Lumbo-Pelvic Stabilization:
An Impairment Based Approach

Presented by:

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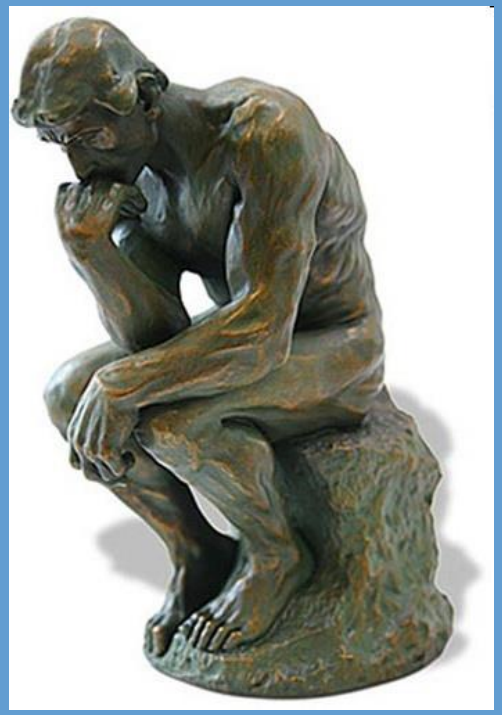
Course Outline

- Introduction & Course Objectives
- Overview of Lumbo-Pelvic Stabilization
- Functional Movement Testing
- Stability Testing Techniques
- Muscle Length/Strength Testing
- Exercise Techniques
- Case Studies, Review, Problem Solving, Speed Mobs.

Course Objectives

- The participant will identify the history of lumbo-pelvic stabilization approaches, and the evidence available for techniques (exam/intervention) taught
- The participant will learn/review specific clinical tests to help identify where and when stabilization exercises are indicated
- The participant will identify clinical presentations, including differentiating lumbar/pelvic/hip dysfunctions, in order to more efficiently prescribe stabilization exercises
- The participant will demonstrate how to appropriately perform lumbo-pelvic stabilization exercises, as well as learn common mistakes/substitutions



Why Manual Therapy?

- Before learning anything new it is important to ask why?

- Brief introduction to include:
  - Name
  - Years of experience
  - Exposure to manual therapy
  - Reason for interest in this course

Stabilization Training Defined

- Stabilization training is an active form of physical therapy designed strengthen muscles to support the spine to prevent low back pain
- It is a regimen of exercises prescribed by a physical therapist where the patient is trained to find and maintain his/her “neutral spine” position. The back muscles are then exercised to teach the spine how to stay in this position.
- Stabilization training utilizes strengthening exercises as well as stretching and aerobic conditioning to rehabilitate the back. Stabilization training programs are individually designed for each patient based on the patient’s condition.

www.spine-health.com/glossary

History of Lumbo-Pelvic Stabilization
Muscle Imbalances

- **Florence Kendall (1910-2006)**
  - First published Muscles, testing and Function 1949
  - Original text based primarily on extensive work in polio research
  - Set whole new standard of detail for musculoskeletal examination and treatment
  - **Very specific** muscle length and strength testing
  - Detailed postural examination
  - Basic treatment principles outlined (still apply today)
  - Classical principles still taught in PT education

History of Lumbo-Pelvic Stabilization
Muscle Imbalances

- **Vladimir Janda (1928-2002)**
  - Considered “Father of Rehabilitation”
  - Principles based on functional approach: emphasis on importance of sensorimotor system
    - Controlling movement
    - Chronic musculoskeletal pain syndromes
  - No text written, but philosophies revolutionary nonetheless
  - Early work on post-polio syndrome (which he also had)

History of Lumbo-Pelvic Stabilization
Muscle Imbalances

- **Vladimir Janda (cont.)**
  - Defined “Crossed Syndromes”
    - Upper Crossed
    - Lower Crossed
    - Layer Syndrome
  - Muscle imbalance= impaired relationship between:
    - Muscles prone to tightness/shortness (aka “tonic muscles”)
    - Muscles prone to inhibition (aka “phasic muscles”)
  - Sensori-motor Training: progressive program using simple exercises and unstable surfaces

History of Lumbo-Pelvic Stabilization
Muscle Imbalances

- **Shirley Sahrmann**
  - Diagnosis and Treatment of Movement Impairment Syndromes (2002)
  - “Kinesiopathological Model”- daily movements can also cause impairments and eventual pathology
  - PICR (path of instantaneous center of rotation): used to determine whether motion is normal or pathological
  - Approach is fully biomechanical, with emphasis on self treatment and education on proper body mechanics
  - Classification System: named by faulty/provocative motion(s)

History of Lumbo-Pelvic Stabilization
Muscle Imbalances

- Motor Control Approach
  - Based on work of Hodges, Jull, Richardson, others
  - Arises from multiple theoretical models, i.e. Panjabi
  - Looks at local vs. global stabilizing system
    - During normal conditions
    - During pathological/painful conditions
    - Adaptive/compensatory strategies
  - Includes anti-gravity muscle support system
    - Local segmental control: deep local system (i.e. multifidus)
    - Anti-gravity control: work together with local system (i.e. gluteus medius) for proper weight bearing control

Lumbo-Pelvic Stabilization

Mid Atlantic Manual Therapy Consultants

- Fusion of aforementioned approaches and philosophies
- Combining motor control principles with proper/specific testing
- Test-Re-test approach
- Very specific interventions applied directly based upon test results/impairments found
- Helps to provide focal treatment and avoid any guesswork associated with exercise prescription

The “Core”

- Buzzword used by rehab professionals and non-professionals alike
- Consists of:
  - Transverse Abdominus
  - Multifidii
  - Diaphragm
  - Pelvic Floor
- Form a 3-D “core” or most basic/innermost layer
- Proper function necessary for all movement

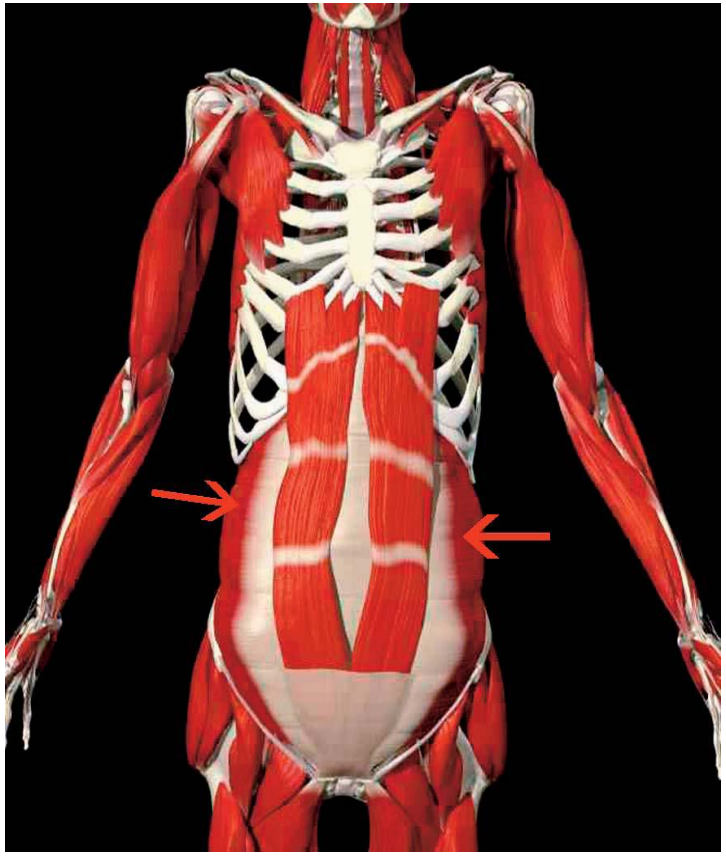
Motor Control Principles

Local Stabilizing System	Global Stabilizing System	Antigravity System
Transverse abdominus	Erector spinae	Gluteals
Multifidii	External/internal obliques	Psoas
Pelvic floor	Quadratus lumborum	Iliacus
Interspinalis	Rectus abdominis	Quadriceps
Intertransversarii	Psoas	Hamstrings
		Soleus

Motor Control Principles

Local Stabilizing System

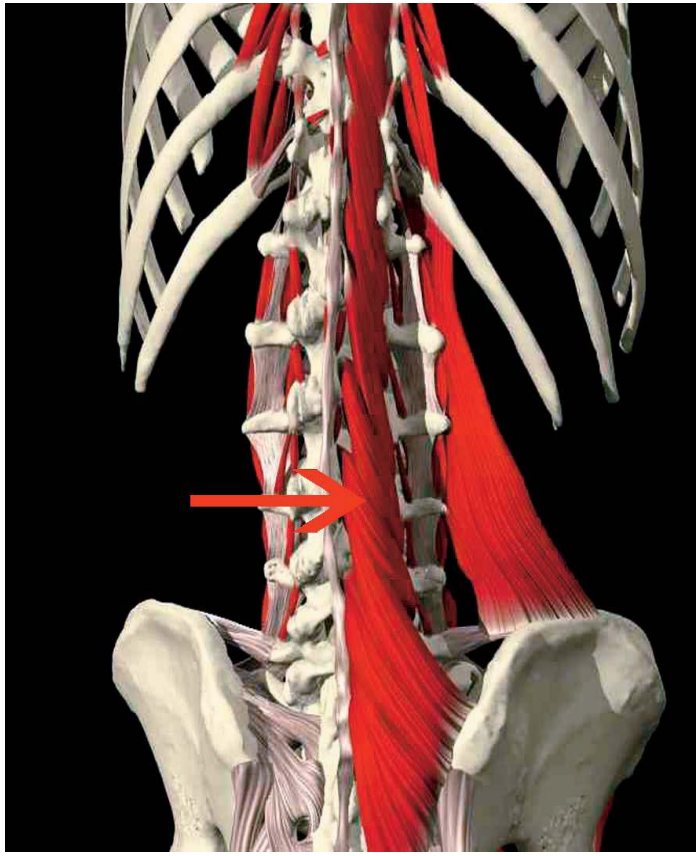
- Transversus Abdominus
  - Primary anterior intersegmental stabilizer
  - Deep fibers attach to zygapophyseal joint capsules
  - Adversely affected with pain/injury, with alterations in: fatigability, composition, size, and consistency



Motor Control Principles

Local Stabilizing System

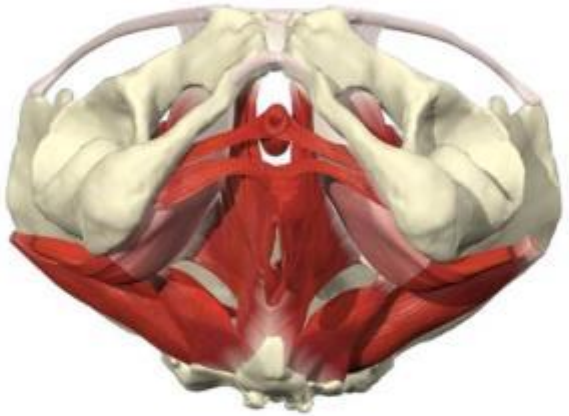
- Lumbar multifidus
  - Primary posterior intersegmental stabilizer
  - Deep fibers attach to zygapophyseal joint capsules
  - Adversely affected with pain/injury, with alterations in
    - Fatigability
    - Composition
    - Size
    - Consistency



Motor Control Principles

Local Stabilizing System

- Pelvic Floor
  - Primary posterior intersegmental stabilizer
  - Deep fibers attach to zygapophyseal joint capsules
  - Can become hypertonic if other local stabilizers become impaired



Spinal Pathology & Low Back Pain

- 3 Major Inter-related Problems Ensue:
  - Increased motion develops at a spinal joint segment
  - Failure of the local stabilizers- lose control/ability to activate in feed-forward manner
  - Global stabilizers then take over to “help out” local stabilizers which will ultimately lead to SPASM and compression
  - Final result…Hypermobility also known as CLINICAL instability

Spinal Pathology & Low Back Pain

- Long-term sequelae of spinal hypermobility:
  - DJD/DDD- excessive wear and tear of passive structures leading to degeneration
    - Ligaments/disc/facets
  - Degeneration leads to loss of disc space height, placing ligaments on slack, leading to further hypermobility
  - Age-related degeneration is normal
    - Leads to osteophytes ensue
  - Trauma-induced (micro/macro) degeneration is abnormal
    - Leads to vicious cycle of repetitive injury, worse over time

Clinical Hypermobility

- Characteristics of Hypermobility
  - Difficulty/pain with prolonged/sustained position/stretch
  - Muscle stiffness follows prolonged position/stretch
  - Muscle stiffness relieved by exercise/movement
  - Full general spinal mobility
  - Increased segmental mobility
  - Aberrant motions may be present (i.e. hinge points)
  - Frequent self manipulators/stretchers
  - Ligamentous tenderness in accessible ligaments
  - H/O trauma, with each onset more trivial

Generalized Hypermobility

- Beighton Scale (clinical Scale for generalized hypermobility)
  - 4/9 criteria is considered a + test
    - Hands flat on floor with knees straight (aka “palm the floor”)
    - Both thumbs touch forearms (+1 per thumb)
    - Both little fingers past 90 degrees ext. (+1 per finger)
    - Both elbow and knees hyperextend (+1 each per elbow and knee)

CPR for Lumbar Stabilization

- CPR to help predict the likelihood of improvement with lumbar stabilization
- 4 variables identified
  - Less than 40 years old
  - SLR over 91 degrees
  - Aberrant motion with trunk AROM
  - Positive prone instability test
- If 3 of 4 variables are met, the +LR is 4.0

Hicks G, Fritz J, Delitto A, McGill S. (2005). Preliminary Development of a Clinical Prediction Rule for Determining Which Patients With Low Back Pain Will Respond to a Stabilization Exercise Program. Archives of Physical Medicine and Rehabilitation, 48: 1753-1762.

A.M. Break

10 minutes

Lumbo-Pelvic Stabilization

- What are we trying to do?
  - Restore motor control/activation to local stabilizers
  - In doing so, will “down regulate” global stabilizers
  - Correct underlying anti-gravity muscle imbalances to further help prevent recurrence (i.e. weak/inhibited glutes vs. dominant hamstrings)
  - Integrate above into functional activities (sports, work, ADL’s)

Functional Stability Testing

Functional Stability/Movement Testing

- Functional-based testing of the lumbar spine/trunk to determine the presence of excessive/abnormal movement patterns
- Observation, along with palpation, during testing can narrow the movement impairment(s) to a specific segment(s)/area
- Helps to form a more complete clinical picture

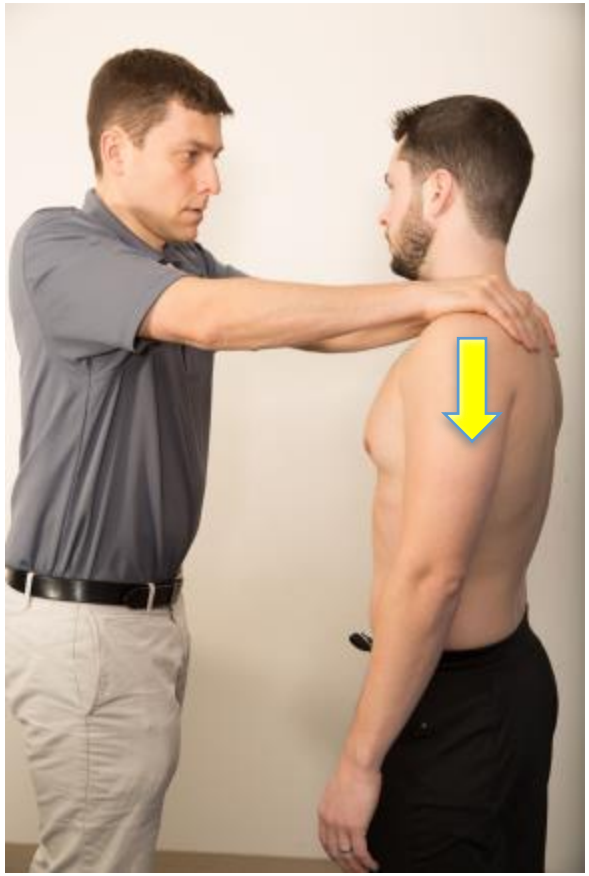
Functional Stability Testing

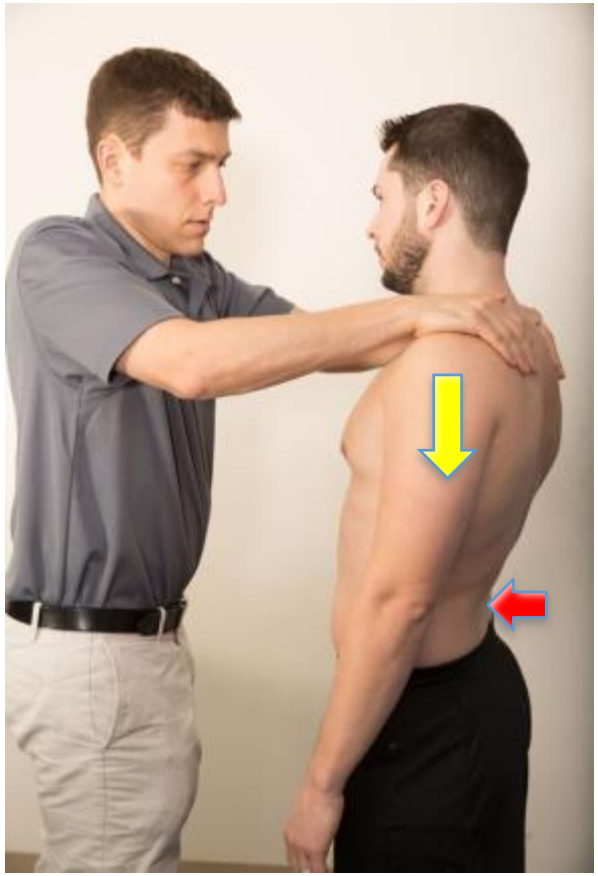
Axial Compression

- Patient stands relaxed
- PT provides an axial load through the shoulders
- PT looks for buckling of the lumbar spine
- Can observe from behind to determine the relative spinal level(s) of buckling
- Indicates possible hypermobile segment(s) or impaired motor control

Functional Stability Testing

Axial Compression





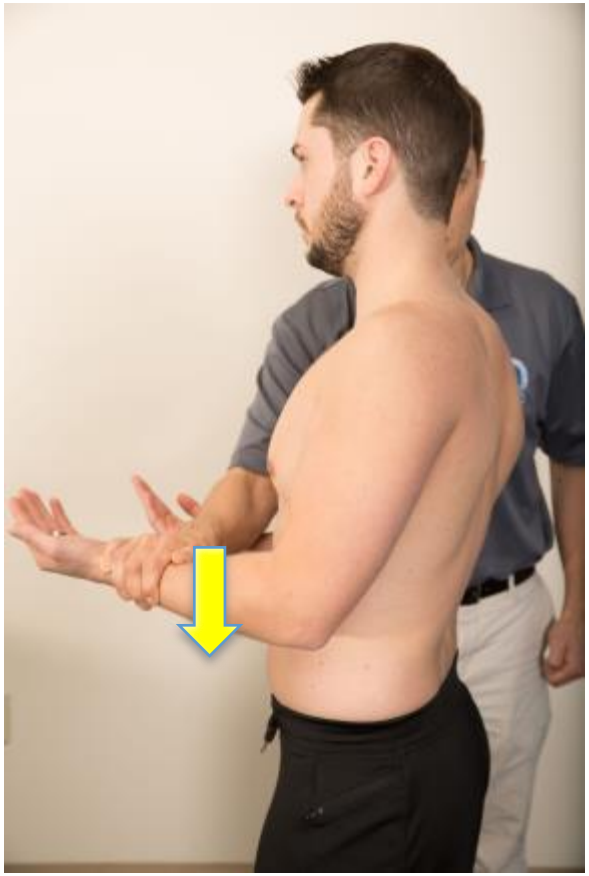
Functional Stability Testing

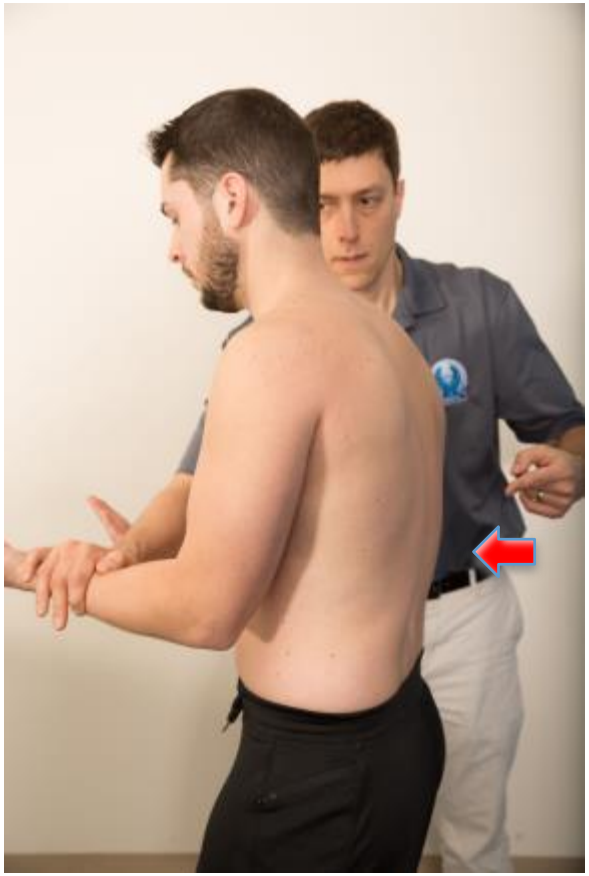
Elbow Flexion Test

- Patient stands relaxed with elbow at 90 degrees
- PT provides a force towards the floor and patient resists
  - **Force is minimal**
- PT observes the back for signs of buckling forward
- Indicates possible impaired motor control

Functional Stability Testing

Elbow Flexion Test





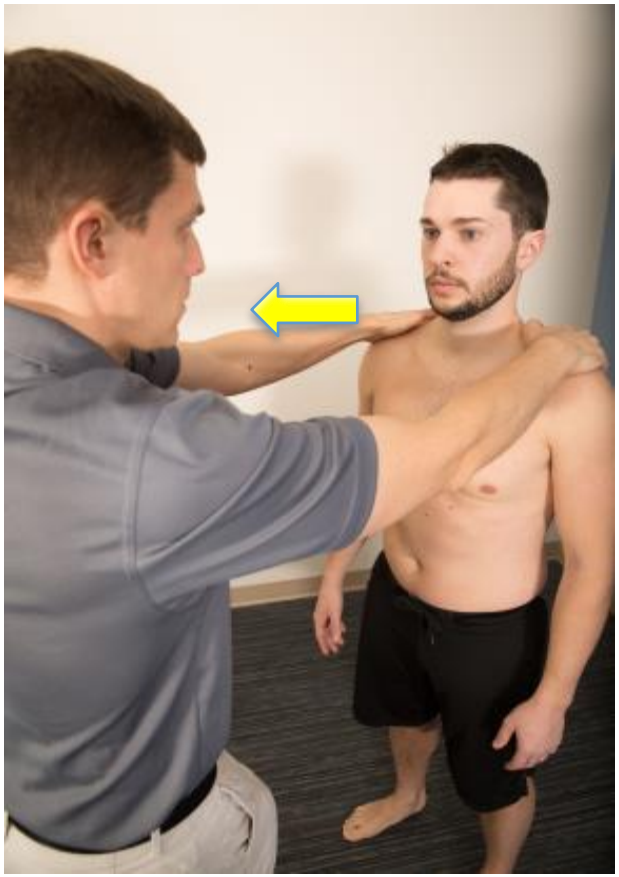
Functional Stability Testing

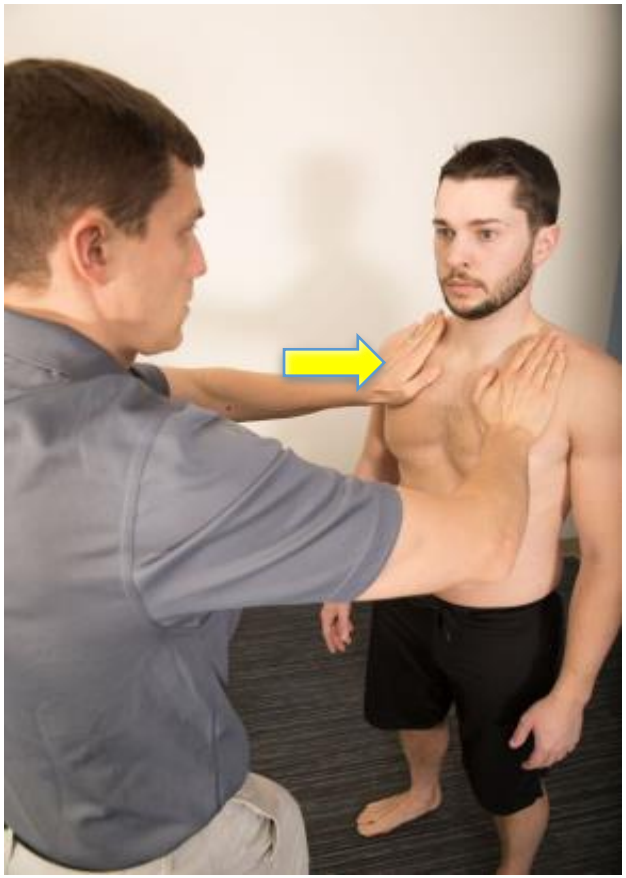
Quadrant Testing

- Patient stands relaxed
- PT stands in front of the patient and provides an A-P and P-A force through the shoulders
- Observe for buckling forward or backwards
  - Buckle forward = (impaired control of) posterior stabilizers
  - Buckle backwards = (impaired control of) anterior stabilizers

Functional Stability Testing

Quadrant Testing





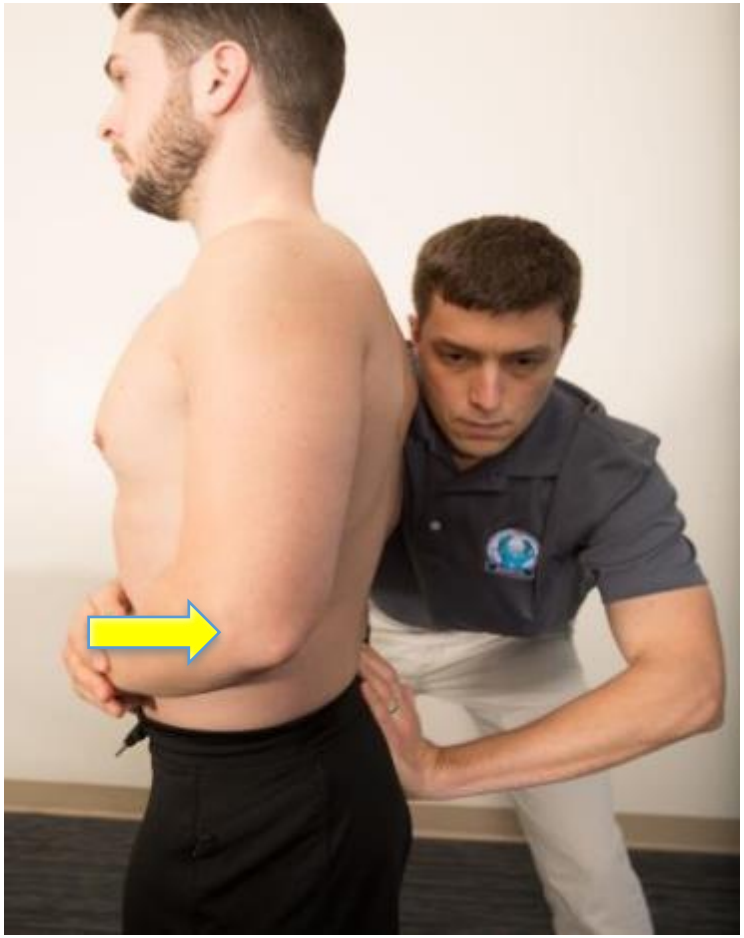
Segmental Shear/Stability Testing

- Used to confirm the presence of specific hypermobile segment(s)
- Very specific and should be performed after Functional Movement Testing
- Standing/Sitting/Sidelying
  - 3 positions used to see what effects posture and gravity have

Shear Testing

Standing Shear Test

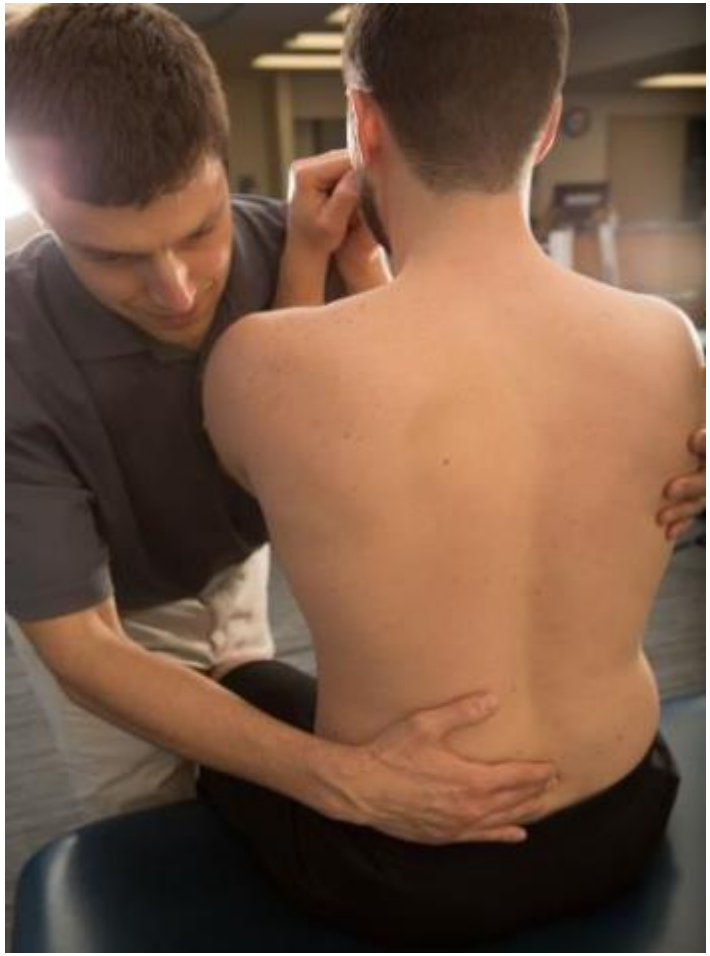
- Patient stands relaxed with hands held on abdomen
- PT stands to the side of the patient
- A-P force provided though the patients hands
- PT palpates the interspinous space of tested segment(s)
- Feel for excessive translation of one or more segments compared to others



Shear Testing

Seated Shear Test

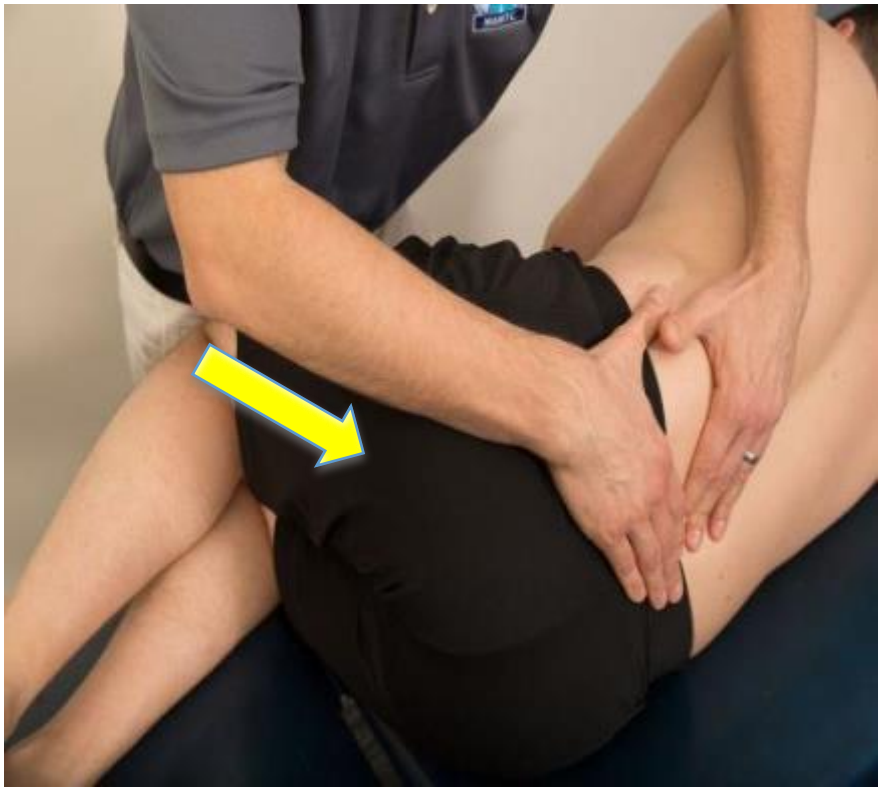
- Patient sits with elbows together in front of his/her chest, feet supported (not pictured)
- PT places clavicle region on patient's forearms and observes the spine
- PT leans into the patient and instructs the patient to resist the force
  - **Force is minimal**
- Observe/palpate for excessive translation



Shear Testing

Sidelying Shear Test

- Patient lays sidelying (side does not matter) and relaxed
- PT flexes the hips to about 70 degrees with knees off of table
- PT provides an A-P force with the anterior hip/thigh through the patient's knees
- Palpate for excessive translation at the interspinous spaces



Functional Movement Testing

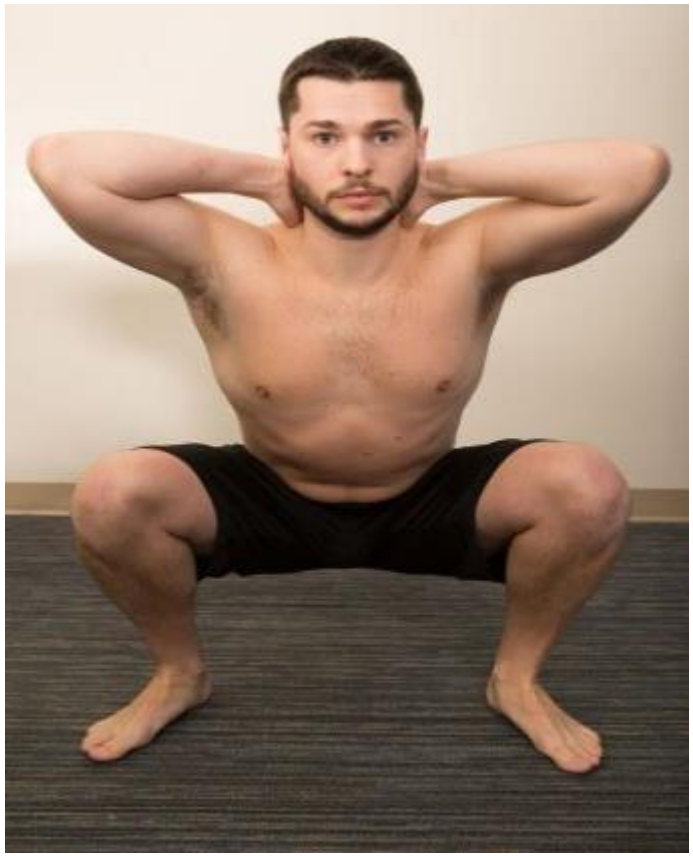
Functional Movement Testing

Gait

Functional Movement Testing

Squat

Normal Squat



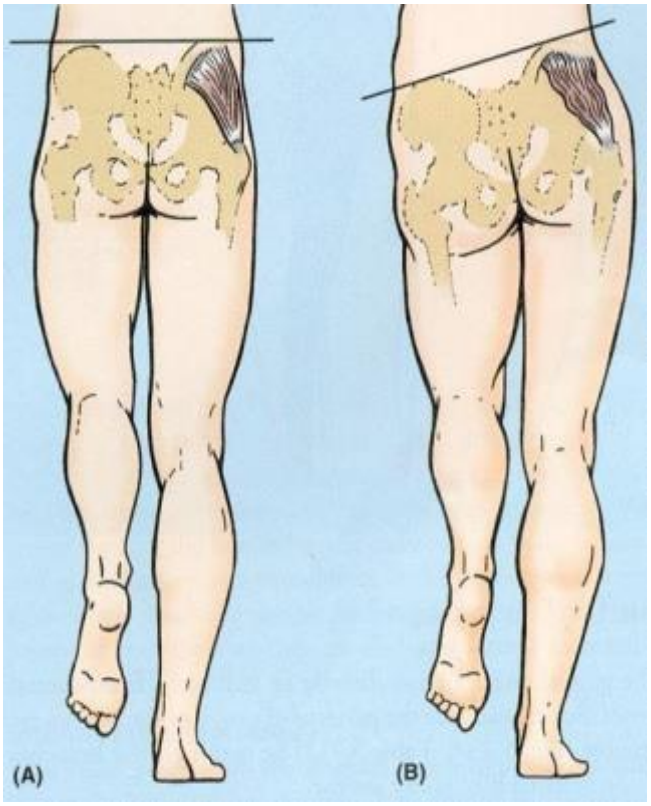
Abnormal Squat

Functional Movement Testing

Single-leg Stance

Compensated via SB

Classic Version

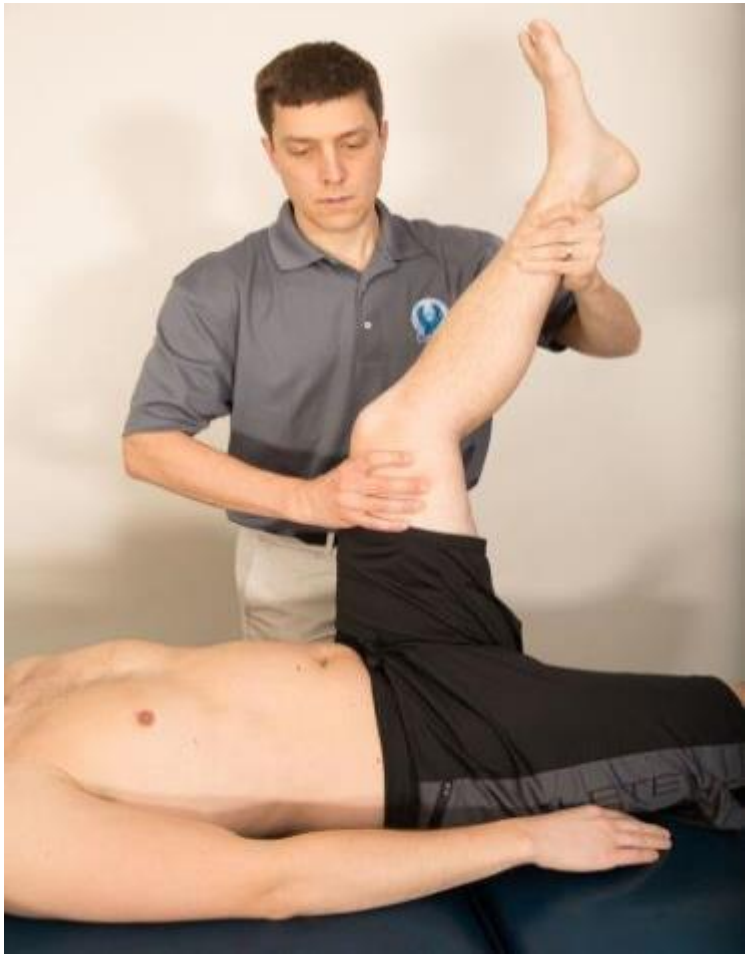


Muscle Length/Dominance Testing

Muscle Length Testing

90/90 Hamstring Length

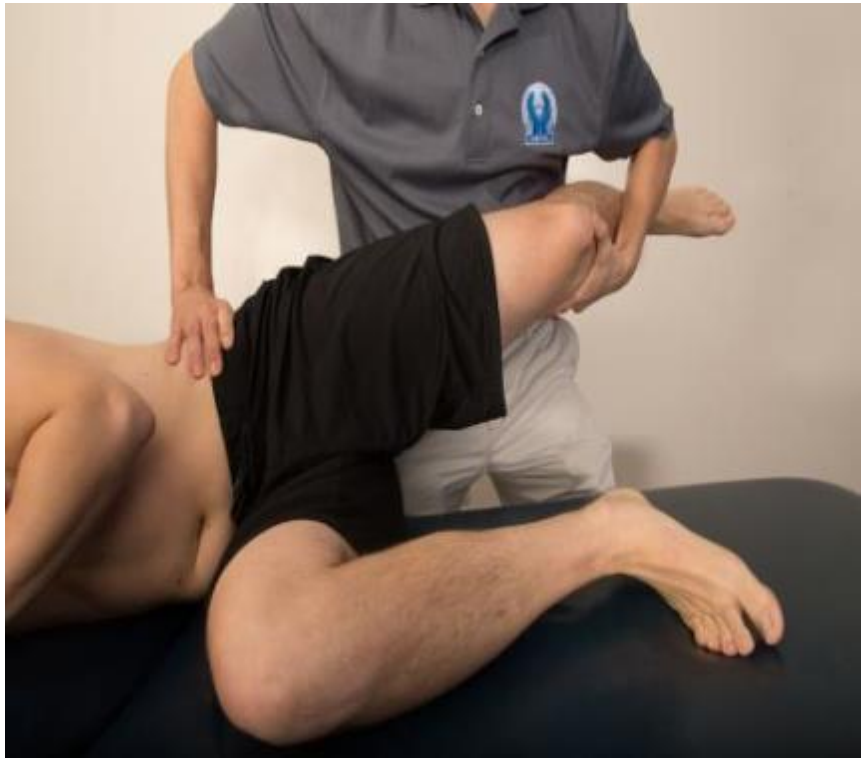
- Patient supine
- Flex hip to 90 deg with knee remaining flexed
- Extend knee until resistance is felt
- Measure the degree of knee flexion
- </= 20 deg. = WNL



Muscle Length Testing

Ober's Test

- Patient sidelying
- Passively abduct the hip while taking from slight flexion to neutral
  - To position the ITB over the greater trochanter
- Keep the knee flexed 20 deg.
- Slowly lower thigh until resistance is felt or the iliac crest moves
- Thigh 10 deg. below horizontal = WNL



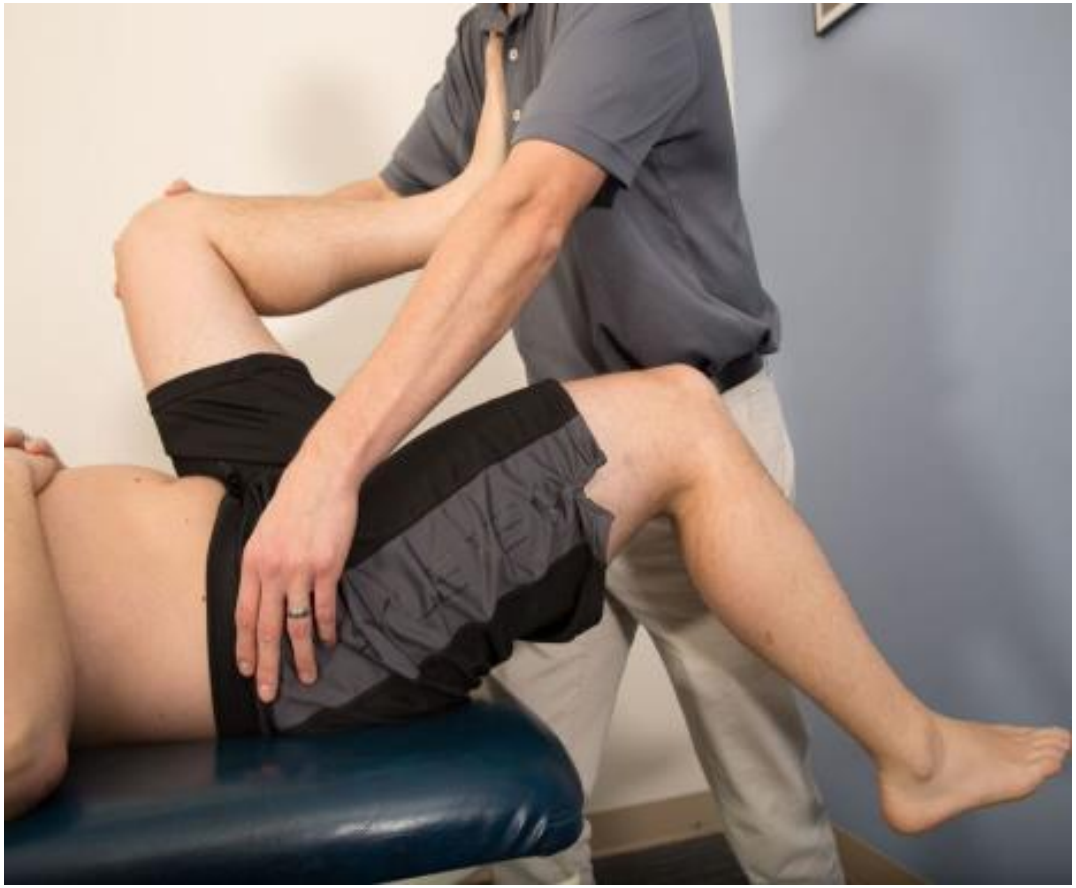
Muscle Length Test

Thomas Test

- Patient supine at the end of the table
- Flex the hips up until the sacrum moves or L/S starts to flex
- PT uses body to stabilize top leg (foot against chest)
- Gradually lower the leg until the ASIS starts to move
- Can differentiate psoas from rectus femoris by extending the knee
- Can also further differentiate TFL/sartorius by abducting the hip

Muscle Length Test

Thomas Test

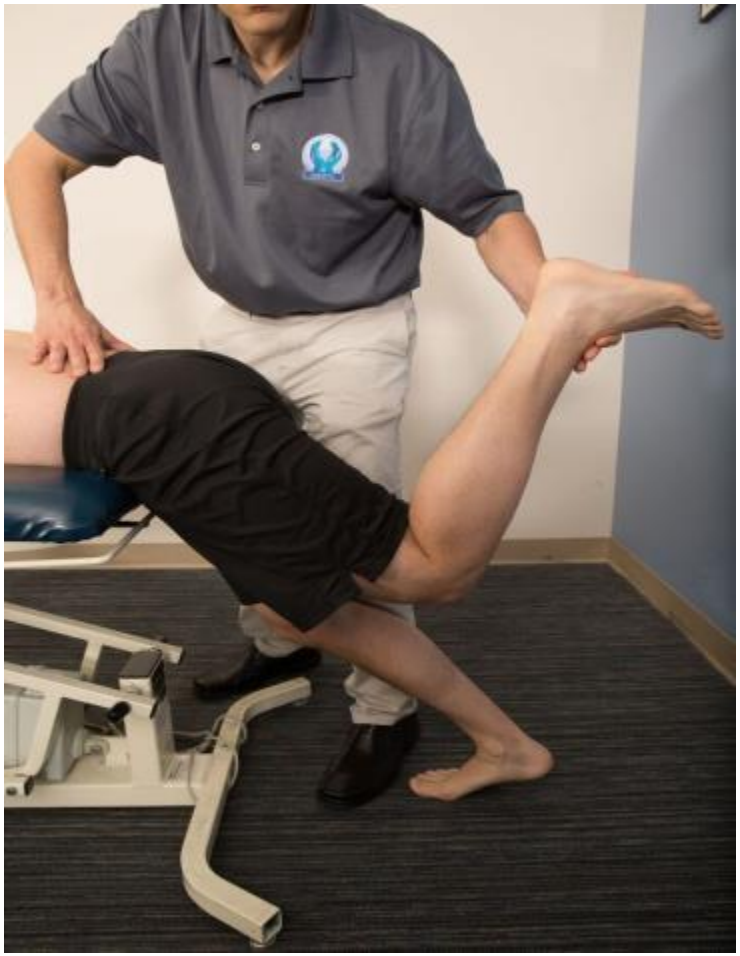


Manual Muscle Testing

Manual Muscle Testing

Gluteus Maximus

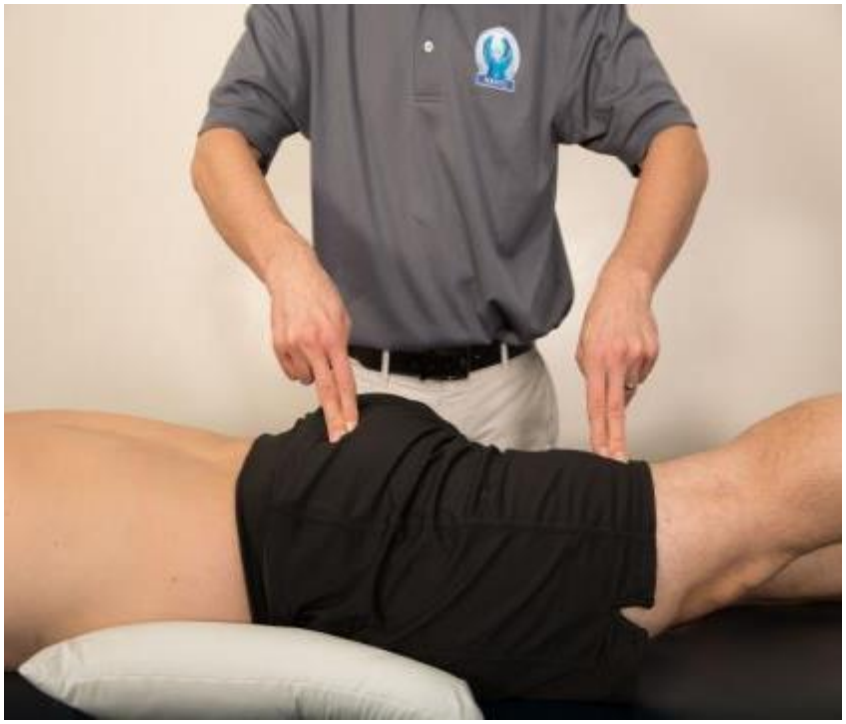
- Patient prone, thighs off the edge of table, with the tested knee bent to 90 degrees
- Other knee remains flexed as well
- Monitor for motion at L-spine and compensations
  - If the patient can not hold end range extension (parallel to floor) then the MMT is less than 3/5
- Resistance can be applied once 3/5 is achieved



Muscle Dominance

Dominant Hamstring

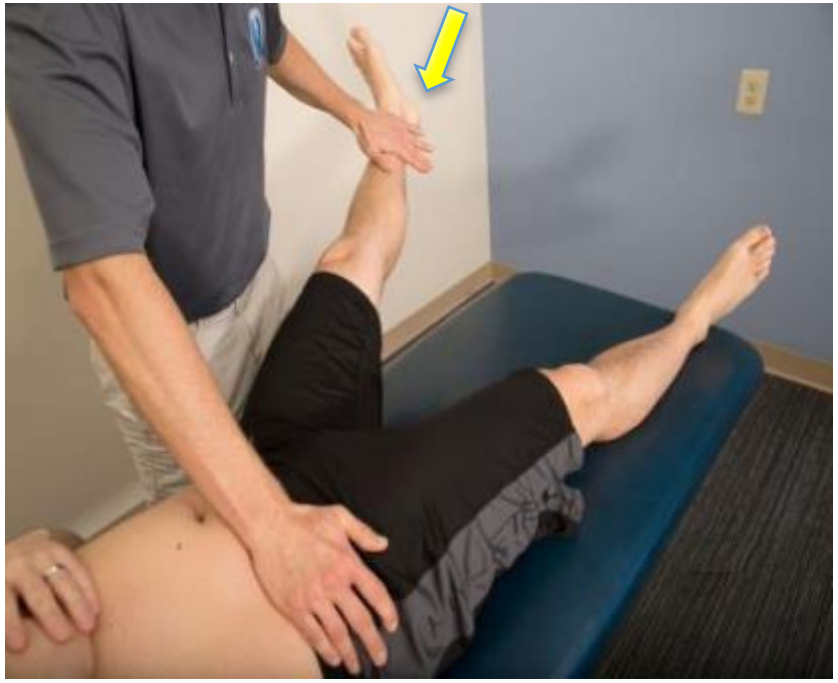
- Patient prone with a pillow under the abdomen
- Palpate the gluteus maximus and hamstring
- Patient lifts the leg off of the table with the knee straight
- Glute max should fire first followed by the HS
- If the HS fires first with a marked delay in glute max then it is a sign of a dominant HS muscle



Manual Muscle Testing

Iliopsoas

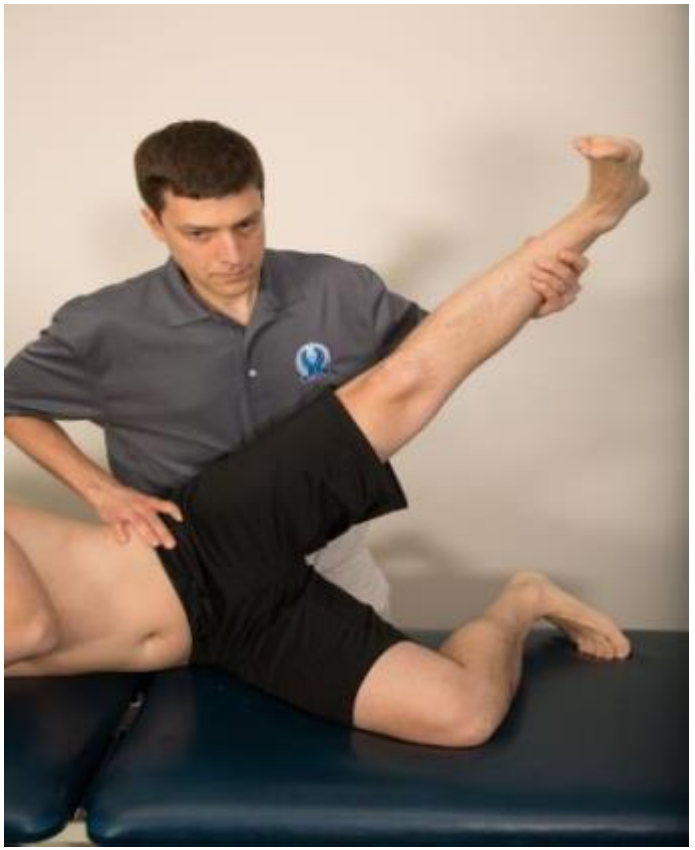
- Patient supine with contralateral leg straight
- Hip placed in about 30 degs flexion, 20 degs abduction, 20 degs ER (open pack position)
- Resistance is applied diagonally in the axis of the hip position



Manual Muscle Testing

Posterior Gluteus Medius

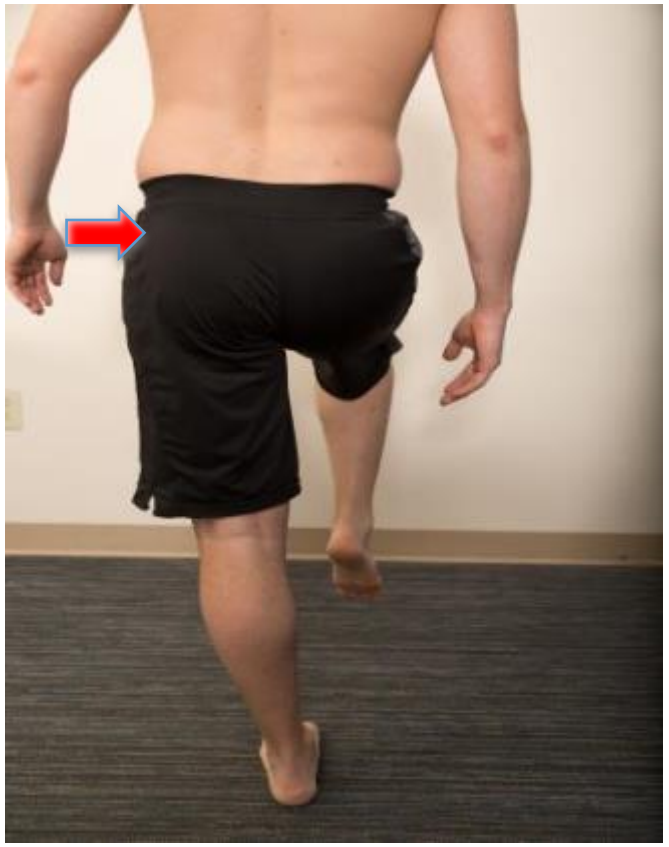
- Patient sidelying, bottom knee bent
- Top leg placed at end range abduction and ER
- Resistance is provided towards the table
  - If the patient can not hold the leg at end range abduction/ER, the MMT is then <3/5



Manual Muscle Testing

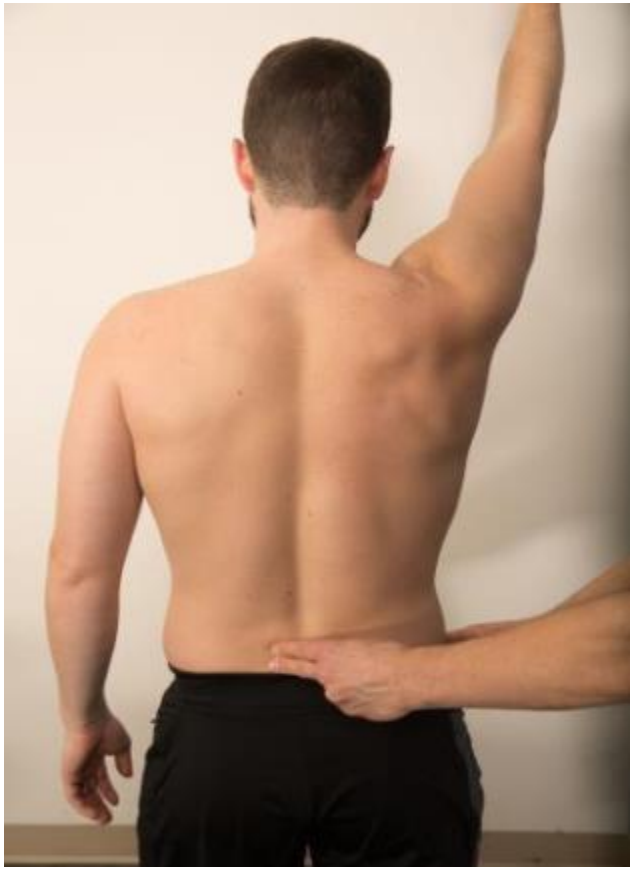
Posterior Gluteus Medius

- Patient standing
- Patient asked to lift his/her foot off the ground
- Look for the hip of the lifted leg to appear to drop (Trendelenburg)
- This is a sign of PGM weakness of the contralateral side



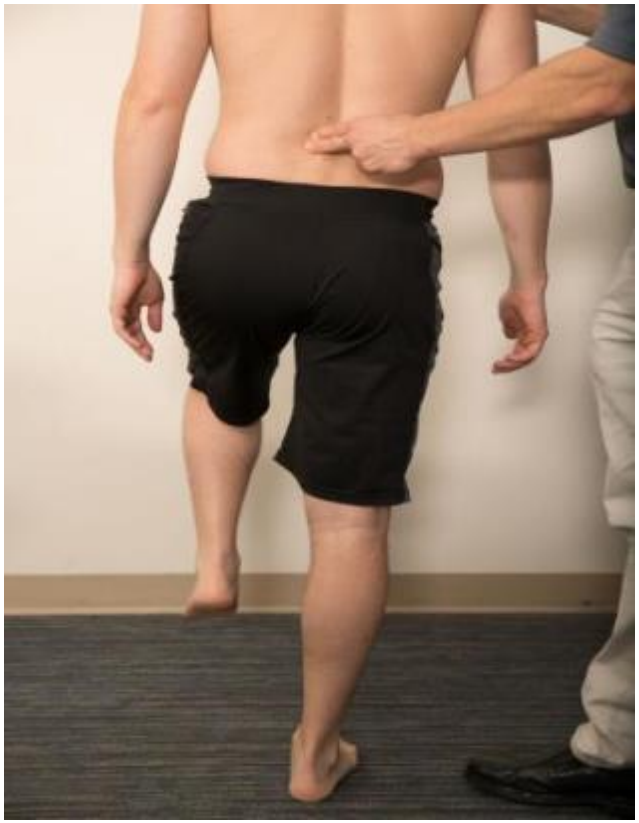
Multifidus Tone

- Can be tested in standing or prone
- Patient raises the contralateral arm while palpating just lateral to the spinous process
- You should feel for the firing (swelling) of the multifidus
  - Compare bilaterally and between multiple spinal segments



Multifidus Tone

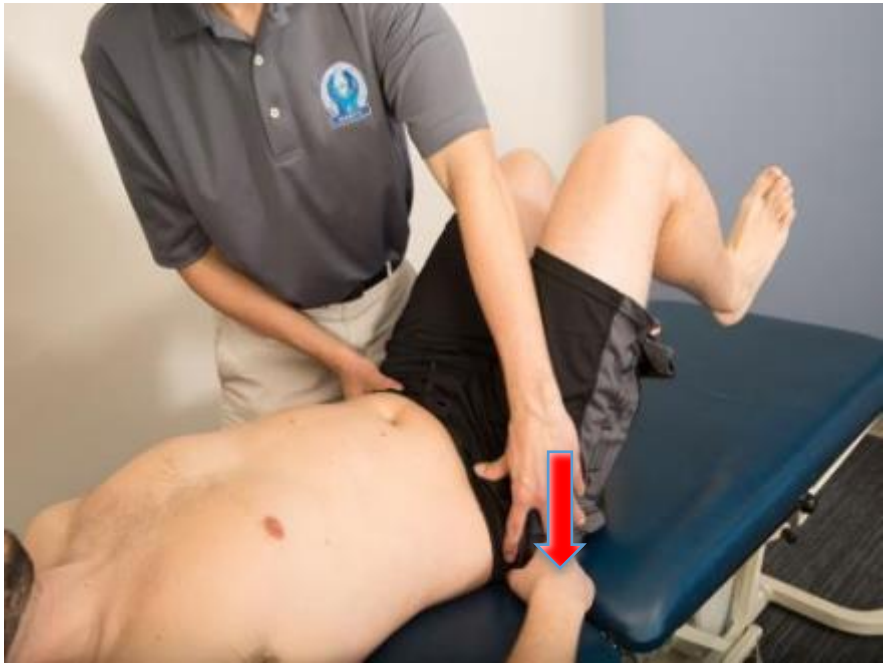
- Patient in standing and is asked to lift a foot off of the ground
- Palpate just lateral to the spinous process of the ipsilateral side of the foot raise and feel for the amount of tone (swelling) of the multifidus
- Can compare bilaterally and between spinal segments



Manual Muscle Testing

Transverse Abdominus

- Patient hooklying
- Palpate both ASIS
- Patient lifts his/her foot off of the table and you palpate for the ASIS to drop
- Compare bilaterally
- Can teach a TA isometric then retest for the ASIS drop to improve



Exercise Techniques

- Corrective exercises for the treatment of muscle imbalances
  - Transverse Abdominals (with progressions)
  - Multifidus
  - Gluteus Maximus
  - Iliopsoas
  - Gluteus Medius

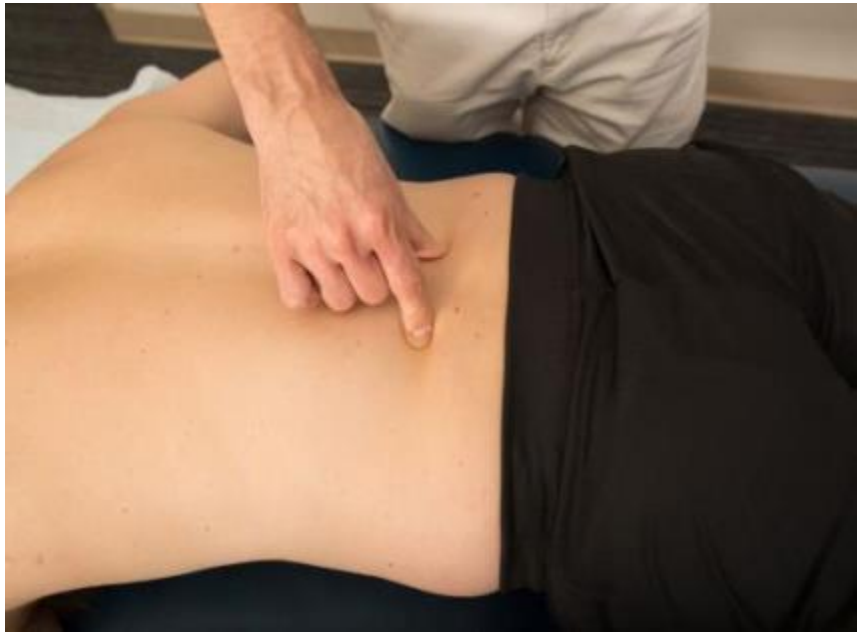
Activation- Transverse Abdominus

- Pt hooklying with BP cuff under their lumbar lordosis
- Pt instructed to perform a TA isometric by drawing the belly button up and in
  - The abdomen should not distend, indicating rectus abdominus contraction
- BP cuff pressure should slightly increase
  - Start at 40 mmHg, increase to no more than 60 mmHg with a target around 50 mmHg

Activation – Multifidus

Multifidis-prone

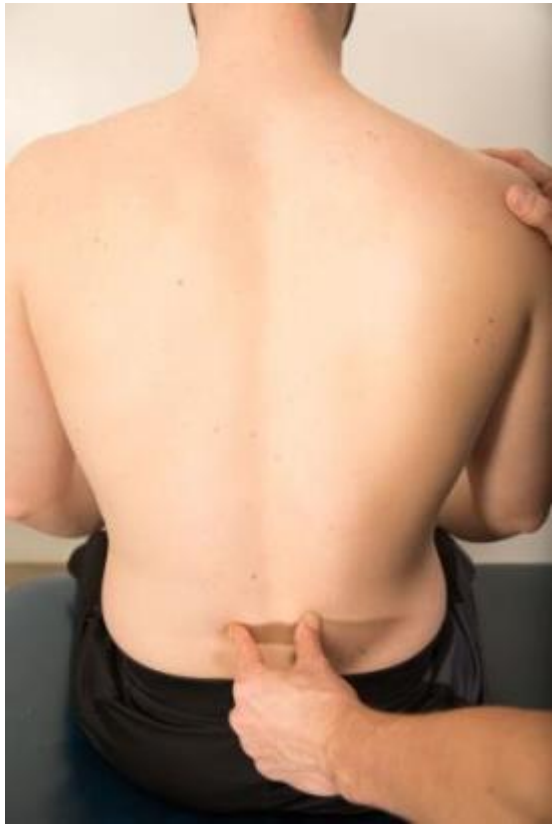
- You monitor the multifidii by palpating just lateral to the spinous processes
- Have the patient perform an isometric contraction by tightening the muscle under your fingers (multifidus swell)
  - You must monitor the paraspinals to ensure it is multifidus contraction



Activation - Multifidus

Multifidis-sitting

- Patient sits with feet supported
- Patient is asked to “tighten the muscles under my fingers”
- There should be some degree of transverse abdominal co-contraction occurring as well



Activation Techniques:
Progressions

- Transverse Abdominus & Multifidus
  - Once learned individually, can be taught as a co-contraction as tolerated by patient
  - This combination can then be performed in sitting, i.e. “in the car”
  - Can then be progressed to standing
  - Co-contraction serves as cornerstone of stabilization exercises and should be performed in conjunction with ALL other exercises (including those that follow in this course)

Strengthening Exercises

Strengthening

Gluteus Maximus

- Patient prone over the end of the table
- Patient flexes the knee to 90 degrees and performs a glute set
- Patient lifts the thigh until it just comes off of the table
  - Monitor the spine to avoid rotation or activation of paraspinals

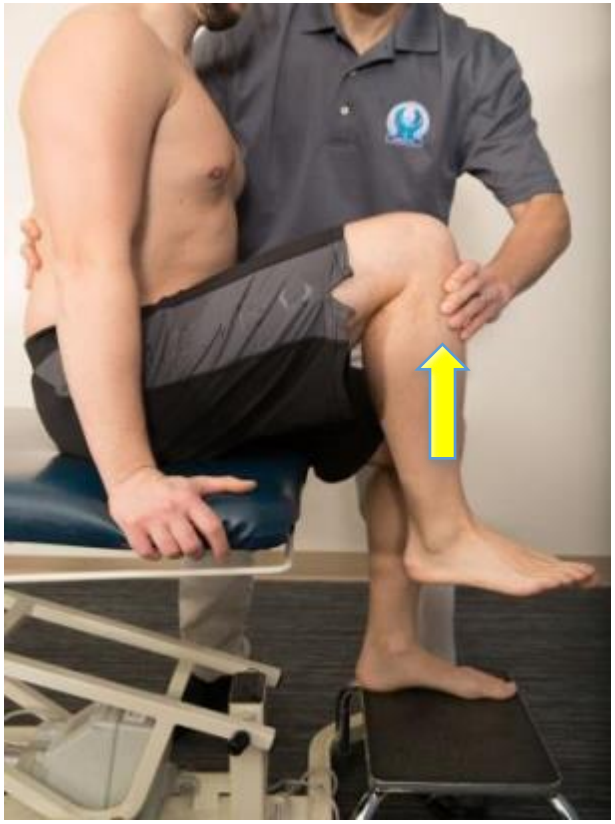
Strengthening
Psoas Facilitation

- Patient in the supine position
- Therapist holds leg (in open packed position of hip) and applies slight distraction
- Patient cued to “draw the hip back into the socket”

Strengthening

Iliopsoas

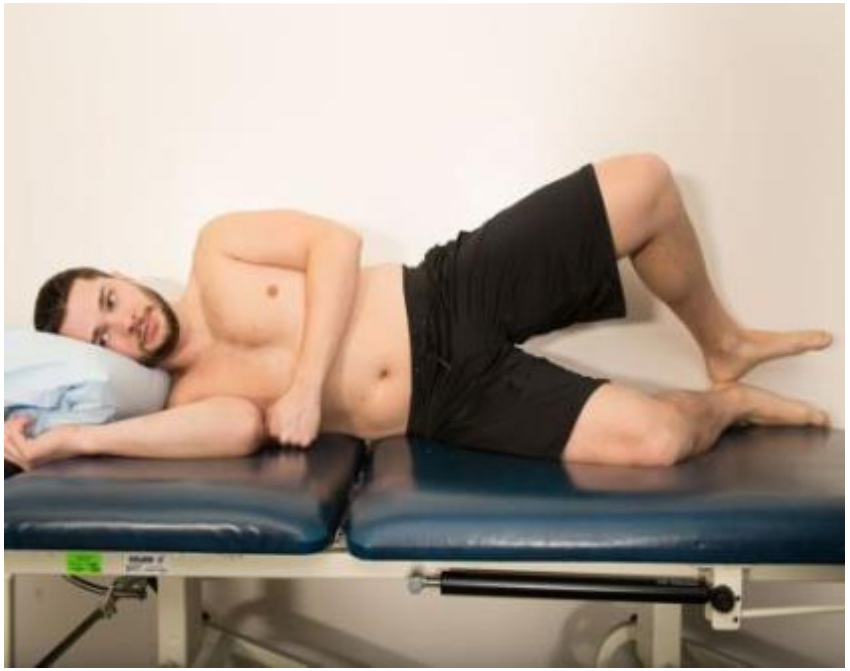
- Patient sits at the end of a table or in a chair
  - Lumbar spine must remain straight
- PT or patient passively flexes the hip to end range
- PT or patient gradually releases the leg and the hip is help fully flexed and the spine must not flex



Strengthening

PGM stage 1

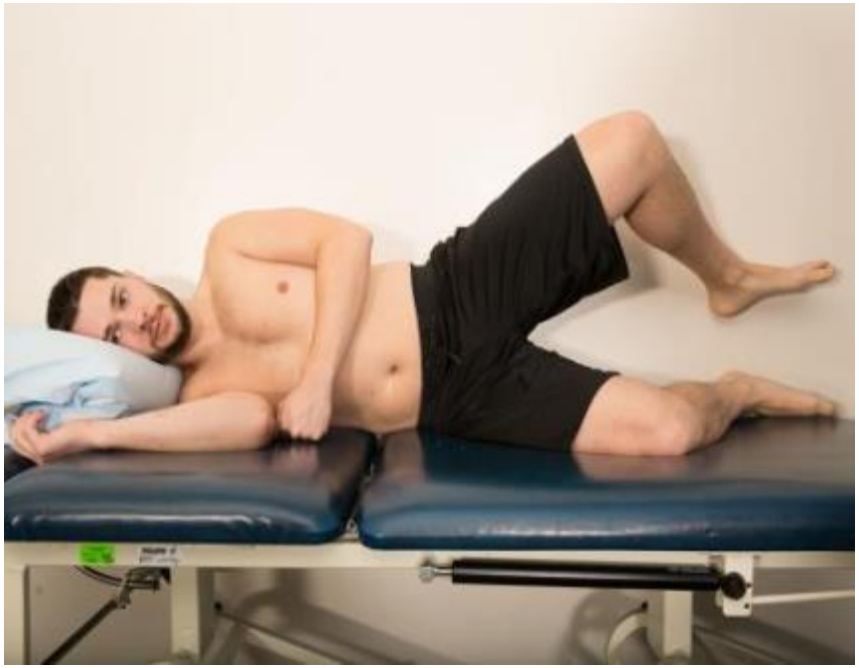
- Pt in sidelying with knees flexed ~60 degrees
- The back is supported against the wall
- Patient pushes the top heel down into the bottom heel to active hip ER
- Patient slowly lifts the top knee off of the bottom then slowly lowers it back



Strengthening

PGM stage 2

- Patient lays supine with the back supported against a wall
- Patient presses the heel down and lifts the knee as in stage 1
- Patient then slowly lifts the top heel off of the bottom heel while maintaining hip ER



Strengthening

PGM stage 3

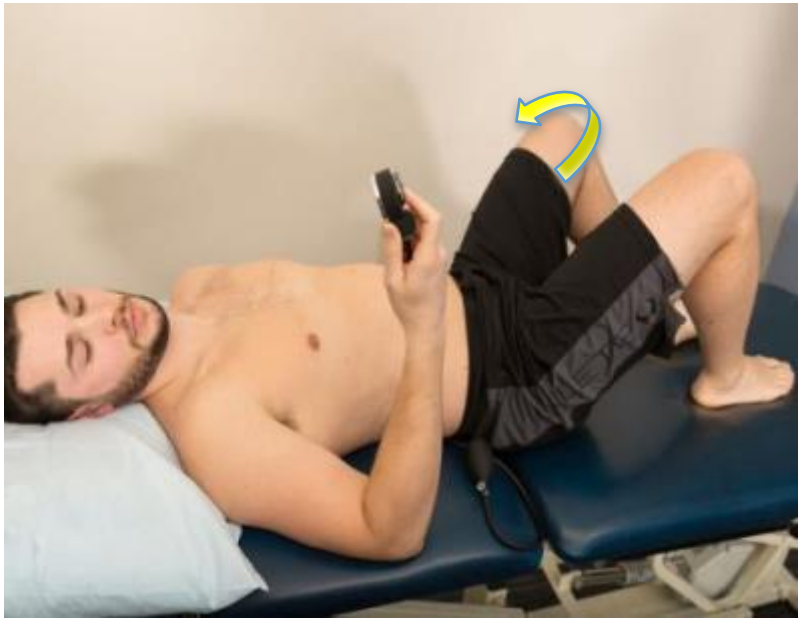
- Patient in sidelying with the back supported against the wall
- The hip is placed in ER and the foot is slid up the wall into hip abduction
- The foot must remain pointed up (hip ER) during the raise and lowering

Stabilization Exercises

Stabilization

Bent Knee Fall Out

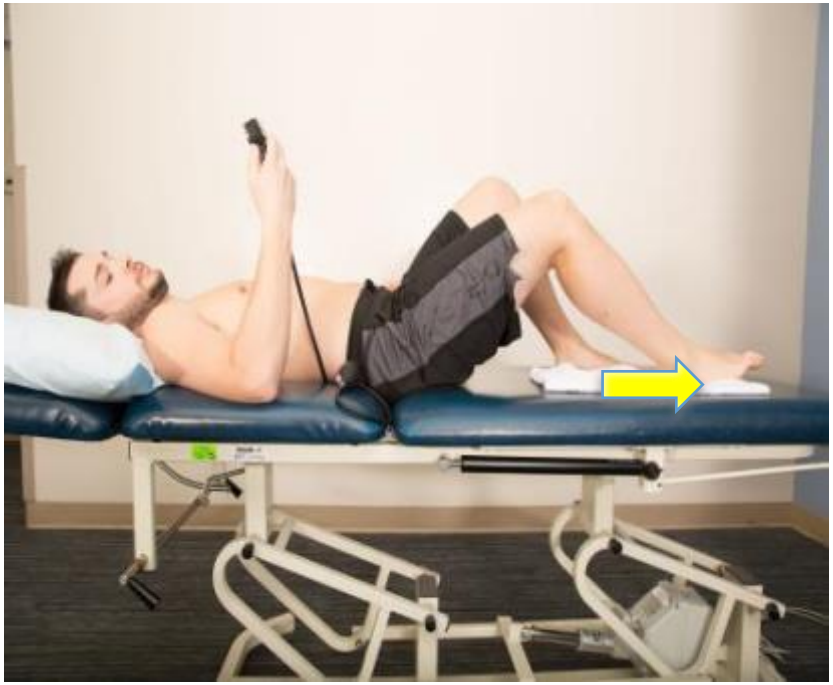
- Can combine TA isometric, posterior pelvic tilt, Kegel, and glute set
- Start at 40 mmHg and do not exceed 60 mmHg
- As all isometrics are held the patient can gradually let one knee fall outwards
- The BKFO should stop once the pressure on the BP cuff starts to drop
  - Indicates a loss of stabilization



Stabilization

Heel Slide

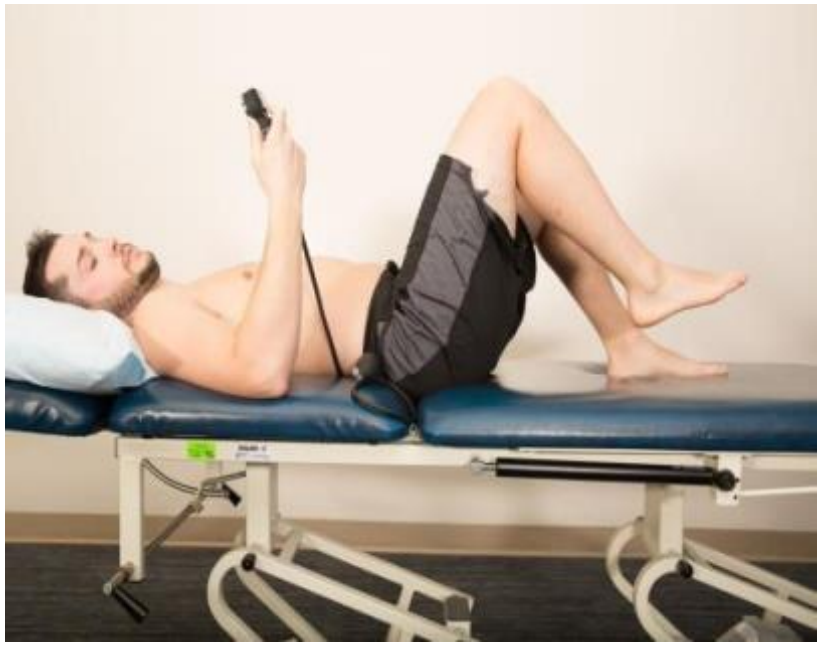
- Isometrics completed as in the BKFO and same parameters on the BP cuff
  - Start at 40 mmHg, increase to no more than 60 mmHg with a target around 50 mmHg
- Patient gradually slides the heel out until the pressure on the BP cuff begins to drop



Stabilization

Heel Lift

- Isometrics completed as in the BKFO and same parameters on the BP cuff
  - Start at 40 mmHg, increase to no more than 60 mmHg with a target around 50 mmHg
- Patient slowly lifts the heel off of the table until the BP pressure starts to drop



Stabilization

Heel lift and arm raise

- Isometrics completed as in the BKFO and same parameters on the BP cuff
  - Start at 40 mmHg, increase to no more than 60 mmHg with a target around 50 mmHg
- Patient slowly lifts the heel off of the table and lifts the opposite arm until the pressure begins to drop
  - Can also be combined with BKFO or heel slide and UE raise

Stabilization

Multifidus- Side-lying

- Pt against wall, towel roll behind ceiling-side of back
- Activate transverse abdominus (TA)
- Slightly move top thigh posteriorly, pushing into towel/wall

Stabilization

Quadruped Multifidus Raises

- Patient in quadruped, aligned against a wall, and perform TA set +/- Kegel
- Patient gently lifts the knee (of the leg opposite the wall) while maintaining all contractions, while keeping the foot on table
- PT monitors for any compensations or excessive motion
- Perform in a smooth, rhythmic manner

Stabilization

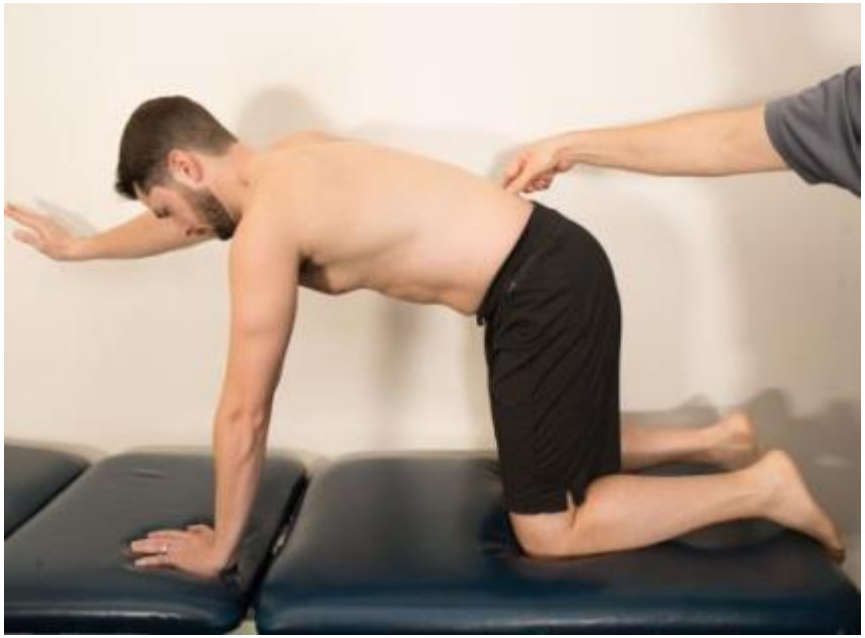
Quadruped Rocks Backs

- Distribute weight evenly on hands/knees
- Wedge ball between the legs, buttocks, and wall
- Maintain straight trunk position & do T-Abd. breathing. Upon exhalation, slowly sit towards the heel while simultaneously compressing the ball.
- Hold 5-10 sec., then slowly return to starting position

Stabilization

Quadruped UE raises

- Patient in quadruped and can perform a PPT, TA set, glute set, Kegel
- Patient gradually lifts the arm while maintaining all contractions
- PT monitors the lumbar spine to ensure no rotation occurs
  - A stick can also be placed and observed for movement, indicating lumbar rotation



Stabilization

Quadruped LE/Combined Raises

- Quadruped stabilization can be progressed to include just a LE raise (harder due to increased limb weight) and opposite UE/LE raise

Case Study #1

- 46 y/o female pt. presents with c/o 3 yr H/O back occasionally “going out”
- Recent flare-up about 2 weeks ago with pain remaining in the center of the L/S after prolonged heavy activity and prolonged positions
- MRI: positive for DJD and multi-level DDD, no nerve root impingement
- AROM: WNL all motions, slight pain at end range flexion and extension
- Lower quarter screen, neural tension testing, SIJ screen all WNL
- What is your hypothesis? What else would you test? How would you treat this patient?

Case Study #2

- 44 y/o male RN with ongoing LBP for several months, primary c/o central LBP and intense tingling into the anterior thigh after work
- MRI: L3-4 HNP, no clear nerve root impingement
- pt completed a 3-week course of PT at another facility but stopped due to increased pain (focus on extension ex's, elliptical, P-A mobilizations by PT)
- Trunk AROM WNL, pain at end range's
- Lower quarter screen, neural tension testing, SIJ screen all WNL
- What is your hypothesis? What else would you test? How would you treat this patient?

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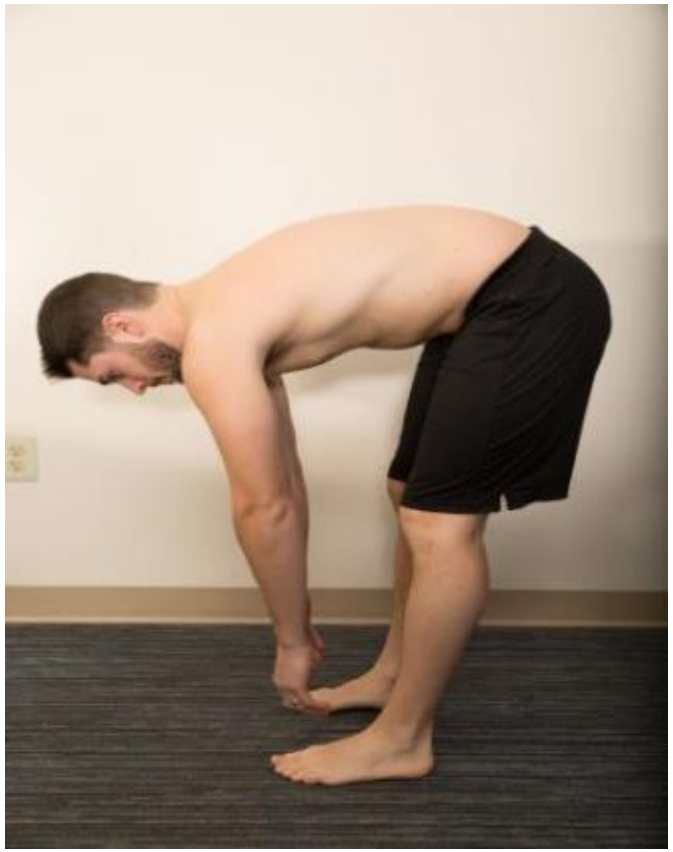
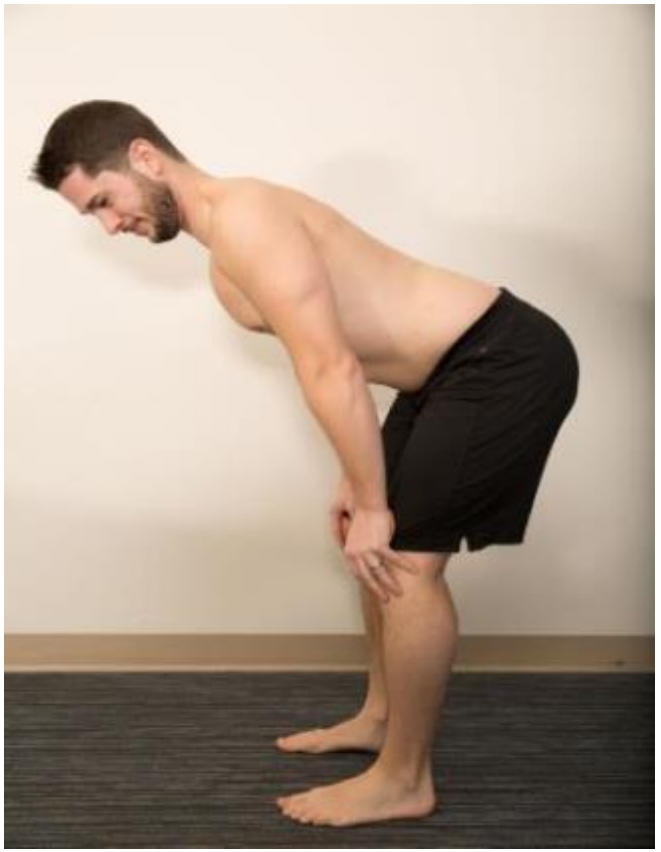
Appendix:
CPR for Lumbar Stabilization

- CPR to help predict the likelihood of improvement with lumbar stabilization
- Developed by Hicks, Fritz, Delitto, McGill
- 4 variables identified
  - Less than 40 years old
  - SLR over 91 degrees
  - Aberrant motion with trunk AROM
  - Positive prone instability test
- If 3 of 4 variables are met, the +LR is 4.0

Appendix:

CPR for Lumbar Stabilization





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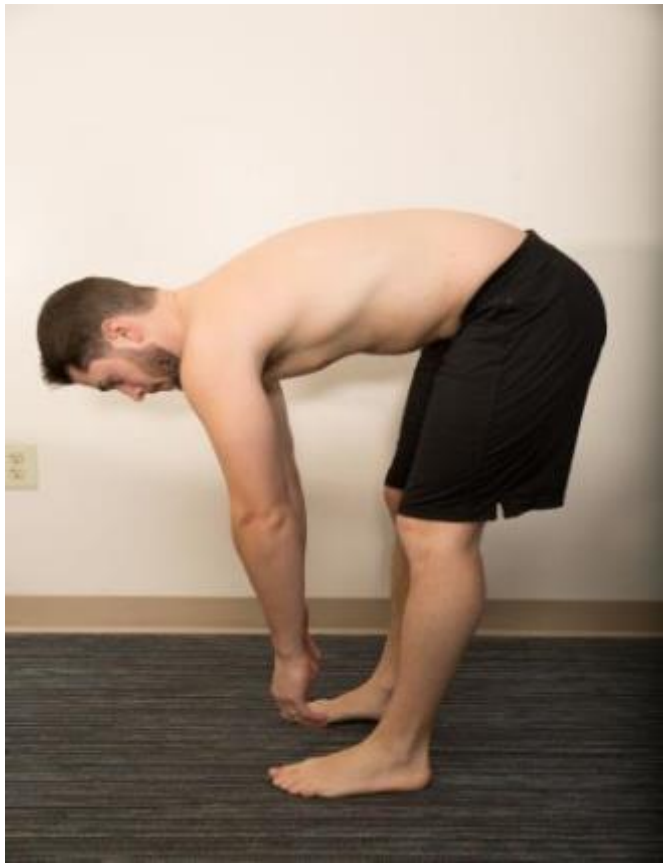

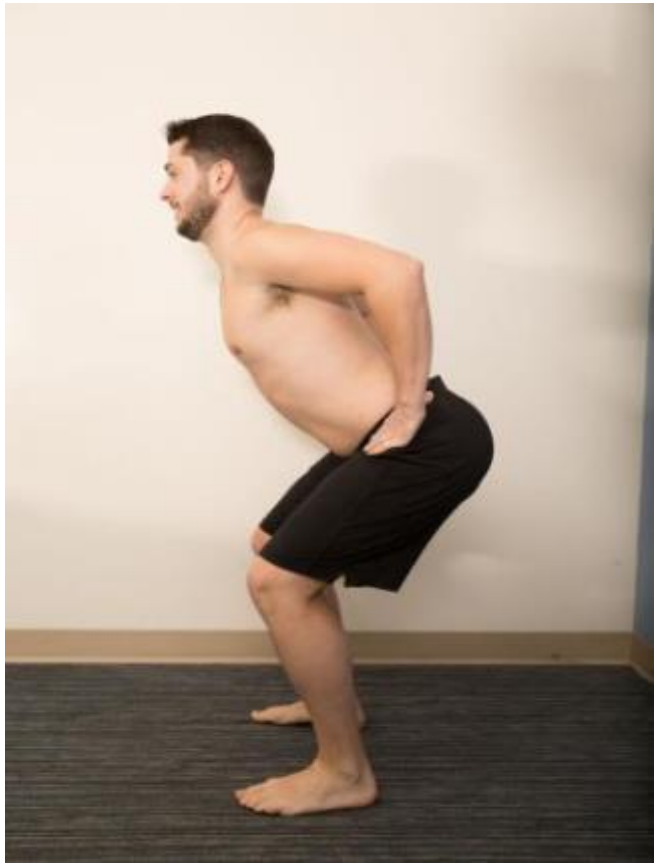

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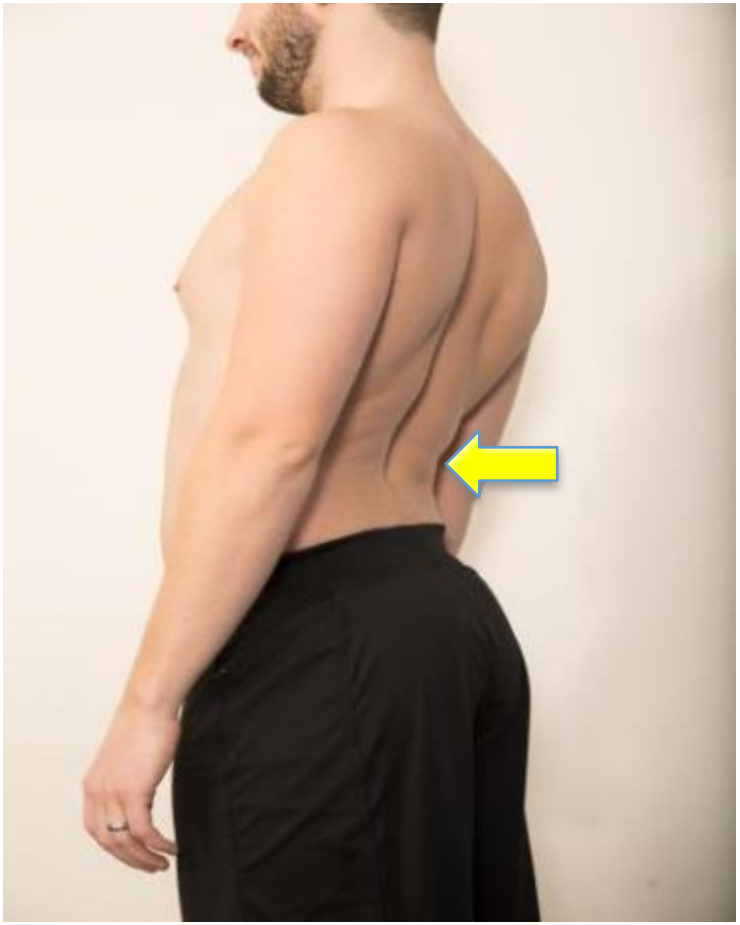

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CPR for Lumbar Stabilization