Orthopedic Diplomate Class 1:

Evidence-based
Best Practices for LBP

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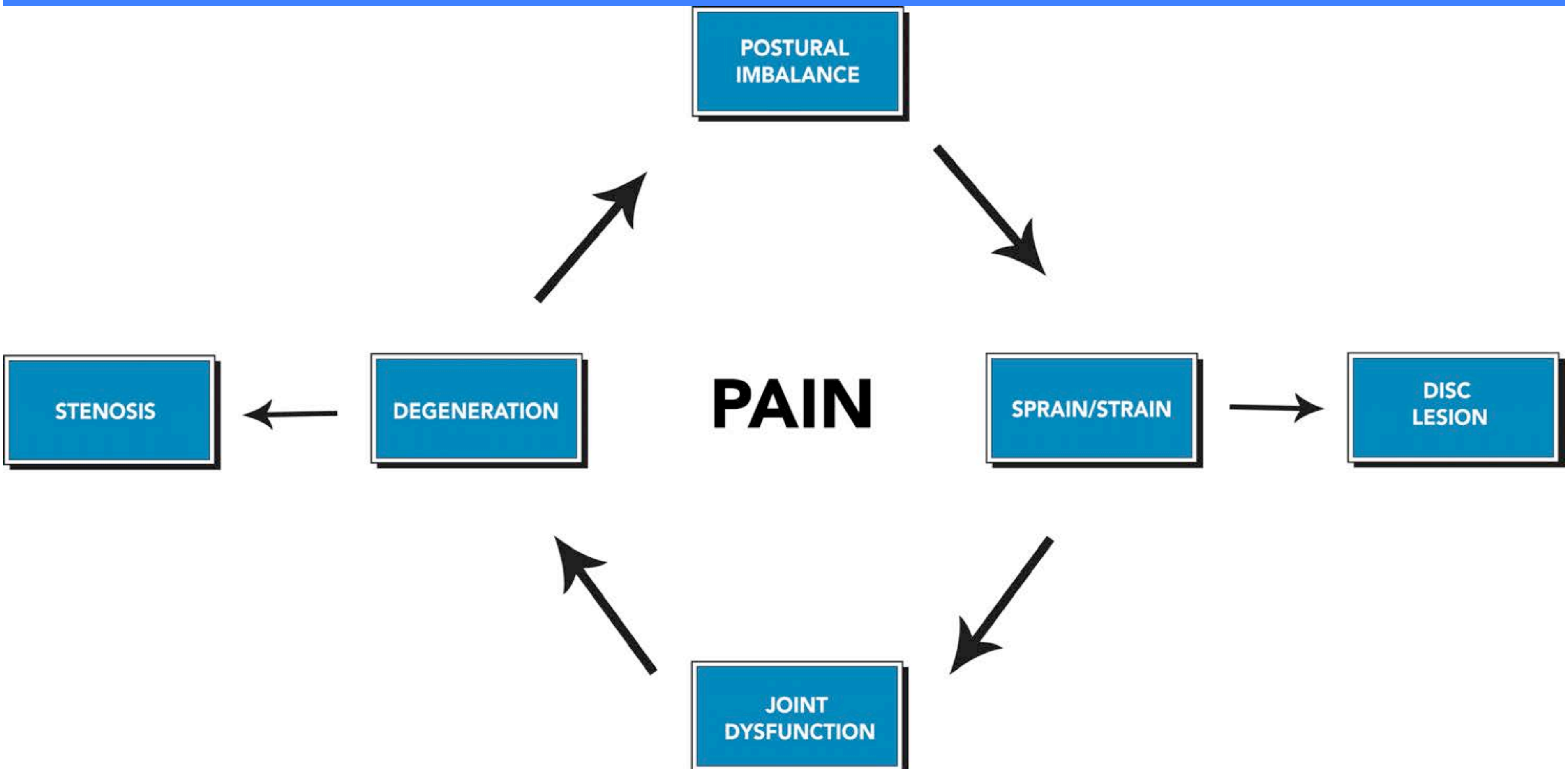
The Prevalence of LBP

- **80%** of adults will experience LBP
- 1-year incidence is up to **36%**
- Most costly benign condition
- Single most common source of disability in workers under the age of 40

LBP Predisposing Factors

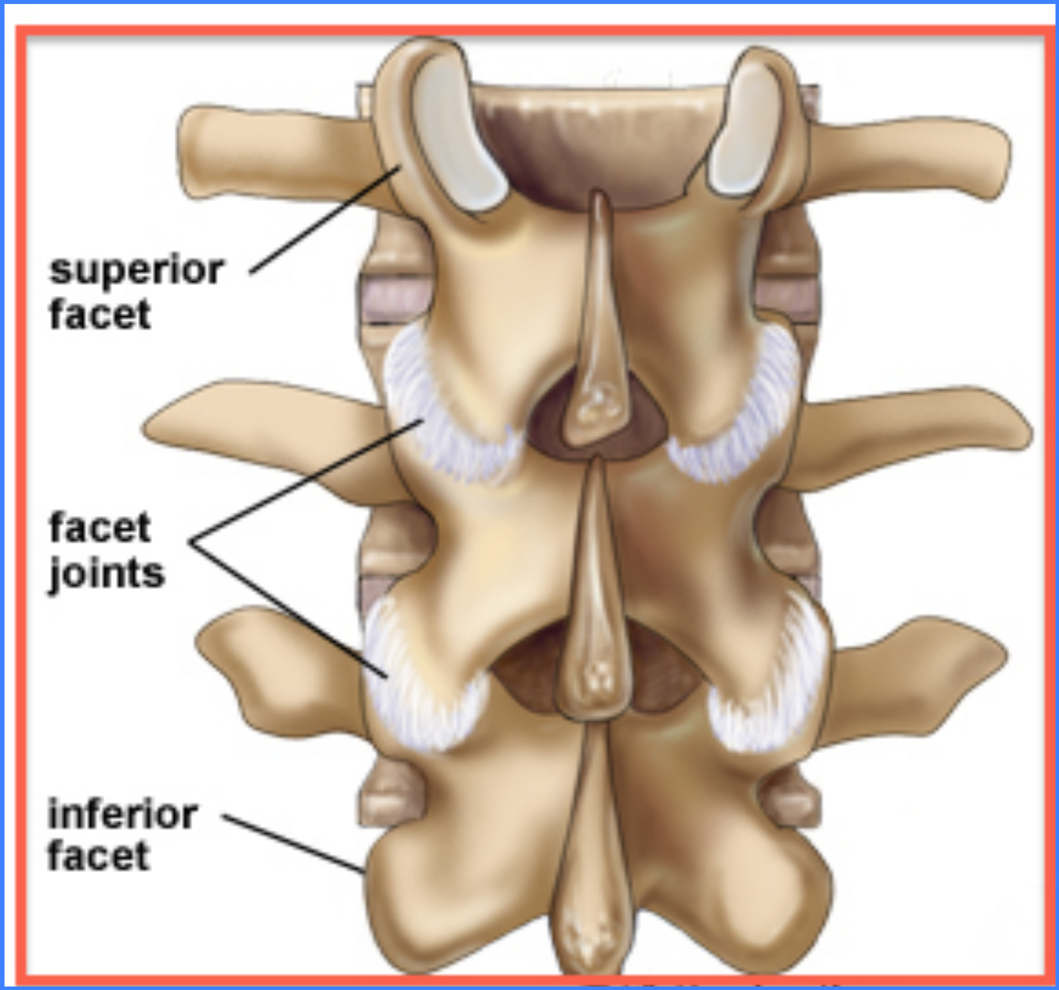
- Obesity
- Smoking,
- Heavy manual labor
- Repetitive bending, twisting and lifting
- Static postures
- Exposure to whole body vibration
- History of lumbar surgery
- Pre-existing structural deformities, including scoliosis, spondylolysis, or spondylolisthesis
- Stress, anxiety, depression
- Dissatisfaction with one's job
- Low educational status
- Fear avoidance behaviors may prolong the course of lower back pain

The LBP Continuum



Lumbar ISJD

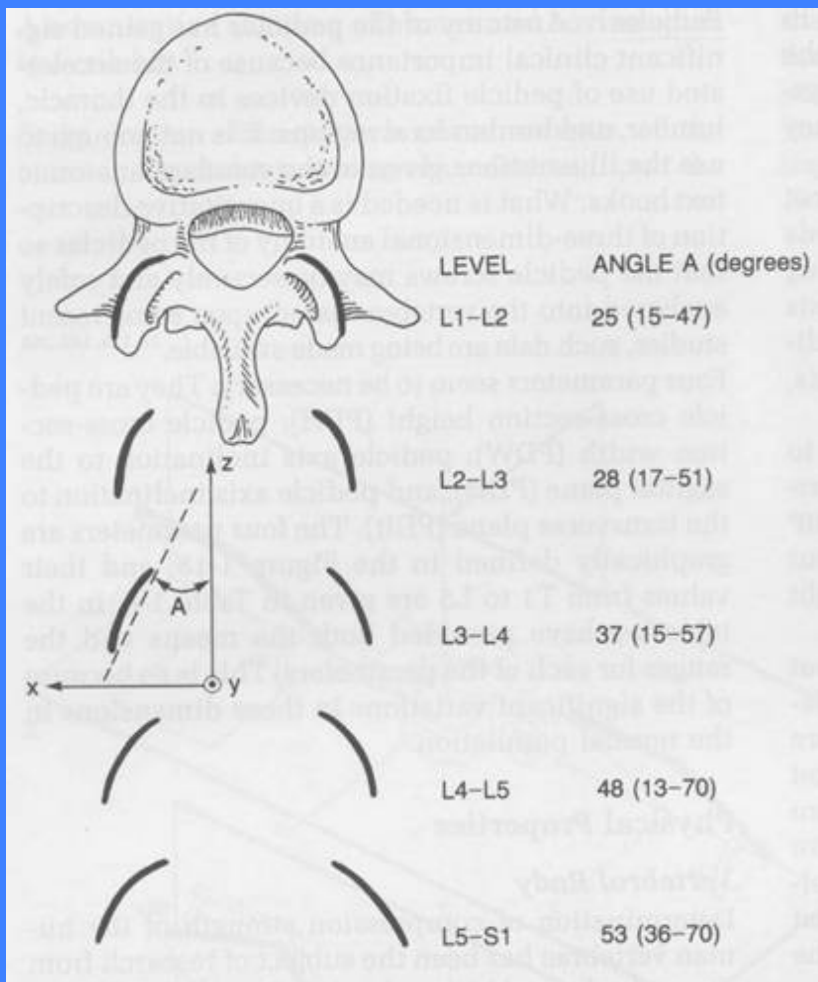
"Spinal segmental joint dysfunction characterized by altered joint alignment, motion, or physiologic function in an intact spinal motion segment."

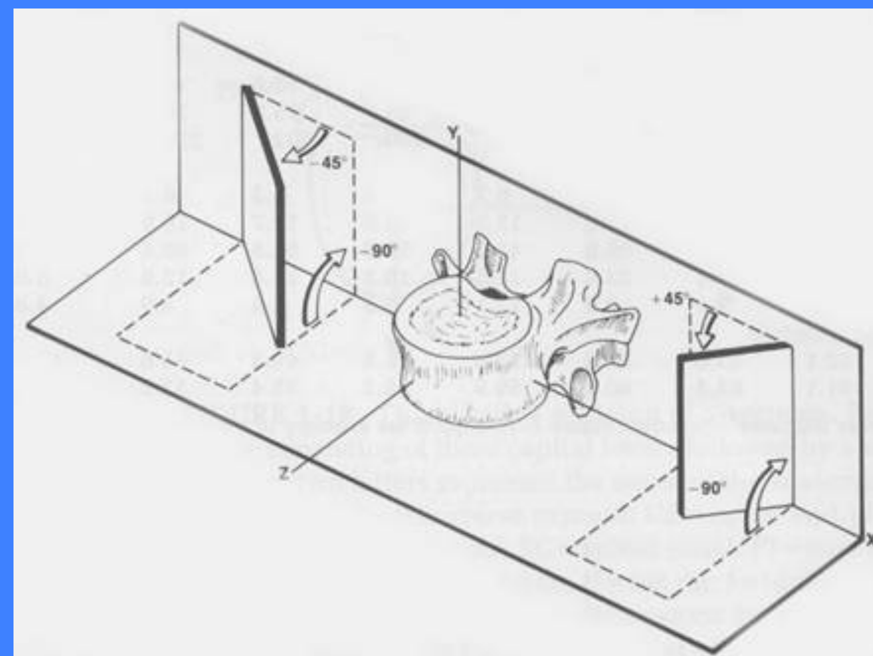


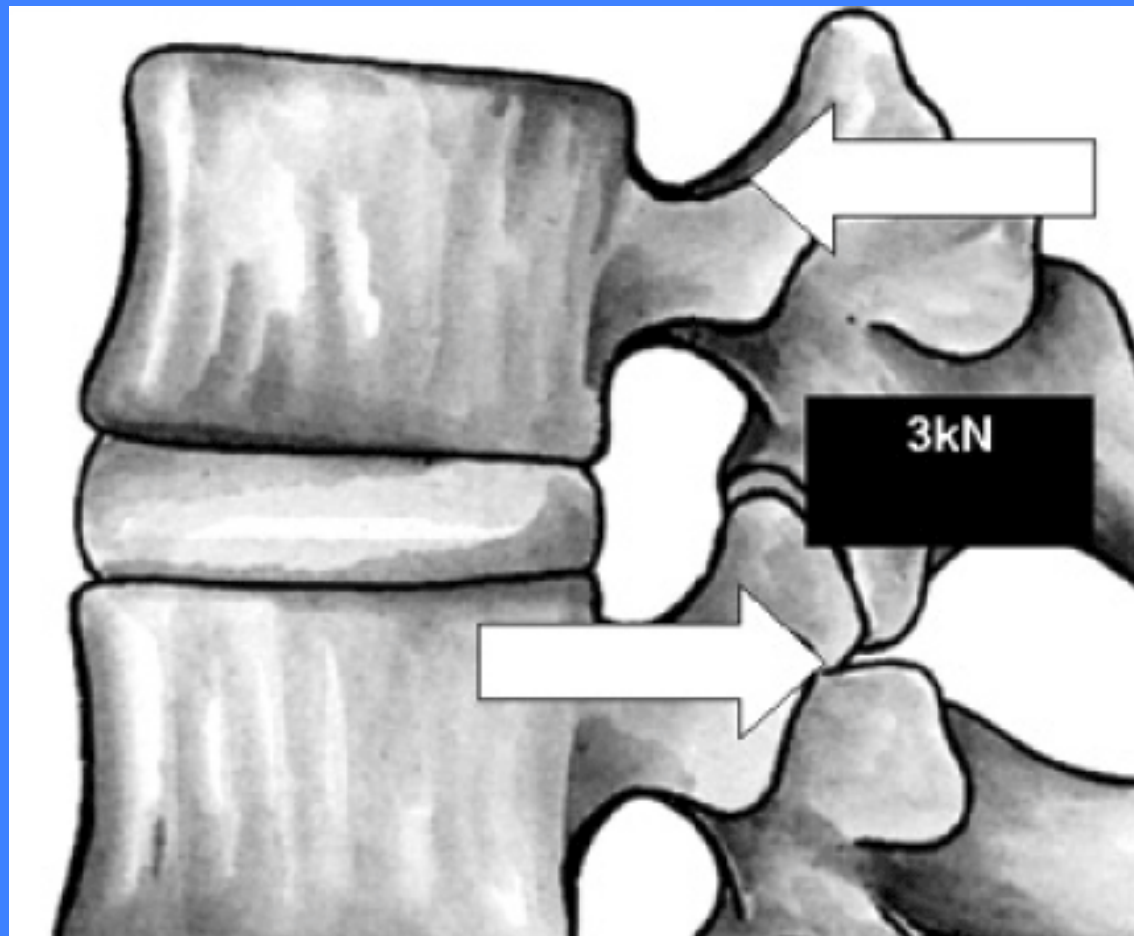
15-45% of all chronic LBP

- *Ray CD. Percutaneous Radiofrequency Facet Nerve Blocks: Treatment of the Mechanical Low Back Syndrome. Radionics Procedure Technique Series. Burlington, Mass: Radionics Inc; 1982.*
- *Schwarzer AC, Aprill CN, Derby R, Fortin J, Kine G, Bogduk N: Clinical features of patients with pain stemming from the lumbar zygapophysial joints. Is the lumbar facet syndrome a clinical entity? Spine 1994, 19:1132-1137.*
- *Manchikanti L, Singh V, Pampati V, Damron K, Barnhill R, Beyer C, Cash K: Evaluation of the relative contributions of various structures in chronic low back pain. Pain Physician 2001, 4:308-316.*
- *Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. Eur J Pain 2006;10:287–333*
- *van Kleef M, Vanelderen P, Cohen SP, Lataster A, Van Zundert J, Mekhail N. 12. Pain originating from the lumbar facet joints. Pain Pract 2010;10:459-69.*
- *Bogduk N: International Spinal Injection Society guidelines for the performance of spinal injection procedures. Part 1: Zygapophyseal joint blocks. Clin J Pain 1997, 13:285-302*

Lumbar Facet Orientation

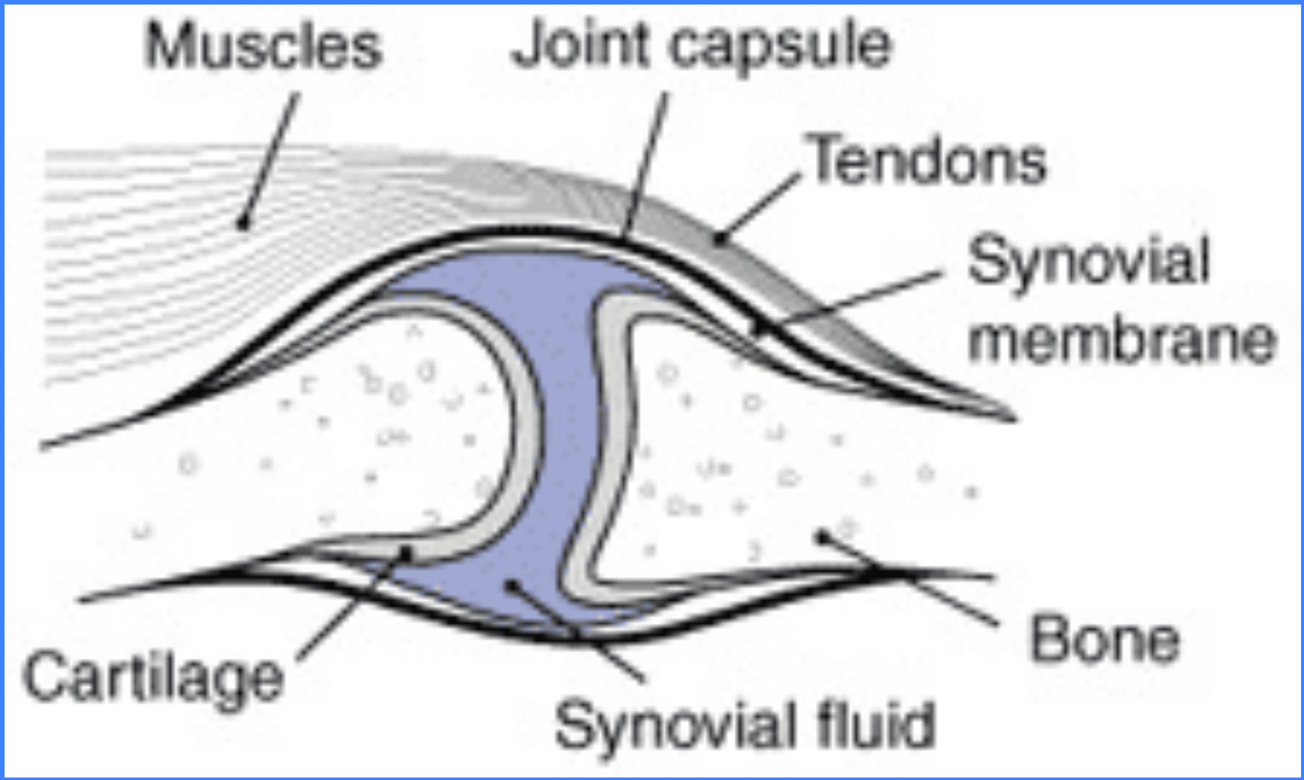




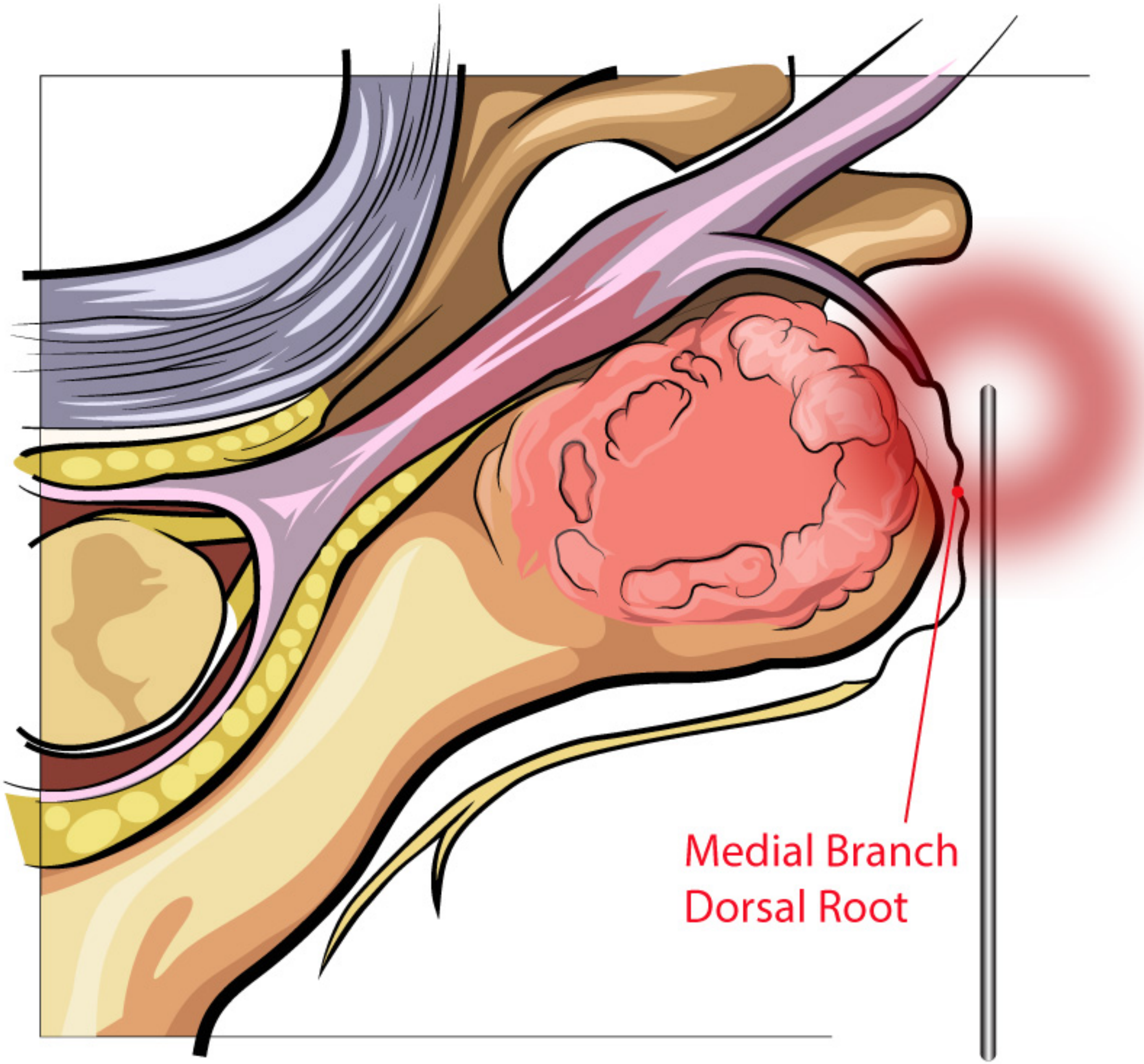


Lamy C, Bazergui A, Kraus H, Farfan HF: The strength of the neural arch and the etiology of spondylolysis. Orthop Clin North Am 6: 215-231, 1975

Centration

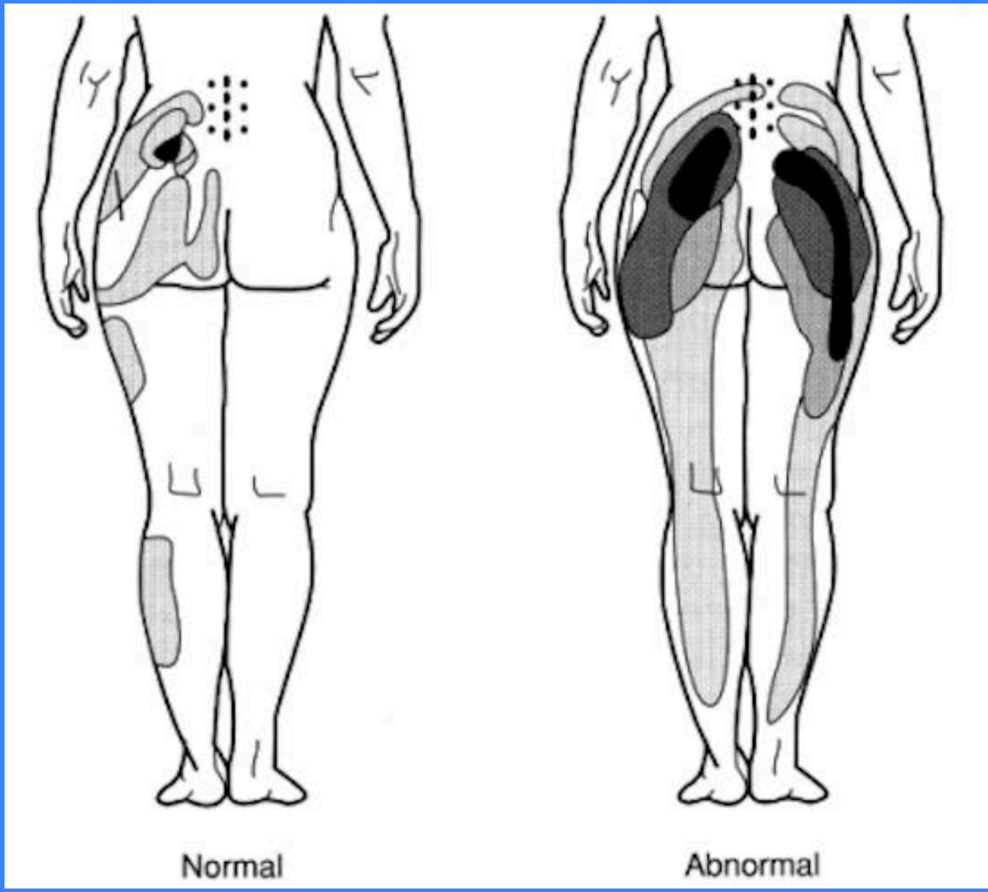


Muscles
Joint capsule
Tendons
Synovial membrane
Bone
Cartilage
Synovial fluid


Medial Branch
Dorsal Root

Facetogenic LBP Presentation

- Sub-acute unilateral LBP
  - Possible radiating symptoms into the buttock or thigh
  - Rarely distal to the knee



Facetogenic LBP Presentation

- Aggravated by:
  - Static loading of the spine, ie prolonged sitting or standing
  - Long lever activities, like vacuuming or working with the arms extended away from the body may aggravate the condition
  - End-range spinal loading such as hyperextension during overhead activity.
  - Prolonged flexion
- Alleviated by:
  - Unloading the spine in a recliner or lying down
  - Balanced light activity like walking
  - Constantly changing positions

~~7~~ 8 Factors Associated with the Diagnosis of Facet Joint Pain

- Older patient (over 65)
- Recurrent low back pain
- Not extending beyond the knee
- Maximally exacerbated with extension from a fully flexed position
- Normal gait
- Absence of muscle spasm
- Negative Valsalva
- Relief with recumbency

Facetogenic Clinical Findings

- Localized tenderness to palpation of the facet joint
- Muscle guarding (but not spasm)
- Pain with lumbar extension & lateral flexion

Lumbar Facet Syndrome

Evaluation

* Fritz Clinical Prediction Rule
* Kemps Test
* Segmental Rotation Test
* Spring Test
* Yeoman Test

Management

Soft Tissue

* STM- Iliolumbar Ligament
* STM- Lumbar Erectors
* STM- Quadratus Lumborum

Manipulation/Mobilization

* Manipulation-Lumbar and Sacral

Phase I exercises

* Hamstring Doorway Stretch
* Knee to Chest
* Dead Bug

Phase II exercises

* Sidebridge
* Bird Dog
* Glute Bridge w/ Band

Kemp's

- This test may be performed with the patient standing and/or seated, arms crossed on their chest. While standing behind the patient, the clinician stabilizes the lumbosacral area with one hand. The other forearm is placed across the patient's shoulders and passively moves the patient into extension, ipsilateral lateral flexion and ipsilateral rotation for 3 seconds. Axial compression may be applied to increase pressure. Local pain on the side being tested indicates facet irritation while radicular pain suggests nerve root involvement. AKA Lumbar Quadrant Test

Yeoman

- The patient lies prone, knee flexed to 90 degrees. The examiner applies P to A pressure to the ipsilateral SI joint and lifts the patient's thigh off of the table to extend the hip. This test stresses the sacroiliac joint, hip, femoral nerve and lumbar spine facets. The test may provoke symptoms related to stenosis.

Spring Test/ PA Shear

- With the patient lying in the prone position, gently palpate the facet joint (Spring) or Spinous (PA sgear). Using approximately 2 lbs of force, challenge the joint in a posterior to anterior direction. Each joint should be assessed individually for joint play, end feel and pain. Limited end feel or reproduction of pain is a positive test and suggests joint dysfunction at that level.

Segmental Rotation

- The clinician places one thumb on each side of two adjacent spinous processes (i.e. left thumb on the left L4 spinous and right thumb on the right of L5 spinous). The clinician stabilizes with one thumb, while applying a perpindicular force (against the spinous process) with the other, to stress the ipsilateral facet at that level. Reproduction of pain suggests facet or facet capsule involvement.

Motion Palpation

Fritz Clinical Prediction Rule

- Pain lasting less than 16 days
- No symptoms distal to the knee
- Low fear avoidance beliefs (FABQ score of less than 19)
- Hip internal rotation greater than 35 degrees
- Hypomobility of at least one lumbar segment

Fritz, J, Cleland, J, Childs, JD, "Subgrouping Patients With Low Back Pain: Evolution of a Classification Approach to Physical Therapy," Journal of Orthop Sports Physical Therapy 37, no. 6 (June 2007): 290-302

Imaging

Lumbar Facet Syndrome

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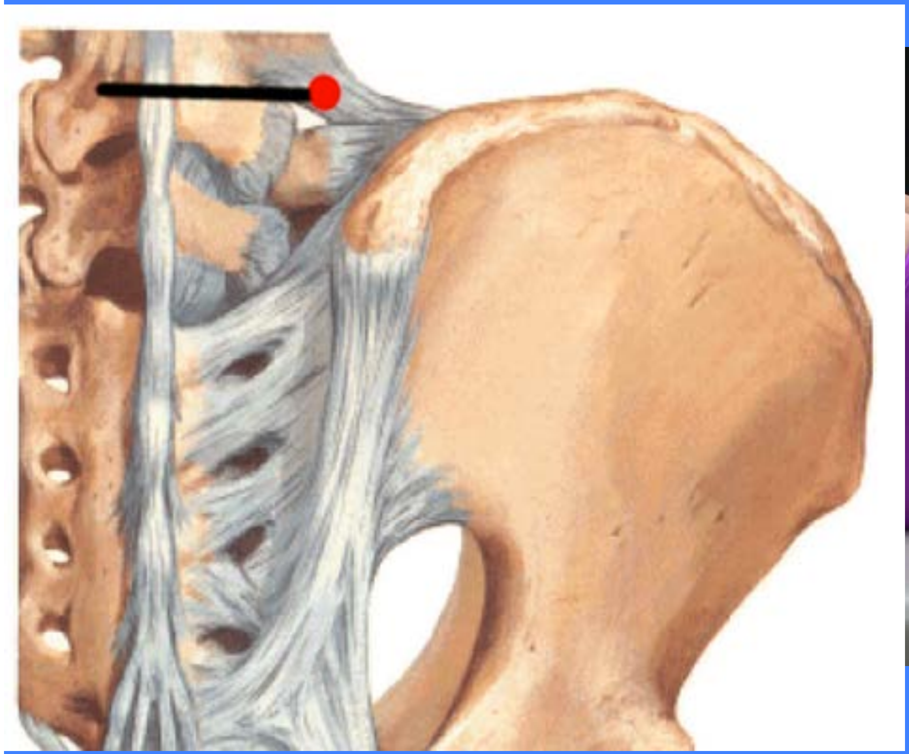
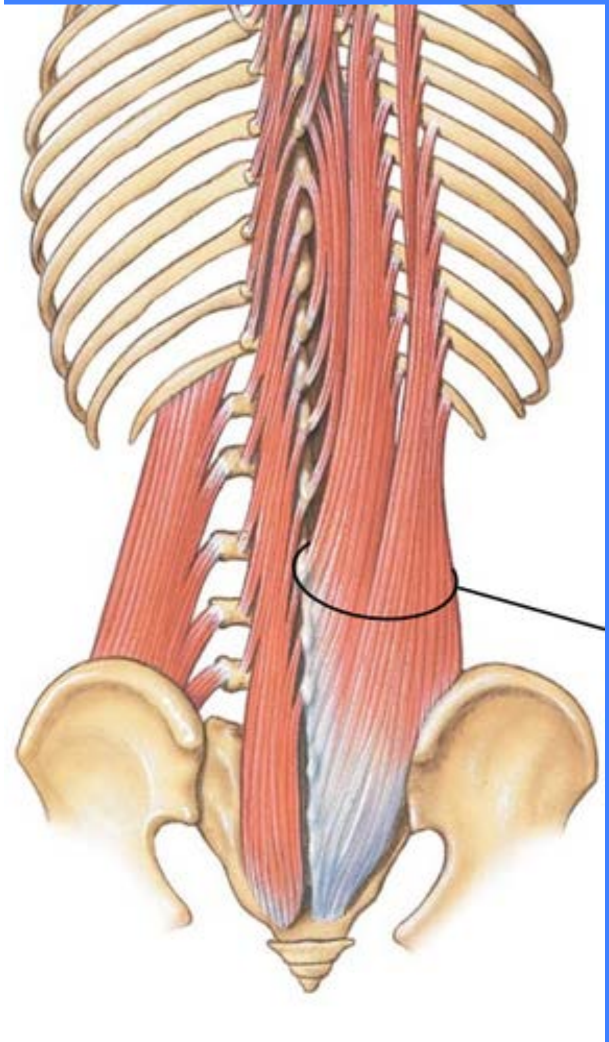
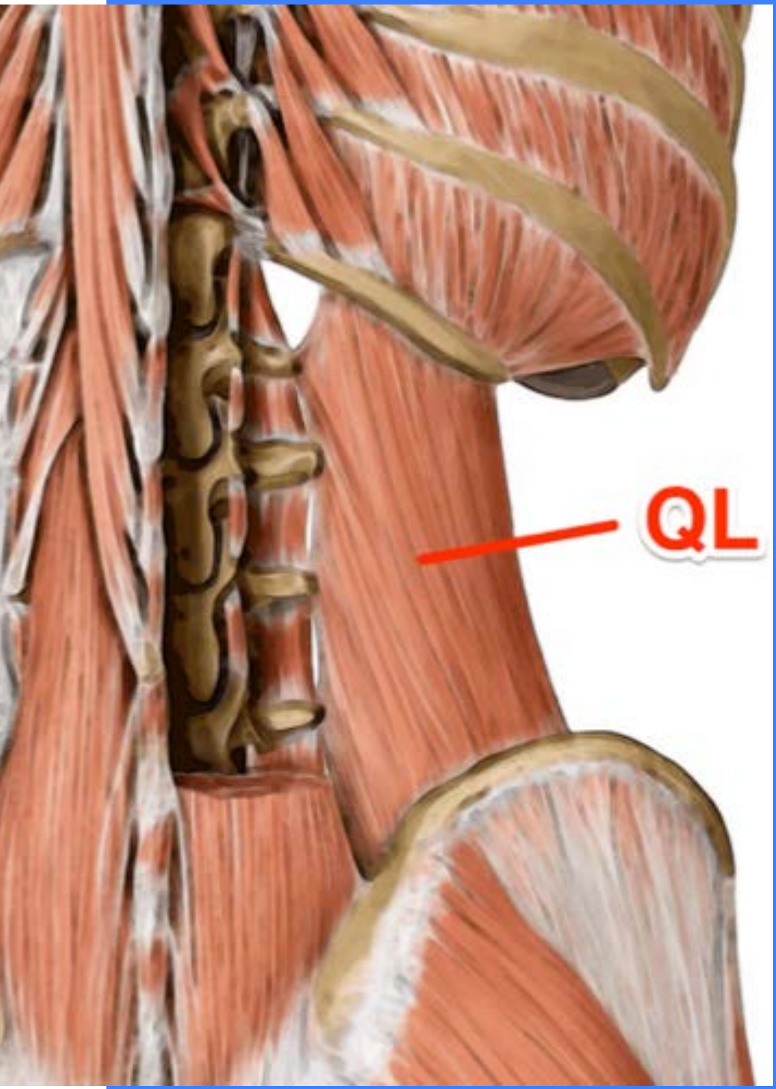
STM- Iliolumbar Ligament



STM- Lumbar Erectors



STM- Quadratus Lumborum



SMT

- Average of 5.2 visits to achieve dramatic clinical improvement.
- 95% of these patients rated their care as "excellent"

Paskowski I, Schneider M, Stevans J, Ventura JM, Justice BD, A Hospital-based Standardized Spine Care Pathway: Report Of A Multidisciplinary, Evidence-based Process. J Manipulative Physiol Ther 2011;34:98-106.

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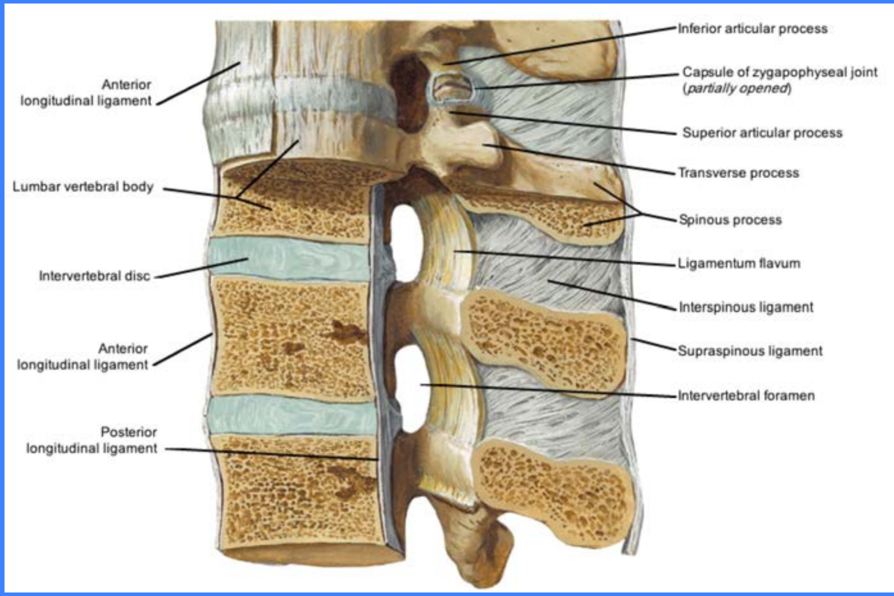
Ancillary Considerations

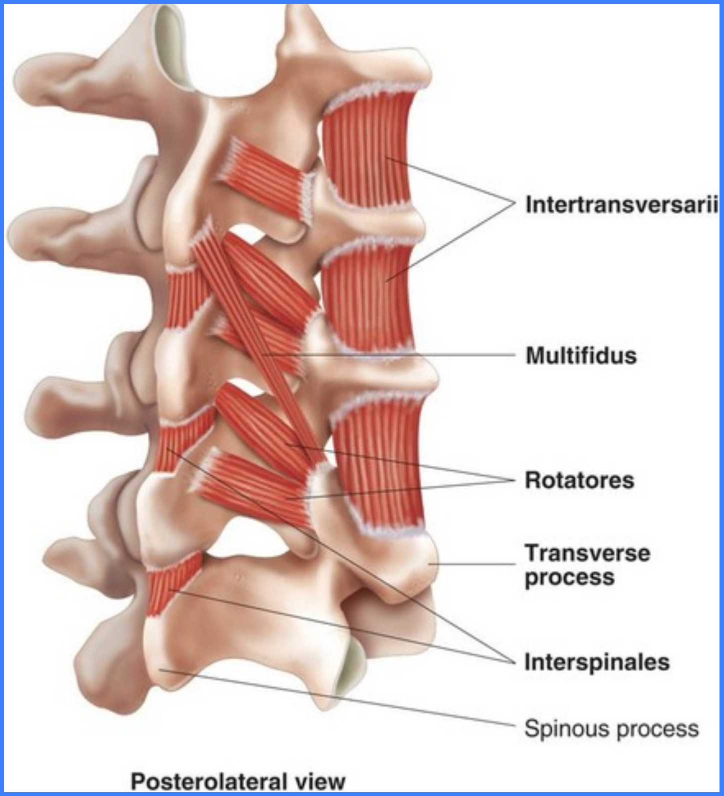
- Lifestyle modifications-**removal of the activity that induces pain**, including avoiding predictable exacerbating activities for lumbar, lumbosacral, and hip trigger points.
- Minimization of prolonged sitting and sedentary hobbies.
- Patients should be counseled on **lifting mechanics, work activities, sleep positions and shoe wear**.
- Yoga has been shown to be an effective treatment for simple mechanical low back pain

Lumbar Sprain/ Strain

“Static” Stabilizers



“Dynamic” Stabilizers



Lumbar Ligament Loads

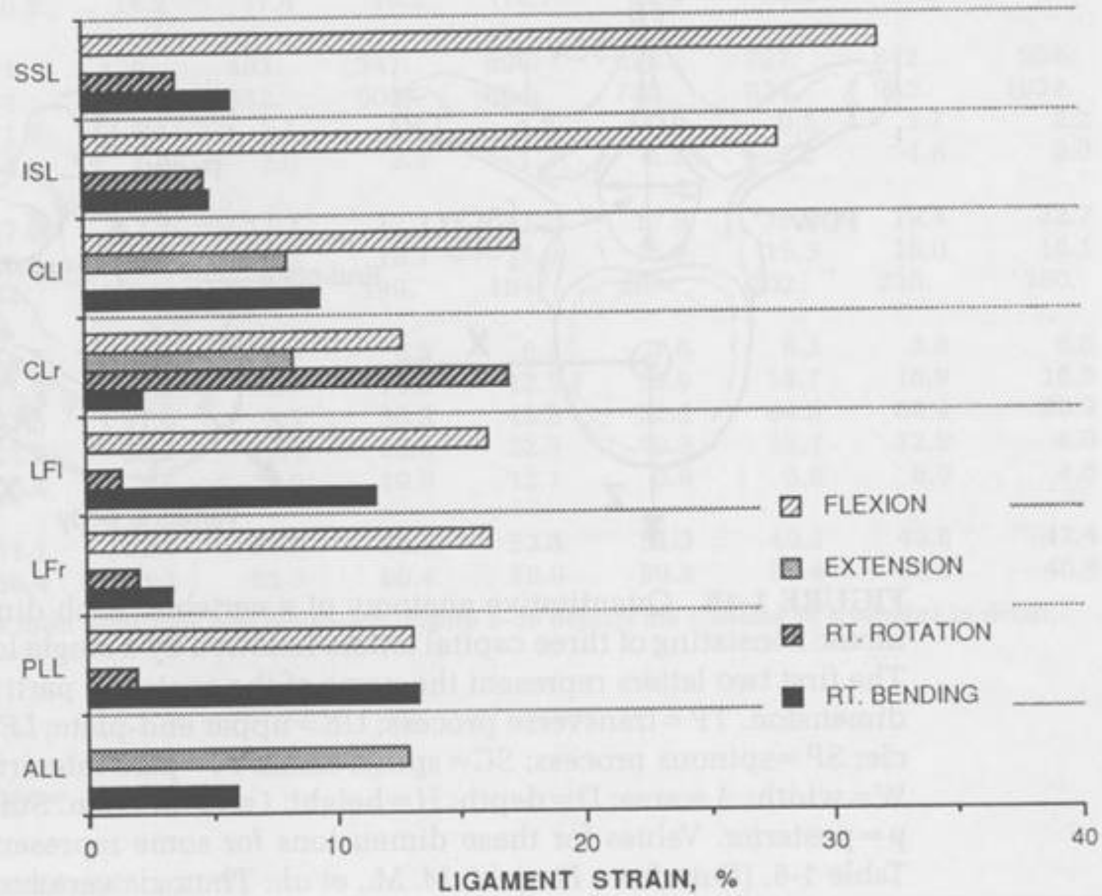


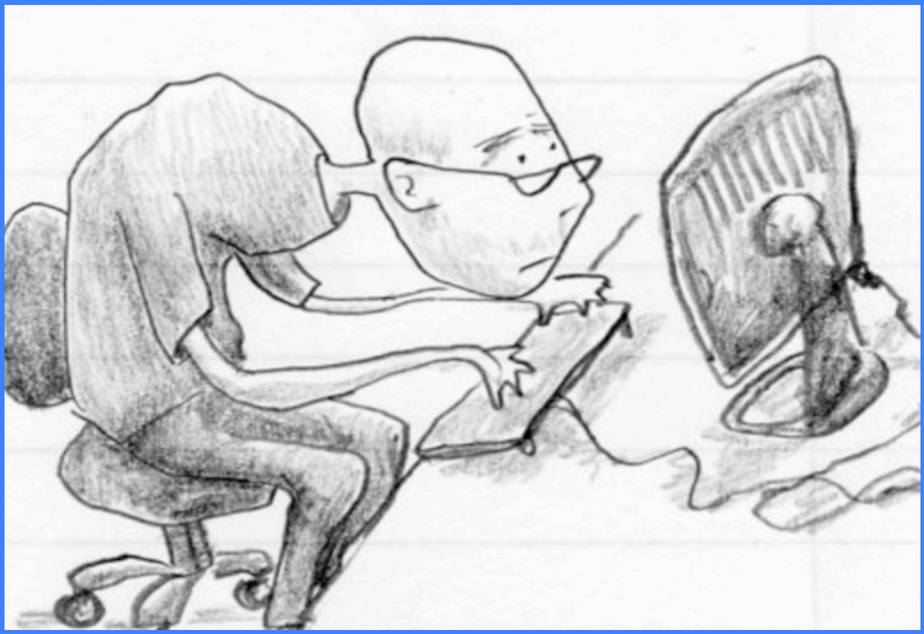
FIGURE 1-17 Physiological strains in lumbar spinal ligaments are shown as functions of the four spinal motions. The ligament strain is defined as the percentage change in its length. *SSL* = supraspinous ligament; *ISL* = interspinous ligament; *CL* = capsular ligament; *LF* = ligamentum flavum; *PLL* = posterior longitudinal ligament; *ALL* = anterior longitudinal ligament. Suffixes *l* and r are respectively left and right. Note that the supraspinous ligament is strained most in flexion, the right capsular ligament in right axial rotation, and the left ligament flavum in flexion right lateral bending. *(Data from Panjabi, M. M., Goel, V., and Takata, K.: Physiological strains in lumbar spinal ligaments. Spine, 7:192, 1982.)*

Cumulative Sprain/ Strain Etiology

- Poor workstations
- Repetitive movements
- Improper lifting
- Sedentary lifestyles
- Poor conditioning
- Pregnancy
- Obesity
- Prolonged static postures

Static Postures

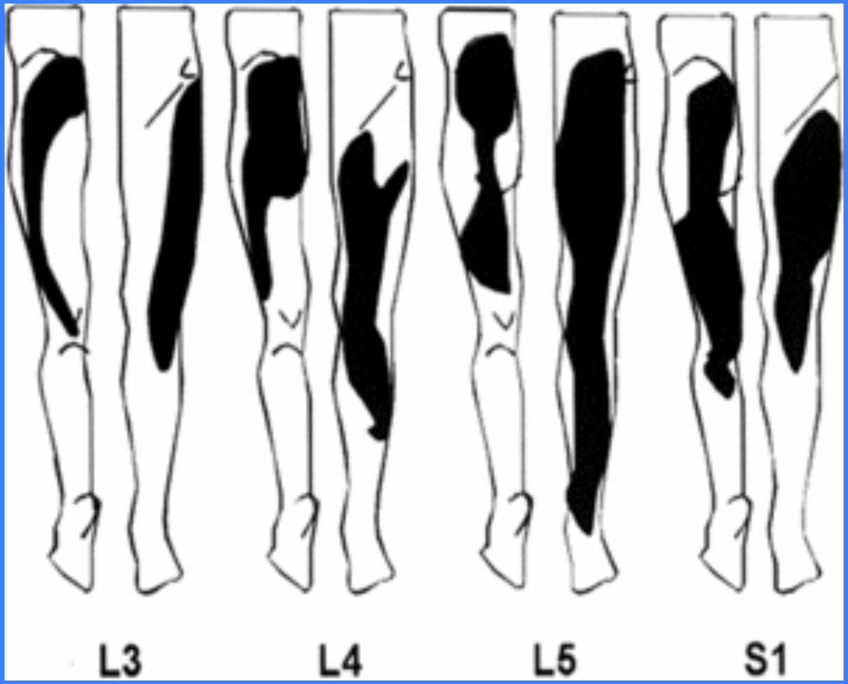
- 3 Minutes of Flexion= 30 minutes of Ligamentous Laxity
- Discs are 300% more susceptible to flexion strains in the AM



•*Bogduk N, Twomney LT (1991) Clinical anatomy of the lumbar spine, 2nd edn. Churchill Livingstone, Mellbourne*
•*Adams MA, Dolan P, Hutton WC (1987) Diurnal variations in the stresses on the lumbar spine. Spine 12: 130-137*

Sprain/Strain Presentation

- Poorly localized, constant, dull lower back pain
- Intensifies or becomes sharp with movement
- Increased symptoms when flexing, bending, twisting, or lifting
- Rest may relieve acute symptoms but often leads to inactivity-stiffness



Sprain/Strain Clinical Findings

- Limited or painful ROM
- Spinous process tenderness
- Paraspinal hypertonicity or spasm
- Motion palpation- restriction or hypermobility

Lumbar Sprain/ Strain

Evaluation

* Fritz Clinical Prediction Rule
* Lumbar Directional Preference Testing
* Modified Slump Test
* PA Shear

Management

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Modified Slump Test

- The modified slump test combines most provocative neural tension maneuvers into a single test by performing a seated bilateral SLR with ankle dorsiflexion, trunk & neck flexion with practitioner overpressure and a Valsalva maneuver. Reproduction of lower extremity complaints suggests radiculopathy or dural tension.

Spring Test/ PA Shear

Motion Palpation

Imaging

Lumbar Sprain/ Strain

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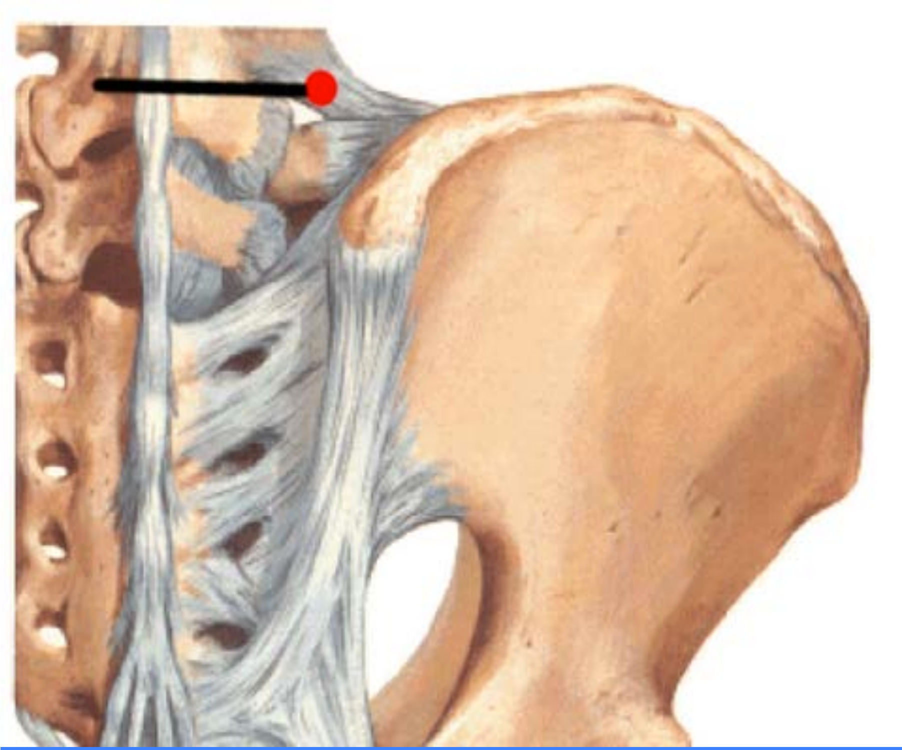
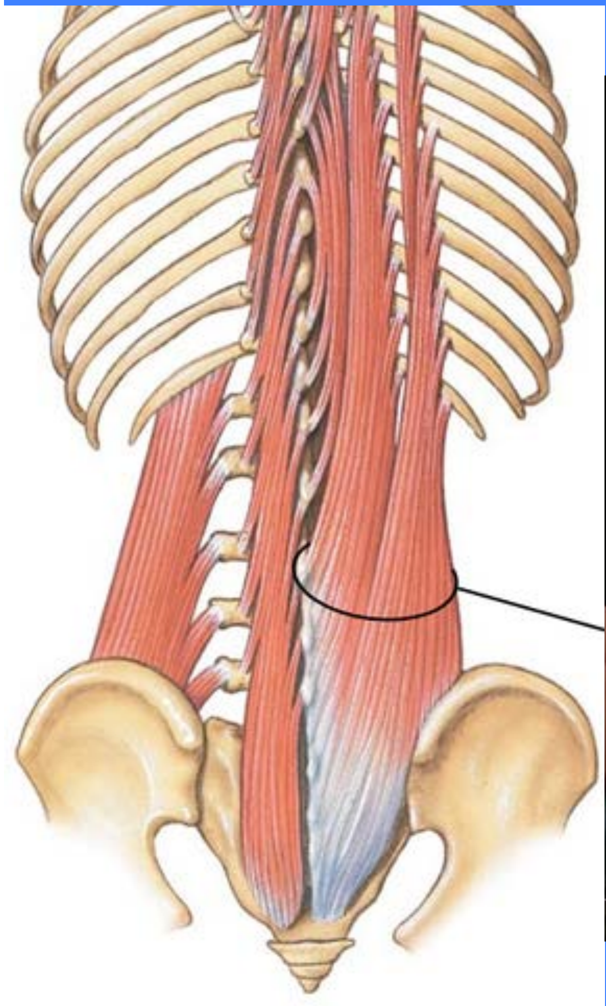


STM- Lumbar Erectors



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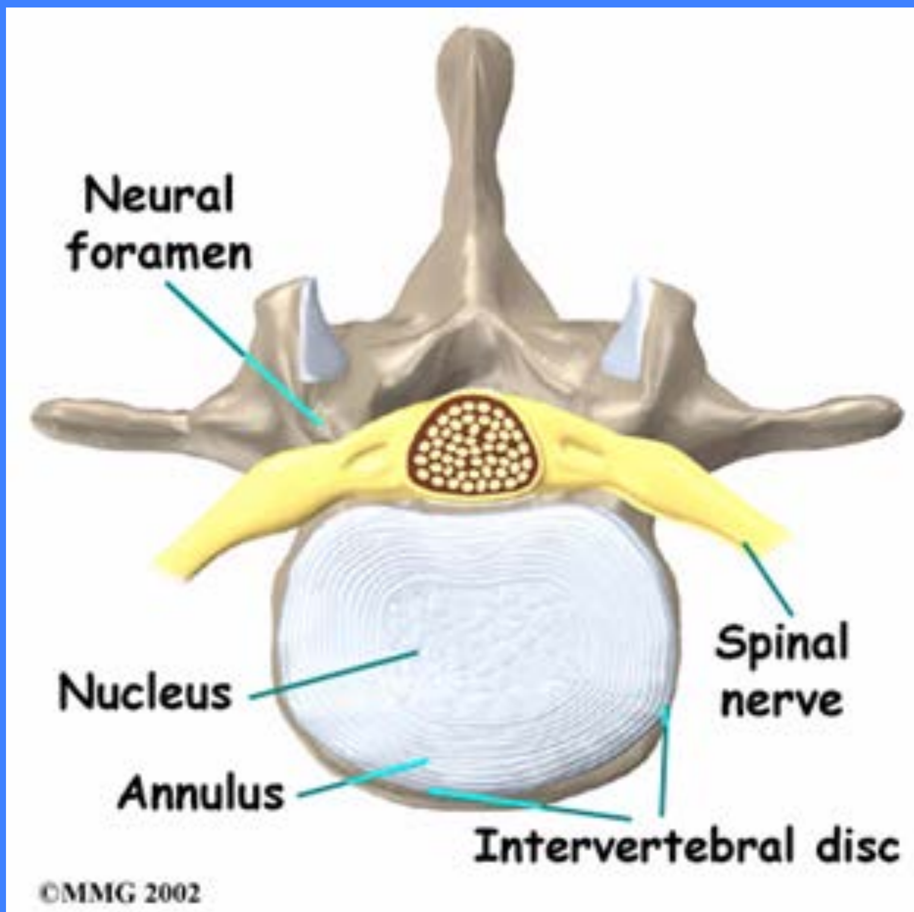
Lumbar Disc Lesion

The Disc



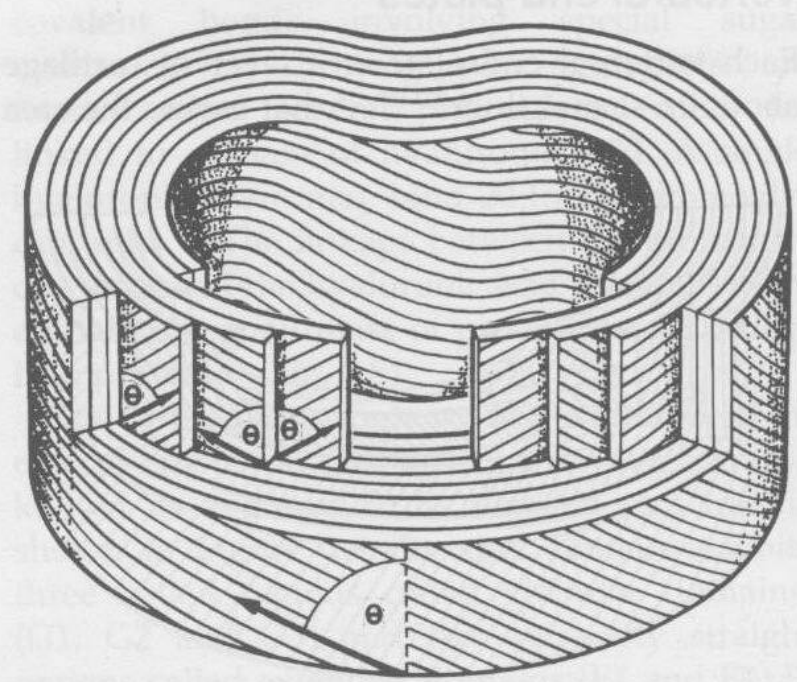
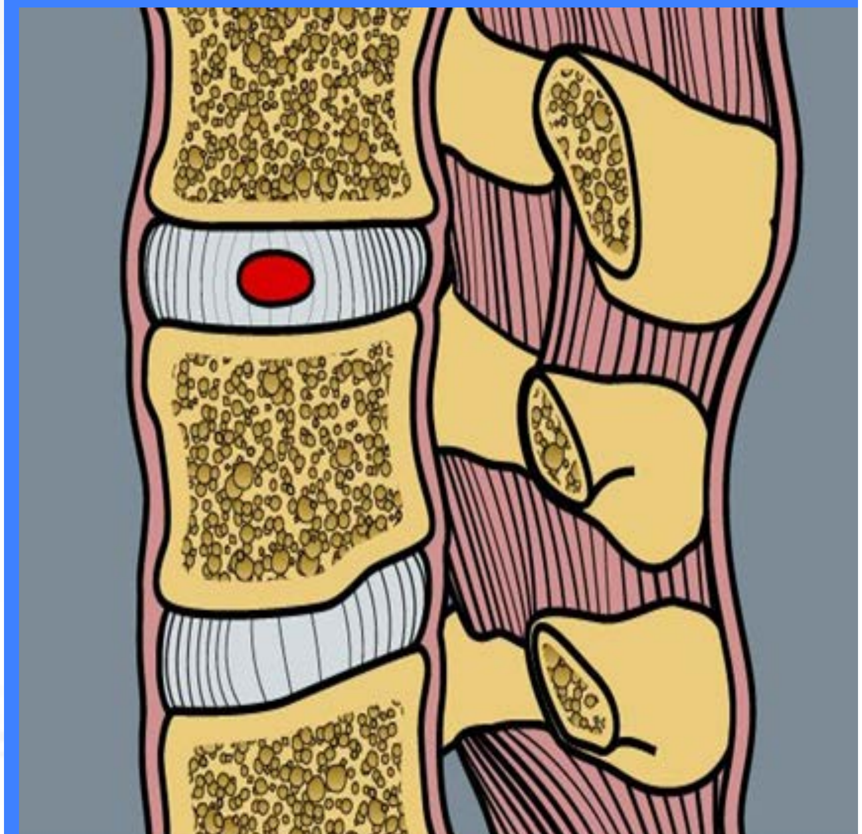


Figure 2.3 The detailed structure of the anulus fibrosus. Collagen fibres are arranged in 10–20 concentric, circumferential lamellae. The orientation of fibres alternates in successive lamellae, but their orientation with respect to the vertical (θ) is always the same, and measures about 65°.

Disc Nutrition

- IVD is the <u>largest avascular structure</u>
- The cartilage end-plate begins to calcify with age

Nucleus Pulposus



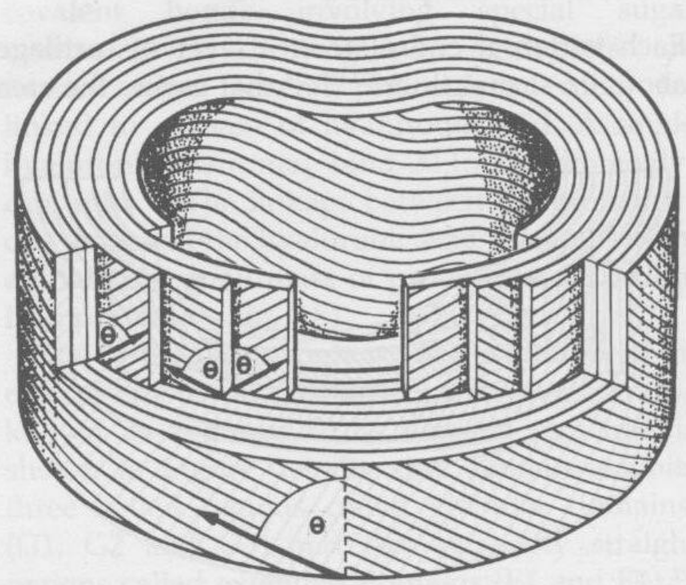
Interactive Spine - Chiropractic edition © 2001 Primal Pictures Ltd

Nucleus Diurnal Changes

- Loss in sitting height 19mm in one day
- 54% of loss in first 30 minutes in the morning
- Increase in lumbar flexion 5-6 degrees during day

Annulus Fibrosus

- 20-30 concentric laminated bands
- Oriented at 30˚ to the disc plane and therefore at 120˚ to each other in the adjacent bands.



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Cartilage End-Plates

- Shock Absorption
- Transfer of Energy
- Transfer of Nutrients

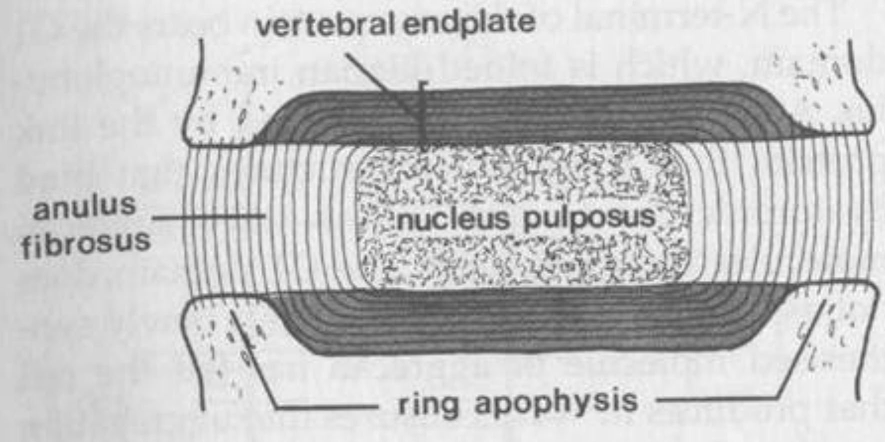


Figure 2.5 Detailed structure of the vertebral end-plate. The collagen fibres of the inner two-thirds of the anulus fibrosus sweep around into the vertebral end-plate, forming its fibrocartilaginous component. The peripheral fibres of the anulus are anchored into the bone of the ring apophysis.

Compression to the Disc

Typically the first structure to fail due to compression is the end-plate, such failure is generally associated with an audible "pop".

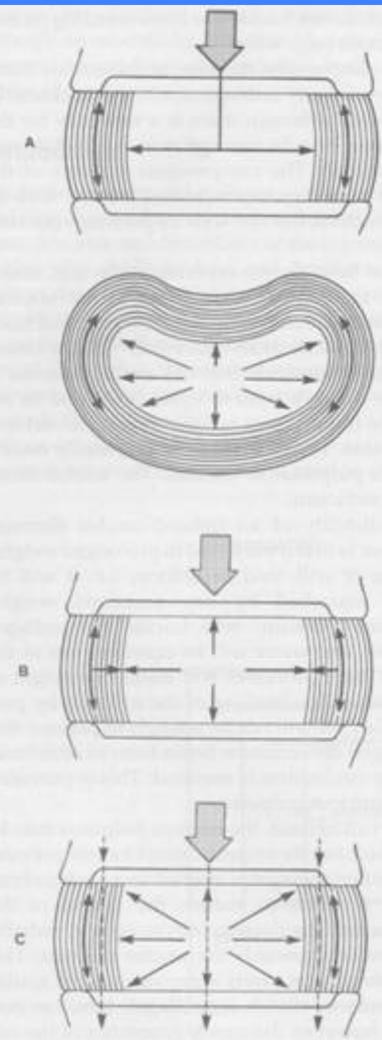


Figure 2.13 The mechanism of weight transmission in an intervertebral disc. A: Compression raises the pressure in the nucleus pulposus. This is exerted radially onto the anulus fibrosus and the tension in the anulus rises. B: The tension in the anulus is exerted on the nucleus preventing it from expanding radially. Nuclear pressure is then exerted on the vertebral end-plates. C: Weight is borne, in part, by the anulus fibrosus and by the nucleus pulposus. The radial pressure in the nucleus braces the anulus, and the pressure on the end-plates transmits the load from one vertebra to the next.

Endplate Fracture

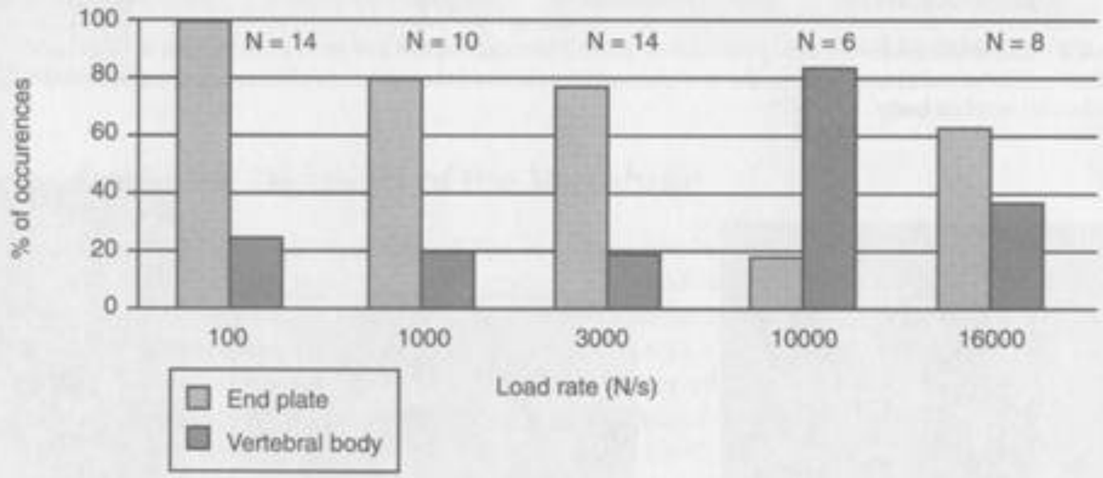


Figure 4.6 Compression injuries at different load rates. At low rates of compressive load the end plate appears to be the first structure to fail, but bone will fracture first under higher rates of load.

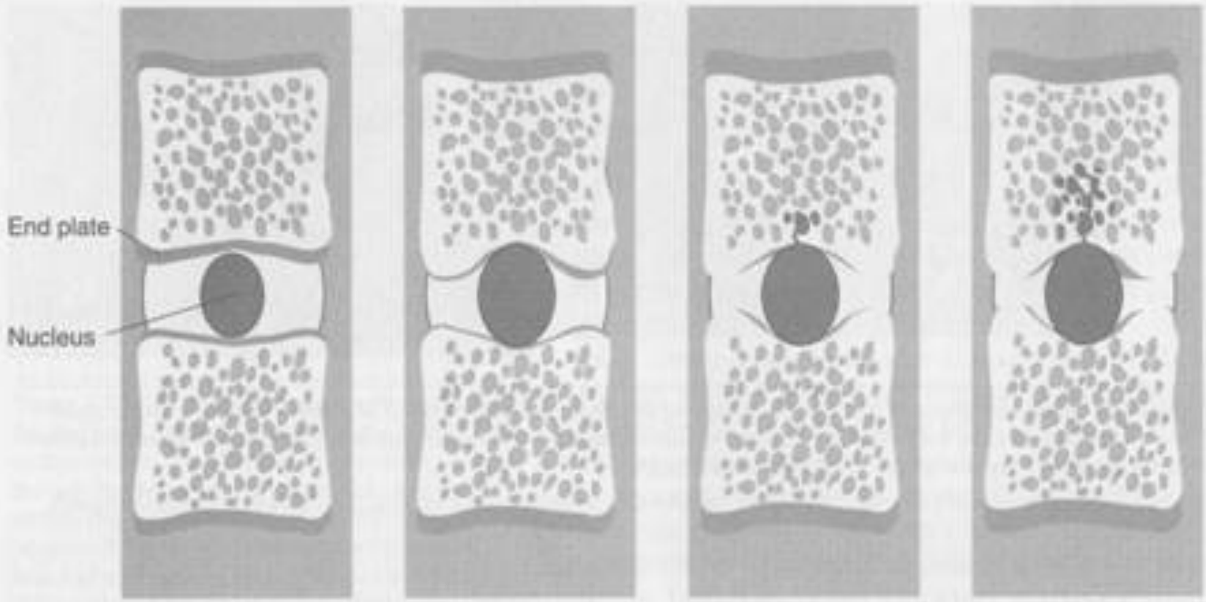
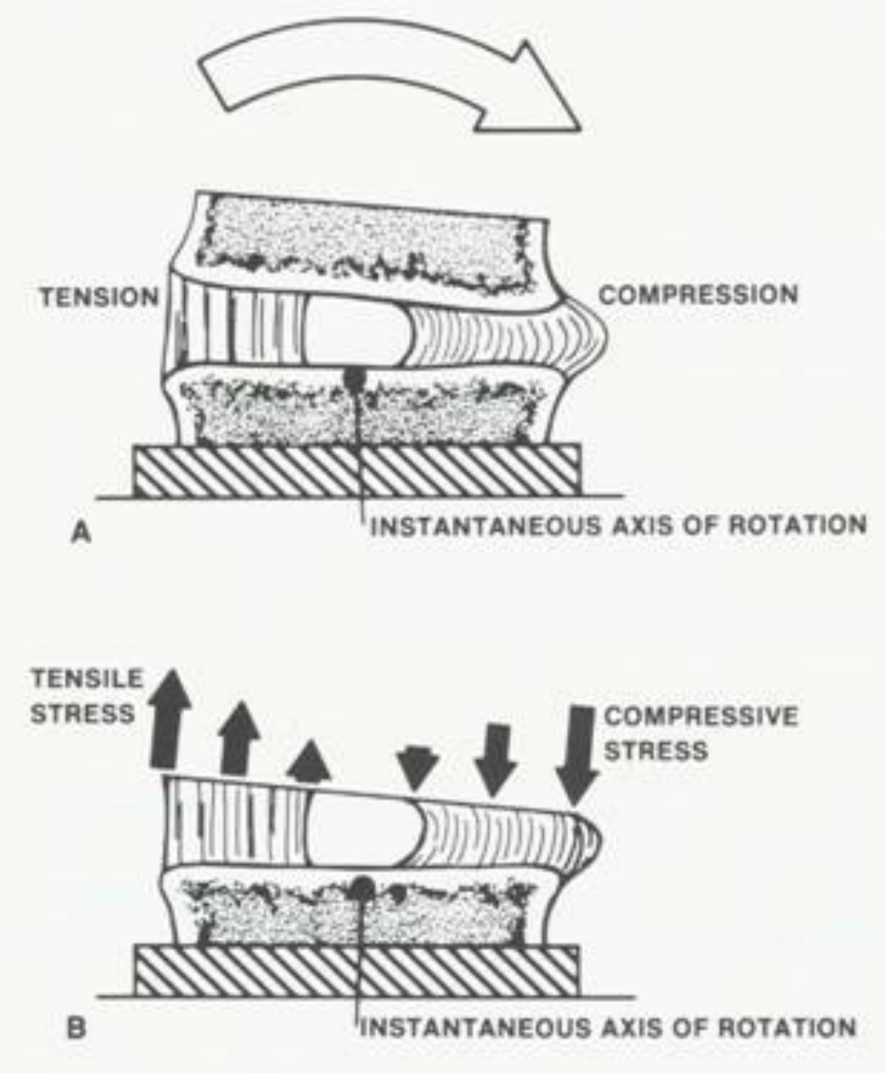
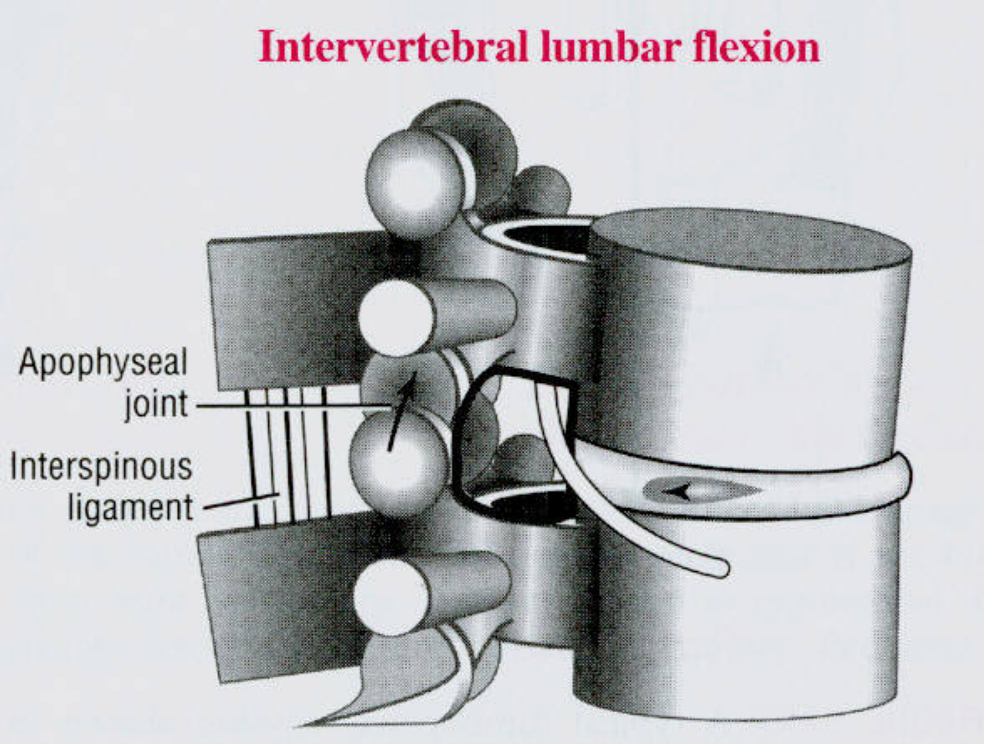


Figure 4.8 Under compressive loading the nucleus pressurizes, causing the end plate to bulge into the vertebral body. With excessive radial-tensile stress the end plate will fracture and the viscous nucleus will squirt through the crack into the vertebral body.

Bending Load to the Disc





Disc Herniation via Rotation?

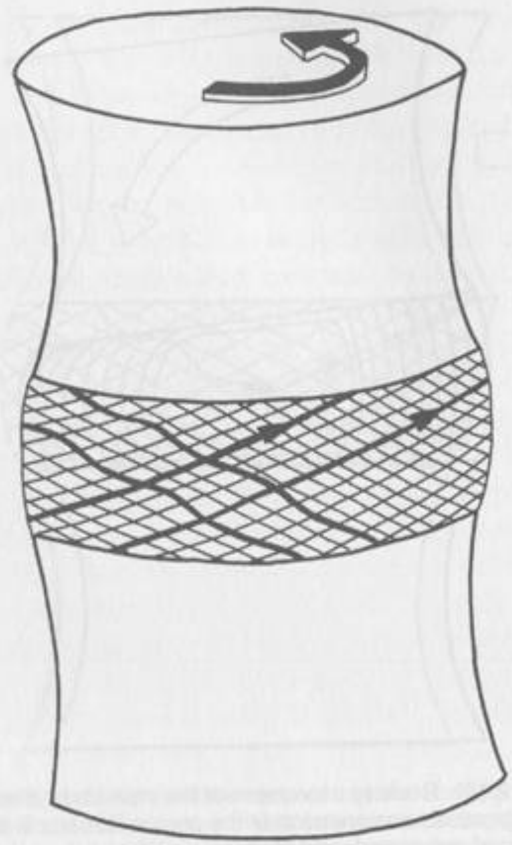
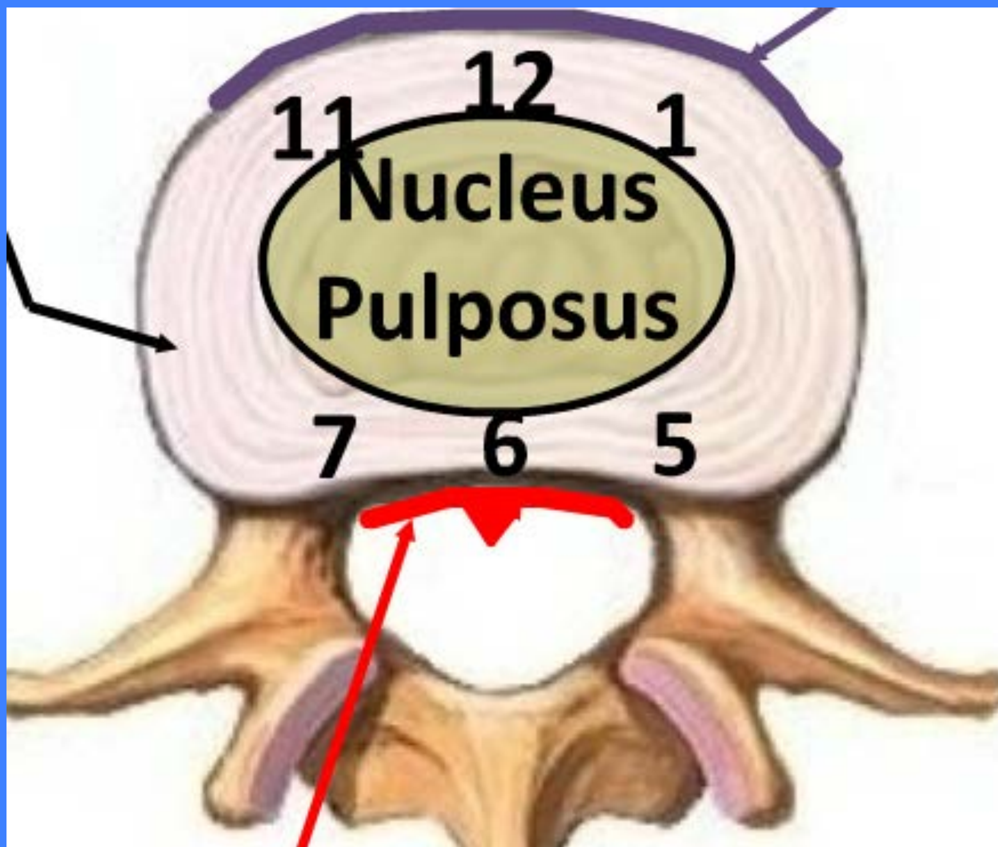


Figure 2.18 Twisting movements of the inter-body joint. Those fibres of the anulus that are orientated in the direction of the twist have their points of attachment separated, and are therefore stretched. Fibres in every second lamella of the anulus have their points of attachment approximated and these fibres are relaxed.

Lumbar Disc Anatomy



- Posterolateral Vulnerability
- >90% at L4/5 or L5/S1

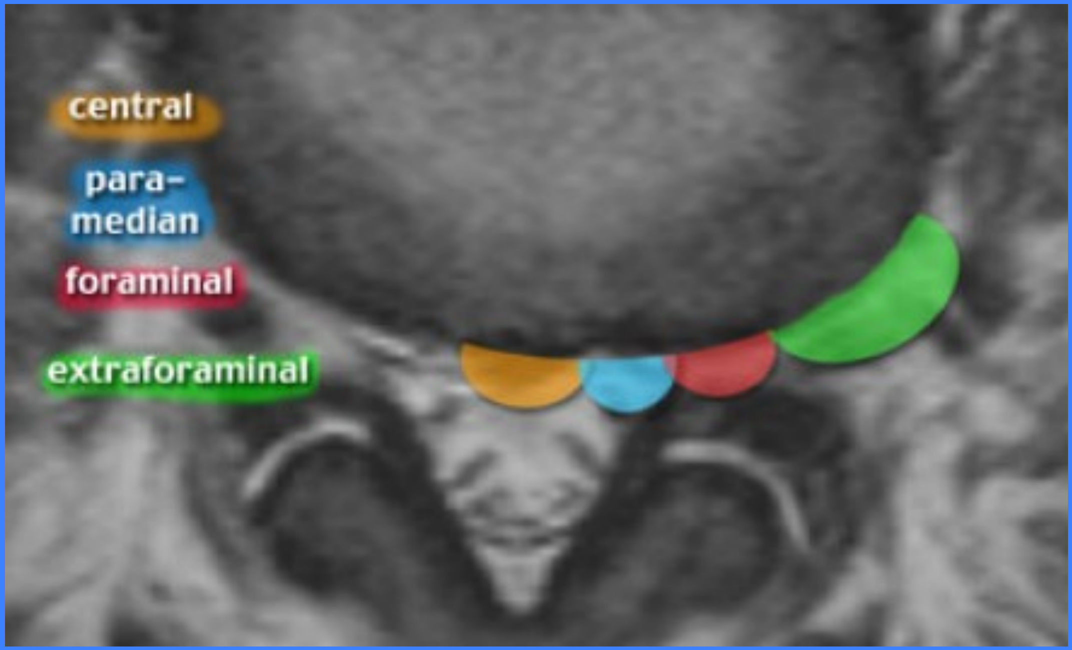
Intercrestal Line

- High IC line= L4/5
- Low IC line = L5/S1

• *Dang L Chen Z, Liu X, et al. Lumbar Disk Herniation in Children and Adolescents: The Significance of Configurations of the Lumbar Spine. Neurosurgery. 2015 Dec;77(6):954-9; discussion 959.*

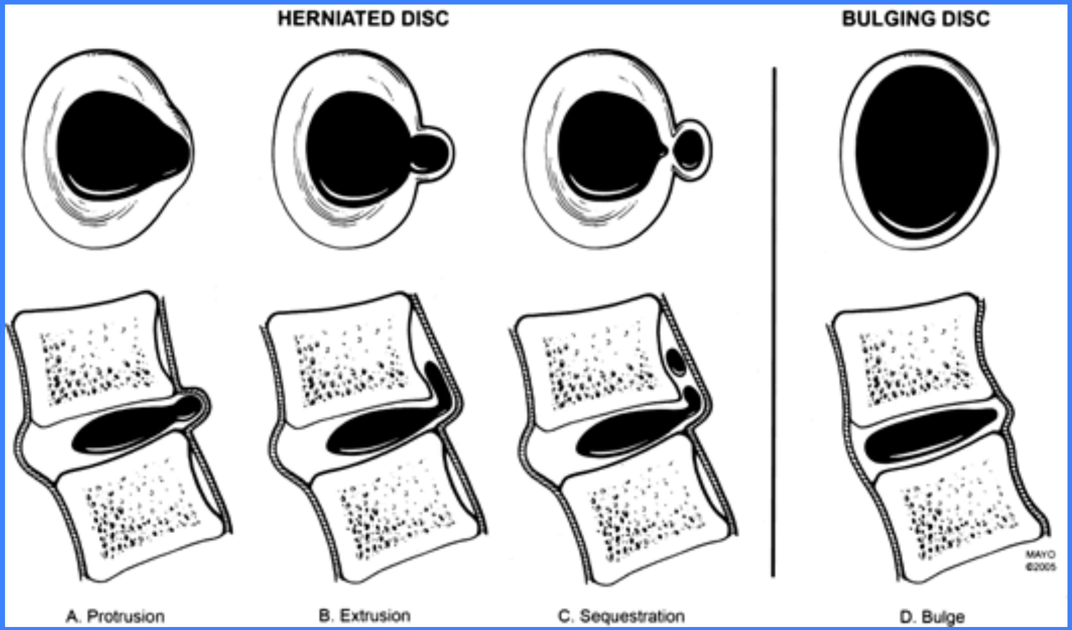
Classification of Disc Lesion Location

- ❑ Central
- ❑ Paracentral
- ❑ Foraminal



Classification of Disc Herniation

- ❑Protrusion
- ❑Extrusion
- ❑Sequestration



Classification of Disc Lesion Peripheral Involvement

- ❑Focal (<25%)
- ❑Broad Based (25-50%)
- ❑Circumferential (>50%)

Disc Lesion Predisposing Factors

- Sedentary lifestyle or occupation
- Driving motorized vehicles
- Vibration
- Smoking
- Previous full-term pregnancy
- Increased BMI
- Tall stature
- Genetic factors
- Age

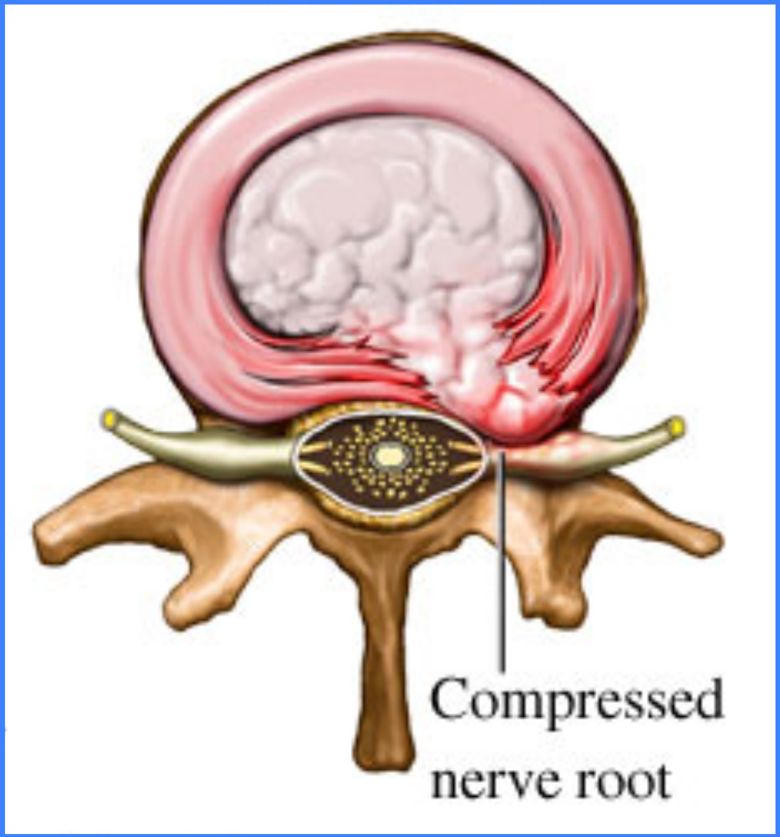
Disc Lesion Presentation

Local

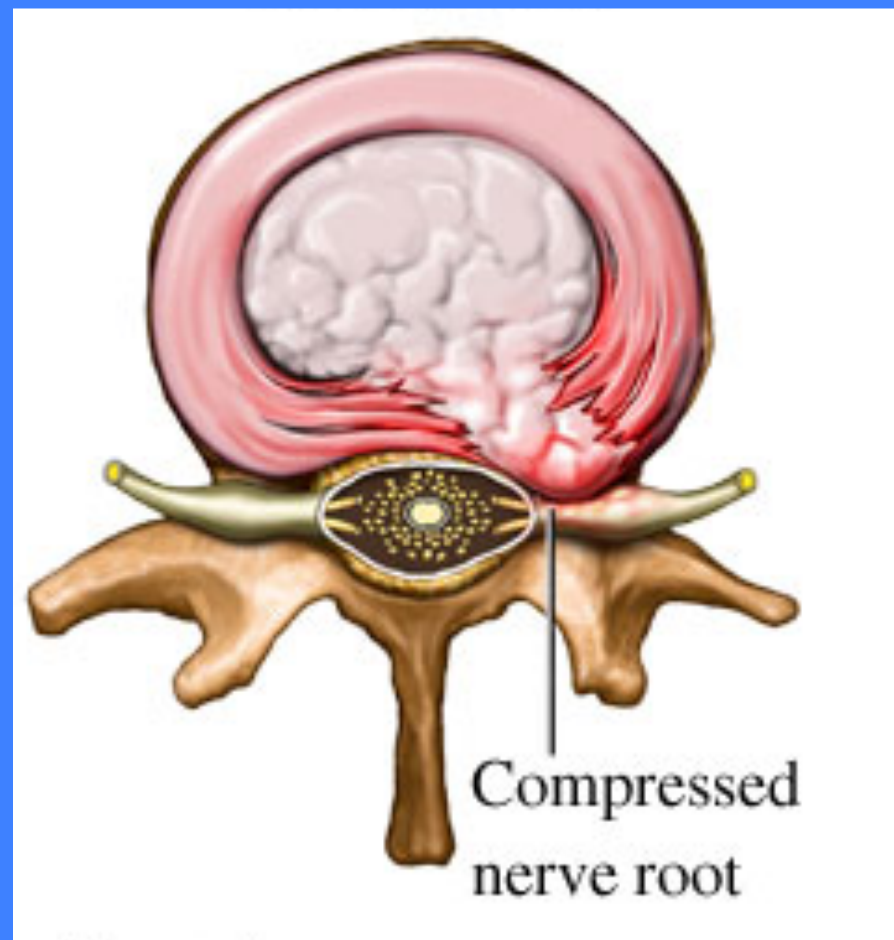
- Pain, or sensory disturbances that radiate into the buttock or thigh

Radicular

- Sharp pain, or sensory disturbances that radiate toward the foot
- Motor deficits
- Diminished reflexes

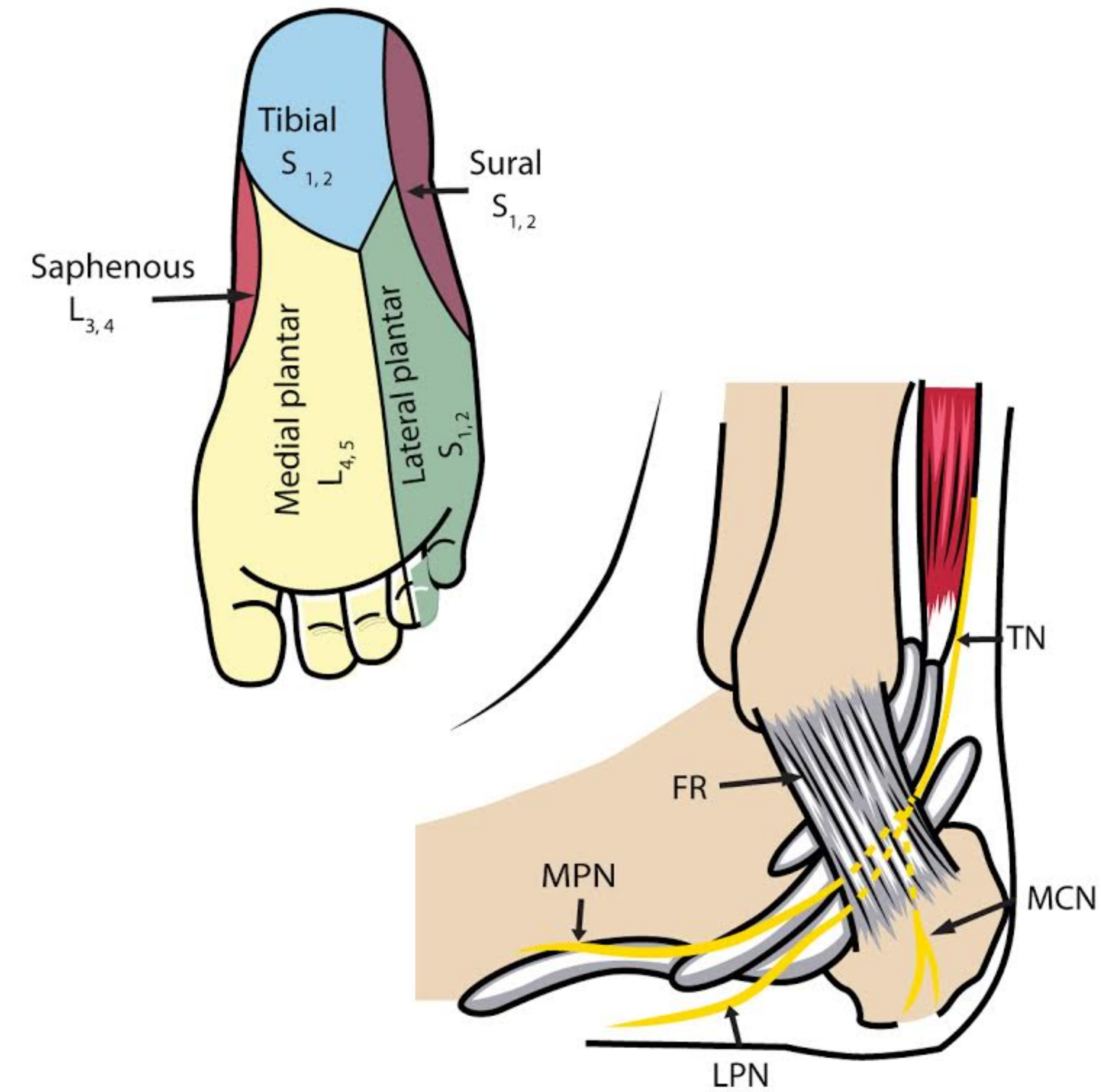


Lumbar Disc Radiculopathy



5% of lumbar radiculopathy patients have co-existant Tarsal Tunnel Syndrome

Zheng C, et al. The prevalence of tarsal tunnel syndrome in patients with lumbosacral radiculopathy. Eur Spine J. 2016 Mar;25 (3):895-905.



Lumbar Disc Lesion

Evaluation

* Braggard Test
* Lower Extremity Neurologic Evaluation
* Lumbar Directional Preference
* Milgrams Test
* Modified Slump Test
* Straight Leg Raise
* Valsalva Maneuver
* Well Leg Raise

Management

Modalities

* Lumbar Traction

Soft Tissue

* Nerve Floss- Sciatic
* STM- Lumbar Erectors

Manipulation/Mobilization

* Directional Preference Therapy- Lumbar
* Manipulation-Lumbar and Sacral

Phase I exercises

* Cat/Camel

Phase II exercises

* Sciatic Floss Supine
* Sidebridge
* Bird Dog
* Dead Bug

Straight Leg Raise (SLR)

- The clinician progressively lifts the supine patients straightened leg until symptoms are reported. Reproduction of radicular symptoms in the 30-70 degree range, suggests involvement of the L4/5 or L5/S1 nerve roots from radiculopathy or dural irritation. Also called Lasegue's Test.

Well Leg Raise

- This test is a standard straight leg raise that reproduces symptoms in the opposite lower extremity. A positive test is strongly suggestive of radiculopathy from disc lesion. Also called Crossed Straight Leg Raise.

Braggard

- This test is performed as an adjunct following a positive Straight Leg Raise (SLR). Lower the patients leg 10 degrees below the point of SLR symptom reproduction and dorsiflex the patients ankle. Reproduction of similar symptoms is a positive test indicating radiculopathy or dural tension.

Femoral Nerve Stretch Test

- The Femoral Nerve Stretch Test is performed on a prone patient by passively extending the hip while flexing the knee. Reproduction of anterior thigh radicular complaints suggests involvement of the L2/3 or L3/4 nerve roots. This test may also elicit symptoms related to stenosis, SI and lumbar facet irritation. a.k.a. Yeoman Test

Bechterews

- This test is a passive seated straight leg raise. The patient sits on the edge of a table while the clinician passively extends the knee. Reproduction of symptoms after 45 degrees of knee extension is indicative of neural irritation. Very similar maneuver to Kernig test and Flip test.

Milgrams

- The supine patient elevates both straightened legs off of the table 6 inches and holds this position for 30 seconds or until symptoms are reproduced. This maneuver increases intrathecal pressure and reproduction of pain suggests space occupying lesion

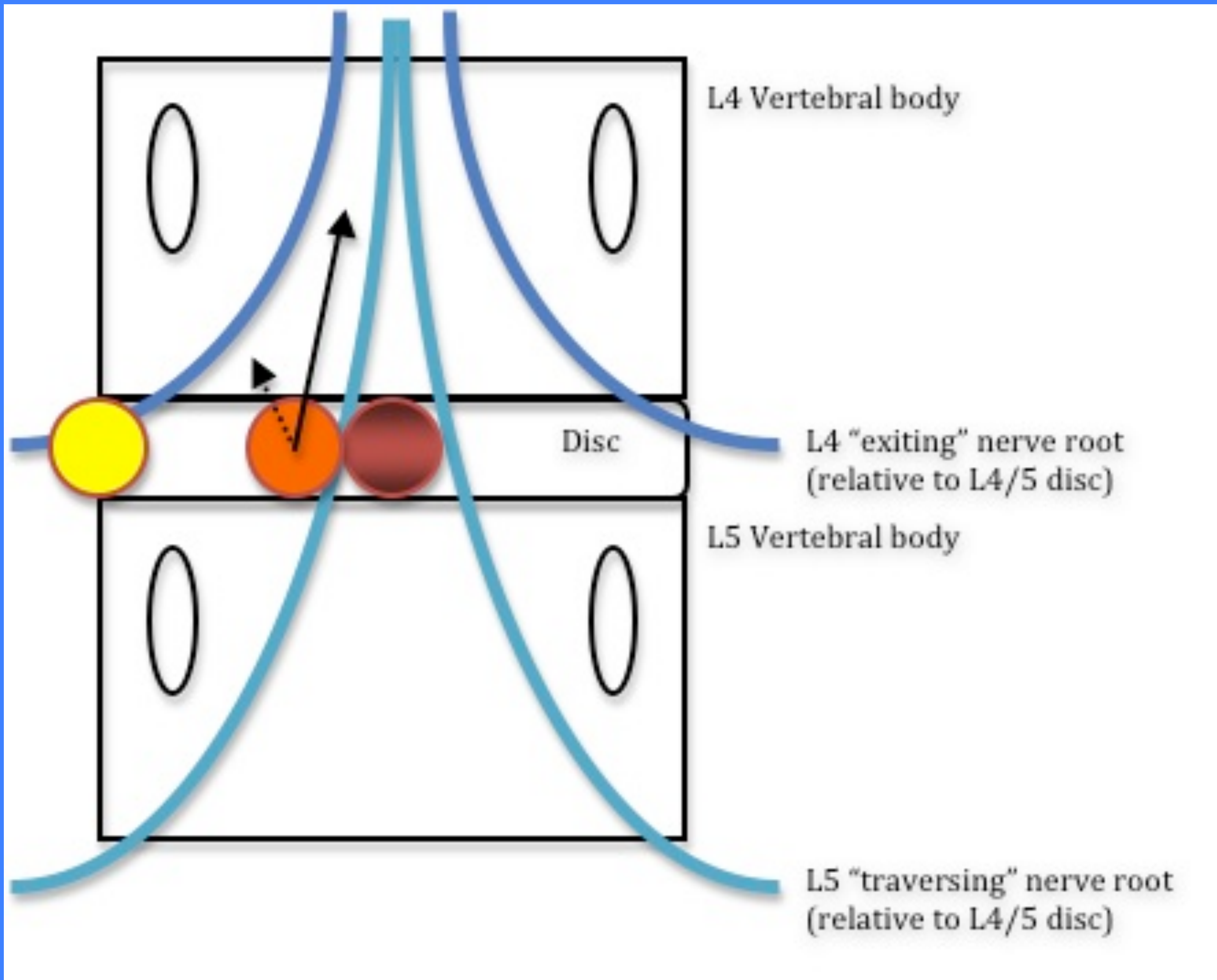
Valsalva

- Instruct a seated patient to "bear down" as though straining for a bowel movement. Reproduction of symptoms suggests space occupying lesion, i.e. disc bulge, osteophyte, neoplasm, etc.

Soto-Hall

- With the patient in a supine position, the clinician stabilizes their sternum with a downward pressure while passively flexing their chin toward their chest.

Level	Root	Sensory	Motor	Reflex
L2/3	L2	Just below groin crease		
L3/4	L3	Anterior thigh to the medial knee		
L4/5	L4	Lateral hip, Anterior thigh & leg	Quad extension (Single raise squat)	Patella
L5/S1	L5	Posterolateral thigh & leg, dorsum of the foot	Great toe dorsiflexion (Heel walk)	Medial Hamstring
S1/2	S1	Posterior thigh & leg and lateral foot	Plantarflexion (Toe walk)	Achilles


L4 Vertebral body
Disc
L4 “exiting” nerve root
(relative to L4/5 disc)
L5 Vertebral body
L5 “traversing” nerve root
(relative to L4/5 disc)

Myelopathy

- Hyperreflexia
- Diffuse weakness
- Spasticitiy
- Pathologic reflexes (Ankle clonus, Babinski sign, Hoffman sign, and Lhermitte's test)

Pathologic Reflexes

- Ankle Clonus
- Babinski Sign
- Hoffman Sign
- Lhermitte's

Ankle Clonus

- The patient is seated or supine with their knee slightly flexed. The clinician gently plantarflexes and dorsiflexes the patient’s ankle and then briskly dorsiflexes the ankle to stretch the Achilles tendon, holding that position for several seconds. Involuntary rhythmic plantarflexion and dorsiflexion of 2-3 “beats” signifies a pathologic reflex suggesting upper motor neuron pathology.

Babinski

- The clinician firmly strokes the sole of the patient's foot, from heel to toe, with a bluntly pointed reflex hammer. No reaction or "Downgoing" toe flexion are normal responses. "Upgoing" great toe extension and toe "fanning" is indicative of a pathologic reflex suggesting upper motor neuron lesion involving the corticospinal tract. This reflex is normally present in children under the age of two. AKA Babinski reflex, Plantar reflex.

Hoffman's Sign

- The clinician pinches the patient's middle finger tip and quickly "flicks" it into a flexed position. Involuntary thumb adduction and finger flexion by the patient is a pathologic reflex suggesting upper motor neuron lesion from spinal cord compression. The reflex may be exacerbated by positioning the patient's neck in extension, or in some cases flexion. AKA Hoffman's reflex

Cauda Equina Syndrome

- Saddle numbness or paresthesia
- Incontinence
- Loss of bowel or bladder control
- Difficulty with urination
- Impotence
- Bilateral radicular signs or symptoms

Imaging Radiculopathy

- "Red flags" including: a history of cancer, fever, chills, recent unexplained weight loss, immunosupression, corticosteroid use
- Symptoms greater than 6 weeks duration
- Progressive neurological deficit

The presence of asymptomatic disc bulge increased from 30% of those 20 years of age to 84% of those 80 years of age.

Brinjikji W, Luetmer PH, Comstock B, Bresnahan BW, Chen LE, Deyo RA, Halabi S, Turner JA, Avins AL, James K, Wald JT, Kallmes DF, Jarvik JG. Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. AJNR Am J Neuroradiol. 2015 Apr;36(4):811-6.

Lumbar Disc Lesion

Evaluation

* Braggard Test
* Lower Extremity Neurologic Evaluation
* Lumbar Directional Preference
* Milgrams Test
* Modified Slump Test
* Straight Leg Raise
* Valsalva Maneuver
* Well Leg Raise

Management

Modalities

* Lumbar Traction

Soft Tissue

* Nerve Floss- Sciatic
* STM- Lumbar Erectors

Manipulation/Mobilization

* Directional Preference Therapy- Lumbar
* Manipulation-Lumbar and Sacral

Phase I exercises

* Cat/Camel

Phase II exercises

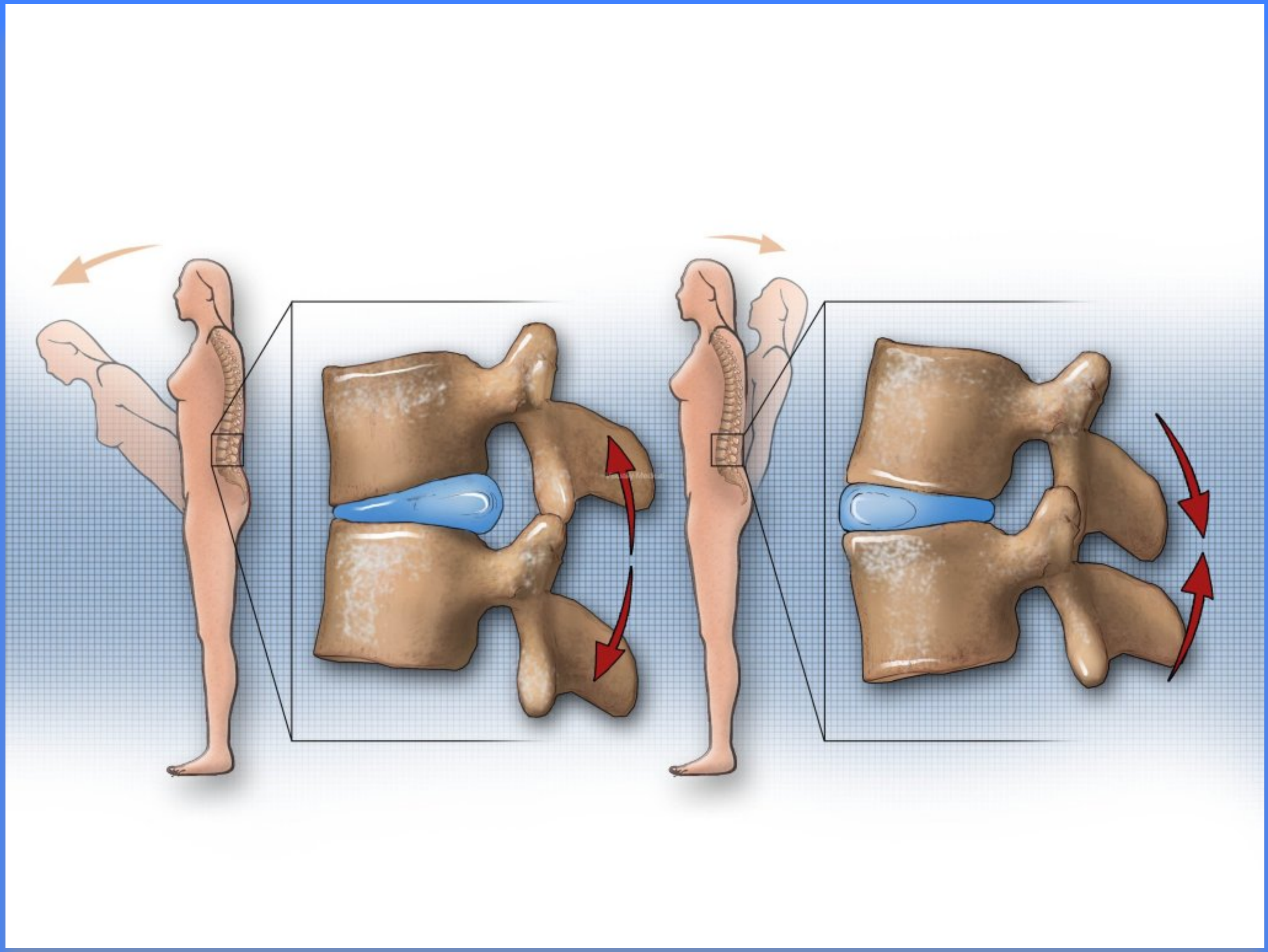
* Sciatic Floss Supine
* Sidebridge
* Bird Dog
* Dead Bug

Distraction/ Traction

SMT produced results equal to surgical decompression in 60% of LDL patients who had failed earlier medical management population

McMorland G, Suter E, Casha S, du Plessis SJ, Hurlbert RJ. Manipulation or microdiskectomy for sciatica? A prospective randomized clinical study . J Manipulative Physiol Ther. 2010 Oct;33(8):576-84.

Directional Preference



Sciatica Management

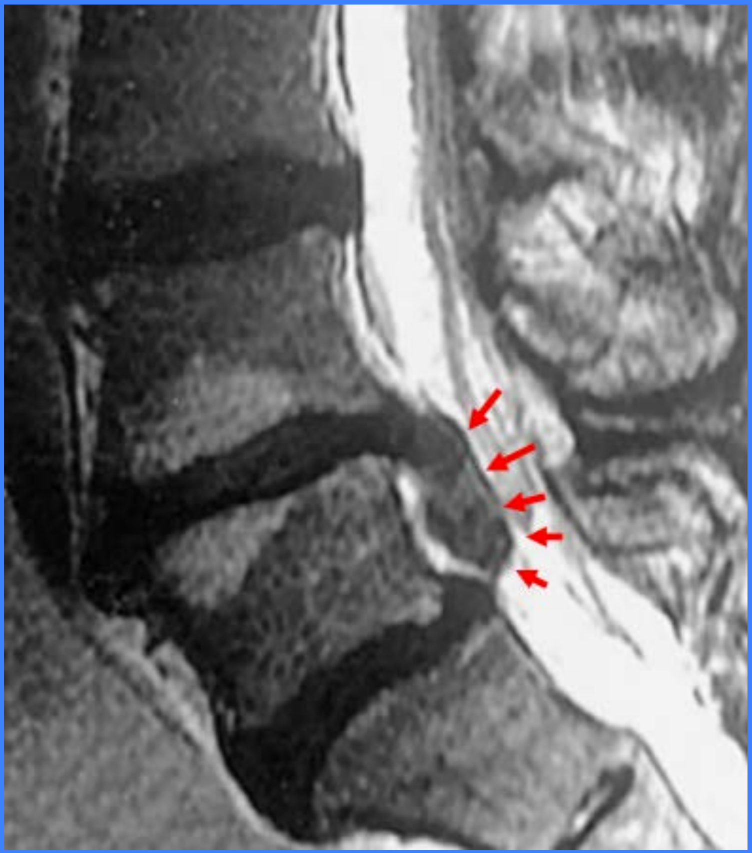
- Disc surgery
- Epidural injections
- Non-opioid analgesia
- Acupuncture
- Manipulation

Lewis RA, Williams NH, Sutton AJ, Burton K, Din NU, Matar HE, Hendry M, Phillips CJ, Nafees S, Fitzsimmons D, Rickard I, Wilkinson C. Comparative clinical effectiveness of management strategies for sciatica: systematic review and network meta-analyses. Spine J. 2015 Jun 1;15(6):1461-1477.

Sciatic Nerve Floss

- The patient should be supine with their affected leg extended. The clinician begins by flexing the patient's hip (SLR) while the patient holds their neck in extension until symptoms are reproduced in the leg. The patient is instructed to flex their neck as the clinician lowers the patient's leg. Alternately, sciatic nerve floss may be performed with the patient seated Flossing motions should not create or intensify any radicular complaints. The flossing pattern should be repeated 10 times, from the starting position to the end position.

Recovery



Chiu CC, Chuang TY, Chang KH, Wu CH, Lin PW, Hsu WY. The probability of spontaneous regression of lumbar herniated disc: a systematic review. Clin Rehabil. 2015 Feb;29(2):184-95.

Ancillary Considerations

- Home inversion therapy
- ADL counseling on sleep and workstation posture, lifting mechanics, footwear (no heels), weight-loss and smoking cessation
- Encourage early return to activity/ work (12mo disability = 20% return)

Lumbar Disc Lesion

Evaluation

* Braggard Test
* Lower Extremity Neurologic Evaluation
* Lumbar Directional Preference
* Milgrams Test
* Modified Slump Test
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* Valsalva Maneuver
* Well Leg Raise

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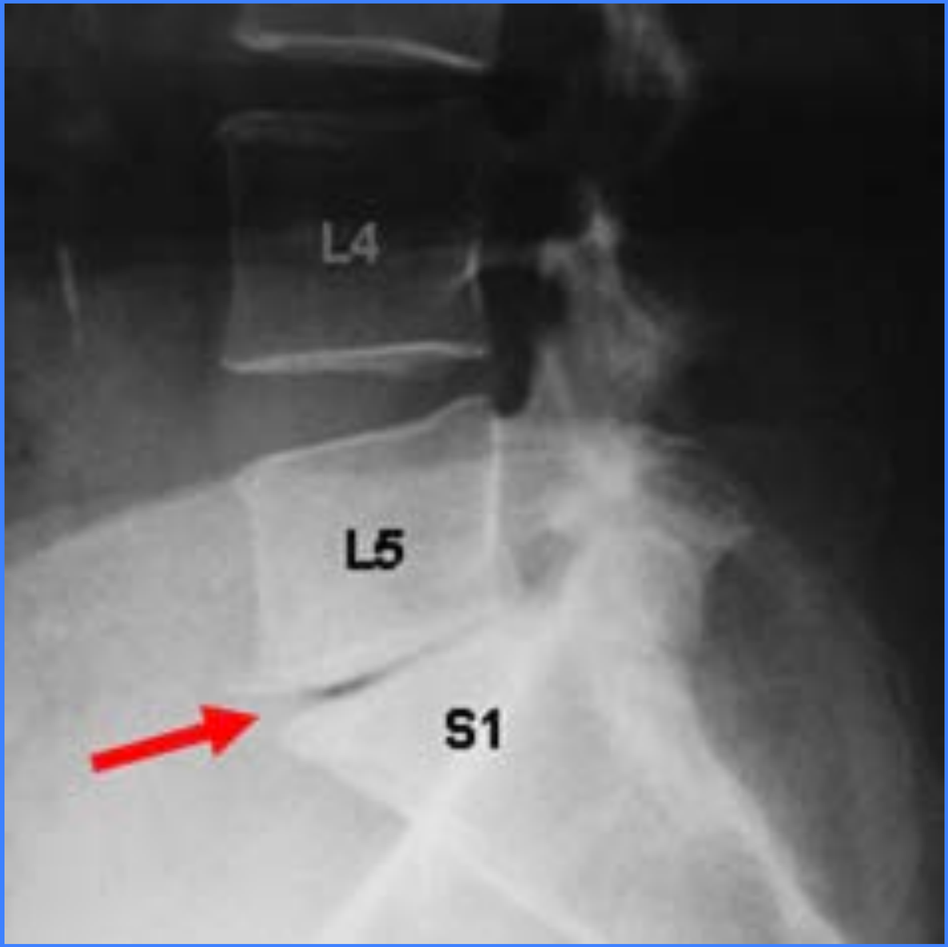
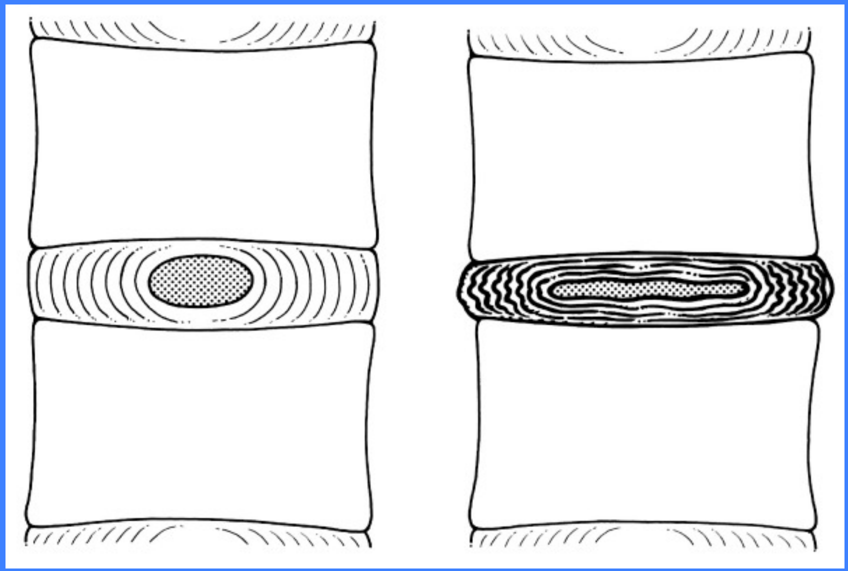
Spondylosis
DJD/DDD



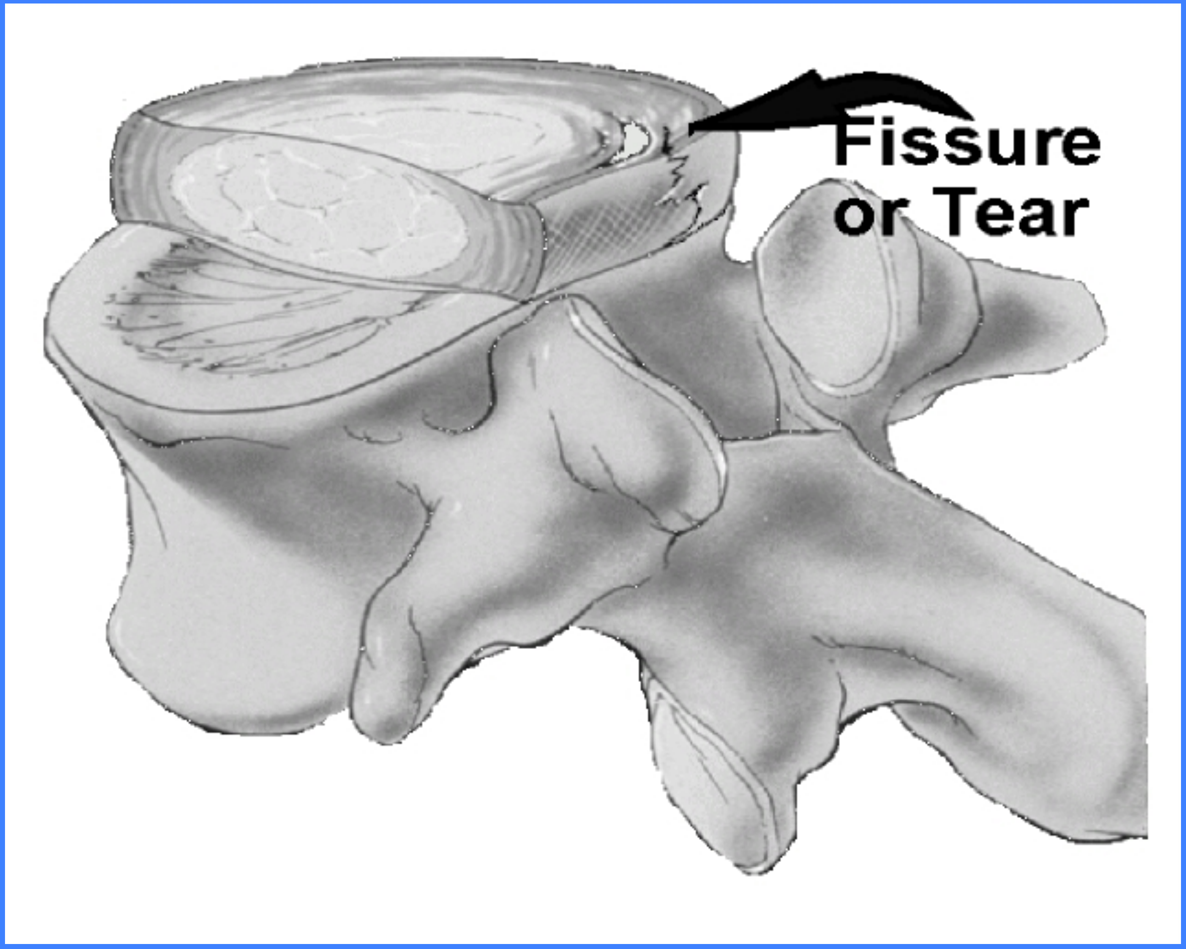
Discogenic Etiology

- Disc dehydration
- Small circumferential annular tears
- Diffuse circumferential bulging
- Disc herniation
- Annular separation from the vertebral endplate
- Compromised disc imbibition and nutrition
- Disc degeneration/ Thinning
- Disproportionate loading of the facet joints
- Facet Degeneration and relative instability
- Osteophytes/ Stenosis

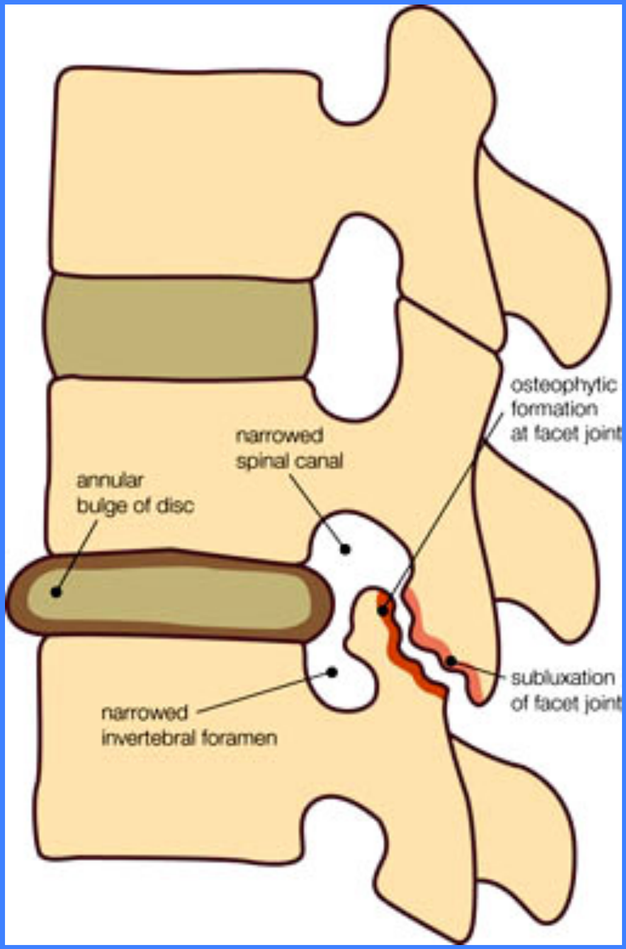
Dehydration



Circumferential Tears



3 Joint Model



Degeneration

Disc Degeneration:

- L4-5
- L5-S1

Posterior facet arthrosis:

- L4-5 (79%)
- L3-4 (72%)
- L2-3 (66%)
- L5-S1 (59%)
- L1-2 (53%)

Age Related Progression

- 16 % of 20-year olds
- 80% of patients over age 40
- 98% of those over 70

•*Lawrence JS. Disc degeneration. Its frequency and relationship to symptoms. Ann Rheum Dis. 1969;28:121–38.*

•*Symmons DPM, Hemert AM, Vandenbrouke JP, et al. A longitudinal study of back pain and radiological changes in the lumbar spines of middle aged women: radiographic findings. Ann Rheum Dis. 1991;50:162–6.*

•*Miller JA, Schmatz C, Schultz AB. Lumbar disc degeneration: correlation with age, sex, and spine level in 600 autopsy specimens. Spine. 1988;13:173–8.*

Risk Factors

- **Age**
- **Genetics**
- higher BMI scores/ obesity
- Smoking
- history of trauma
- repetitive lifting, twisting, bending, or sitting
- exposure to whole body vibration
- male (at birth)

Degeneration Presentation

- Variable and inconsistent
- Asymptomatic to severe pain
- Begins with “axial” back and buttock pain
- Morning Stiffness that dissipates with light activity
- Intensifies with strenuous or prolonged activity
- Relieved by sitting or lying down.
- Advances to “radicular” complaints

Lumbar Spondylosis/ DJD/ DDD

Evaluation

* Fritz Clinical Prediction Rule
* Kemps Test
* Sphinx Test
* Yeoman Test

Management

Soft Tissue

* STM- Iliopsoas
* STM- Lumbar Erectors

Manipulation/Mobilization

* Manipulation-Lumbar and Sacral

Phase I exercises

* Cat/Camel
* Knee to Chest
* Bird Dog
* Dead Bug

Phase II exercises

* Sidebridge

Degeneration Clinical Findings

- Diminished ROM
- Exacerbated by extension or ipsilateral lateral flexion

Sphinx

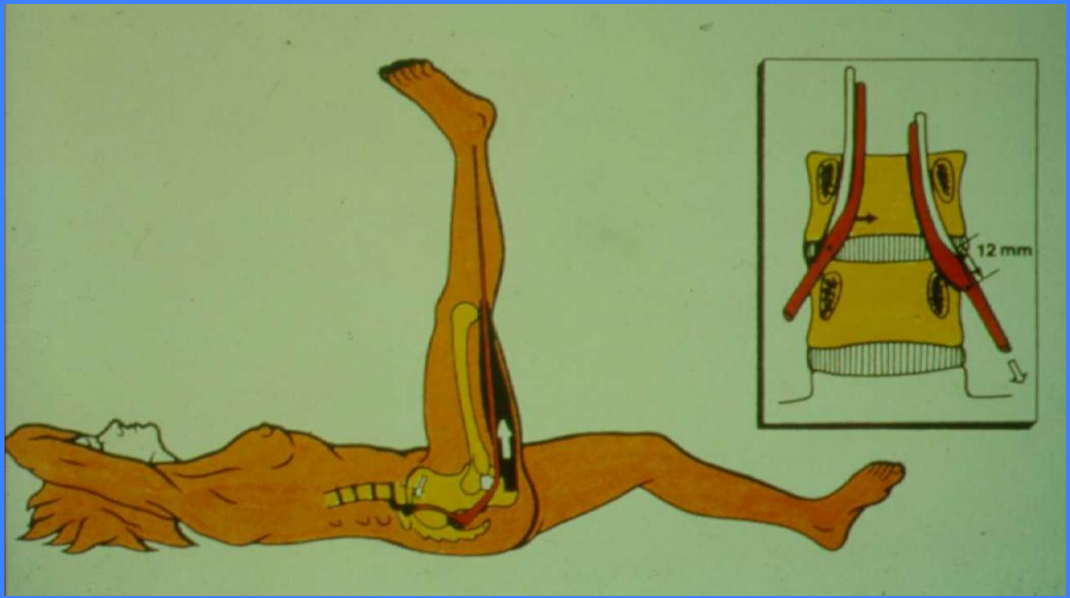
- The prone patient is instructed to perform a press-up, resting on their forearm/elbows for 15-30 seconds or until symptoms are reproduced. Hyperextension may provoke facet symptoms immediately and sustained extension may reproduce the symptoms of stenosis and neurogenic claudication. a.k.a. Prone press up.

Kemp's

Yeoman

Nerve Involvement

- Straight leg raise, Braggard, Bechterew's, and Slump tests may rouse radicular complaints
- Space occupying lesion tests, including Valsalva or Soto Hall, may be positive in more severe cases.



Imaging Spondylosis

"The presence of osteophytes and the degree of radiographic change does not correlate with symptom severity"

Lumbar Spondylosis/ DJD/ DDD

Evaluation

* Fritz Clinical Prediction Rule
* Kemps Test
* Sphinx Test
* Yeoman Test

Management

Soft Tissue

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* STM- Lumbar Erectors

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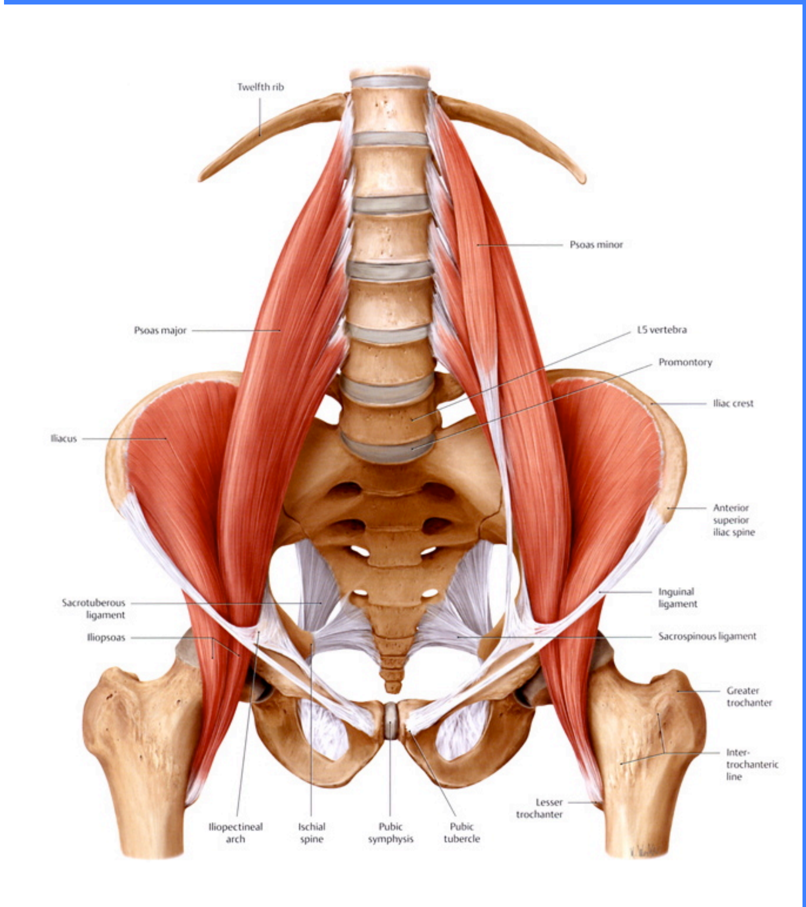
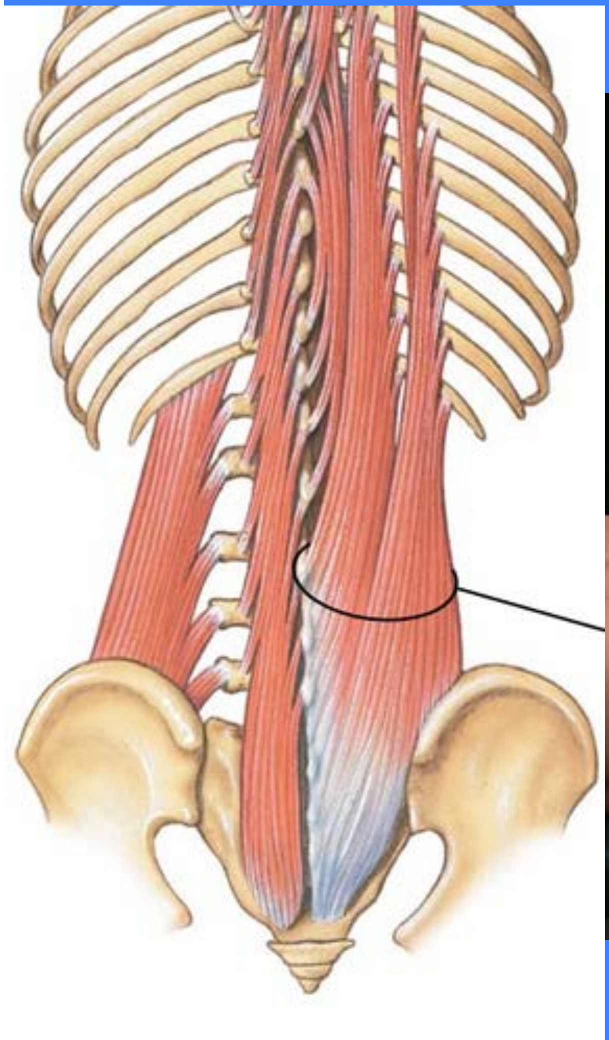
* Sidebridge

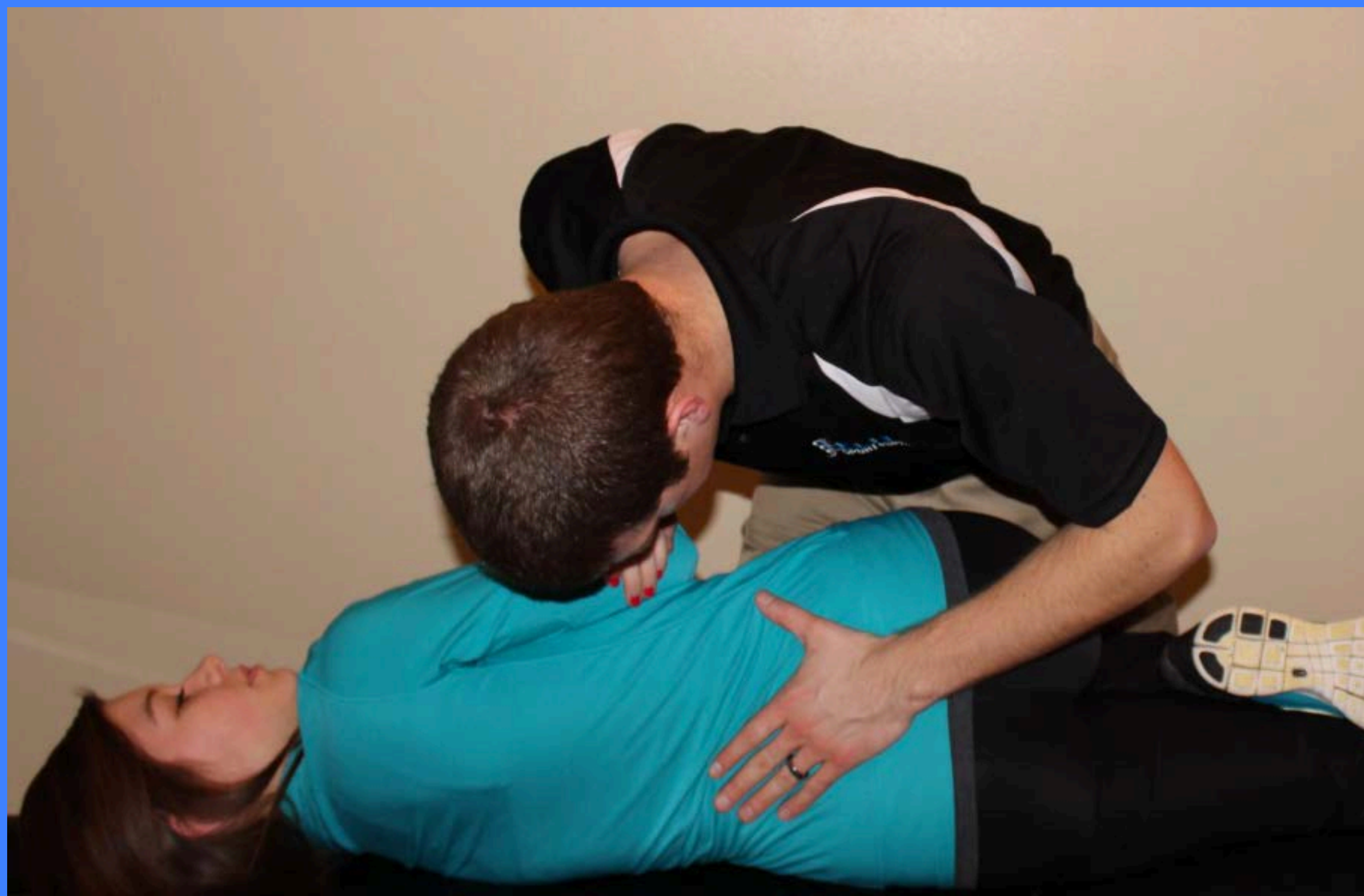
Iliopsoas


Twelfth rib
Psoas minor
Psoas major
L5 vertebra
Promontory
Iliac crest
Iliacus
Anterior superior iliac spine
Inguinal ligament
Sacrotuberous ligament
Sacrospinous ligament
Iliopsoas
Greater trochanter
Inter-trochanteric line
Lesser trochanter
Iliopectineal arch
Ischial spine
Pubic symphysis
Pubic tubercle

STM- Lumbar Erectors



Manipulation



Joint dysfunction is a primary risk factor for the development & progression of degeneration.

Roos EM, Herzog W, Block JA, et al. Muscle weakness, afferent sensory dysfunction and exercise in knee osteoarthritis. Nat Rev Rheumatol. 2011;7:57–63.

Manipulation restores joint function.

Pickar JG. Neurophysiological effects of spinal manipulation. Spine J. 2002;2:357–71.

Manipulation is an “important component to reduce the progression of chronic DJD and pain”.

Srbely J. Spinal manipulative therapy and its role in the prevention, treatment and management of chronic pain J Can Chiropr Assoc. 2012 March; 56(1): 5–7.

Spinal manipulation decreases pain and improves mobility in patients with degenerative change.

Vieira-Pellenz F, Oliva-Pascual-Vaca A, Rodriguez-Blanco C, Heredia-Rizo AM, Ricard F, Almazán-Campos G. Short-Term Effect of Spinal Manipulation on Pain Perception, Spinal Mobility, and Full Height Recovery in Male Subjects with Degenerative Disc Disease: A Randomized Controlled Trial. Arch Phys Med Rehabil. 2014 May 23.

Flexion distraction has shown similar benefit to HVLA in patients with subacute and chronic LBP

Xia T, et al. Similar effects of thrust and nonthrust spinal manipulation found in adults with subacute and chronic low back pain: A controlled trial with adaptive allocation. Spine (Phila Pa 1976). 2016 Jun;41(12):E702-9.

Lumbar Spondylosis/ DJD/ DDD

Evaluation

* Fritz Clinical Prediction Rule
* Kemps Test
* Sphinx Test
* Yeoman Test

Management

Soft Tissue

* STM- Iliopsoas
* STM- Lumbar Erectors

Manipulation/Mobilization

* Manipulation-Lumbar and Sacral

Phase I exercises

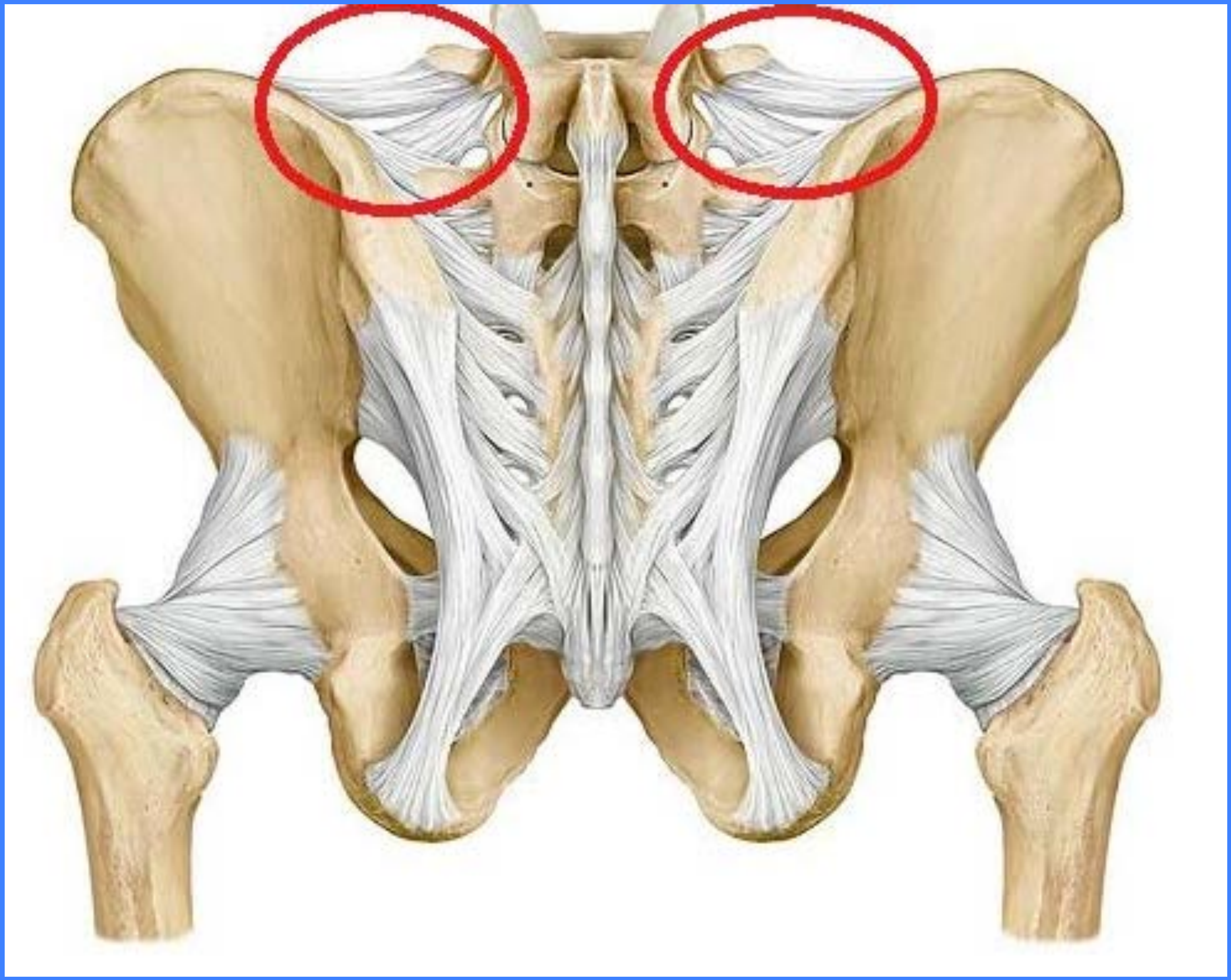
* Cat/Camel
* Knee to Chest
* Bird Dog
* Dead Bug

Phase II exercises

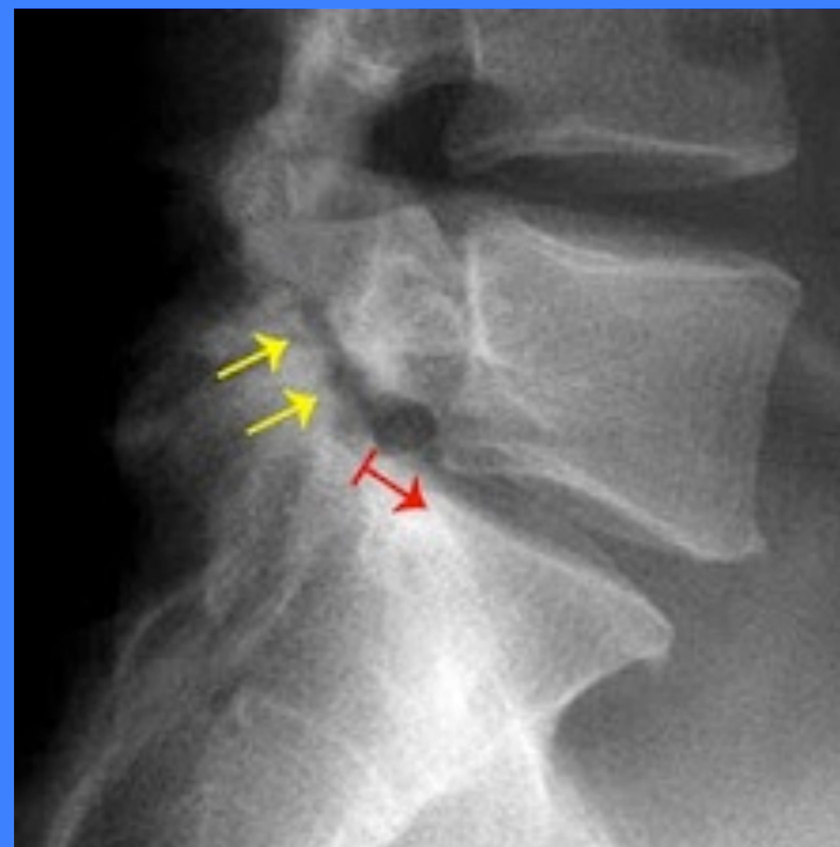
* Sidebridge

Degenerative Spondylolisthesis

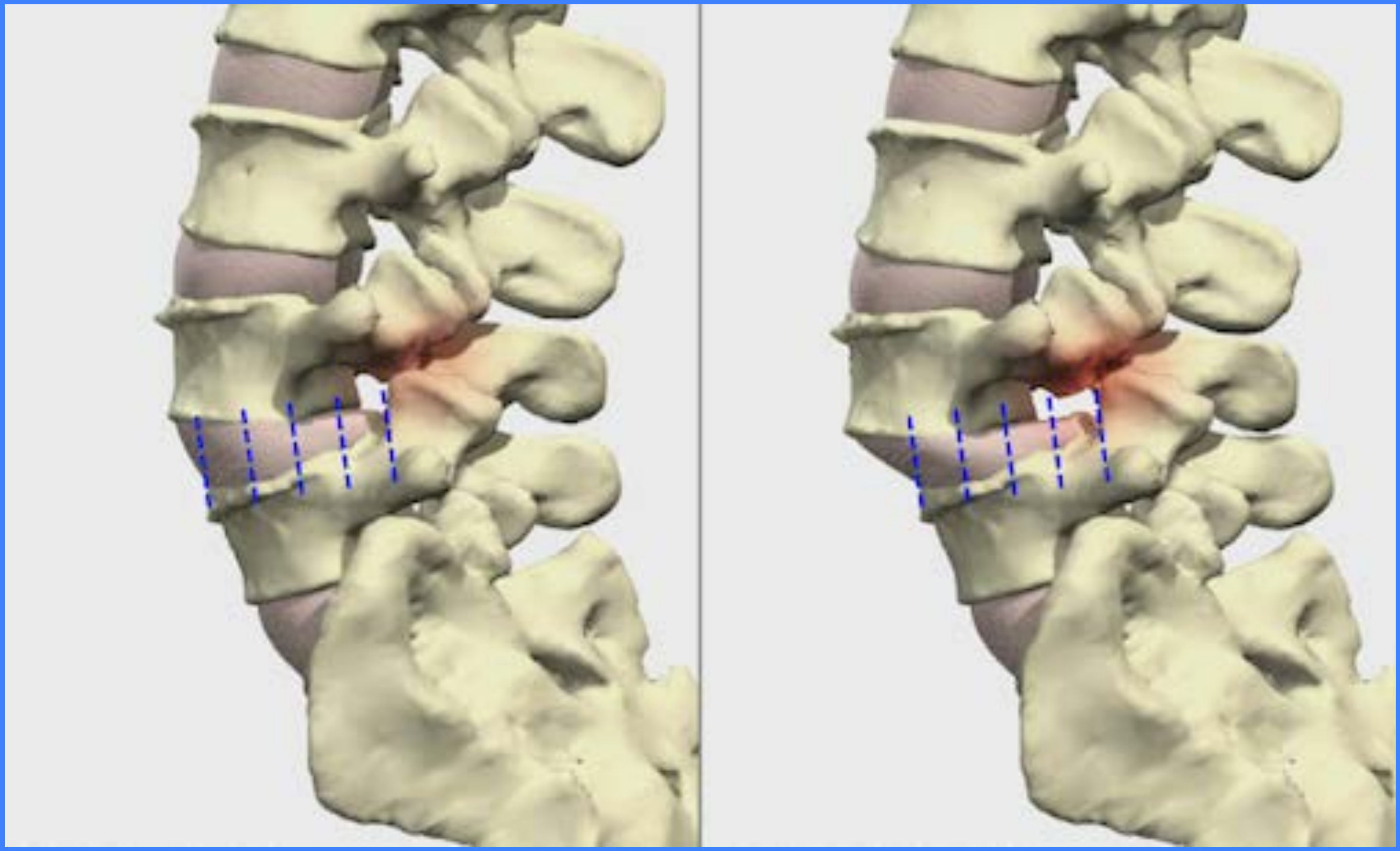
- Six times more common in women
- L4/5 is affected 6-9 times more frequently



Degenerative vs Isthmic



Typical degree of anterior translation averages 14% and rarely exceeds 30% of vertebral width



Rosenberg NJ. Degenerative spondylolisthesis. Predisposing factors. J Bone Joint Surg Am. 1975;57:467–474

Jacobsen S, Sonne-Holm S, Rovsing H, Monrad H, Gebuhr P. Degenerative lumbar spondylolisthesis: an epidemiological perspective: the Copenhagen Osteoarthritis Study. Spine 2007;32:120-125

Symptoms

- Episodic and recurrent LBP for many years
- Symptoms change in relation to mechanical loading - patients often report increased pain with standing or when transitioning to a standing position
- Pain tends to increase throughout the course of the day

Frymoyer JW. Degenerative spondylolisthesis. In: Andersson GBJ, McNeill TW, editors. Lumbar spinal stenosis. St Louis: Mosby Year Book; 1992.

Symptoms

- Scleratogenous referral of pain into the posterolateral thigh
- Radicular complaints typically involve the L4 or L5 nerve roots and may be unilateral or bilateral
- Radicular complaints that shift from side to side are characteristic of degenerative spondylolisthesis.

Spondylolysis Progression

- Progression of slippage occurs in approximately 1/3 of patients.
- 76 % of patients presenting without neurologic deficit remain stable.
- 83% of those who demonstrate neurologic signs symptoms at presentation will deteriorate.
- There is no correlation between the progression of spondylolisthesis and the patient's clinical symptoms.

Lumbar Spondylolisthesis- Type III Degenerative

Evaluation

* Kemps Test
* Spinal Instability Cluster
* Spring Test
* Yeoman Test

Management

Soft Tissue

* STM- Hamstrings
* STM- Iliopsoas
* STM- Lumbar Erectors

Manipulation/Mobilization

* Manipulation-Lumbar and Sacral

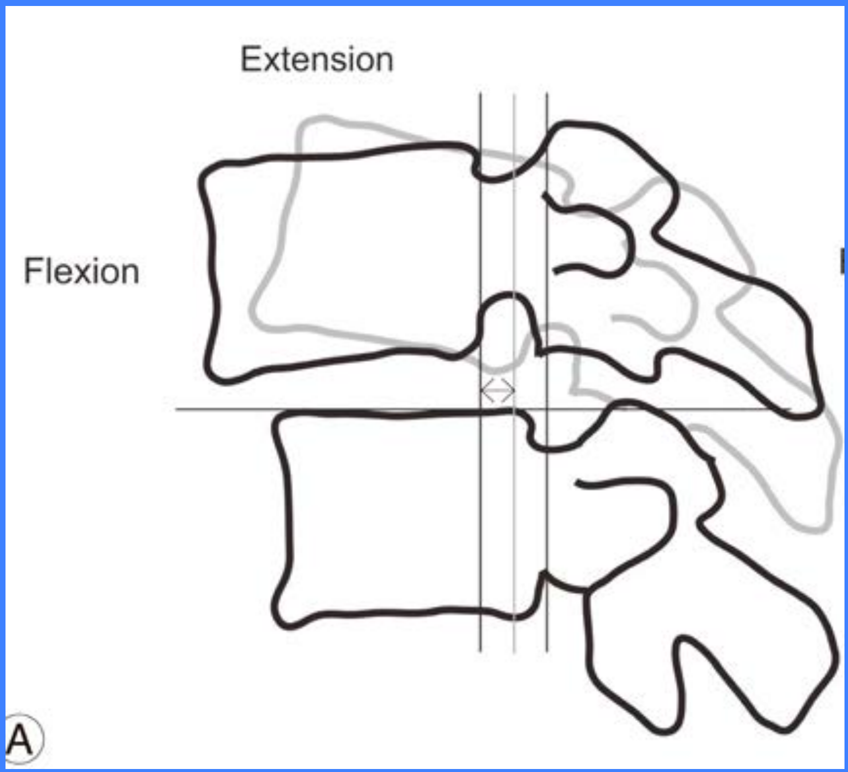
Phase I exercises

* Hamstring Doorway Stretch
* Knee to Chest
* Psoas Stretch- Standing
* Dead Bug

Phase II exercises

* Sidebridge
* Bird Dog

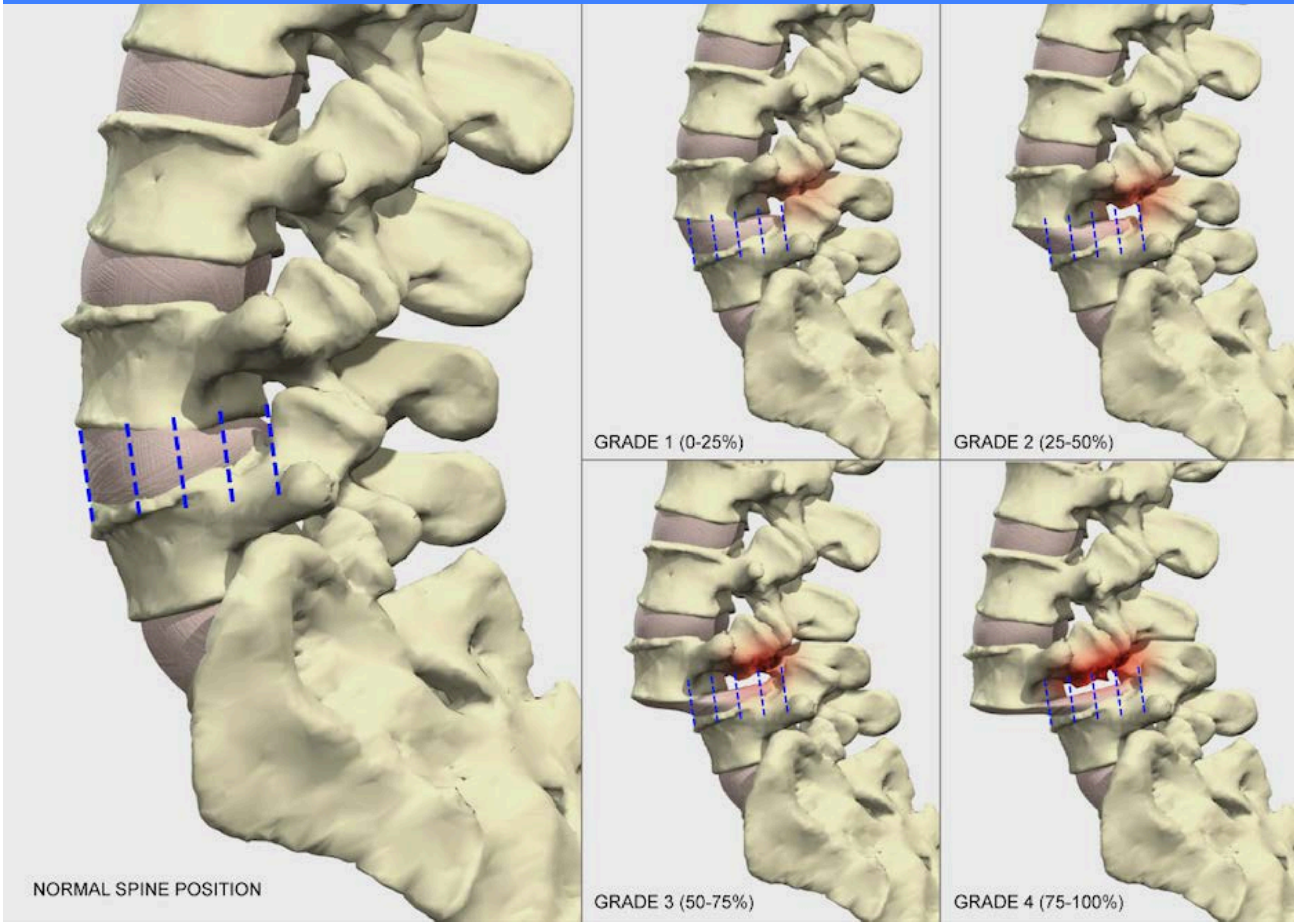
Segmental Instability



- Aberrant forward flexion; catching, disruption of normal lumbopelvic rhythm, and pain while bending or upon return.
- Passive lumbar extension
- Prone instability test
- Active straight leg raise test

Imaging

- Anterior translation
- Loss of disc height
- Joint space narrowing
- Osteophytosis
- Subchondral sclerosis
- Vacuum phenomenon
- Cyst formation


GRADE 1 (0-25%)
GRADE 2 (25-50%)
NORMAL SPINE POSITION
GRADE 3 (50-75%)
GRADE 4 (75-100%)

Lumbar Spondylolisthesis- Type III Degenerative

Evaluation

* Kemps Test
* Spinal Instability Cluster
* Spring Test
* Yeoman Test

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Soft Tissue

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Phase I exercises

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* Psoas Stretch- Standing
* Dead Bug

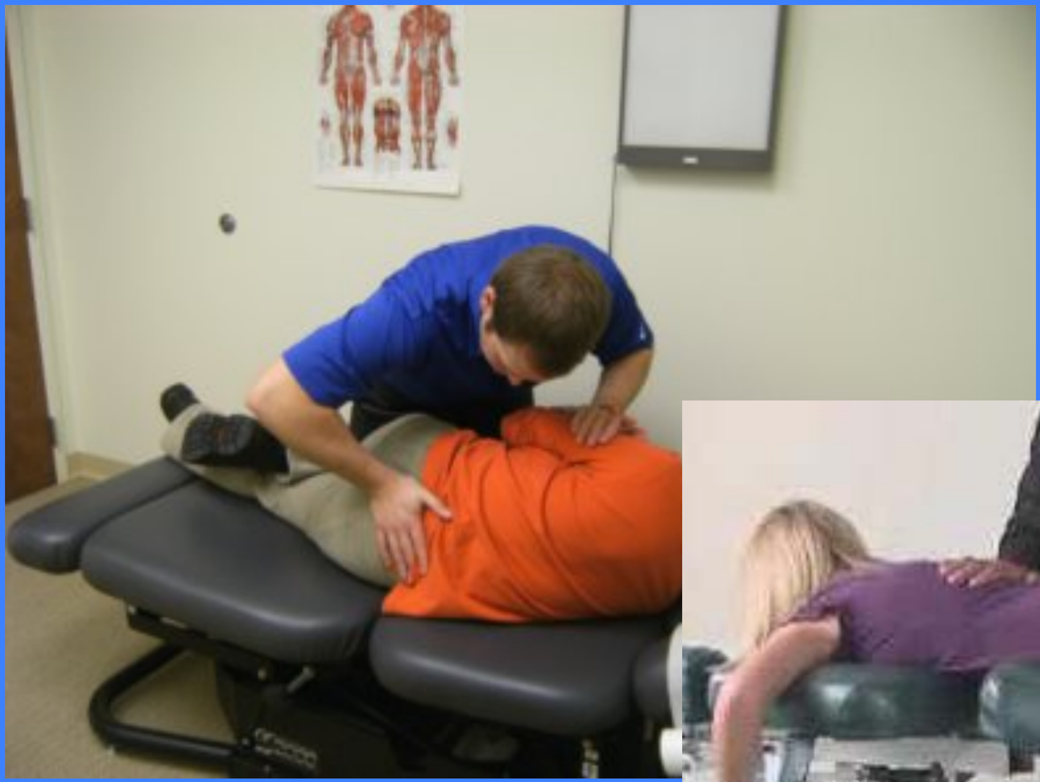
Phase II exercises

* Sidebridge
* Bird Dog

No advantage for surgery over non-surgical care for most cases of degenerative spondylolisthesis

Weinstein JN, et al. Surgical versus Nonsurgical Treatment for Lumbar Degenerative Spondylolisthesis N Engl J Med 2007; 356:2257-

Manipulate?



HVLA manipulation of a translated segment may create greater instability and aggravate the condition- particularly in the prone position

Mierau D, Cassidy JD, McGregor M, Kirkaldy-Willis WH. A comparison of effectiveness of special manipulative therapy for low back pain patients with or without spondylolisthesis. JMPT. 1987;2:49–55.

Cassidy JD, Potter GE, Kirkaldy-Willis WH. Manipulative management of back pain in patients with spondylolisthesis. J Can Chiropr Assoc. 1978;22:15.

Lumbar Spondylolisthesis- Type III Degenerative

Evaluation

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* Spinal Instability Cluster
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* Bird Dog

Ancillary Considerations

- Aerobic activity; stationary cycling walking, swimming, water walking, and elliptical machines.
- ADL counseling on posture, proper lifting technique, weight loss, aerobic exercise, mattress selection, and sleep position to avoid stomach sleeping.
- Limit hyperextension movements and avoid wearing high heels.

Approximately 10-15% of symptomatic degenerative spondylolisthesis patients will require surgery.

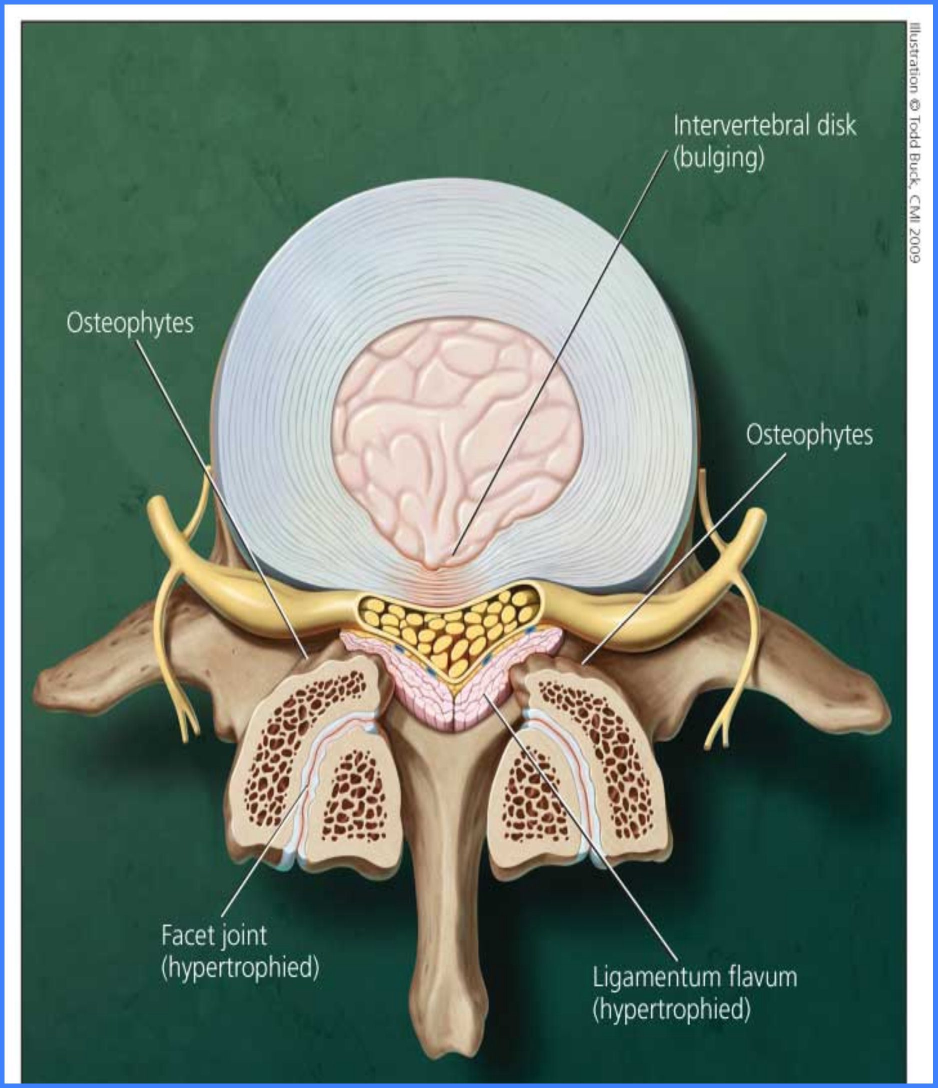
Postacchini F, Cinotti G, Perugia D. Degenerative lumbar spondylolisthesis II. Surgical treatment. Ital J Orthop Traumatol. 1991;17:467–477.

Surgical Indicators

- Ongoing and significantly disabling symptoms that have failed a trial of conservative care (three months)
- Progressive neurologic deficit
- Presence of bowel or bladder symptoms

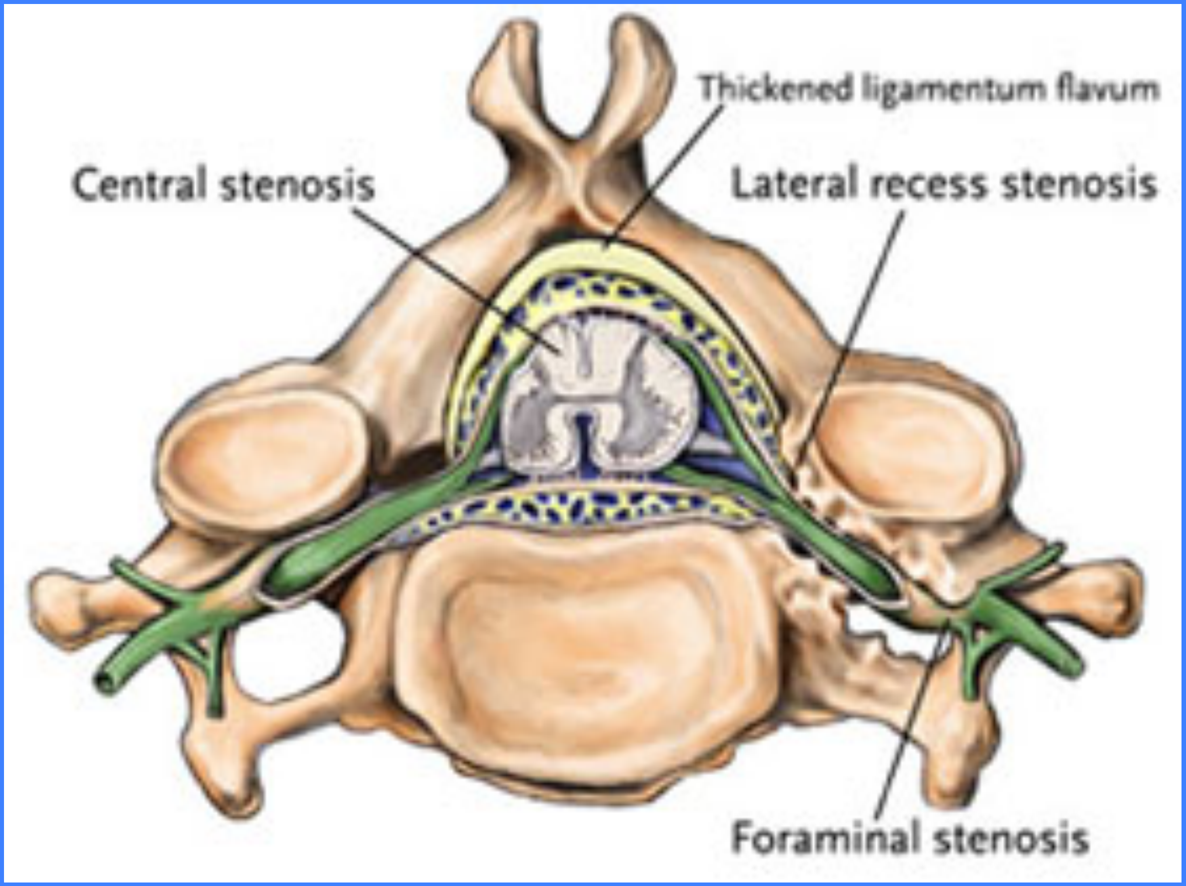
Herkowitz HN. Spine update: degenerative lumbar spondylolisthesis. Spine. 1995;20:1084–1090.

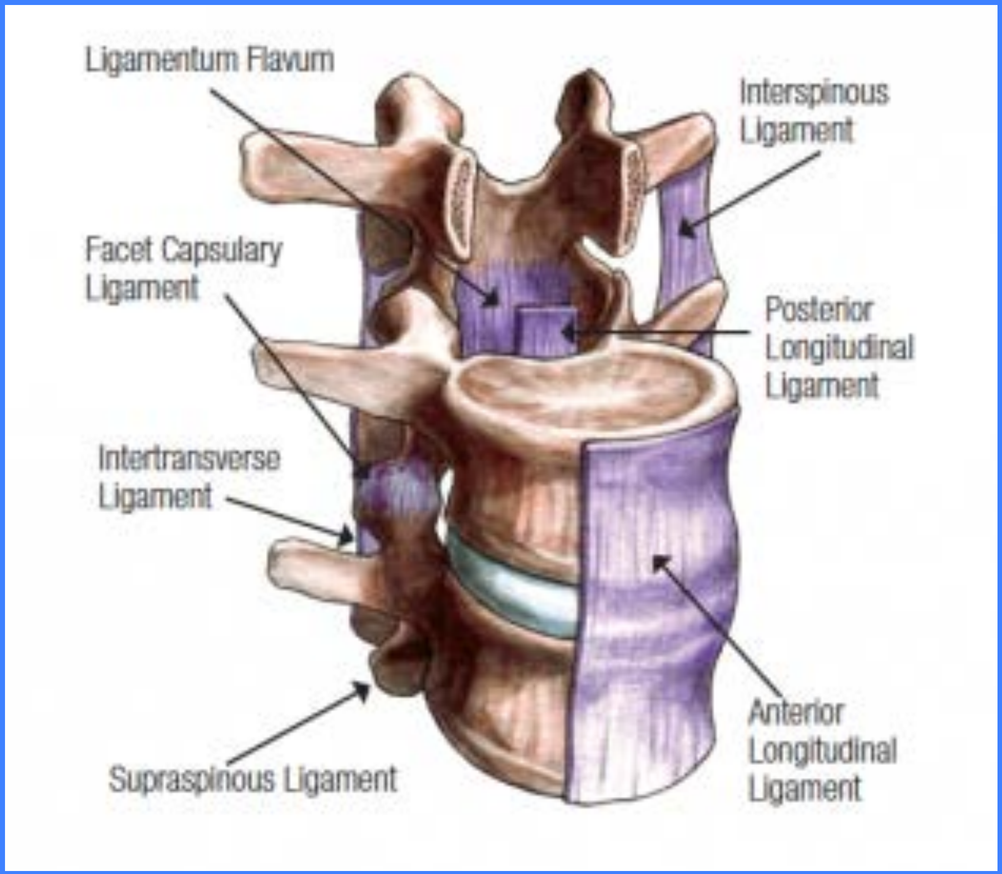
Stenosis

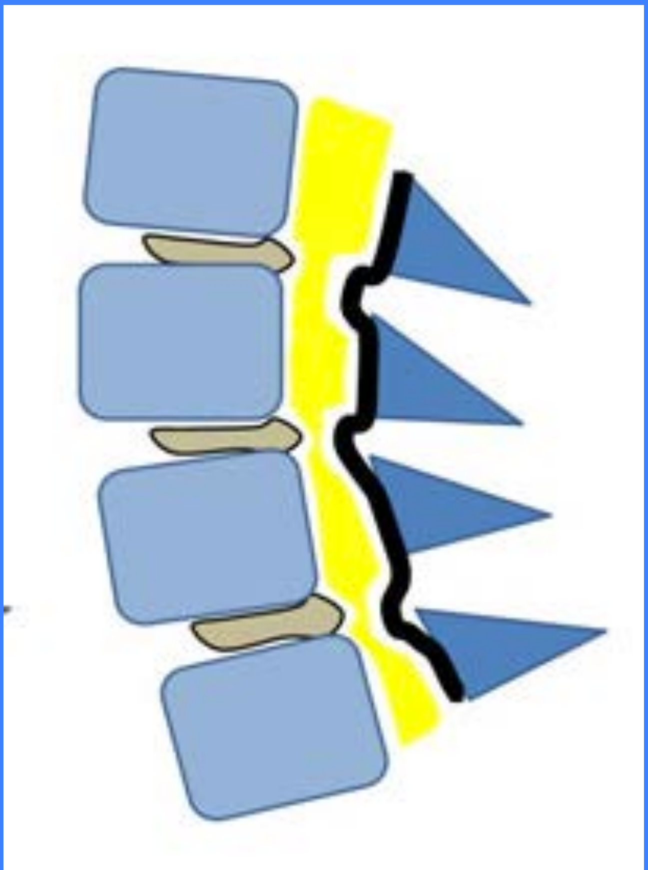

Intervertebral disk
(bulging)
Osteophytes
Osteophytes
Facet joint
(hypertrophied)
Ligamentum flavum
(hypertrophied)
Illustration © Todd Buck, CMI 2009

Stenosis Location

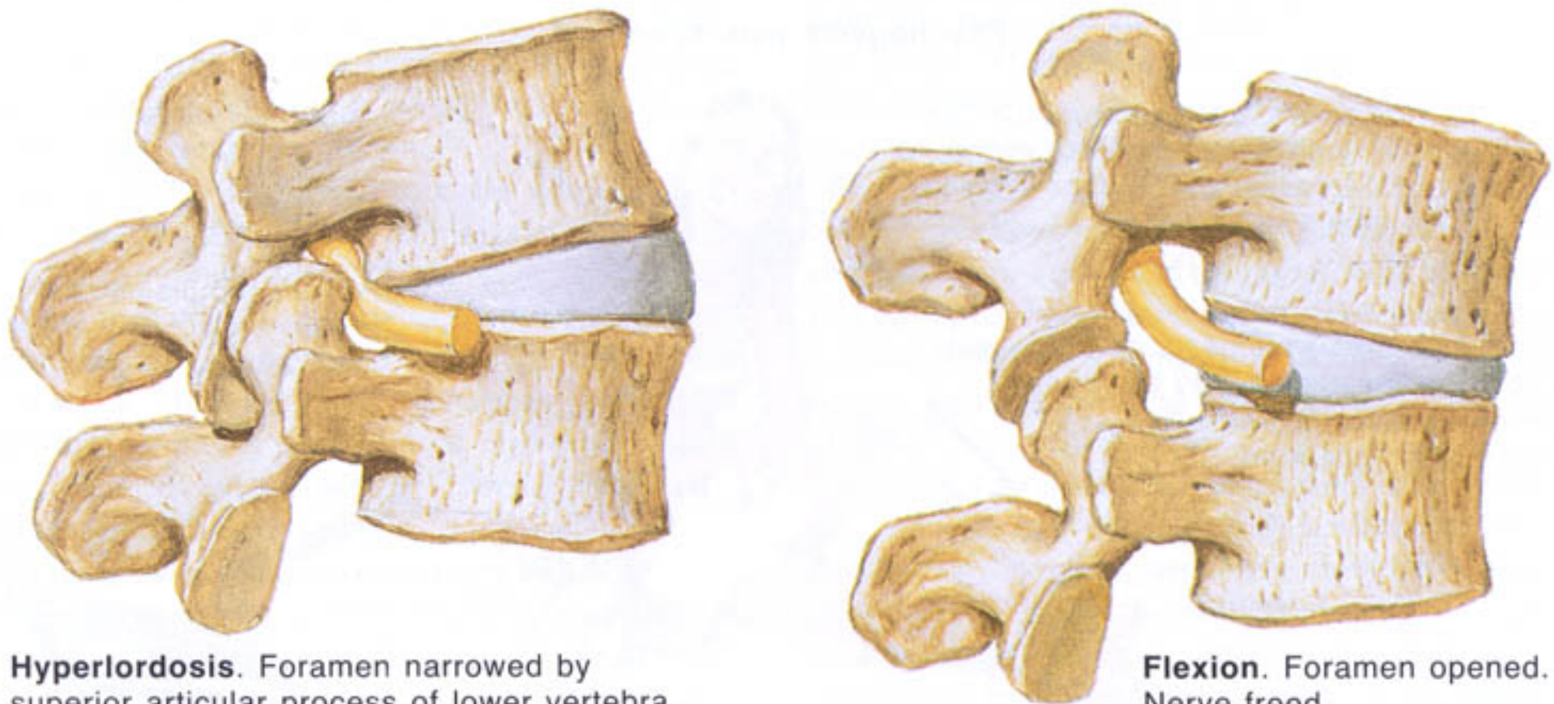
- Central canal
- Lateral recess
- Foraminal




Ligamentum Flavum
Interspinous Ligament
Facet Capsulary Ligament
Posterior Longitudinal Ligament
Intertransverse Ligament
Anterior Longitudinal Ligament
Supraspinous Ligament



Stenosis Biomechanics



Hyperlordosis. Foramen narrowed by superior articular process of lower vertebra. Nerve compressed

Flexion. Foramen opened. Nerve freed

Nerve roots can tolerate up to a 70% reduction in IVF diameter

Critical dimensions:

- Disc thinning to less than 4 mm of height
- reduction of the IVF height to less than 15mm

Stenosis

- Asymptomatic-Disabling
- 50-70% remain stable
- Uncommon before age 50
- Most common reason for spine surgery in seniors

Stenosis Presentation

- Chronic LBP
- Transient neurogenic claudication symptoms
- Bilateral and symmetrical pain, paresthesia, numbness, fatigue, heaviness and/or weakness
- Progressively increasing symptoms from standing or walking
- Relief while sitting.
- Slightly forward flexed posture with knee, hip and trunk flexion, i.e. “Simian” stance
- Progression of stenosis may result in a wide-based gait, exercise intolerance and major lifestyle restrictions. Patients with more significant cauda equina compression may report urinary incontinence.

Kono Stenosis Questionnaire

Do you Have?

1. Numbness and/or pain in the thighs down to the calves and shins.
2. Numbness and/or pain increases after walking and is relieved by resting.
3. Standing for a while brings on numbness and/or pain in the thighs down to the calves and shins.
4. Numbness and/or pain are reduced by bending forward.
5. Numbness is present in both legs.
6. Numbness is present in the soles of both feet.
7. Numbness arises around the buttocks.
8. Numbness is present but pain is absent.
9. A burning sensation arises around the buttocks.
10. Walking nearly causes urination.

(Affirmative answers to questions 1-4 predict the presence of lumbar spinal stenosis, with questions 5-10 differentiating between central and lateral stenosis. Low positive scores on questions 5-10 suggest lateral recess involvement, while higher scores on these questions suggest central canal stenosis.)

Lumbar Stenosis

Evaluation

* Kemps Test
* Lower Extremity Neurologic Evaluation
* Modified Slump Test
* Pathologic Reflexes
* Sphinx Test
* Yeoman Test

Management

Modalities

* Lumbar Traction

Soft Tissue

* STM- Hamstrings
* STM- Lumbar Erectors

Manipulation/Mobilization

* Directional Preference Therapy- Flexion
* Manipulation-Lumbar and Sacral

Phase I exercises

* Cat/Camel
* Hamstring Doorway Stretch
* Sciatic Floss S/L
* Knee to Chest
* Seated Lumbar Flexion

Phase II exercises

* Standing Knee to Chest

Stenosis Clinical Findings

- Global reduction in lumbar mobility, particularly in extension
- Intersegmental restriction
- Significant myofascial involvement

Kemp's

Yeoman

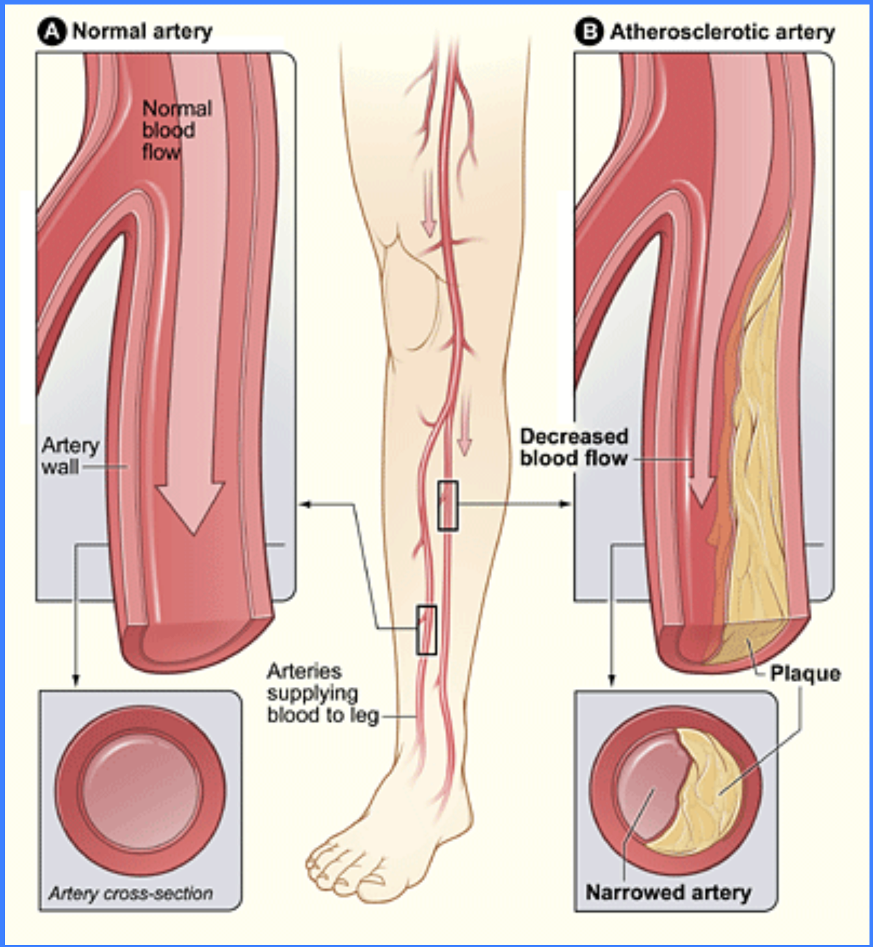
Nachlas

Sphinx

SLR/ Braggard

Vascular Claudication 5 P's

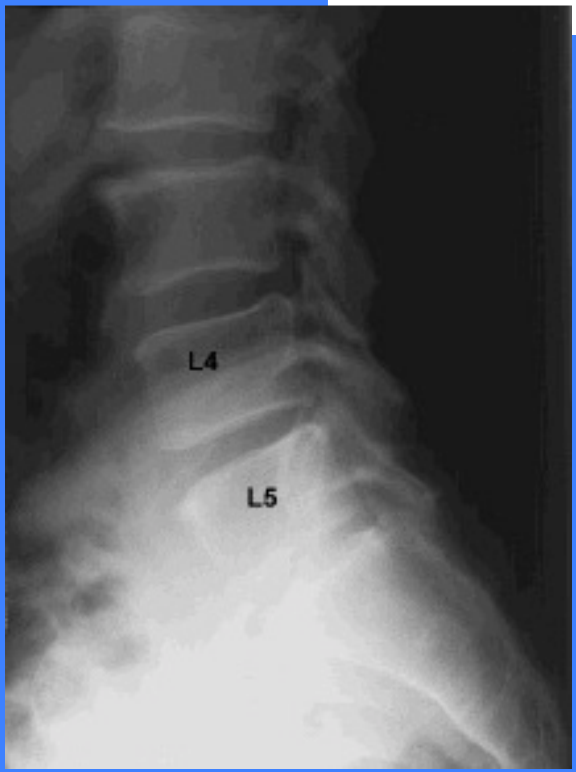
- Pulselessness
- Paralysis
- Paresthesia
- Palor
- Pain

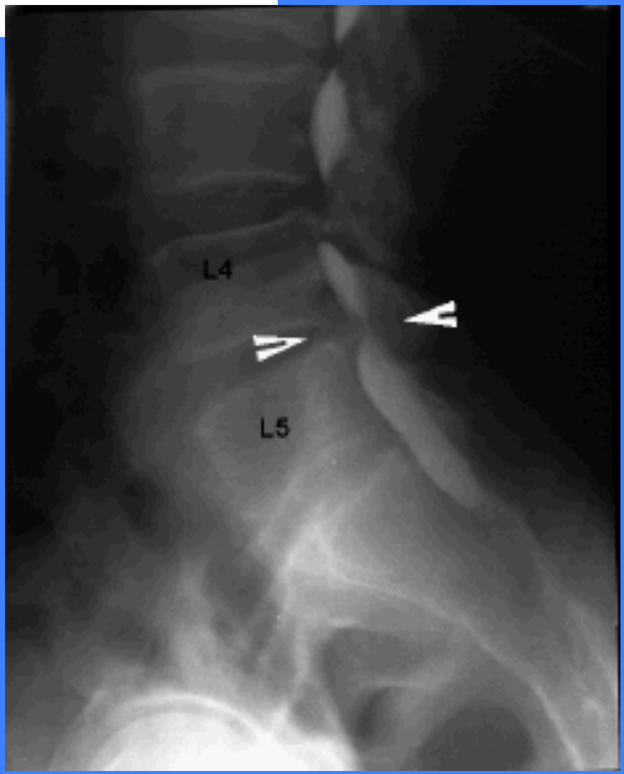


Defining Stenosis

10-12 mm = "relative stenosis"

< 10 mm = "absolute stenosis





Lumbar Stenosis

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Phase II exercises

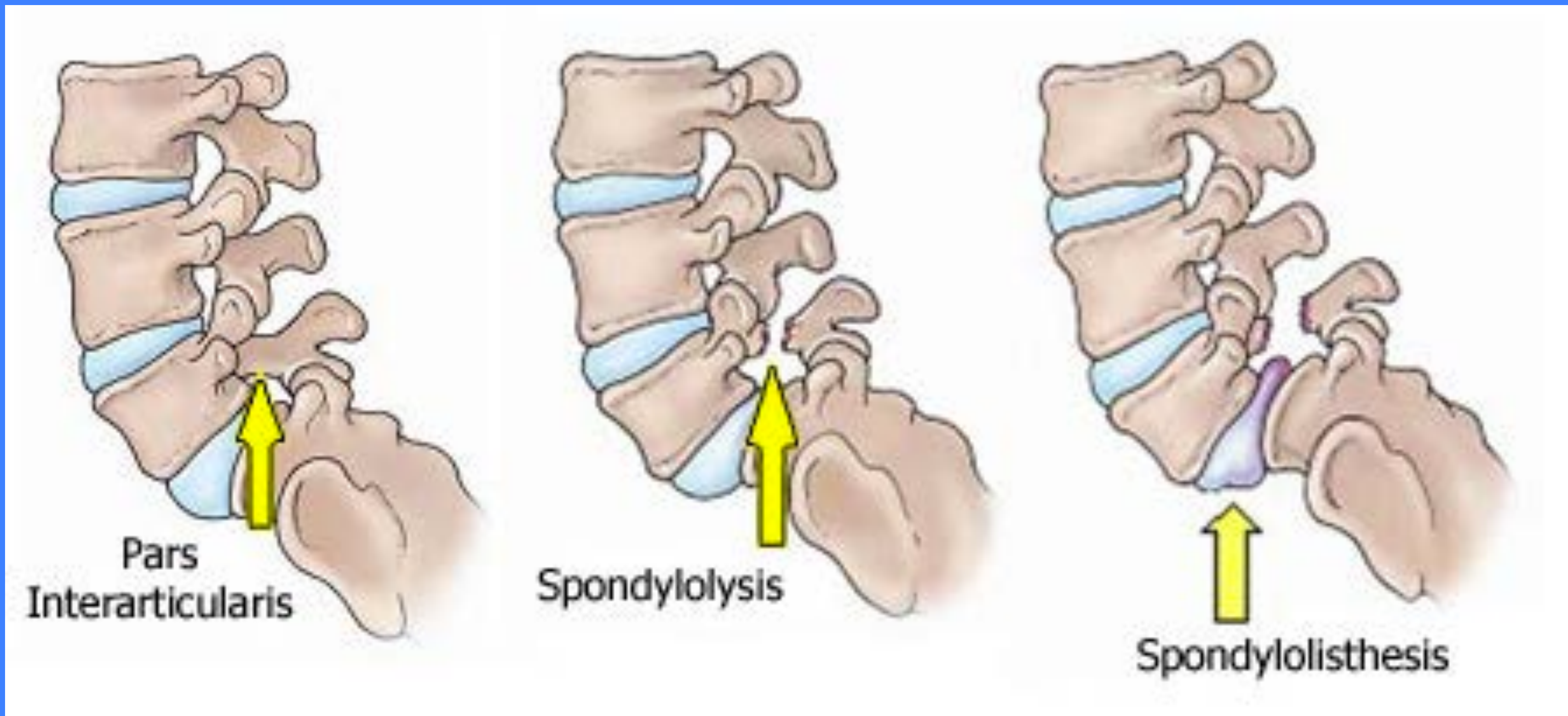
* Standing Knee to Chest

Patients most likely to respond:

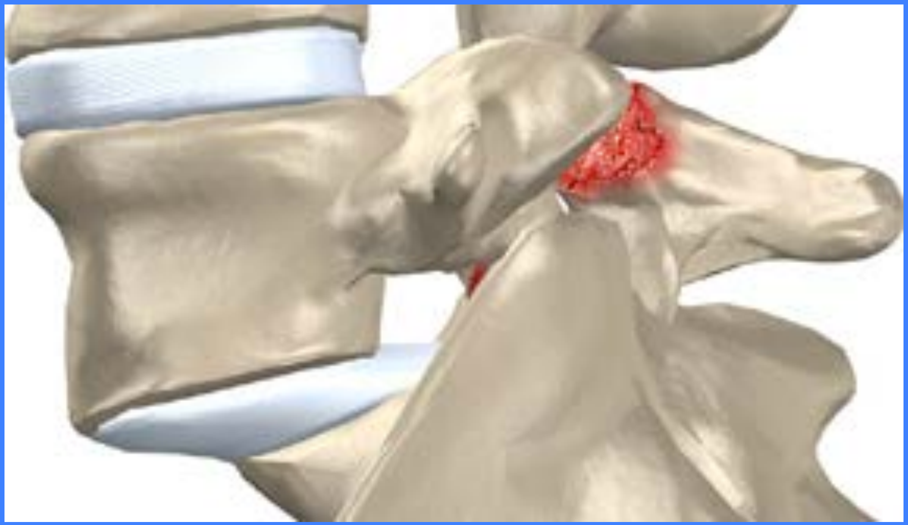
- Lower initial VAS and disability scores
- Relatively younger age
- Radicular symptoms described as "pain", as opposed to parasthesia or weakness
- Higher body mass index (BMI).

Schneider MJ, et al. Exploratory analysis of clinical predictors of outcomes of nonsurgical treatment in patients with lumbar spinal stenosis. J Manipulative Physiol Ther. 2016 Feb;39(2):88-94.

Lumbar Spondylolysis/ Spondylolisthesis



Type I – Congenital (dysplastic)
Type II – Isthmic (spondylolytic)
Type III – Degenerative
Type IV – Traumatic
Type V – Pathologic
Type VI – Post-surgical



Spondylolysis

- 90% at L5
- 6% of general population
- 8-14% of elite adolescent athletes
- Twice as common in males
- Caucasians 2-3x more frequently than African Americans

Spondylolysis

- Acquired- does not occur before ambulation
- Two-thirds of cases occur prior to first grade, with the remainder occurring during later childhood or adolescence.
- Cases developing before adolescence seem to be less symptomatic, or possibly less recognized.
- The most common cause of chronic low back pain in adolescent athletes.
- The presence of spondylolysis in an adult is likely an incidental finding in the absence of concurrent spondylolisthesis with instability.

Spondylolisthesis is probable following spondylolysis

Of those with spondylolysis

- 75% of six-year olds
- 50% of elite athletes

demonstrate some degree of spondylolisthesis

•*Fredrickson BE, Baker D, McHolick WJ, et al. The natural history of spondylolysis and spondylolisthesis. J Bone Joint Surg Am 1984;66:699–707*
•*Soler T, Calderon C. The prevalence of spondylolysis in the Spanish athlete. Am J Sports Med. 2000:28(1)57-62.*

Diving	57	23	40.35
Wrestling	80	20	25
Weight Lifting	112	25	22.32
Modern Pentathlon and Triathlon	54	11	20.37
Track/field	353	61	17.28
Sailing	128	22	17.18
Gymnastics	673	112	16.64
Football	400	65	16.25
Skiing	154	25	16.23
Judo and martial arts	64	10	15.62
Bobsleighing	36	5	13.88
Cycling	95	13	13.68
Fencing	143	19	13.28
Tennis	306	36	11.76
Canoeing	69	8	11.59
Water skiing	18	2	11.11
Boxing	27	3	11.11
Water polo, swimming, syncro.	307	34	11.07
Rugby	65	7	10.76
Volleyball	150	16	10.66
Shooting	76	8	10.52
Basketball	174	17	9.77
Luge	25	2	8
Rowing	246	19	7.72
Ice and field hockey	170	13	7.64
Handball	42	3	7.5
Ice skating	42	3	7.14
Equestrian	83	5	6.02
Golf	38	2	5.26
Baseball	21	1	4.76
Archery	26	0	0
Motorcycling	8	0	0
Table tennis	1	0	0

Spondylolysis Presentation

- Most patients are asymptomatic.
- Chronic axial low back pain that is provoked by activity-especially repetitive extension, rotation, or axial loading
- Relieved by rest.
- Slow progressive symptoms.
- The diagnosis should be considered in every adolescent athlete who presents with low back pain.

Clinical Findings

- Tenderness to palpation over the affected spinous process or that of the superior vertebra.
- Range of motion testing will likely provoke symptoms with hyperextension.
- Chronic myofascial involvement.
- Neurologic findings are characteristically absent.

- High-grade slips may demonstrate a “step off” deformity between the spinous processes

Kemp's

Spring Test/ PA Shear

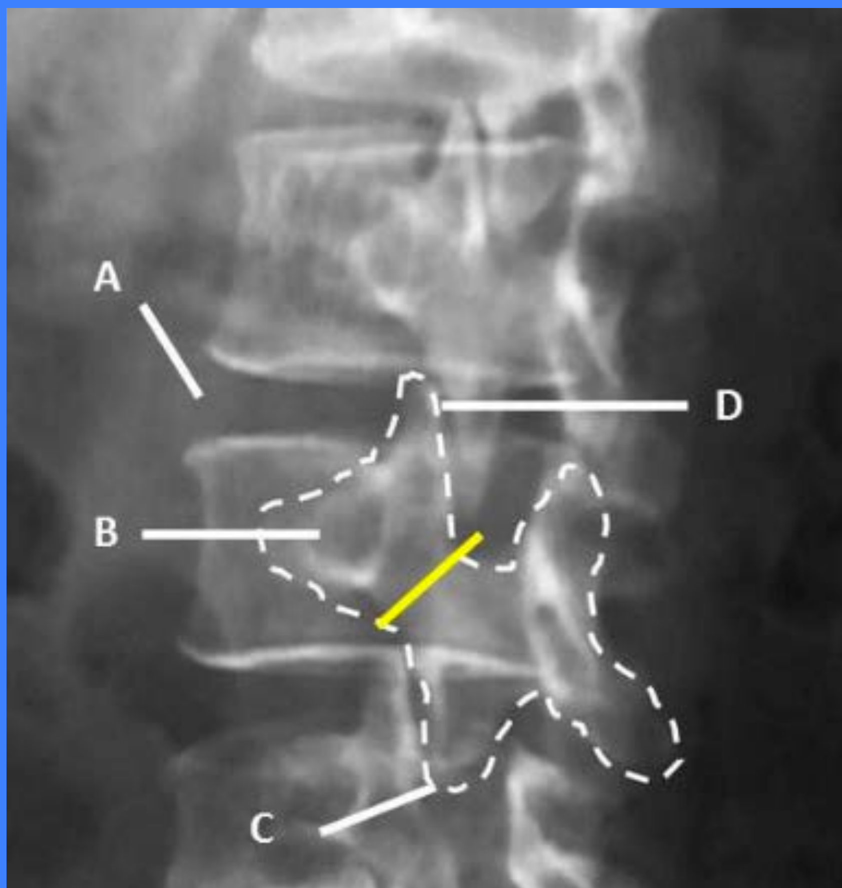
One Legged Hyperextension

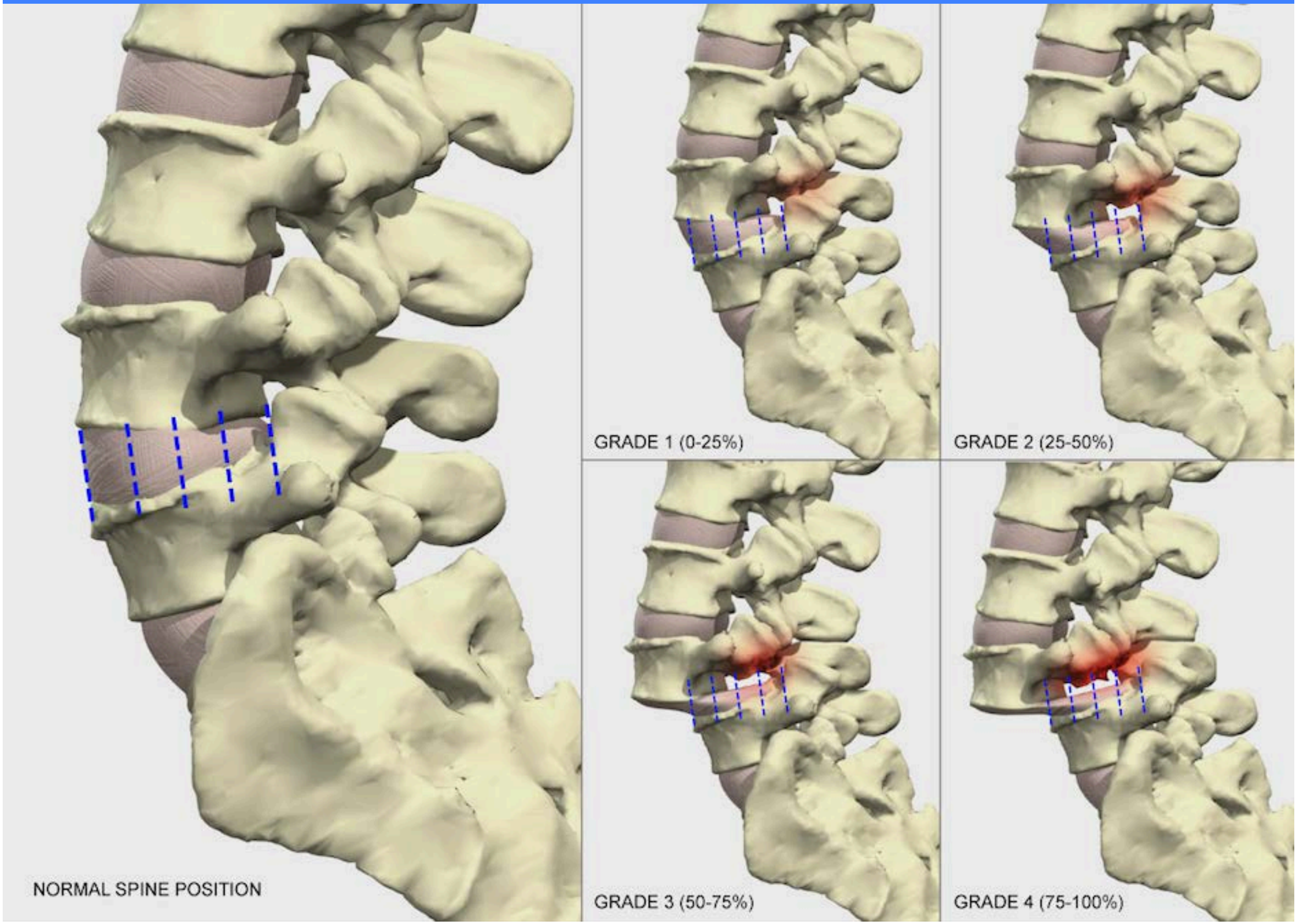
- The patient stands on one leg and leans backward. Reproduction of pain raises suspicion for posterior element pathology including spondylolysis/ spondylolisthesis. Unilateral lesions often produce pain standing on the ipsilateral leg. (AKA Stork Test)

Prone Instability Test

- The patient lies prone on the exam table with their legs over the edge, feet on the floor. The clinician applies a posterior-to-anterior shearing force (PA Shear Test) to each lumbar level, and notes pain provocation. The patient then lifts their legs off the floor and the clinician repeats the PA shear over any segments that were identified as painful. Symptoms that disappear when the test is performed with the legs lifted, suggest segmental instability.

Imaging Spondylolysis

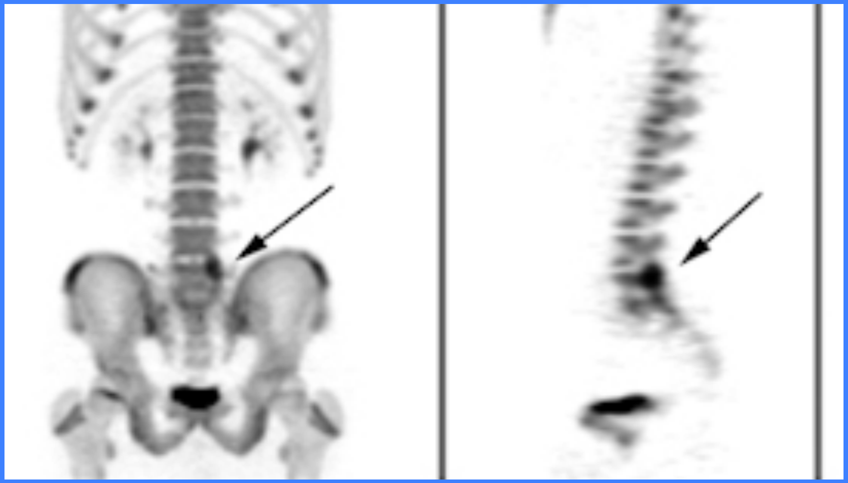



GRADE 1 (0-25%)
GRADE 2 (25-50%)
NORMAL SPINE POSITION
GRADE 3 (50-75%)
GRADE 4 (75-100%)

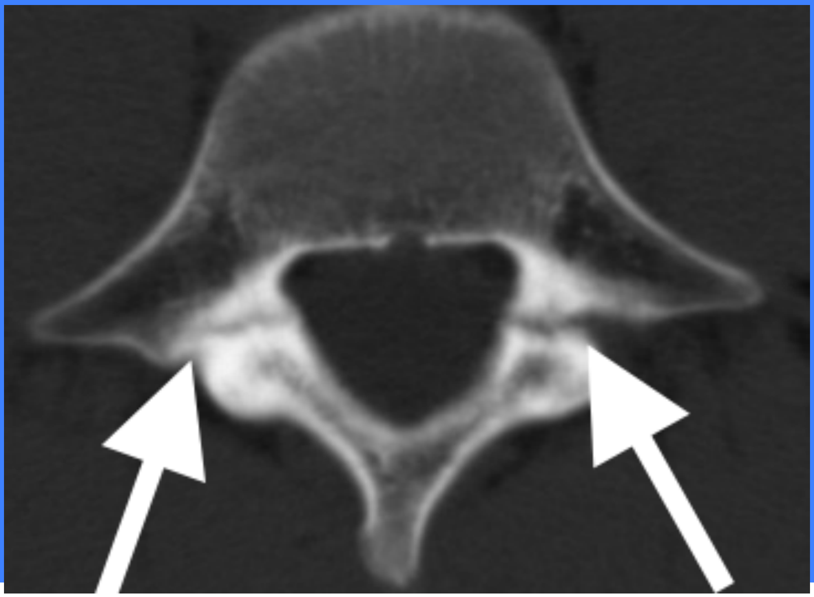
Advanced Imaging

Negative plain films with lingering suspicion:

- SPECT bone scan



- Thin cut CT through area of concern



Management

Active

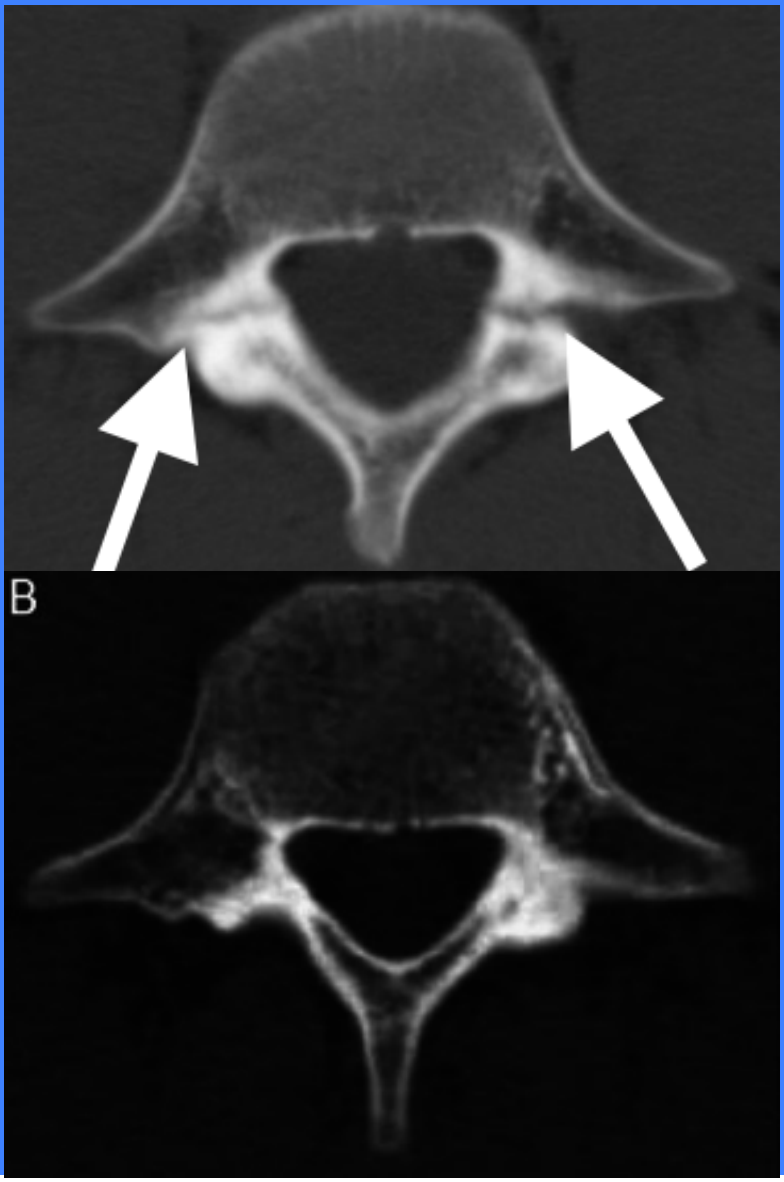
- Rest- up to 3 months
- Bracing ???
- ADL counseling on; posture, proper lifting technique, weight loss, aerobic exercise, mattress selection, sleep position to avoid stomach sleeping, limit hyperextension movements, and avoid wearing high heels

Inactive

- Limited Hyperextension
- Low impact aerobic activity
- Stability Training
- Manipulation- adjacent

Rest

- Active- 3 months
- Impending- 6-12 weeks
- Inactive- less important



Bracing Considerations

Benefits

- Activity restriction

Concerns

- Increase L5-S1 stress
- Compliance for 3-6 months
- Cost

Up to 80% of patients with spondylolysis responded favorably to spinal manipulation.

Cassidy JD, Potter GE, Kirkaldy-Willis WH. Manipulative management of back pain in patients with spondylolisthesis. J Can Chiropr Assoc. 1978;22:15.

Ventura JM, Justice BD. Need for multiple diagnoses in the presence of spondylolisthesis. JMPT. 1988;11:41–42.

Rehab

- Low impact aerobic training
- Flexion based program that limits extension and promotes an anti-lordotic posture
- Stretch hamstrings, hip flexors, L/S erectors
- Strengthen abdomen and core

Return to activity

Grade I

- full pain-free range of motion
- normal strength
- appropriate aerobic fitness
- adequate spinal awareness of mechanics
- ability to perform sports-related skills without pain

Grade II- IV

- avoid repetitive loading in hyperextension
- may require long-term activity limitations

Lonner BS, Song EW, Scharf CL, Yao J. Reduction of high-grade isthmic and dysplastic spondylolisthesis in 5 adolescents. Am J Orthop (Belle Mead NJ). Jul 2007;36(7):367-73.

Surgical Indications

- high-grade slip (>50%)
- slip progression
- neurologic deficit
- unresponsive to a prolonged (6month) course of conservative treatment

•*Agabegi SS, Fischgrund JS, Contemporary management of isthmic spondylolisthesis: pediatric and adult. The Spine Journal 10 (2010) 530–543*

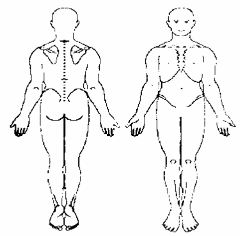
•*Kalichman L, Hunter DJ. Diagnosis and conservative management of degenerative lumbar spondylolisthesis. Eur Spine J. Mar 2008;17(3):327-35..*

•*Moller H, Hedlund R. Surgery versus conservative management in adult isthmic spondylolisthesis: a prospective randomized study: part 1. Spine 2000;25:1711–5.*

Case Study

- 36 y/o male with 3 month history of LBP after a long weekend of golf. Feels like he has a "hitch". Pain radiates to the right buttock. Increases with activity. Alleviated with OTC meds. Constant dull discomfort with sharper pain upon movement. VAS=3-6/10. Third episode in past 6 years.

Problem #



O:

P↑:

p↓:

Q:

Dx:

Comments:

Lumbar Spine		Initial Eval	Re-Exam 1	Re-Exam 2	Re-Exam 3
Date					
VAS					
Oswestry					
% Subjective Improvement					
Subjective Complaints					
ROM					
Flexion / 60					
Extension / 25					
Left Lat Flex / 25					
Right Lat Flex / 25					
Directional Preference					
Orthopedic					
Disc	SLR				
	WLR				
	Braggard				
	Slump Test				
	Milgrams				
	Valsalva				
Facet	Spring Test/ PA Shear				
	Segmental Rotation				
Stenosis	Kemp's				
	Yeoman				
	Nachalas				
	Sphinx				
S-lysis	One Leg Hyperextension				
	ASLR				
	Posterior Instability Test				
SI	SI Distraction				
	SI Compression				
	Sacral Thrust				
	Thigh Thrust				
Hip	Thomas				
	FABER				
	FADIR				
	C-Sign				
Neurologic					
Dermatomes					
Myotomes					
Reflex					
Mensuration					
Palpation					
Tenderness					
Intersegmental Restriction					
Gait, Posture & Function HAB Weakness Lower Crossed Breathing Evaluation Foot Hyperpronation					
Plan			O R R S	O R R S	O R R S
Treatments		/ Visits	/ Visits	/ Visits	/ Visits
Time Frame		weeks	weeks	weeks	weeks
Treatment Outcome Goal		%	%	%	%

Lumbar ROM

Flexion	60
Extension	30
Left Lat Flexion	25
Right Lat Flexion	25

- Spinal range of motion may be assessed by visual estimate, long-arm goniometer, or dual inclinometer. The referenced values are averages and “normal” ROM’s may vary between patients.

Level	Root	Sensory	Motor	Reflex
L2/3	L2	Just below groin crease		
L3/4	L3	Anterior thigh to the medial knee		
L4/5	L4	Lateral hip, Anterior thigh & leg	Quad extension (Single raise squat)	Patella
L5/S1	L5	Posterolateral thigh & leg, dorsum of the foot	Great toe dorsiflexion (Heel walk)	Medial Hamstring
S1/2	S1	Posterior thigh & leg and lateral foot	Plantarflexion (Toe walk)	Achilles

Neuro Grading

Motor function

- Grade 0: Total paralysis
- Grade 1: Palpable or visible contraction
- Grade 2: Full range of motion with gravity eliminated
- Grade 3: Full range of motion against gravity
- Grade 4: Full range of motion with decreased strength
- Grade 5: Normal strength

Reflexes

- 0: Absent
- 1+: sluggish
- 2+: normal
- 3+: brisk
- 4+: sustained clonus

Sensation

- Normal, impaired, or absent

Pathologic Reflexes

- Ankle clonus
- Babinski sign
- Hoffman sign
- Lhermitte's test

American College of Physicians (ACP) & American Pain Society (APS) Guidelines for Imaging LBP

Imaging is appropriate for patients with:

- Severe or progressive neurologic deficits
- History of prior lumbar surgery
- Suspected congenital deficit or instability
- Those whose pain is unusually severe, progressive, prolonged or unaffected by position
- Signs or symptoms that suggest a serious or specific underlying condition (Red Flags)

LBP "Red Flags"

History of:

- Cancer
- Recent unexplained weight loss
- Bone disease, i.e. osteoporosis
- Systemic disease
- Inflammatory arthropathy
- Corticosteroid use
- Immune suppression
- Fever, chills, night sweats
- Recent infection or surgery
- Nocturnal pain

Advanced Imaging of LBP

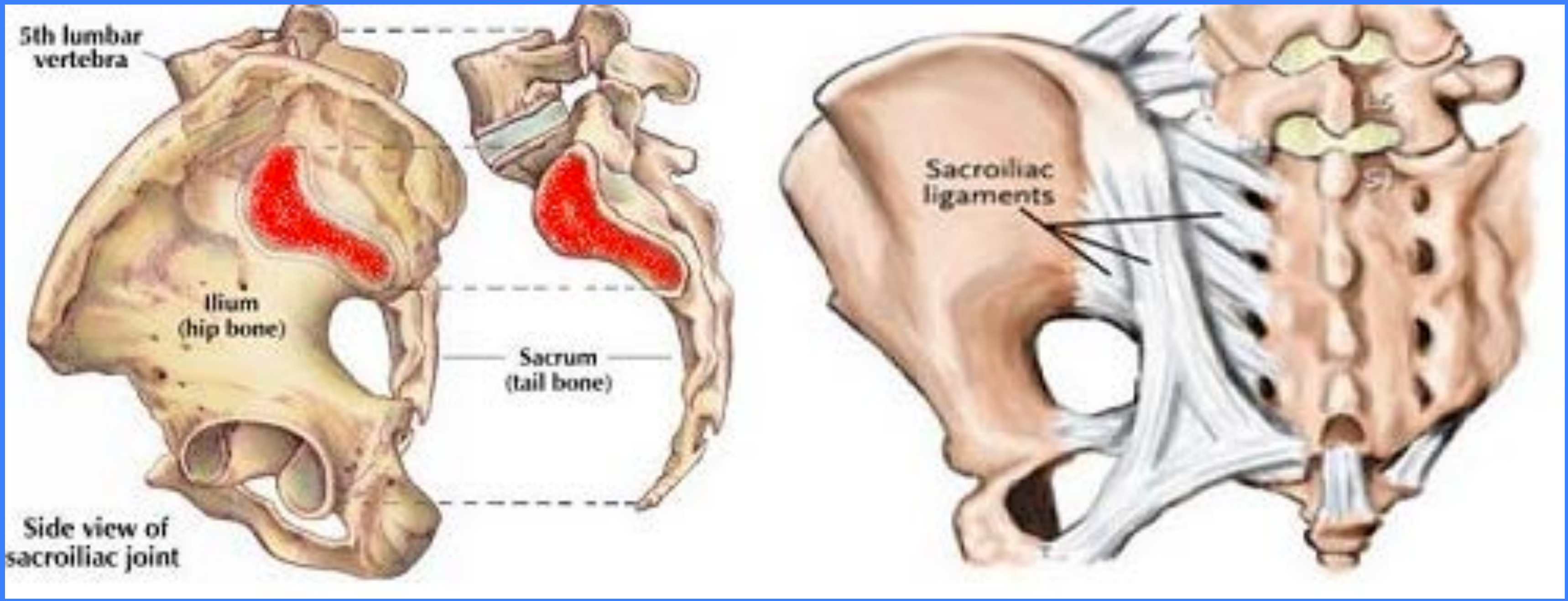
Reserved for patients with:

- Radicular complaints who are potential candidates for surgery or epidural steroid injections <u>and</u> only when the results of the test are likely to affect clinic decision making.
- Patients with a history of red flags, major trauma, severe neurologic compromise, or suspicion of vertebral infection

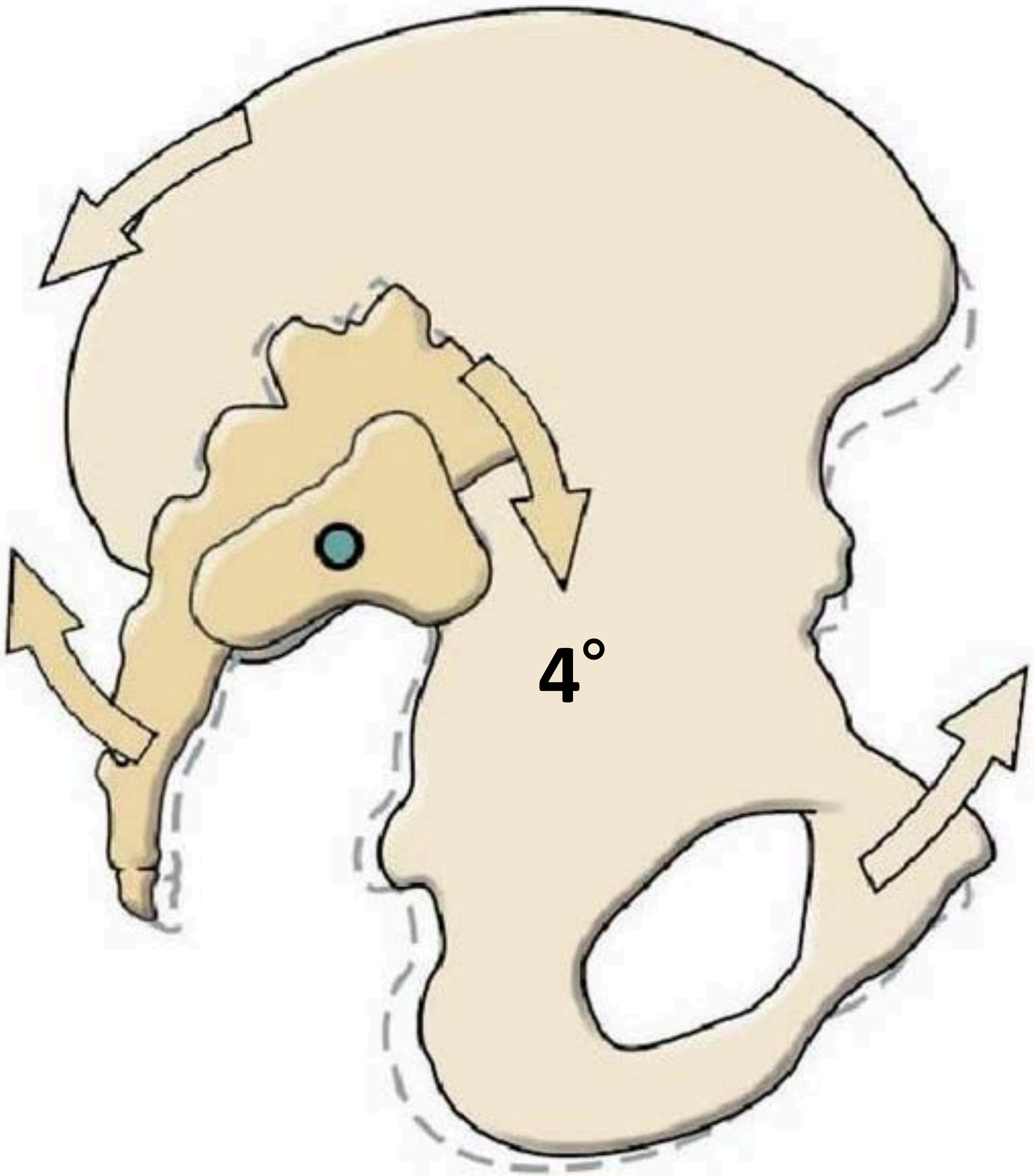
Differential Diagnosis of LBP

- ISJD, sprain/strain, disc lesion, DJD/DDD, myofascial pain, spondylolysis, spondylolisthesis, fracture, compression fracture, stenosis, DISH, neoplasm, infection, rheumatologic disease, inflammatory arthropathy, sacroiliac joint dysfunction, hip pathology/ osteoarthritis, peripheral neuropathy, piriformis syndrome, hip or knee pathology, herpes zoster, abdominal aortic aneurysm and referred pain- particularly from the gastrointestinal or genitourinary systems.

Lumbar vs. Sacroiliac



Nutation

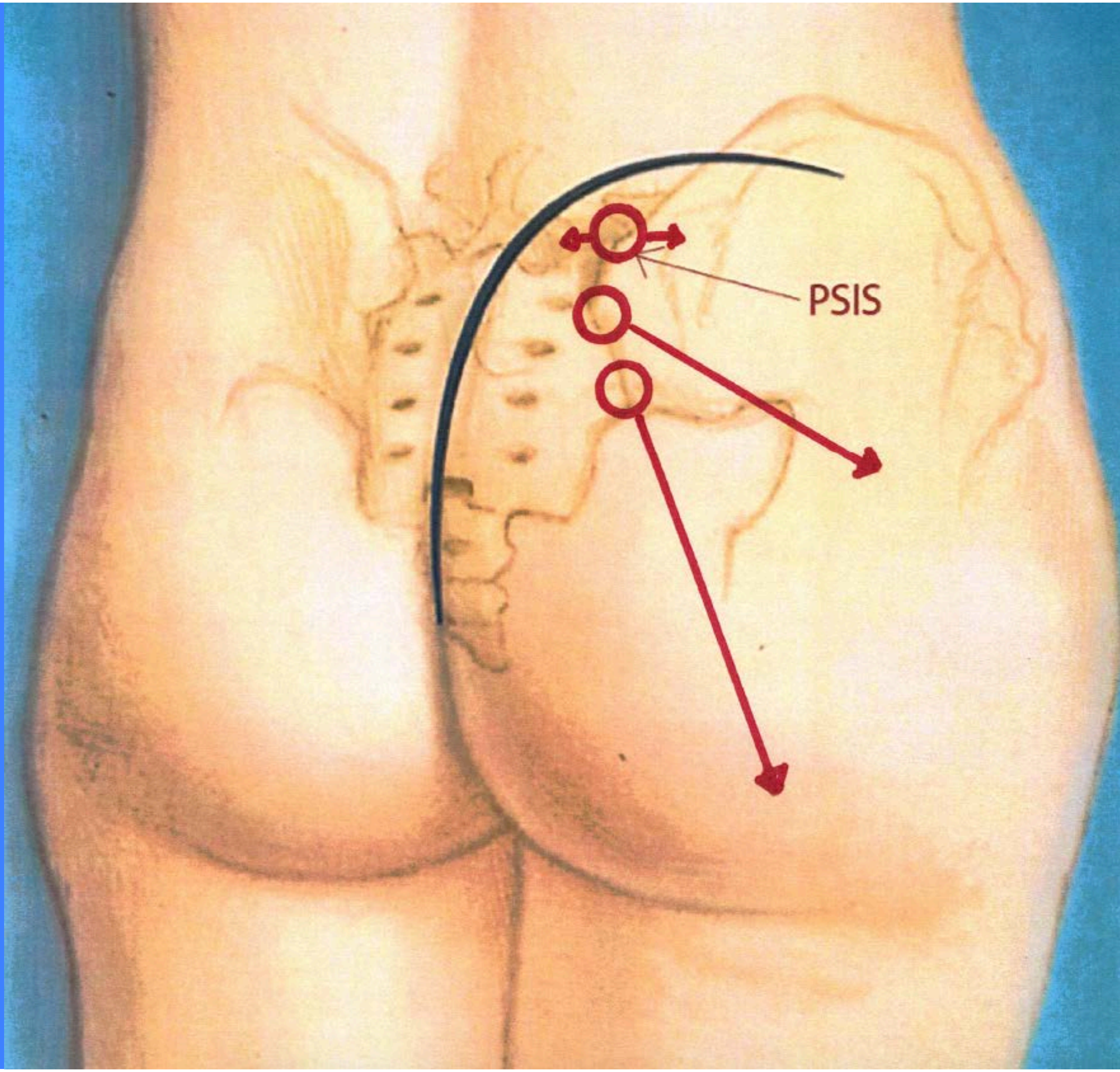


Precipitating Factors

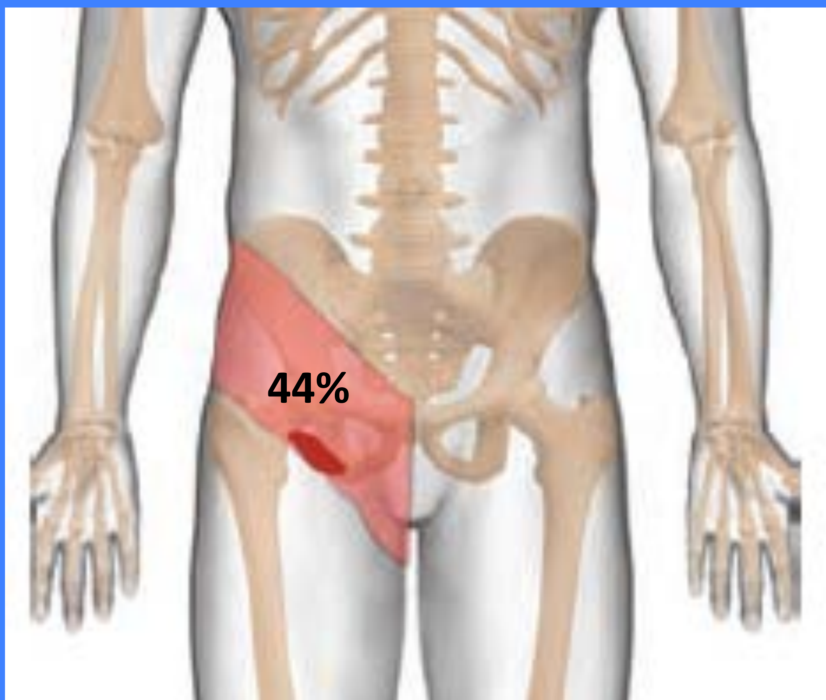
- Pregnancy
- Gait abnormalities
- Leg length inequalities
- Pes planus/ Hyperpronation
- Improper shoes
- Lower extremity joint pain
- Scoliosis
- Prior lumbar fusion
- Lumbopelvic myofascial dysfunction

Sacroiliac Joint Symptoms

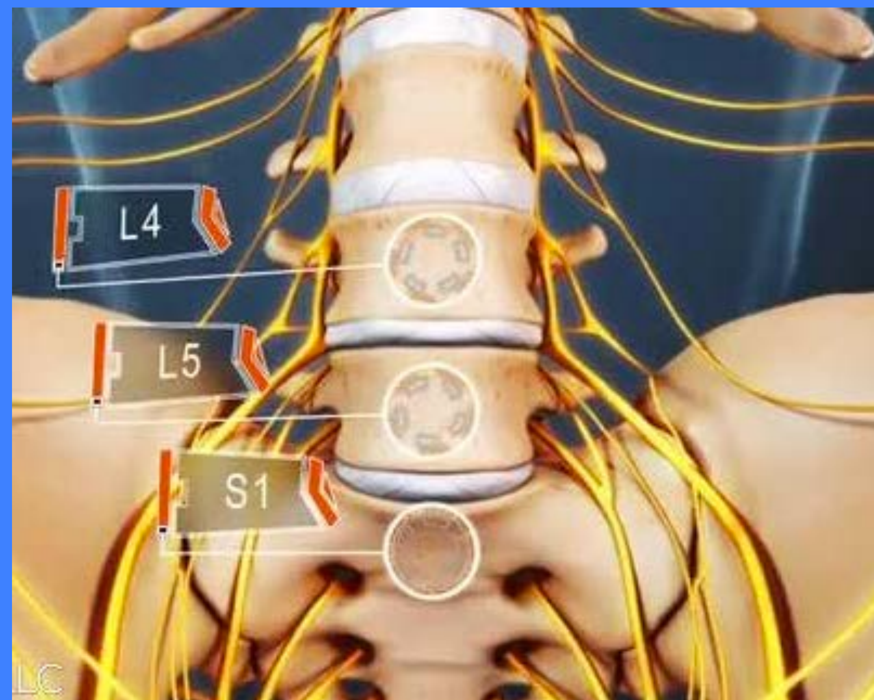
- PSIS Pain
- Referral to the lower back, buttock, thigh


PSIS

Groin pain & Sciatic Referral



Kurosawa D, Murakami E, Aizawa T. Referred pain location depends on the affected section of the sacroiliac joint. Eur Spine J. 2015 Mar;24(3):521-7.



Fortin JD, Washington WJ, Falco FJE. Three pathways between the sacroiliac joint and neural structures. AJNR. 1999;20:1429–1434.

Provocative

- Exacerbated by bearing weight on the affected leg
- Provoked by arising from a seated position, long car rides, transferring in and out of a vehicle, rolling from side to side in bed or by standing flexion
- Standing or walking

Palliative

- Relieved by shifting weight to the unaffected leg
- Relieved by lying down

Sacroiliac Joint Assessment

- SI distraction
- Thigh thrust (aka P4)
- SI compression
- Sacral thrust
- Gaenslen's

SI Distraction

- Performed on a supine patient by clinician applying simultaneous posterior directed force to patient's ASIS's with straightened arms. This test is thought to distract the anterior SI joint. Reproduction of SI complaints is a positive test.

SI Compression

- Test performed on a side lying patient in the fetal position. Clinician applies a downward compressive force to the uppermost iliac crest. Reproduction of SI complaints is a positive test.

Sacral Thrust

- Clinician applies a P to A force over the prone patients sacrum. This is thought to create a shearing force to the SI joints. Reproduction of SI complaints is a positive test.

Thigh Thrust

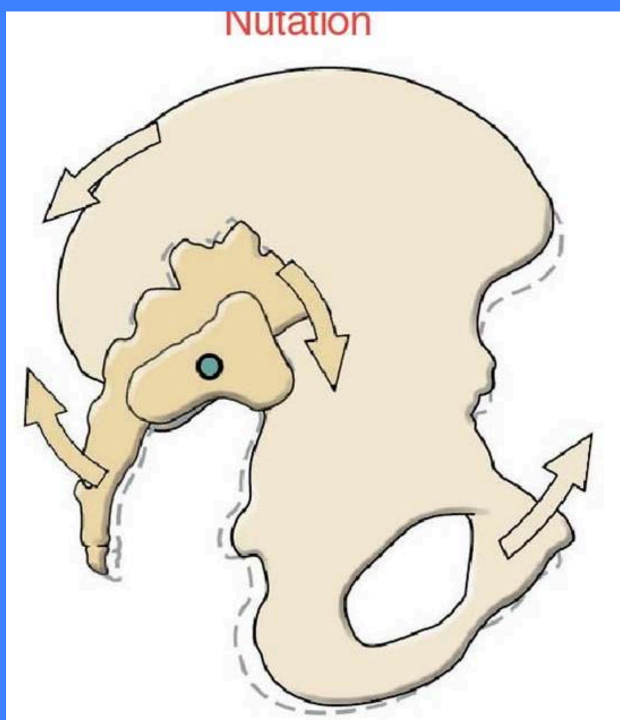
- Performed on a supine patient with hip and knee flexed to 90 degrees, thigh slightly adducted. Clinician places one hand beneath the patient's sacrum and the other contacts the knee as a downward force is applied to create shearing of the SI joint. Reproduction of SI complaints is a positive test.

Gaenslen's

- The test is performed on a supine patient who is lying on the edge of a table with one leg hanging off and the other leg in a knee-to chest position. The clinician applies overpressure to the flexed side and downward pressure on the overhanging thigh. The test is repeated on the opposite side. Reproduction of SI complaints is a positive test.

Gillet

- While standing behind the upright patient, the clinician places one thumb over the SI joint to be tested and the other thumb over the patient's S2 spinous process. The patient then flexes their affected hip beyond 90 degrees, moving their knee toward their chest. The PSIS should move inferior and laterally relative to the sacrum. A loss of this expected motion is a positive test suggesting sacroiliac dysfunction. Both sides should be tested and compared.


Nutation

Lumbar vs. Hip

- Hip OA/ Pathology
- Femoroacetabular Impingement (FAI)
- Labral Injury
- Iliopsoas Tendinopathy
- Greater Trochanteric Pain Syndrome
- Fracture, Infection, Neoplasm
- Inflammatory Arthropathy
- Slipped Capital Femoral Epiphysis (SCFE)
- Avascular Necrosis (LCP)

Hip Complaints

- Groin Crease Pain
- Buttock and thigh pain
- Hip Stiffness (morning)
- Exacerbated by prolonged periods of sitting, stair climbing, or stressful activity
- Difficulty to put socks on, shave legs, or climb stairs
- Exiting a vehicle or swimming breast-stroke
- Hip Crepitus

C Sign

- Demonstrated when the patient describes the location of their hip pain by placing their index finger over the anterior aspect of the hip, near their ASIS, and their thumb over the posterior trochanteric region.

Hip Evaluation

- Limited Internal Rotation
- FABER
- FADIR
- Hip Scour
- Hip Quadrant

FABER

- The supine patients hip is flexed, abducted and externally rotated into a figure four position with their ankle resting just above their opposite knee. The clinician stabilizes the opposite ASIS and applies a pulsating downward force to the knee. FABER test is a generalized screening test that is routinely positive (88%) for most causes of hip pathology.

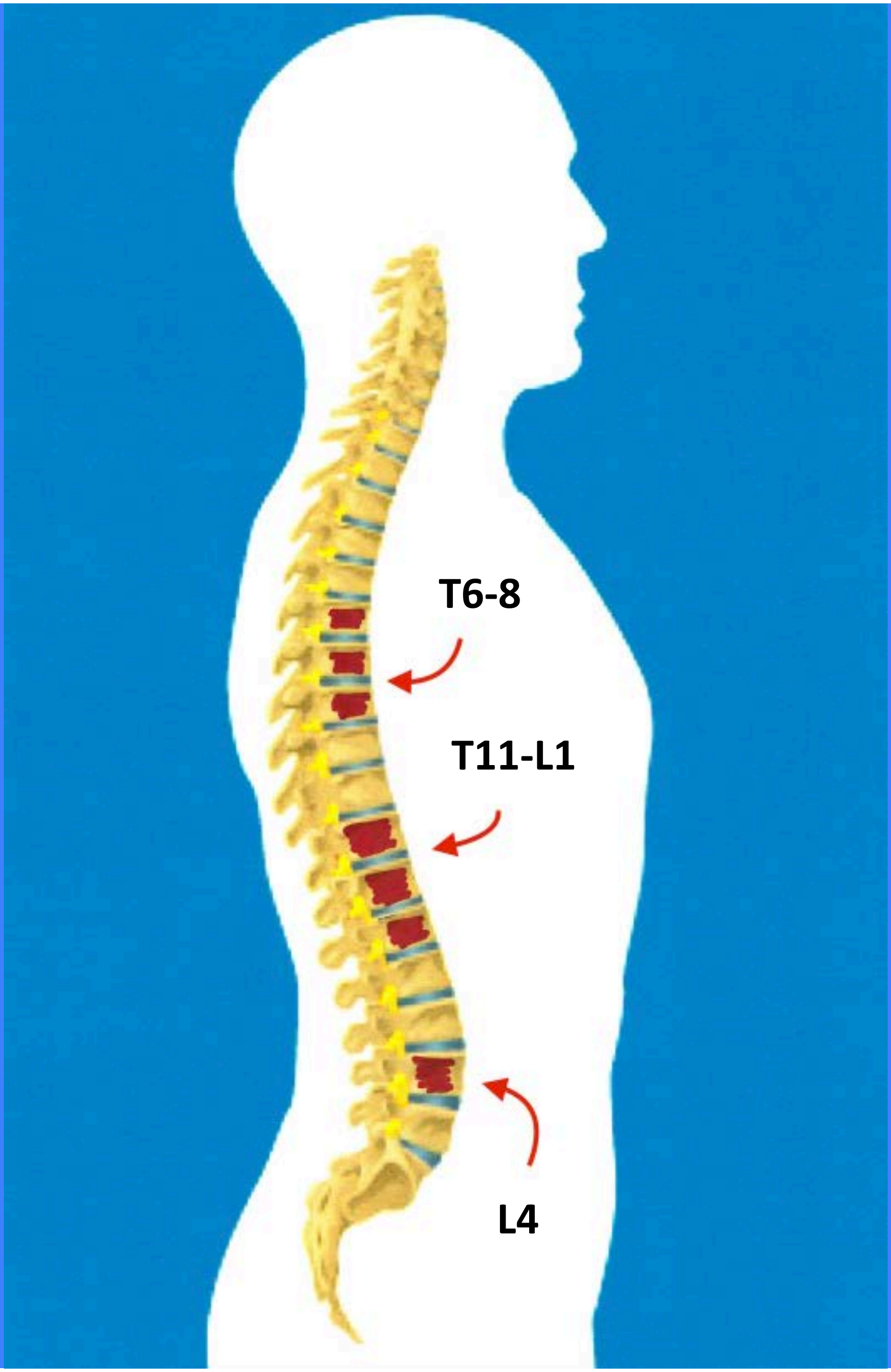
FADIR

- Performed with the patient lying supine. The clinician moves the thigh into 90 degrees of flexion, then adds adduction and internal rotation. This creates a shear force on the labrum and reproduction of hip pain during this maneuver suggests "cam" type hip impingement or labral tear. Reproduction of sciatic complaints may suggest piriformis syndrome. Sometimes called the "Pace sign" when positive. AKA Anterior Hip Impingement

Hip Scour

- The patient is supine with the examiner standing on the involved side. The clinician passively flexes the patient's hip to 90 degrees with the knee in full flexion. The clinician then adducts the hip and applies a downward force along the shaft of the femur while passively internally and externally rotating the hip. The clinician then passively abducts the hip and applies a downward force along the shaft of the femur while passively internally and externally rotating the hip. Any pain, apprehension, or unusual movement indicates a positive (non descript) sign for acetabular or labral pathology.

Lumbar Compression Fracture

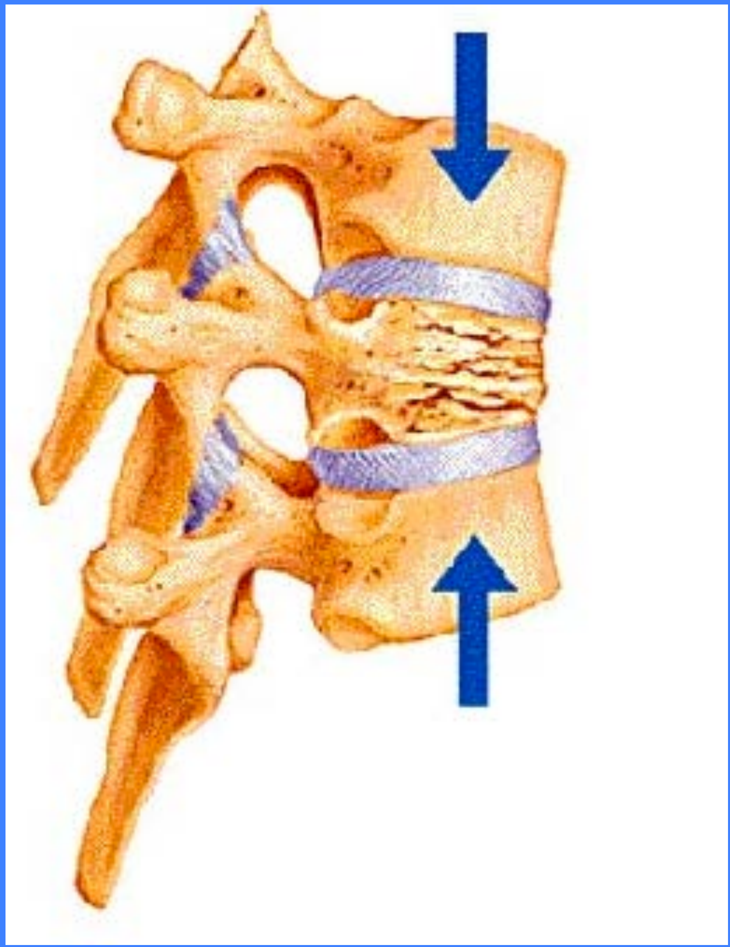

T6-8
T11-L1
L4

OVCF Risk Factors

- Age
- Female gender
- Prior OVCF
- Prior vertebroplasty/ kyphoplasty
- Scoliosis
- Family history of osteoporosis
- Low body weight/ recent weight loss
- Smoking
- Sedentary lifestyle
- Poor dietary choices; inadequate calcium or Vitamin D intake, excessive alcohol or caffeine intake

OVCF Presentation

- Variable Trauma
- 23-33% Symptomatic
- "Aching"- Stabbing" axial back pain
- Non-radicular, referred pain to the ribs, hip, groin, or buttocks is present in the majority of cases



OVCF Evaluation

- Increased thoracic kyphosis, or loss of lumbar lordosis
- Noticeable loss of overall height
- Fingertips extend to the lower thigh when standing
- Limited ROM
- Tenderness to palpation
- Seated Closed Fist Percussion
- Supine sign

Supine Sign

- The patient is asked to lie supine on an exam table with only one pillow supporting their head. The inability to lie in this position due to pain has relatively high sensitivity and specificity for vertebral compression fracture.

Heel Drop Test

- The patient is asked to stand on their toes and abruptly drop down onto their heels in a jarring fashion. The Heel Drop Test may increase pain originating from a vertebral compression fracture or peritoneal inflammation i.e. appendicitis. AKA Markle test.

Closed Fist Percussion

- The clinician percusses the seated patients spine with the fleshy aspect of their closed fist. Reproduction of acute pain has a high sensitivity and specificity for vertebral compression fracture.

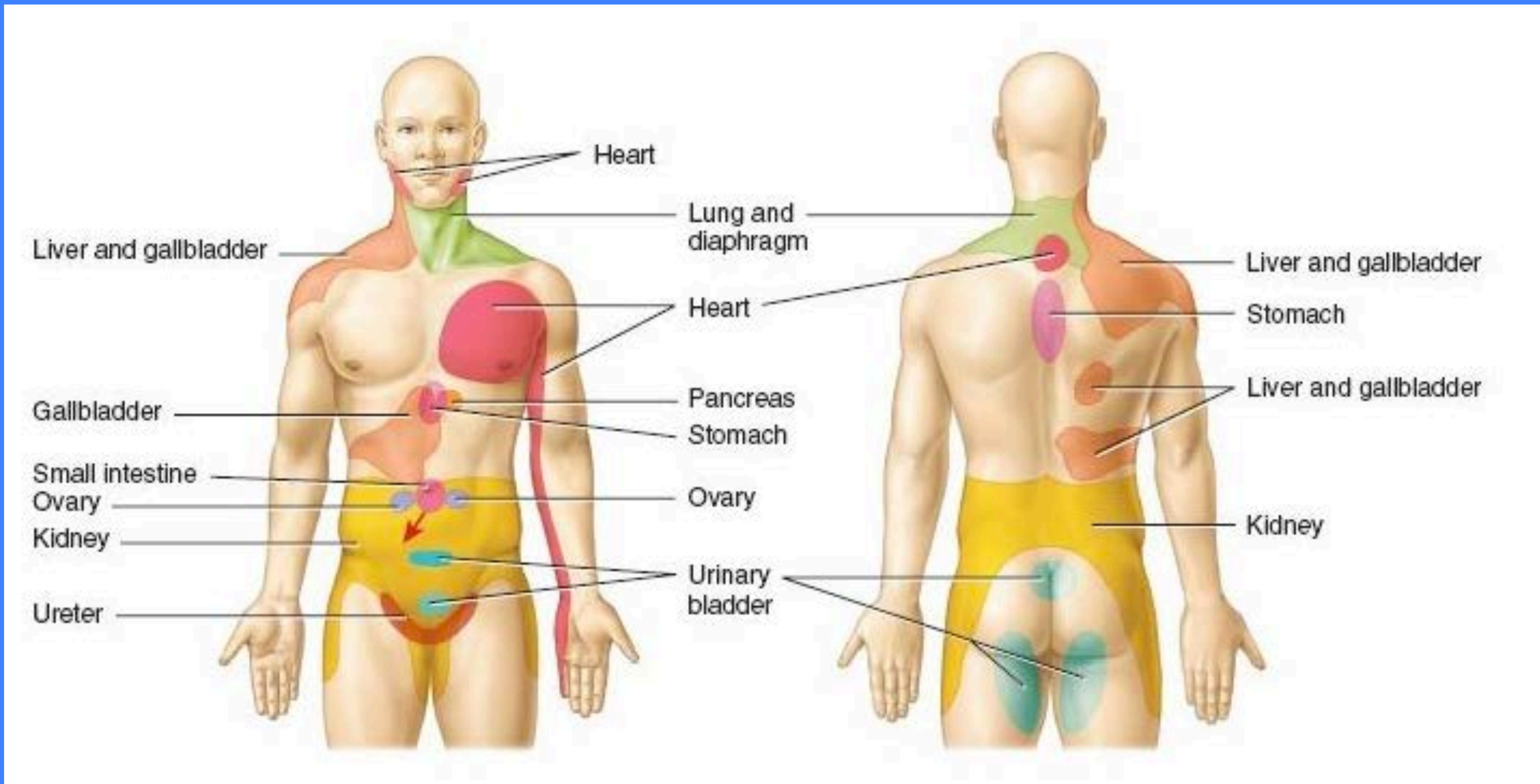
DEXA

1.0 - 2.5=
Osteopenia
> 2.5=
Osteoporosis


a

"Your X-ray showed a broken vertebrae, but we fixed it with Photoshop"

Lumbar vs. Viscerosomatic Referral



The phenomenon of referred pain is secondary to the convergence of visceral afferent (sensory) nerve fibers entering the spinal cord at the same level as the superficial, somatic structures experiencing the pain. This leads to a misinterpretation of incoming signals by higher brain centers.

Vecchiet L; et al.. "Pain from renal/ureteral calculosis: evaluation of sensory thresholds in the lumbar area". Pain 1989. 36: 289–295.

Cervero F" Gut 2000; 47:56–57

Visceral Referred Pain Characteristics

- Insidious onset
- Continuous
- Not Provoked by movement
- Local symptoms are vague, diffuse, poorly defined
- Spans from midline to body wall
- Referred pain may be sharper and more defined
- Accompanied by motor and ANS reflexes: muscle guarding, pallor, sweating, nausea, vomiting, anxiety

Sensory characteristics of visceral pain and related mechanism

Psychophysics	Neurobiology
Not evoked from all viscera	Not all viscera are innervated by "sensory" receptors
Not linked to injury	Functional properties of visceral "sensory" afferents
Referred to body wall	Viscerosomatic convergence in central pain pathways
Diffuse and poorly localised	Few "sensory" visceral afferents. Extensive divergence in central nervous system
Intense motor and autonomic reactions	Mainly a warning system, with a substantial capacity for amplification

Cervero, Fernando et al. Visceral pain. The Lancet , Volume 353 , Issue 9170 , 2145 - 2148

Lumbar vs. Rheumatologic Disease

Disease	Typical age of onset	M:F Ratio (Prevelance /100K US population)	Typical Sites of Involvement	Clinical Manifestations	Lab Diagnosis (in addition to CBC with differential, UA, CRP & ESR)
Rheumatoid Arthritis *Chronic destructive autoimmune synovitis*	40-50 years	1:3 (500/100K)	Bilateral & symmetrical: small joints of the hand (PIP, MCP), wrist, elbow, knee, & foot (MTP),	Morning stiffness, warm, tender, swollen joints, provoked by inactivity, subcutaneous nodules. Associated with Sjogrens syndrome (dry mucous membranes)	RA factor, anti-CCP antibody test
Ankylosing Spondylitis *Chronic joint inflammation leading to bony fusion*	20-40 years	3:1 (130/100K)	Symmetric sacroiliitis, lumbar and lower thoracic spine, ribs, asymmetric lower extremities	Intermittant LBP and stiffness provoked by inactivity, night time pain, aortic regurgitation	HLA B27 (90%)
Psoriatic Arthritis *Inflammatory artritis preceeded by psoriasis*	35-45 years	1:1 (100/100K)	Asymmetric hands, wrists, ankles, feet, sacroiliitis, cervical spine, DIP joint	Psoriasis, enthesitis, dactylitis (sausage appearance), nail dystrophy	HLA B27 (40%)
Reactive Arthritis/ Reiters syndrome *Reaction secondary to enteric infection or UTI*	20-40 years	5:1 (35/100K)	Asymmetric sacroiliitis, lumbar spine and lower extremities	Nearly clinically identical to AS, provoked by inactivity, inflammation of the; joints, urinary tract and eyes, ulcerations of the skin and mouth enthesitis, dactylitis, uveitis, aortic regurgitation, "flu-like" symptoms	HLA B27 (80%)
Enteropathic Arthritis *Chronic inflammatory arthropathy secondary to Crohns or UC*	Any age	1:1 (65/100K)	Symmetric sacroiliitis, lower extremities	Self-limiting but recurrent- correlating with bowel disease	HLA B27 (30%)
SLE *Chronic autoimmune disease of skin, joints and organs*	16-55	1:10 (45/100K)	Asymmetric fingers, hands, wrists and knees	Fatigue, headache, joint pain disproportionate to swelling, fever, "flu-like" symptoms, malar rash (50%), photosensitivity, hair loss, discoid lesions, migratory pattern, episodic. Associated with Sjogrens syndrome. 11 diagnostic criteria	Leukopenia, ANA, Sjogren's syndrome A, Sjogren's syndrome B antibodies
Scleroderma *Overproduction of collagen in skin and/or organs*	30-50	1:4 (25/ 100K)	"Localized" affects only skin, "Systemic"affects organs; esophagus, colon, lung, heart, kidneys	Raynauds, GERD, skin changes: thight, thickened or shiny skin (especially fingers and face)	
Lyme Disease *Bite from black-legged tick infected with Borrelia burgdorferi*	Bimodal age 5-19 and >30	1:1 (9/100K)	Polyarticular, knee	Initial "flu-like" symptoms beginning days or weeks post tick bite, expansile "bullseye" rash (75%), if untreated, episodic pain and swelling of joints. Late symptoms include; paresthesias, weakness, facial paralysis	ELISA for Lyme, Western blot
Septic Arthritis *Joint infection via puncture or spread from another body infection*	young & elderly (>65)	1:1 (8/100K)	Monoarticular, adults- knee, children- hip	Low-grade fever (40-60%), pain (75%), and impaired range of motion.	Joint aspiration & culture, blood culture
Gout *Uric acid crystals accumulate in and around joints*	>40	9:1 (500/100K)	Monoarticular, great toe, less commonly ankle or knee	Sudden, severe joint pain and swelling lasting days, tophaceous deposits at the helix of the ear or extensor surfaces of fingers	Uric acid in blood, joint aspiration
Pseudogout/ CPPD *CPPD crystals accumulate in joints*	>60	1:1 (130/100K)	Monoarticular, knee, less commonly ankle, wrist or elbow	Sudden, severe joint pain and swelling lasting days	Joint aspiration
Polymyalgia Rheumatica *Acute imflammatory myopathy*	70	1:2 (52/ 100K)	Hip and shoulder girdle	Rapid development of "flu-like" symptoms, especially myalgia and inactivity stiffness, limited range of motion, weakness, fever, weight loss. Associated with Giant cell arteritis (15% of cases).	ESR, CRP
Polymyositis *Chronic progressive inflammatory myopathy*	45-60	1:2 (<.8/100K)	Symmetrical skeletal muscles near trunk; hips, thighs, shoulders, upper arms and neck	Mild joint and muscle tenderness, fatigue and shortness of breath. Slowly progressive muscle weakness leading to difficulty moving swallowing or speaking. Dermatomyositis affects skin also.	CPK, urine myoglobin, serum aldolase, EMG/NCV and muscle biopsy

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Rheumatoid Arthritis (RA)

- Chronic synovial inflammatory autoimmune disorder that typically affects small joints in the hands and feet causing painful swelling and eventually bony erosion and joint deformity.
- The cause of RA is unknown
- RA can affect anyone, but is more common in middle-aged females.
- RA typically affects joints bilaterally and symmetrically.
- The disease often begins slowly with minor joint pain. Morning stiffness with warm, swollen, tender joints is common.
- The symptoms seem to be aggravated by inactivity.
- RA is often associated with Sjogern's syndrome (dry mucus membranes).
- RA specific lab work may include RA factor and anti-CCP antibody test.

Ankylosing Spondylitis (AS)

- Ankylosing spondylitis is a chronic inflammatory disorder of the spine and pelvis, particularly the sacroiliac joints.
- Affects 1 in 2000 persons
- The specific cause of AS is unknown, but a genetic factor seems to be present.
- The disease starts with intermittent lower back pain and stiffness following inactivity especially in the morning. Nighttime pain, which may wake the patient from sleep is common. The pain typically improves with light activity.
- Bony fusion usually begins in the sacroiliac joints but over time may involve part or all of the spine as well as the rib cage. Sacroiliac fusion will result in a "waddling" gait.
- Typical age of onset is 20-40 years, but it may begin before age 10.
- The male to female ratio is 3:1. It affects males more commonly and more severely than females.
- AS specific lab work includes HLA-B27, which is positive in 90% of AS patients.


L
R

Psoriatic Arthritis

- Psoriatic arthritis is an inflammatory arthropathy that affects approximately one in 20 psoriasis suffers. In most cases, psoriasis precedes the arthritis, but psoriatic arthritis may affect people who do not suffer with psoriasis.
- The cause of psoriatic arthritis is unknown, but a genetic component is suspected.
- Psoriatic arthritis has a variable presentation sometimes mildly affecting only the fingers and toes and other times, more severely affecting spinal joints, particularly the lumbar, sacroiliac and cervical regions.
- X-rays commonly show marginal erosions similar to those of rheumatoid arthritis.
- The disease is generally less symmetrical than rheumatoid arthritis.
- Typical age of onset is 35-45 years and has an equal male to female distribution.
- HLA-B27 is positive in 40% of psoriatic arthritis patients.

Reactive Arthritis/Reiter's Syndrome

- Reactive arthritis, formerly known as Reiter's syndrome, is an acute non-purulent arthritis secondary to enteric or urogenital infections.
- Reactive arthritis and ankylosing spondylitis may appear nearly identical clinically.
- Reactive arthritis commonly affects the sacroiliac joints, lumbar spine and lower extremities, asymmetrically.
- Three characteristic features of reactive arthritis are inflammation of the; joints, urinary tract and eyes. A fourth more recently recognized feature includes ulcerations of the skin and mouth.
- The disease often produces "flu like" symptoms include low-grade fever, malaise, myalgias and lower back pain.
- Symptoms increase with rest or inactivity. Most patients have severe symptoms lasting weeks to months. Approximately 15-50% have recurrent bouts, and chronic arthritis occurs in 15-30% of cases.
- Reactive arthritis primarily affects men between the ages of 20 and 40. It has a 5:1 male to female distribution. It rarely affects African Americans.
- HLA-B27 is positive in 80% of reactive arthritis patients.

Enteropathic Arthritis

- Enteropathic arthritis is a chronic inflammatory arthropathy associated with inflammatory bowel disease (IBD), the two most common of which are Ulcerative colitis and Crohn's disease.
- Approximately 20% of IBD sufferers will be affected with enteropathic arthritis.
- Although the exact mechanism is unknown, the disease is though to be triggered from abnormal bowel permeability allowing microorganisms to enter the blood stream, triggering an autoimmune arthropathy. This hypothesis is not confirmed.
- Symmetric involvement of the lower extremity is a common presentation.
- The severity of the disease often correlates with the course of the IBD. The disease is often self limiting, but recurrences are common.
- It does not seem to have a predilection for any specific age or gender.
- HLA-B27 is positive in 30% of enteropathic arthritis patients.

Systemic Lupus Erythematosus (SLE)

- SLE is a chronic autoimmune disorder affecting the skin joints and organs.
- The underlying cause of the disease is not fully understood.
- Symptoms vary from patient to patient and are often relapsing and remitting.
- Nearly all patients present with joint pain and swelling- typically involving the fingers, hands, wrists and knees.
- In contrast to rheumatoid arthritis, SLE may be asymmetrical with pain that is disproportionate to swelling.
- "Flu-like" symptoms often accompany new or recurrent SLE exacerbations.
- Three characteristic symptoms of SLE include; butterfly/ <u>malar rash</u> over the cheeks and nasal bridge (50% of cases), <u>photosensitivity</u> of the skin, <u>discoid lesions</u>- usually on sun-exposed areas.


Systemic Lupus Erythematosus (SLE)

(Cont)

- In total, there are 11 recognized diagnostic criteria of SLE. The presence of four of the 11 criteria yield a sensitivity of 85% and a specificity of 95% for SLE. The 11 diagnostic criteria include:
- Malar rash
- Discoid rash (erythematous raised-rimmed lesions with scarring) Patients who have only skin symptoms are diagnosed with “Discoid lupus”
- Photosenstivity
- Serositis (pleurisy or pericarditis)
- Oral ulcers
- Nonerosive arthritis affecting two or more peripheral joints
- Blood disorder (abnormal CBC)
- Abnormal urinalysis (proteinuria or cellular casts)
- Positive ANA
- Immunologic phenomena
- Neurologic disorders (seizures or psychosis),

Scleroderma

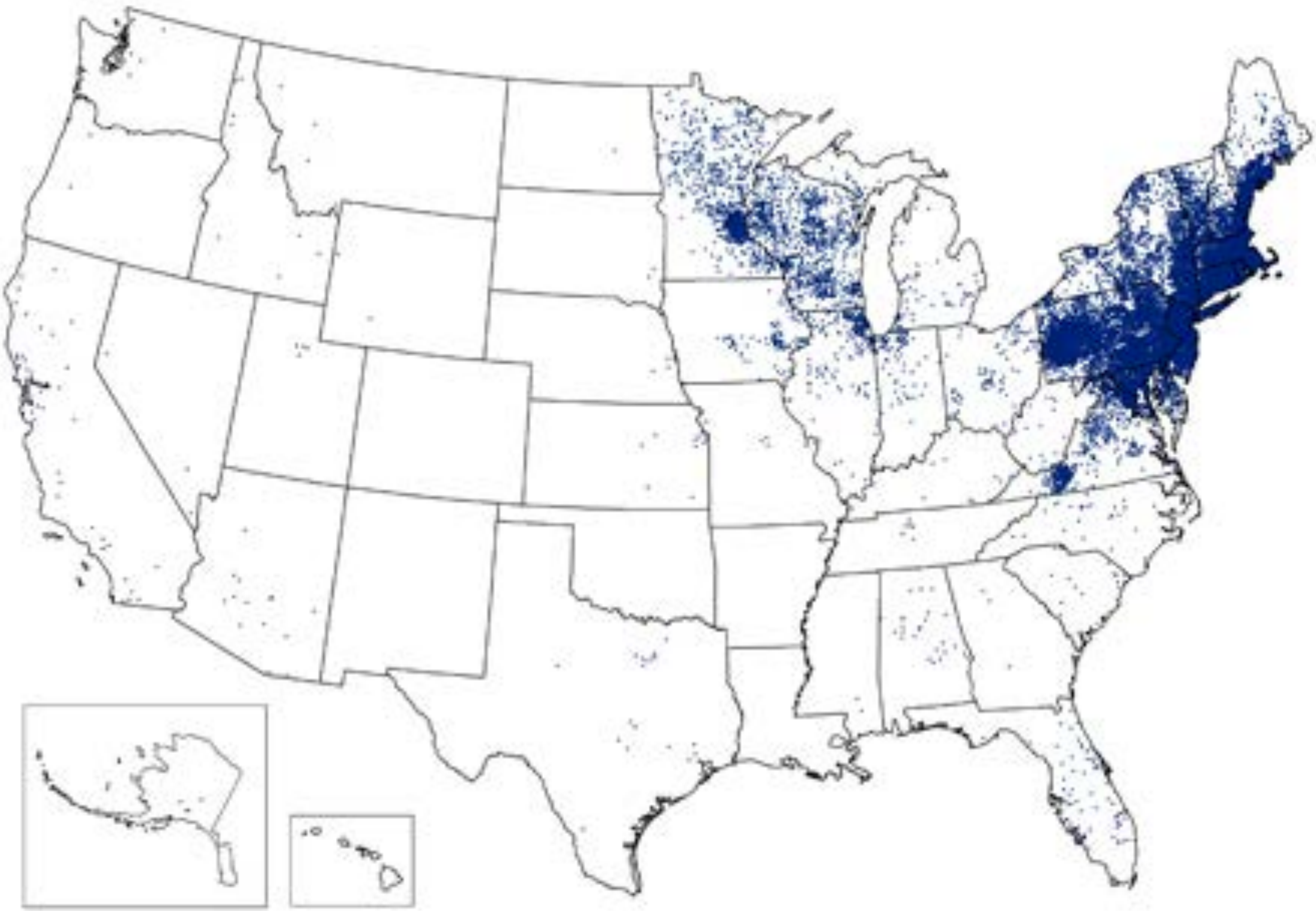
- Scleroderma or "systemic sclerosis" results from an overproduction and accumulation of collagen in body tissues. The disease may be "Localized"-affecting only the skin, or "Systemic"- affecting organs and vessels as well.
- The exact cause of scleroderma is unknown but an autoimmune mechanism is present.
- Scleroderma symptoms vary depending on which organ systems are affected, and diagnosis can be difficult because some of the early symptoms are non-specific to scleroderma. The most prevalent signs and symptoms of scleroderma include Raynaud's phenomenon, GERD and thickened, tight or shiny skin on the hands, face or mouth.
- Age of onset is typically between 30 and 50.
- The disease is four times more common in women than men and is more common in African Americans and Native Americans.
- One subtype of "Systemic" scleroderma is "CREST syndrome", also called "Limited scleroderma". Symptoms of this less aggressive variant include: Calcium deposition in connective tissue, Raynaud's phenomenon, Esophageal dysmotility/ GERD, Sclerodactyly-tight, thickened or shiny skin commonly affecting the fingers or toes, and Telangiectasis-red vascular lines on hands and face.

Scleroderma

Lyme Disease

- Lyme disease is caused by bites from tiny black-legged ticks infected with a bacteria called *Borrelia burgdorferi*. Lyme disease was first reported in the United States in the town of Old Lyme, Connecticut in 1975.
- Lyme disease infections have been reported in all 50 states but 95% of cases originate in 12 states: the Northeastern states from Virginia to Maine, the North central states, mostly Wisconsin and Minnesota and Northern California. In certain areas of New York where Lyme disease is common, over half of the ticks are infected.
- In most cases, a tick must be attached to your body for 24-36 hours to spread to the bacteria to your blood.
- Symptoms of early localized Lyme disease begin days or weeks after infection. Initial symptoms are similar to the flu, and 75% of the time will include a “bulls eye” rash with a flat or slightly raised red spot at the site of tick bite and a clear area in the center of the rash. The rash is often expansile and resolves without treatment in about a month.
- Early symptoms are relapsing and remitting but if left untreated, 60% of patients will eventually develop pain and swelling of the large joints. Lyme disease typically affects one or two joints at a time with the knee involved most commonly.
- Painful episodes are separated by periods of complete remission. Chronic Lyme disease may result in paresthesias, weakness, paralysis of facial muscles and difficulty speaking.
- The most commonly used Lyme-specific lab test is the ELISA for Lyme disease. A Western blot test is done to confirm ELISA results.

Reported Cases of Lyme Disease -- United States, 2014



1 dot placed randomly within county of residence for each confirmed case

Reported Cases of Lyme Disease -- United States, 2001

Septic Arthritis

- Septic arthritis is a joint infection secondary to an infection elsewhere in the body, most commonly, an upper respiratory tract or urinary tract infection. Less commonly, a puncture wound, drug injection or surgical puncture near a joint may precipitate the infection.
- Pathogens may be viral but are much more commonly bacterial. Bacterial septic arthritis is commonly classified as either gonococcal or non-gonococcal. Non-gonococcal arthritis is mostly commonly caused by staph or strep bacteria.
- Patients with an infected joint typically present with a triad of; low-grade fever (40-60%), pain (75%), and impaired range of motion. Symptoms may develop over a period of days to weeks.
- Young children and elderly are most likely to develop septic arthritis. 45% of septic arthritis patients are older than 65 years old.
- In adults, the knee is the most common site of infection, and in children, the hip joint is most likely to be affected.
- The following conditions are known risk factors for developing septic arthritis: arthroplasty, diabetes, rheumatoid arthritis, IV drug use, immunosuppressive therapy, recent joint injury or surgical procedure.
- Lab evaluation includes joint aspiration and culture as well as blood culture.

Gout

- Gout is a complex form of arthritis characterized by sudden, severe attacks of pain and swelling in joints-most commonly the great toe. Gout occurs when excess uric acid accumulates in the body. This may occur because of increased uric acid production or the inability for the kidneys to clear uric acid from the blood stream. Over time, increased uric acid levels in the blood lead to deposits of monosodium urate crystals in and around the joints. These crystals can provoke severe painful gout attacks.
- Certain foods, that are rich in purines such as anchovies, sardines, shell fish, red meat, organ meat, and alcohol may increase uric acid levels and precipitate gout attacks.
- Symptoms are generally monoarticular and most commonly involve the great toe and less commonly the knee or ankle joints.
- The pain of gout often starts suddenly and is described as crushing or excruciating. Joint palpation will reveal exquisite tenderness, warmth and swelling. Initial attacks may last for days.
- Half of first-time gout patients will suffer a subsequent attack, and additional attacks often last longer.
- Gout is more common in men than women.
- Comorbidities, including hypertension, diabetes, renal insufficiency, elevated triglycerides or cholesterol, diabetes, obesity, and early menopause, are associated with a higher incidence of gout.
- Lab tests to determine the presence of gout include synovial fluid analysis demonstrating the presence of uric acid crystals and high uric acid levels in the blood, although not everyone with high uric acid levels in the blood will suffer from gout.

Pseudogout/CPPD

- Pseudogout or Calcium Pyrophosphate Dihydrate (CPPD) crystal deposition disease is characterized by sudden painful swelling in one or more joints.
- Pseudogout is aptly named because of its similarity to gout. Gout is caused by uric acid crystals. Pseudogout is caused by calcium pyrophosphate crystals accumulating in joints.
- While gout has a tendency to affect the great toe, pseudogout typically affects the knees but may also develop in ankles, wrists and elbows.
- Symptoms include severe pain, warmth and swelling of a joint.
- Pseudogout typically occurs in older adults and affects men and women equally.

Polymyalgia Rheumatica (PMR)

- Polymyalgia Rheumatica is an inflammatory disorder that causes muscle pain and stiffness, primarily involving the proximal limb regions.
- Its cause is unknown, but the disease often co-exists with Giant-cell arteritis. Polymyalgia rheumatica and Giant-cell arteritis may in fact be variations of the same disease since there is significant overlap and concurrence.
- Symptoms of polymyalgia rheumatica include “flu-like” aches and pains involving the shoulders, neck, trunk, back and hips. Fever, weakness, myalgia, inactivity stiffness and limited range of motion are common.
- PMR occurs in older adults and very rarely in people younger than age 50. The average age of onset of symptoms is 70, and women are affected twice as often as men. The disease often develops very quickly.
- Lab work should search for the presence of inflammation, including elevated ESR and CRP levels.

Polymyositis

- Polymyositis is a chronic inflammatory myopathy causing weakness of skeletal muscles.
- It is hypothesized to be an unidentified autoimmune disorder.
- Polymyositis signs and symptoms usually develop gradually over weeks or months and include progressive symmetrical muscular weakness, difficulty swallowing, difficulty speaking, mild joint and muscle tenderness, fatigue and shortness of breath.
- Polymyositis typically affects the muscles closest to the trunk, particularly those in the hips, thighs, shoulders, upper arms and neck.
- Polymyositis may occur at any age but typically affects middle-aged adults.
- It is more common in the African American population, and women are affected twice as often as men.
- Remission of symptoms is rare, and tests to assist with the diagnosis include CPK, urine myoglobin, serum aldolase, EMG/NCV and muscle biopsy.

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Differentiating Structural vs Functional Diagnoses

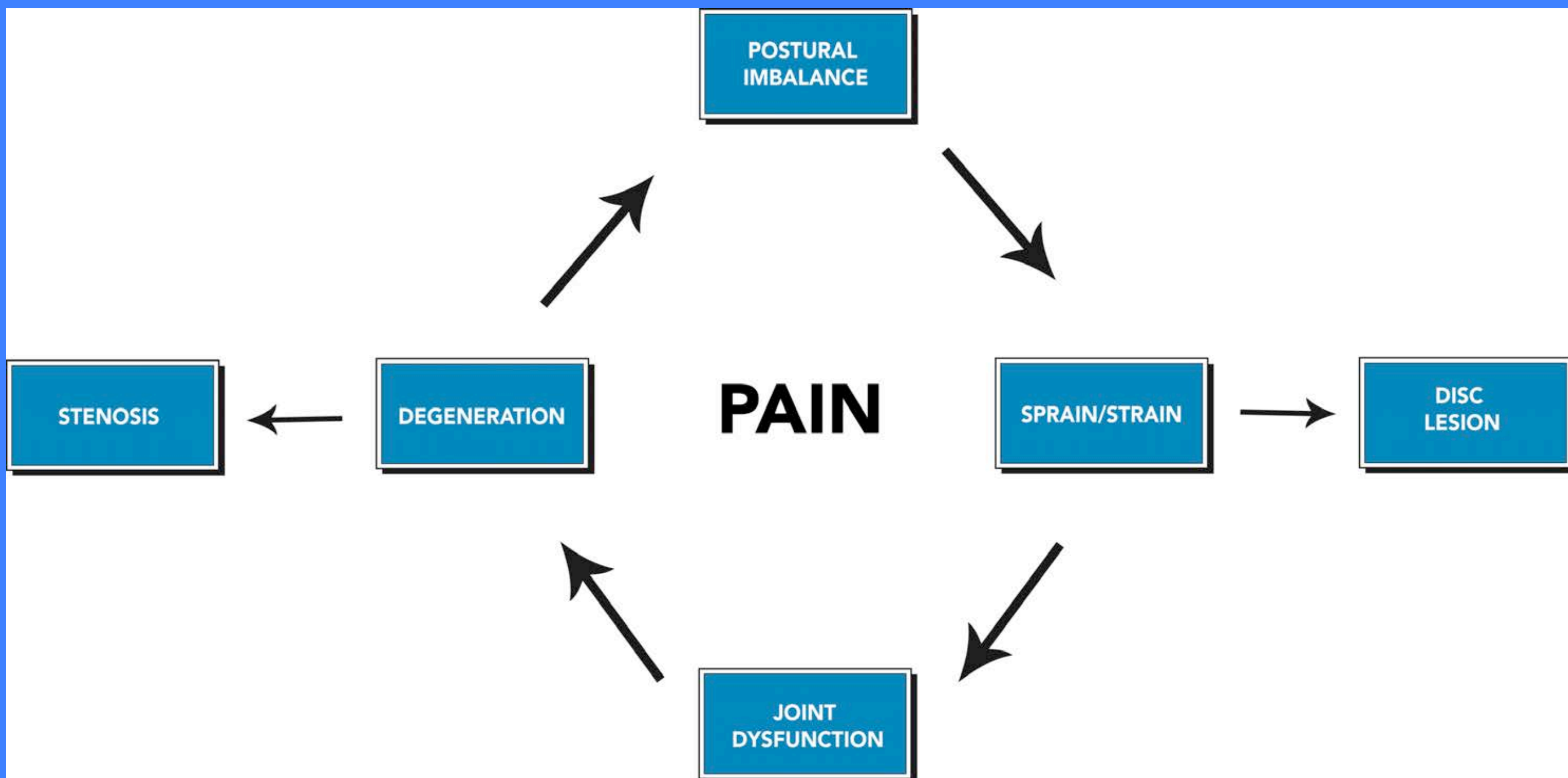
HOW | WHAT | WHY

Causes of Dysfunction | **Specific Tissue Injured** | **Factors Leading to Tissue Failure**

John played baseball everyday for the last 2 weeks creating right shoulder inpingement syndrome from underlying scapular dyskinesis and segmental dysfunction of the cervical and thoracic spine.

John played baseball everyday (S43.401A) for the last 2 weeks creating right shoulder impingement syndrome (M75.41) from underlying scapular dyskinesis and segmental dysfunction of the cervical and thoracic spine (M99.01,M99.02)

The LBP Continuum



Disc Lesions

A systematic review of 33 studies demonstrated the presence of asymptomatic disc bulge increased from 30% of those 20 years of age to 84% of those 80 years of age.

Brinjikji W, Luetmer PH, Comstock B, Bresnahan BW, Chen LE, Deyo RA, Halabi S, Turner JA, Avins AL, James K, Wald JT, Kallmes DF, Jarvik JG. Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. AJNR Am J Neuroradiol. 2015 Apr;36(4): 811-6.

Lumbar Degeneration

A systematic review of 33 studies demonstrated the presence of asymptomatic degeneration increased from 37% of 20-year-old individuals to 96% of 80-year-old individuals.

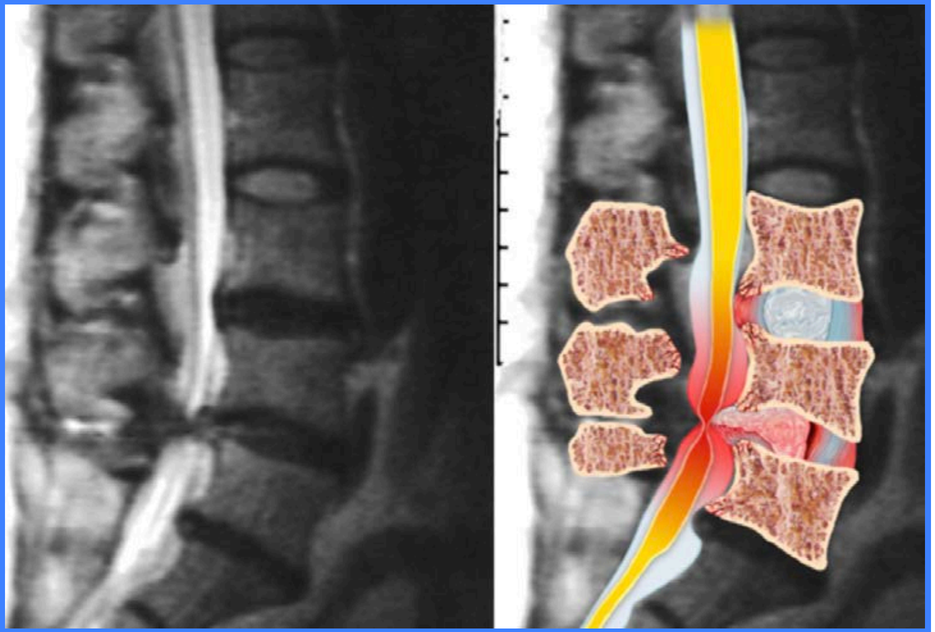
W. Brinjikji, P.H. Luetmer, B. Comstock, B.W. Bresnahan, L.E. Chen, R.A. Deyo, S. Halabi, J.A. Turner, A.L. Avins, K. James, J.T. Wald, D.F. Kallmes, J.G. Jarvik. Systematic Literature Review of Imaging Features of Spinal Degeneration in Asymptomatic Populations. AJNR November 27, 2014

Degenerative Spondylolisthesis

There is no correlation between the progression of spondylolisthesis and the patient's clinical symptoms.

Mac-Thiong JM, Duong L, Parent S, et al. Reliability of the Spinal Deformity Study Group classification of lumbosacral spondylolisthesis. Spine (Phila Pa 1976). Jan 15 2012;37(2):E95-102

Lumbar Stenosis



Up to 20% of asymptomatic patients meet the radiographic criteria for the diagnosis of lumbar spine stenosis.

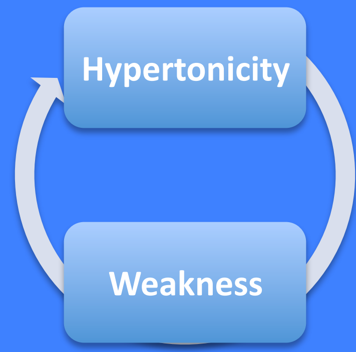
Jarvik JG, Deyo RA. Diagnostic evaluation of low back pain with emphasis on imaging. Ann Intern Med. 2002 Oct 1;137(7):586–97.

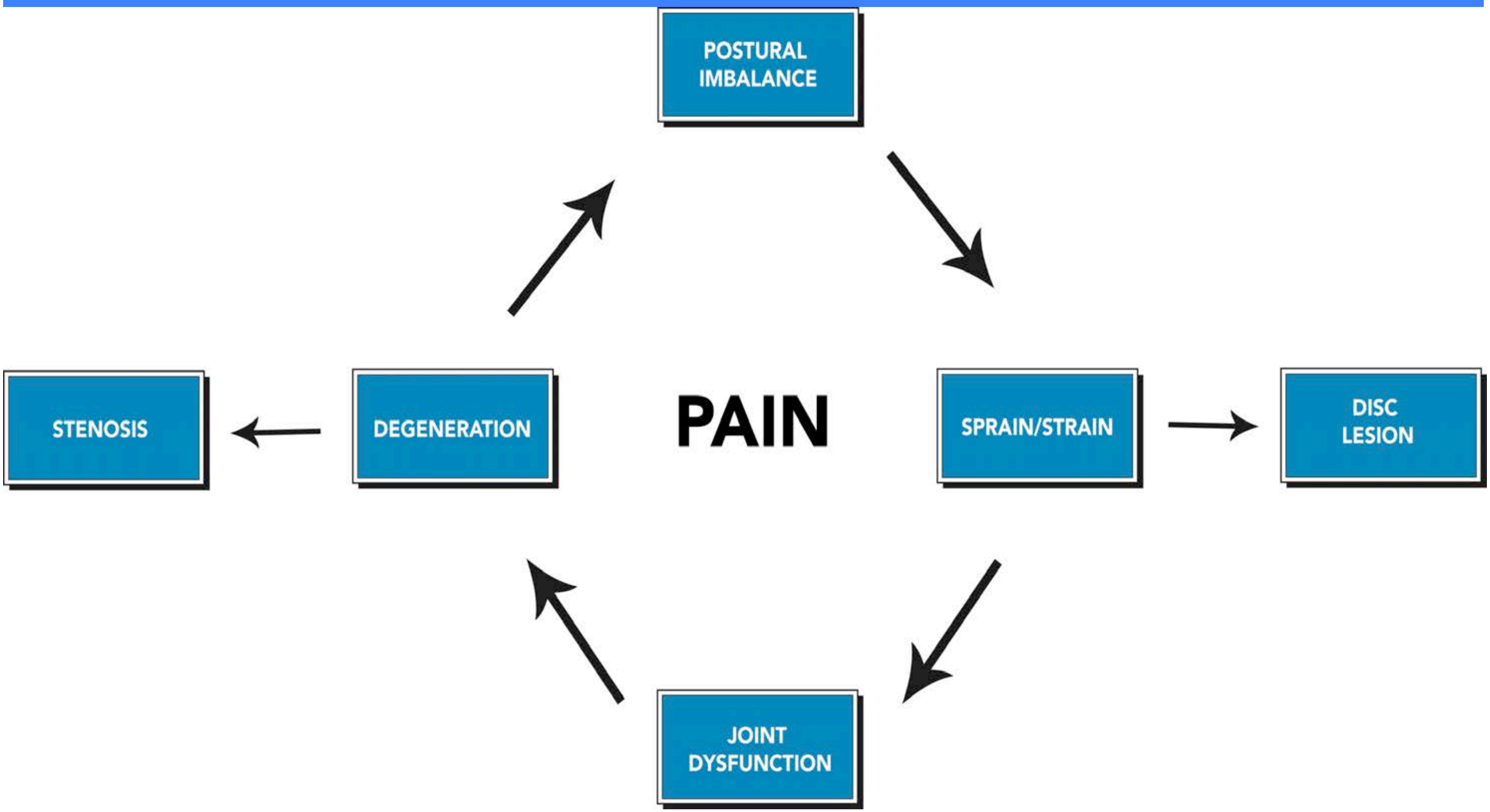
Jensen MC, Brant-Zawadzki MN, Obuchowski N, Modic MT, Malkasian D, Ross JS. Magnetic resonance imaging of the lumbar spine in people without back pain. N Engl J Med 1994;331:69-73

LBP Continuum

Dysfunction → Structural Change → Dysfunction

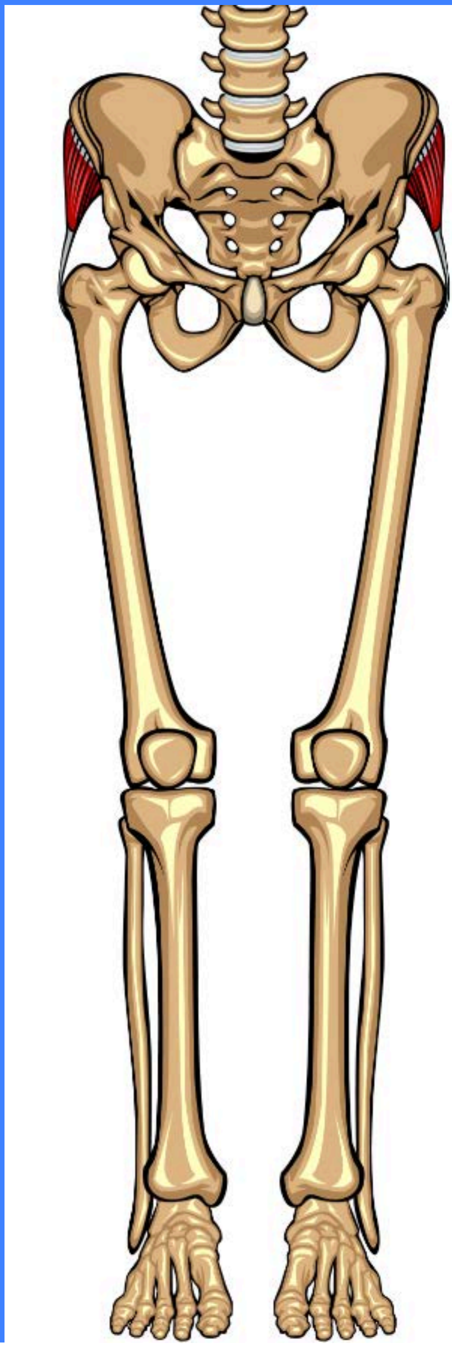
Dysfunction	Structural Change	Dysfunction
Postural Imbalance Joint Dysfunction	Disc Lesion Degeneration Degenerative Spondylolisthesis Stenosis	Instability Nerve Irritation

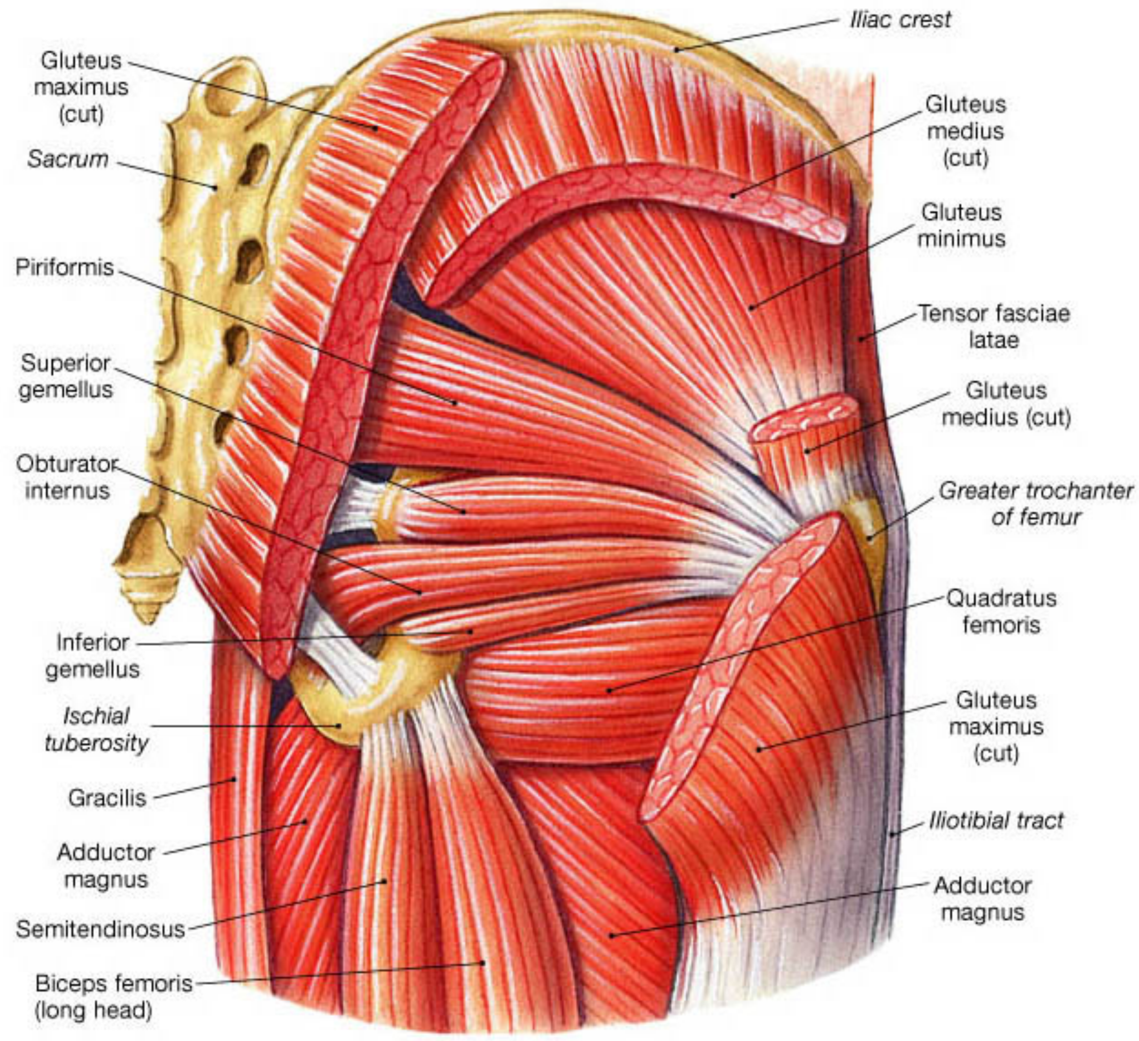

Hypertonicity
Weakness


POSTURAL IMBALANCE
STENOSIS
DEGENERATION
PAIN
SPRAIN/STRAIN
DISC LESION
JOINT DYSFUNCTION

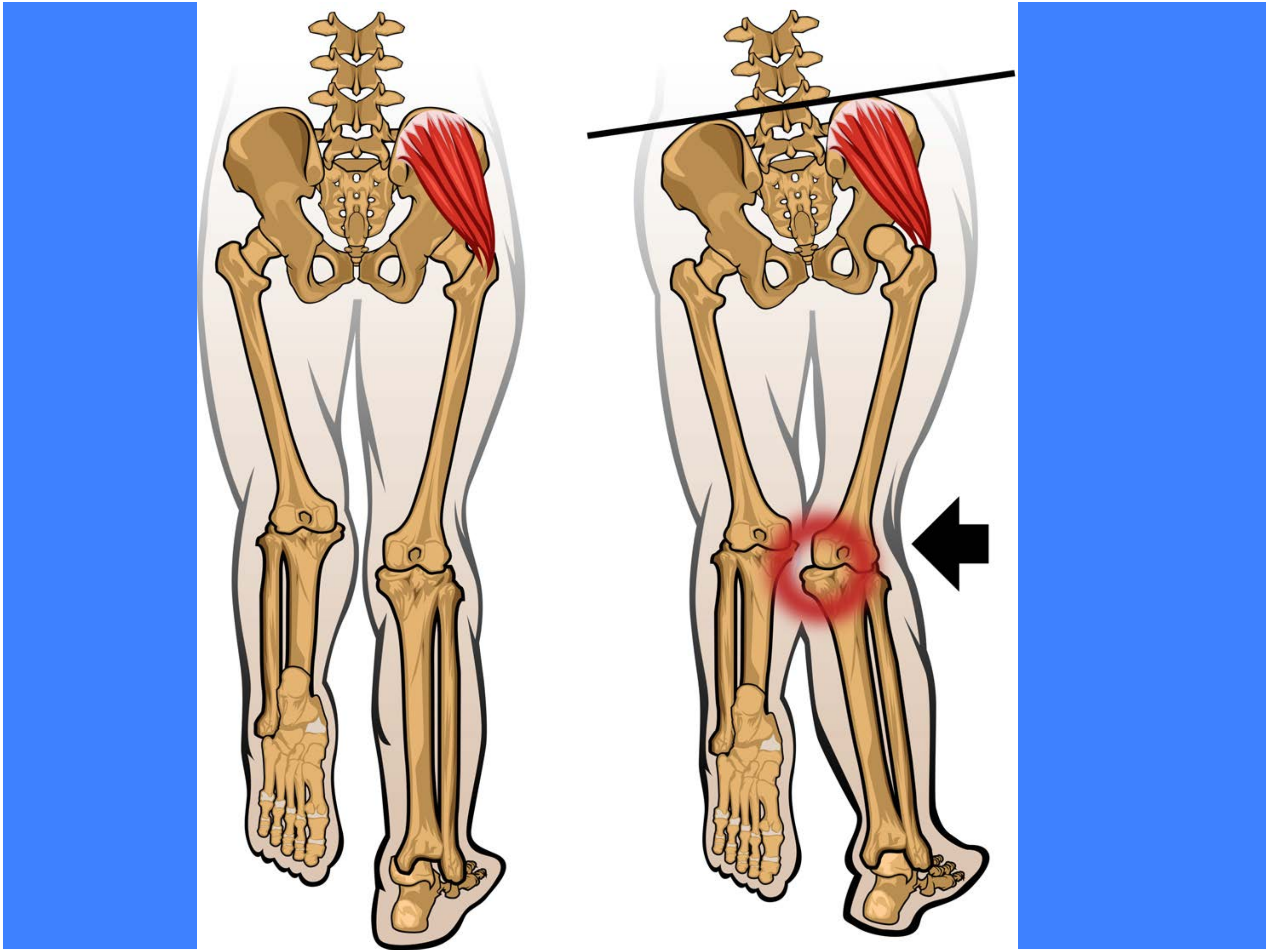

Scapular Dyskinesis
Upper Crossed
Dysfunctional Breathing
Spinal Instability
Hip Abductor Weakness
Lower Crossed
Foot Hyperpronation

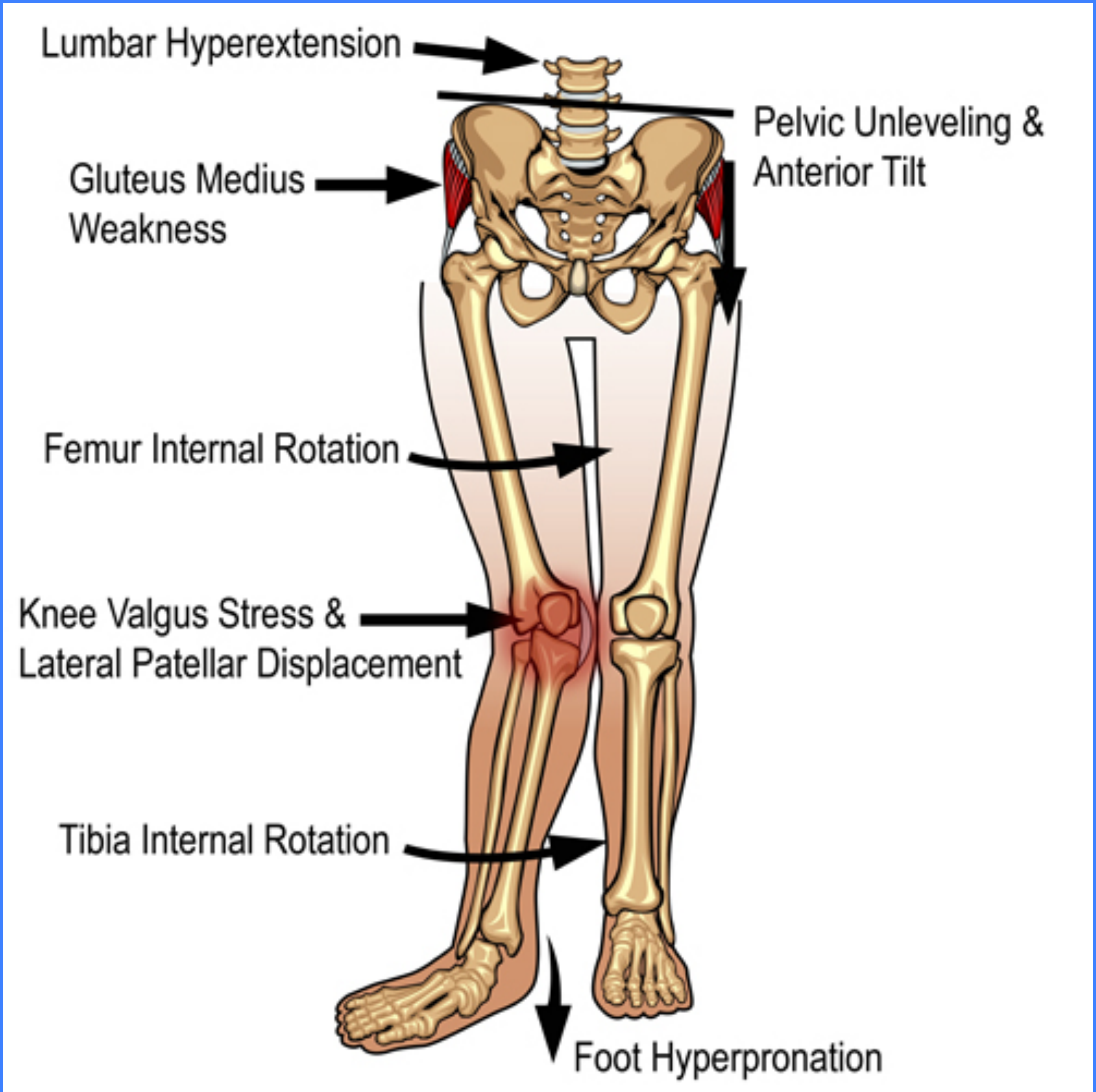
Hip Abductor Weakness



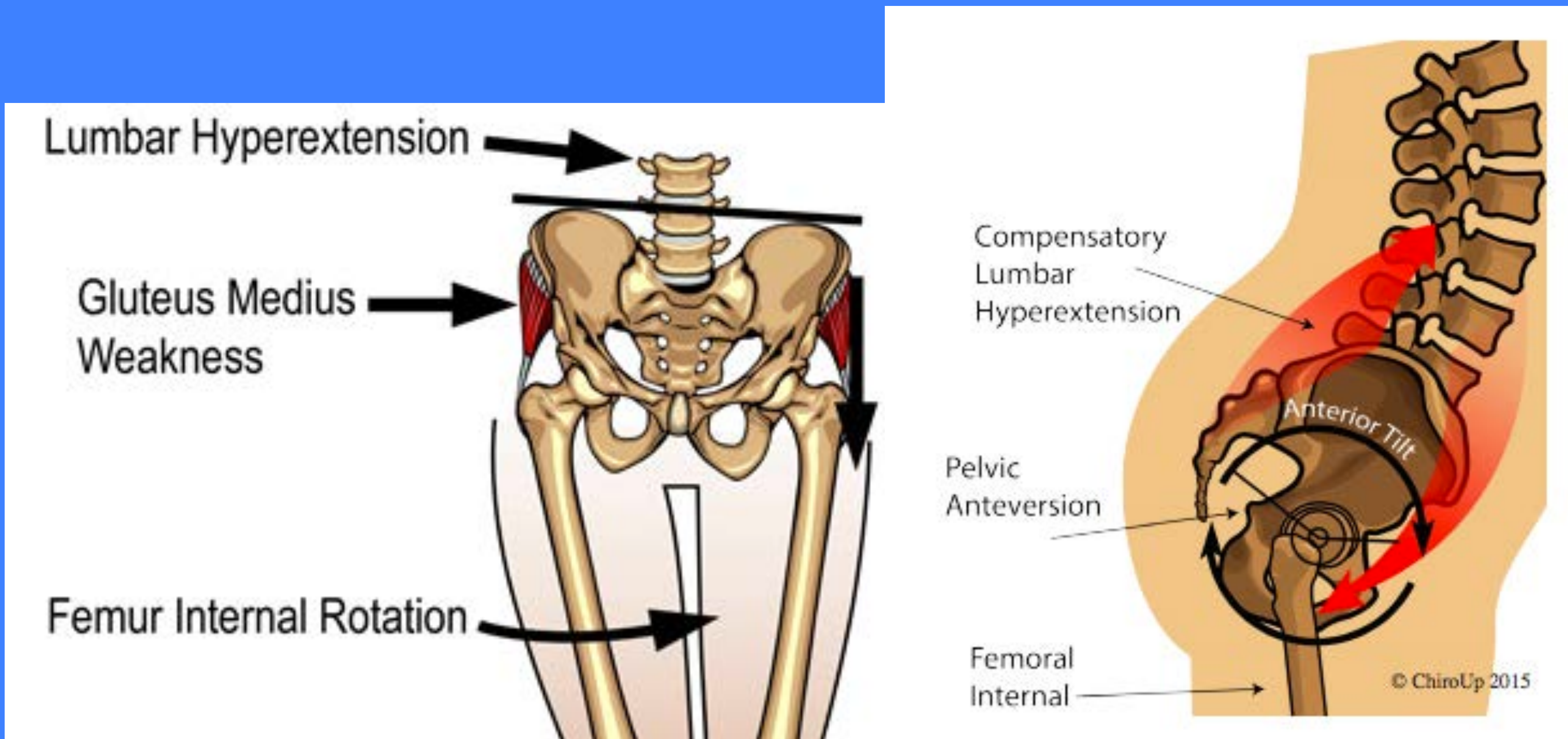


(a) Posterior view, deep muscles





Lumbar Hyperextension
Pelvic Unleveling & Anterior Tilt
Gluteus Medius Weakness
Femur Internal Rotation
Knee Valgus Stress & Lateral Patellar Displacement
Tibia Internal Rotation
Foot Hyperpronation



Lumbar Hyperextension
Gluteus Medius Weakness
Femur Internal Rotation
Compensatory Lumbar Hyperextension
Anterior Tilt
Pelvic Anteversion
Femoral Internal
© ChiroUp 2015

HAB Weakness Complaints

- Lumbar & Sacroiliac joint dysfunction
- Lumbar Facet Syndrome
- Lumbar Sprain/strain
- Discogenic pain
- Degeneration

- Greater Trochanteric Pain Syndrome
- ITB Syndrome
- Knee Sprain/ Strain
- Patellofemoral Pain Syndrome
- MTTP- Shin Splints
- Hyperpronation
- Achilles Tendinopathy
- Plantar Fasciitis

Hip Abductor Weakness

Evaluation

* Modified Trendelenberg
* Q Angle Measurement
* Side Lying Active Hip Abduction Test
* Single Leg Squat Test
* Trendelenburg Sign

Management

Soft Tissue

* STM- Gluteals
* STM- Hip Adductors
* STM- Iliopsoas

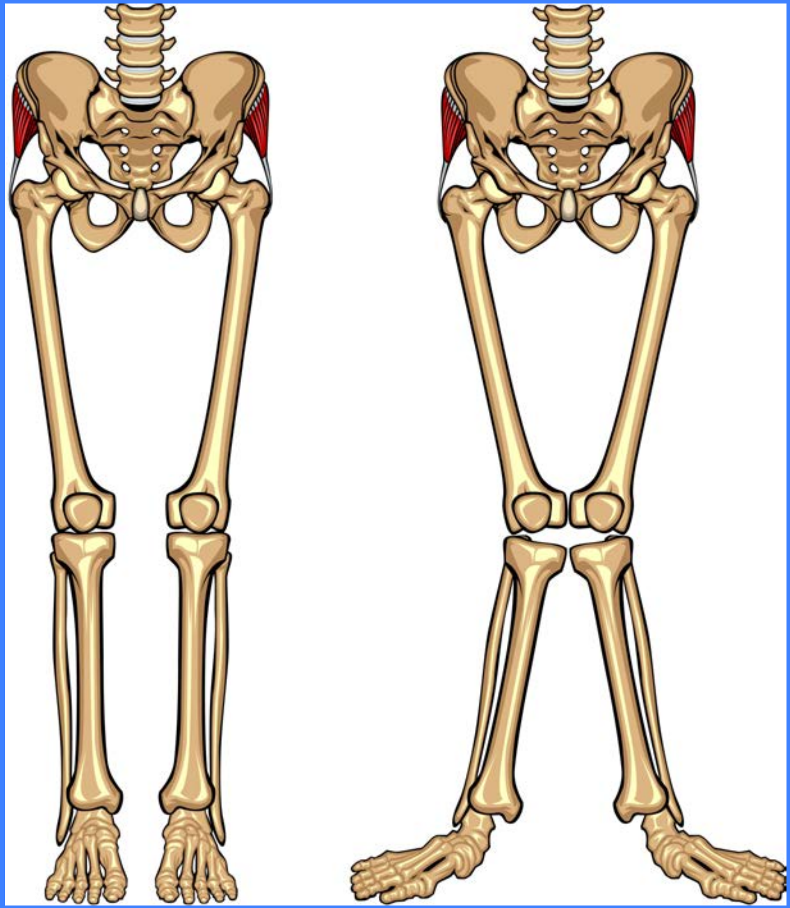
Phase I exercises

* Posterior Lunge
* Clam w/Band
* Sidebridge

Evaluation

* Modified Trendelenberg
* Q Angle Measurement
* Side Lying Active Hip Abduction Test
* Single Leg Squat Test
* Trendelenburg Sign

Static Assessment

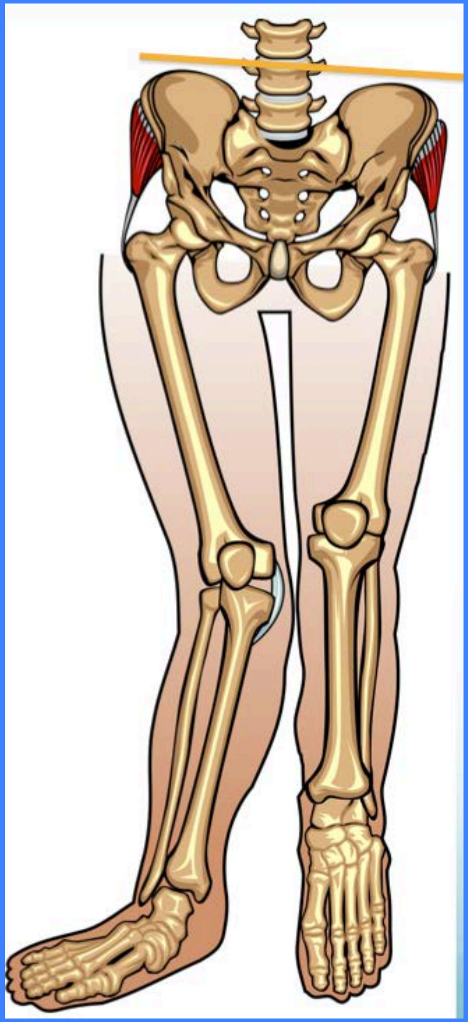


Q Angle Measurement

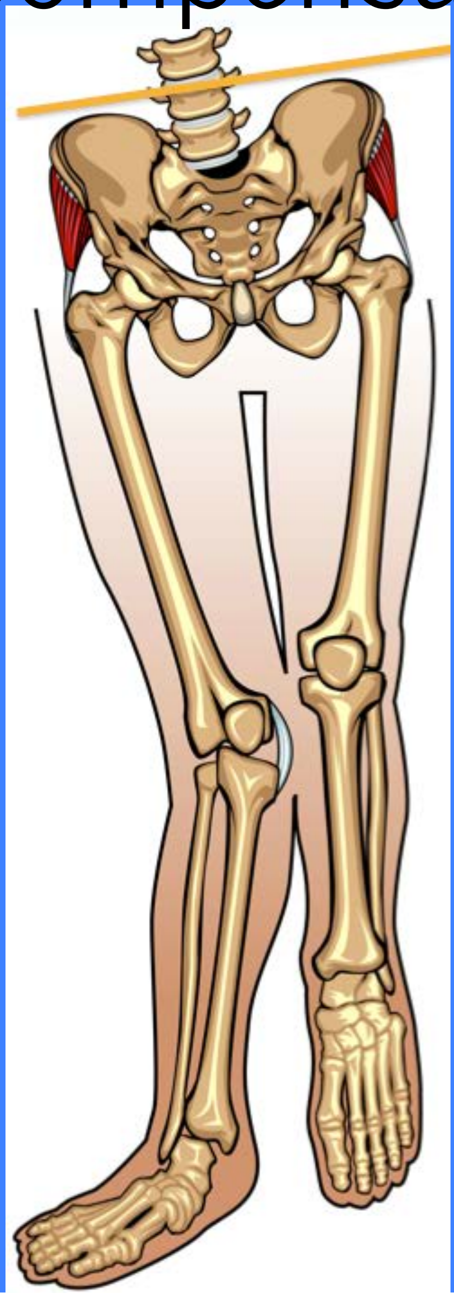
- The clinician creates 2 lines: the first from the tibial tuberosity to the midpoint of the patella and another that connects the ASIS to the midpoint of the patella. The clinician measures the resultant angle. The normal Q angle is 13.5 degrees +/- 4.5 for adult males and 18 degrees for females, due to a wider pelvis and increased femoral anteversion

Trendelenburg Sign

- The Trendelenburg test is performed by having the patient cross their arms over their chest and lift one leg at a time, while the clinician observes for pelvic drop or knee valgus. The presence of an "uncompensated" pelvic drop when performing the Trendelenburg maneuver suggests gluteus medius weakness.



Compensated Trendelenburg



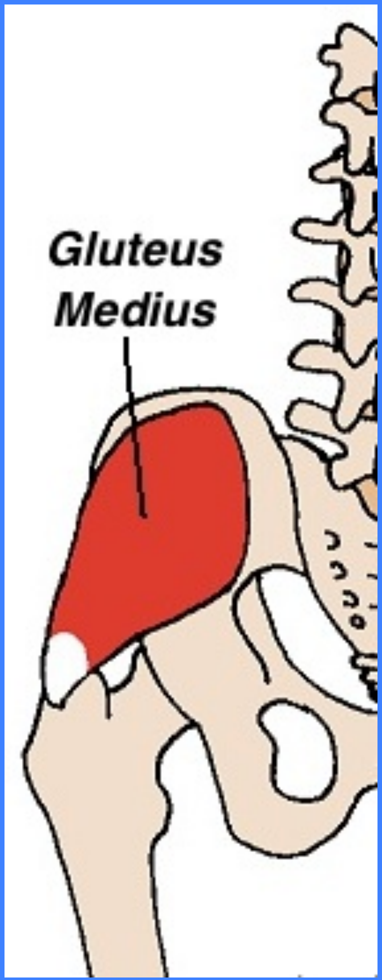
Modified Trendelenburg Sign

- The test is performed by having the patient stand on one leg with the trunk upright, while maximally elevating the opposite hip for 30 seconds. The inability to elevate and maintain this position for 30 seconds suggests hip abductor weakness on the dependent side

Single Leg Squat Test

- Begin with the patient standing on the affected leg, without support. Have the patient squat three times, returning to a fully upright position between each repetition. The patient should squat as low as possible, stopping for any pain, weakness, or significant loss of balance. The clinician will assess for the presence of a Trendelenburg sign, knee varus/valgus movement, foot pronation, or poor balance. Repeat on the opposite leg.

Hip Abductor Weakness



Hip Abductor Weakness

- Pelvic drop
- Medial thigh rotation and adduction
- Knee buckling
- Insatbility
- Excessive foot pronation
- Lumbar hyperlordosis

Side Lying Hip Abduction

- The Side Lying Active Hip Abduction test (S-AHAB) is an assessment of the patient's ability to maintain frontal plane stability of the lower limbs, pelvis, trunk, and shoulders in the while performing side lying hip abduction. The loss of frontal plane alignment while performing this test can reveal substitution strategies related to hip abductor weakness and/or core instability.

Hip Abductor Weakness

Evaluation

* Modified Trendelenberg
* Q Angle Measurement
* Side Lying Active Hip Abduction Test
* Single Leg Squat Test
* Trendelenburg Sign

Management

Soft Tissue

* STM- Gluteals
* STM- Hip Adductors
* STM- Iliopsoas

Phase I exercises

* Posterior Lunge
* Clam w/Band
* Sidebridge

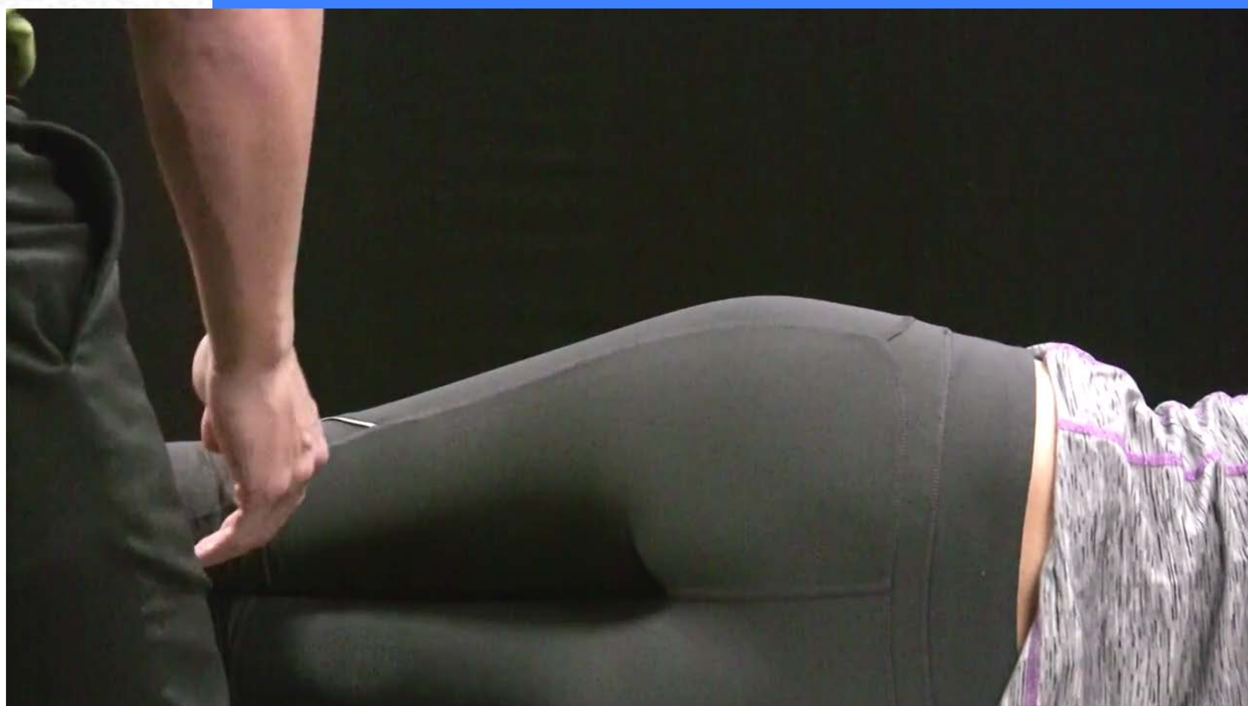
Management

Soft Tissue

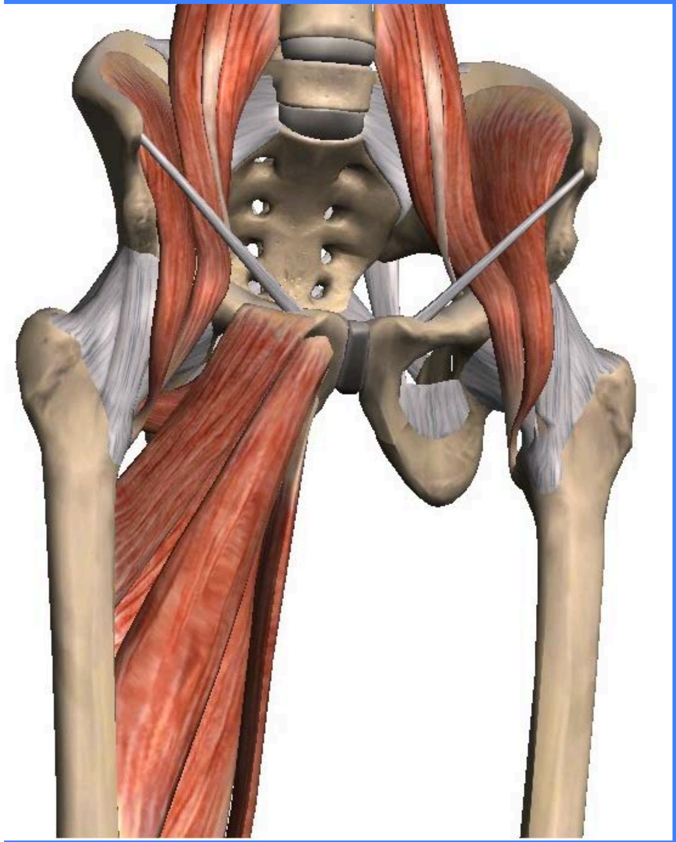
* STM- Gluteals
* STM- Hip Adductors
* STM- Iliopsoas

Gluteals

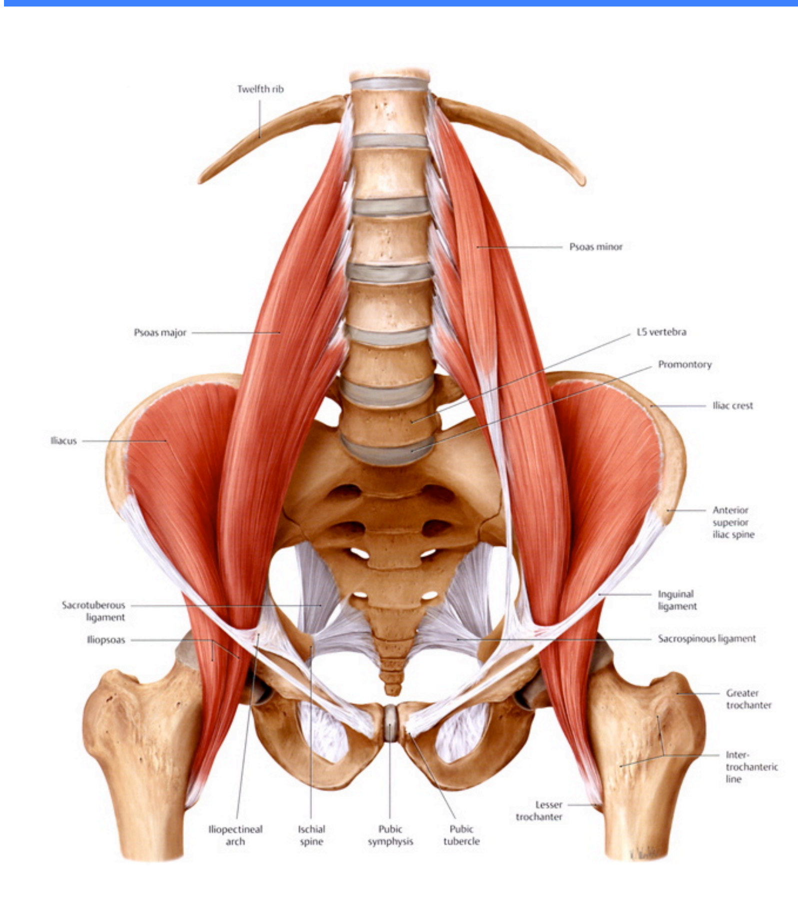
TFL



Hip Adductors



Iliopsoas



Twelfth rib
Psoas minor
Psoas major
L5 vertebra
Promontory
Iliac crest
Iliacus
Anterior superior iliac spine
Sacrotuberous ligament
Inguinal ligament
Iliopsoas
Sacrospinous ligament
Greater trochanter
Inter-trochanteric line
Lesser trochanter
Iliopectineal arch
Ischial spine
Pubic symphysis
Pubic tubercle

Hip Abductor Weakness

Evaluation

* Modified Trendelenberg
* Q Angle Measurement
* Side Lying Active Hip Abduction Test
* Single Leg Squat Test
* Trendelenburg Sign

Management

Soft Tissue

* STM- Gluteals
* STM- Hip Adductors
* STM- Iliopsoas

Phase I exercises

* Posterior Lunge
* Clam w/Band
* Sidebridge

Phase II exercises

* Side Plank Abduction

Phase I exercises

* Posterior Lunge
* Clam w/Band
* Sidebridge

Posterior Lunge

While standing on one leg, slowly bend your knee to lower your hips toward the floor as though you are going to sit in a chair. Keep your knee positioned directly above your ankle and do not allow it to shift forward. Try not to allow your back leg to touch the ground. Consciously contract your gluteal muscle on the planted leg side to return to the start position and repeat three sets of 10 repetitions once per day or as directed.

Clam (#1)

- Lie on your side with your affected hip pointing up. With your feet together, knees bent at 90 degrees and hips at 45 degrees, lift your knee upward without rolling your hips backward. Lower your legs so that your knees are touching and repeat on each side for three sets of 10 repetitions once per day or as directed.

Clam with Band

- Lie on your side with your affected hip pointing up. Keep your feet together, knees bent at 90 degrees and hips at 45 degrees. Place an elastic band around the outside of both knees. Lift your knee upward without rolling your hips back. Maintain a pain-free range of motion. Slowly lower your legs so that your knees are touching and repeat on each side for three sets of 10 repetitions once per day or as directed.

Sidebridge

- Begin lying on your side. Rest your weight on your forearm and feet. Lift your hips forward and toward the ceiling until your body is in a straight “plank” position. Initially, you may need to use your knees for support. Slowly lower your hips back to the floor and repeat for three sets of 10 repetitions per day on each side, or as directed.

Side Plank with Abduction

- Begin lying on your side. Rest your weight on your forearm and feet. Lift your hips forward and toward the ceiling until your body is in a straight “full plank” position. Slowly spread your legs by lifting your straightened upper leg toward the ceiling. Slowly lower your legs back together and repeat for three sets of 10 repetitions per day on each side, or as directed. If the “full plank” position is too difficult to maintain, begin from a modified position with your lower knee on the ground.

Advanced Clam (#4)

- Lie on your side with your affected hip pointing up, knees bent at 90 degrees and hips at 45 degrees. Begin with your ankles together and knees spread about 6-8 inches, so that your top thigh is horizontal to the ground. Without elevating your thigh any further, rotate your leg to lift your top ankle toward the ceiling as high as possible. Lower your legs so that your ankles are touching and repeat on each side for three sets of 10 repetitions once per day or as directed. For a more challenging variant, perform this exercise with your top hip straight.

ADL's

- Avoid:
  - "hanging on one hip" while standing
  - sitting crossed legged, and
  - sleeping in a side lying position with hip flexion & adduction
- Consider:
  - orthotics or arch supports
  - diet and exercise recommendations

Where is the ICD?

- Hip Abductor Weakness

- Lumbar Segmental Joint Restriction
- Lumbar Facet Syndrome
- Sacroiliac Joint Dysfunction
- Lumbar Sprain/ Strain
- Lumbar Disc Lesion
- Lumbar Spondylosis/ DJD/ DDD
- Chronic Lumbar Discogenic pain
- Greater Trochanteric Pain Syndrome
- ITB Syndrome
- Knee Sprain/ Strain- ACL, MCL
- Patellofemoral Pain Syndrome
- MTTP- Shin Splints
- Hyperpronation
- Achilles Tendinopathy
- Plantar Fasciitis

Hip Abductor Weakness

Evaluation

* Modified Trendelenberg
* Q Angle Measurement
* Side Lying Active Hip Abduction Test
* Single Leg Squat Test
* Trendelenburg Sign

Management

Soft Tissue

* STM- Gluteals
* STM- Hip Adductors
* STM- Iliopsoas

Phase I exercises

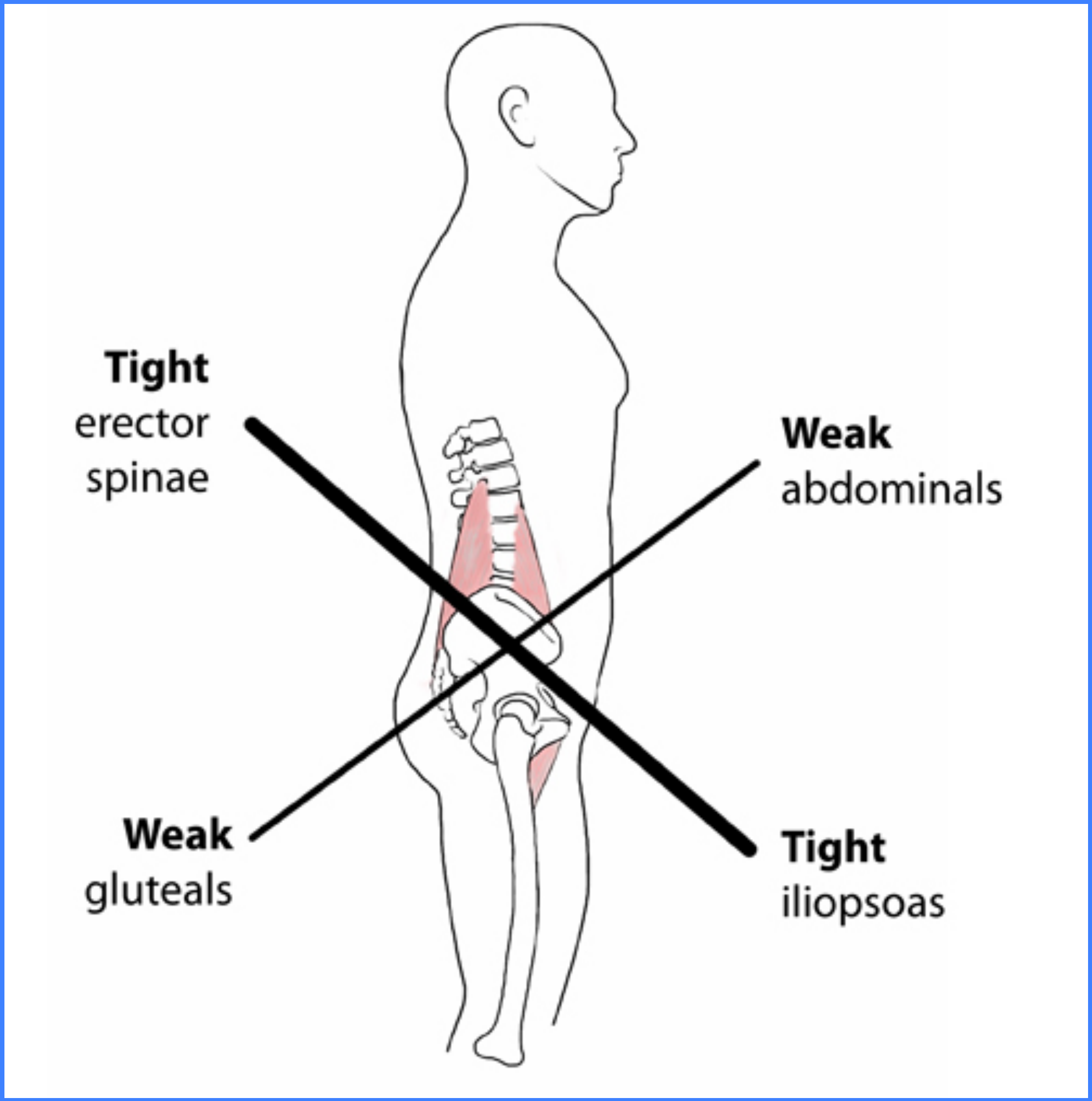
* Posterior Lunge
* Clam w/Band
* Sidebridge

Clinical Pearls

* The gluteus medius contributes approximately 70% of the abduction force required to maintain pelvic leveling during single leg stance.
* Hip abductor strength is the single greatest contributor to lower extremity frontal plain alignment during activity.
* There is no “typical” presentation for hip abductor weakness, but the problem must be considered in any patient with lower chain symptomatology, particularly those with hip tendinopathy, greater trochanteric pain syndrome, iliotibial band syndrome, patellofemoral pain syndrome, ACL injury, medial knee pain, and lower back pain.

Lower Crossed Syndrome

Lower Crossed Syndrome



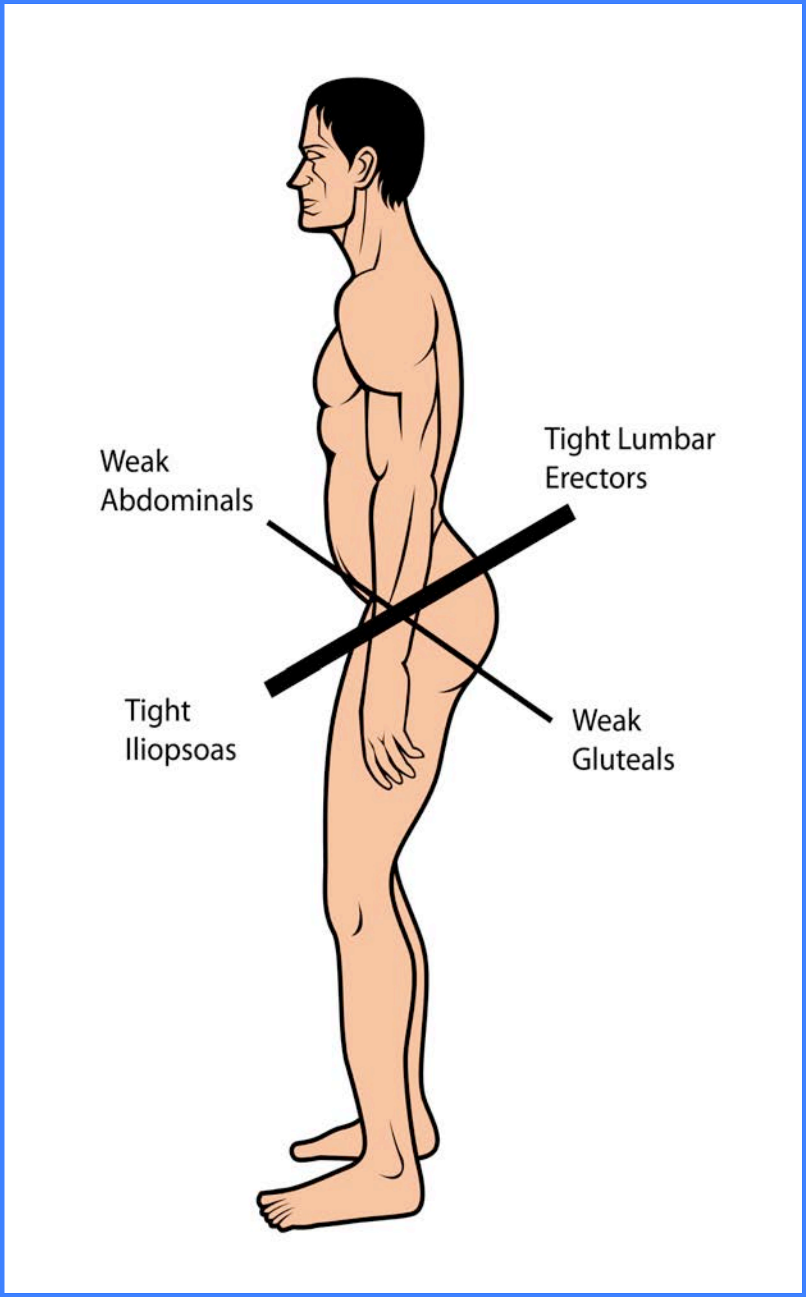
Lower Crossed Syndrome

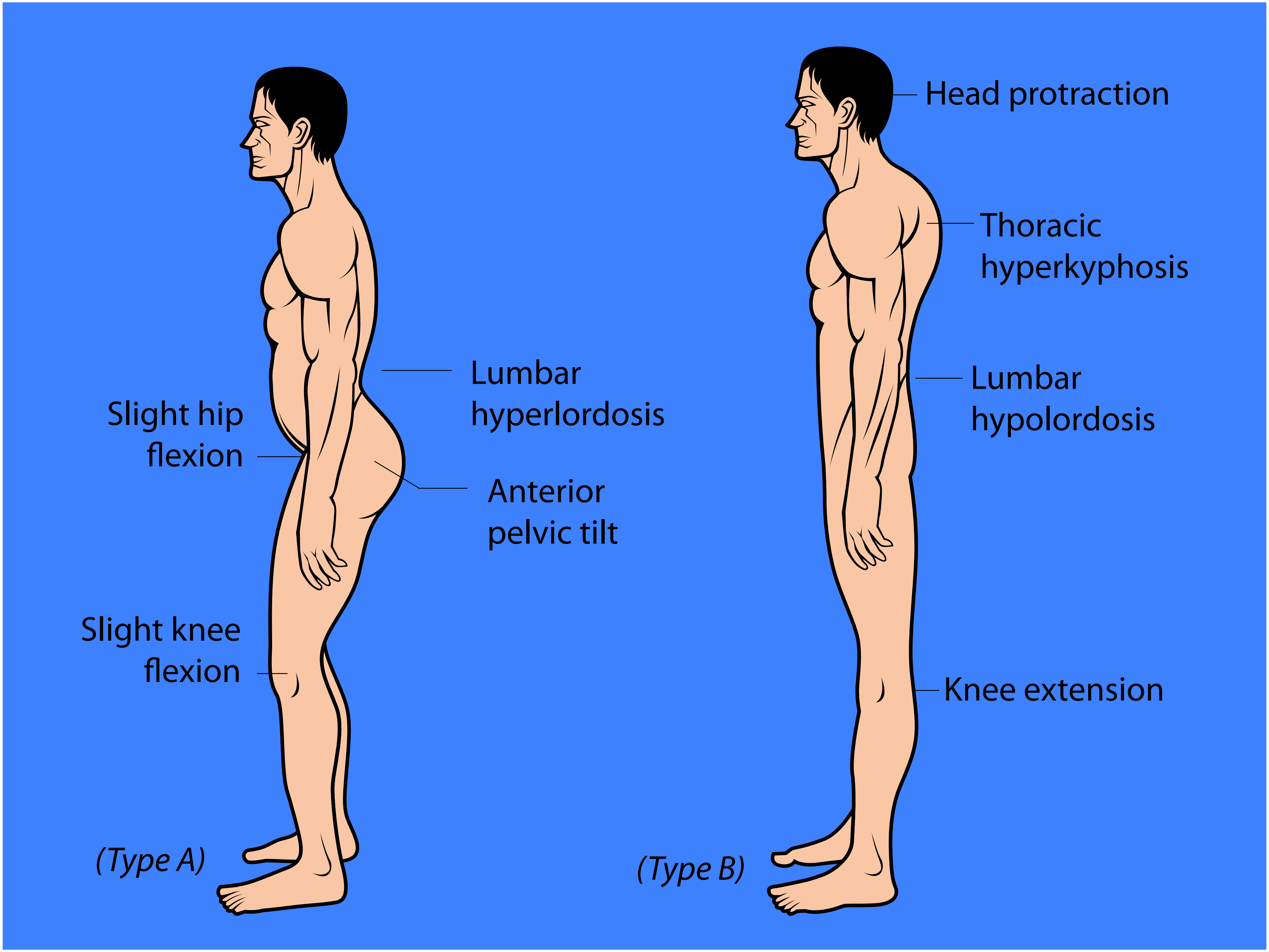
"**Postural**" Muscles Tighten

- Iliopsoas
- Rectus Femoris
- Spinal Erectors
- Hamstring
- Piriformis
- TFL

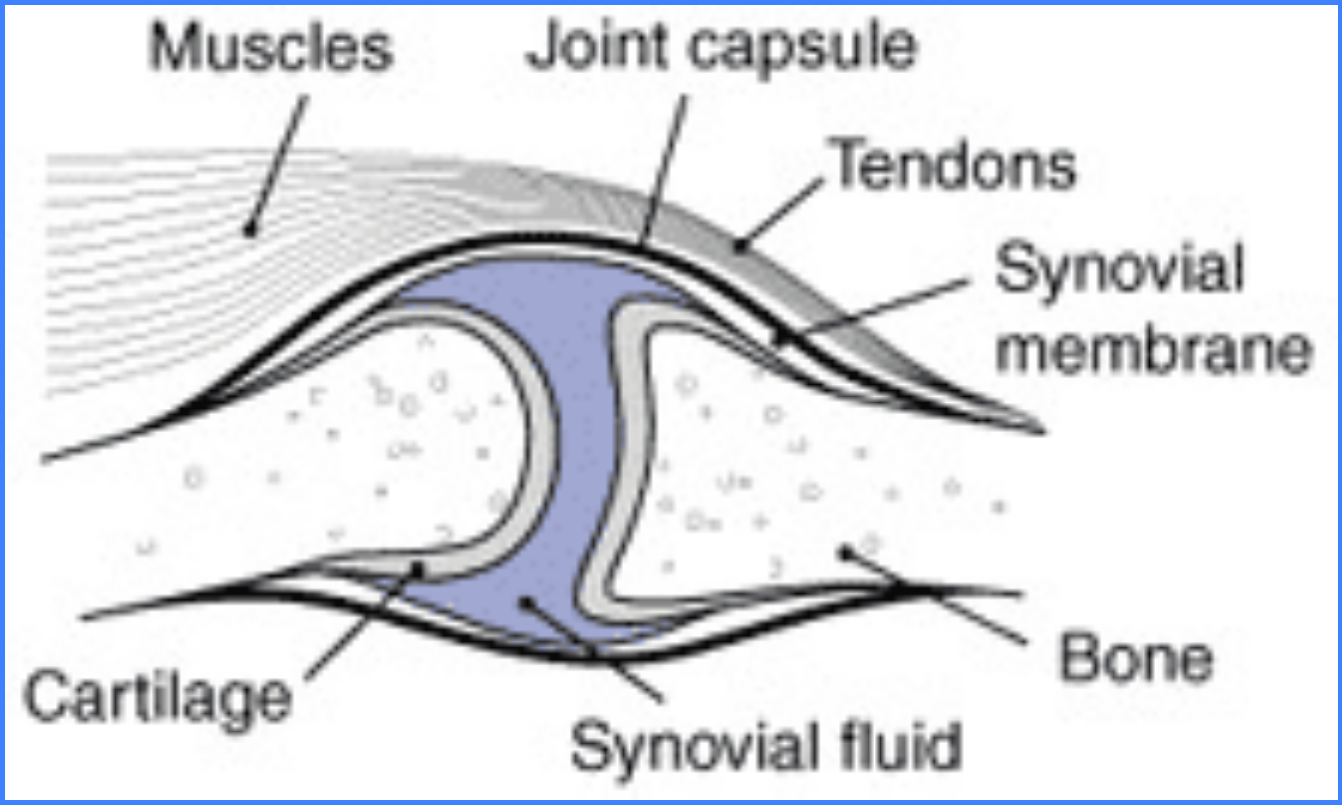
"**Phasic**" Muscles Weaken

- Deep abdominal muscles
- Gluteals

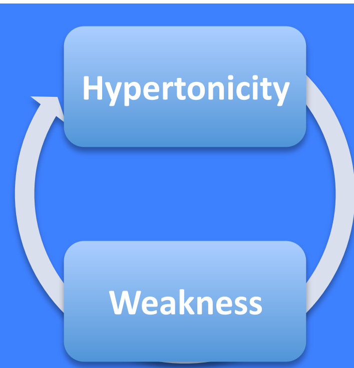


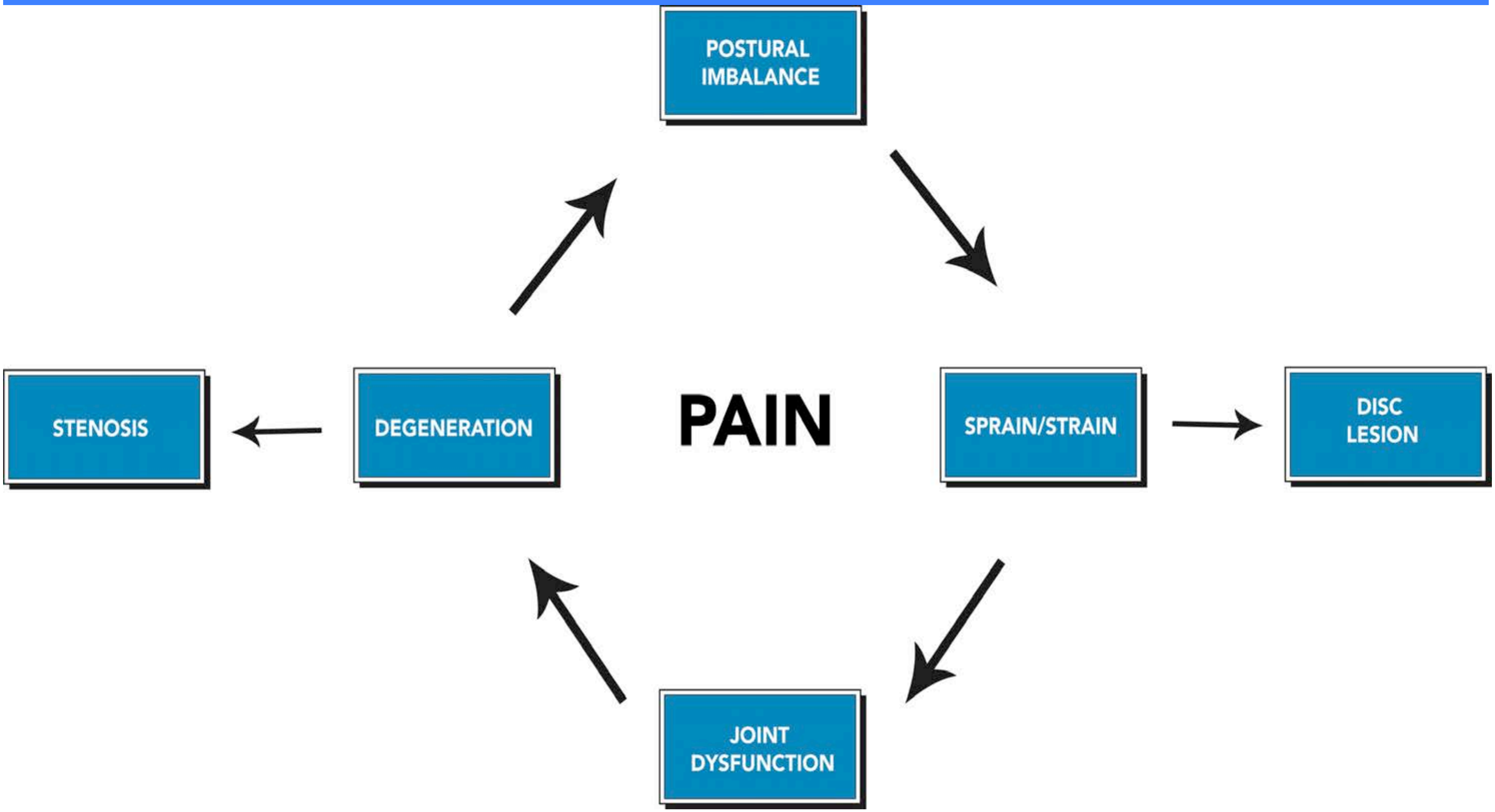

Slight hip flexion
Lumbar hyperlordosis
Anterior pelvic tilt
Slight knee flexion
(Type A)
Head protraction
Thoracic hyperkyphosis
Lumbar hypolordosis
Knee extension
(Type B)

Centration



Muscles
Joint capsule
Tendons
Synovial membrane
Cartilage
Synovial fluid
Bone


Hypertonicity
Weakness


POSTURAL IMBALANCE
SPRAIN/STRAIN
DISC LESION
PAIN
JOINT DYSFUNCTION
DEGENERATION
STENOSIS

Lower Crossed Complaints

- Lumbar & Sacroiliac joint dysfunction
- Lumbar Facet Syndrome
- Lumbar Sprain/strain
- Discogenic pain
- Degeneration

- Greater Trochanteric Pain Syndrome
- ITB Syndrome
- Knee Sprain/ Strain
- Patellofemoral Pain Syndrome
- MTTP- Shin Splints
- Hyperpronation
- Plantar Fasciitis

Lower Crossed Syndrome

Evaluation

* Hip Abductor Weakness Cluster
* Standing Postural Evaluation
* Thomas Test
* Wall Angel Screen

Management

Soft Tissue

* STM- Iliopsoas
* STM- Lumbar Erectors
* STM- Piriformis

Manipulation/Mobilization

* Manipulation-Lumbar and Sacral

Phase I exercises

* Diaphragm Breathing
* Standing ITB Stretch
* Psoas Stretch- Kneeling

Phase II exercises

* Semi-Stiff Dead Lift
* Posterior Lunge
* Sidebridge

Evaluation

* Hip Abductor Weakness Cluster
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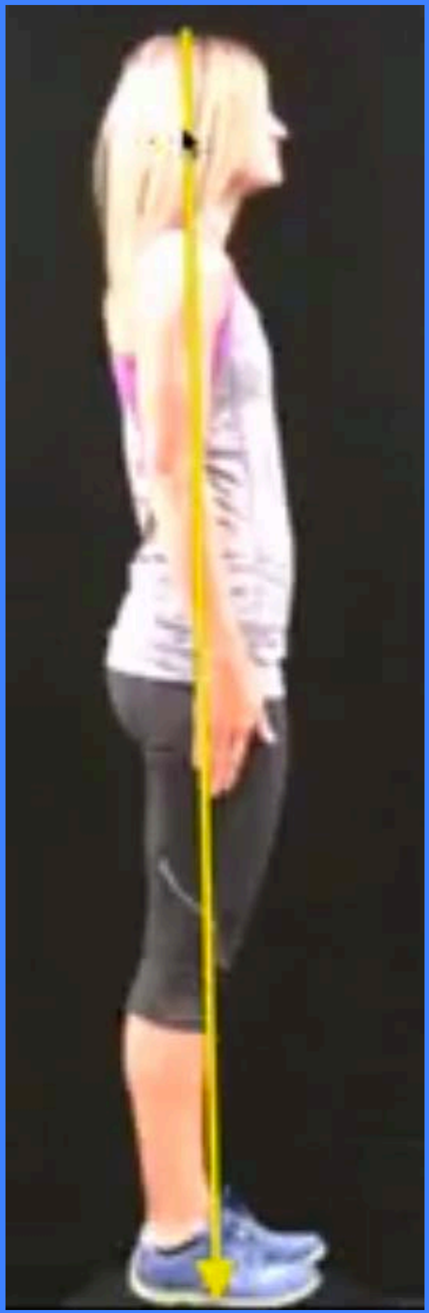
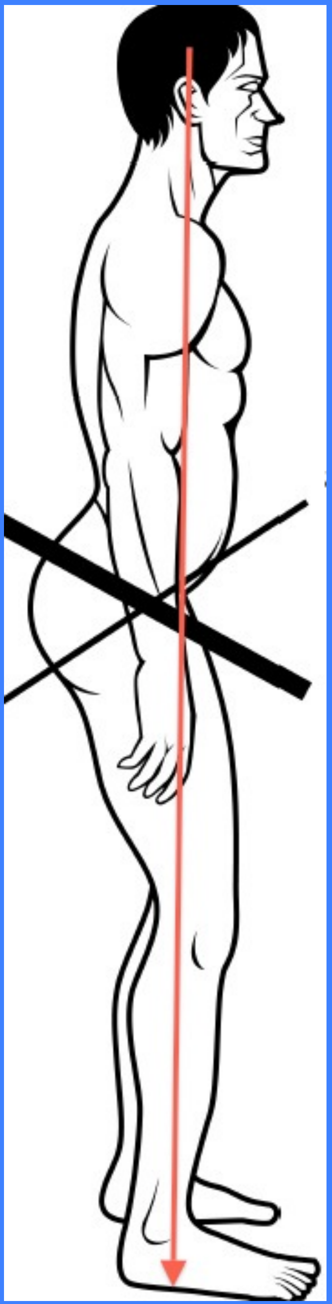
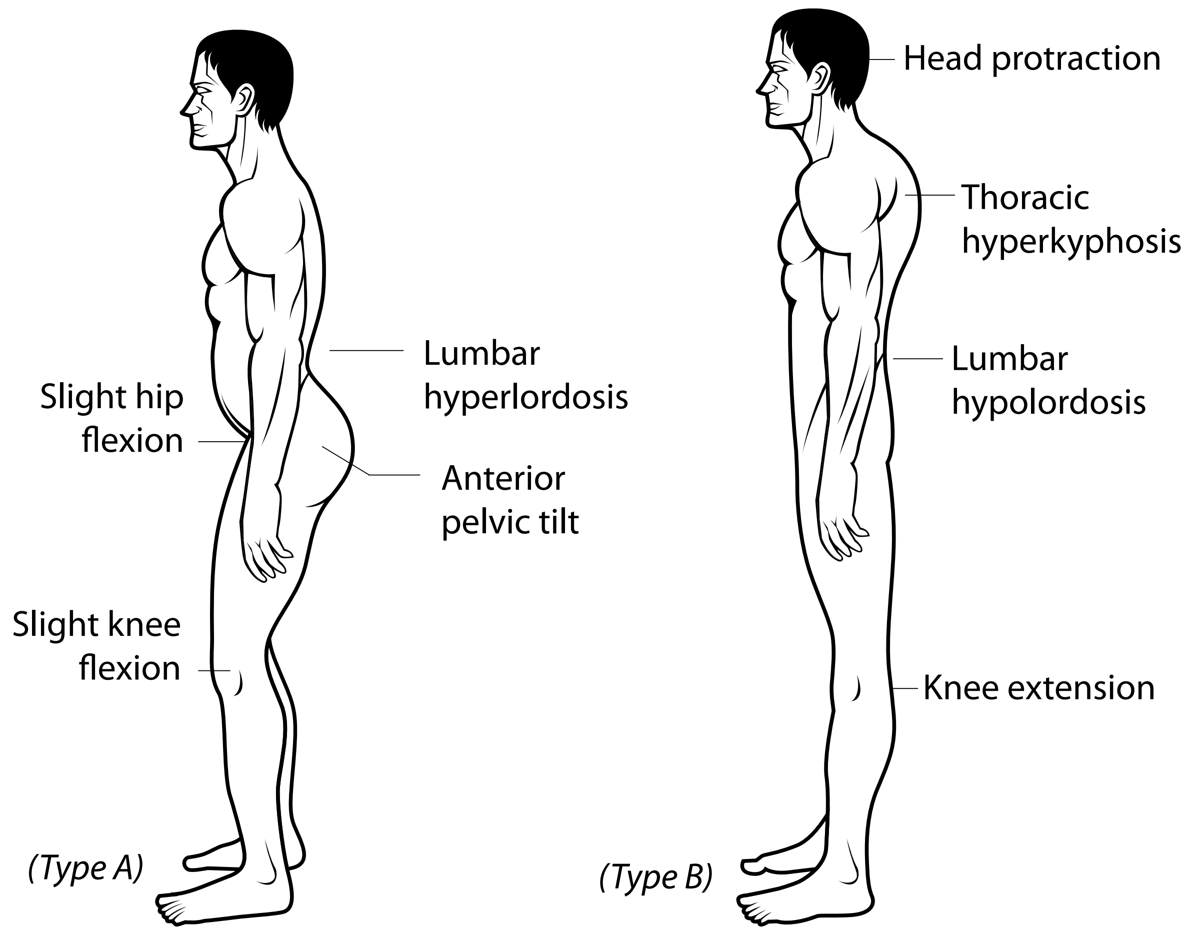


- Ear
- Shoulder
- Greater Trochanter
- Anterior to
  Lateral Malleoli



Lower Crossed Presentation

- Type A- Anterior pelvic tilt/ hyperlordosis
- Type B- Flat glutes/ knee hyperextension



Muscular Assessment

Hypertonicity

- Thoraco-lumbar erectors
- Rectus femoris
- Iliopsoas(Thomas Test)
- TFL (Obers Test)
- Hamstring (SLR)
- Piriformis

Weakness

- Abdominals/ transversus abdominus
- Gluteal muscles (single leg stand, single leg squat, or single leg 6” step down)
- Lumbar hyperlordosis

Thomas Test

- This test entails having the patient perform a single knee to chest maneuver, while the clinician observes the opposite thigh to determine whether it remains flat on the table or rises. Patients with excessive hip flexor tightness will flex or lift their straightened leg.

Obers Test

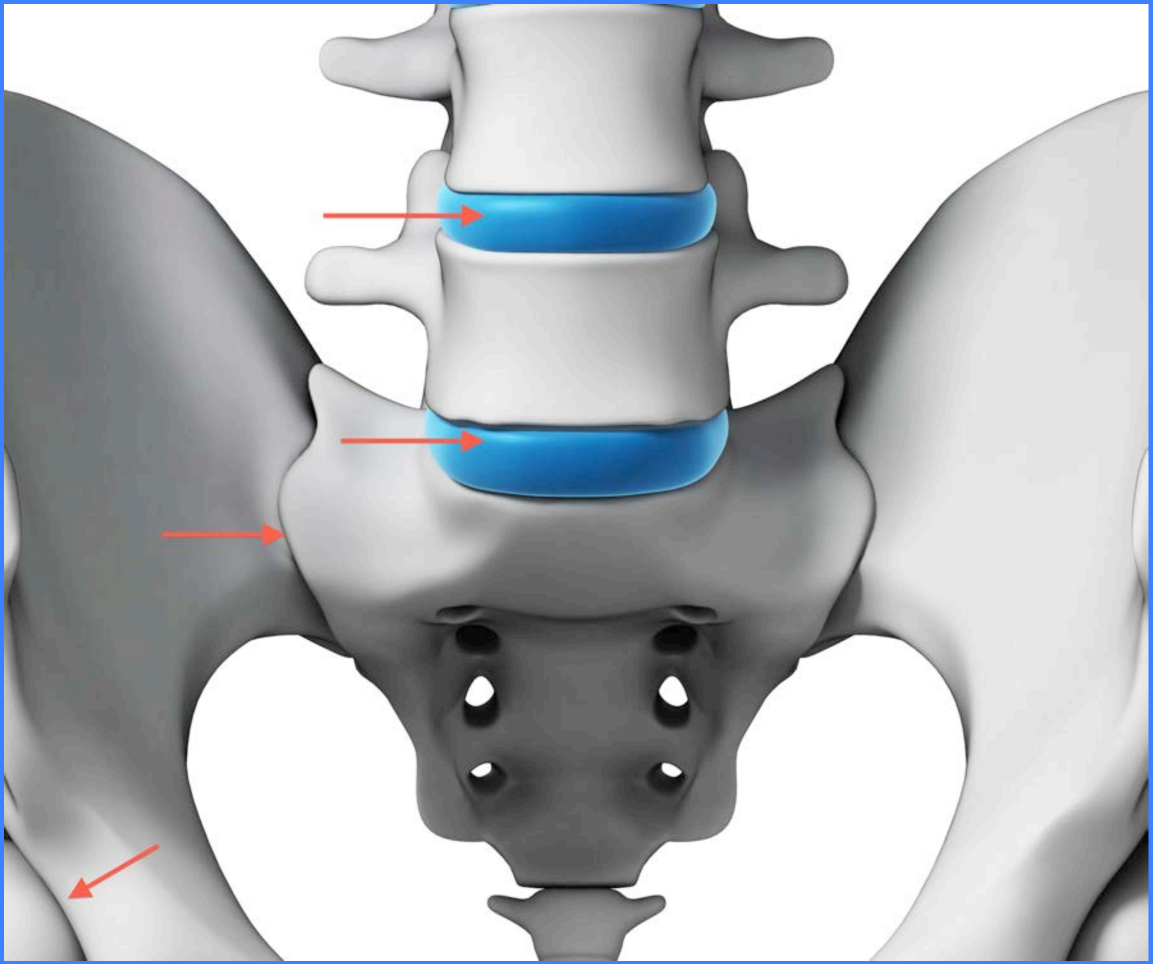
- The patient is side-lying, with their top knee flexed to 90 degrees. The clinician extends the patient’s hip and lift’s their leg into abduction, then releases it, asking the patient to slowly lower their leg toward the table. The clinician assesses the flexibility of the TFL/ITB based upon how far the thigh drops. Lack of mobility suggests TFL/ITB hypertonicity.

SLR

- The clinician progressively lifts the supine patients straightened leg

Predictable Joint Dysfunction

- L4/5
- L5/S1
- SI Joints
- Hips



Lower Crossed Syndrome

Evaluation

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* Standing Postural Evaluation
* Thomas Test
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Management

Soft Tissue

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* STM- Piriformis

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* Manipulation-Lumbar and Sacral

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* Posterior Lunge
* Sidebridge

Management

Soft Tissue

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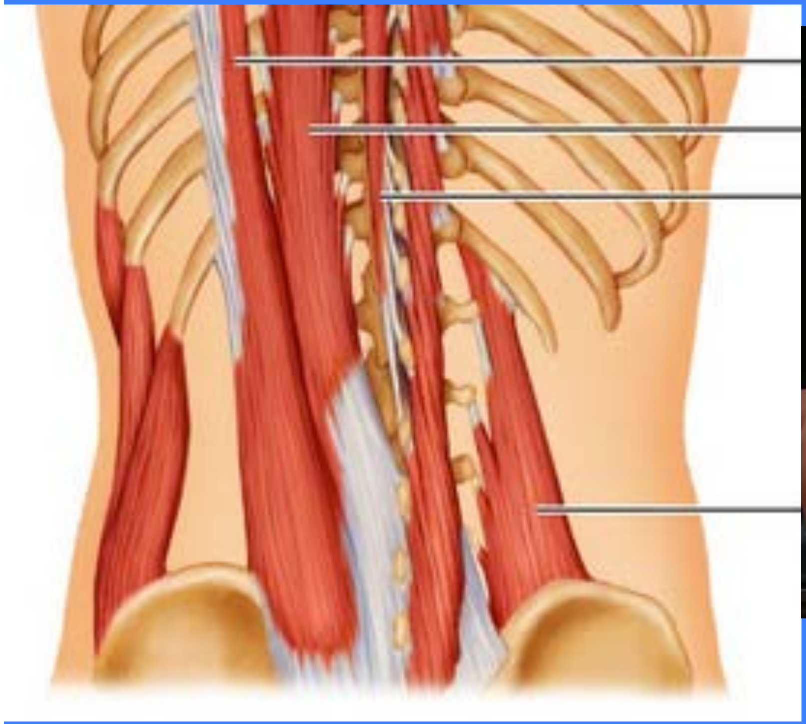
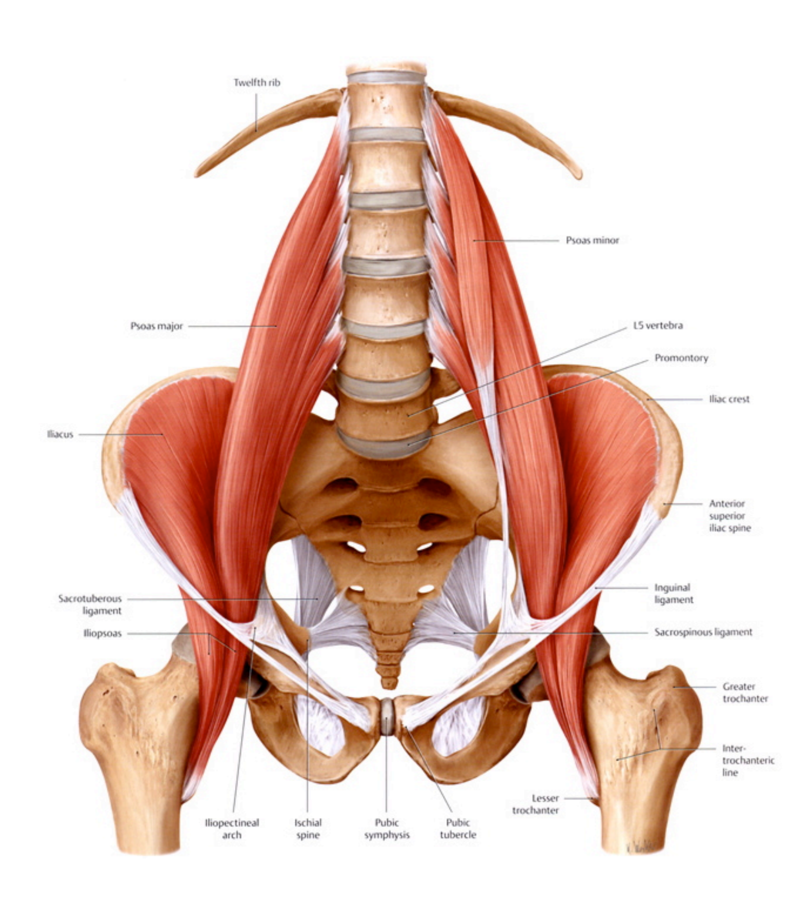
Manipulation/Mobilization

* Manipulation-Lumbar and Sacral

Lumbar Erectors

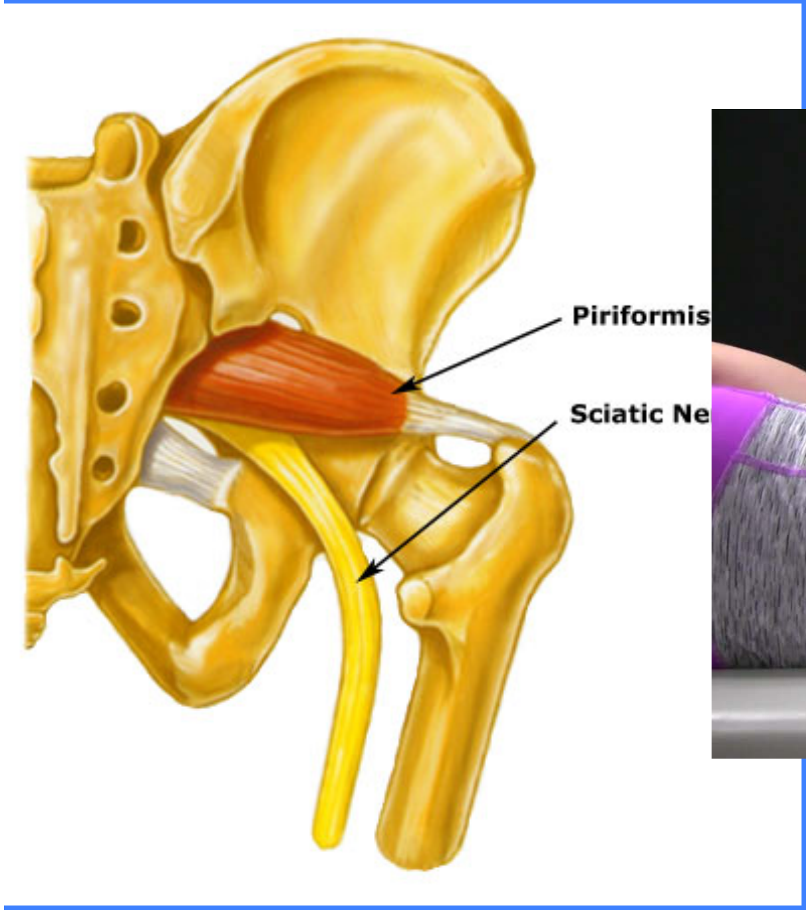


Iliopsoas

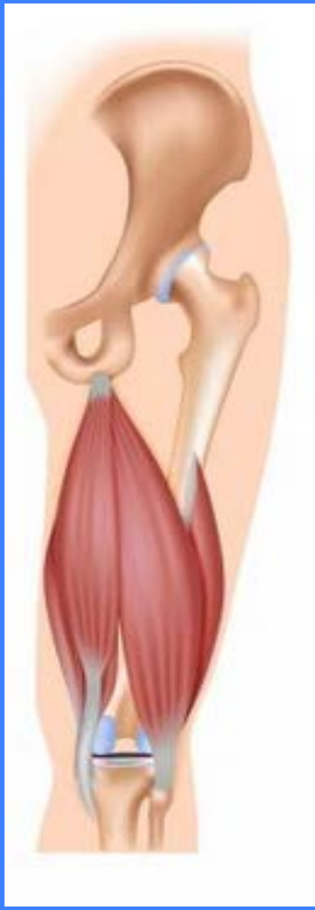

Twelfth rib
Psoas minor
Psoas major
L5 vertebra
Promontory
Iliac crest
Iliacus
Anterior superior iliac spine
Inguinal ligament
Sacrotuberous ligament
Iliopsoas
Sacrospinous ligament
Greater trochanter
Inter-trochanteric line
Lesser trochanter
Iliopectineal arch
Ischial spine
Pubic symphysis
Pubic tubercle

Rectus Femoris

Piriformis



Hamstring



TFL

Gluteals

Lower Crossed Syndrome

Evaluation

* Hip Abductor Weakness Cluster
* Standing Postural Evaluation
* Thomas Test
* Wall Angel Screen

Management

Soft Tissue

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* STM- Lumbar Erectors
* STM- Piriformis

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* Manipulation-Lumbar and Sacral

Phase I exercises

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* Psoas Stretch- Kneeling

Phase II exercises

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* Posterior Lunge
* Sidebridge

Phase I exercises

* Diaphragm Breathing
* Standing ITB Stretch
* Psoas Stretch- Kneeling

Phase II exercises

* Semi-Stiff Dead Lift
* Posterior Lunge
* Sidebridge

Iliopsoas

Begin in a half-kneeling position with the side to be stretched on the floor and your opposite knee bent at 90 degrees, foot planted on the floor. Shift your pelvis forward slowly, keeping your hips and back straight. Against the resistance of the floor, contract your involved thigh in an attempt to flex it forward toward your chest for seven seconds. Relax and shift your pelvis further forward to increase the stretch. Keep your trailing leg rotated outward. “Lock in” to each new position and perform three contract/relax cycles twice per day or as directed.

Hamstring

Lie flat on your back with your leg elevated and positioned in a doorway as shown. “Scoot” toward the doorframe until your hamstring is taut. Contract your hamstring by attempting to push your heel into the doorframe for seven seconds. Relax and gently slide your buttocks toward the doorframe while keeping your knees straight to increase the stretch. Repeat three contract/relax cycles on each side, twice per day or as directed. Alternately, you may provide your own resistance by looping a belt or towel around your heel instead of using a doorframe.

Piriformis

Lie flat on your back with your affected knee bent and your ankle touching the outside of your opposite leg. Grasp your knee and pull your thigh across your chest toward your opposite shoulder. If you are unable to comfortably reach your knee, grasp a thin towel wrapped around your knee. Against the resistance of your hand, contract your affected hip in an attempt to push your knee outward for seven seconds. Relax and pull your knee further across your body towards your shoulder to increase the stretch. "Lock in" to this new position and perform three contract/relax cycles on each side twice per day or as directed.

ITB

Stand approximately two feet from a wall with your affected hip facing the wall. Move your opposite leg forward so that your legs are in a scissors position. The outsides of your feet should be facing each other. Most of your weight should be on your straightened rear leg with your front knee slightly bent and relaxed. With your trunk upright, rotate your pelvis away from the wall and drop your buttock towards the wall until you feel a stretch. Be sure to keep your pelvis forward, not allowing it to drop backward. Keep your breastbone over your uninvolved hip throughout this stretch. Against the resistance of the floor, attempt to contract your rear leg away from your body (toward the wall) for seven seconds. Relax and drop into this stretch to increase the pull. "Lock in" to this new position and repeat three contract/relax cycles on each side twice per day or as directed.

Sidebridge

- Begin lying on your side. Rest your weight on your forearm and feet. Lift your hips forward and toward the ceiling until your body is in a straight “plank” position. Initially, you may need to use your knees for support. Slowly lower your hips back to the floor and repeat for three sets of 10 repetitions per day on each side, or as directed.

Posterior Lunge

While standing on one leg, slowly bend your knee to lower your hips toward the floor as though you are going to sit in a chair. Keep your knee positioned directly above your ankle and do not allow it to shift forward. Try not to allow your back leg to touch the ground. Consciously contract your gluteal muscle on the planted leg side to return to the start position and repeat three sets of 10 repetitions once per day or as directed.

Semi-Stiff Deadlift

Begin standing with your thumbs on your rib cage and your fingers on the crests of your hip, making sure not to approximate your fingers throughout the exercise. Stand on one leg with your knee bent only slightly. Slowly flex forward from the hips moving your chest toward the floor, making certain not to flex your back. Return to an upright position. Repeat 15 repetitions on each leg once per day or as directed.

Lower Crossed Syndrome

Evaluation

* Hip Abductor Weakness Cluster
* Standing Postural Evaluation
* Thomas Test
* Wall Angel Screen

Management

Soft Tissue

* STM- Iliopsoas
* STM- Lumbar Erectors
* STM- Piriformis

Manipulation/Mobilization

* Manipulation-Lumbar and Sacral

Phase I exercises

* Diaphragm Breathing
* Standing ITB Stretch
* Psoas Stretch- Kneeling

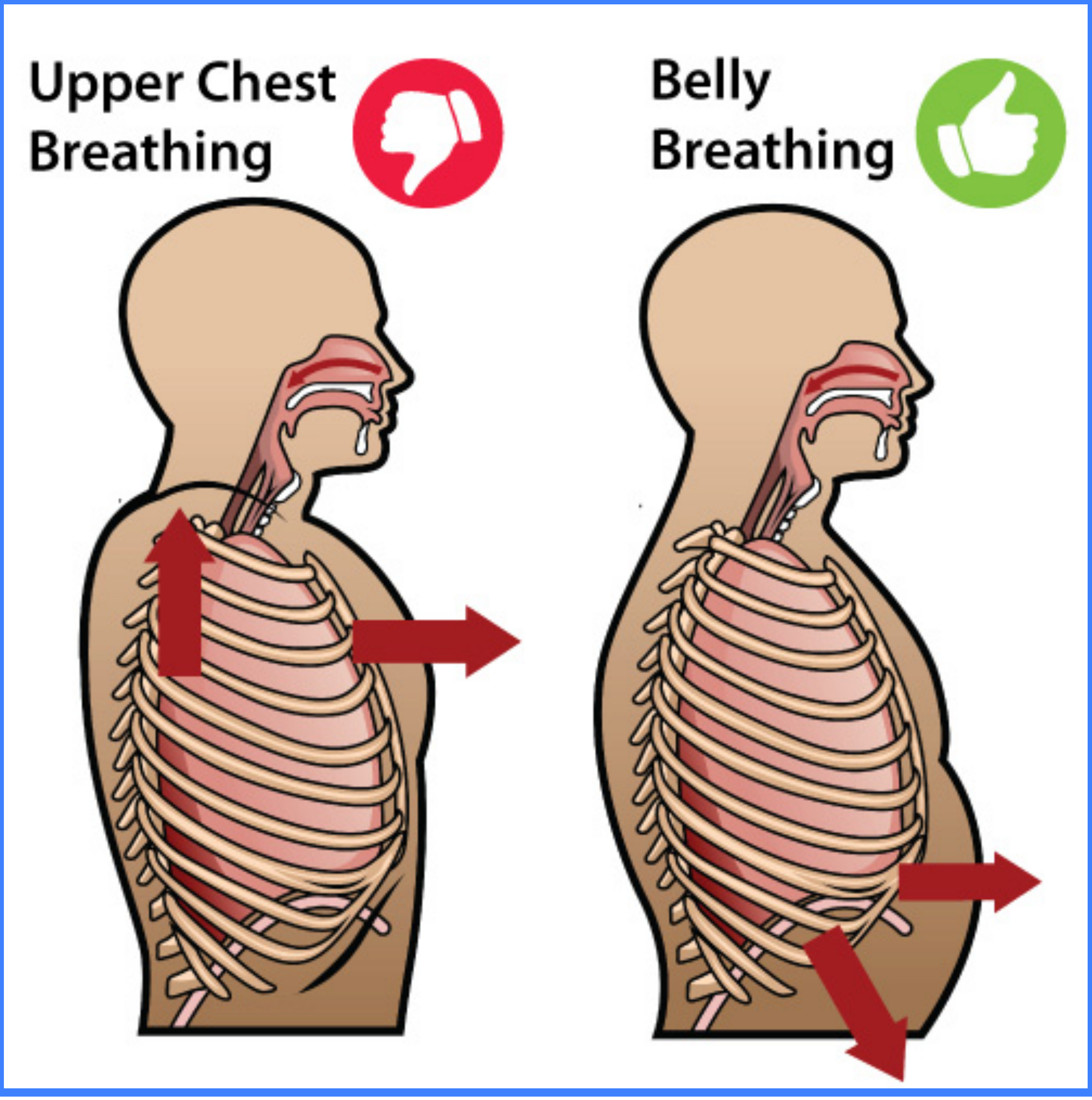
Phase II exercises

* Semi-Stiff Dead Lift
* Posterior Lunge
* Sidebridge

Clinical Pearls

* Lower crossed syndrome may be sub-classified & treated based on upon whether the patient's dominant postural imbalance is hypertonicity (sub type A) or weakness (subtype B).
* Lower crossed syndrome creates a predictable pattern of joint dysfunction involving the L4/5, L5/S1, sacroiliac and hip joints.
* Functional rehabilitation must include proprioception and exercises to "groove new movement patterns."

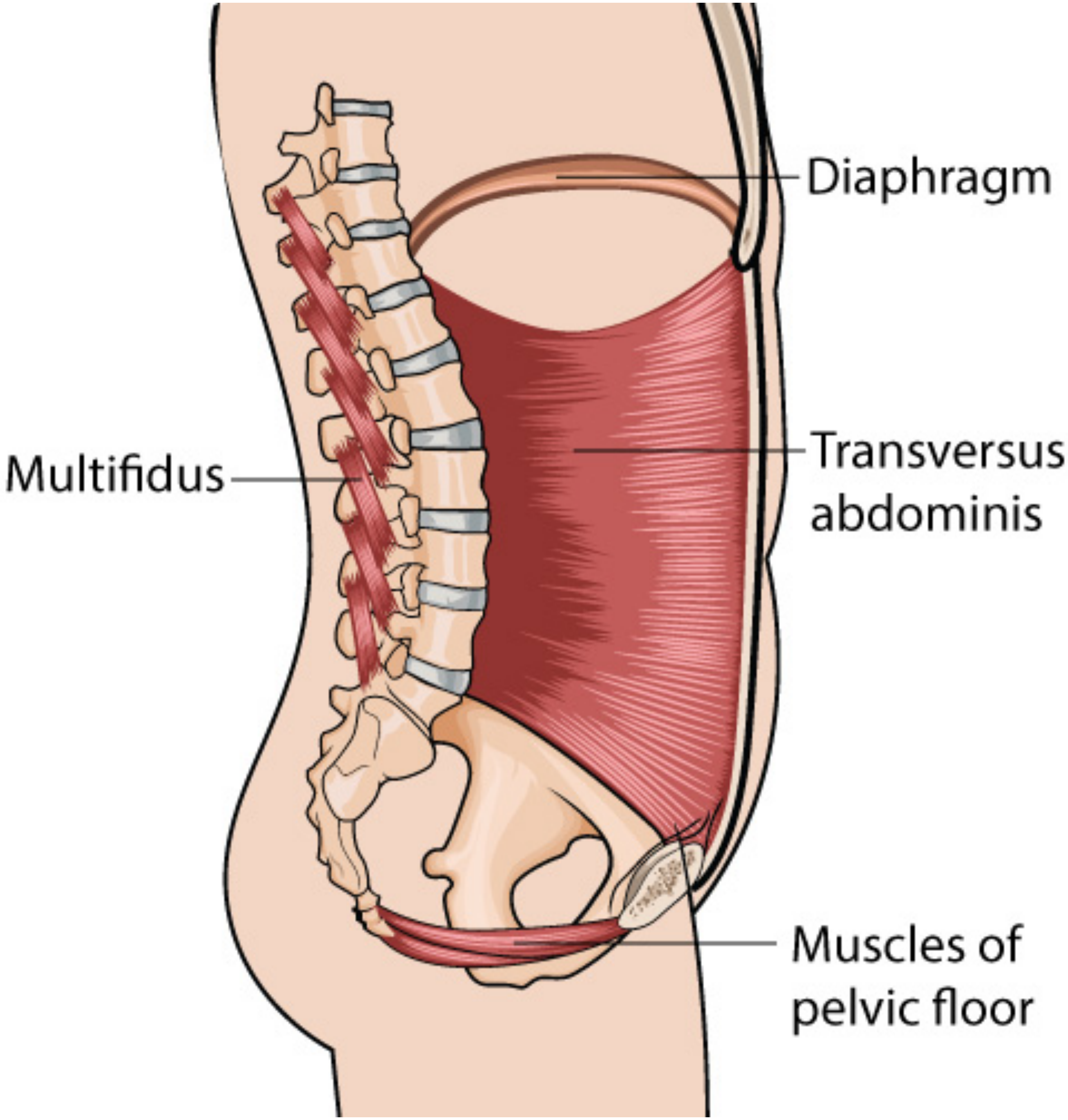
Dysfunctional Breathing



Aesthetics

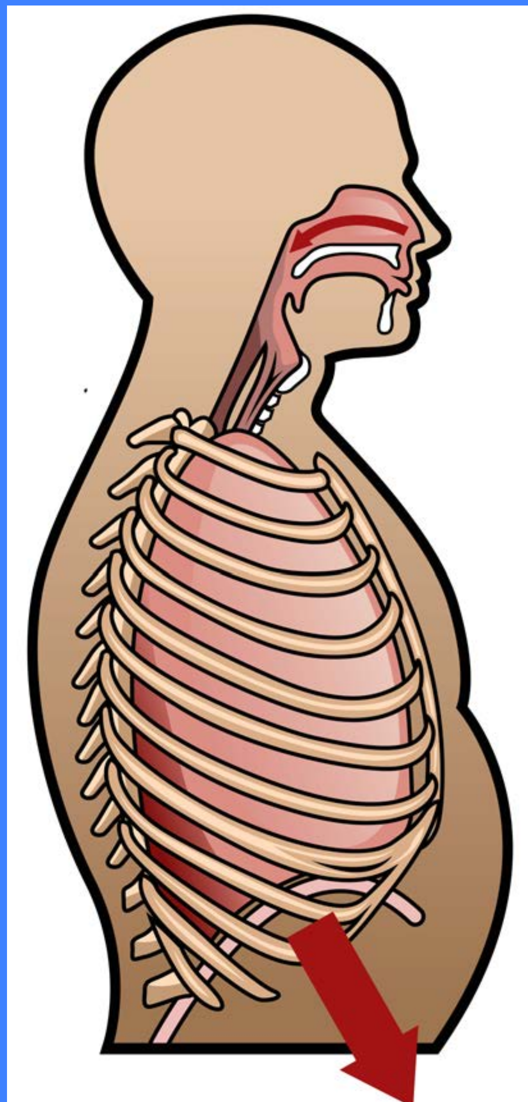
Pregnancy

Workstation Ergonomics


Diaphragm
Transversus abdominis
Multifidus
Muscles of pelvic floor

Dysfunctional Breathing Complaints

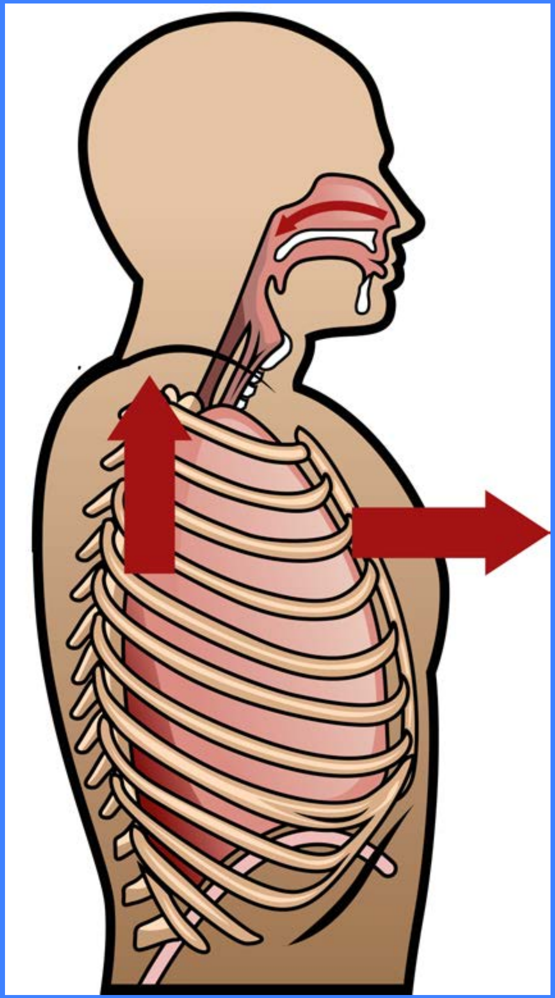
- Thoracic, Lumbar & Sacroiliac joint dysfunction
- Sprain/strain
- Disc Lesion
- Spondylolisthesis
- Myofascial Pain
- Degeneration



Signs of Dysfunctional Breathing

- Elevation of the upper rib cage
- Inadequate or asymmetrical lateral rib cage expansion
- Nasal flaring
- Labored breathing
- Frequent yawning
- Hyperventilation
- Mouth breathing
- Excessive paraspinal muscle contraction
- Initiation of breathing from the chest rather than the abdomen
- Breath Holding

Paradoxical Breathing



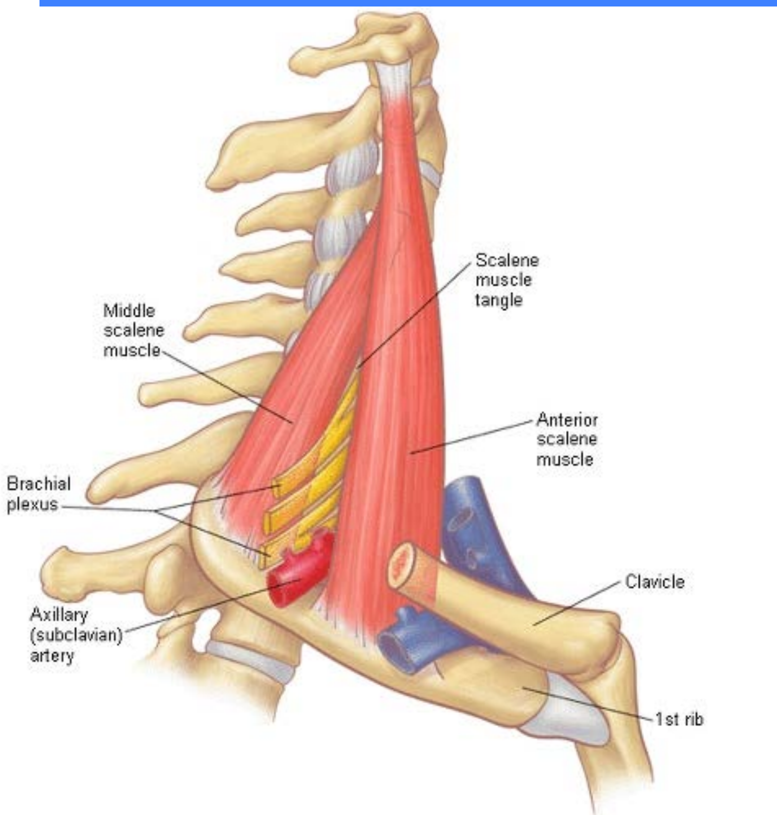
Breathing Assessment

- Breathing may be assessed with the patient lying supine, knees bent having the patient place one hand over their umbilicus, the other hand on their sternum.
- Initiation of a deep breath should start in the abdomen with minimal chest elevation.
- Normal breathing should cause a wave-like pattern of spinal flexion beginning at the diaphragm then moving cephlad (best observed in a prone patient).

Secondary Sites of Myofascial Irritation

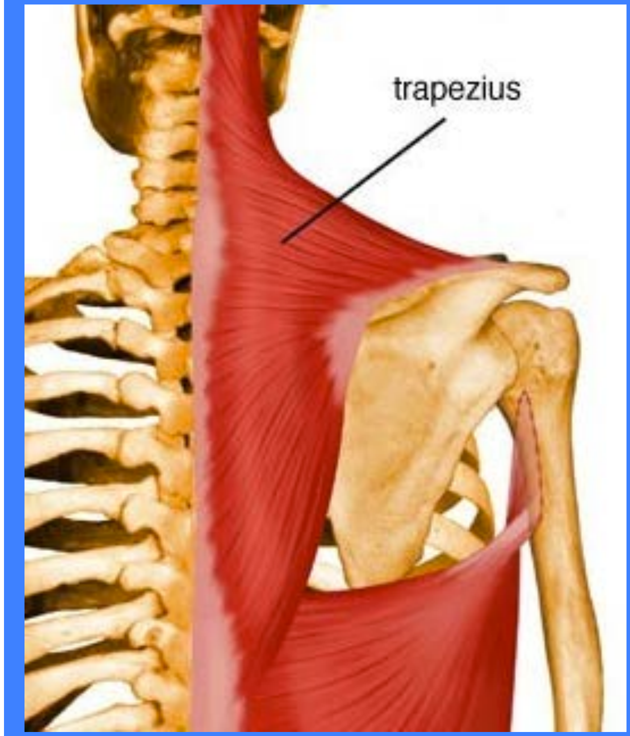
- Upper trapezius
- Scalenes
- Levator scapula
- SCM
- Pectoral muscles

Scalenes

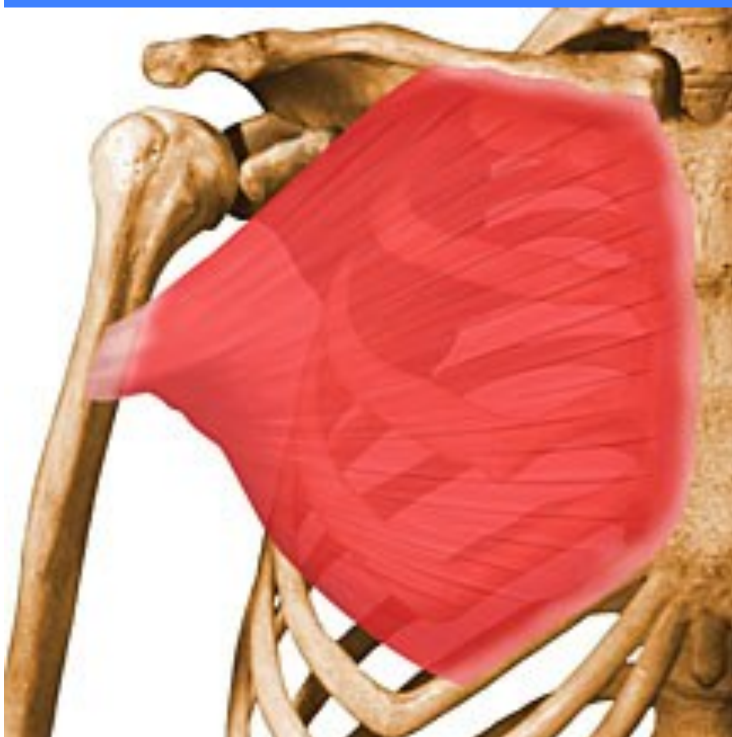

Scalene muscle tangle
Middle scalene muscle
Anterior scalene muscle
Brachial plexus
Clavicle
Axillary (subclavian) artery
1st rib

Levator

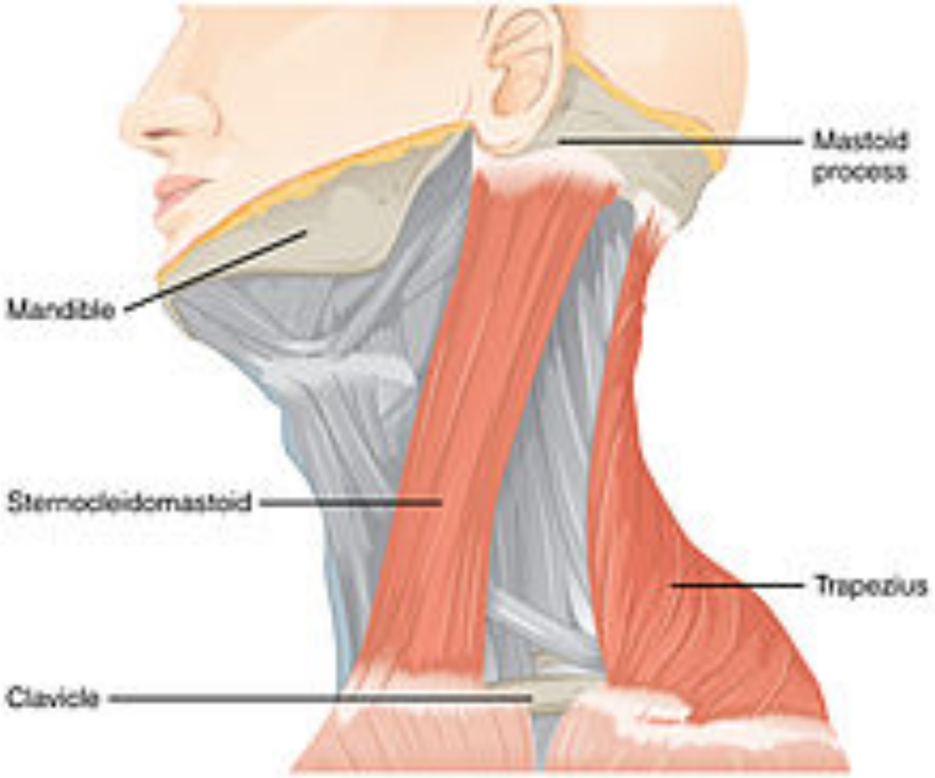
Upper Trapezius



Pectoralis Major



SCM


Mastoid process
Mandible
Sternocleidomastoid
Trapezius
Clavicle

Rehab Progression

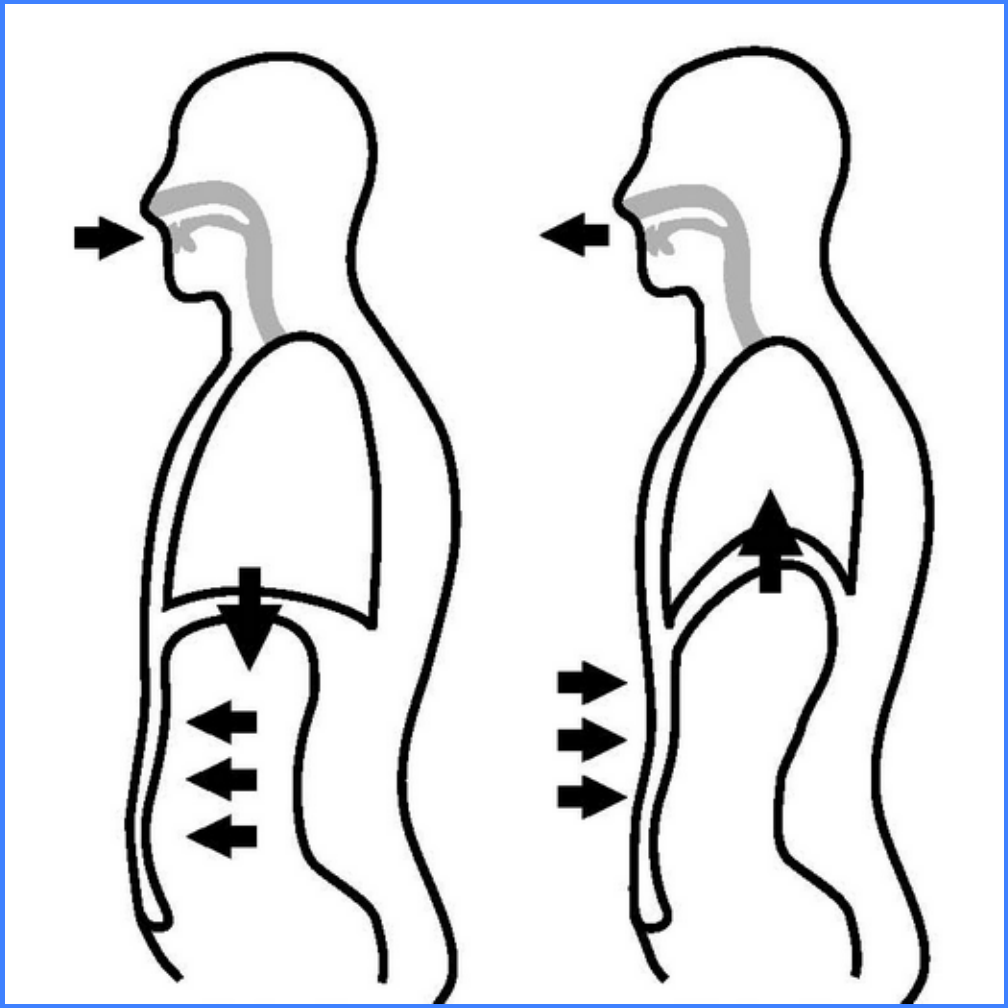
- Educate the patient about the detrimental effect of abnormal breathing and how poor mechanics contribute to their symptoms.
- Briefly describe the patient's abnormal breathing pattern.
- Allow the patient to recognize their fault by manually palpating the areas of dysfunction while observing themselves breathe in a mirror.
- Demonstrate normal breathing mechanics, so that the patient may visualize proper abdominal and lower rib cage expansion while the chest remains still.

Training

- Training proper breathing techniques may begin with the patient in a supine hook-lying position, placing one hand on their abdomen and the other over their sternum. The patient should breathe in slowly and deeply through their nose. If they are breathing properly from their diaphragm, only the hand over their abdomen should rise, and the hand over their chest should remain still. Clinicians must stress the emphasis on abdominal expansion. Instruct the patient to lightly compress their abdomen while they breathe in, followed by relaxation of the pressure as they breathe out. The patient may apply light pressure to the lower lateral rib borders as they inhale and exhale. The patient should practice two to three breaths hourly and 10-20 breaths upon awakening and retiring. Patients should "groove" proper breathing mechanics by practicing in a progressive fashion- first in a supine position, then seated, then standing, and finally, while performing dynamic movements (i.e. overhead squat).

1:2 Rhythm

Inhale 3 seconds **Exhale** 6 seconds



Dysfunctional Breathing

Evaluation

* Breathing Evaluation

Management

Phase I exercises

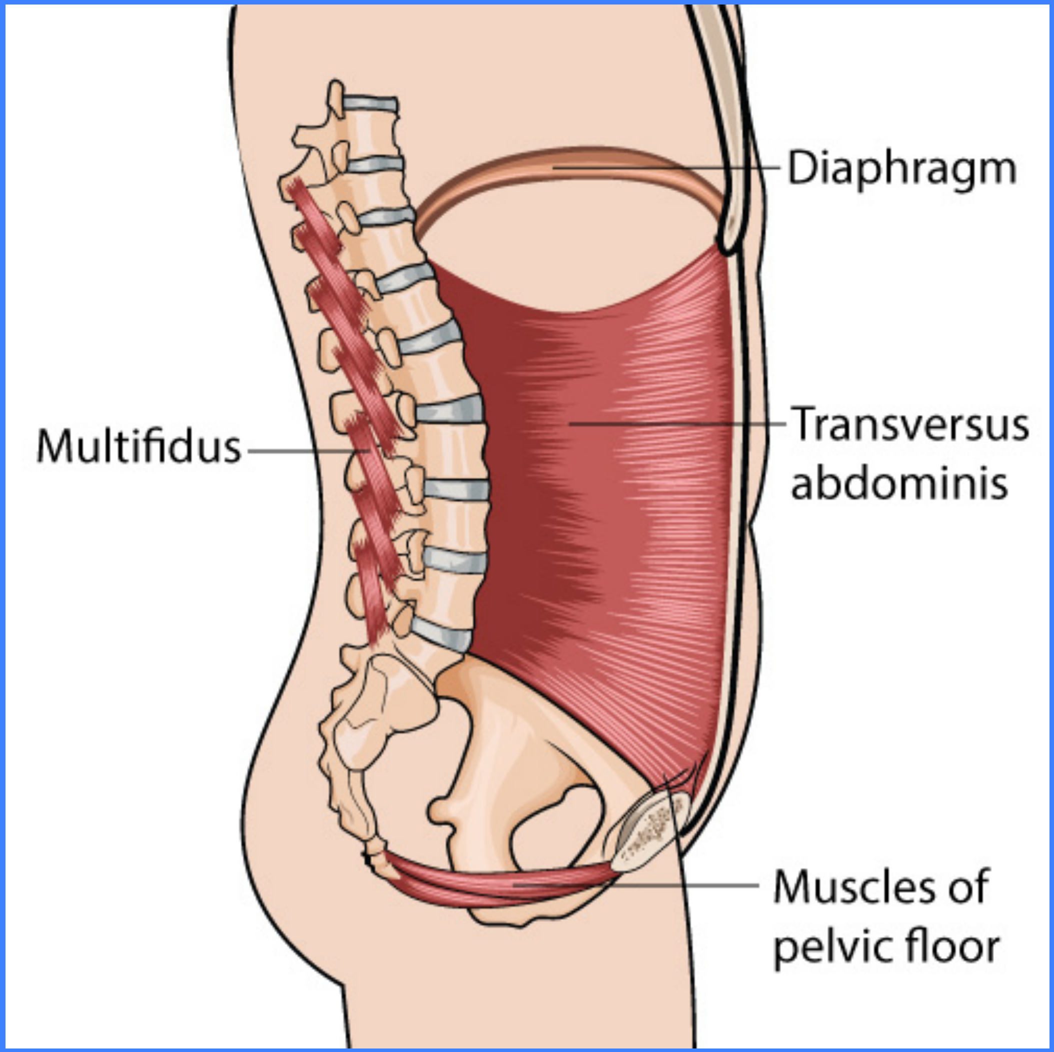
* Diaphragm Breathing

Clinical Pearls

* Intraabdominal pressure (IAP) is a key determinant of spinal stability- as increased intraabdominal pressure equates to improved spinal stability.
* The diaphragm can adapt to perform its dual role of respiration and stabilization simultaneously and independently- although this becomes more of a challenge with repetitive limb movements.
* Patients who are unable to efficiently contract their diaphragm for postural stability have an increased risk of lower back pain.
* Patients with dysfunctional patters often present with a "paradoxical" breathing pattern- where the abdomen remains still or retracts while the upper chest elevates and expands.
* Diaphragmatic function should be restored prior to initiating balance or stability exercises

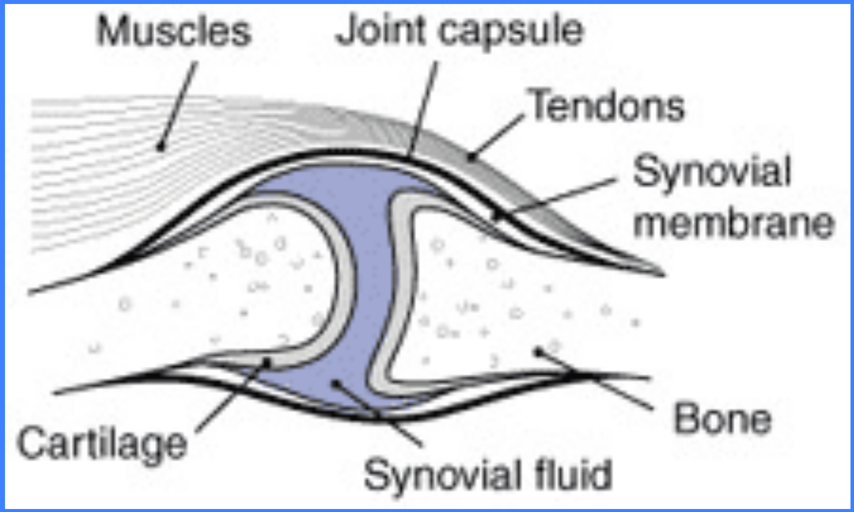
Spinal Instability

Spinal Stability

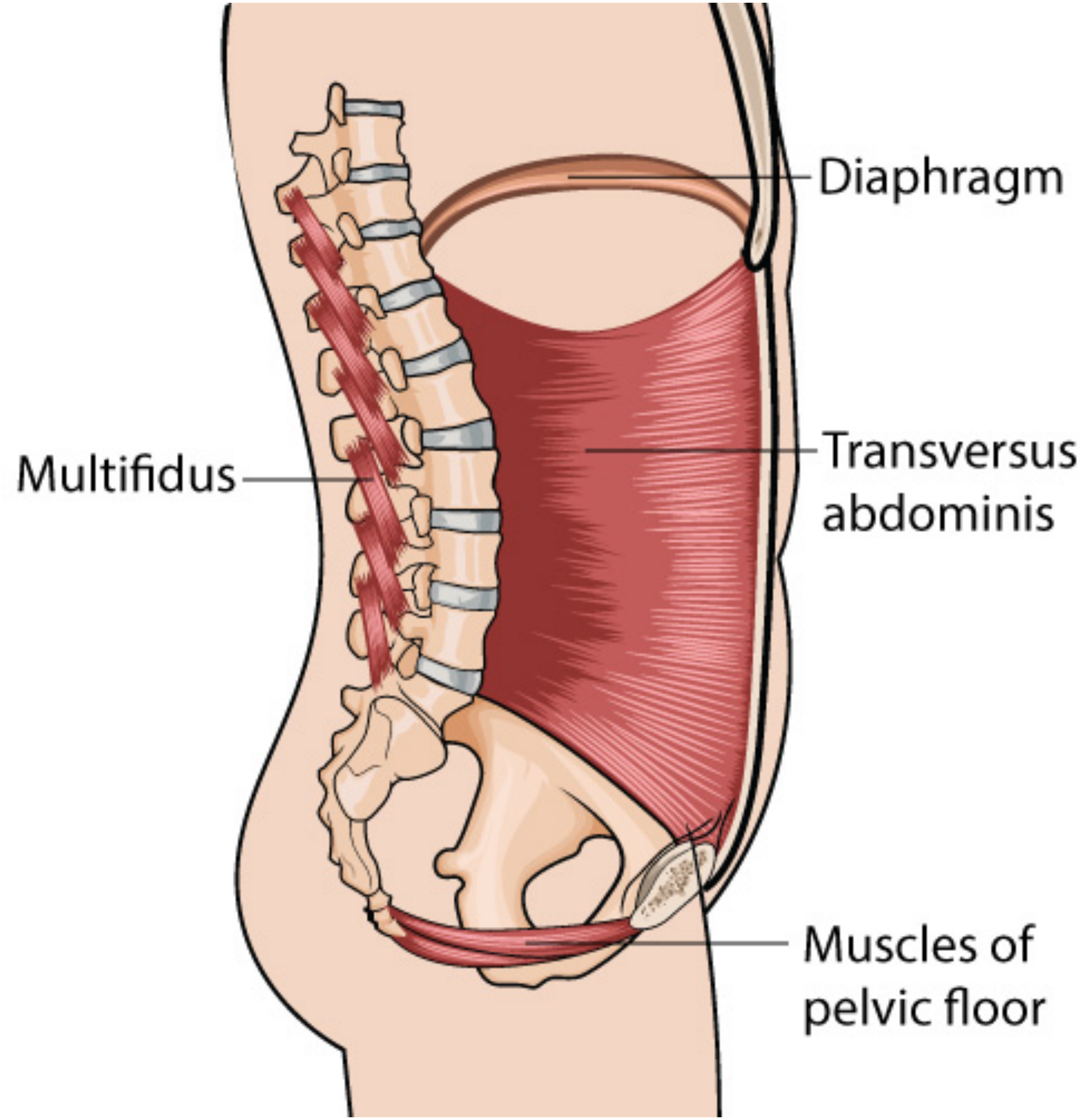





Centration



Muscles
Joint capsule
Tendons
Synovial membrane
Cartilage
Synovial fluid
Bone


Diaphragm
Multifidus
Transversus abdominis
Muscles of pelvic floor

Symptoms

Modifier- Spinal Instability

SHOW ICD

Evaluation
* Breathing Evaluation
* Spinal Instability Cluster

Management
Soft Tissue
* STM- Iliolumbar Ligament
* STM- Lumbar Erectors
* STM- Quadratus Lumborum

Phase I exercises
* Diaphragm Breathing
* Sidebridge
* Bird Dog
* Dead Bug

Evaluation
* Breathing Evaluation
* Spinal Instability Cluster

Spinal Instability Assessment Cluster

- Assessment for aberrant motion during lumbar flexion
- Active straight leg raise test
- Prone instability test
- PA shear test
- Passive lumbar spine extension
- Bridging maneuvers
- Assessment of breathing

Aberrant Motion

- During standing lumbar forward flexion, the clinician should assess for pain while bending or upon return, catching, disruption of normal lumbopelvic rhythm, sudden acceleration or deceleration of trunk movement, the presence of unexpected lateral flexion or rotation during flexion, the use of arms to return to an upright position, presence of knee flexion and/or an anterior shift of the pelvis. The presence of any single aberrant movement suggests instability.

Active Straight Leg Raise

- Ask the supine patient to actively lift their straightened leg as high as possible (SLR). The clinician compares both sides. Average elevation beyond 90 degrees is a positive test for instability. The clinician should also note: the speed of leg elevation, the appearance of a tremor, the amount of trunk rotation, and the verbal and nonverbal emotional expressions of the patient. Impairment suggests lumbar or posterior pelvic girdle dysfunction/ instability.

PA Shear

- With the patient lying in the prone position, gently palpate the lumbar and thoracic spinous processes. Using approximately 2 lbs of force, challenge the joints in a posterior to anterior direction. Each joint should be assessed individually for joint play, end feel and pain. Limited end feel or reproduction of pain is a positive test and suggests joint dysfunction at that level.

Prone Instability Test

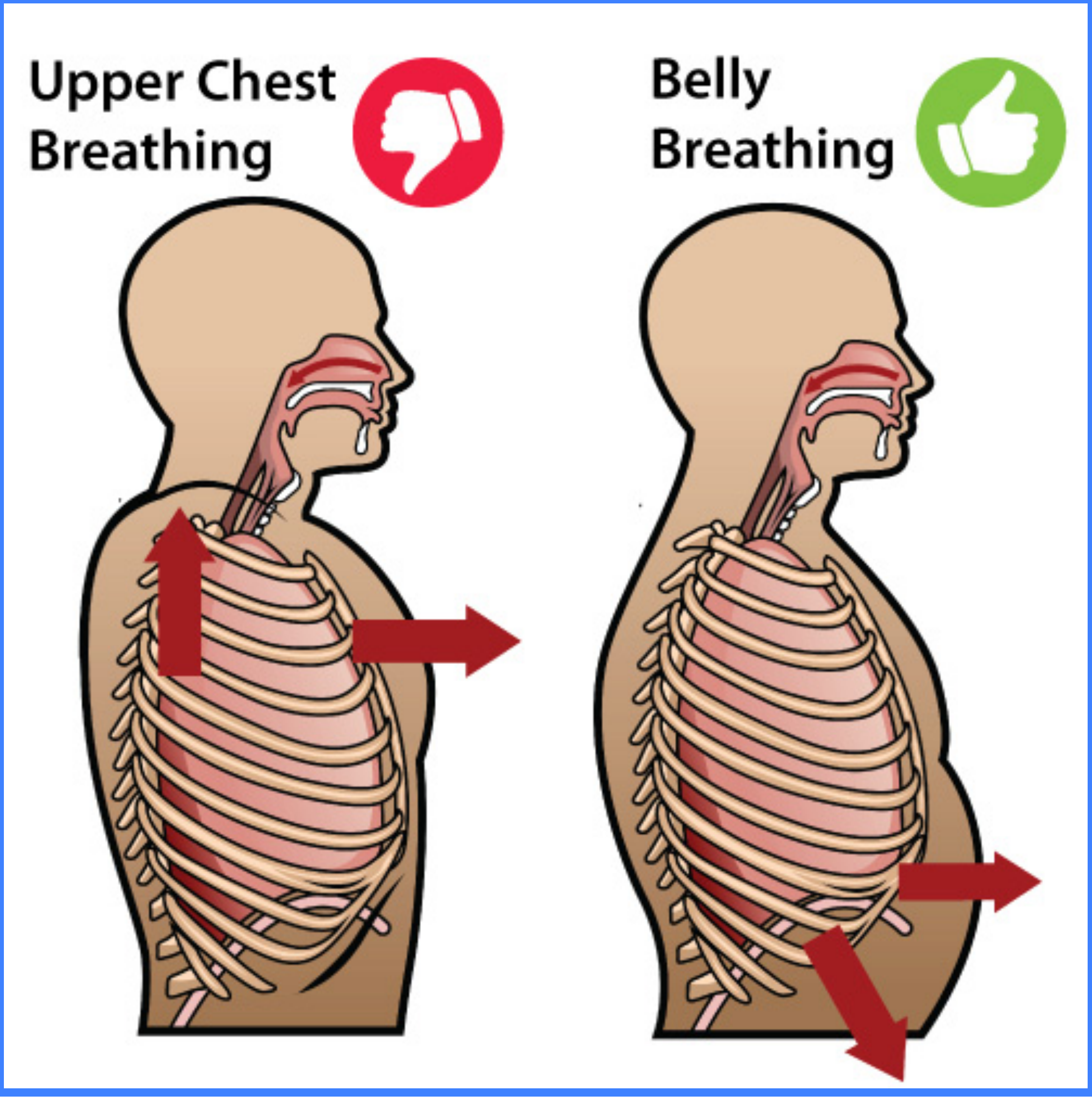
The Prone instability test is a comparison of the PA shear test when performed in two different positions. The prone instability test is performed with the patient lying prone on the exam table with their legs over the edge, feet on the floor. The clinician applies a posterior to anterior shear force to each lumbar level and notes pain provocation. The patient then lifts their legs off of the floor, and the clinician repeats the PA shear over any segments that were identified as painful. Symptoms that disappear when the test is performed with the legs lifted suggest spinal instability.

Passive Lumbar Spine Extension

- The test is performed when the patient lies prone with their knees locked in an extended position. The clinician gently tractions and simultaneously elevates both of the patients legs about 12 inches off of the table. Increased low back discomfort or “heaviness” demonstrates good sensitivity and specificity for lumbar instability.

Bridging Maneuvers

Dysfunctional Breathing



Breathing Assessment

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- Normal breathing should cause a wave-like pattern of spinal flexion beginning at the diaphragm then moving cephlad (best observed in a prone patient).

Modifier- Spinal Instability

SHOW ICD

Evaluation

* Breathing Evaluation
* Spinal Instability Cluster

Management

Soft Tissue

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* STM- Lumbar Erectors
* STM- Quadratus Lumborum

Phase I exercises

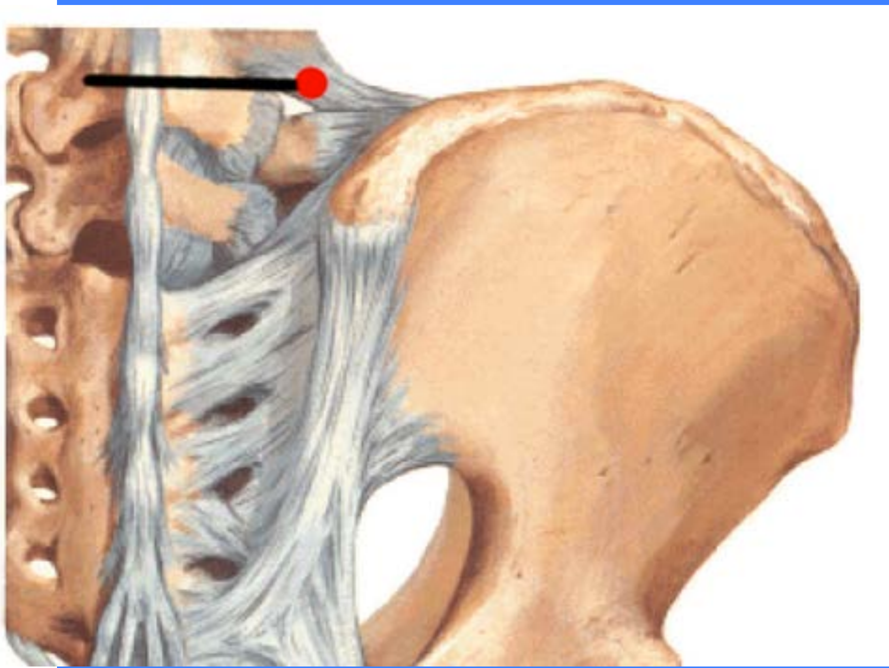
* Diaphragm Breathing
* Sidebridge
* Bird Dog
* Dead Bug

Management

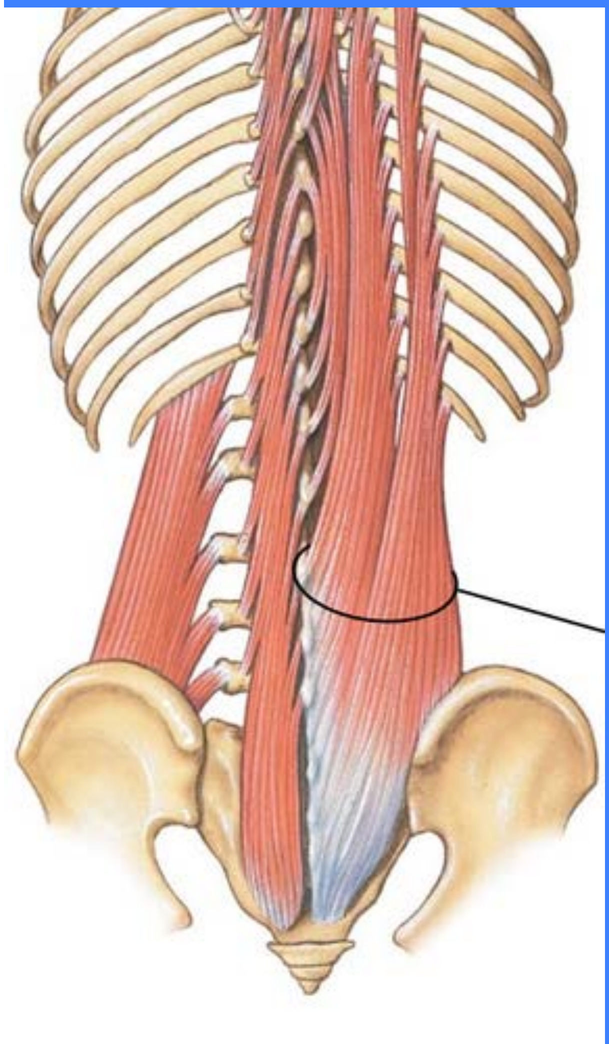
Soft Tissue

* STM- Iliolumbar Ligament
* STM- Lumbar Erectors
* STM- Quadratus Lumborum

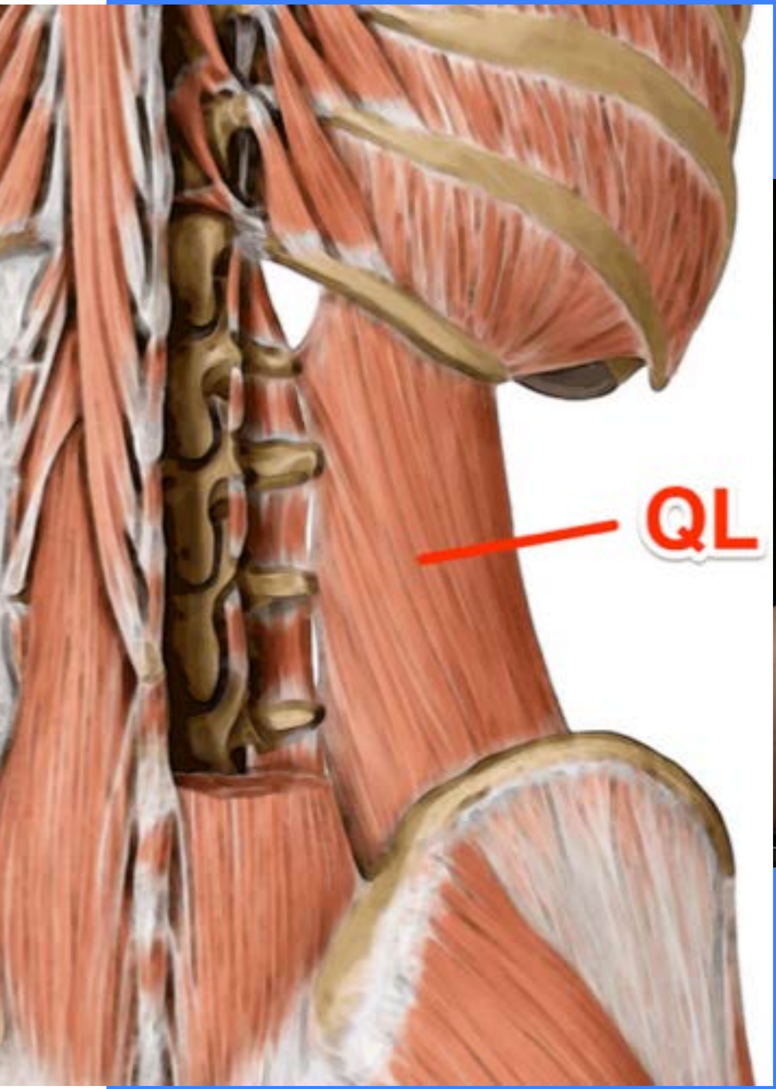
STM- Iliolumbar Ligament



STM- Lumbar Erectors



STM- Quadratus Lumborum



Mobilize or Stabilize?

- Under 40 years old
- ASLR greater than 90 degrees
- Positive prone instability test
- Presence of aberrant movement during lumbar flexion

Modifier- Spinal Instability

SHOW ICD

Evaluation

* Breathing Evaluation
* Spinal Instability Cluster

Management

Soft Tissue

* STM- Iliolumbar Ligament
* STM- Lumbar Erectors
* STM- Quadratus Lumborum

Phase I exercises

* Diaphragm Breathing
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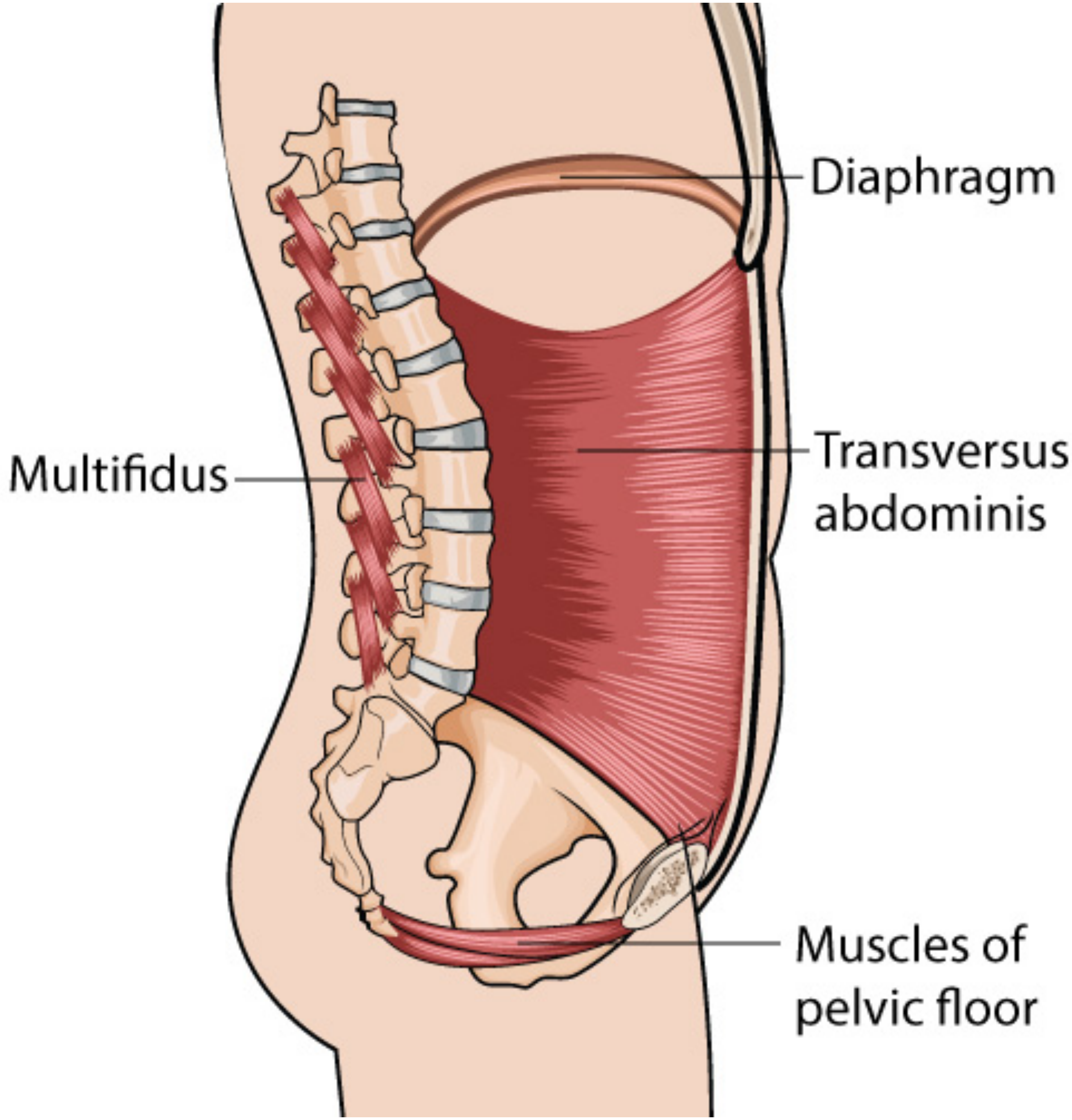
* Dead Bug

Phase I exercises

* Diaphragm Breathing
* Sidebridge
* Bird Dog
* Dead Bug


Diaphragm
Multifidus
Transversus abdominis
Muscles of pelvic floor

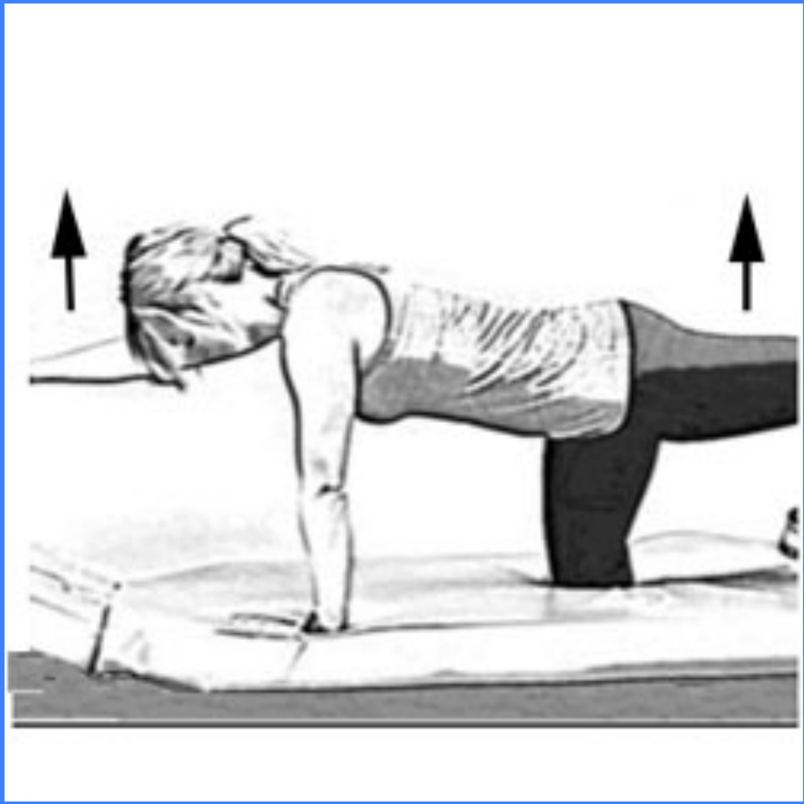
Side Bridge

- Begin lying on your side. Rest your weight on your forearm and feet. Lift your hips forward and toward the ceiling until your body is in a straight "plank" position. Initially, you may need to use your knees for support. Slowly lower your hips back to the floor and repeat for three sets of 10 repetitions per day on each side, or as directed.

Dead Bug

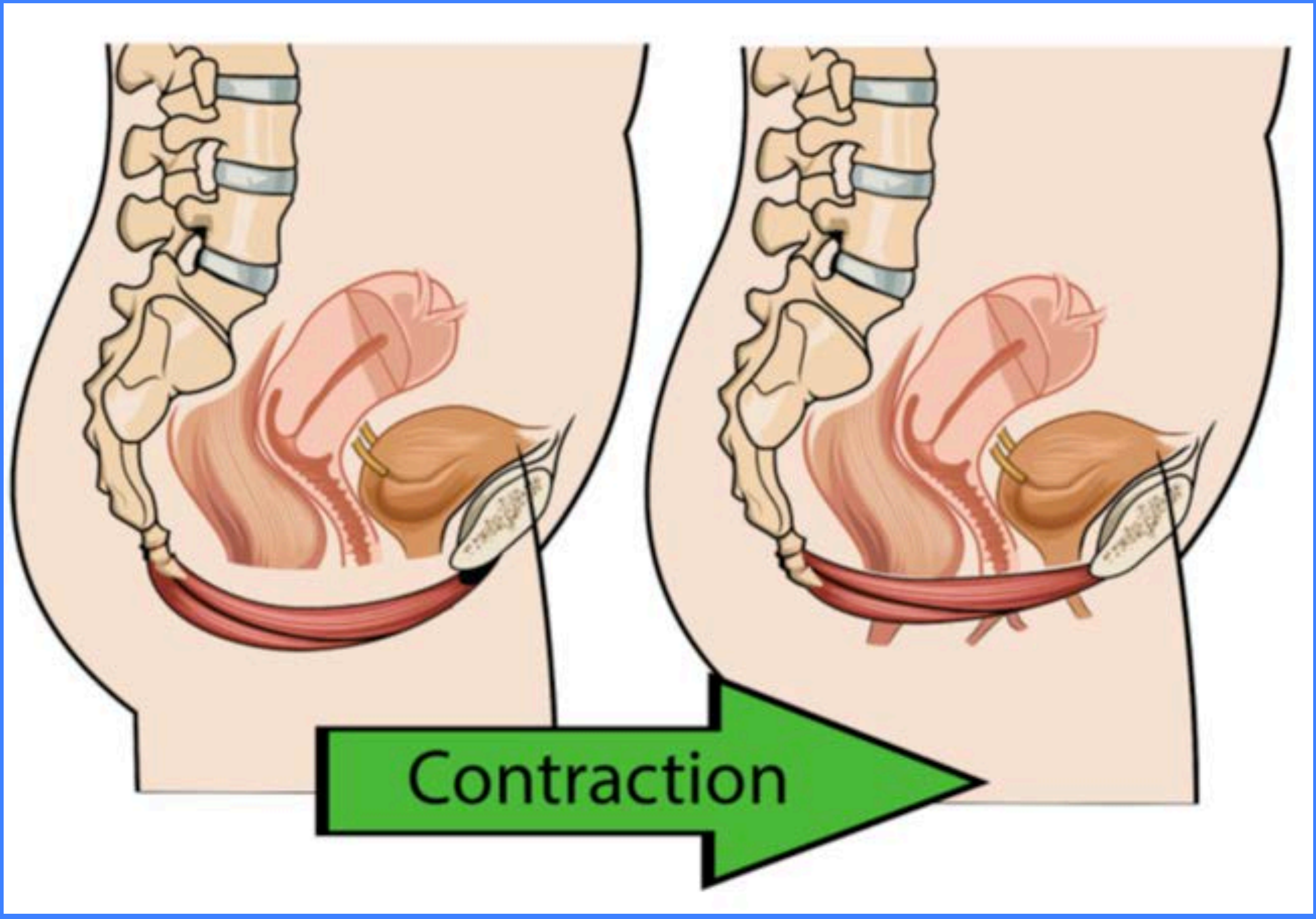
- Begin lying on your back with your right arm reaching overhead and your left leg flat on the table. Your right knee should be bent 90 degrees and your hip 45 degrees. Place your left wrist beneath your back to prevent your back from flattening against the ground. Slowly begin by raising your left knee and right arm at the same time until your hand touches your knee. Be sure not to lift your head or allow your spine to flatten against the floor. Return to the start position and repeat for three sets of 10 repetitions on each side, twice per day or as directed.

Bird Dog



- Begin on your hands and knees in a quadruped position. Extend your right leg and left arm into a fully straightened “bird dog” position. Hold this contraction for two seconds and return to the quadruped position. Do not arch your back or twist your hips at any point. Repeat with your opposite limbs, slowly alternating for three complete sets of 10 repetitions two times per day or as directed.

Pelvic Floor Training



Modifier- Spinal Instability

SHOW ICD

Evaluation

* Breathing Evaluation
* Spinal Instability Cluster

Management

Soft Tissue

* STM- Iliolumbar Ligament
* STM- Lumbar Erectors
* STM- Quadratus Lumborum

Phase I exercises

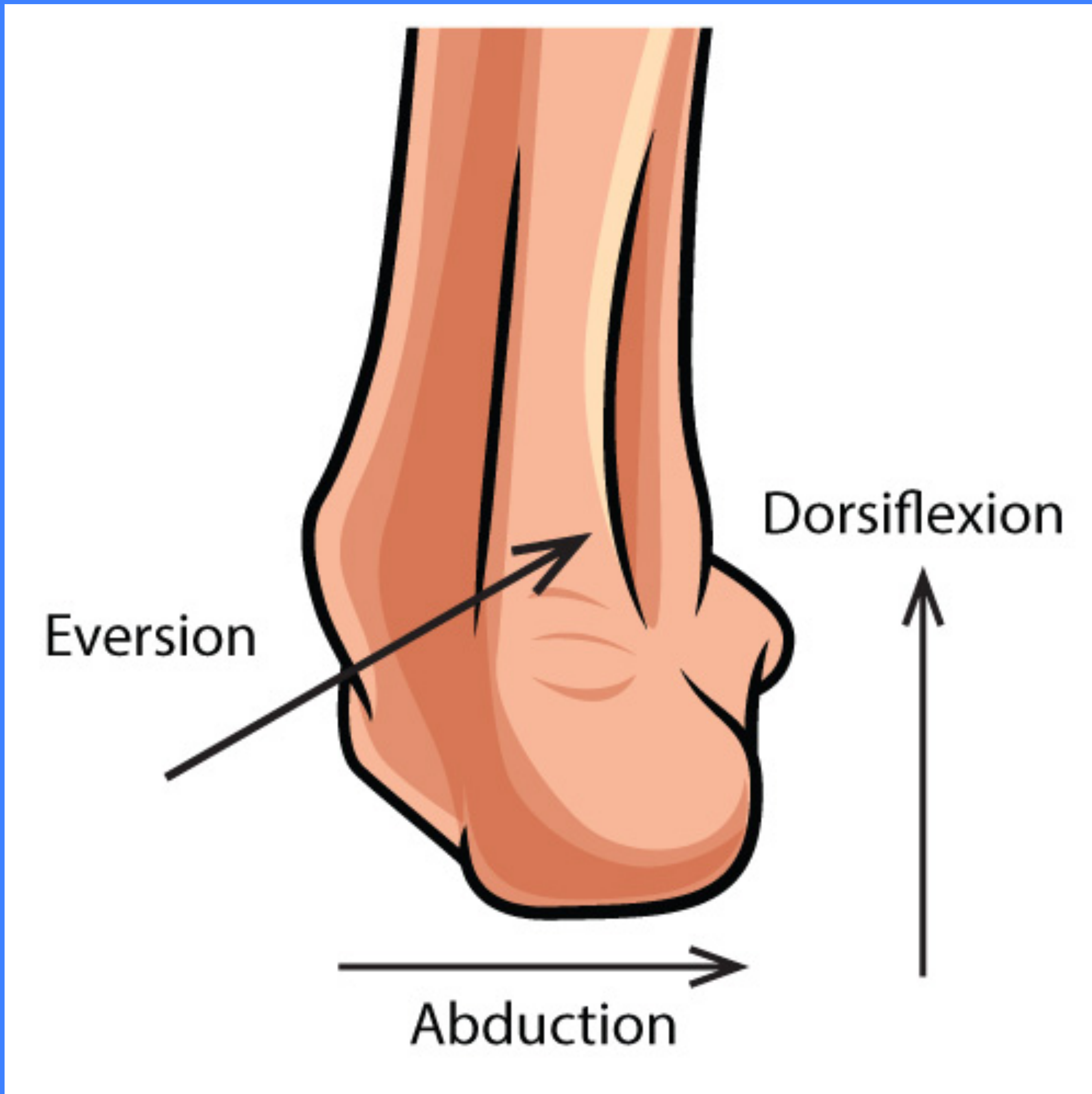
* Diaphragm Breathing
* Sidebridge
* Bird Dog
* Dead Bug

Clinical Pearls

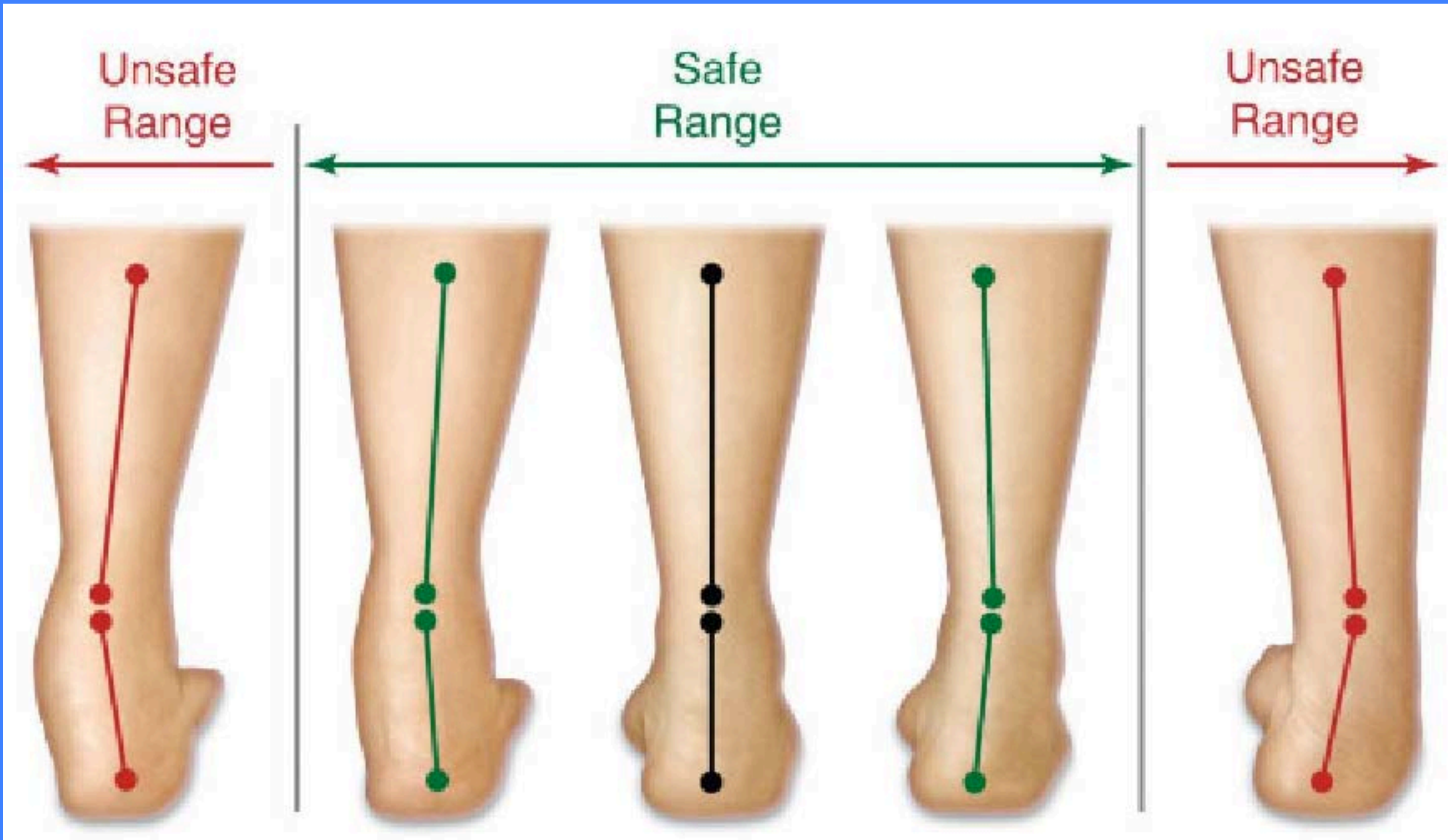
* A deficiency, injury, or weakness in one spinal stabilizer requires compensatory recruitment of other muscles and altered global movement patterns. This compensatory muscle activation leads to strain and overuse injury, with ongoing problems creating "learned" dysfunction.
* IAP is largely determined by the strength and tone of the muscles forming the "abdominal canister" : Front & sides- transverse abdominus & intercostals, Back- paraspinal muscles, Bottom- pelvic floor, Roof- diaphragm.
* The diaphragm performs a dual function as a respiratory muscle and postural stabilizer.
* LBP patients who are most likely to respond to lumbar stability exercises include: those who are under 40 years old, those who demonstrate ASLR greater than 90 degrees, those with a positive prone instability test, and the presence of aberrant movement during lumbar flexion. The presence of three or more of these variables predicts a 67% success rate with incorporation of a stabilization program.

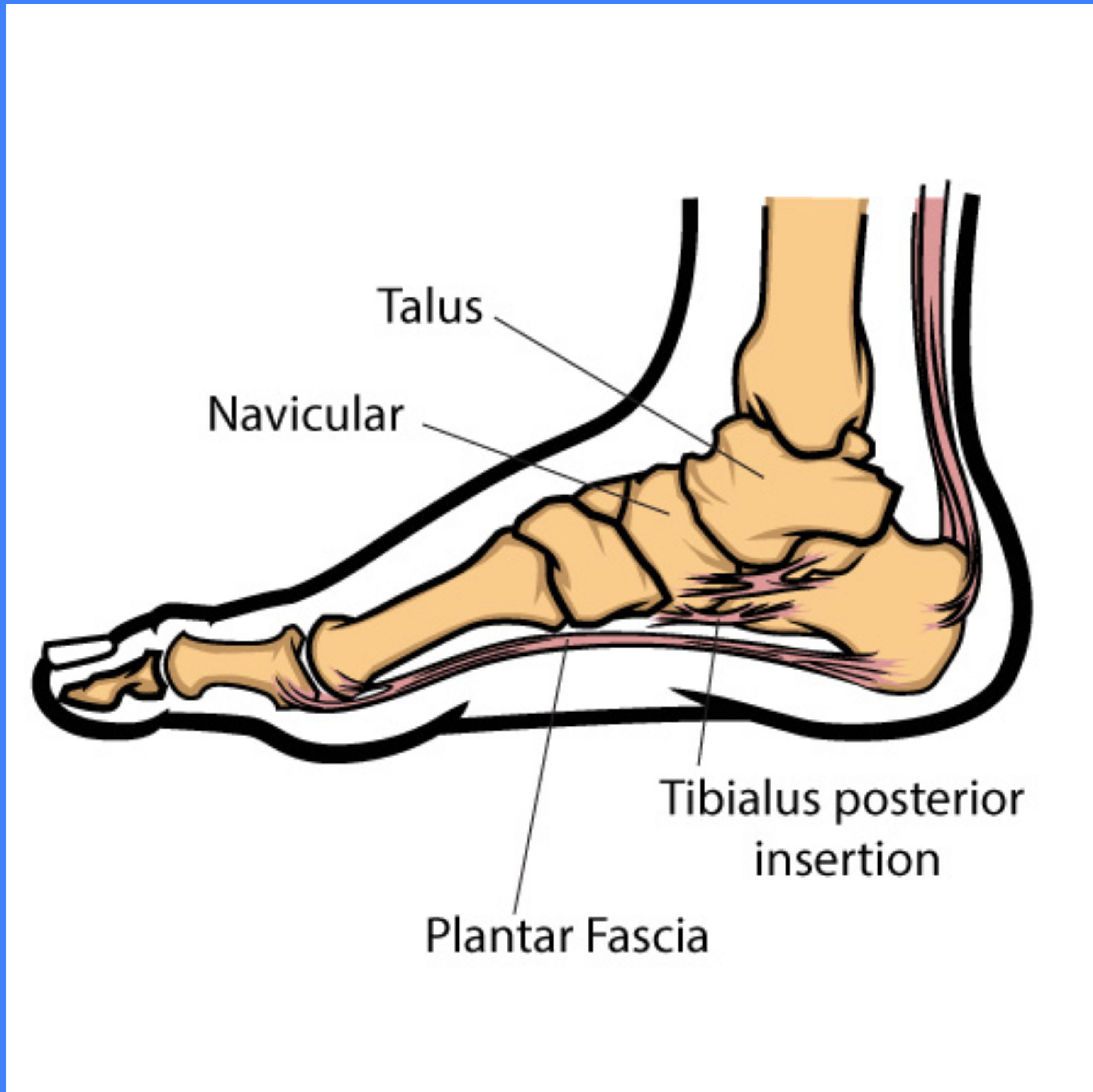
Foot Hyperpronation

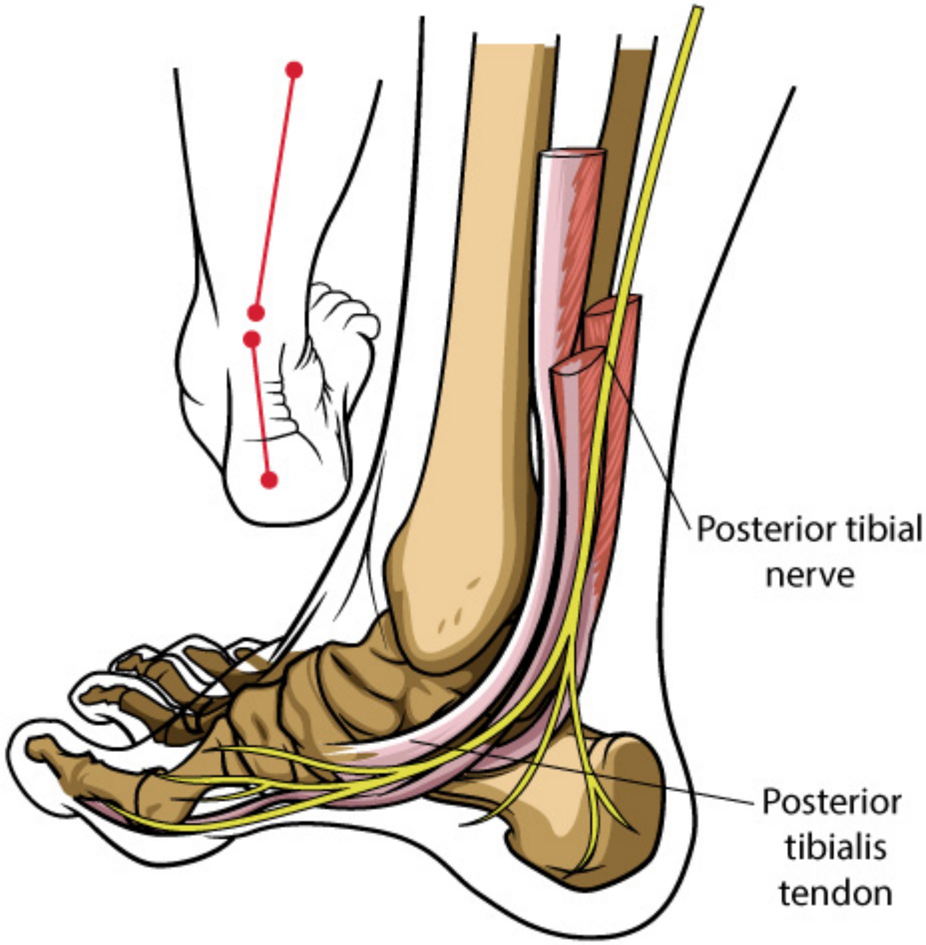

2
3
1
5
5
5
5
4
7b
8
7a
6
9
9
9
10
11
10
10
10

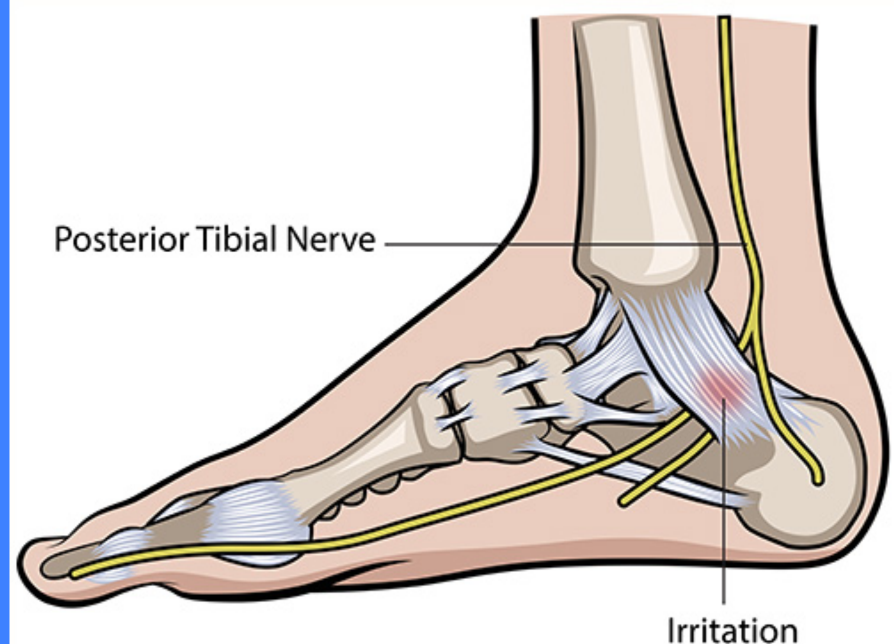

Dorsiflexion
Eversion
Abduction

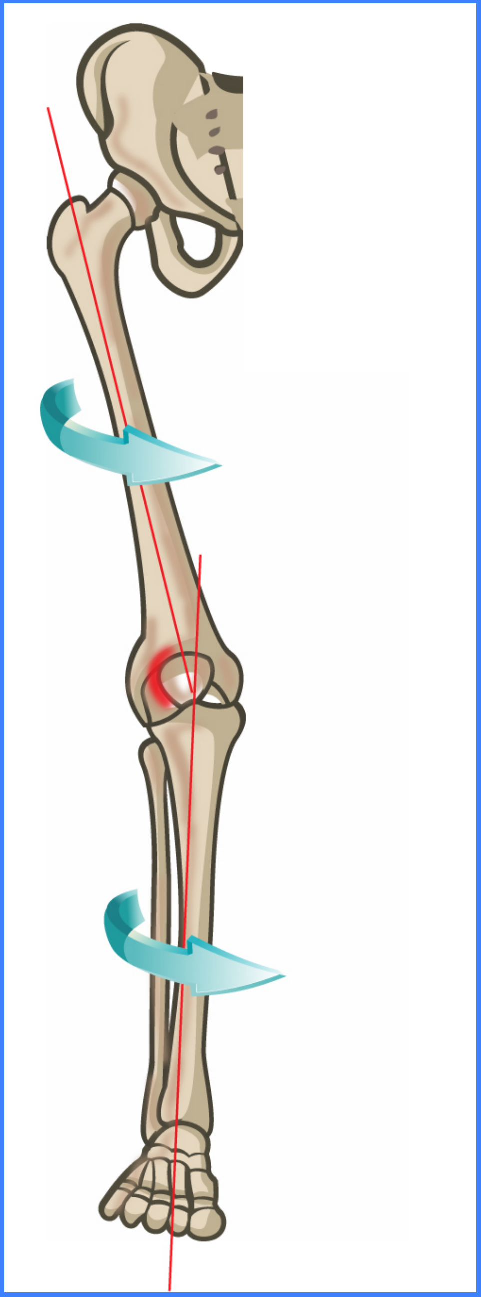
Gait Mechanics

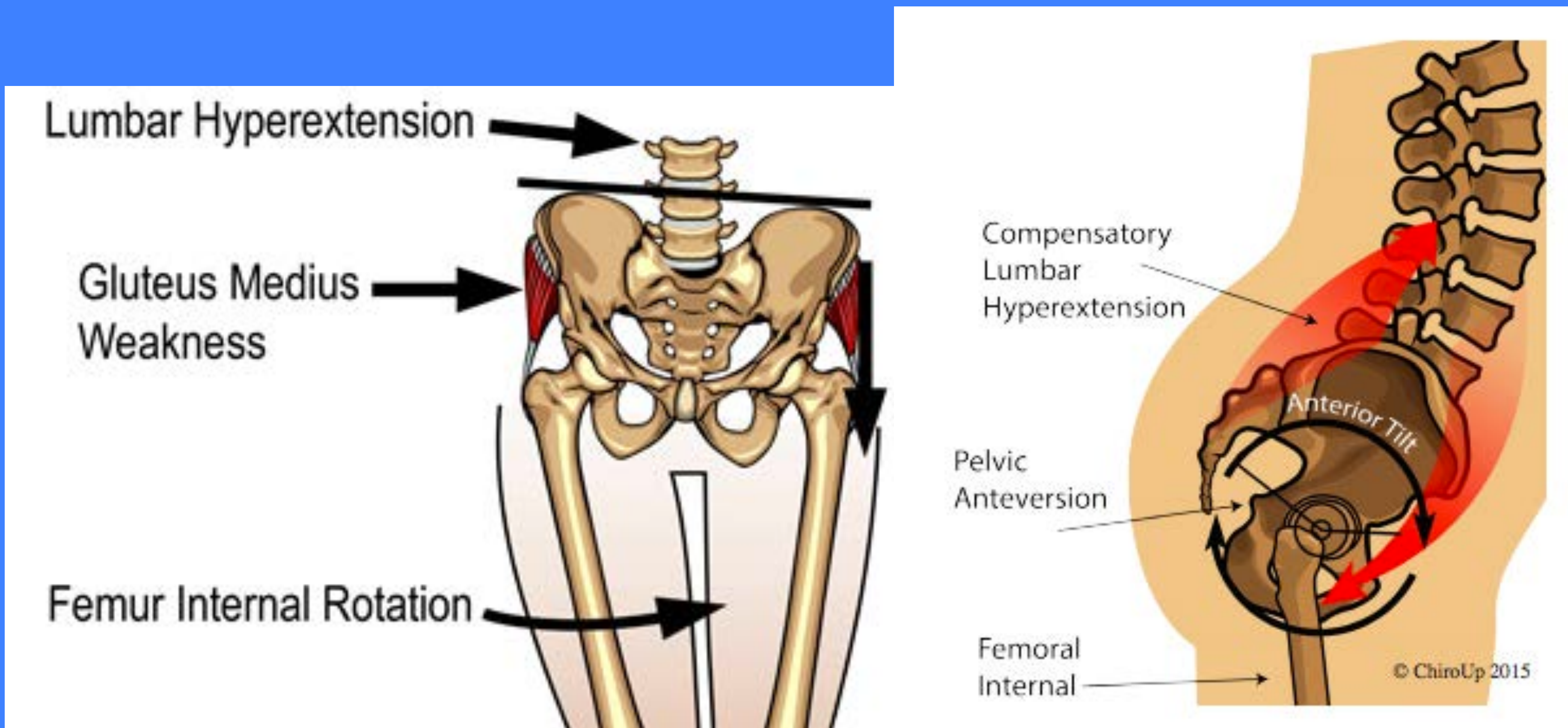

Unsafe
Range
Safe
Range
Unsafe
Range


Talus
Navicular
Tibialus posterior insertion
Plantar Fascia

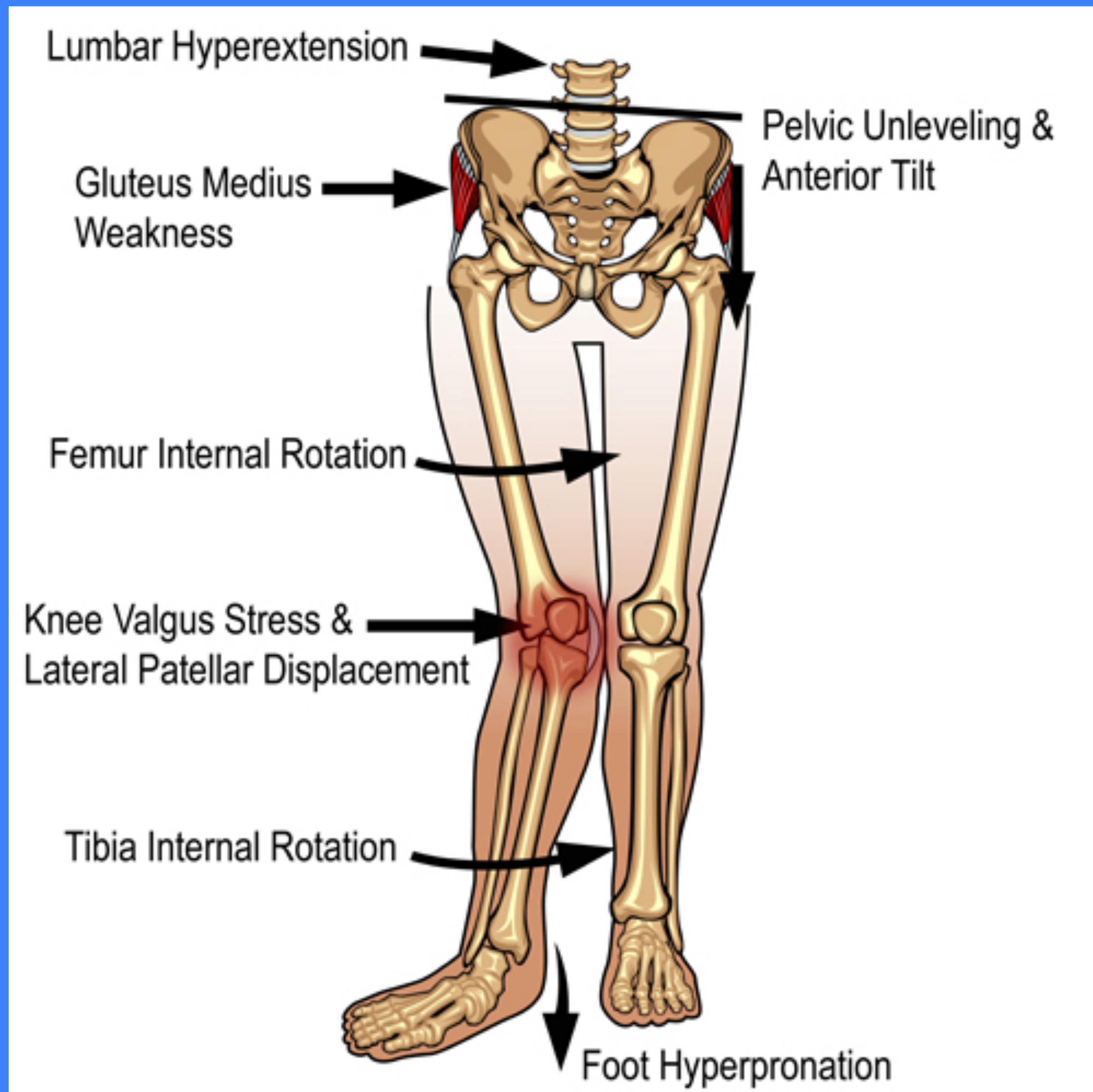

Posterior tibial nerve
Posterior tibialis tendon

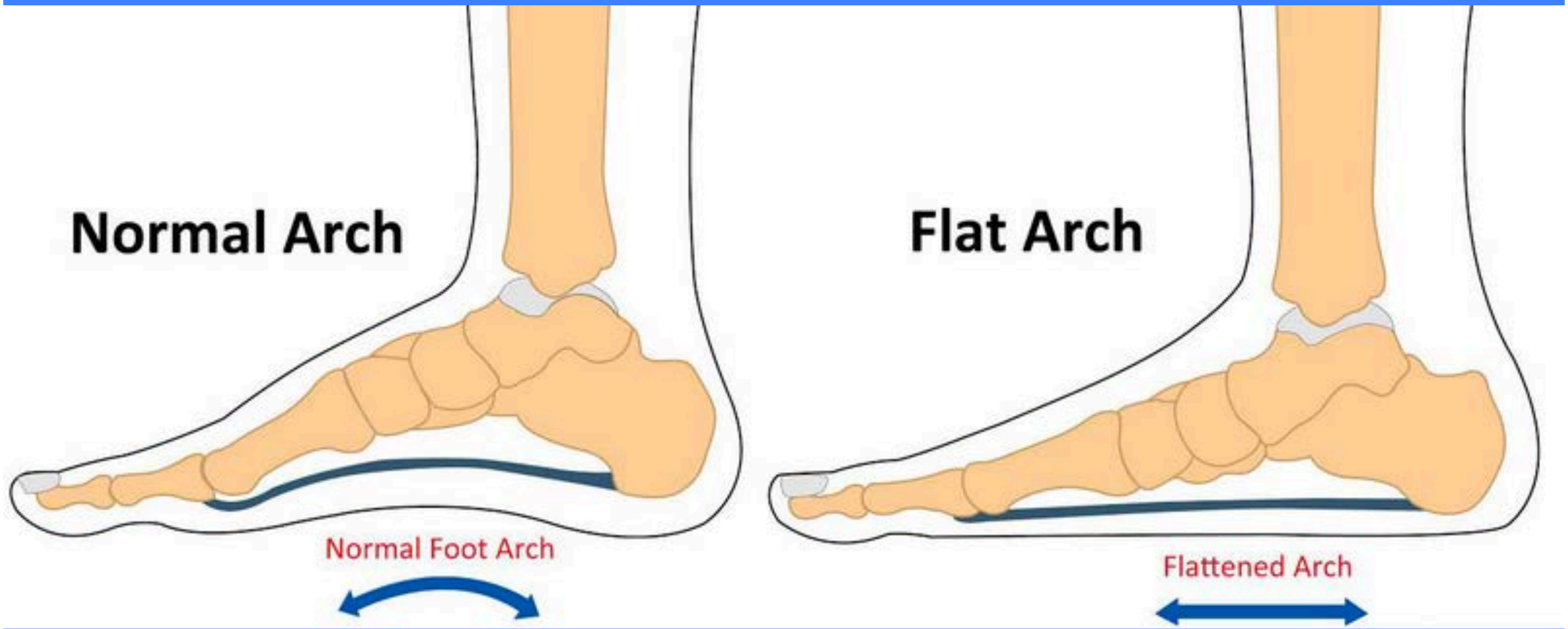

Posterior Tibial Nerve
Irritation





Lumbar Hyperextension
Gluteus Medius Weakness
Femur Internal Rotation
Compensatory Lumbar Hyperextension
Anterior Tilt
Pelvic Anteversion
Femoral Internal
© ChiroUp 2015


Lumbar Hyperextension
Pelvic Unleveling & Anterior Tilt
Gluteus Medius Weakness
Femur Internal Rotation
Knee Valgus Stress & Lateral Patellar Displacement
Tibia Internal Rotation
Foot Hyperpronation


Normal Arch
Flat Arch
Normal Foot Arch
Flattened Arch

Presentation

- Plantar fasciitis
- Achilles tendinopathy
- Metarsalgia
- Medial tibial stress syndrome
- Patellofemoral pain syndrome
- Greater trochanteric pain syndrome
- Low back pain

Foot Hyperpronation

SHOW ICD

Evaluation

* Foot Arch Height Ratio
* Foot Hyperpronation Cluster
* Hip Abductor Weakness Cluster
* Navicular Drop Test

Management

Soft Tissue

* STM- Plantarflexors

Manipulation/Mobilization

* Manipulation-Foot and Ankle

Misc

* Arch Support/ Orthotic

Phase I exercises

* Single Leg Stance
* Vele's

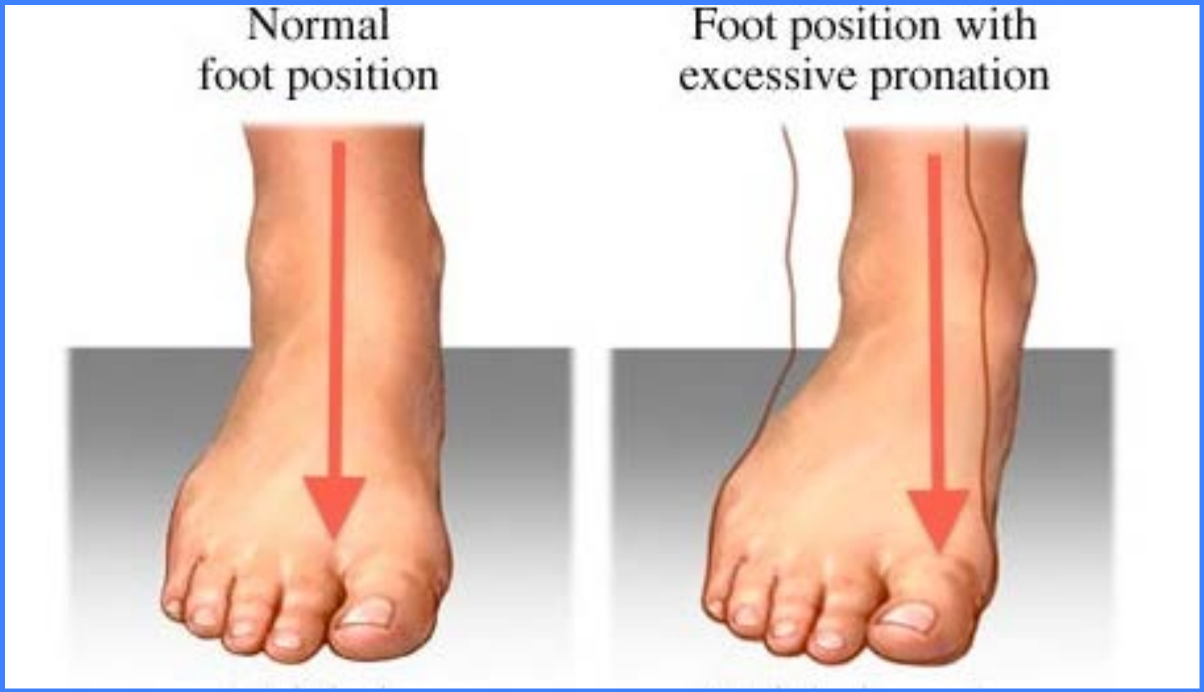
Phase II exercises

* Resisted Posterior Tibialis Strengthening

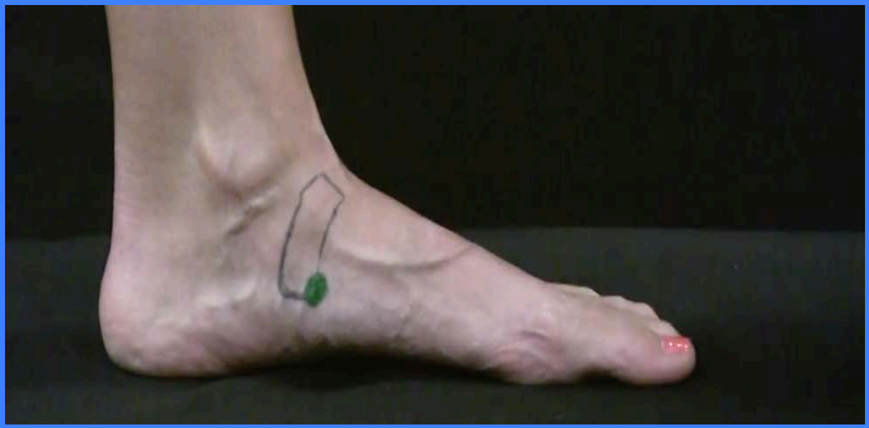
Hyperpronation Cluster

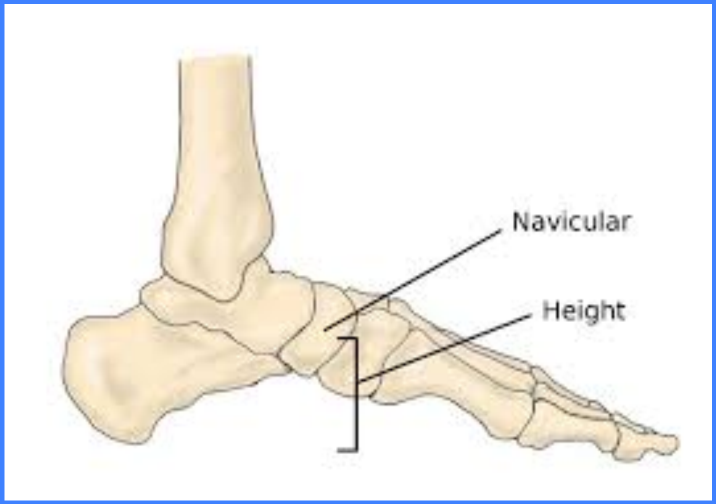
- Excessive forefoot abduction
- Calcaneal eversion
- Loss of the medial longitudinal arch
- Navicular drop

Evaluation


Normal
foot position
Foot position with
excessive pronation

Navicular Drop Test



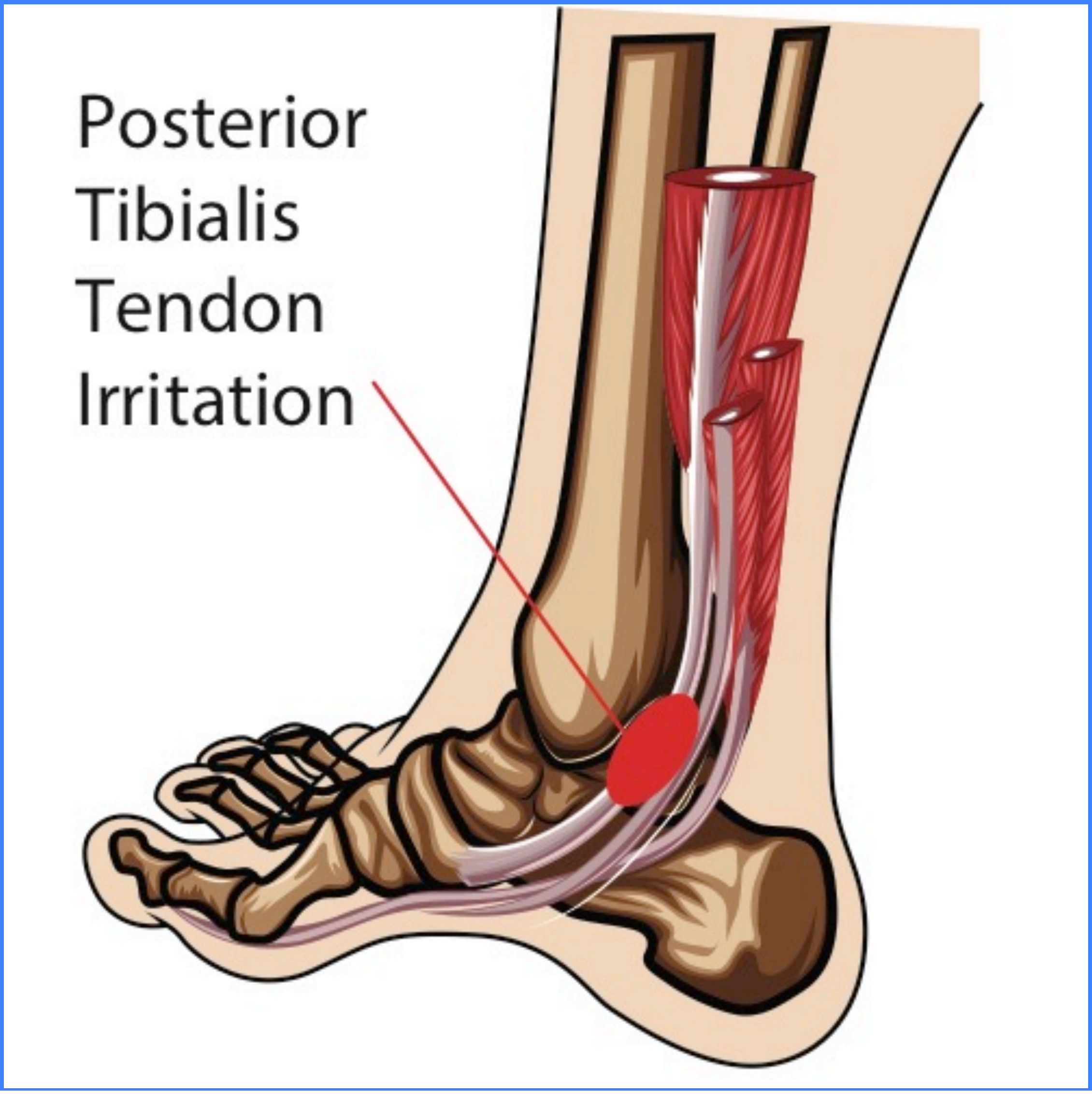


- Mark the position of the seated patient's navicular by placing a dot over their navicular tuberosity, while their foot is in a non-weight bearing and neutral position. The clinician then places an index card on the floor next to the patient's foot and marks the index card at the position of the dot. The patient then stands (on both feet), and the clinician marks the new position on the card. If the navicular drops more than 10 mm, the test is positive for hyperpronation. Normal navicular drop is 6 to 8 mm.

Foot Arch Height Ratio =Height/Partial Length

- The assessment begins by measuring the entire length of the foot from heel to toe. Next, measure the height of the foot at the midpoint of the length of the foot (i.e. if the foot is 22cm long, the height measurement would be taken at 11cm). Finally, measure the partial length of the foot from heel to 1st MTP. The arch height ratio is calculated by dividing the height of the foot by the partial length of the foot- measured from the heel to the 1st MTP. Ratios of less than .275 define “low” arches while ratios greater than .356 characterize “high” arches. “Normal” arches fall within the aforementioned reference zone.

Posterior Tibialis Assessment



Plantarflexor Assessment

Hip Abductor Weakness Assessment

- Hip abductor weakness may be assessed by observing for pelvic drop or knee valgus (Trendelenberg sign) when performing a single leg stand, single leg squat, single leg 6 inch step down, or overhead the squat test.

Foot Hyperpronation

SHOW ICD

Evaluation

* Foot Arch Height Ratio
* Foot Hyperpronation Cluster
* Hip Abductor Weakness Cluster
* Navicular Drop Test

Management

Soft Tissue

* STM- Plantarflexors

Manipulation/Mobilization

* Manipulation-Foot and Ankle

Misc

* Arch Support/ Orthotic

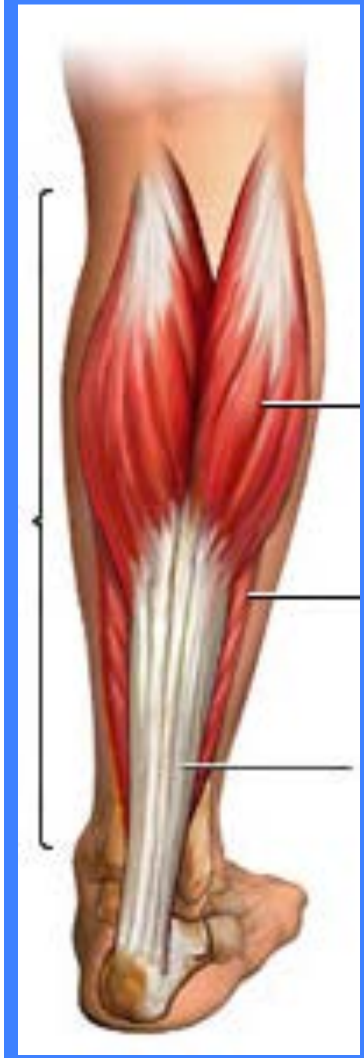
Phase I exercises

* Single Leg Stance
* Vele's

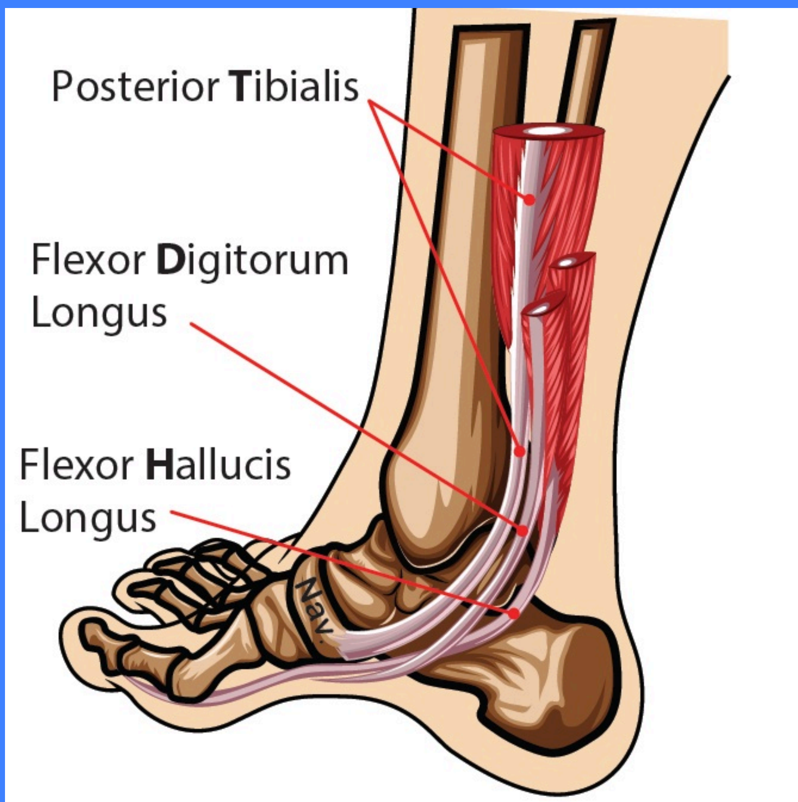
Phase II exercises

* Resisted Posterior Tibialis Strengthening

STM- Gastroc/ Soleus



STM- Posterior Tibialis



Manipulation & Mobilization

Orthotics


PSC

Foot Hyperpronation

SHOW ICD

Evaluation

* Foot Arch Height Ratio
* Foot Hyperpronation Cluster
* Hip Abductor Weakness Cluster
* Navicular Drop Test

Management

Soft Tissue

* STM- Plantarflexors

Manipulation/Mobilization

* Manipulation-Foot and Ankle

Misc

* Arch Support/ Orthotic

Phase I exercises

* Single Leg Stance
* Vele's

Phase II exercises

* Resisted Posterior Tibialis Strengthening

Single Leg Stance

- Stand on one leg and slowly bend your knee while maintaining your balance for 30 seconds. As your balance improves, you may increase the difficulty of this exercise by closing your eyes or standing on a softer surface like a pillow or a BOSU ball. Perform this exercise one minute on each foot twice per day or as indicated.

Vele’ s

- Begin standing near a wall for stability. Stand with your feet shoulder width apart. Keeping your body straight, bend at the ankles to shift your weight forward onto your toes until your heels are about to lift off the floor. Return to the start position and perform three sets of 20 repetitions twice per day or as directed.

Gastroc Stretch

- Stand facing a wall with your hands on the wall at head level. Your affected leg to be stretched should be back and straight with your heel on the floor. Your unaffected leg may be bent in front of your for support. While keeping your back straight, lean forward until you feel a stretch in your calf. Against the resistance of the floor, attempt to push the toes of your trailing foot into the floor for seven seconds. Do not lift your heel off of the floor. Relax and lean further forward to increase the stretch. "Lock in" to this new position and repeat three contract/relax cycles on each side twice per day or as directed.

Soleus Stretch

- Stand facing the wall with the ball of your affected foot on the wall, heels on the ground with your other leg behind you for stability. As an alternate to placing your foot on the wall, you may step on a 2-4 inch block or book on the floor in front of the wall. Place your hands on the wall for additional stability. Bend your forward knee while lowering your body toward the wall until you feel a strong stretch in your calf. Against the resistance of the wall/block, attempt to flex the front of your foot toward the floor. Hold this contraction for seven seconds. Relax and stretch further. "Lock in" to this new position and repeat three contract/relax cycles on each side twice per day or as directed.

Posterior Tibialis Strengthening

- Sit with your involved leg crossed over your uninvolved leg. Loop a piece of resistance tubing over your forefoot and secure it beneath your foot on the floor. Stabilize your lower leg with one hand. Against the resistance of the elastic, roll your involved foot upward, as though you are attempting to look at the bottom of your foot. Slowly return to the start position and repeat three sets of 10 repetitions daily or as directed.

ADL’s

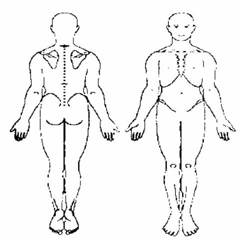
- Wear shoes with good arch supports
- Avoid going barefoot
- Avoid high heels or shoes with narrow toe boxes
- Maintain a normal weight
- Increase activity slowly (10% rule)

<table>
<tr><th colspan="4">FUNCTIONAL EVALUATION</th><th>STRETCH</th><th>STRENGTHEN</th><th>OTHER</th></tr>
<tr><td>FH/FS Posture</td><td></td><td rowspan="6">Upper Crossed</td><td rowspan="3"></td><td rowspan="6">Pectorals, Upper Traps, Levator, Cervical Retractions (1--4)</td><td rowspan="3">Deep Nek Flexors (5)</td><td rowspan="6"></td></tr>
<tr><td>Neck Flexion Test</td><td></td></tr>
<tr><td>DNF Endurance Test</td><td></td></tr>
<tr><td>SICK Scapula</td><td></td><td rowspan="3">Scap Dyskinesis</td><td rowspan="3">Serratus Anterior, Lower Traps, Rhomboids: YTWL, Low Row, Brugger (6-8)</td></tr>
<tr><td>Quadruped Rock Test</td><td></td></tr>
<tr><td>Scapulohumeral Rhythm</td><td></td></tr>
<tr><td>Aberrant Forward Flex</td><td></td><td rowspan="6">Spinal Instability</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4">Transverse Abdominus, Lumbar Paraspinal: Bird Dog, Side Bridge, Dead Bug (9-11)</td><td rowspan="6"></td></tr>
<tr><td>Passive L/S Extension</td><td></td></tr>
<tr><td>Prone Instability Test</td><td></td></tr>
<tr><td>ASLR</td><td></td></tr>
<tr><td>Upper Chest Breathing</td><td></td><td rowspan="2">Dysfn Breath</td><td rowspan="2">Scalene, Levator, SCM, Pecs (1,3)</td><td rowspan="2">Diaphragm Breathing (12)</td></tr>
<tr><td>Dininished Ab/Rib Expansion</td><td></td></tr>
<tr><td>Lower Cross Posture A B</td><td></td><td rowspan="6">Lower Crossed</td><td rowspan="2"></td><td rowspan="6">Psoas, Lumbar Paraspinal, Hamstring, ITB, Rectus Femoris (13-15)</td><td rowspan="2">Sidebridge (11)</td><td rowspan="6"></td></tr>
<tr><td>Thomas Test</td><td></td></tr>
<tr><td>Trendelenberg Test</td><td></td><td rowspan="4">HAB Weakness</td><td rowspan="4">Gluteus Medius: Clam, Sidebridge with HAB, Posterior Lunge, Semi-stiff deadlift (16-19)</td></tr>
<tr><td>Overhead Squat Test</td><td></td></tr>
<tr><td>Single Leg Squat</td><td></td></tr>
<tr><td>6" Step Down</td><td></td></tr>
<tr><td>Fallen Arch</td><td></td><td rowspan="5"></td><td rowspan="5">Hyperpronation</td><td rowspan="5">Ankle Plantar Flexors (20)</td><td rowspan="5">Posterior Tibialis, Vele's, Single leg stance (21-23)</td><td rowspan="5">Orthotic, Arch wrap</td></tr>
<tr><td>Too Many Toes Sign</td><td></td></tr>
<tr><td>Navicular Drop Test</td><td></td></tr>
<tr><td>Posterior Tibialis Weakness</td><td></td></tr>
<tr><td>Plantarflexor Hypertonicity</td><td></td></tr>
</table>

Case Study

- 36 y/o male with 3 month history of LBP after a long weekend of golf. Feels like he has a “hitch”. Pain radiates to the right buttock. Increases with activity. Alleviated with OTC meds. Constant dull discomfort with sharper pain upon movement. VAS=3-6/10. Third episode in past 6 years.

Problem #



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P↑:

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Q:

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Comments:

Lumbar Spine			Initial Eval	Re-Exam 1	Re-Exam 2	Re-Exam 3
Date						
VAS						
Oswestry						
% Subjective Improvement						
Subjective Complaints						
ROM						
Flexion / 60						
Extension / 25						
Left Lat Flex / 25						
Right Lat Flex / 25						
Directional Preference						
Orthopedic						
Disc		SLR				
		WLR				
		Braggard				
		Slump Test				
		Milgrams				
		Valsalva				
Facet		Spring Test/ PA Shear				
		Segmental Rotation				
	Stenosis	Kemp's				
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S-lysis		Sphinx				
		One Leg Hyperextension				
		ASLR				
		Posterior Instability Test				
	SI	SI Distraction				
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		FABER				
		FADIR				
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Neurologic						
Dermatomes						
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Mensuration						
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Tenderness						
Intersegmental Restriction						
Gait, Posture & Function HAB Weakness Lower Crossed Breathing Evaluation Foot Hyperpronation						
Plan				O R R S	O R R S	O R R S
Treatments			/ Visits	/ Visits	/ Visits	/ Visits
Time Frame			weeks	weeks	weeks	weeks
Treatment Outcome Goal			%	%	%	%

Classification of LBP

Clinical Prediction Rules

Tool designed to assist the classification process and improve decision making by using evidence to determine which patients are likely to benefit from a specific treatment strategy

Laupacis A, Sekar N, Stiell IG. Clinical prediction rules. A review and suggested modifications of methodological standards. JAMA.1997;277:488-494.

Flynn T, Fritz J, Whitman J, Wainner R, Magel J, Rendeiro D, Butler B, Garber M, Allison S. A clinical prediction rule for classifying patients with low back pain who demonstrate short-term improvement with spinal manipulation. Spine. 2002;27:2835-2843.

Classification

- Manipulation
- Extension Biased
- Flexion Biased
- Stability
- Traction

**Groups are not mutually exclusive*

Manipulation Criteria

- Pain lasting less than 16 days
- No symptoms distal to the knee
- Low fear avoidance beliefs (FABQ score of less than 19)
- Hip internal rotation greater than 35 degrees
- Hypomobility of at least one lumbar segment

Fritz, J, Cleland, J, Childs, JD, "Subgrouping Patients With Low Back Pain: Evolution of a Classification Approach to Physical Therapy," Journal of Orthop Sports Physical Therapy 37, no. 6 (June 2007): 290-302

Effectiveness of Manipulation

Chiropractors and physical therapists treated 432 patients an average of **5.2** visits at a mean cost of $302.

Mean intake pain rating score dropped from **6.2** of 10 to **1.9** of 10 with **95%** of respondents rating their care as excellent.

116 patients where seen once and triaged to either advanced imaging or specialty care.

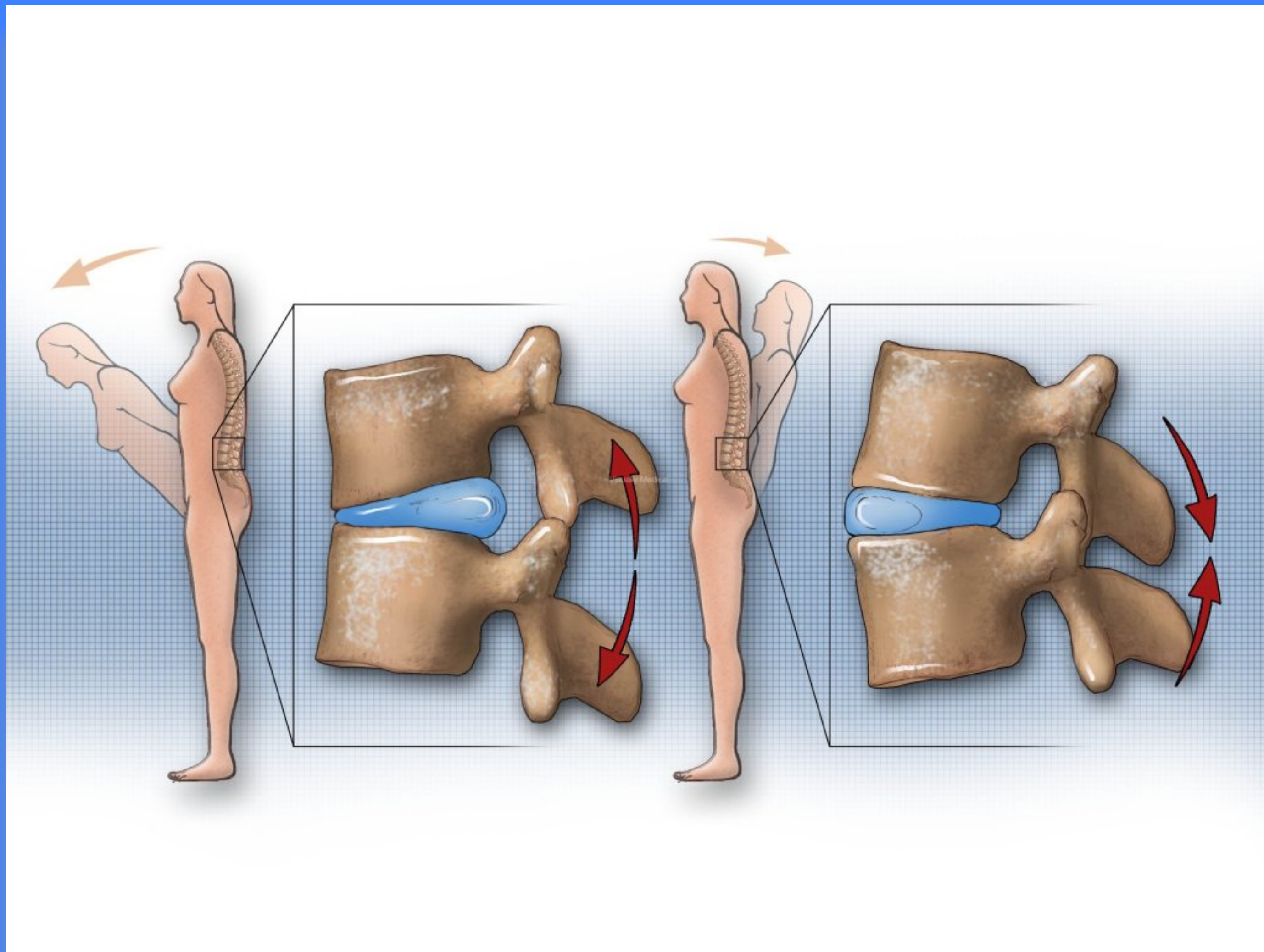
Paskowski I, Schneider M, Stevans J, Ventura JM, Justice BD. A hospital-based standardized spine care pathway: Report of a multidisciplinary, evidence-based process. JMPT 2011;34(2): 98-106

Directional Preference

Flexion

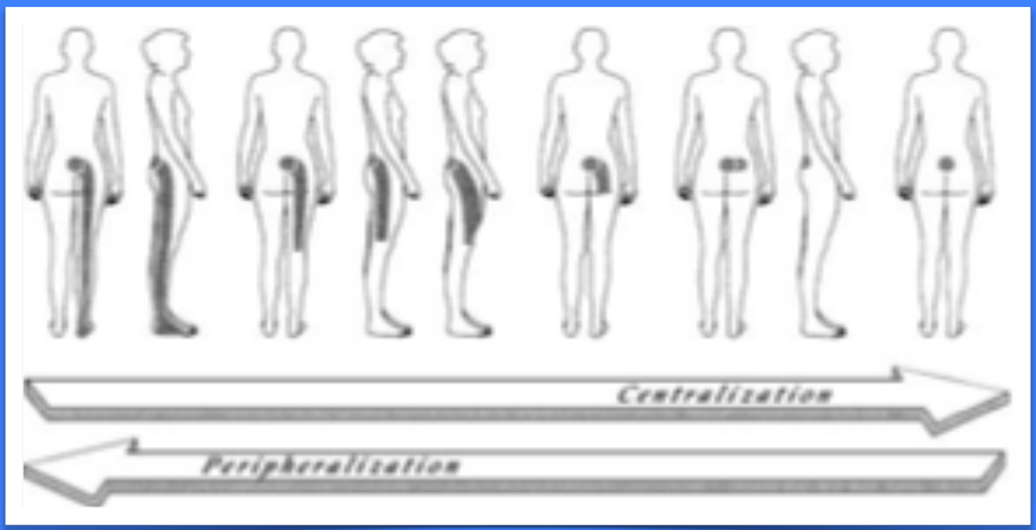
Extension

Dynamic Disc Model



Centralisation vs. Peripheralisation

- **Centralisation**: repeated end range lumbar movements rapidly decrease the most distal referred or radicular symptoms towards midline
- **Peripheralisation**: repeated end range lumbar movements rapidly increases the most distal referred or radicular symptoms



Predictability

- "study of non-herniated disc in chronic, out of work, workers compensation/litigation patient population strongly supports that a noninvasive, low-tech, relatively inexpensive clinical assessment using repeated end-range lumbar test movements can provide considerably more relevant information than noninvasive imaging studies. Namely, it can reliably distinguish between discogenic and non-discogenic pain and provides considerable help in distinguishing between a competent and incompetent annulus."
  Donelson 1997

- "Patients with sciatica and suspected disc herniation who have centralization response to a mechanical evaluation will have significantly better outcomes. Patients who do not have centralization will be 6 times more likely to undergo surgery"
  Skytte 2005

Clinical Justification

- In a study of acute vs chronic pain and axial LBP versus sciatica, it was found that 91-100% either improved or resolved completely. -*Donelson 2012*
- "In patients with low back pain for more than 6 weeks presenting with centralization or peripheralization of symptoms, we found the McKenzie method to be slightly more effective than manipulation when used adjunctive to information and advice." - *Peterson 2011*

Extension Biased History

- Pain with sitting that may or may not increase distal symptoms
- Pain/difficulty with rising
- The most distal symptoms improve with standing/walking
- Patient may present with kyphotic deformity*

Extension Biased Evaluation

- Extension testing progresses through the following stages:
  1) standing extension
  2) lying prone
  3) propped up on the elbows
  4) propping up on extended arms
  5) performing repetitive extension
  6) performing repetitive extension with practitioner overpressure

Flexion Biased Evaluation

- Flexion based testing progresses as follows:
  1) supine knee to chest maneuver
  2) standing forward flexion

Management Strategies

1.) End-Range Loading

2.) Posture Correction

3.) Restoration of Function

End Range Loading

Extension-Biased Treatment

Lying Prone

Extension in Lying

Wall Extensions

Standing Extensions

Extension Biased

Lying in Prone

Extension Biased

Extension in Prone

Extension Biased

Wall Extension

Extension Biased

Standing Extension

End Range Loading

Flexion-Biased Treatment

Supine Knee to Chest

Seated Flexion

Standing Knee To Chest

Flexion Biased

Supine Knee to Chest

Flexion Biased

Seated Flexion

Flexion Biased

Standing Knee to Chest

Management Strategies

1.) End-Range Loading

2.) Posture Correction

3.) Restoration of Function

Postural Correction

<u>Habits</u>

Sitting

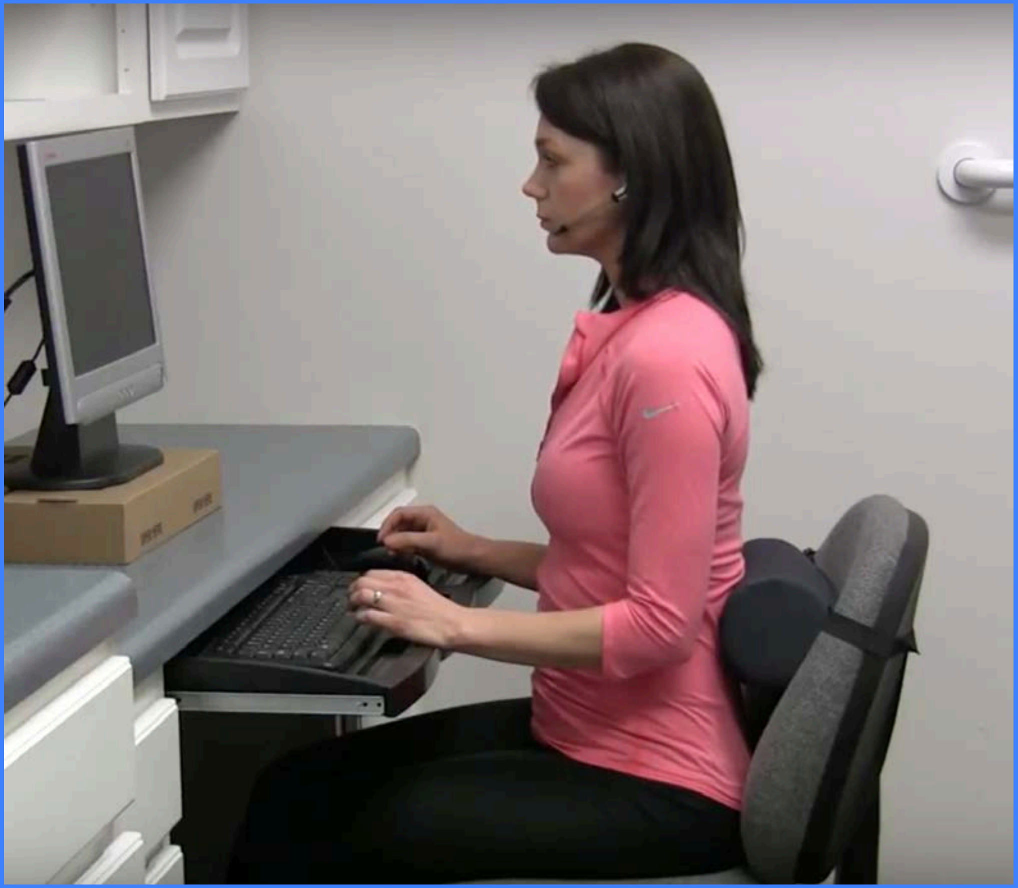
Standing

Bending

Abdominal Bracing

Abdominal Bracing

Lifting Mechanics



Workstation Ergonomics

Management Strategies

1.) End-Range Loading

2.) Posture Correction

3.) Restoration of Function

TABLE 3	Special Tests Suggested to Be Important Examination Criteria for Identifying Patients in the Stabilization Classification
Examination	**Description**
Prone instability test[66]	The patient lies prone with the body on an examining table and legs over the edge with feet resting on the floor. While the patient rests in this position, the therapist applies posterior-to-anterior pressure to the lumbar spine. Any provocation of pain is reported. Then the patient lifts the legs off the floor and posterior compression is applied again to the lumbar spine. If pain is present in the resting position but subsides in the second position, the test is positive
Posterior pelvic pain provocation (P4) test[97]	The patient is supine. The therapist passively flexes the patient's hip to 90° and applies a posteriorly directed force through the longitudinal axis of the femur. The test is positive if the patient reports a deep pain in the gluteal area during the test
Active straight-leg raise test[93]	The patient is supine with straight legs and feet 20 cm apart. The patient is instructed to lift the legs one after the other approximately 20 cm above the table without bending the knee. The patient is asked to score the difficulty of the task on a 6-point scale (0, no difficulty at all; 1, minimally difficult; 2, somewhat difficult; 3, fairly difficult; 4, very difficult; 5, unable to do). Any score greater than 0 is a positive test
Provocation of the long dorsal sacroiliac ligament[118]	The patient is supine. The therapist palpates the long dorsal sacroiliac ligament bilaterally. A positive test occurs if at least 1 side is painful, and the pain persists at least 5 seconds after the removal of the therapist's hand
Provocation of the pubic symphysis with palpation[4]	With the patient in supine the entire front side of the pubic symphysis is palpated gently. If the palpation causes pain that persists more than 5 seconds after the removal of the therapist's hand, it is recorded as positive
Modified Trendelenburg test[4]	The therapist is behind the standing patient. The patient is asked to stand on one foot while flexing the opposite knee and hip to 90°. The test is positive if the hip descends on the flexed side

Spine Stability

Sub-Group


HAHA! SO WE MEET AGAIN!!

Indications for Stability Program

- Younger Age <40
- Average SLR > 91 degrees
- Aberrant Lumbar Forward Flexion
- Positive PA Shear Test/ Prone Instability

Prior to any movement the core needs to brace

Hodges, P., 2004. Lumbopelvic stability: a functional model of biomechanics and motor control. In:Richardson, C. (Ed.),Therapeutic Exercise for Lumbopelvic Stabilization. Churchill Livingstone, Edinburgh, pp. 13e28

McGill, S.M., McDermott, A., Fenwick, C.M., 2009. Comparison of different strongman events: trunk muscle activation and lumbar spine motion, load, and stiffness. J. Strength Cond. Res. 23,1148e1161

Balance or strengthening exercises prescribed to a patient with poor stabilization will have limited effect or they may even promote pathological patterns of movement and exacerbate the patient's pain.

Akuthota, V., Ferreiro, A., Moore, T., Fredericson, M., 2008. Core stability exercise principles. Curr. Sports Med. Rep. 7, 39 e44

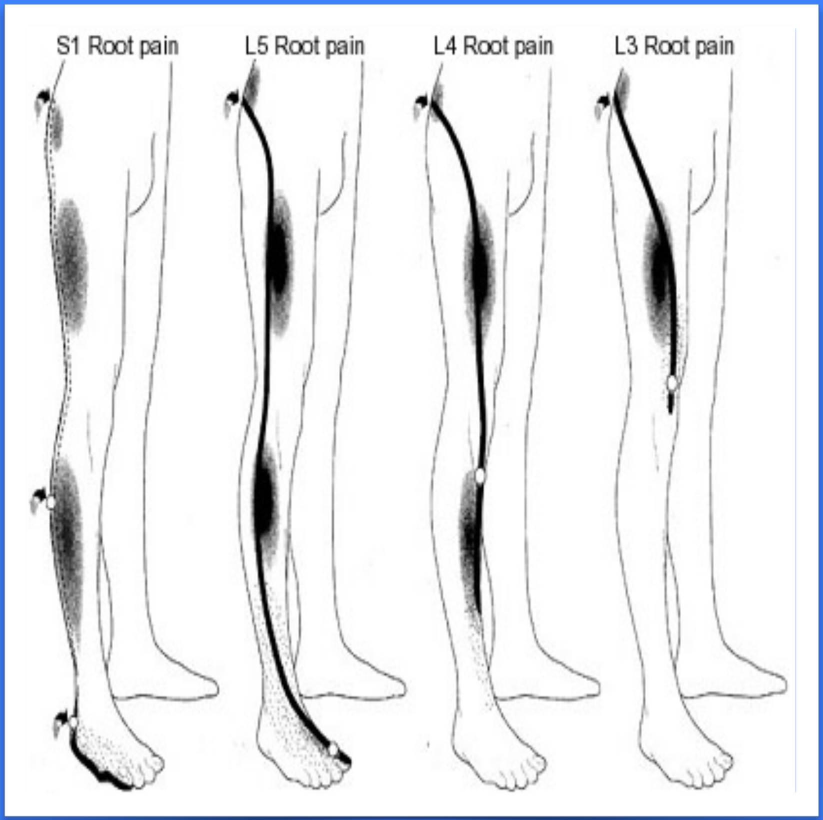
Kobesova,A.,Kolar,P.,Mlckova,J.,Svehlik,M.,Morris,C.E.,Frank,C., Lepsikova, M., Kozak, J., 2012. Effect of functional stabilization training on balance and motor patterns in a patient with Charcot-Marie-Tooth disease. Neuroendocrinol. Lett. 33, 101 e108

Whole Body and Spine Stability

Curl-up Side Bridge Bird Dog

Traction Sub-Group

- Assessment
  - Symptoms extend distal to the buttock
  - Signs of Nerve Root Compression
  - Peripheralization with extension
  - Positive WLR



Treatment Traction Sub-Group

"Why don't we call ourselves chiropractors and charge people for our services ?"

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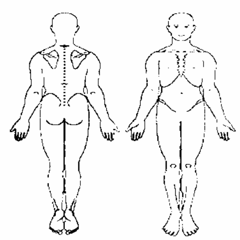
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Comments:

		Lumbar Spine	Initial Eval	Re-Exam 1	Re-Exam 2	Re-Exam 3
		Date				
		VAS				
		Oswestry				
		% Subjective Improvement				
		Subjective Complaints				
ROM						
		Flexion / 60				
		Extension / 25				
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Plan				O R R S	O R R S	O R R S
		Treatments	/ Visits	/ Visits	/ Visits	/ Visits
		Time Frame	weeks	weeks	weeks	weeks
		Treatment Outcome Goal	%	%	%	%

The Problem or the Solution

In fact, from 1994 to 2007, the following Medicare expenditure rates were observed in these key spine care interventions:

- diagnostic imaging—a 307% increase in MRIs;
- spinal surgery—a 220% increase in spinal fusion;
- spine injections—a 629% increase in the use of epidural steroid injections; and
- prescription medications—a 423% increase in the use of opiates

BI Martin, RA Deyo, SK Mirza, JA Turner, BA Comstock, W Hollingworth, SD Sullivan Expenditures and health status among adults with back and neck problems JAMA, 299 (2008), pp. 656–664

RA Deyo, SK Mirza, JA Turner, BI Martin Overtreating chronic back pain: time to back off? J Am Board Fam Med, 22 (2009), pp. 62–68