Core Implications For the Extremities
Core Stability

• Not new stuff
• Everyone’s jumping on the bandwagon
  – PT, ATC, CSCS, Fitness Industry
  Even the researchers – easier to get funding if you mention the spine
• Conceptual Framework in place since 1950’s
  – Clinically: last 20 years
  – The research has now paralleled what we do in the clinic
History of Core Stability

*Gets everyone on the same page*

- 1950 – Kendall → Stability through the core
  - Activate the Transverse Abdominus and Multifidus
- 1970 – Janda → “Pelvic Cross” Framework
- 1980 – Sahramen → Focused on the chronic malignation that occurs when muscles get stretched or weak
- 1980’s – Richardson → Activation of the Transverse Abdominus through “Abdominal Hollowing” looking at local muscles vs. the pelvic clock and global muscle approach
- 1990’s – McGill – Biomechanist “Abdominal Bracing”
Why Core Stability? Because our bodies were designed to produce and most importantly reduce force

- Ex: anatomic action vs. functional action

Glut Medius

- Muscles have anatomical individuality but do not function that way
Why Core Stability?

• 60% of our bodies mass is in the trunk
• We need to control and consider this to optimize LE and UE function
Core and Kinetic Link Evidence…

- 34% more rotational stress to the Glenohumeral joint when there is a 20% loss of trunk power-Kibler 2001
- 64% of shoulder patients will have scapular asymmetry-Micheli
- 23.6% loss of elevation ROM and 16% loss of strength with T-SPINE Kyphosis-Kebaetse et al 1999
- 23-38 degrees of loss of trail arm ER in the golf swing : senior player vs. early 20”s player-Baker, Mitchell 2003
Core Drawing
Fundamentally you have…

• Local Muscles
  – Transverse Abdominus, Multifidus, Internal Obliques, Diaphram, Pelvic Floor muscles

• Global Muscles
  – Rectus Abdominus, Erector Spinae, External Obliques
Erector Spinae  Transverse Abdominis  Multifidus
Local Muscles

- Directly control the lumbar segment

- Deep “corset like” action – essential for core stability – via the “Hoop Mechanism”

- Posture/positional sensory sense – Proprioception

  inhibition of these muscles – chronic LBP
How does the Transverse Abdominus (TA) work?

- Wraps around the spine and blends into the thoracolumbar fascia and thus attaches to vertebrae (the TA contracts pulls on the fascia and thus provides intrinsic stability)
- Increases intra-abdominal pressure – acts like a canister with the diaphragm, pelvic floor – increasing the abdominal pressure creates an extension moment at the spine and thus stability-which decreases compressive forces
How does the Multifidus work?

- Increases rotational segmental stability
- Contributes 2/3 of the segmental stability
- Fatigue resistance-type I fibers – slow twitch
Global Muscles

• Control movement around the spine relative to the rib cage and pelvis
• Core Training/Power-conditioning in a specific movement-dynamic
So What is Core Stability?

- Local and global muscles working together.
- Proper activation of these muscles.
- It is oversimplified
- Abdominal crunches are not core stability exercises
- Stability means **NO** FLEXION, EXT, ROTATION
Core Stability Objective?

• Neuromuscular Control
• Proper Activation Pattern of Upper and Lower Extremity Movements will occur if core muscles are firing properly
• “Corset Like” Action – Spinal Segmental Stability
• Balance of the motion segment
Intro Summary—So Why Core Stability?

• What happens at the core influences the pelvis and thus the upper and lower extremities
• In order to have proper integration of efficient movement performance of kinetic chain you need proper activation patterns of the core
• Intrinsic stability first → Extrinsic stability
• Lumbopelvic Stability → Pelvicfemoral stability → Thoracolumbar stability → Scapulothoracic stability → Scapulohumeral Stability etc… it’s a chain reaction
  More on this later…
• Implications on injury prevention and rehabilitation
  – High level athlete / patients
  – Low level patients
Technique of Core Stability

• Must successfully have local and global neuromuscular activation

• “Neutral” spine position – clinically small lumbar curve – slight activation of erector spinae

• Strict initiation of intrinsic local muscle contracture via the “Drawing in Mechanism” –“BBTS”

• Abdominal Hollowing

Reference: Richardson - McGill
Two Methods:

1. Train the Locals
2. Train the Global Ms
Bracing vs. Hollowing?

- The literature has looked primarily at lumbopelvic stability so there is a bias towards bracing for spine stability
So what is the best method?

• Training the local muscles or the global muscles?
Objective Exam LE/UE

- Start with a little bit more “core awareness”
- Evaluate from the “inside out”
- Proximal Stability for Distal Mobility (medical model often leaves this fundamental out)
- Our bodies are designed to produce and reduce force-need to have a stable and correct activation of the core muscles to do this efficiently and therefore less compensation to the entire chain
CLINICAL IMPLICATIONS

• “Inside out approach”
• Small postural position sense muscle inhibited
• Overall integration of the kinetic link—remember that muscles have anatomical individuality but not functional individuality

• We all know and treat high and low level demand patients that function fine, however…
• UE-Examples—influence of a weak core
• LE—Examples—influences of a weak core
Lack of Trunk Control

• 60% of total body mass

• Need to control this in deceleration activities
  – landing, running, and cutting

• Important to control this huge mass especially in change of direction in sports
Upper Extremity—Let’s Discuss

• Weak and inhibited core causes over activation of global extrinsic muscles i.e. Thoracolumbar fascia / Latissamus Dorsi

• Tight ‘lats’ increases medial rotation of the humerus – forward tipping of scapula THUS, anterior superior migration of the humeral head occurs → Impingement/RTC dysfunction

• 16% less elevation strength and 24% active shoulder elevation
Upper Extremity con’t

• Weakened and inhibited gluteus medius post THR – downward and forward rotation opposite shoulder – incidence of RTC dysfunction opposite THR
• Baseball Pitchers
• 34% more rotational stress to the shoulder when there is a 20% decrease in trunk strength
Janda – Pelvic Cross Syndrome

- Weak and inhibited Abdominals
- Weak and inhibited Glut Max/Med
- Tight Hip Flexors
- Results in loss of hip extension
- Loss of lateral pelvic control
- ITBFS Trochanteric Bursitis, lateral knee pain, “piriformis syndrome”
- Cascade – domino effect abdominal muscle / joint tissue loads resulting in pain and dysfunction
Core Assessment - Clinical

• Postural Assessment
  – Hyperlordotic posture – tip that intrinsics are weak and inhibited – erector spinae dominance
  – Abdominal Protruding – Pouching out sign that you have lost the intrinsic control
  – Look for forced postural changes
Core Assessment-UE
Swimmer

• How do we identify a weak core? -- Clinically

• Core Stability – Where do I start? What level?

• A common problem is starting at a level that is too advanced

• How to incorporate into your current rehab plans

• Where you fail is where you start
LOWER EXTREMITY—Also starts with trunk control

- Occurs at 3 levels
  - Local Spinal Control – Position Sense
    - Muscles that can influence/control intervertebral motion
  - LumboPelvic Control – Controlling the thoracic cage on the pelvis
  - Overall whole body posture – the global muscles attach the thoracic cage to the pelvis, THUS controlling the majority of the body “mass”
Lower Extremity

• Dynamic loading activities

• Proper activation of Transverse Abdominus controls trunk flexion and the chain reaction i.e. SOFTER LANDING-less repetitive compensation-our bodies are great at compensating-it is the repetition that we have to control

• Mechanism of injury – landing MOI – ACL

• Classic landing mechanism
  – pronated foot, ER tibia, IR femur, genu valgum,
CARLY

• Let’s assess the good side........
CARLY

- Let’s assess the involved side........
Clinical Progression-Level One
goal-activation of local muscles

• Supine- “Draw in and up”-hips and knees at 45 deg 30 sec contraction 5-8 reps

**watch for loss of natural lordosis which means poor transverse Abdominis control**
Level 2-goal alternating arms and legs without loss of local control (TA and Multi)

• Supine ex- alternate arm flexion then to arm and leg flexion

• Quadruped ex-arm flexion to alternate arm and legs

• 3 sets for one minute- 1-2 sec concentric 2-3 sec eccentric rhythm
Level 3-Weight Bearing and Multi Plane Movements
Level 4-Continued Multi Plane with faster pace of movement
Putting it all together- Sequencing

- Release tight muscles first- set core before stretching
- Proceed through your core program
- Remember where you fail is where you start
- Document postural changes, reps and ability to perform exercises etc
REVIEW: Stability Exercise vs. Training Exercise—remember to set local muscles first
TRAINING AND RX TIPS

• Remember that you activate your intrinsic core muscles first when walk – step etc.
• Rehab all planes and contraction types
• Change speeds and angles to progress
• Stay basic and boring-Fundamental’s
• Because a lot of our balancing/core PT Ex’s look like a circus act and create nothing but compensation
• DRAW-IN MECHANISM-Before you do any ther-ex’s
TRAINING AND RX TIPS CON’T

• Core training and power-chops, lifts etc remember to “Draw-in” first
• Transitional movements will expose postural change, compensation and the real cause of the pain and dysfunction.
• Ex: impact landing-soft or hard?
• TRUST YOUR EARS AND YOUR EYES
• Remember “in every patient lies the truth”
  James Cyriax MD
TRAINING/RX TIPS Con’t

- Remember the kinetic link:
  Lumbopelvic: patellafemoral, scapulothoracic etc

- Remember a lot of highly trained athletes and patients function with over dominant

- Global muscles potentially resulting in overcompensation and pain
Training Faults and Misconceptions

“Practice today become habit tomorrow” Duane Saunders, PT

• Too many so called “Core” exercises – too difficult for our patients-they are “training a plane vs. “stability”
• Compensation results in the dominant global muscles taking over – sloppy technique
  *Only getting about 50% of the benefit
• Program are strength based sets and reps
  – “3 sets of 10” vs. Neuromuscular activation force tension development
• Need to instill the constant activation of the ith ADL’
Core References

- As well as the work by Sahrmann, Janda, Kendall and Hodges
Thank You!

- Andrew Graham— for IT support and video taping
- Eoin Colleran— research assistance