Pelvic floor dysfunction in the adult athlete

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Introduction

- Jessica Reale, PT, DPT, WCS
  - Background
  - Involvement in Pelvic Health
  - Teaching
Objectives

- Identify the role of the pelvic floor muscles in sphincteric, supportive, sexual and especially, stabilizing functions.
- Identify the relationship between the diaphragm, transverse abdominis, multifidus and pelvic floor muscles in providing functional stability.
- Recognize common diagnoses involving pelvic floor dysfunction in adult athletic populations
- Integrate the pelvic floor muscles and diaphragm within progressive functional stabilization programs.
- Identify key components of "return to sport" screening for women postpartum.

Pelvic Floor Anatomy

“The Pelvic Diaphragm”
Obturator internus & Piriformis
The Role of the Pelvic Floor

- Support
  - Organ support
- Sphincteric
  - Urinary, Bowel
- Sexual
  - Arousal, Orgasm
- Stabilization

Supportive Role of Pelvic Floor
Supportive Role of Pelvic Floor

- The interaction between the PFM and supportive ligaments is crucial to pelvic organ support
  - Levator ani (LA) creates constant tone that maintains the organ support
  - Constant adjustments in muscular activity stabilize the organs in position
  - LA pre-contracts before movement to provide support to organs during movement

- When this fails, pelvic organ prolapse (POP) is likely
- POP is defined as the descent of one or more of: the anterior vaginal wall, posterior vaginal wall, or the apex of the vagina (uterus) or vault after hysterectomy.

![Diagram of Pelvic Floor Anatomy and Prolapse Types]
Sphincteric Role of Pelvic Floor

- Constrictor or continence mechanism to the urethral, anal, and vaginal orifices (in females).
  - Produces an “inward lift and squeezes around the urethra, vagina, and anus”.
- Relaxation to allow for complete emptying

Sexual Role of Pelvic Floor

- Male Sexual Function
  - Erection
  - Ejaculation/Orgasm
- Female Sexual Function
  - Arousal
  - Orgasm
Stabilizing Role of Pelvic Floor

• Pelvic floor muscles have direct attachments to the coccyx and sacral ligaments.
• Perturbation of pelvis → coordinated control of forces

Pelvic Floor Dysfunction in the Athlete

• Underactivity/Incoordination
  – Anticipatory core function
  – Integration of PF/diaphragm into core stability

• Overactivity/Pain
  – PF/OI Referral Patterns
  – Role of OI in hip stability

• Special Populations- Postpartum concerns
  – Common dysfunction postpartum
  – Postural changes during/after pregnancy
  – Diastasis Rectus Abdominis
  – Returning to sport
Pelvic Floor Dysfunction in the Athlete

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Case Study- Initial Evaluation

• 22 yo male self-referred to PT for R sided mid/low back pain after performing cross-fit weight lifting and deep squatting.
  – **Subjective:** Pain originally began 4-5 months ago, but decreased with stretches/rest. Pain slowly has been increasing over past 2 months, and became severe 3 days ago after lifting workout. Pain currently is limiting sleeping and sitting. Modified ODI: 42% disability. No radiating symptoms/numbness/tingling.
  – **Objective:**
    • All lumbar and thoracic AROM decreased, especially flexion (limited to <30% available motion)
    • Hypomobility with CPA at R UPA mid thoracic – lumbar segments
    • Tenderness with palpation over R paraspinal mm (radiating to sacrum)
    • (+) Slump sit test with noted neural tension B, R>L
    • Loss of lumbar neutral with deep squat
Case Study- Initial Evaluation

- **Treatment:**
  - Screw manipulation to thoracic spine
  - MET to lumbar spine
  - Grade II-III mobilization Tsp – Lsp
  - HEP: Cat-cow stretch, prone extension, SL rotation stretch
- Pain was reduced by 50% following initial intervention
- **Assessment**
- **Plan:** 2x/week for 2-3 weeks, followed by 1x/week x 2 visits, 1x/2 weeks x 1-2 visits.

Case Study- What would you do?

- What else do you want to know?
- Would you use a stabilization program for this patient?
- What would your program involve?
Core Stabilization - Where Have We Been?

• “the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated activities” (Kibler 2006)
• Pelvic tilts
• Transverse abdominis and multifidus retraining for low back pain
  – “Abdominal bracing” & blood pressure cuffs
  – Prolonged holding
  – Holding with movements

Flaws of Traditional Model

• Assumption that constant bracing is functional
• No alteration of force for task
• Isolated vs. Integrated
• Pelvic floor muscles (PFM) and diaphragm are left out
Introducing the Anticipatory Core

- Pelvic Floor Muscles
- Diaphragm
- Transverse Abdomen
- Multifidus

Diaphragm Anatomy

- “The Respiratory Diaphragm”
- Attachments:
  - L1-3, inner part of ribs 6-12, xiphoid process
The Role of the Diaphragm

- Role:
  - Respiration
  - Modulation of intra-abdominal pressure
  - Stabilization of the spine and pelvis
  - Modulation of the autonomic nervous system

The Diaphragm & Pelvic Floor Piston

- Phase-locked parallel movement of the diaphragm and pelvic floor during breathing and coughing—a dynamic MRI investigation in healthy females (Talasz et. al. 2011)
  - 14 nulliparous females
  - Pelvic floor examination to ensure able to voluntarily use pelvic floor
  - Dynamic MRI at rest, forceful breathing and coughing
- Results: Synchronous phase-locked movements of the diaphragm, pelvic floor and abdominals with all phases of respiratory cycle
The Diaphragm & Pelvic Floor Piston

- **Inhalation**: diaphragm flattens and descends caudally, pelvic floor descends caudally and abdominal wall relaxes out

- **Exhalation**: diaphragm arches upward into thoracic cavity, pelvic floor lifts, waist narrows

Posture & the Diaphragm/PF

- **Do posture and alignment matter?**
  - Sitting posture affects pelvic floor muscle activity in parous women: an observational study (Sapsford 2006)
  - 8 women with history of at least 1 vaginal delivery, normal weight, no pelvic floor dysfunction noted
  - Pelvic floor and abdominal mm activity assessed with surface EMG

<table>
<thead>
<tr>
<th>Sitting postures</th>
<th>Pelvic floor muscles mean (SD)</th>
<th>Obliquus internus abdominis mean (SD)</th>
<th>Obliquus externus abdominis mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stump supported</td>
<td>7.20 (4.78)</td>
<td>6.46 (3.45)</td>
<td>7.86 (6.70)</td>
</tr>
<tr>
<td>Upright unsupported</td>
<td>12.61 (7.80)</td>
<td>10.12 (6.91)</td>
<td>9.82 (5.16)</td>
</tr>
<tr>
<td>Very tall unsupported</td>
<td>24.25 (14.19)</td>
<td>22.25 (19.30)</td>
<td>20.18 (15.54)</td>
</tr>
</tbody>
</table>

Figure 2. Sitting postures (a) stump supported, (b) upright unsupported, and (c) very tall unsupported showing placement of electrodes recording abdominal/muscle activity.
Posture & the Diaphragm/PF

- The role of lumbopelvic posture in pelvic floor muscle activation in continent women (Capson 2011)
  - 16 women, continent, 22-41 yo
  - Standing in neutral posture, hypolordotic, hyperlordotic

Reminder: composed of pelvic floor, diaphragm, transverse abdominis and multifidus

- Pre-activate for dynamic stability during any movements
- Postural and respiratory functions of the pelvic floor muscles (Hodges 2007)
  - 7 subjects, excluded if hx of LBP or respiratory disorder
  - Results:
    - Preactivation to prepare body for perturbation
Alterations in Motor Control in Pain Populations

• Postural function of the diaphragm in persons with chronic low back pain (Kolar et. al. 2012)
  – 29 healthy subjects compared to 18 subjects with chronic low back pain (pain greater than 6 mo)
  – Dynamic MRI of diaphragm with breathing observed at rest in supine, with isometric hip flexion and with isometric UE flexion
  – Results: Similar excursion of diaphragm in resting breathing, significant alterations when task required (less excursion, more cranial position)
Alterations in Motor Control in Pain Populations

- Motor control patterns during an Active Straight Leg Raise (ASLR) in chronic pelvic girdle pain subjects (Beale et al. 2009)
  - 12 women with chronic PGP (unilateral)
  - EMG at anterior abdominal wall, chest wall and scalenes, measuring intra-abdominal pressure and intra-thoracic pressure, breathing strategy, pelvic floor kinematics, LE downward pressure of affected vs. unaffected
Alterations in Motor Control & Functional Performance

• Breathing pattern disorders and functional movements  
  – 34 healthy men & women performed FMS  
  – Monitored resting and active end-tidal CO2 production, resting and active respiratory rate (RR), breath holding ability, observed breathing pattern.  

Results

Effect of Retraining Motor Control Patterns on Pain and Function

• Changes in pelvic floor and diaphragm kinematics and respiratory patterns in subjects with sacroiliac joint pain following a motor learning intervention: a case series. (O’Sullivan and Beale 2007)  
  – 9 subjects with SIJ pain and abnormal motor control strategies noted with ASLR  
  – Specific individualized motor control training  
  – Results:  
    • Abnormal kinematics of the diaphragm and pelvic floor during the ASLR improved Respiratory patterns were also influenced in a positive manner  
    • Improved ability to consciously elevate pelvic floor  
    • Improved pain and disability
Effect of Retraining Motor Control Patterns on Pain and Function

- Breathing evaluation and retraining as an adjunct to manual therapy (McLaughlin 2010)
  - Case series of 19 men & women with neck or low back pain who had plateaued in treatment with manual therapy, exercise and education
  - Identified to have low end tidal CO2 levels
  - Intervention: retraining breathing pattern using MT when needed, postural tasks and awareness of proper inhalation/exhalation
  - Results: 93% had improvements in pain and function that was statistically significant

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Pre treatment, post treatment and difference values.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Pre (SD)</td>
</tr>
<tr>
<td>NPRS</td>
<td>6.1 (1.7)</td>
</tr>
<tr>
<td>PSFS</td>
<td>13.5 (4.0)</td>
</tr>
<tr>
<td>Sitting CO2</td>
<td>31.0 (3.2)</td>
</tr>
</tbody>
</table>

Data expressed as mean (standard deviation).
* p < 0.001.

Integration of the Diaphragm and Pelvic Floor within Dynamic Core Stabilization

- Evaluation Strategies & Treatment Techniques
Evaluation

• Assessment of posture and alignment
  – Standing, sitting, supine
  – Rib cage position over pelvis
  – The “bells”
    • Ribs flared out?
    • Gripping patterns?
  – Foot position & center of mass

Evaluation

• Breathing strategy assessment
• Observe in:
  – Supine
  – Sitting
  – Standing
  – With activity
• Palpate/observe:
  – 360 degree expansion of ribcage
  – Belly breathing/chest breathing
  – Relaxation of abdomen
  – Accessory muscle use
Evaluation

• Assessing PFM and TA coordination with diaphragm
  – Palpate pelvic floor muscles medial to the ischial tuberosity
  – Palpate TA medial to the ASIS
• Observe/Palpate:
  – RELAXATION of PFM and TA during inhalation
  – Small ACTIVATION of PFM and TA at end-range exhalation
• Cueing as needed

Treatment: Neuromuscular Patterning

• Key Principles:
  – Goal: Timing, not strength
  – Force = Task requirement
  – Exhalation & Inhalation are equally important
  – Pre-activation for task
  – Integration into movements
Treatment Progression

• Initial exercise: Coordinated DB and F hooklying
• Progression:
  – Quadruped
  – Tall or Half Kneel
  – Sitting
  – Standing
  – With movement
• Always keep alignment in mind!

Treatment Progression

• Consider myofascial chains/anatomy trains (Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists)
  – Front functional line: pectoralis major, rectus abdominis, adductor longus
  – Back functional line: latissimus dorsi, contralateral gluteus maximus, vastus lateralis,
  – Superficial back line: hamstrings, gastrocnemius, plantar fascia, short toe extensors
  – Superficial front line: SCM, rectus abdominis, rectus femoris/quadriceps, short/long toe extensors, tibialis anterior
  – Lateral line: SCM, intercostals, lateral abdominal obliques, gluteus medius, TFL, peroneals
Case Study- Visit 2

- 22 yo male cross-fit athlete with low back pain
- Visit 2 (3 days later)
  - Pain reduced by 50% since that time, sleeping without pain
  - Treatment: DN to lumbar multifidus, erector spinae; Grade II/III mobilization to Tsp/Lsp, Screw manipulation to Tsp
  - Neurac redcord testing for load transfer and stability
    - Required B LE assistance and double bungee support
    - Breath holding
  - Initiated DB-PF-TA with palpation

Case Study- Visit 3

- Visit 3 (4 days later)
  - Min to no pain since last visit, mild “tightness” at R sacrum
  - Treatment: Mobilization, STM to longissimus— all pain quickly eliminated
  - Neurac Redcord: supine pelvic lift normalized and equal bilaterally with performing DB-PF-TA
    - Weakness B with Hip ABD/ADD assessment
  - HEP: DB-PF-TA with SL bridge, wall press, weight shifting in quadruped maintaining neutral spine
Case Study- Visits 4-5

• Visit 4 (3 days later):
  – No pain since last visit
  – DN to multifidus, followed by mobilization
  – Treatment: DB-PF-TA with
    • Opposite lumbar rotation and adductor activation
    • Side plank with adductor activation
    • SL balance with 3 way hip motion

• Visit 5 (1 week later):
  – No pain during any ADLs.
  – Cross-fit lifting evaluation
    • Loss of lumbar neutral with deadlift, cleans, Olympic lifts
  – Treatment: Neural glides/neural stretching, quadruped
    weight shift toward squatting position with DB-PF-TA,
    Overhead squat prep with T-band resistance

Questions so far?
Pelvic Floor Dysfunction in the Athlete

• Underactivity/Incoordination
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  – Integration of PF/diaphragm into core stability

• Overactivity/Pain
  – PF/OI referral patterns
  – Role of OI in hip stability

• Special Populations- Postpartum concerns
  – Common dysfunction postpartum
  – Postural changes during/after pregnancy
  – Diastasis Rectus Abdominis
  – Returning to sport

Case study

• 45 yo female referred to PT for evaluation and treatment of L proximal hamstring strain
  – 5’4”, 118 lbs
  – Marathon runner
• History:
  – 4 mo prior, onset of pain at L posterior thigh while shifting to avoid falling on trail run; Pain at L ischial tuberosity
    • Self tx of NSAIDs, Ice, stretching hamstring/piriformis
  – 6 weeks later, pain began to increase in sitting on hard chair, with increased pain/tingling at posterior thigh
    • Pain limiting sitting >1 hr
  – At initial evaluation:
    • Stopped running, unable to sit for >15 min, aching/burning at ischial tuberosity, aching at L gluteal region and pubic ramus
    • Pain 7/10 sitting or hills running, increases with foot strike
Case Study

• Prior Medical Hx:
  – Hx of lumbar and pelvic pain 7 mo ago with aching/burning at L ischial tuberosity
  – MRI indicated mild osteitis pubis, minimal L lateral disc bulge at L3/4, mild facet hypertrophy at L4/5
  – Treated with corticosteroids and rest, and all sx resolved

Denies pain with sexual intercourse, bowel or bladder dysfunction

Case study

• Objective findings:
  – Normal posture/gait
  – + SLR and Slump test, reproducing concordant sx
  – No increase in sx with segmental lumbosacral testing
  – SI Tests (-), except (+) Thigh Thrust
  – B hip flexor/quadriceps tightness
  – (-) Scour test B, (-) FADIR
  – MMT 5/5 LE, except 4/5 hip extension, slight pain on L; 4/5 knee flexion
  – Palpation: tenderness at L ischial tuberosity, inferior pubic ramus, proximal bicep femoris

Palpation: tenderness at L ischial tuberosity, inferior pubic ramus, proximal bicep femoris
Case study

- Diagnosis: ischiogluteal bursitis/hamstring syndrome
- Initial Treatment:
  - Sitting on wedge modification
  - Neural mobilization
  - Trunk stabilization exercises
  - Gluteus maximus strengthening

- After 4 visits:
  - Sxs decreased to 0/10 at rest, 3/10 in sitting
  - Pain localized to L pubic ramus
  - Pain unable to be reproduced with examination

Figure 1. Supine neural mobilization at the knee and ankle.

Cas study

- Where would you go next?

- What structures could be contributing to this patient’s pain?
Pelvic Floor/OI pain

- Review- Role of PF in dynamic stability
- How is this impacted with pain?

Typical referral patterns- PF pain

- Pain localized to:
  - Suprapubic area
  - Urethra, perianal
  - Coccyx
  - Groin
  - Lateral hip
  - Sacrum/low back
- Symptoms may/may not include:
  - Urinary dysfunction (urgency, frequency, incontinence, dysfunction in urination)
  - Bowel dysfunction (constipation, difficulty with BM)
  - Sexual dysfunction (pain)
Obturator internus

- Origin: Internal surface of obturator membrane
- Insertion: Passes through lesser scatic foramen, underneath sacrotuberous ligament to attach to lateral aspect of greater trochanter
- Action:
  - Hip external rotation
  - Support pelvic floor function
  - Stability?

Role of OI in hip stability

- OI active in hip external rotation, abduction and extension
  - First muscle to activate

- OI role in hip stabilization
  - “Adjustable ligament”
  - Active in many behaviors, with varying force directions when torque is applied with movement

Hodges 2014
**OI Implications for hip Pain**

- Failure of passive system (ligamentous laxity, labral tear, etc) may lead to greater muscular need to augment stability (Retchford 2013)
  - Possible OI overactivity
  - Femoroacetabular impingement

- Referral patterns for OI:
  - ASIS
  - Groin
  - Perineum
  - Anterior hip pain
  - Posterior hip/gluteals
  - Coccyx

**Examination Strategies**

- **Typical orthopedic examination, but make sure to:**
  - **Screen:**
    - Urinary
    - Bowel
    - Sexual
    - Pain presentation
  - **Observe:**
    - Posture
    - Movement patterns/load transfer
    - Breathing strategy

- **Examine:**
  - Abdominal wall
  - Bony pelvis landmarks
  - External pelvic floor/OI

- **Refer for examination by Pelvic PT, if:**
  - Unable to reproduce pain on exam (OR tender at pelvic floor/OI)
  - (+) Screen for urinary, bowel, sexual dysfunction
  - Recent hx of postpartum, pelvic surgery, gynecological dysfunction
  - Pt is not responding or worsening with neuromuscular patterning exercises
Case study

• 45 yo female runner with improving ischial pain, but persistent pain at pubic ramus, unable to be reproduced with musculoskeletal examination
• Referred to Pelvic PT:
  – Internal vaginal examination: tenderness at L levator ani and obturator internus, reproduced deep pain
• Treatment:
  – 7 additional sessions, manual treatment to PFM/OI
  – Continued progression toward dynamic stability

Case Study

• At Discharge:
  – Sxs reduced to 1/10 if sitting >2 hrs
  – Running up to 15 miles
  – No c/o pain with walking, single leg hopping or running

Wanna know more?

Pelvic Floor Dysfunction in the Athlete

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Postpartum pelvic floor dysfunction

- Urinary incontinence
  - Persisting after first 2-4 weeks
- Fecal incontinence
- Painful scarring
  - Episiotomy, tear or c-section scar
- Pelvic girdle pain
- Painful sexual intercourse
Postural Considerations Postpartum

• Alterations during pregnancy
  – Rib cage position
  – Spinal curve changes
  – Hormonal changes

Postural Considerations Postpartum

• Persistent postural dysfunction
  – Breastfeeding
  – Carrying child
  – “Butt Grippers” and “Chest Grippers”

• Hormonal changes-breastfeeding

Lee 2008
Diastasis Rectus Abdominis

• Definition: Separation of rectus abdominis at linea alba
• Present in up to 100% of women at full-term, reduces to 35-39% of women at 6 months postpartum
• Correlate with low back pain?

Diastasis Rectus Abdominis

• Evaluation:
  – Manual assessment or calipers
  – Assess at umbilicus, 2” above umbilicus and 2” below umbilicus
    • 2 fingers placed at umbilicus
    • Patient performs gentle “crunch”
  – Assess for width and depth - >2 fingers (+)

• Treatment:
  – Restoration of postural variety
  – Elizabeth Noble exercise
  – Pressure modulation
  – Neuromuscular patterning (TA, PF, DB, Multifidus)
  – To brace or not to brace?
Return to sport

- Considerations regarding current symptoms related to:
  - Pain
  - Urinary, bowel or sexual dysfunction
  - Hormonal status (breastfeeding?)
- Sport requirements
  - Stability needed?
    - Walking vs. Crossfit
  - Pelvic floor health
  - Abdominal wall health
    - DRA
- Restoration of dynamic stability
  - Gradual progression toward movement

Conclusions

- Recognize the role the pelvic floor and obturator internus plays in lumbopelvic and hip stability
- Remember that integration of the pelvic floor and diaphragm within functional stability is more about timing and force modulation than brute strength.
- Pelvic floor and OI dysfunction can present as lumbopelvic, hip, SI, abdominal and groin pain in adult athletes.
- Postpartum women have specific needs and should be evaluated from a full body standpoint prior to progressing to high demand exercise
Questions

References

References