

Training the Core for Athletic Performance

Anthony Inzillo, PT, DPT, SCS
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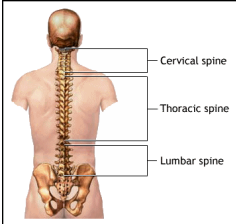
Objectives

- Define “the core” and what core stability really means
- Discuss the importance of core stability and how it relates to athletic performance and injury reduction
- Share assessment techniques for breathing, mobility, and stability
- Discuss training concepts and provide examples of treatment progressions

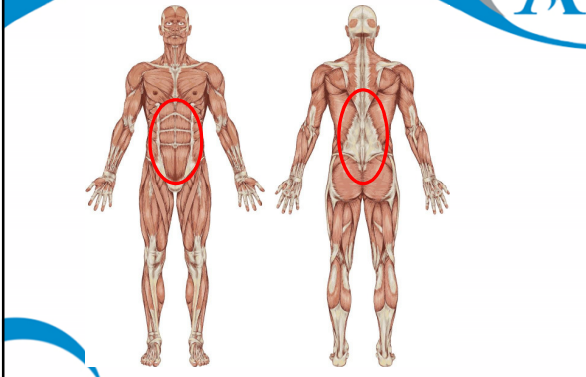
What is the Core?

- No universally accepted definition
- Majority of “experts” identify abdominals, obliques, TA, multifidi, pelvic floor, diaphragm, paraspinals, QL, glutes
- I prefer a simple but more comprehensive view

- **The axial skeleton, pelvis and rib cage and all of the muscles attaching to these structures**



What is the Core?



Primary Roles of the Core

- **Stabilize** the body in all three planes
- **Provide proximal stability** to allow for distal mobility and more efficient muscle use
- **Control** the position and motion of the trunk over the pelvis and legs
- **Trunk stiffness** allows the extremities to produce power while providing a stable base and protecting the spine
- Link between upper and lower quarters to **transfer power** between different segments

Strength vs Stability?

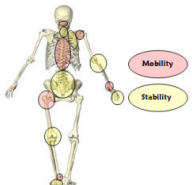

- **Core stability:** the ability of the core to resist unwanted movement
- **Core strength:** the amount of force that the core is able to produce to perform a desired movement



What About Mobility?

- Inadequate **mobility** in the hips and t-spine can be a reason for inadequate **stability** in the lumbar spine
- Don't forget about ankle mobility when squatting

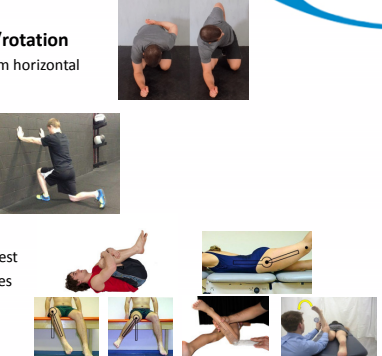
Joint by Joint Approach

Developed by Mike Boyle and Gray Cook

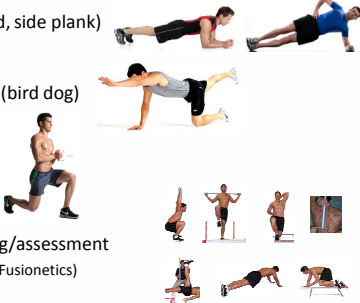
Assessing Mobility

- Thoracic extension/rotation**
 - 50 degree angle from horizontal
- Ankle dorsiflexion**
 - 10 cm from wall
 - 45-50 degrees
- Hip ROM**
 - Flexion: knees to chest
 - Extension: 10 degrees
 - ER: 40 degrees
 - IR: 30 degrees



Assessing Stability and Movement Patterns

- Plank tests (standard, side plank)
- Quadruped stability (bird dog)
- ½ kneeling stability
- Movement screening/assessment
 - FMS, SFMA, DMA, Fursionetics



Normative Values

J Phys Ther 2014 Mar 27; 40: 93-102
Published online 2014 Apr 9. doi: 10.2478/jpt.2013.0011

Norms for an Isometric Muscle Endurance Test
Sarah L. Strand,¹ John Helm,² Todd C. Shoeps,¹ and Mateo A. Fajardo³

- Plank norms for healthy college male varsity athletes (Strand, 2014)
 - 10th percentile: **74** seconds, 50th percentile: **125** seconds, 90th percentile: **228** seconds
 - Lower times for JV athletes

Arch Phys Med Rehabil. 1999 Aug;80(8):941-4.

Endurance times for low back stabilization exercises: clinical targets for testing and training from a normal database.
McGill SM,¹ Cholewicki A, Lieberman C.

- Side plank norms for healthy young men (McGill, 1999)
 - Right: **94** seconds Left: **97** seconds



Injury Risk



Athletic Performance

Core Stability Measures as Risk Factors for Lower Extremity Injury in Athletes

DARIN T. LEETUN,¹ MARY LLOYD IRELAND,¹ JOHN D. WILSON^{2,3},
BRYON T. BALLANTYNE,² and IRENE MCCLAY DAVIES²
¹Hennrich Sports Medicine Clinic, Lexington, KY; ²Snyder Sportsmedicine Institute, Lexington, KY; and ³University of Kentucky, Department of Physical Therapy, Newark, DE

- Uninjured males and females had higher hip ABD and ER strength and increased side bridge and back extension endurance than their injured counterparts

Deficits in Neuromuscular Control of the Trunk Predict Knee Injury Risk

A Prospective Biomechanical-Epidemiologic Study
Bohdanna T. Zazulak,^{1,2} DPT, MS, OCS, Timothy E. Hewett,³ PhD, FACSM,
N. Peter Reeves,⁴ MSc, Barry Goldberg,⁵ MD, and Jacak Cholewicki,⁶ PhD

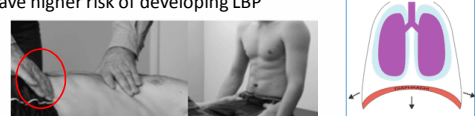
- Trunk displacement was greater in athletes with knee, ligament, and ACL injuries than in uninjured athletes
- Factors related to core stability predicted knee injury in female athletes
 - Increased lateral displacement was the strongest predictor
 - No significant differences were found in male athletes



A pyramid diagram with three levels. The top level is labeled 'Sport Skills'. The middle level is labeled 'Power, Speed, & Agility Skills'. The bottom level is labeled 'Movement Skills'. To the left of the pyramid is a photograph of the Great Pyramids of Giza. Below the pyramid is the URL 'https://mikereinoold.com'.

Training from the Inside Out


- Training proper breathing techniques and diaphragm function is the most fundamental aspect of core stability
- 2 simultaneous functions: **Respiration** and **Stabilization**³
- When the diaphragm functions properly, it pushes down into the abdominal cavity, increasing intra-abdominal pressure
 - Should observe a lateral expansion of the ribcage rather than upward
 - Otherwise, respiratory capacity and core stability are reduced
- Individuals with a limited ability to contract the diaphragm for stability have higher risk of developing LBP



Two diagrams illustrating diaphragm function. The left diagram shows a person's torso with a red circle highlighting the diaphragm area. The right diagram is a cross-section of the thorax showing the lungs and diaphragm, with an arrow pointing down from the diaphragm to indicate its contraction and downward movement.

Bracing vs Hollowing

- Where did the drawing-in maneuver originate?
 - Study by Paul Hodges et al in 1999
 - TA in healthy subjects fired a fraction of a second prior to arm movement
 - Found that the TA in those with LBP (14 subjects) was delayed by a fraction
 - This led to a worldwide attempt to train the TA in isolation
- What's the problem with this approach?
 - Abdominal hollowing does activate the TA but it is at the cost of decreasing activity of the rest of the trunk muscles and creates a less stable spine
- Perform abdominal bracing instead
 - Activates all layers of the trunk muscles
 - Increases trunk stiffness/stability
 - Allows for safer and more effective movements



A photograph of a large sailing ship with its masts and rigging visible against a blue sky.

Getting Started

- Stability training begins with improving one's ability to maintain a neutral spine in a variety of postures
- Supine → Quadruped → Kneeling → Standing → Walking
- Then progress to maintaining a neutral spine during functional activities
- Finally, we must improve their ability to control the spine beyond the neutral zone during functional/athletic activities

❖ Important to establish adequate baseline core stability and movement patterns then train for the unique needs of each athlete and their position

Supine/Prone/Sidelying Exercises

- Rolling patterns
- Marching progressions
- Dying bug progressions
- Bridging progressions
- **Reverse crawling progressions**
- **Plank progressions**
- **Side plank progressions**



A series of small images showing various core exercises. At the top right is a person lying on their back with one leg raised. Below that are several images showing different plank and side plank variations, including a person on a ball and a person on a mat.

Quadruped Exercises

- Bird dog progressions
 - Alternating arms
 - Alternating legs
 - Alternating opposite arm/leg
- Quadruped rocking
- Low bear → High bear → Bear crawls






Three photographs showing quadruped exercises. The first shows a person in a bird dog position. The second shows a person in a quadruped rocking position. The third shows a person in a low bear position.

Kneeling/Standing Exercises

- Anti-rotation/Palof press progressions
 - Static hold (1/2 kneeling, tall kneeling, hip hinge, split stance)
 - Side steps
 - Rotations
- Chop and lift progressions (Level 1, 2, 3)
 - Half kneeling
 - Split stance


❖ General rule of thumb:

- Must be able to prevent rotation before training to produce it

Hip Hinge

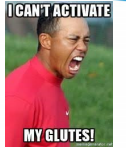
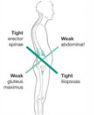

- Inability to do so leads to back pain/knee pain
- Training a proper hip hinge unloads the knees and lower back
 - Stretch/mobilize hip flexors, activate glutes
- Example hip hinge training progression:
 - Bridge with manual cueing on ASIS
 - Quadruped cat/camel (pelvis only)- find neutral
 - Quadruped rocking with neutral spine
 - Short to tall kneel (shoulders over knees)
 - Standing hip hinge into wall (fingers on hips)
 - Cable pull-through
 - Kettlebell deadlift with box between feet



<https://breakingmuscle.com>

Training the Glutes





- “Gluteal amnesia” – Stuart McGill
 - Inability to use the glutes effectively to extend the hips
 - Can either be a cause or result of LBP
- Restore hip extension, stretch/mobilize hip flexors
 - Reciprocal inhibition of glutes from overactive hip flexors
 - Glutes function poorly when hips can't fully extend
 - Avoid prolonged sitting!
- Glute retraining/strengthening
 - Bridging/hip thrusters
 - Active or resisted hip extension
 - Standing clamshells/monster walks
 - Deadlifts/RDL's/KB swings
 - SQUATS

Because NO ONE RAPS ABOUT little butts

Dynamic Strength/Stability

- Turkish Get-up
- Weighted sled push/pull/lateral pull
- Farmer's carry, suitcase carry, waiter's carry, overhead carry
- Landmine rotation

Power Development

- Medicine ball chops and throws
- Kettlebell swings
- Rotational press “Hadouken”
- Olympic lifts
- Box jumps/depth drops





Position Specific Needs

- Important to train each athlete for the unique needs of their position
- Watch practices, work with position coaches to develop position specific training programs
- Be creative in exercise design and prescription to keep athletes challenged and engaged




Improving Athletic Performance

The effects of isolated and integrated 'core stability' training on athletic performance measures: a systematic review.

Reed CA¹, Ford KR, Myer GD, Hewett TE

- **CONCLUSIONS:** "Targeted core stability training provides marginal benefits to athletic performance. Conflicting findings and the lack of a standardization for measurement of outcomes and training focused to improve core strength and stability pose difficulties. Because of this, further research targeted to determine this relationship is necessary to better understand how core strength and stability affect athletic performance."

Effect of torso rotational strength on angular hip, angular shoulder, and linear bat velocities of high school baseball players.

Szymanski DJ¹, McIntyre JS, Szymanski JM, Bradford TJ, Schade RL, Madsen NH, Pascoe DD

- Athletes performing 12 weeks of rotational and full body medicine ball exercises 3x/week had improved angular hip and shoulder velocity, torso rotational strength, and linear bat end speed than the control group who performed only strength training
- **Need to train for movements specific to the demands of the sport!**

Thank You!



References

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