



2018 14th Annual
ORTHOPAEDIC UPDATE
For Allied Healthcare Professions

Functional Core Stability in Chronic Musculoskeletal Conditions

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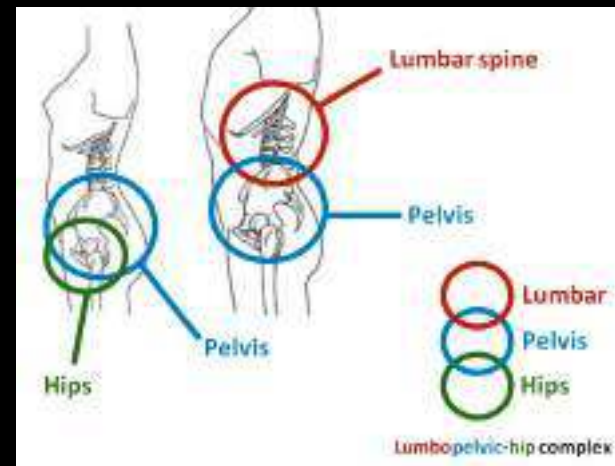
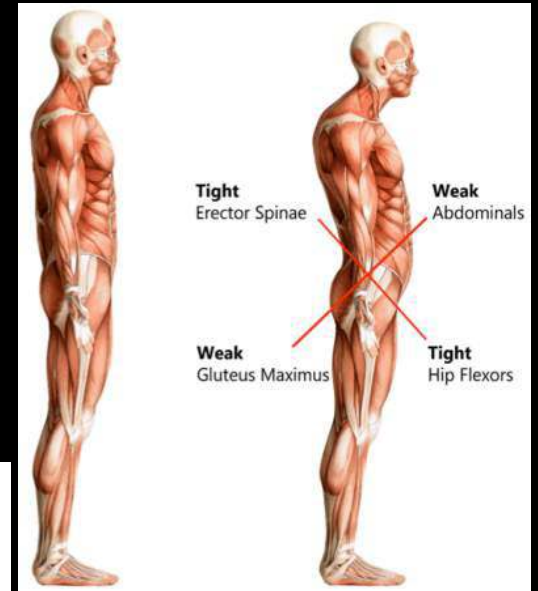




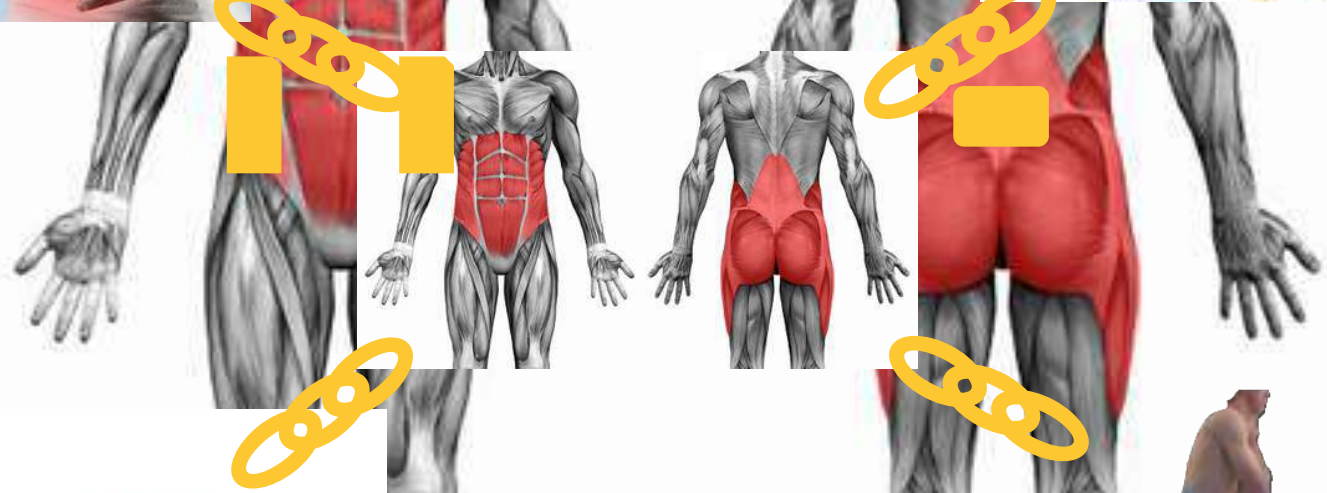
Background

Core Stability & Function

- Local stabilizers & global movers
- Consideration of various moving parts
- Lower crossed syndrome presence
- Degree of difficulty in task



Lumbopelvic-Hip Complex



Lower-Crossed Syndrome

Tight (Shortened)

- Erector spinae
- Latissimus dorsi
- Adductors
- Hip flexor complex
- Soleus
- Gastrocnemius



Weak (Lengthened)

- Internal oblique
- **Transverse abdominis**
- **Gluteus medius**
- **Gluteus maximus**
- Posterior tibialis
- Anterior tibialis

Potential Injuries



Back Injuries



Low Back Pain (LBP)
Chronic LBP

Up to 23%

**Non-Specific LBP
(NSLBP)**



(Balague 2012)

Knee Injuries



Overuse Injuries/
Chronic Knee Pain
Anterior Knee Pain

Up to 25%

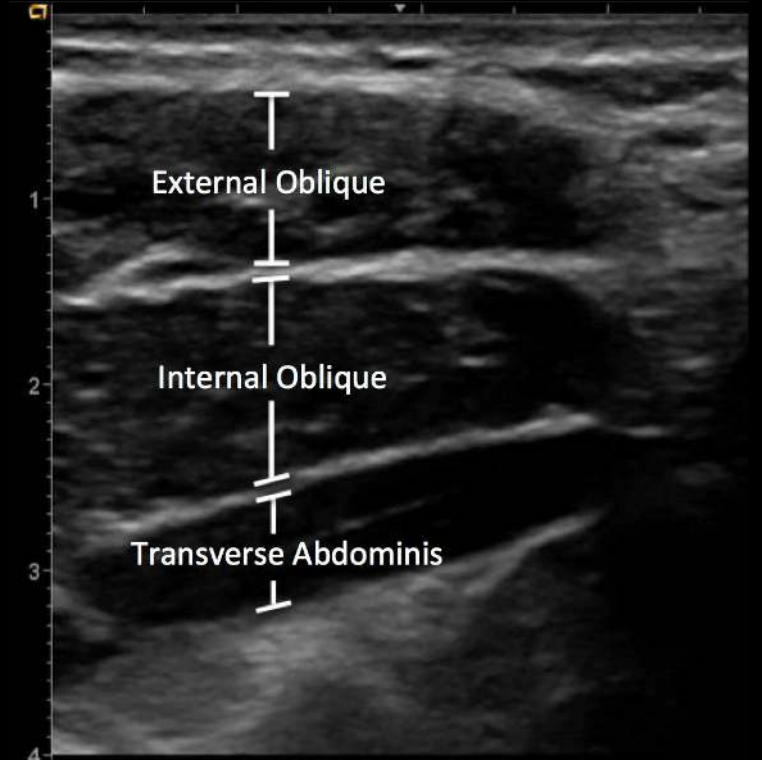
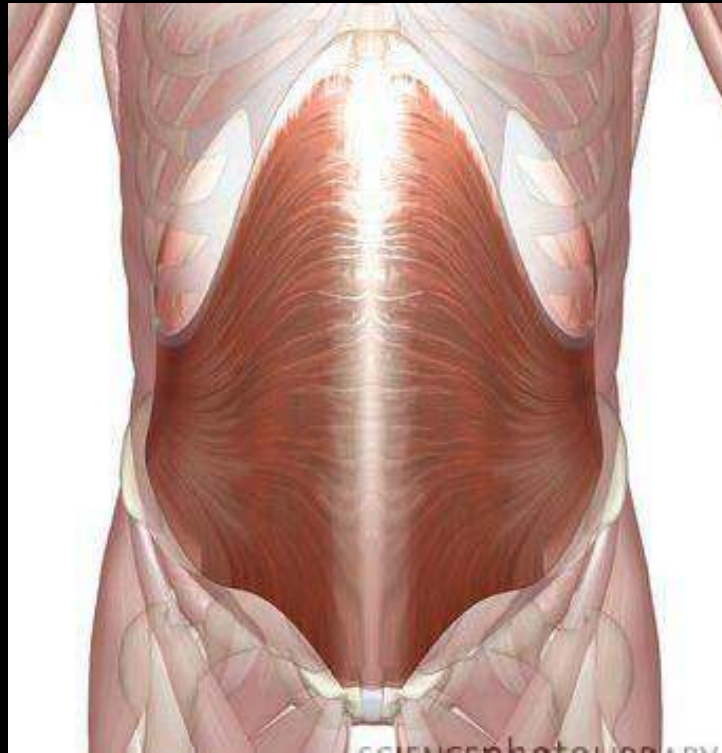
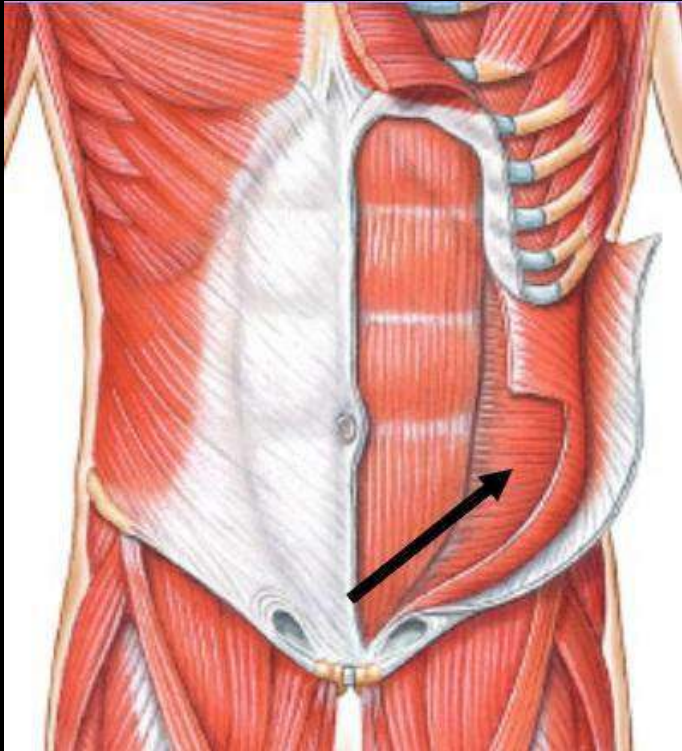
Patellofemoral Pain

(Devereaux 1984)



Muscle (Dys)function

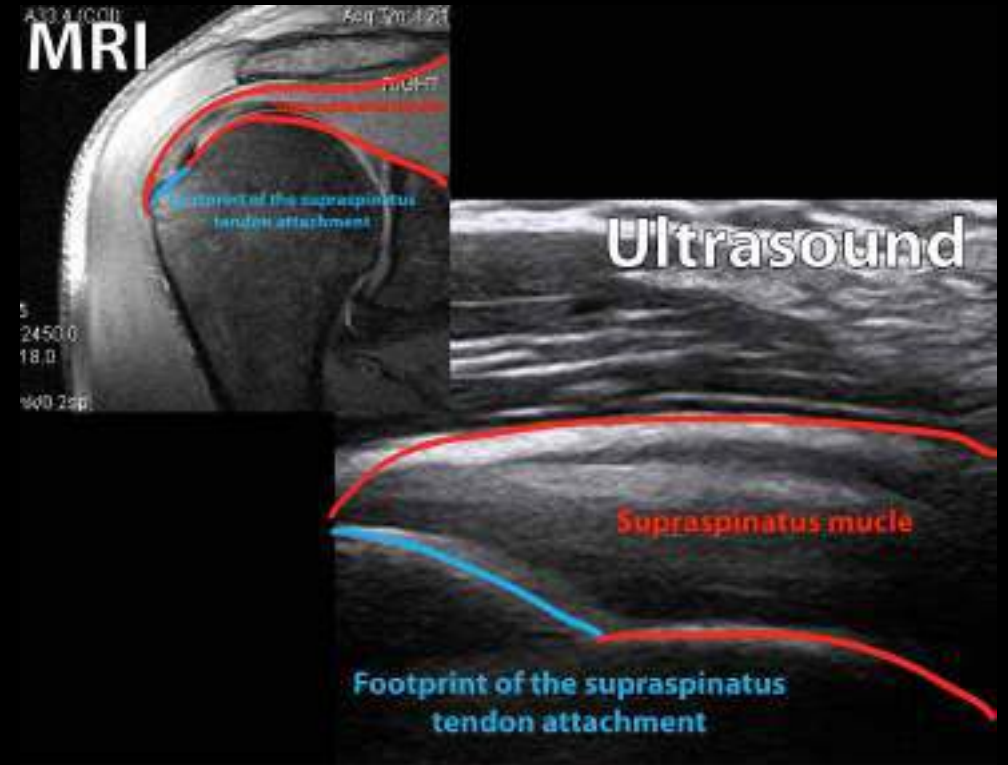
- Lack of spinal stabilization in NSLBP literature
(Mannion 2010, Key 2013, Macedo 2014)
- Gluteus maximus & medius weakness well established in PFP-focused literature (Crossley 2016)
- Cross-over of lumbopelvic-hip complex contribution
- If so...
 - How do we assess?
 - How do we measure?
 - Address the weakness?
 - Address the instability?



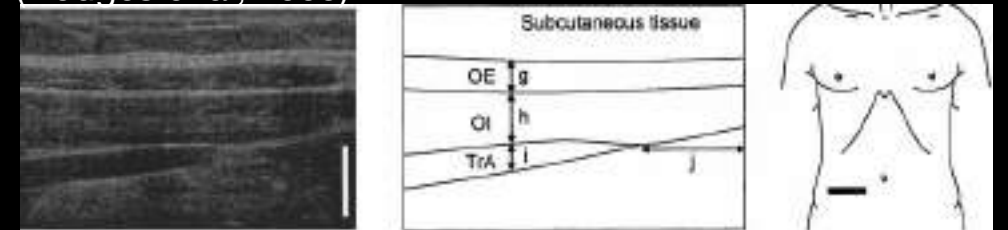
LPH Assessment

Ultrasound Imaging

- Visual solution
- EMG, USI, MRI
- Ultrasound Imaging (USI)
 - Positioning
 - Sample Size
 - Reliability Measures
 - Tabletop (Lariviere, 2013, Whittaker, 2013)
 - Functional in Healthy (McPherson, 2012, Linek, 2014)



(Hodges et al, 2003)

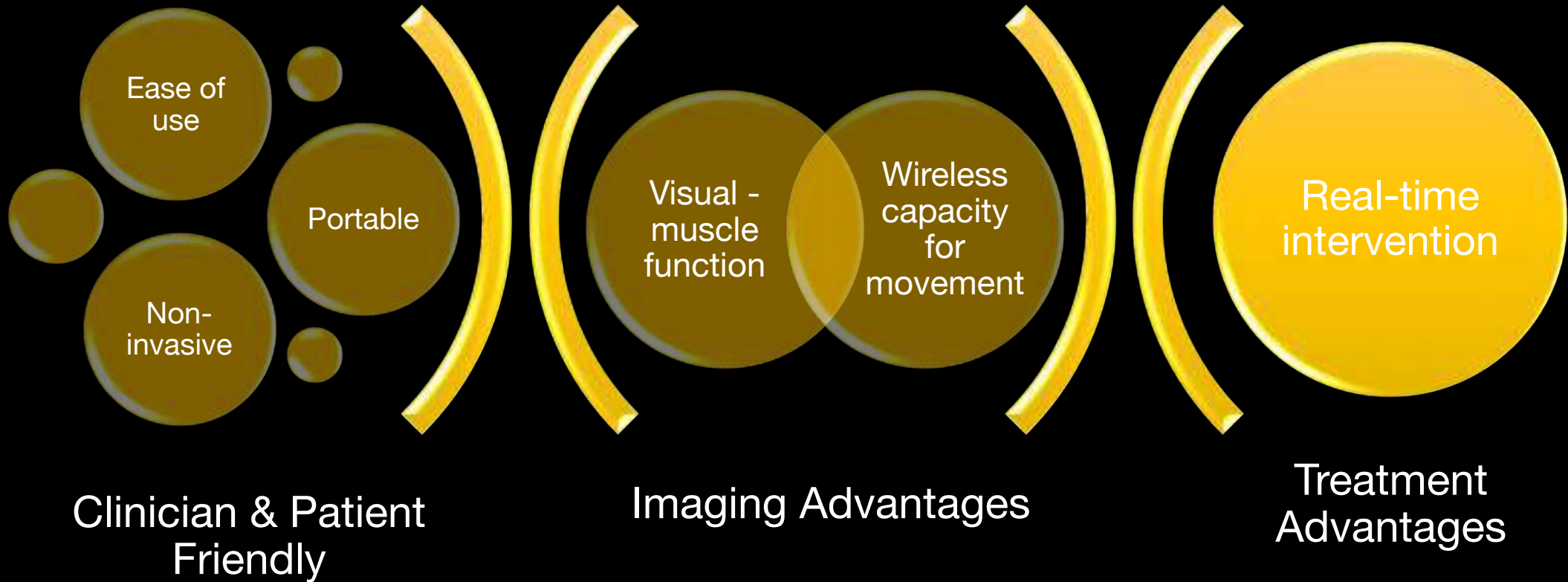


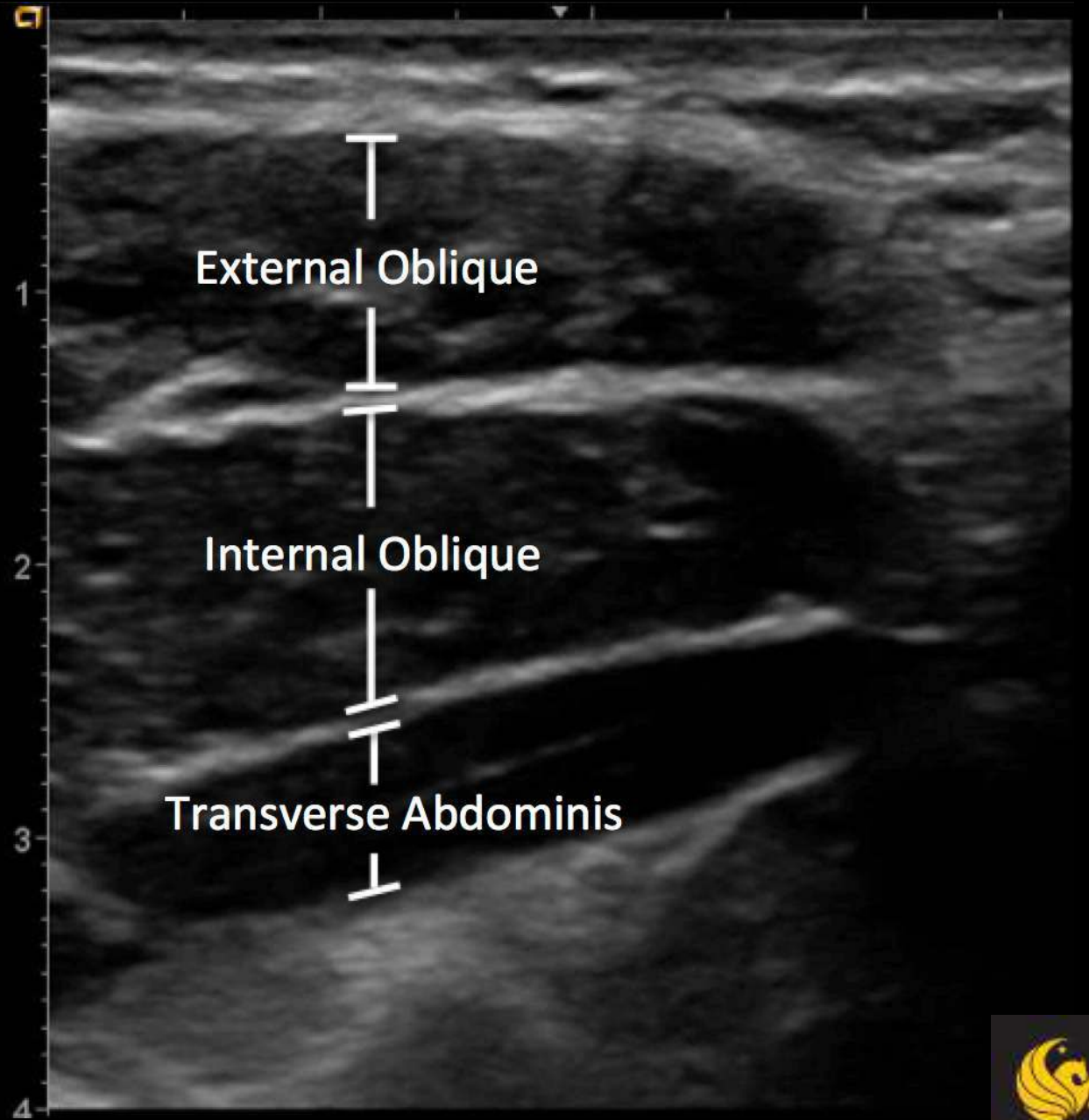
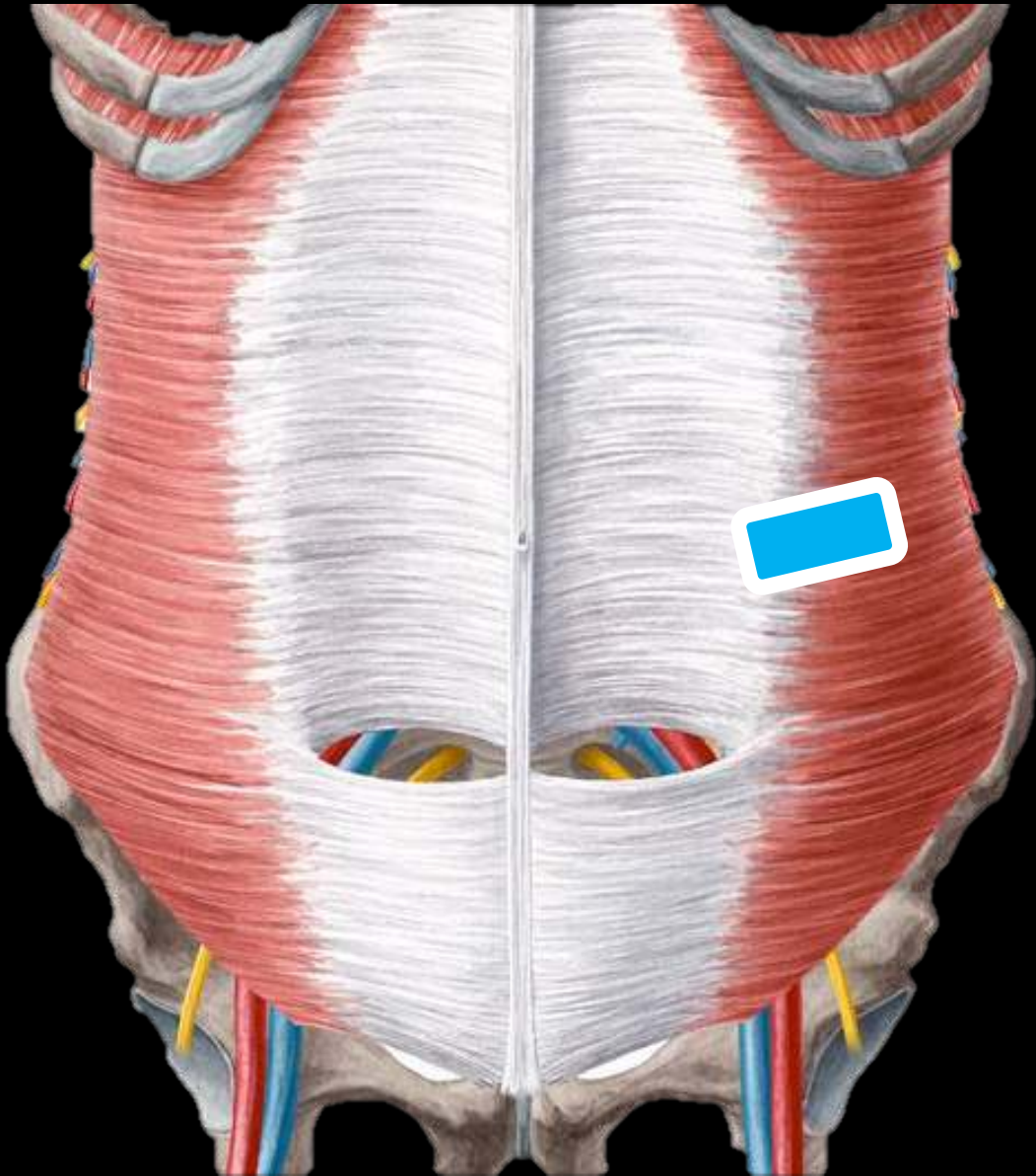
Ultrasound Imaging

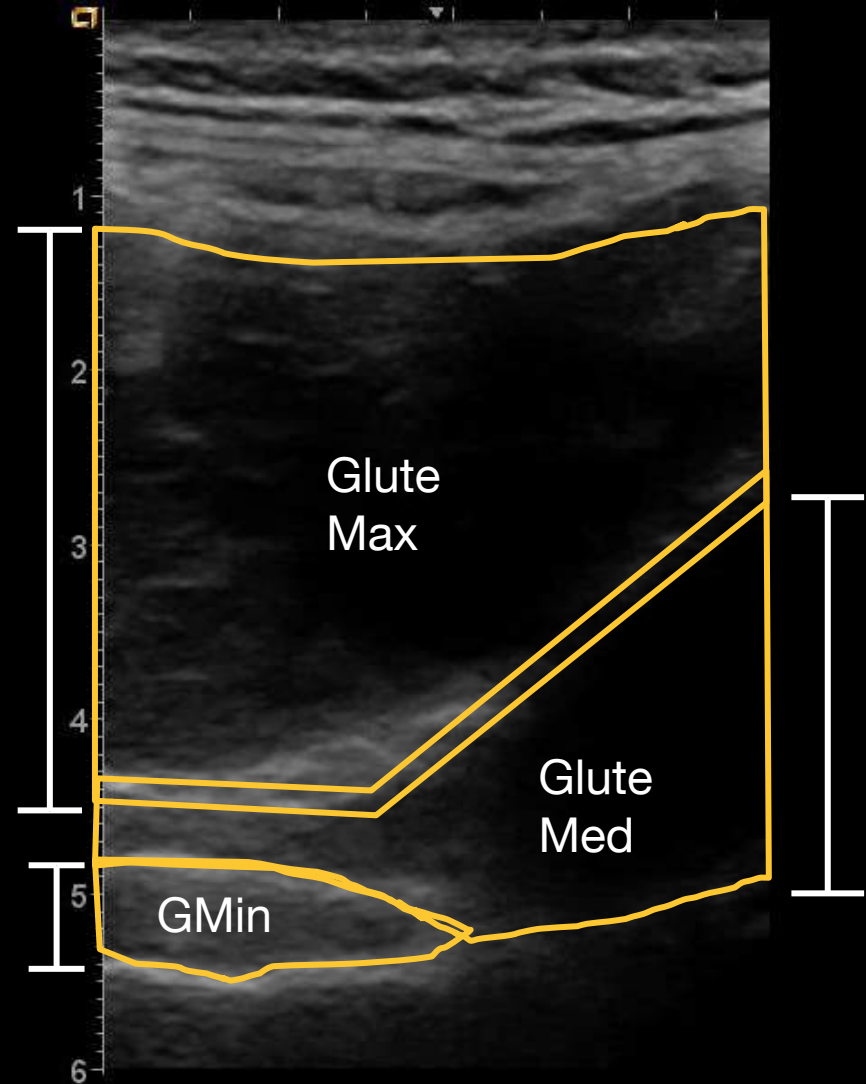
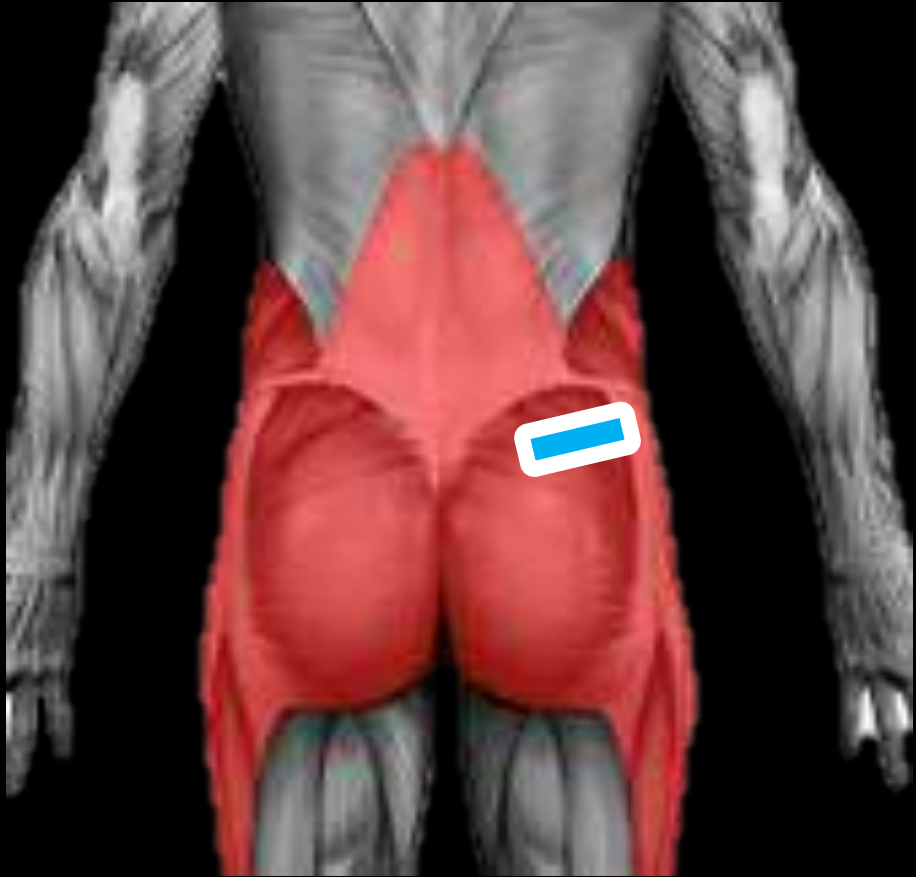
- 2D Cross-sectional image
 - Measure muscle thickness
 - Calculate percent change during active contraction
- Used frequently for abdominal wall
 - Transverse Abdominis
 - Lumbar Multifidus
 - Internal and External Oblique (Koppenhaver, 2009)
 - Reliable in functional positions (Mangum, 2016)



Clinical Advantage





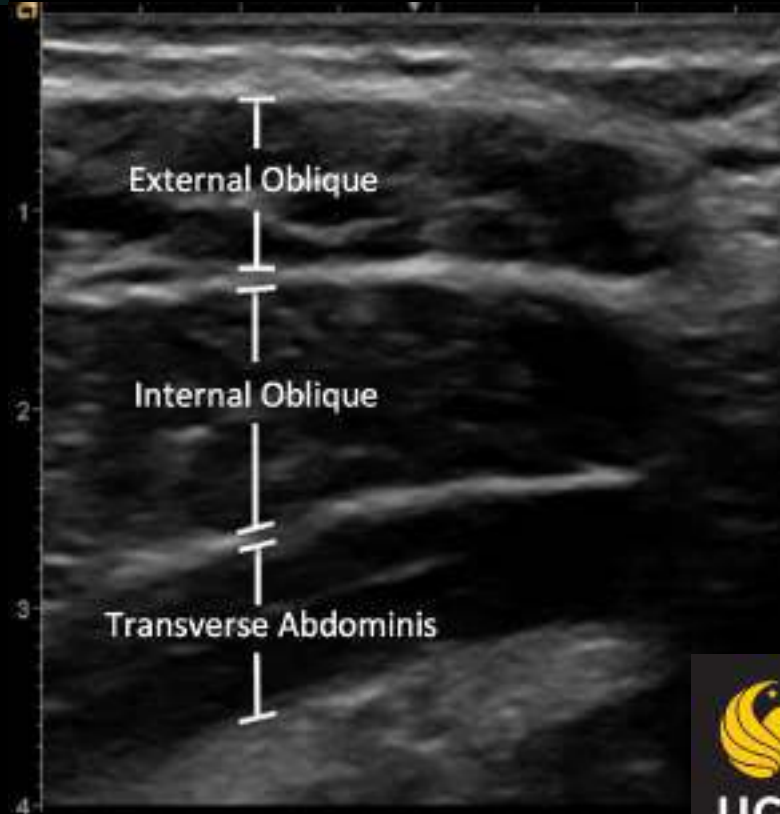
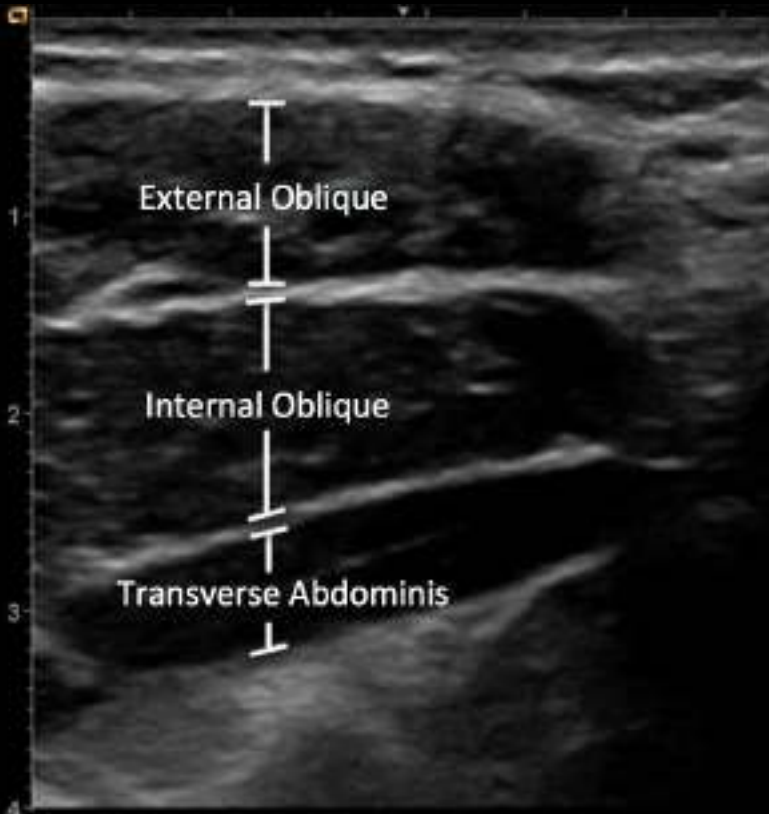


Rest



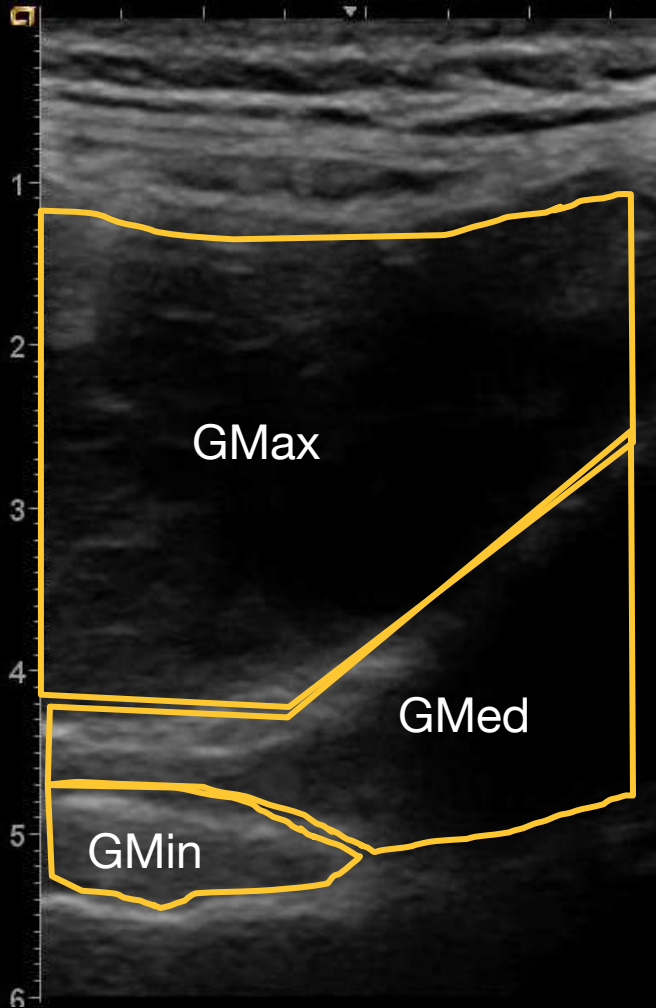
ADIM

Removing the Guess Work

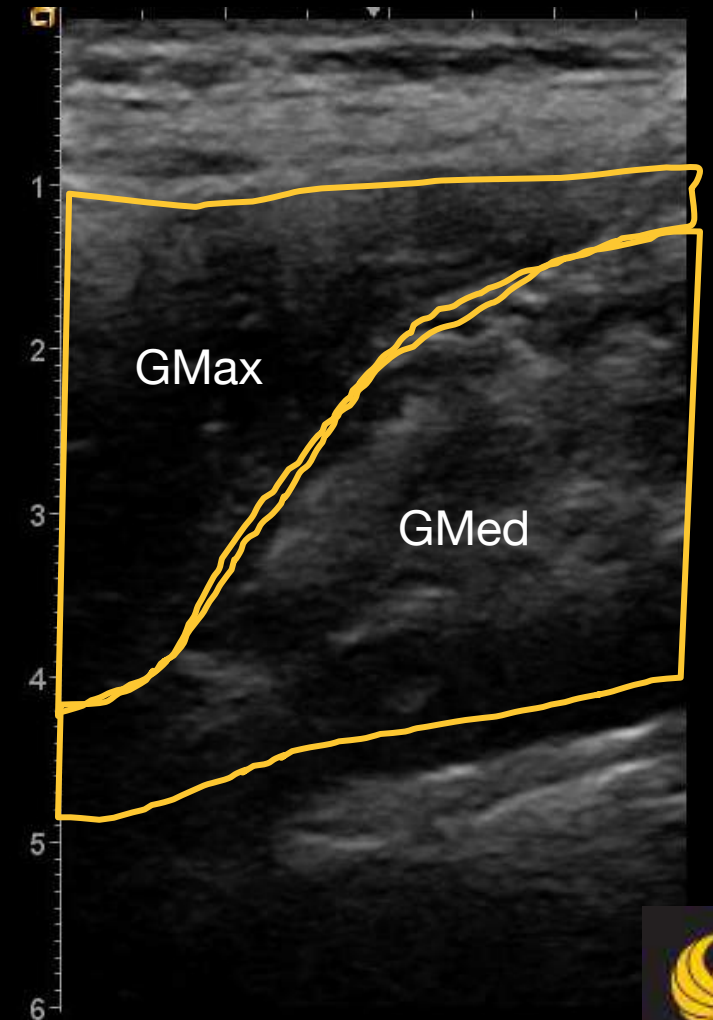


Removing the Guess Work

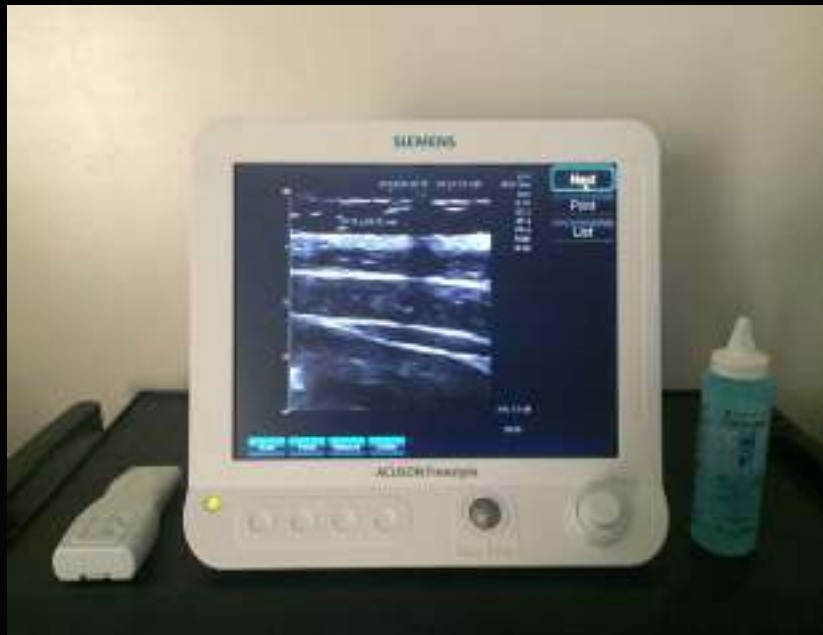
Rest



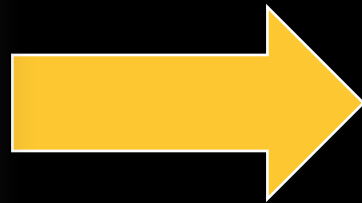
Hip Abduction



Progressive Utilization of USI



WIRELESS portable ultrasound unit



Maximizing USI Capacity



Functional US in Rehab

- Moving beyond tabletop
- Biofeedback single session vs. learning over time
- Benefits for:
 - Clinician
 - Patient
 - Other stakeholders





Back in Action

USI in Functional Tasks

- TrA thickness changes during single leg squat
- SLS performance
- Lack of noteworthy relationships in healthy population
- Side-to-side correlation strongest
- Natural transition to clinical usage



Tabletop

Bipedal/Unipedal

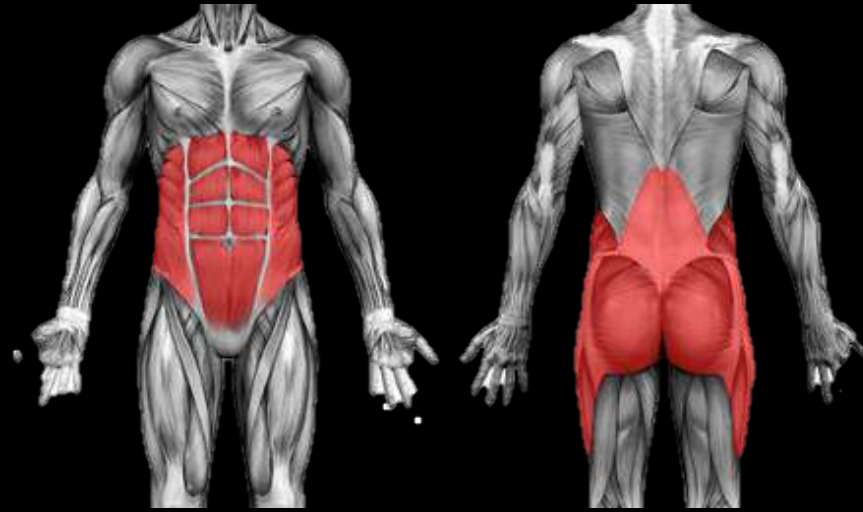
Single Leg Squat

Clinical Implications

- Connection to activity during specific positions
 - Moving off tabletop to assess and treat
 - Healthy athletes – review linking core stability & lower extremity function (DeBlaiser et al 2018)
- Different chronic MSK groups
- Use of functional tasks
 - Portable nature of USI
 - Single leg squat
 - Support for advanced task assessment with USI



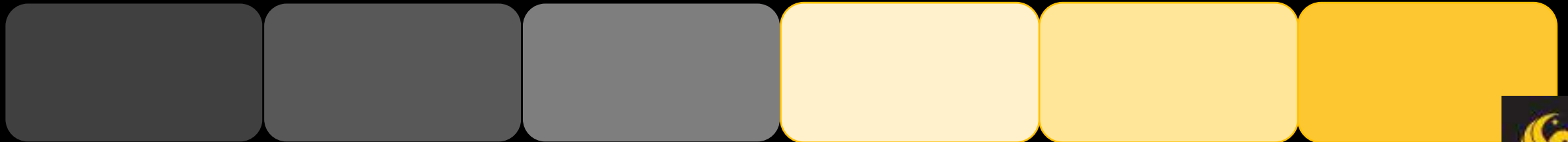
LPH Pathologic Spectrum



Tabletop

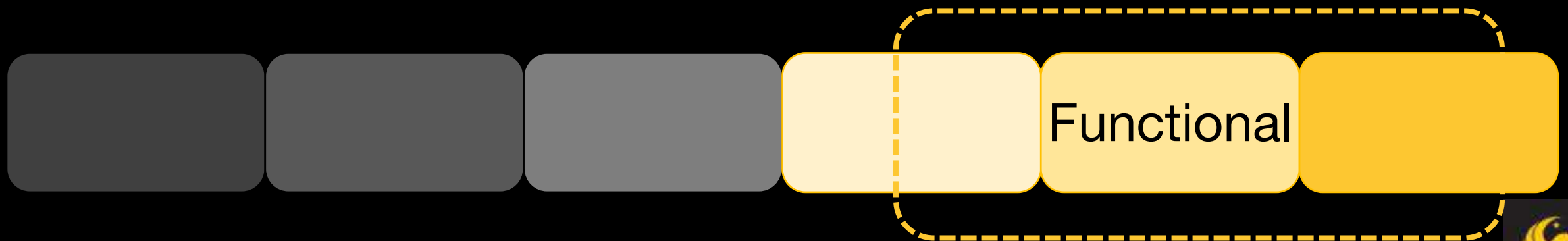
...Middle Ground...

Highly
Functional



LPH Pathologic Spectrum

- Subcategories of low back pain
- Difference in presentation for highly active people
- Appear “normal” on tabletop
- Disparity appears in functional activities



Impairment-Based Rehabilitation

- Designed from individual patient deficits
 - Range of motion, strength, core strength, movement patterns in functional tasks
 - Patellofemoral pain (Glaviano 2016)
 - Can be adapted to any MSK pathology
 - Mirrors assessment structure
- Progression based on performance
 - Individualized impairment-based model (Selfe 2013)



Impairment-Based Rehabilitation

- Knee-focus (quadriceps)
- Hip-focus (gluteus medius)
- Core-focus (TrA, multifidus)
- Quality of movement



(Baldon et al, 2012)

TREATMENT PROTOCOL PERFORMED BY THE SUBJECTS IN THE FUNCTIONAL STABILIZATION TRAINING GROUP

Exercise/Progression	Description	Illustration
Transversus abdominis and multifidus muscle training Weeks 1 to 2	<ul style="list-style-type: none"> • Quadruped and prone (not shown): 2 sets of 15 repetitions, with 10-second isometric cocontraction • Sitting on the Swiss ball: 5 repetitions with 20-second isometric cocontraction • Exercise progression: increasing 5-second hold 	
Weeks 3 to 5 Weeks 6 to 8	<ul style="list-style-type: none"> • Not performed • Not performed 	
Lateral bridge (A) and ventral (B) bridge Weeks 1 to 2 Weeks 3 to 5	<ul style="list-style-type: none"> • Not performed • 5 sets of 30 seconds • Exercise progression: increasing 5-second hold • Exercises performed with knee support (not shown) 	
Weeks 6 to 8	<ul style="list-style-type: none"> • 5 sets of 45 to 60 seconds • Exercise progression: increasing 5-second hold • Exercises performed with foot support 	

Impairment-Based Rehabilitation

4-week adaptation

- Knee-focus (quadriceps)
- Hip-focus (gluteus medius)
- Core-focus (TrA, multifidus)
- Quality of movement

Weeks	Exercise	Set	Repetitions or Seconds, s
1-2	4-Way SLR	3	10
	Seated Knee Flexion and Extension	3	10
	Wall Squats	3	10
	Isometric Hip Abd/ER	3	10
	Clam Shells	3	10
	Pelvic Tilt Prone	3	20s
	Pelvic Tilt on Swiss Ball	3	20s
	Single Leg Balance, eyes open	3	30s
	Single Leg Balance, eyes closed	3	30s
3-4	4-Way SLR	3	10
	Seated Knee Flexion and Extension	3	10
	Wall Squats	3	10
	Step Ups/Downs	3	10
	Lateral Rotation in CKC	3	10
	Pelvic Drops	3	10
	Clam Shells	3	10
	Planks (Anterior and Lateral)	3	30s
	Trunk Extension on Swiss Ball	3	10
	Single Leg Balance, eyes open	3	30s
	Single Leg Balance, eyes closed	3	30s
	Single Leg Squat w/ mirror training	3	10
	Lunge w/ mirror training	3	10
	Single Leg Deadlift w/ mirror training	3	10



(Glaviano 2016)

Innovative Approach

- Gain novel USI info, use in impairment-based rehab
- Real-time USI during variety of tasks
- Increase clinical efficiency
- Pair with rehab to elevate care





Thank You!



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