**The Good, the Bad & the Ugly: Are We Choosing the Best Neuromuscular Re-education Exercises for Our Patients?**

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**Session Learning Objectives**

- Understand the role dynamic ultrasound imaging plays in neuromuscular re-education
- Be able to critically evaluate common trunk, hip and pelvic floor exercises for appropriateness based on existing evidence

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**Course Outline**

- Trunk
- Hip
- Pelvic Floor

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**Rehabilitative Ultrasound**

- US provides visual biofeedback
- Can be used to help activate or inhibit
- For motor re-education follows phases of motor learning:
  - Cognitive: Mentally pre-set the muscle
  - Associative: Combine muscle activation with movement tasks
  - Automatic: Muscle activation occurs without pre-setting

  \( \text{(O’Sullivan).} \)

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**Rehabilitative Ultrasound**

- US Validated for measuring CSA of MF and found it to be atrophied segmentally ipsilateral to LBP \( \text{(Hides et al, 1992) \ (Hides et al, 1994)} \)
- Change in MF thickness on US correlated to EMG \( \text{(Kiesel et al, 2007)} \)
- Specific multifidus retraining increased MF CSA at L5 and dec. pain in Cricketer’s \( \text{(Hides et al, 2008)} \)
Rehabilitative Ultrasound

- TrA thickness with contraction is correlated to LBP (Ferreira et al, 2004)
- TrA thickness increased more than 10 in simulated weight bearing in normals (Hides et al, 2007)

EMG

Limitations:
- Onset: Mechanical tension development
  - Passive and neurochemical properties
- Output: Mechanical Force Production
  - Depends on X-Sectional Area of muscle
  (Hug et al, 2015)

Conclusion: “The findings in this study may be used to select specific exercises to enhance a core training program”.

Unstable Surfaces

(Anderson & Behm, 2004)
Unstable Surfaces

• Unstable Isometric MVC 59.6% Less  (Anderson & Behm, 2004)

BUT

70-85% of 1RM Proposed to be optimal for Hypertrophy  (ACSM Position Stand, 2002)

Glut Med

• Highest EMG output of Clam Variants  
  (Boren et al, 2011)

• Glut Med Activity Higher in Stance Leg during Band walks  
  (Berry et al, 2015)

Glut Med

• Glut Med to TFL Index Greatest
  — Clam > Sidestep  
  (Selkowitz et al, 2013)

  • Gluteus Medius Activation in Clam
    — greatest with hip flexed 60 degrees
    — Greatest in Neutral pelvic position  
    (Willcox & Burden, 2013)

Glut Med

BUT

• Hip Strengthening DOES NOT change hip or knee mechanics during running!!  
  (Willy & Davis, 2011)
Glut Min

- Glut min fires slightly before glut med in SLS
- Weight bearing ex’s promote functional differential between deep and superficial hip abductors

(Dieterich et al. 2015)

Glut Min

• Those who fell had sig higher fatty degen of glut min > glut med (OR = 3.2)

(Kiyoshige & Watanabe, 2015)

Glut Min

Glut Min

Glut Min

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Ortho in a warm, dark place.
Is it really all about the Kegel?

Know the role

- Support of pelvic organs
- Continence
  - Closure urethra/anus
- Postural function
  - Intra-abdominal pressure
- Sexual function

PFM Literature
(Not Patellofemoral)

Pelvic Health/Orthopaedic
- Urinary Incontinence
  - Stress, Urge, Mixed UI
- Pelvic organ prolapse
- Fecal Incontinence
- Peripartum
- Athletes
- Low back pain
- Femoroacetabular Impingement (Poswiata 2015)

Pelvic Floor Muscle Training
- Repetitive selective voluntary contraction and relaxation of specific pelvic floor muscles (2002 ICS)
  - Involves directly contracting the PFM...specifically designed to increase muscle strength, endurance, rapidity, & coordination. (Dumoulin 2014)

Strategies in Literature

- Conscious contraction before/during increased IAP
  - Not possible with fast dynamic movement
- Indirect PFM training via Transverse Abdominals (Sapsford 2001/04)
  - Isolation or integration?
- Strength training to:
  - Increase structural support
  - Stiffness/hypertrophy of PFM
  - Elevate levator plate
  - Quicker coordination response if plate is higher
  - Prevent descent of increased IAP

Strategies in Literature

- Focus on:
  - % improve v. cure rate
- Rx: PFMT, BFB, E-stim
  - EMG not recommended for inter-session comparison due to poor reliability
  - If Rx doesn’t work:
    - Follow closely, increase intensity, bladder training
- Recommendations:
  - Teach about mm/proper contraction
  - Assess for max contraction for HEP
  - 3 x 8-1 reps/day
  - Pre-contract with ADL’s
  - Weekly follow up

But what about the athlete...

- Higher prevalence of SUI
- Higher cross sectional area of mm
- Strength is equal v. non-SUI...But still have SUI
- Poswiata 2014:
  - Of 112 professional XC skiers/runners:
    - 50% had urine loss (50% SUI)
    - 58% c/o frequency
    - 36% abdominal pain
    - 33% issues with bladder emptying
IS STRENGTHENING ALWAYS THE ANSWER?

Consider OVERactivity

- Overactive PFM: do not relax/may even contract when relaxation is functionally needed (micturition/defecation) (Haylen ICS Terminology 2010)
  - Dyspareunia (Polackwich 2015, Faubion 2012)
    - Common to have high tone/non-relaxing/overactive pelvic floor (Spring van der Zalm 2008)
      - Can be related to trauma with childbirth, postural/biomechanical
      - Obstructed defecation (constipation)
    - Voiding problems (hesitancy/urgency-frequency)
      - PF spasm potential cause of dysfunction (Kuo 2015)

MMT grade to Function

- Always assess; don’t assume
- Look beyond strength
  - Muscle may appear weak due to incomplete relaxation
  - Strong muscle may need more tissue integrity
- Look further at coordination
  - Are we achieving contraction AND relaxation?
- Should we consider PFM overactivity in addressing continence, LBP or hip pain?

How can we assess PFM function?

- Ask the questions: Is patient seeing anyone for these issues?
  - Continence
    - Difficulty starting or stopping urine flow?
    - Urgency/Frequency?
    - Incomplete emptying?
    - Pain?
  - Defecation
    - Constipation?
    - Splinting
  - Sex
    - Pain?
    - Be sure what sexual activity is for your patient
- General screen:
  - Observe breath holding with ADL's
  - Posture/alignment
  - External palpation
    - Urogenital triangle
    - Sidelying Oburator Internus
  - Levator Ani
  - RTUS
  - Referral to practitioner for internal assessment when appropriate

Photo sidelying palp of LA/OI

RTUS & PFM

- Use for diagnosis/Neuro Re-education
- Video
  - Normal PFM activity
  - Abnormal PFM activity
Treatment options:

- Manual therapy
  - Spine
    - Thoracic-sympathetic upregulation
    - Lumbosacral
  - Deep hip rotators
  - Hooklying/Sidelying
  - Intra-muscular manual therapy/trigger point dry needling
- Neuro Re-ed
  - Biofeedback/RTUS
  - Posture/alignment
    - Spine/hip biomechanics
  - Breath
  - Pain education
- Neuro Re-ed
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Mechanics of breath

- Cranio-caudal parallel movement of PFM/ Diaphragm during breathing/coughing (Talasz)
- PFM is involved in diaphragmatic motion and affects pulmonary function (Park 2015)

Breath Neuro Re-education

- How to train
  - Piston breath- imagery, sensory input (tactile, visual (RTUS) to refresh homunculus
  - Initially coordinate PFM training with breath
    - Inhale eccentric elongation
    - Exhale concentric lift
  - Coordinate with familiar techniques
    - Same cues with iyengar yoga (inhale to the earth, exhale to the heavens)

PFM integration

- HEP: Visual assessment with hand mirror (at home)
- Cognitive to automatic progression
  - Breath:
    - No breath holding initially
    - Task specific breath holding with high load
- Alignment
  - (Capson 2011)

When you need more help...

- When to refer
  - PF assessment:
    - External visual
    - Cotton swab test
    - Internal digital palpation:
      - tenderness/tone/ability to contract & relax
    - Assessment of strength AND coordination

Knowing where to refer...

- www.womenshealthapta.org
Summary

- Educated Pelvic Floor Muscle contractions can be beneficial...
  - With appropriate assessment
  - With appropriate integration into orthopaedic treatment plan
  - When appropriate referral to internal practitioner

References