Low Back Pain

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"Since we got up off all fours I've been having these low back pains."
Pain generators

- Disc
- Posterior elements
- Sacro-iliac joint
Education - Spine Positioning

Neutral  Extension  Flexion
Disc disease
Discogenic low back pain

- Axial
- May radiate
  - lower extremities, groin, lower abdomen
- Exacerbating factors:
  - sitting, riding in a car, Valsalva, bending, lifting, prolonged positioning
- Relieving factors:
  - walking, lying down
Posterior elements pain

- Back +/- leg pain
  - with standing +/- walking
  - relieved by sitting, grocery cart
  - pain immediately upon wt. bearing

- Arthritic pain
  - morning stiffness
  - better with activity, heat
Lumbar Facet Mediated Pain
Sacroiliac joint pain
Sacroiliac joint dysfunction

- Often after a fall directly on to buttocks
  - also pregnancy, ankylosing spondylitis
- Low back/PSIS pain
  - can radiate - posterior thighs, groin
- Painful transitions
  - sit to stand, getting in/out of car, steps
  - turning in bed, putting socks on
Sacroiliac Joint Dysfunction
Why exercise?

- Treatment for back pain can vary from medications, to injections, to surgery...
- One common pathway for ALL CAUSES: muscle retraining (exercise)
- How does exercise work in back pain?
Spine stability (Panjabi model)

- Bone and ligaments
- Muscles surrounding the spine
- Neural control system coordinating peri-spinal muscular contraction
Bones and Ligaments

- An intact spine from which muscles have been removed will buckle under 9 kgs!! (Cisco, Panjabi 1992)
Muscles

- Main stabilizing system

- Deep perispinal muscles:
  - Deep portion of multifidus
  - Transversus abdominis (TA)
  - Quadratus lumborum
Multifidus

- Deepest of the posterior muscles
- Short
- Segment to segment stability
- Primary slow-twitch (endurance) muscle fibers
Transversus abdominis

- Deepest of the oblique muscles
- Activated separately from other abdominal muscles
- Acts like a natural corset
Quadratus lumborum

- Important for lateral stability
What makes the spine “unstable”

- “Big Movers”
  - Rectus abdominis
  - Obliques
  - Big proximal limb muscles
Neural control system

- Stabilizers contract before big movers (deltoid, hip abductors) in response to a visual stimulus
- In healthy spine: 10% of maximal contraction is needed for stabilization
- Stabilization is carried throughout the whole movement
- This response is altered in LBP, the stabilizers firing late or quickly fatigued
Effect of Injury or Pathology

- Pain inhibition
- Change in sensory input to the muscles
  - with ligamentous or capsular damage
- Reflex inhibition
  - appears to affect small, mono-joint muscles more
- Significant muscle inhibition noted in acute LBP patients
Instability

- Evidence shows serious dysfunction of the stabilizing system in LBP
- Multifidus atrophies in patients with LBP (Laasonen et al. 10-30% smaller on the painful side)
- Switch from type 1 (endurance) to type 2 (quick firing) muscle fibers
Multifidus atrophy
Instability’s vicious cycle

- Instability
- Inhibition and weakness of stabilizers
- Back pain
Increased lordosis
Neutral spine
Break the cycle

- Specific “core strengthening” targets the deficient muscles (multifidi, TA)
- Reestablish the proper neuromuscular sequence = stabilizers contract before big movers
Goals of Physical Therapy

- Stabilize the spine during activities of daily living
- Improve muscles strength, endurance (multifidi, TA, etc.)
- Change muscle activation patterns
Goals of Physical Therapy

- Increase lumbar segmental stiffness
  - without interfering with trunk movement
- Tonic low grade contraction of supporting muscles for joint protection
- Re-establish effective automatic motor patterns
Exercises

- Exercises vary according to the pain generator

- “Unload” the pain generator
  - Extension biased lumbar stabilization for disc pain
  - Flexion biased for facetogenic pain
  - Strengthening of SIJ stabilizers: hip abductors...
Conclusion

- Pain generator may vary
- Pain from whatever cause leads to lumbar “instability” by muscle inhibition
- Retraining stabilizing muscles is essential
Slowly draw in the lower abdominal wall.

**Abdominal Contents**

- Rectus Abdominis (relaxed)
- External Obliques (relaxed)
- Internal Obliques (relaxed)
- Transversus Abdominis (contract)
- Multifidus (co-contract)
- Spine
- Back
Evidence shows no effect of exercise on intensity or duration of acute episode of LBP (Hayden et al.)

Decrease in recurrence and intensity of LBP (mechanical and radiculopathy) (Hides et al.)
What exercise program?

● Dynamic Lumbar Stabilization

● Promoted in the 1990’s by Hodges and Richardson (Queensland physio group)

● Concept not so new (Pilates in 1920’s)
Dynamic Lumbar Stabilization

- Most recent trend in physical therapy and athletics
  - Back pain
  - Increase in performance
  - Injury prevention

- Yoga, Tai Chi, Pilates: all target “core strength”
Dynamic Lumbar Stabilization

- Synonyms
  - Core strengthening
  - Neuromuscular retraining
  - Neutral spine control
  - Muscular fusion
  - Trunk stabilization
Training the Transversus Abdominis

- Bracing technique: patient supine, draws in lower abdomen, tightens pelvic floor, slight anterior pelvic tilt
Training the TA

- Biofeedback for proper TA activation:
  - Therapist experience
  - Pressure device placed beneath lumbar spine
  - Real time ultrasound to visualize TA contraction
Training the TA

- Progress from supine bracing
- Standing
- Sitting
- Bracing during lumbar motion
Dynamic Lumbar Stabilization

- Supine bridging: activates multifidi
- Side bridging: quadratus lumborum
- Dog bird exercise
- Prone bridging
Supine Bridging
Side Bridging
“Dog Bird” exercise
Prone Bridging
Physical Therapy: Progression

- Unstable surface (soft mattress, physio ball)
- External challenges (throwing and catching a ball)
- Advance to sport or activity specific exercise with “core stabilized”
Efficacy of DLS

- Hides et al. Exercise program reversed multifidi atrophy and reestablished symmetry

- O’Sullivan et al. Core strengthening group showed significant improvement in pain and function
Multiple studies showed significant pain improvement in spondylolysis and spondylolisthesis.

Reduces the intensity and recurrence of chronic, recurrent LBP (Hides et al. 2001)
Practices to avoid

- Classic “sit ups”: excessive compression forces

- Heavy strengthening of the extensors: loads are typically too heavy

- Avoid spinal exercises in the first hour of the morning: high hydrostatic pressure inside discs
ED'S 1 SECOND ACUPUNCTURE TREATMENT

Ready?
Goals of DLS

- Increase lumbar segmental stiffness
  - without interfering with trunk movement
- Tonic low grade contraction of supporting muscles for joint protection
- Relearn motor skills required for joint support
- Re-establish effective automatic motor patterns
Transversus Abdominis

- Controlled independently of other abdominal muscles
- Activated prior to other abdominal muscles
- Activation is not direction-specific
  - opposite occurs in back pain patients
Role of Transversus Abdominis

- Proposed mechanisms of action
  - Conversion to a rigid cylinder
  - Restriction of inter-segmental motion
  - Inter-segmental compression
  - Rotatory control of inter-segmental motion
  - Helps stabilize the sacroiliac joint