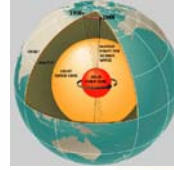


Current Concepts of Lumbar Stabilization Programs

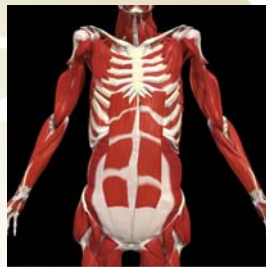
Terry L. Grindstaff, PT, ATC, CSCS
VATA Annual Symposium
January 2007

What is the Core?



Core Defined

- Area between the sternum and the knees
 - Abdomen
 - Lumbar Spine
 - Pelvis
 - Hips



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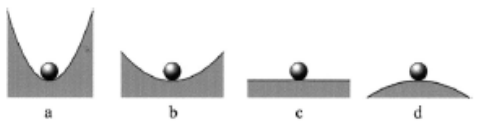
Low Back Pain

- 80% incidence rate (Nachemson, 1985)
- 60% recurrence rate (Turner et al, 1992)
- Up to 20% of all sport injuries involve the spine
- Lumbar Segmental Instability (LSI) is often implicated



Low Back Pain

- Lumbar Segmental Instability



Low Back Pain

- Difficult to identifying the involved anatomical structure (Abenhaim et al, 1995)
 - 90% of patients do not have precise diagnosis
- Treatment classifications
 - Cluster of common signs and symptoms (Delitto et al, 1995; George and Delitto, 2005)
 - Matched to treatment strategy

Exercise Evidence

- Limited evidence with mixed findings
- Recent systematic review regarding exercise (Colle et al, 2002)
 - Chronic > Acute



Long Term Effects

- Patients who received specific exercises experienced fewer recurrences of LBP than controls (Hides et al, 2001)
 - Exercises focused on multifidus
- Recurrence Rates
 - Year 1: 30% vs 84%
 - Year 2: 35% vs 75%

Red Flags

- Signs or symptoms that suggest a more serious underlying pathology
- May necessitate medical referral or surgical interventions
- Fracture
 - Compression, Stress, Traumatic
- Cauda Equina
 - Bowel/bladder
- Neoplastic Conditions
 - Fever, night pain
- Ankylosing Spondylitis
- Spinal Infection

Yellow Flags

- Findings that indicate an increased risk for prolonged pain and disability
 - Due to psychosocial or other factors
- Hypermobility
- Pregnancy
- Joint effusion
- Inflammation
- Total joint replacements
- Newly formed/weak connective tissue
 - Injury, surgery, disuse

Other Issues

- Psychosocial variables
 - Better able to predict successful outcomes than physical signs and symptoms (Macfarlane, 1999; Fritz et al, 2001)
- High level of fear-avoidance beliefs
 - Active rehab with positive reinforcement



Stabilization Classification

Using a Clinical Predictor Rule

Stabilization Classification

- Increasing frequency of episodes
- > 3 previous episodes
- Other classifications
 - Manipulation/Mobilization
 - Specific Exercise
 - Extension
 - Flexion
 - Lateral Shift
 - Traction

Clinical Predictor Rule (CPR)

- Quantifies individual contributions from various components of the history and physical exam results make towards the diagnosis, prognosis, or likely response to treatment in an individual patient (Laupacis et al, 1997)

Lumbar Stabilization CPR

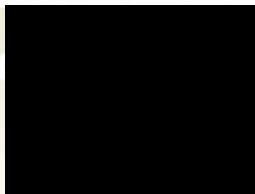
- Hicks et al, 2005 Arch Phys Med Rehabil
 - 54 patients with nonradicular LBP
 - Comprehensive physical exam
 - Age
 - SLR
 - Aberrant movement
 - Lumbar PA Glide
 - Prone instability test
 - Standardized stabilization exercise program
 - Treatment response (success or failure) was categorized based on changes in the Oswestry Disability Questionnaire scores after 8 weeks

Fear-Avoidance Beliefs Questionnaire (FABQ)

- Quantifies the level of fear of pain and beliefs about avoiding activity in patients with LBP (Waddell et al, 1993)
- 16 items
 - Scored 0-6
 - 2 subscales
 - Work
 - Physical activity

Straight Leg Raise

- Leg is slowly passively raised to the maximum tolerated position



Lumbar Mobility Assessment

- Passive accessory motion
 - PA Glide
 - Spring Test
- Judges mobility
 - Hypomobile
 - Normal
 - Hypermobile



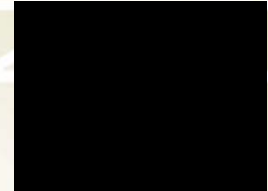
Lumbar Mobilization

- Force is applied through the arms using body weight
- Patient is in prone position
- Uses hypothenar eminence over the spinous process of the vertebra to be tested
 - Contact point of hand is distal to the pisiform



Aberrant Motion

- Testing flexion and extension
 - Most occur in flexion
 - Thigh climbing
 - Painful arc



Prone Segmental Instability Test

- Patient is prone on exam table
 - Legs over edge
 - Feet on floor
- Apply PA pressure to lumbar spine
- Patient reports pain



Prone Segmental Instability Test

- Patient lifts legs off of floor
- PA Glide applied again
- Positive (+) test
 - No pain with second test



Clinical Predictor Rule

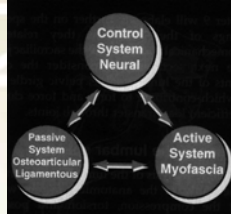
- | | |
|--|---|
| <ul style="list-style-type: none"> • Predictor for Success <ul style="list-style-type: none"> – < 40 years of age – Average SLR > 91° – Aberrant movement present – (+) Prone instability test • 3 out of 4 variables <ul style="list-style-type: none"> – Positive LR 4.0 (95% CI: 1.6-10.0) | <ul style="list-style-type: none"> • Predictor for Failure <ul style="list-style-type: none"> – FABQ Physical Activity Subscale score > 8 – Aberrant movement absent – (-) Prone instability test – No hypermobility during lumbar spring testing • > 2 variables <ul style="list-style-type: none"> – Negative LR 0.18 (95% CI: 0.8-0.38) |
|--|---|

Treatment Programs



Strength

- The lumbar spine is very unstable without muscular control (Panjabi, 1992)



Musculature

- Superficial (Extrinsic)
 - Traps, latissimus dorsi, rhomboids
- Anterior and Lateral
 - RA, TrA, EO, IO
 - Quadratus Lumborum
- Deep (Intrinsic)
 - Erector Spinae
 - Iliocostalis
 - Longissimus
 - Spinalis
 - Transversospinalis
 - Semispinalis
 - Multifidus
 - Rotatores

Function

- Coordinated, properly sequenced muscle activity increases spine stiffness/rigidity
 - Trunk Muscles: Spine
 - Rigging: Ship Mast



The Best Stabilization Program?

- Specific Muscle
 - Transversus Abdominus
 - Hollowing
 - Multifidus
- Abdominal Bracing



Abdominal Hollowing

- Patient is instructed to draw navel up toward head and in towards the back of the spine
 - Stomach flattens, but spine remains neutral
- Key is to isolate deep muscles and not utilize stronger rectus abdominus

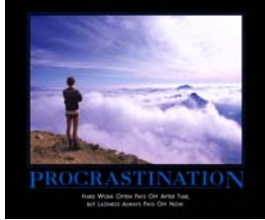


Abdominal Hollowing

- Recommended that hollowing be combined with other aspects of the stabilization program
 - Functional positions and postures



Multifidus



- Long term results (Hides et al, 2001)
 - Selective multifidus retraining in addition to medical management is more effective for reducing recurrences than medical management and normal activity



Multifidus

- Individual vertebral segment stabilization
- While in prone muscle is palpated adjacent to the spinous process
 - Side to side comparison at each level
- Gently swell muscles under fingers
 - Can use pressure biofeedback with cocontraction TVA



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Abdominal Bracing

- No single muscle is only responsible for lumbar spine stability (Kavic, 2004)
- Therefore training should not focus solely on one specific muscle



Potential Issues with Selective Recruitment

- Does not occur with normal movements
 - Although the multifidus and TrA act to stabilize the system prior to movement they are not the only muscles responsible for stabilization
- Why would a stabilization program continue to emphasize selective contraction once the patient is able to function normally?

Which would you choose?

- Motor Reeducation
 - Abdominal hollowing
 - Multifidus retraining
- Increase stability
 - Abdominal bracing



Exercise Concepts

Objectives

- Teach the patient
- Make the treatment session active
- Challenge dysfunctional muscles
 - Applying adequate stress to surrounding tissues

Education

- Avoid
 - End ranges of motion
 - Spine overload
 - Exacerbating activities
- Promote
 - Proper posture
 - Muscle endurance
 - Safe exercises and healthy alternatives



Clinical Pearls

- Maximal strength is not a good test
- Treatment should focus on
 - Muscular endurance
 - Muscle balance
 - Neuromuscular control

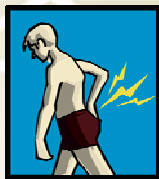


Stages of Management

- Stage I
 - Difficulty performing basic ADLs
 - Sitting, standing, walking
 - Increased levels of pain and disability
- Stage II
 - Able to perform basic ADLs
 - Difficulty with demanding activities
 - Running, lifting, athletics
 - Symptoms are less severe
 - Usually longer duration

Stage I

- Goal
 - Reduce symptoms and associated disability



Stage II

- Goals
 - Improve functional abilities
 - Address impairments
 - Strength
 - Endurance
 - Flexibility
 - Return to activity
 - Reduce likelihood of recurrence
- Three components
 - Specific trunk strength
 - General strength and flexibility
 - Aerobic conditioning

Specific Exercises



The Best Exercise?

- Walking (Nutter, 1988)
 - Produces low levels of passive tissue loading and prolonged activation of supporting musculature
 - Fast walking with arm swing



Stage I

- Difficulty performing basic daily activities
 - Sitting, standing, walking
- Goal
 - Reduce symptoms and associated disability
- Increased levels of pain and disability



Stage I- Neuromuscular Retraining

Prone Drawing In	Deadbug
Prone Multifidus Isometric	Standing Drawing In
Supine Drawing In	Standing Arm Extension
Trunk Flexion/Ext in Quadruped	Standing Side Bridge
Prone Heel Lift/Leg Slide	Single Leg Hip Ext

Abdominal Hollowing

- Patient is instructed to draw navel up toward head and in towards the back of the spine
 - Stomach flattens, but spine remains neutral
- Key is to isolate deep muscles and not utilize stronger rectus abdominus
 - Palpate just medial to the ASIS

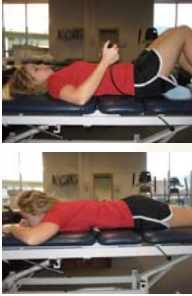


Abdominal Hollowing

- Pressure biofeedback
 - Prone 70 mmHg
 - Reduces 4-10 mmHg
 - Supine 40 mmHg
 - Increases 0-5 mmHg



Abdominal Hollowing



Real Time Ultrasound

- Visual biofeedback (Henry et al, 2005)
- Assess activation of deep muscles (Teyhen et al, 2005)
 - Muscle thickness



Multifidus

- Prone or quadruped position
- Palpate adjacent to the spinous process
 - Side to side comparison at each level
- Gently swell muscles under fingers
 - Can use pressure biofeedback with cocontraction TVA



Standing Shoulder Extension

- Grasp bar with shoulder width grip
 - Elbows extended
- Perform drawing-in maneuver followed by isometric gluteus maximus squeeze
- Hold contraction while extending shoulders
- Return to starting position
- Relax muscles in reverse order



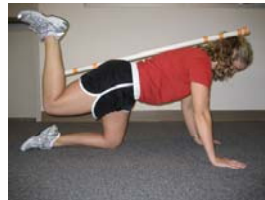
Gluteal Muscles

- Single Leg Hip Extension with Trunk Support
 - Knee flexed to create active insufficiency of the hamstrings and decrease contribution to hip extension
 - Lay upper torso across treatment table and one foot in contact with the ground



Gluteal Muscles

- Single Leg Hip Extension
 - Knee flexed to create active insufficiency of the hamstrings and decrease contribution to hip extension
 - Place dowel across back to provide feedback
 - Spine should remain neutral



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Stage II

- Able to perform basic daily activities
- Difficulty with demanding activities
 - Running, lifting, athletics
- Goals
 - Improve functional abilities
 - Address impairments
 - Strength
 - Endurance
 - Flexibility
 - Return to activity
 - Reduce likelihood of recurrence
- Three components
 - Specific trunk strength
 - General strength and flexibility
 - Aerobic conditioning

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Stage II

	Alt Arm/Leg Extension	Side Bridge	Curl Ups	Bridging
Stage 1	Single Arm/Leg Extension	Sidelying bilateral leg raises	Rotate at mid-thoracic with hands under lumbar spine	Raise 1"
Stage 2	Alternating Arm/Leg Extension	Forearm support with bent knees	Same as above and raise elbows	Raise max height without back arch
Stage 3	Sweeping Motion	Forearm support legs straight	Hands across chest	Single Leg
Stage 4	Unstable Surface (Hands)	Dynadisc under knees	Fingers on forehead	Both Legs on Ball
Stage 5	Unstable Surface (Knees)	Dynadisc under feet	Deep Breathing	Single Leg Dynadisc
Stage 6	Arm/Leg weights	Hand support	Added weight	Single Leg Ball

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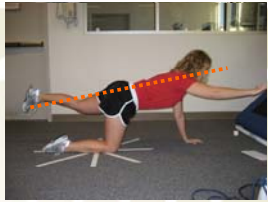
Quadruped Arm/Leg Ext.

- Maintain neutral spine
 - Do not let back curve or hyperextend
- Use a dowel to ensure neutral spine is maintained
 - Ball or cup
- Maintain stability
- ~27% MVC for spinal extensors
- Load is over 3000N

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Quadruped Arm/Leg Ext.


- Single Arm/Leg Extension
- Alternating Arm/Leg Extension
- Sweeping Motion
- US Under Hands
- US Under Knees
- Arm/Leg weights



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Side Bridge

- Produces greatest muscle activity
 - 54% MVC
- Low compressive loads
 - 2500 N



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Side Bridge

- Side-lying bilateral leg raises
- Forearm support with bent knees
- Forearm support with legs straight
- US Under Knees
- US Under Feet
- Hand support



Trunk Curl

- Keep one leg straight and one bent
 - Helps maintain neutral curve of low back
 - Do not flatten low back to floor
- Lift shoulders from floor
- Rotate at rib cage
- Shoulders should not come up any more than six inches
- Intention is to contract rectus
 - Not to produce spine motion

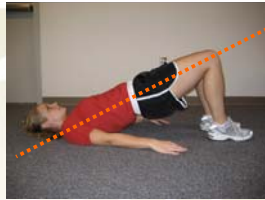
Trunk Curl

- Hands under curve of low back
- Elbows flat, one leg straight
- Same as above and raise elbows
- Hands across chest
- Fingers on forehead
- Deep Breathing (i.e. after exercise)
- Added weight



Bridging

- Raise hips off of ground
- Maintain neutral spine
- Do not hyperextend back
- Keep knees, hips, and shoulder in straight line



Bridging

- Raise 1"
- Raise max height without back arch
- Single Leg
- Both Legs on Ball
- Single Leg with US
- Single Leg Ball



Balance

- Single Limb Stance
- Half Star
- Full Star
- Single Limb Stance with US
- Half Star with US
- Full Star with US



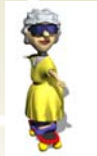
Balance

- Single Leg RDL
- 3-Point Touch
- Airplane
- Single Leg RDL with US
- 3-Point Touch with US
- Airplane with US



Stages of Progression

- Awareness of spine position and muscular contraction
- Begin appropriate spine exercise and stability/mobility tasks
- Develop muscular endurance
- Transfer to daily activities



General Exercise Progression

- Slow → Fast
- Stable → Unstable
- Eyes Open → Eyes Closed
- Normal Respiratory Rate → Elevated Respiratory Rate



Key Concepts

- The number one predictor of future injury is a previous injury
- Most core stabilizing muscles are slow twitch muscles
 - They respond better with pause of 3-5 sec at end range of exercise motion
 - Maintain slight (10-30% max) abdominal contraction (bracing) to provide optimal stability during all exercises
- Exercises should be performed multiple times per week
- Emphasis should be placed on proper technique and development of endurance, not amount of weight lifted or strength gains

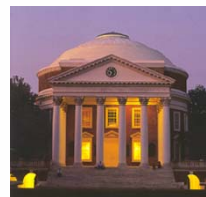
“Practice does not make perfect, It makes permanent”

Stuart McGill

Thank You



Questions?



Suggested Readings

Articles

- Childs JD, Fritz JM, Flynn TW, et al. A Clinical Prediction Rule To Identify Patients with Low Back Pain Most Likely To Benefit from Spinal Manipulation: A Validation Study. *Ann Intern Med*. December 21, 2004;141(12):920-928.
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- Fredrickson M, Cookingham CL, Chaudhari AM, Dowdell BC, Oestreicher N, Sahrman SA. Hip abductor weakness in distance runners with iliotibial band syndrome. *Clin J Sport Med*. 2000;10(3):169-175.
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