

GO FIT for a functional spine!!!

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Muscle Category

- **Agonists**
 - Muscles that act as prime movers (gluteus maximus)
- **Antagonists**
 - Muscles that act in direct opposition to prime movers (psoas)
- **Synergists**
 - Muscles that assist prime movers during functional movement patterns (semimembranosus)
- **Stabilizers**
 - Muscles that support or stabilize the body while the prime movers and the synergists perform the movement patterns (transverse abdominis)



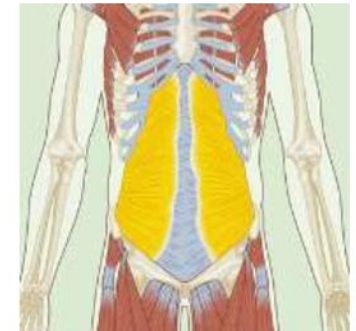
Gluteus maximus



Psoas

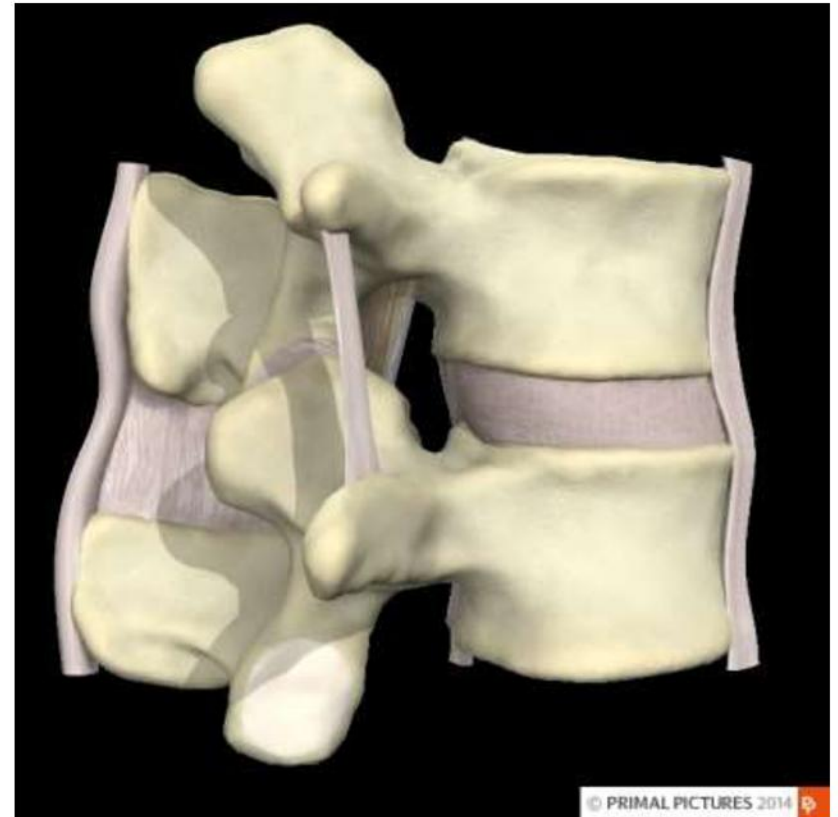


Semimembranosus

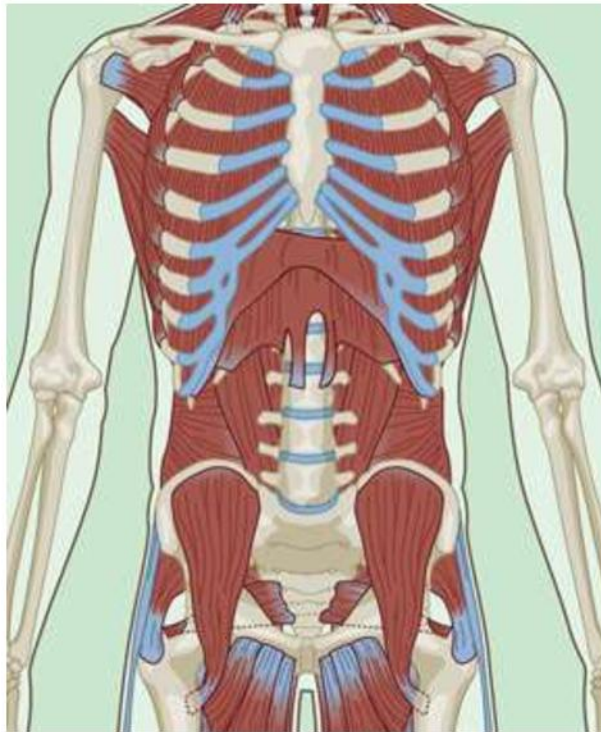


Transverse abdominis

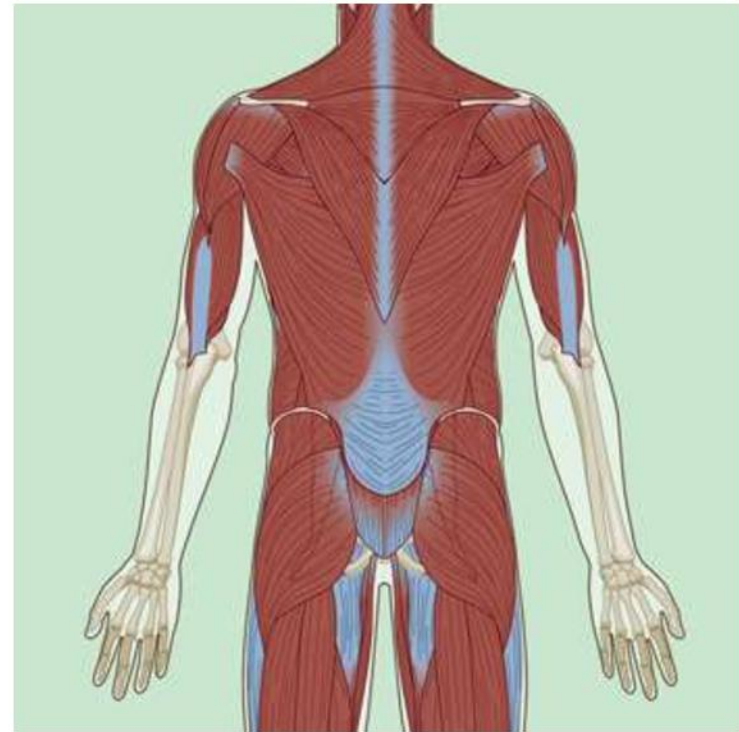
- 2 distinct and interdependent muscular systems that enable our bodies to maintain proper stabilization and ensure efficient distribution of forces for the production of movement:
 - Muscles located more centrally to the spine provide intersegmental stability
 - The more lateral muscles support the spine as a whole



Current Concepts in Functional Movement



Local musculature system



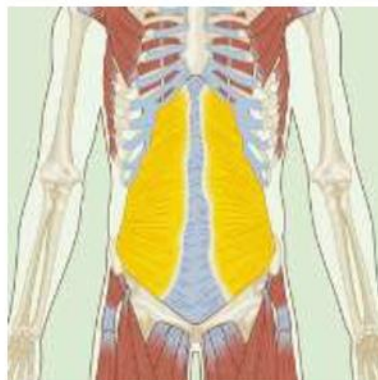
Global musculature system

Local Musculature System (Stabilization System)

- The local musculature system consists of muscles that are predominantly involved in joint support or stabilization, they are not movement specific, rather they provide stability to allow movement of a joint.



Rotator cuff



Transverse abdominus



Multifidus

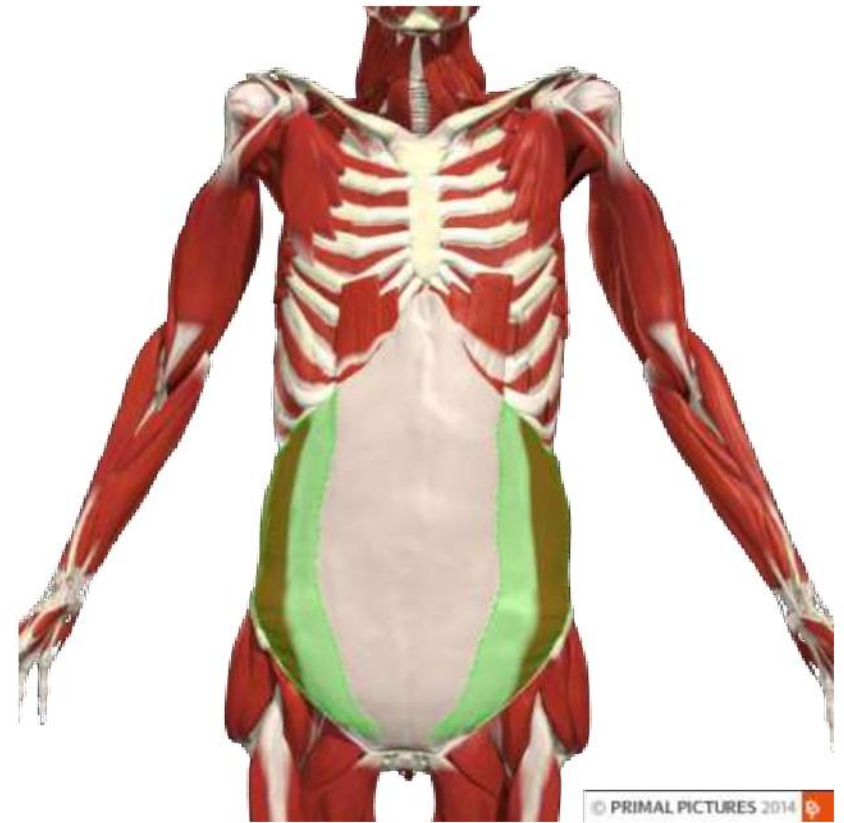


Diaphragm

Core stabilizers: Transversus abdominis



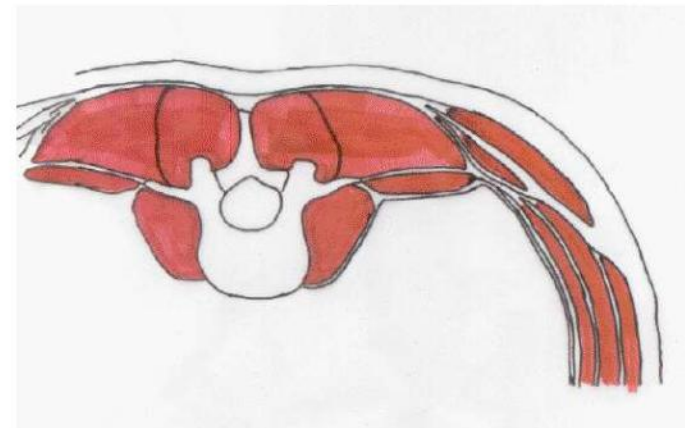
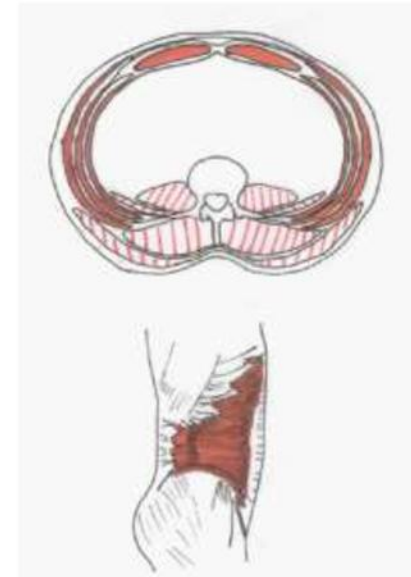
Core stabilizers: Multifidus – Internal Oblique



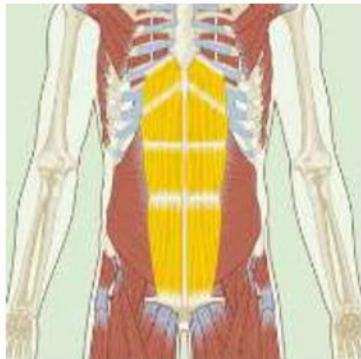
Local/segmental Stability Muscles

Function

- Increase muscle stiffness to control segmental translation
- No or minimal length change in function movements
- Anticipatory recruitment prior to functional loading provides protective stiffness
- Activity is continuous and independent of the direction of movement



Global Muscular Systems (Movement Systems) responsible for movement



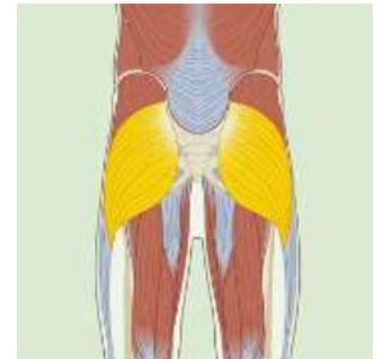
Rectus abdominis



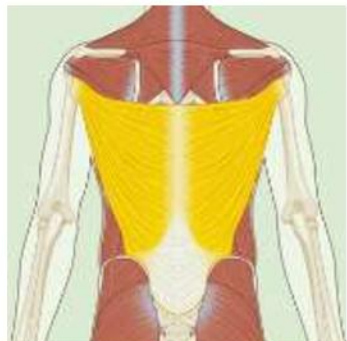
External oblique



Erector spinae



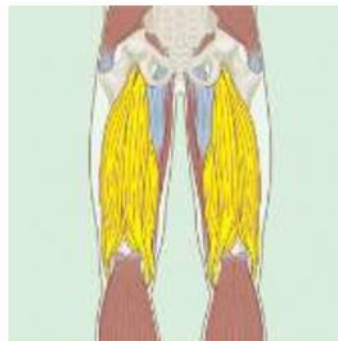
Gluteus maximus



Latissimus dorsi



Adductors



Hamstrings



Quadriceps

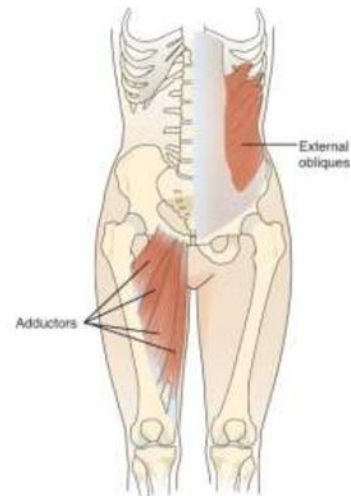


Gastrocnemius

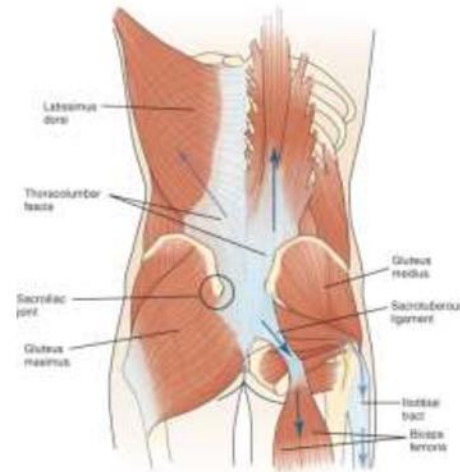
Subsystems



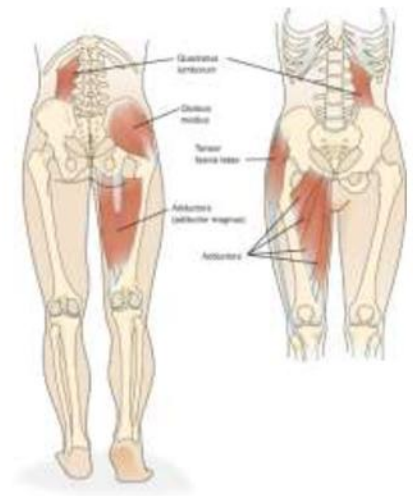
Deep longitudinal subsystem



Posterior oblique subsystem



Anterior oblique subsystem



Lateral subsystem

Deep Longitudinal Subsystem

- Deep longitudinal subsystem
 - ▣ Erector spinae
 - ▣ Thoracolumbar fascia
 - ▣ Sacrotuberous ligament
 - ▣ Biceps femoris
- Provides force transmission longitudinally from the ground to the trunk and back down
- The dominant role of the deep longitudinal system is to control ground reaction forces during gait motions.



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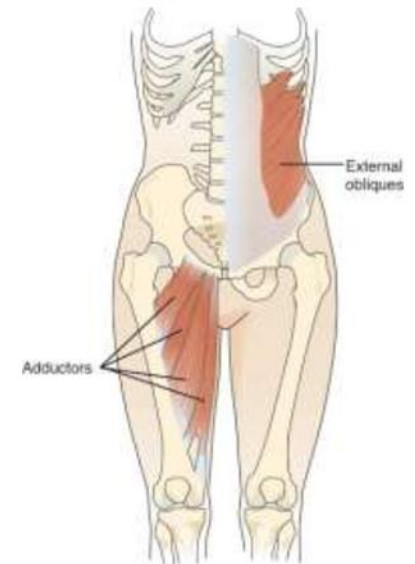


Posterior Oblique Subsystem (Slide 1 of 2)

- Posterior oblique subsystem
 - ▣ Gluteus maximus
 - ▣ Latissimus dorsi
 - ▣ Thoracolumbar fascia
- The muscle fiber arrangements of the posterior oblique subsystem run perpendicular to the sacroiliac joint and provides transverse plane stabilization to the SI joint.



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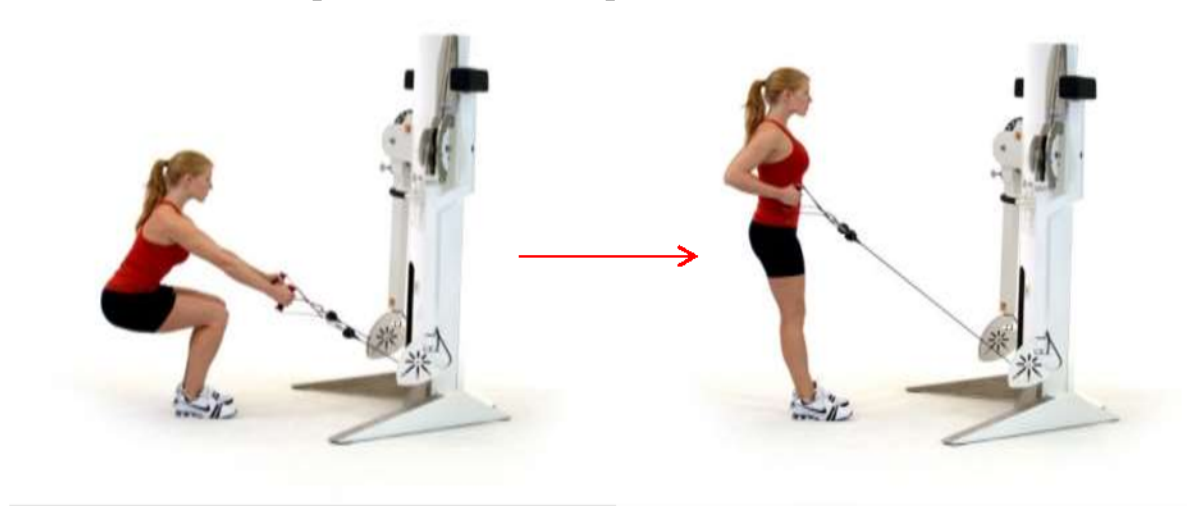


Posterior Oblique Subsystem (Slide 2 of 2)

- ❑ Dysfunction of any structure in the posterior oblique subsystem can lead to sacroiliac joint instability and low-back pain.
- ❑ The weakening of the gluteus maximus and/or latissimus dorsi can lead to increased tension in the hamstring and therefore cause reoccurring hamstring strains.

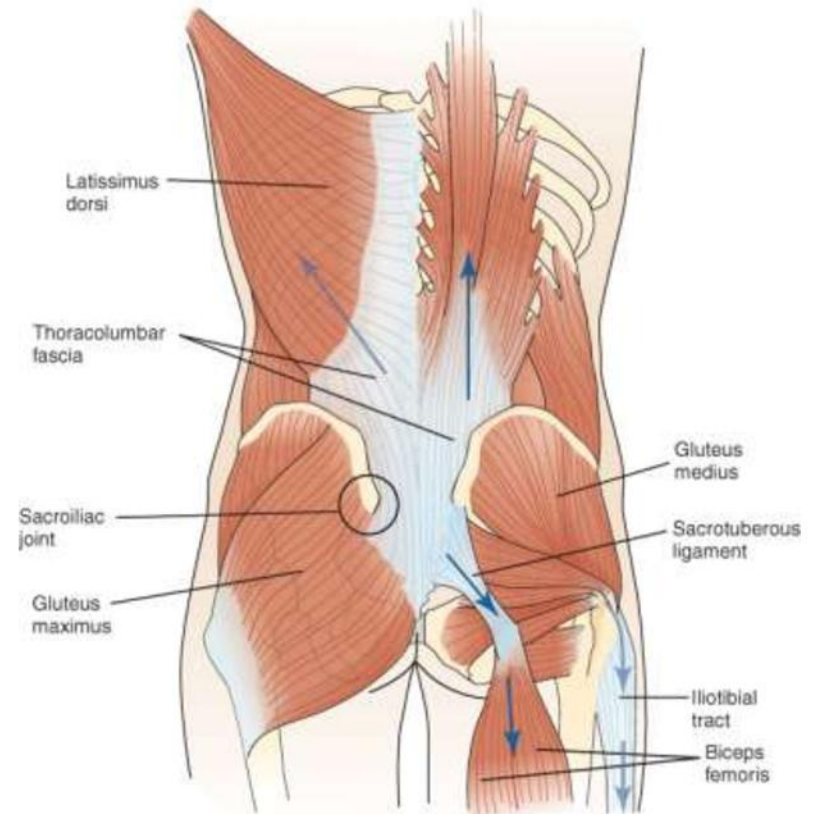


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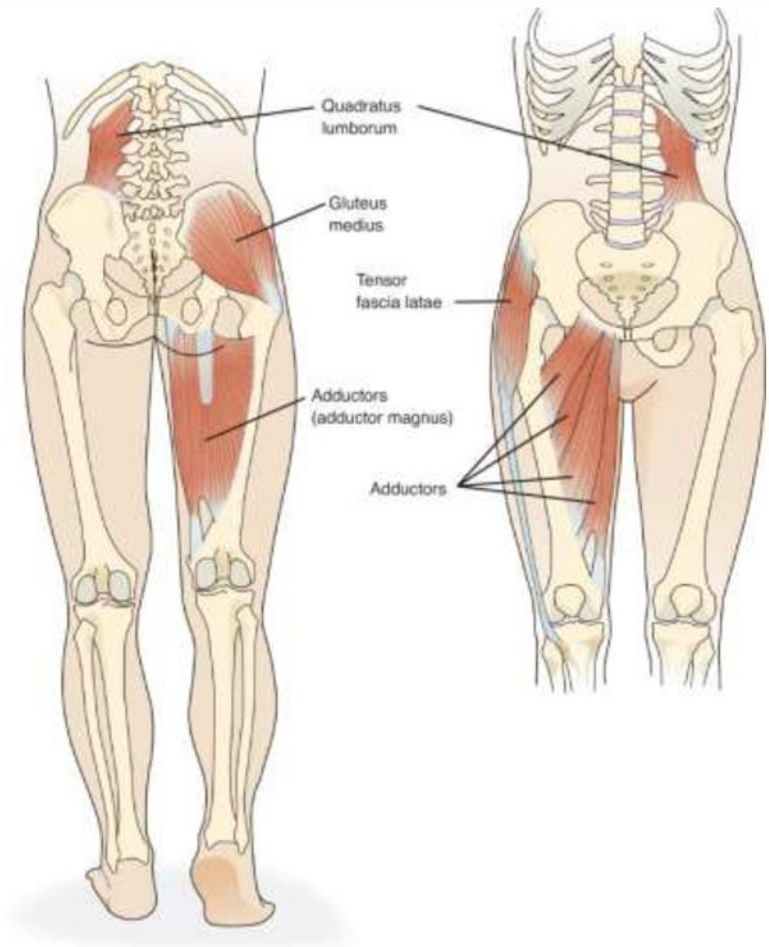
Anterior Oblique Subsystem

- Anterior oblique subsystem
 - ▣ Internal oblique
 - ▣ External oblique
 - ▣ Adductor complex
 - ▣ External rotators
- Functions in a transverse plane orientation, mostly in the anterior portion of the body
- The obliques, in concert with the adductor complex, not only produce rotational and flexion movements, but are instrumental in stabilizing the lumbo-pelvic-hip complex.



Lateral Subsystem

- Lateral subsystem
 - ▣ Gluteus medius
 - ▣ Tensor fascia latae
 - ▣ Adductor complex
 - ▣ Contralateral quadratus lumborum
- Implicated in frontal plane stability and is responsible for pelvo-femoral stability during single-leg functional movements such as in gait, lunges, or stair climbing



Global muscles



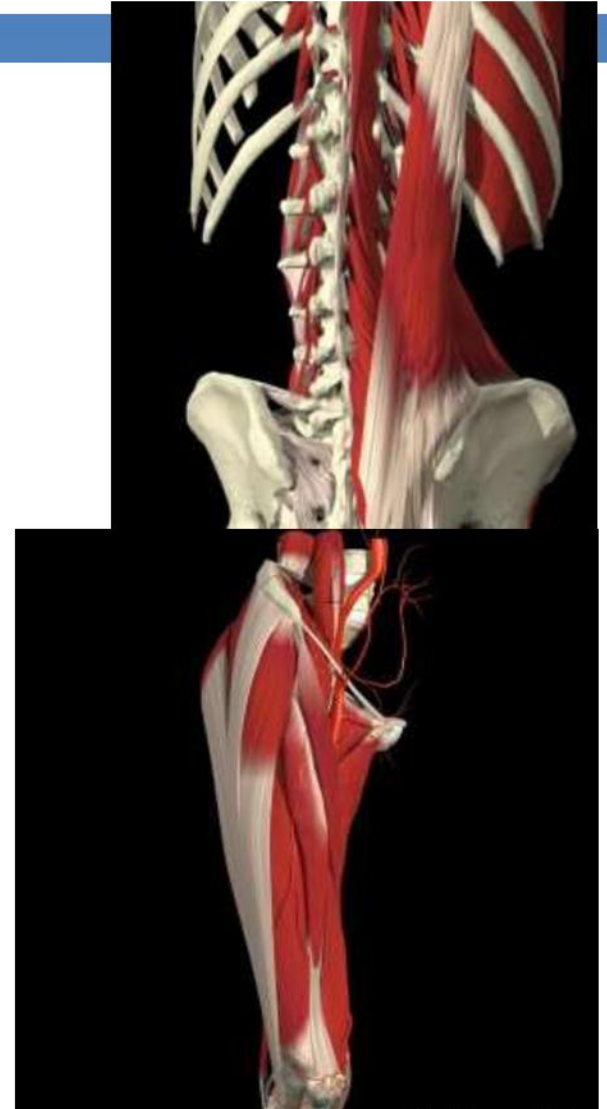
Global Mobility Muscles

Function

- Generates force to produce range of movement
- Concentric acceleration of movement (sagittal plane: power)
- High load shock absorption
- Activity is especially phasic (on:off pattern) and is direction dependent

Comerford & Mottram 2001)

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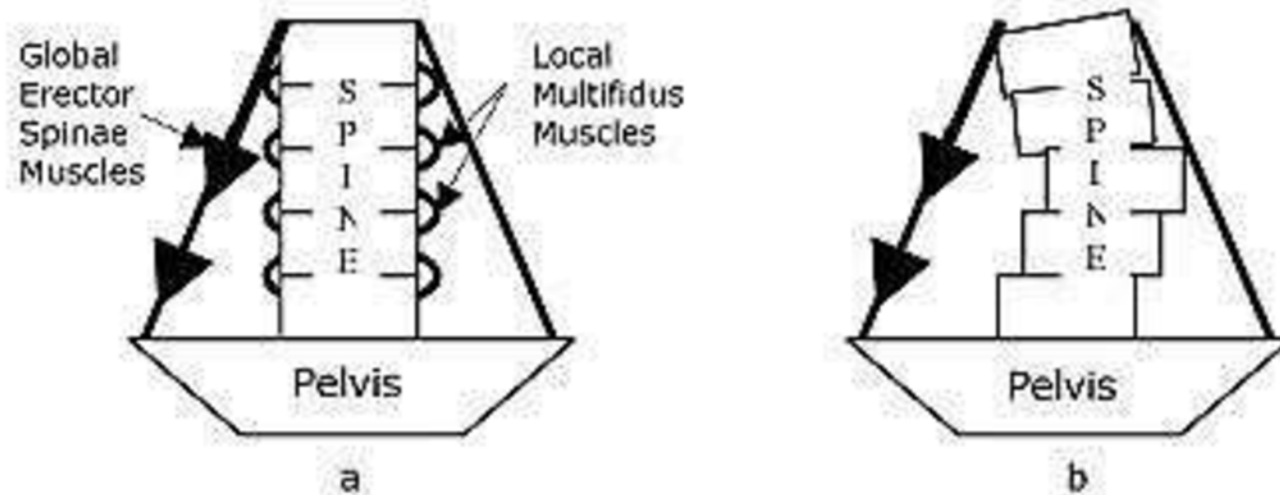


Local stability segmental control

- The segmental stability of the spine is dependent on recruitment of the deep local stability muscles
- The spine will fail if local activity is insufficient even if the global muscles work strongly

*(Cholewicki & McGill 1996, Crisco & Panjabi 1991,
Hoffer & Andreasson 1981)*

For the spine the problem is...



- ❖ Coordinated action of local(segmental) and global stabilizers is needed
- ❖ If local(segmental) stabilizers don't initiate contraction the spine will be de-stabilized by global stabilizers and mobilisers

Local Muscle System Dysfunction

There are changes in motor recruitment resulting in a loss of segmental control

Local inhibition

Dysfunction in **Local Stability System**

- **Motor control deficit associated with delayed timing or recruitment deficiency**

(Hodges & Richardson 1996)

- **Reacts to pain & pathology with inhibition**

(Stokes & Young 1984, Hides et al. 1994)

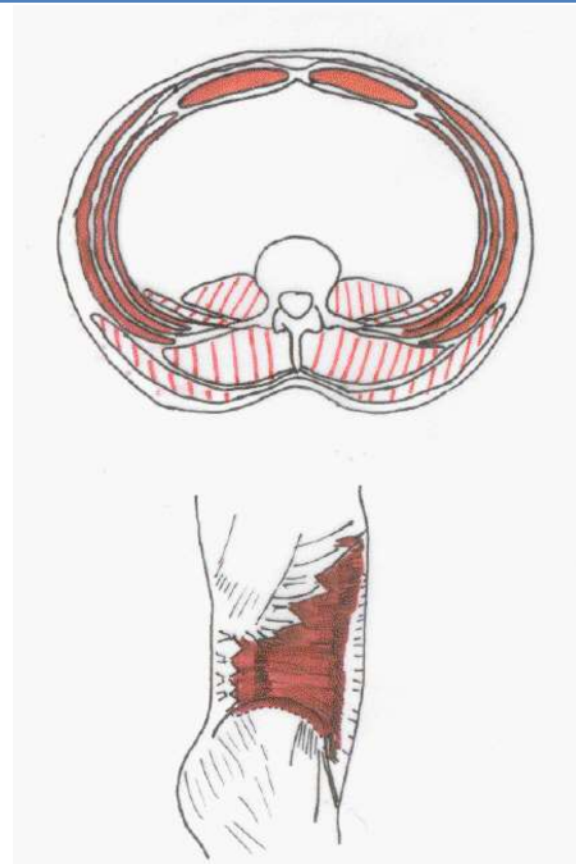
- **Decrease in muscle stiffness and poor segmental control**
- **Loss of control of joint neutral position**

Transversus Abdominis

- Activates prior to movement of the limbs or trunk to increase stiffness and stability of the spine
- Its activity is independent of the direction of trunk movement or limb load

(Cresswell 1992, 1994)

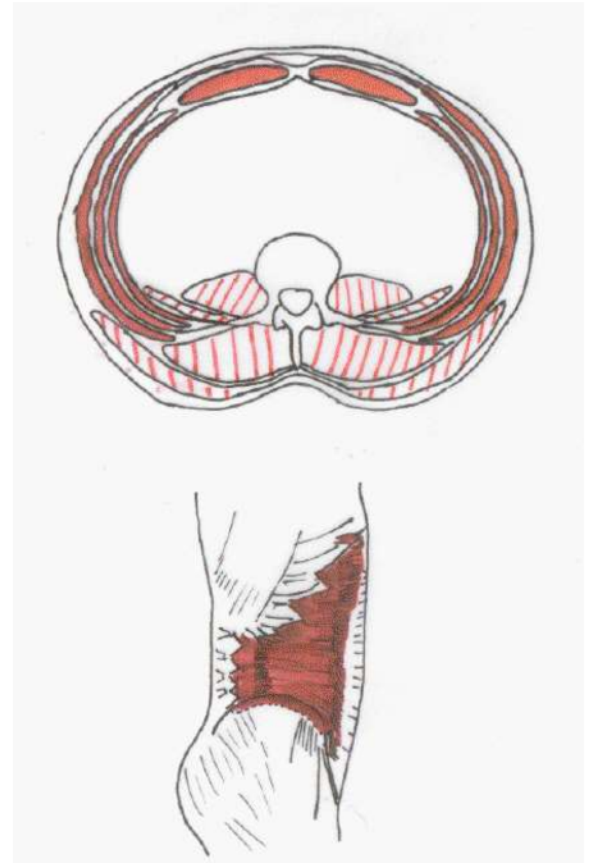
(Hodges and Richardson 1995, 1996)



Transversus Abdominis

- A motor control deficit is present in subjects with low back pain
- Activation of transversus is significantly delayed
- The timing delay is independent of the type or nature of pathology

(Hodges & Richardson 1995, 1996)

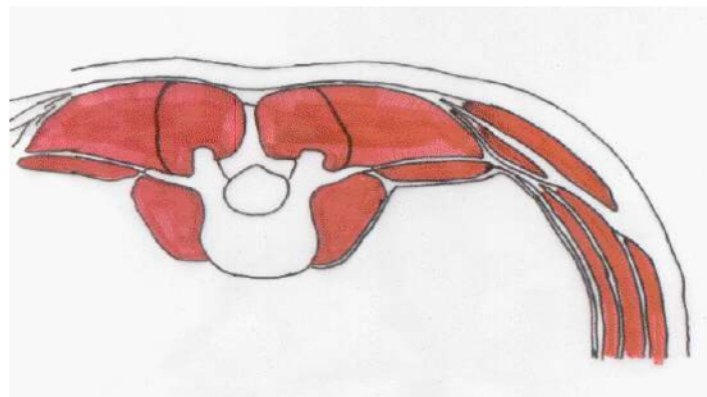


Lumbar Multifidus

- Asymmetry of cross sectional area of multifidus in back pain subjects

(Stokes et al. 1992)

(Hides et al. 1994, 1995)



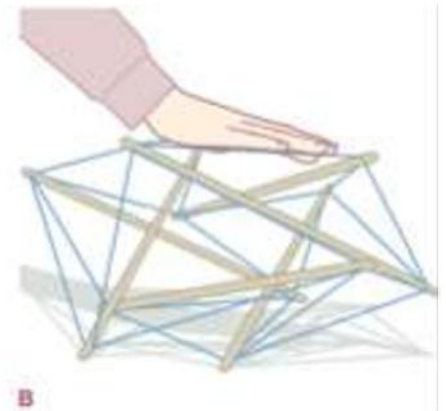
Dysfunction does not correct automatically when pain resolves & specific training can correct dysfunction and recurrence

(Richardson et al. 1998, Hides et al. 1995, 1996)

Dysfunction in Global mobility System

- **Myofascial shortening which limits physiological and / or accessory motion**
- **Overactive low load or low threshold recruitment**
- **Reacts to pain and pathology with spasm**

Myofascial functions...



Dysfunction: What comes 1st ?

- Global dysfunction can precede and contribute to the development of pain & pathology
- Pain & pathology are not a necessary consequence of global dysfunction
- Local dysfunction does not precede the development of pain and pathology but rather is due to pain & pathology
- Pain & pathology do not have to be present (may be related to distant history)

'Motor Control' Stability versus 'Core' Stability

- **Motor control stability**
 - = low threshold recruitment of local and global stability muscle system
 - Well supported by the research literature
- **Core stability**
 - = high threshold recruitment of proximal trunk & girdle muscles

Multifidus Muscle Recovery Is Not Automatic After Acute First Episode LBP

- Hides, Richardson, Jull. SPINE 1996:21
- Control (n=19) medical management/ activity
- Specific ex. (n=20) + med manage/ activity
- Multifidus ex. 2x/wk x 4 weeks
- Ultrasound image: smaller multifidus on painful side in all at start *(St Anna Hospital Herne Germany)*

Results

- Multifidus CSA at most affected vertebral level painful side difference corrected in ex group but not in controls at 4 and 10 weeks.
- $P < 0.0001$ at both times
- Pain and Disability scores same in groups (pain and disability resolved at 4 wks in 90%)

Long Term Effects of Stabilizing Exercises for First-Episode LBP

- Hides, Jull, Richardson. SPINE 2001:26
- Control(n=19) medical management/ activity
- Specific Ex(n=20) +med manage/ activity
- Multifidus ex. 2x/wk for 4 weeks

Results

- 1 year recurrence: control=84%,
ex.=30%
- $P < 0.001$
- 3 year recurrence: control=75%,
ex.=25% (3 controls lost at 3 year)

1



A systematic review on economic evaluations investigated the cost-effectiveness of conservative treatments for non-specific neck pain and they found that therapeutic exercise was the most cost-effective therapy for non-specific neck pain patients.

Sometimes You Need To ...



Change Your Point of View