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Maximizing Core Retraining 1

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Objectives

- Explain anatomy and physiology of the entire core and its interrelationship with the rest of the body
- Assess for appropriate motor control of core musculature and identify sources of impairment if they exist
- Name at least 3 options for use of manual therapy to provide a neuromotor "reset" to the core
- Provide at least 3 examples of motor control retraining for patients regardless of impairment, beginning with very basic muscle activation and progressing all the way into motor control for high-level athletic activities
- Explain what the concept of "core stability" should look like and how to practically apply during exercise and athletic training
Anatomy & Physiology of “The Core”

Floor to ceiling!

What is Core Stability?
- What do we mean when we talk about the core?
  - Muscles
  - Strength?
  - Anticipatory function?
  - Do we understand how the core actually works?
Muscles

- Neck
  - Deep neck flexors
- Trunk
  - Rhomboids
  - Lower/middle trapezius
  - Transverse abdominus
  - Multifidus
  - Diaphragm
  - Obliques
  - Erector spinae
  - Latissimus dorsi (and on...)

- Pelvis
  - Pelvic floor
  - Hip adductors
  - Gluteus medius

Muscle Function

- Anticipatory control
  - Core muscles (all of them) should fire. Every time we do anything.
  - Example: multiple studies show the pelvic floor fires (under normal circumstances) when you reach to open a door or get something off a shelf
- Motor control/coordination
  - Is strength really all that important in the core? Or is coordination the key?
- Endurance
  - Fast vs. slow twitch fibers
  - We do have BOTH in our core—which to focus on?
What do we Mean by “Core Stability”?

- **History**
  - 1960s-1980s: Sit-up/rectus abdominus city!
  - 1990s-early 2000s: Paul Hodges early theories on motor control and the role of transverse abdominus plus the development of lumbar CPRs including the stability category. PTs started teaching abdominal hollowing/bracing with TrA and teaching patients to “tuck and hold” to maintain support for lumbar spine.
  - Later 2000s-present: Hodges publishes more papers and states that PTs have taken his theories way further than he ever intended and we start realizing the story may not start and end with TrA. Diane Lee publishes her canister theory. At the same time, therapeutic neuroscience education becomes more popular-some people throw out core training entirely.
  - Short answer: it’s complicated and we may not have all the answers-and this is JUST for the lower core!!

Current Understanding of Core Function

- Dynamic mobile system which must all work together in order to provide ideal structure/function for spine and appendicular skeleton during movement
- Balloon example
- The key here is intra-abdominal pressure, NOT muscles holding the skeleton still as we once thought
- This means that retraining the core WHILE MOVING is much more important than we ever considered; does this mean we throw out TrA activation isometrics entirely?
- Motor control AND anticipatory training AND working with dynamic control for “big movements” have to be part of our core work for maximal function
- Note role of posture/alignment
How Does Stability Work?

Let’s Take a Tour!!

- Let’s chat about the role of each of the major areas of the core in function…as with any good tour, we can start in the basement…
Pelvic Floor

- 3 layers of musculature—for purposes of this course we are most concerned with deepest layer (stability layer)
- Coordinates with diaphragm, transverse abdominus, and multifidus for stability—is it possible to adequately retrain the core while ignoring the pelvic floor?
- Connections to pubic symphysis, coccyx, anterior sacrum, lumbar spine, hips
What types of patients are likely to have PF problems?

- Anyone with a postural issue
- Patients with current or history of low back pain, SIJ pain, or hip pain
- Patients with a history of surgery in one of the above areas or abdominal surgery
- History of a difficult vaginal birth or Caesarean birth
- Athletes, especially in high impact sports
- Postmenopausal women, women who have had at least 1 child
- Men
- Patients with a history of cancer treated by chemo or radiation
- And the list goes on…

Pelvic Floor May Sound Like…

- I have more pain during my period.
- I have pain with intercourse.
- I have trouble with constipation or have a hard time initiating the flow of urine.
- I feel pressure/heaviness low in my pelvis.
- I have tailbone pain.
- I have an SI joint that keeps “going out.”
- I have problems with leakage of urine or stool.
- I have abdominal pain and cramping that doesn’t test positive for anything else.
- I have back pain and have had physical therapy many times in the past and it always comes back a few months after stopping therapy.
Pelvic/Hip Girdle Stabilizers

- Piriformis
  - Tends to be overactive to compensate for underactive PF
- Gluteus Maximus
  - “Butt clenchers”-this is a motor pattern to compensate for a weak core!
- Gluteus Medius
  - The “poles” of the hammock
- Hip flexors
  - More of a mover, but also tends to spasm to compensate for underactive/poor motor controlled core
- Hip adductors
  - Tends to mirror pelvic floor activity

Patients Likely to Have Dysfunction in the “Hip Girdle/Pelvis”

- History of hip pain or surgery
- History of low back pain (especially chronic)
- History of pelvic girdle pain (especially posterior pelvic girdle)
- History of significant change in weight
- History of abdominal surgery
- History of a limb dysfunction/surgery that caused the patient to limp (or patient was using crutches or a scooter)
  - Note: We should be working to PREVENT this during rehab for these conditions!!!
Anterior Trunk Musculature-Lower

- **Transverse Abdominus**
  - The “marathon runner” and deepest muscle
  - Keep in mind ALL attachments!
- **Obliques**
  - Rotational support and heavy lifting
- **Rectus Abdominus**
  - Trunk tilting and heavy lifting

Posterior Trunk Musculature-Lower

- **Multifidus**
- **Erector Spinae**
- **Quadratus Lumborum**
- **Latissimus Dorsi**
- All of these will often become overly active/spasm to compensate for a weak core—the patients with “steel rods” down their backs as they hang on their ligaments
Anterior Trunk-Uppper

- Serratus Anterior
- Diaphragm
  - Roof of lower core/vital role in maintenance of appropriate IAP
  - What has to happen for diaphragm to work?

Patients likely to have Dysfunction in These Muscle Groups

- History of abdominal surgery
- History of low back pain
- History of hip pain or surgery
- Reactive response to anything that decreases function in the pelvic floor or hip stabilizer muscles
- Runners who don’t also weight train/strengthen
- Patients with history of non contact ACL injuries (cause?)
Posterior Trunk-Uppper

- Lower Trapezius
- Middle Trapezius
- Rhomboids
- Multifidus
- Erector Spinae
- Serratus Anterior

Cervical Musculature

- Deep neck flexors
- Suboccipitals
Patients Likely to Have Dysfunction in Scapular Stabilizers and Cervical Musculature

- History of neck pain or surgery
- History of thoracic or rib dysfunction
- History of shoulder surgery
- History of whiplash related injury (even if long ago/mild/didn’t seek care)
- And all of the previously mentioned patient types…

The Point…

- “The Core” is a very complex and dynamic system with a LOT of moving parts and pieces; they ALL have to work well together for the body to have optimal support and function
- You really can’t JUST work with 1 of the muscles or even 1 category of muscles if you want patients to have optimal outcomes
Examination Techniques

How do I assess the function of the core??

How Should we Test the Core Muscles?

- Manual muscle testing?
- Functional movement assessment?
- A combination of all of the above?
Subjective Exam

- Be sure to ask about:
  - History of prior injuries
  - History of falls, motor vehicle accidents, prior surgeries (even years ago)
  - Birth history (if applicable)
  - Is pain better or worse with movements? Which ones?
  - Currently having problems with:
    - Leakage of urine or stool
    - Painful intercourse
    - Constipation

Gait

- When core control is happening correctly (in absence of other injuries/issues) you should see good pelvic stability during gait and single leg stance; the person should appear relaxed/not overly stiff and have good trunk movement (regardless of pace)

- What might these gait patterns suggest about core control?
Visual Observation

- Symmetry?
  - Uneven creases?
  - Significant difference
- Lateral shift?
- Posture
- BREATHING

Posture

- Appropriate posture facilitates ideal core motor control
- BUT!! Remember that, via the IAP system, we really should be able to exhibit core support/motor control in a multitude of positions
- Posture is probably more of a sign/symptom of lack of core control vs. a position to retrain in therapy (aka: if you fix the underlying issue, the posture likely will improve without you doing much)
Breathing

- Improper breathing patterns—most likely inappropriate pelvic floor & core activation patterns
- Chest breathing (rising up or flaring out), shallow breathing, creases in back
- Overusing accessory muscles
- Chest flares or “sucking in” around ribs without excursion of lower ribs
- Breath holding

Breathing

- Look in different positions
- Watch throughout treatment—this is a really great clue as to when they are starting to substitute/losing form (breath holding is a huge clue—it’s a way to “cheat” and force IAP without using all their muscles in an organized/coordinated fashion)
- If you can get the breathing down, you can use it to help re-teach the rest of the core muscles to work correctly
- Palpate the diaphragm and lower ribs to ensure they are moving correctly
Muscle Activation Assessment

- Request an isolated activation (just PF, just anterior core) and observe what happens with the rest of the core
- Warning/trouble signs could include:
  - Breath holding or large change in the way breath is happening
  - “Bulging out” of other core muscles
  - Shaking/jerking of muscles (prior to the point of muscle fatigue)
  - Lack of coordination for the movement
  - Loss of balance
  - Severe tucking of pelvis or “sucking in” of muscles in an exaggerated way
  - Odd movements of the neck or upper extremities (shoulder shrugging)
  - Scapular dyskinesia

Active Straight Leg Raise Test (ASLR)

- Gives good clues about core recruitment and closure across pelvis
- Patient in supine, legs extended
- Patient lifts leg straight up one at a time 6-12 inches
- Ask if one feels heavier/harder to lift than the other,
- If yes, patient repeats while therapist applies pressure:
  - ASIS toward one another (replicates anterior force closure)
  - PSIS toward one another (increases force closure posteriorly of the SIJ)
  - Oblique (one anterior / one posterior)
- Does it feel lighter/easier compared to previously?
Pelvic Floor Screen

- Assess for tone & function
- Knees supported
- Fingers on ischial tuberosity, “sink in” to palpate
- Bilateral
- Pain, trigger points, resting tone
- Palpate hip adductors also-mirror PF activity
- Can be performed in supine or sidelying

Assessing Pelvic Floor Function

- Palpate pelvic floor with 1 hand, TrA with the other
- Ask patient to contract their abdominal muscles, then ask them to do whatever they think a Kegel is (if they don’t know, ask them to act like they are trying not to pass gas in a crowded elevator)
- Assess for ability to contract AND ability to relax after (KEY)
- Grade: strong, good, weak
- Co-contraction with Transverse Abdominus?
  - Can they? What happens without cuing? Re-teach PF contraction first, then TrA
- How long can they hold?
  - Normal: 10 repetitions at least 10 seconds with good form (is this normal?)

Look to see whether the bottom pulls up and in toward the scapula or whether it bulges down toward you. The gluteal muscles should NOT be contracting. What happens with breathing?
Coccygeal Movement Test

- Patient in sitting, sidelying, standing
- Place proximal portion of hand on sacrum with 2nd and 4th digits on gluteal muscles and 3rd digit on coccyx
- Request a contraction of pelvic floor
- Inward displacement of coccyx = correct contraction
- Outward displacement of coccyx = straining/bulging/incorrect contraction
- No displacement of coccyx = nothing

Diastasis Rectus Evaluation

- Diastasis rectus evaluation
  - Patient in hooklying
  - Fingers perpendicular with rectus abdominus, have patient lift head and shoulders up off table
  - Measured by number of fingers that “sink into” cavity (Width) and depth (Min, Mod, Deep)
  - Have patient repeat the test and cue breath / Pelvic Floor, does width/depth change?
  - MOTOR CONTROL/intra-abdominal pressure!
Abdominal Soft Tissue Mobility Assessment

- Abdominal scar tissue has potential for major impact on pelvic floor & abdominal organs!
- Assess structures involved, amount of restriction, tenderness of structures
- Difference between a scar and adhesions
- Adhesions form as a response to trauma (surgical or impact or emotional!) AND inflammation (endometriosis, pelvic inflammatory disease, gallbladder disease, appendix disease…)
- Layers (sink down through each to appreciate where the adhesion is):
  - Skin
  - Muscle
  - Fascia
  - Organs

Evaluating Adhesions

Visual—is it indented? What happens in weight-bearing? What changes with breathing? How about functional movements?
Tenderness—or numbness
Gentle, full hand mobilizations in all 3 planes (A-P, rotational, up/down)—where do you feel resistance at various levels?
Symmetry, resistance, pain, guarding, breath changes
C Section/Abdominal Hysterectomy Scar

Cholecystectomy
Appendectomy

Functional Movement Assessment

- Watch people move (core predominant work or just typical movement patterns)-what substitution patterns do you see and where?
  - Movement ideas:
    - Single leg stance
    - Tall tandem kneeling
    - “Bird dog”
    - Burpee
    - Pilates roll up or V up
    - Squat
    - Step up
    - Balance on unstable surface
    - Various types of planks with reaching/slapping/leg lifts
The Key

- Remember that the body does an amazing job of substituting to allow us to continue functioning even in absence of perfect musculoskeletal control/activity
- What we lose first is MOTOR CONTROL
- Think of the visual things you see as being the clue to what is occurring vs the actual problem (correcting posture without addressing the motor control and the muscles does nothing but give your patient another incorrect movement pattern)
- If you lay the right foundation, the higher level activities will fall into place easily
- The core has to work more if you are slightly less balanced

Questions? jstone@eimpt.com
References


References (Cont.)
References

- Coccyx.org – coccyx taping technique


References