **AL4**: inferior side of AIIS, press cephalad
- **AL5**: anterior surface of pubic rami approximately 1 cm lateral to pubic symphysis and inferior to tubercle, press posteriorly

Treatment Position

(See Figure 10-3.)

FIGURE 10-3. Counterstrain, anterior L1–L5 (AL1–AL5).

AL1

- Patient is supine.
- Physician stands on same side as the AL1 tenderpoint.
- Tenderpoint is palpated with physician's cephalad hand.
- Physician places caudad leg on table to serve as support for patient's legs.
- Patient's hips are markedly flexed to the level of the L1 vertebrae.
- Patient's legs are placed by physician on physician's caudad leg.
- Patient's feet are pulled toward the tenderpoint side to sidebend the lumbar spine.
- Patient's knees are pulled toward the tenderpoint side to introduce rotation of the L1 segment away form the tenderpoint side.
- Physician monitors tenderpoint for maximum decrease in tension is palpated and maximum decrease in tenderness is perceived by patient.
- Position is held for 90 seconds.
- Physician returns patient's legs to the table without assistance from patient.

AL2–L4

- Patient is supine.
- Physician stands on opposite side of tenderpoint.
- Physician places caudad leg on table to serve as support for patient's legs.
- Patient's hips are moderately flexed to the level of the dysfunctional vertebrae
- Patient's legs are placed by physician on physician's caudad leg.
- Patient's knees are rotated away from the tenderpoint, with the amount varying at different vertebral levels.
- Patient is sidebent by moving feet away from tenderpoint side.
- Physician monitors tenderpoint for maximum decrease in tension is palpated and maximum decrease in tenderness is perceived by patient.
- Position is held for 90 seconds.
- Physician returns patient's legs to the table without assistance from patient.

AL5

- Patient is supine.
- Physician stands on same side of AL5 tenderpoint.
- Physician places caudad leg on table to serve as support for patient's legs.
- Patient's hips are markedly flexed to the level of L5.
- Patient's legs are placed by physician on physician's caudad leg.
- Patient's knees are pulled toward the tenderpoint and patient's feet are moved away from the tenderpoint. This produces sidebending away and torso rotation away from the tenderpoint.
- Physician monitors tenderpoint for maximum decrease in tension is palpated and maximum decrease in tenderness is perceived by patient.
- Position is held for 90 seconds.
- Physician returns patient's legs to the table without assistance from patient.

Counterstrain, Posterior L1–L5 (PL1–PL5)

Tenderpoint Location

- **PL1–PL5**: inferolateral side of the deviated spinous process, which signifies vertebral rotation of this segment to the opposite side

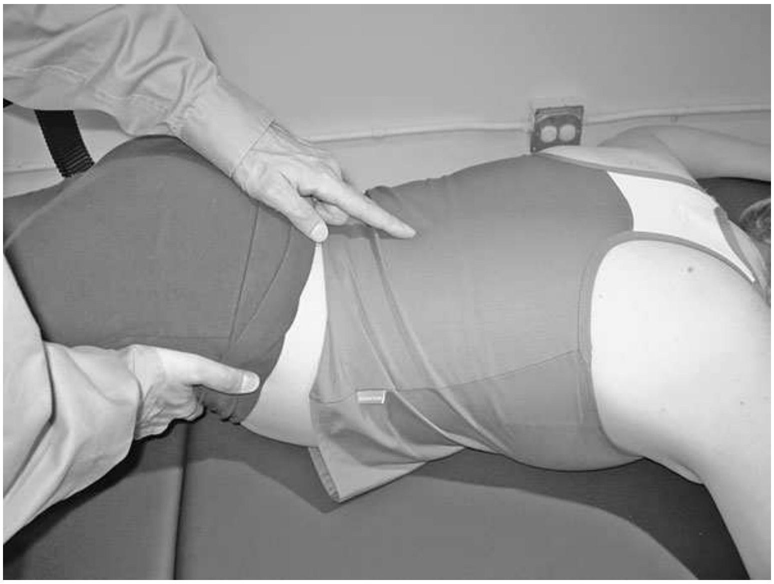

FIGURE 10-4. Counterstrain, posterior L1–L5 (PL1–PL5).

TREATMENT POSITION

(See Figure 10-4.)

PL1–PL5

- Patient is **prone**.
- Physician stands on the same side of posterior tenderpoint.
- Physician extends patient's trunk on the same side of the tender by lifting the pelvis posteriorly, which creates extension and rotation of the lower vertebrae toward the tenderpoint side.
- Physician monitors tenderpoint for maximum decrease in tension is palpated, and maximum decrease in tenderness is perceived by patient.
- Position is held for 90 seconds.
- Physician returns patient to neutral position without assistance from patient.

Facilitated Positional Release, Extended Somatic Dysfunction

(See Figure 10-5.)

- Patient is prone with the side of the somatic dysfunction close to the edge of the table.
- Place pillows under the abdomen to cause flattening of the lumbar lordosis.
- Physician stands facing the head of the table on the same side of the patient's dysfunction.
- A pillow is placed under the patient's thigh on the side of the dysfunction.
- Physician monitors the posterior transverse process of the dysfunctional lumbar vertebrae with the hand closest to the patient.
- Physician uses the other hand to abduct patient's leg on the same side as the dysfunction creating lumbar sidebending (physician stands between table and patient's abducted leg).

FIGURE 10-5. Facilitated positional release, extended somatic dysfunction.

- Physician internally rotates patient's abducted leg until motion is palpated under physician's monitoring finger.
- Physician flexes patient's hip by moving the abducted leg toward the floor.
- With the pillow acting as a fulcrum, the physician lifts the patient's pelvis from the table introducing lumbar extension.
- Physician holds this position until a release is appreciated, usually 3–5 seconds.
- Physician slowly returns the patient to neutral without assistance from the patient.

Facilitated Positional Release, Flexed Somatic Dysfunction

(See Figure 10-6.)

- Patient is prone with the side of the somatic dysfunction close to the edge of the table.
- Place pillows under the abdomen to cause flattening of the lumbar lordosis.
- Physician sits facing the head of the table on the same side of the patient's dysfunction.
- Physician monitors the posterior transverse process of the dysfunctional lumbar vertebrae with the hand closest to the patient.
- Physician flexes patient's leg (on the side of the dysfunction) at the knee and the hip, resting the lower leg between his/her legs, creating flexion of the spine until motion is palpated at the site of the dysfunction.
- The physician then abducts the knee until motion is appreciated at the somatic dysfunction.
- The physician holds and supports the knee throughout the remainder of the technique.
- Physician then rotates his/her body clockwise to introduce rotation.
- Compression can be added through the patient's knee.
- Physician holds this position until a release is appreciated, usually 3–5 seconds.
- Physician slowly returns the patient to neutral without assistance from the patient.

FIGURE 10-6. Facilitated positional release, flexed somatic dysfunction.

High Velocity, Low Amplitude: Leg Pull Dysfunction: Short Leg

(See Figure 10-7.)

- With the patient lying supine and the physician standing at the foot of the bed, the physician holds onto the patient's ankle. The patient is asked to hold onto the sides of the table.
- Next, the physician gently leans backward applying a traction force onto the patient's leg.
- The physician then slowly abducts the leg until a restrictive barrier is met.
- Slight internal rotation is then applied to the leg by rotating the ankle medially.
- The corrective force is applied as the physician forcefully tugs on the patient's leg.
- Reassess.

FIGURE 10-7. HVLA: leg pull dysfunction: short leg.

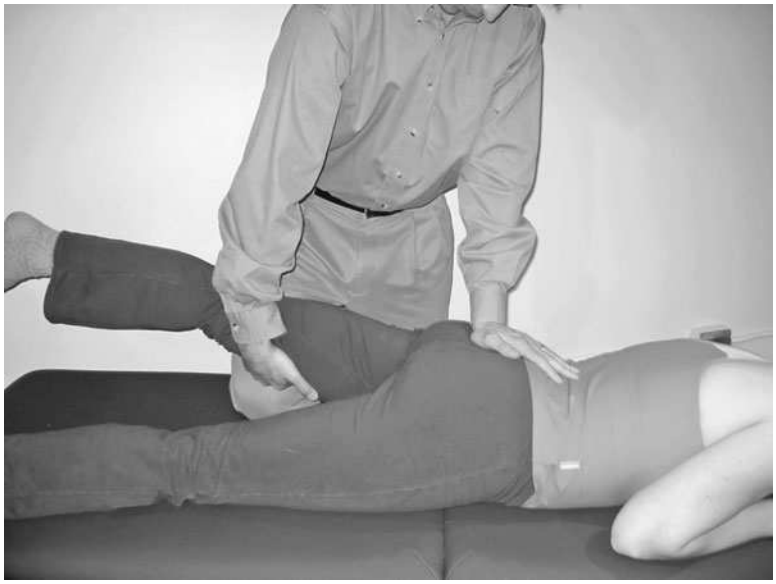

FIGURE 10-8. Muscle energy—psoas muscle spasm.

Muscle Energy—Psoas Muscle Spasm

(See Figure 10-8.)

- The patient lies prone.
- The physician stands at the side of the table on the side of the tight psoas.
- The physician stabilizes the patient's lumbar paravertebral area with his/her cephalad hand.
- With his/her caudad hand, the physician grasps the patient's leg, proximal to the knee and extends the leg at the hip.
- The physician asks the patient to gently push their knee down toward the table for 3–5 seconds and then to relax.
- The physician re-engages the barrier and repeats the above sequence.
- Reassess.

CHAPTER 11

Sacrum and Pelvis Techniques

Muscle Energy for Forward Torsion

(See Figure 11-1.)

- Patient is positioned on side of involved axis (left side for left on left forward torsion).
- Physician stands facing the patient.
- Patient is asked to "hug" the table.
- Patient's superior shoulder is brought as close to the table as possible.
- Patient's hips and knees are flexed 90°.
- Legs are brought off the table.
- Physician places hand on upper leg just proximal to lateral malleolus.
- Patient is instructed to raise legs toward ceiling.
- Physician counters patient's force for 3–5 seconds.
- Patient is told to relax; physician waits 1–2 seconds.
- Patient's legs are brought further toward the floor.
- The final four steps are repeated three to five times or until no further improvement is demonstrated.

Muscle Energy Technique for Backward Torsion

(See Figure 11-2.)

- Patient is positioned on side of involved axis (left side for right on left backward torsion).
- Physician stands facing the patient.
- Patient's superior shoulder is brought posteriorly until restrictive barrier is reached.
- Patient's hips are flexed to 45° while knees are flexed to 90°.
- Patient's upper leg is brought off the table while lower leg remains on table.

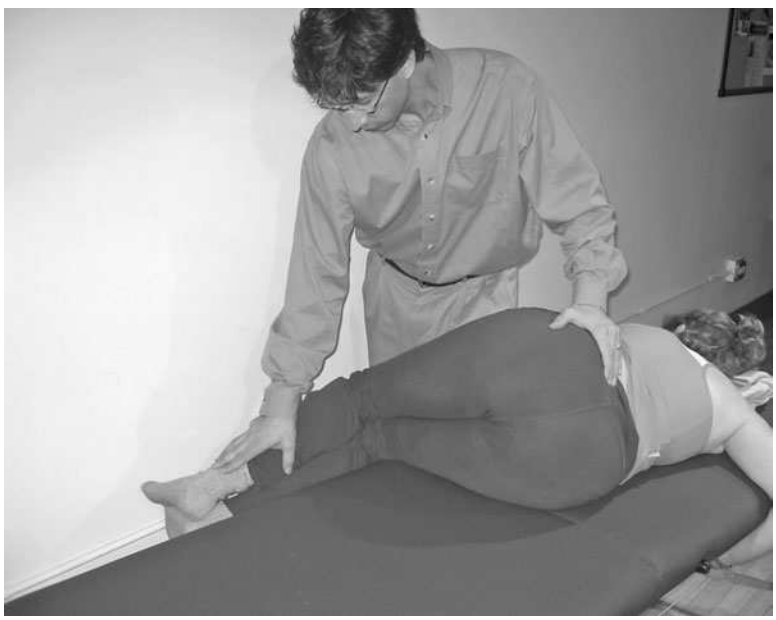

FIGURE 11-1. Muscle energy for forward torsion.

FIGURE 11-2. Muscle energy technique for backward torsion.

- Physician places hand on upper leg of the patient just proximal to lateral malleolus.
- Patient is instructed to raise upper leg toward ceiling.
- Physician counters patient's force for 3–5 seconds.
- Patient is told to relax; physician waits 1–2 seconds.
- Patient's upper leg is brought further toward the floor.
- The final four steps are repeated three to five times or until no further improvement is demonstrated.

High Velocity, Low Amplitude Technique for Anterior Sacrum

(See Figure 11-3.)

- Patient is positioned on opposite side of dysfunction (left side for a right anterior sacrum) such that the dysfunctional sacroiliac (SI) joint is up (sacrum supreme).
- Patient's hips and knees are flexed until motion is detected at dysfunctional SI joint.
- Patient's upper leg is brought off table.
- Physician's cephalad hand monitors the dysfunctional SI joint while the cephalad forearm places posterior force on patient's upper shoulder to stabilize the patient.
- Physician's caudad forearm is placed over the ilium just anterior to the dysfunctional SI joint.
- A quick, gentle thrust is applied to the patient's ilium rotating the ilium in an anterior position from behind.

High Velocity, Low Amplitude Technique for Posterior Sacrum

(See Figure 11-4.)

- Patient is positioned supine.
- Physician stands on opposite side of dysfunction (left side for a right posterior sacrum) facing patient.

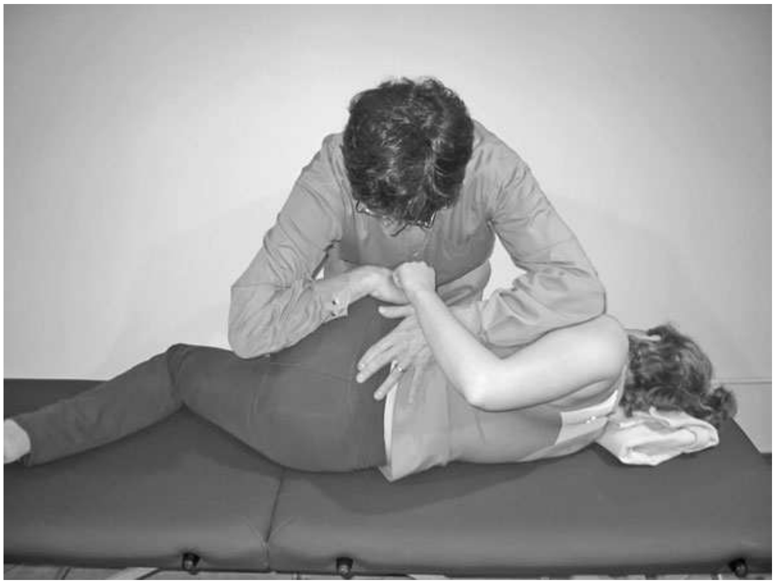

FIGURE 11-3. HVLA technique for anterior sacrum.

- Patient either crosses their arms on their chest or interlaces fingers behind their neck.
- Physician moves patient's shoulders such that the torso is sidebent to the side of the dysfunctional SI joint and rotated away from the dysfunctional SI joint.
- The physician rotates the patient's torso toward the physician pivoting on the patient's downward shoulder.
- A quick, gentle thrust is applied to the patient's torso toward the physician with the physician's cephalad hand while a gentle counterforce is applied to the patient's ilium on the side of the dysfunctional SI joint with the physician's caudad hand.

FIGURE 11-4. HVLA technique for posterior sacrum.

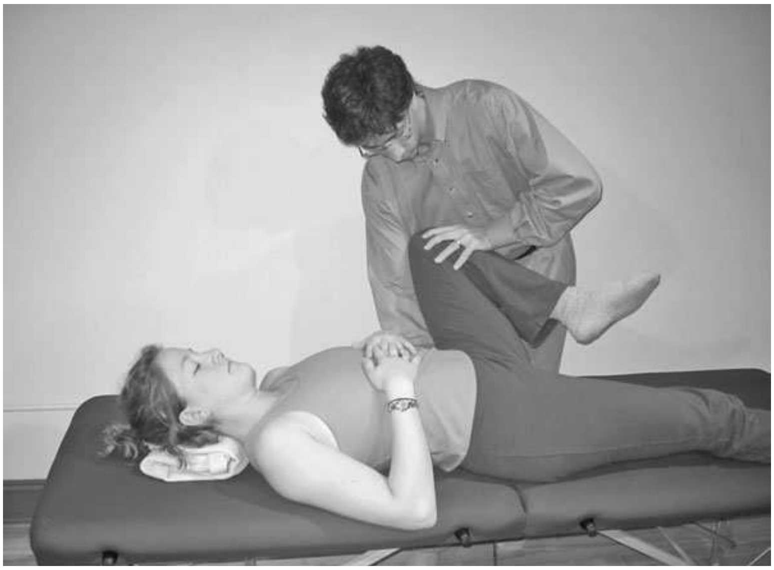

FIGURE 11-5. **Muscle energy technique for anterior innominate.**

Muscle Energy Technique for Anterior Innominate

(See Figure 11-5.)

- Patient is positioned supine.
- Patient's knee and hip are flexed such that knee is brought to patient's chest on side of anterior ilium.
- Physician contacts patient's knee while stabilizing patient's pelvis. If necessary, physician contacts both sides of the table, while patient's knee is brought into physician's axilla.
- Patient is instructed to push knee into physician's hand/axilla, while physician maintains counterforce for 3–5 seconds.
- Patient is told to relax.
- Physician waits 1–2 seconds, then engages the new restrictive barrier.
- Final three steps are repeated three to five times or until further improvement is demonstrated.

Muscle Energy Technique for Posterior Innominate

(See Figure 11-6.)

- Patient is positioned prone.
- Physician stands on opposite side of dysfunction.
- Patient's knee is flexed 90°.
- Physician contacts patient's thigh just proximal to the knee.
- Patient's hip is passively extended while patient's sacroiliac joint is stabilized.
- Patient is asked to push knee into physician's hand while physician maintains counterforce for 3–5 seconds.
- Patient is told to relax.
- Physician waits 1–2 seconds, then engages the new restrictive barrier.
- Final three steps are repeated three to five times or until further improvement is demonstrated.

FIGURE 11-6. Muscle energy technique for posterior innominate.

High Velocity, Low Amplitude Technique for Innominate Up-Slip

(See Figure 11-7.)

- Patient is positioned supine.
- Physician stands at patient's feet.
- Physician holds ankle on the side of dysfunction.
- Physician applies a traction force to the leg from the ankle to the hip.
- Physician slightly flexes and internally rotates leg.
- A quick, gentle thrust is applied to leg by increasing traction from ankle.

FIGURE 11-7. HVLA technique for innominate up-slip.

CHAPTER 12

Extremity Techniques

Muscle Energy for Shoulder

(See Figure 12-1.)

- Patient sits on table with physician standing behind.
- Range of motion is tested in all directions.
- Decreased range of motion is noted.
- The restrictive barrier is engaged.
- The patient performs three to five repetitions of a 3–5-second isometric contraction against the physician's resistance.
- The range of motion is reassessed for improvement.

Articulatory—Spencer Seven-Step Technique

- Patient lies in the lateral recumbent position with affected shoulder up.
- The physician stands behind or facing the patient.
- The physician stabilizes the clavicle and scapula (shoulder girdle).
    - Step one: The physician gently extends the arm in the sagittal plane with the elbow flexed. Repetitions are made according to the patient's comfort level (see Figure 12-2 A).
    - Step two: The physician flexes the patient's arm in the sagittal plane, with the elbow extended, and induces a rhythmic, swinging movement, increasing range so that the patient's arm covers the ear (see Figure 12-2 B).
    - Step three: The physician circumducts the patient's abducted humerus with the elbow flexed. The physician makes clockwise and counterclockwise concentric circles, gradually increasing the range within limits of pain (see Figure 12-2 C).

FIGURE 12-1. Muscle energy for shoulder, patient resisted with arm flexion.

FIGURE 12-2(A). **Spencer technique—step 1, arm extension.**

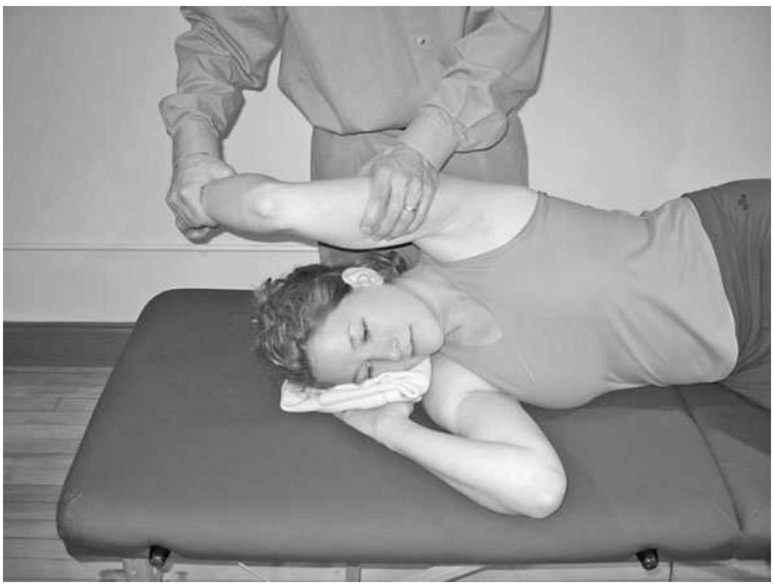

FIGURE 12-2(B). **Spencer technique—step 2, arm flexion.**

FIGURE 12-2(C). **Spencer technique—step 3, circumduction with elbow flexion.**

- Step four: The physician circumducts the patient's humerus with the elbow extended. The physician makes clockwise and counterclockwise circles with the arm, increasing range as permitted by the patient's pain tolerance (see Figure 12-2 D).
- Step five: The physician abducts the patient's arm with the elbow flexed and gradually increases the range of abduction against the stabilized shoulder girdle (see Figure 12-2 E).

FIGURE 12-2(D). **Spencer technique—step 4, circumduction with elbow extension.**

FIGURE 12-2(E). Spencer technique—step 5, arm abduction.

- Step six: The physician places the patient's hand behind the rib cage and gently springs the elbow forward and inferior, increasing internal rotation of the humerus (see Figure 12-2 F).
- Step seven: The physician grasps the patient's proximal humerus with both hands and applies a lateral and caudad traction in a pumping fashion (see Figure 12-2 G).

- Retest.

FIGURE 12-2(F). Spencer technique—step 6, arm internal rotation.

FIGURE 12-2(G). Spencer technique—step 7, arm traction.

Counterstrain—Coracoid Tenderpoint Counterstrain Technique

(See Figure 12-3.)

- The physician stands behind the seated patient.
- The physician finds a tenderpoint located over the coracoid process, at the insertion of pectoralis minor and the short head of the biceps, with the cephalad hand.
- The physician flexes the patient's arm at the elbow with the caudad hand, unloading the biceps and loading the triceps.
- The physician protracts the shoulder to shorten pectoralis minor.
- The physician monitors the tenderpoint for 90 seconds, palpating for a release.

FIGURE 12-3. Coracoid tenderspot counterstrain technique.

FIGURE 12-4. Technique for anterior radial head dysfunction.

High Velocity, Low Amplitude—Thrust Technique for Anterior Radial Head and Posterior Radial Head

- The physician stands facing the seated patient.
- For anterior radial head dysfunction, the physician grasps the dysfunctional arm and flexes the arm at the elbow while adding pronation at the wrist.
- The physician places the 2nd and 3rd digits of his other hand into the crease of the patient's elbow, directly over the radial head.
- The physician exerts a rapid hyperflexion force on the elbow while simultaneously thrusting the radial head dorsally with the fingers of the other hand (see Figure 12-4).
- For a posterior radial head dysfunction, the physician grasps the patient's arm at the elbow and extends it.
- The physician places his/her thumbs over the head of the radius posteriorly and the phalanx of his index finger over the radial head anteriorly.
- The physician exerts a rapid hyperextension force on the patient's elbow, while simultaneously inducing a ventral counterforce through the radial head (see Figure 12-5).

Muscle Energy—Supination and Pronation Dysfunction

- The physician stands in front of the seated patient.
- The physician flexes the patient's elbow to 90° and stabilizes the joint with his medial hand. The lateral hand grasps the distal forearm, wrist, and hand with the thumb pointed vertically.
- The physician induces supination and pronation, testing for dysfunction and comparing to the opposite side.
- To treat supination dysfunction, the physician stabilizes the elbow and monitors the radial head with the lateral hand, while the medial hand supinates the forearm to the resistant barrier (see Figure 12-6).
- The patient performs three to five contractions for 3–5 seconds against resistance offered by the physician's medial hand.

FIGURE 12-5. **Technique for posterior radial head dysfunction.**

- The physician engages a new supination barrier after each patient contraction.
- Treatment of pronation dysfunction involves the same hand placement, but engages the barrier in pronation.
- The patient performs three to five contractions for 3–5 seconds against resistance offered by the physician's medial hand.
- The physician engages a new pronation barrier after each patient contraction.
- The physician reassesses.

FIGURE 12-6. **Technique for restriction in supination.**

FIGURE 12-7. **Counterstrain for lateral epicondyle tenderpoint.**

Counterstrain—Lateral Epicondyle Tenderpoints

(See Figure 12-7.)

- The patient is seated.
- The physician stands on the side of affected extremity.
- The physician palpates the tenderpoint over the lateral epicondyle.
- With his other hand, the physician flexes the elbow and places the wrist in extension.
- The physician fine-tunes the position with supination or pronation.
- The position is held for 90 seconds.
- The arm is slowly returned to a neutral position.

Muscle Energy—Wrist Restriction in Radial Deviation

(See Figure 12-8.)

- The joint is moved into the barrier of radial deviation.
- The patient is asked to push toward the ulnar aspect against physician resistance.
- The contraction is held for 3–5 seconds.
- The joint is moved into a new barrier.
- The technique is repeated three more times.

Counterstrain—to Treat Wrist Tenderpoints

(See Figure 12-9.)

- The physician finds the tenderpoint on the dorsal or ventral aspect of the wrist.
- The physician flexes or extends the wrist around the tenderpoint.
- The physician holds the position for 90 seconds.
- The physician returns the wrist to neutral and reassesses the tenderpoint.

FIGURE 12-8. **Muscle energy for wrist restriction in radial deviation.**

Articulatory Treatment for the Hand

- The physician locks one metacarpal between the thumb and index finger of one hand.
- With the thumb and index finger of his/her other hand, the physician moves the adjacent metacarpal into rotation her anterior or posterior glide (see Figure 12-10).

FIGURE 12-9. **Counterstrain for dorsal wrist tenderpoint.**

FIGURE 12-10. Metacarpal articulation.

Counterstrain—Piriformis

(See Figure 12-11.)

- The patient lies prone and the physician stands on the side of the tight piriformis.
- The patient locates the piriformis tenderpoint with his cephalad hand.
- The physician grasps the patient's leg with his/her caudad hand and flexes the patient's knee to 90°.
- The physician abducts the leg and externally rotates the leg.
- The physician reassesses the tenderpoint.
- The physician holds the position for 90 seconds and slowly returns the leg to neutral.
- The physician reassesses the tenderpoint.

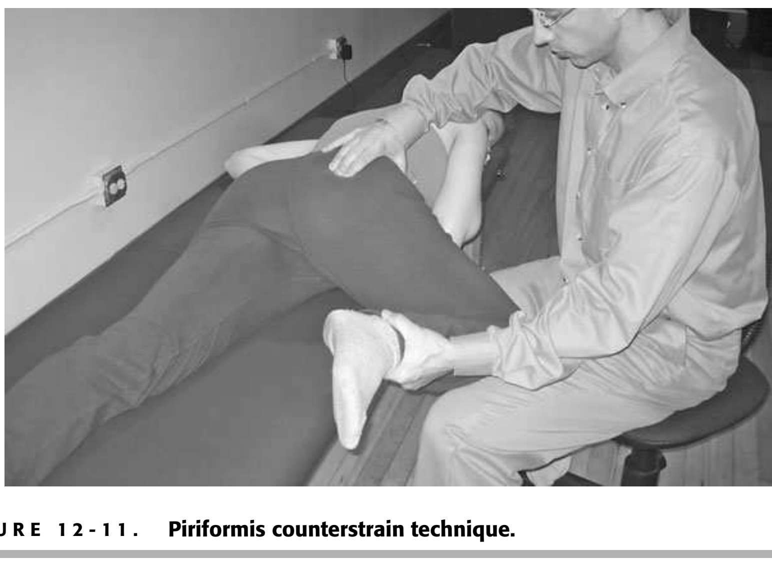

FIGURE 12-11. Piriformis counterstrain technique.

FIGURE 12-12. **HVLA for anterior fibular head dysfunction.**

High Velocity, Low Amplitude—Anterior Fibular Head Dysfunction

(See Figure 12-12.)

- The patient lies supine.
- The physician stands by the table on the same side as the dysfunction.
- The physician grasps the patient's foot on the side of the somatic dysfunction with the nonthrusting hand.
- The physician places the thenar eminence of his/her thrusting hand on the anterior superior aspect of the fibular head.
- The patient's knee is gently flexed.
- The physician extends the patient's knee rapidly, while simultaneously introducing a downward and medial thrust through the fibular head.

Counterstrain—Patellar Tenderpoint

(See Figure 12-13.)

- The patient lies supine.
- The physician stands beside the table.
- A rolled pillow is placed below the patient's calf.
- The knee is hyperextended as the physician presses down on the anterior thigh, proximal to the patella.
- The foot is internally rotated.

Counterstrain—Medial Ankle Tenderpoint

(See Figure 12-14.)

- The patient lies on his/her side with the affected leg up.
- The physician sits beside the table.
- The physician takes the affected foot off the table and a towel is placed under the anterior ankle.
- The physician inverts the foot, pressing forcefully on the lateral side of the foot.
- The physician holds the foot for 90 seconds following traditional counterstrain technique.

FIGURE 12-13. **Counterstrain for anterior patellar tenderpoint.**

High Velocity, Low Amplitude—Cuboid and Navicular Somatic Dysfunction

(See Figure 12-15.)

- The patient lies prone.
- The physician stands beside the table on the side of the dysfunction.
- The physician drops the dysfunctional leg off the side of the table and flexes the patient's hip and knee.
- The physician grasps the patient's foot with both hands and places his/her thumbs in a "V" shape over the cuboid or navicular.
- The physician exerts a downward thrust through his/her thumbs while simultaneously inducing a whip-like action at the patient's ankle and knee.

FIGURE 12-14. **Medial ankle tenderpoint counterstrain.**

FIGURE 12-15. **HVLA for navicular somatic dysfunction, performed with patient prone.**

Articulation—Metatarsal Heads

(See Figure 12-16.)

- The patient lies supine.
- The physician stands at the end of the table.
- The physician grasps the shaft of the second metatarsal with the medial hand and the shaft of the third metatarsal with the lateral hand.
- The physician moves the second metatarsal dorsally and ventrally to increase mobility.

FIGURE 12-16. **Metatarsal articulation.**

CHAPTER 13

Systemic Techniques

Sinus Technique

Inhibitory Pressure of the Three Branches of the Trigeminal Nerve to Improve Drainage of the Respiratory Sinuses

(See Figure 13-1.)

- The physician lies at the head of the table.
- The patient lies supine.
- The physician locates the supraorbital foramen above the orbits bilaterally.
- The physician applies gentle, alternating pressure to the area for approximately 3–5 seconds.
- The physician performs the same motion to the infraorbital foramen on the maxilla and the mental foramen on the mandible.

Volmer Pump

(See Figure 13-2.)

- The physician stands by the side of the table, next to the patient's head.
- The patient lies supine.
- The physician places their gloved index finger of the caudad hand inside the patient's mouth contacting the intermaxillary suture line.
- The physician places the cephalad index finger over the frontonasal articulation.
- The patient gently closes their mouth.
- The physician presses in a cephalad direction in a rhythmic fashion.
- The physician feels for motion at the frontonasal articulation.
- Upon feeling motion, the physician stops the technique.

FIGURE 13-1. Sinus technique inhibitory pressure.

FIGURE 13-2. Sinus technique: volmer pump.

MANDIBULAR DRAINAGE TECHNIQUE FOR OTITIS MEDIA—GALBREATH TECHNIQUE

(See Figure 13-3.)

- The patient is seated or lies supine, her head tilted to 30° and turned with the affected ear up.
- The physician is seated at the side of the table, adjacent to the patient's head, looking directly at the patient.

FIGURE 13-3. Mandibular drainage technique for otitis media—Galbreath technique.

- The physician's cephalad hand is placed on the patient's occiput.
- The physician's caudad hand is placed on the patient's mandible with the index and middle finger on the condyle of the mandible.
- The physician applies a gentle pressure with the caudad hand, pushing the condyle down and inward, and drawing the mandible toward the physician. The pressure is released.
- The motion is repeated every 3–5 seconds over 30–60 seconds.

LYMPHATIC PUMP

(See Figure 13-4.)

- With the patient supine and the physician standing at the head of the patient, the physician places their hand on the patient's thoracic wall, with the thenar eminence of each hand inferior to the respective clavicle. The fingers are spread apart.
- As the patient breathes, the physician applies a compressive force through their arms, following exhalation and resisting inhalation.
- This is continued through 3–4 cycles, resisting inhalation and following exhalation.
- One-third of the way through the fourth inhalation, quickly remove your hands from the patient's thoracic wall. This causes a negative intrathoracic pressure within the thoracic cavity, assisting flow.

PEDAL LYMPHATIC PUMP

(See Figure 13-5.)

- The patient lies supine.
- The physician stands at the foot of the table.
- The physician grabs the soles of the patient's feet, and dorsiflexes them.
- The physician applies an oscillatory dorsiflexion force through the longitudinal axis of the patient's body, at a rate of about 2–3 forces per second.
- The physician can continue the force for up to 5–10 minutes.

FIGURE 13-4. Lymphatic pump.

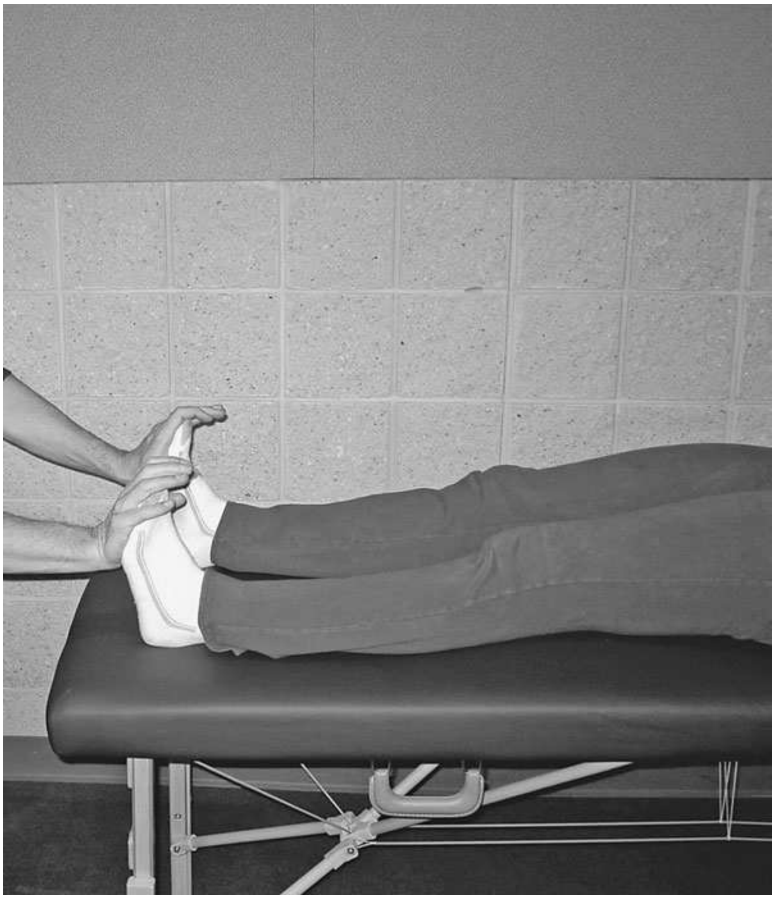

FIGURE 13-5. Pedal lymphatic pump.

MYOFASCIAL RELEASE OF THE THORACIC OUTLET

(See Figure 13-6.)

- With the patient lying supine and the physician seated at the head of the patient, the physician places both hands on either side of the patient's neck. The thumbs are placed posterior to the neck; the thenar eminence is superior to the superior border of the scapula.
- The fingers spread apart and placed inferior to the clavicle on each side. Contact is light so as to assess motion of the fascia.
- Assess the motion in all planes.
- Once the position of least tension is achieved, hold that position until a release is felt.
- Return to neutral and reassess.

Techniques for the Gastrointestinal Tract

MESENTERIC LIFT (SMALL INTESTINE, CECUM)

(See Figure 13-7.)

- Patient position = supine.
- Patient places feet on table by bending knees to relax abdomen.
- Physician gently "scoops" viscera in area of focus toward mesenteric attachment.
- Tissues are held until a sense of relaxation is palpated.

FIGURE 13-6. Myofascial release of the thoracic outlet.

General Lower Abdominal/Pelvic Lift

(See Figure 13-8.)

- Patient position = supine.
- Patient places feet on table by bending knees to relax abdomen.
- Physician places hands over viscera in area of focus, keeping fingers flat.
- Viscera are lifted superiorly, until an area of restriction is noted.
- Maintain lift until tissues release.

FIGURE 13-7. Mesenteric lift (small intestine, cecum).

FIGURE 13-8. **General lower abdominal/pelvic lift.**

TREATMENT OF ANTERIOR CHAPMAN REFLEXES FOR THE COLON

- Patient position = supine.
- Chapman reflexes for the colon are located along the iliotibial band, in relation to the mirror image of the colonic anatomical structures they represent (see Chapman diagram).
- Once a Chapman point is localized, firm pressure is applied to the point.
- Pressure is applied in a circular pattern with the attempt to flatten the mass.
- Continue pressure until the mass disappears, or until the patient can no longer tolerate the procedure.

PUBIC SYMPHYSIS COMPRESSION

(See Figure 13-9.)

MUSCLE ENERGY

- With the patient lying supine and the physician standing on the side of the patient so the dominant hand is caudad, the physician has the patient flex his/her legs so feet are flat on the table.
- The physician places their dominant arm between the patient's medial aspects of their knees, with the elbow contacting the medial aspect of one knee and the thenar eminence contacting the medial aspect of the other knee.
- The physician's opposite hand is placed on the anterior/superior aspect of the patient's pelvis for stabilization.
- The patient is instructed to abduct their knees together against the wedge created by your forearm.

FIGURE 13-9. Pubic symphysis compression.

- This position is held for 3–5 seconds.
- The patient relaxes for 3 seconds.
- These steps are repeated three to five times.
- Reassess.

Techniques for the Hospitalized Patient

See rib raising (Chapter 10) and pedal lymphatic pump (earlier in this chapter).

APPENDIX

Abbreviations

Abbreviation	Meaning
AIIS	Anterior Inferior Iliac Spine
ANS	Autonomic Nervous System
AOA	American Osteopathic Association
AP	Anteroposterior
ART	Articulation
ASIS	Anterior Superior Iliac Spine
ATF	Anterior Talofibular Ligament
BPH	Benign Prostatic Hypertrophy
BLT	Balanced Ligamentous Tension
CABG	Coronary Artery Bypass Graft
CFL	Calcaneofibular Ligament
CHF	Congestive Heart Failure
CN	Cranial Nerves
COMLEX	Comprehensive Osteopathic Medical Licensing Examination
COPD	Chronic Obstructive Pulmonary Disease
CRI	Cranial Rhythmic Impulse
CRP	Chapman's Reflex Point(s)
CS	Counterstrain
CSF	Cerebrospinal Fluid
CT	Computerized Tomography
CV	Cardiovascular
DA	Deep Articulation
DJD	Degenerative Joint Disease
DOE	Dyspnea on Exertion
ER	Emergency Room
FHT	Fetal Heart Tones
FPR	Facilitated Positional Release
GI	Gastrointestinal
GU	Genitourinary
H&P	History and Physical
HA	Headache
HEENT	Head, Ears, Eyes, Nose, Throat
HVLA	High Velocity, Low Amplitude
ILA	Inferior Lateral Angle
ITB	Iliotibial Band
IUP	Intrauterine Pregnancy
IVC	Inferior Vena Cava
ME	Muscle Energy
MFR	Myofascial Release
MI	Myocardial Infarction
NBOME	National Board of Osteopathic Medical Examiners
OA	Occipitoatlantal
OCP	Oral Contraceptive Pills
OMM	Osteopathic Manipulative Medicine
OMT	Osteopathic Manipulative Techniques
PMS	Premenstrual Syndrome
PRM	Primary Respiratory Mechanism
PSIS	Posterior Superior Iliac Spines
PTF	Posterior Talofibular Ligament
ROM	Range of Motion
RTM	Reciprocal Tension Membrane
SBR	Sidebending Rotation
SBS	Sphenobasilar Synchondrosis
SCM	Sternocleidomastoid
SD	Somatic Dysfunction
SI	Sacroiliac
SOAP	Subjective, Objective, Assessment, Plan
SOB	Shortness of Breath
ST	Soft Tissue
TL	Thoracolumbar
TMJ	Temporal Mandibular Joint
US	Ultrasound
UTI	Urinary Tract Infection
VS	Viscerosomatic
VSR	Viscerosomatic Reflex(es)

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