Lumbar Spine and SI Evaluation

58th Eastern Athletic Trainers Association
January, 2006 Philadelphia, Pa
Michael Higgins PhD, ATC/PT, CSCS
Towson University
“Could be back spasms.”
Components of an Evaluation

- History (very important)
- Observation
- Palpation
- ROM
- Special Tests
- Neurological Tests
Importance of History

- Establish a pattern
  - What brings on symptoms?
  - What relieves symptoms?

- Type of symptoms present
  - Sharp, stabbing
  - Dull, aching
  - Stretching
  - Pinching
Importance of History

● Intensity of Symptoms
  – Pain levels

● Location of Symptoms
  – Rule in/out potential causes
  – Add focus to your evaluation
Neurological Examination

- Indication - Symptoms Below the Knee
  - LE Sensory Testing
  - Muscle Strength Assessment
  - Reflex Testing
  - Nerve Root Testing
  - Babinski testing
  - Clonus
Postural Observation

- Presence of a Lumbar Shift
  - Named by the shoulder
Pelvic Translocation

- Performed Bilaterally
  - Assess Symptom response
  - Worsen
  - Improve
  - Status Quo
Ligaments

- Anterior Long (ALL)
- Posterior Long (PLL)
- Supraspinous
- Ligamentum Flavum
- Interspinous
- Intertransverse
Biomechanics:

- C7/T1
- T12/L1
- L5/S1
  - Facet capsules are strongest at transitions to resist sheer
Motion Segment

- Superior Vertebrae
- Intervertebral Disc
- Inferior Vertebrae
- Facet Joint
  - zygoapophyseal
  - apophyseal

*Always name superior vertebrae on inferior
Spinal Motion
6 degrees of freedom
Facet Joints

- Guide motion
- Limit Anterior Sheer and torsion
- Load Bearing
- Superior contribution (inferior articular process)
- Inferior contribution (superior articular process)
Facet Joints

- Facets are oriented in the sagittal plane (flexion and extension occur in this plane)
- ROM increases from L1 - L5. Most mobility is at L5 - S1
Facet Orientation Dictates Movement

- Cervical 45° off sagittal
  - Ext and Rot
- Thoracic Coronal
  - Lateral flexion
- Lumbar (Sagittal)
  - Flexion/Ext
Arthrokinematics:

- **Flexion**
  - upper facets glide up and forward
- **Extension**
  - upper facets glide down and backward
- **Sidebending(R)**
  - the left facet glides upward while the right glides downward
Arthrokinematics:

- Flexion
- Extension
Coupled Motion

- Motion about 1 axis occurs in conjunction with motion about another axis
- Rotation of the spine is associated with sidebending
Coupled Motion

- **Cervical**
  - SB and Rot. ipsilateral
- **Thoracic**
  - Upper follows cervical
  - Lower follows lumbar
- **Lumbar**
  - SB and Rot. Contralateral
  - (least amount here)
LUMBAR MOTION TESTING

- Assess lumbar range of motion for
  - quantity of motion
  - quality of motion
  - provocation of symptoms
Movement Testing

- Assess for a Lumbar Shift
  - Pelvic translocations PRN
- Single Motion Testing
- Repeated Motion Testing
- Alternate Positioning (if needed)
Movement Testing Results

- Symptoms **worsen**: Paresthesia is produced or the pain moves distally from the spine
  - Peripheralizes
- Symptoms **improve**: Paresthesia or pain is abolished or moves toward the spine
  - Centralizes
- **Status quo**: Symptoms may increase or decrease in intensity, but no centralize or peripheralize
Lumbar Sidebending

- Determine Capsular/NonCapsular
- Perform Movements
  - Pelvic Translocation
  - Flexion
  - Extension
- Status
  - Worsen
  - Improve
  - Status Quo
Pelvic Translocation

- Assess Status
  - Worsen
  - Improve
  - Status Quo
Flexion

- Assess Status
  - Worsen
  - Improve
  - Status Quo

- Note ROM limits
- Quality of Motion
Extension

- Assess Status
  - Worsen
  - Improve
  - Status Quo

- Note ROM limits

- Quality of Motion
Sidebending/Worsen

- Symmetrical Sidebending
  - Cyriax Capsular Pattern
- Do Repeated Motions Worsen
  - Traction Syndrome
  - If Extension worsens begin in flexion
  - If Flexion worsens begin in extension
Sidebending/Worsen

- Asymmetrical Sidebending
  - Cyriax Non Capsular Pattern
- Do Repeated Motions Worsen
  - Traction Syndrome
Sidebending/Improve

- Symmetrical (Capsular)
- Do Repeated Motions Improve?
  - Flexion Syndrome
    - ACTIVE FLEXION
  - Extension Syndrome
    - ACTIVE EXTENSION
Sidebending/Improve

- Asymmetrical (Non Capsular)
- Do Repeated Motions Improve?
  - Lateral Shift Syndrome
    - Active Pelvic Translocation
Sidebending/Status Quo

- Symmetrical (Capsular)

- Mobilization Syndrome
  - Passive Flexion General
  - Passive Extension General
Sidebending/Status Quo

- Asymmetrical (Non capsular)
- No Pattern
  - General Mobilization
- Specific Pattern
  - Specific Mobilization
Opening Restriction

- **Forward Flexion**
  - Deviation to the side of the Restriction

- **Sidebending**
  - Limitation to the contralateral side

- **Combined Flexion and Contralateral SB’ing**
Maximal Opening

- Flexion Mobilizations
- Flex LE to desired levels
- Posterior Glide of LE on segments
Opening Mobilization

- Flex to desired level
- Lift Bilateral LE to ceiling to gap/open
- Opening on side on table
- Progression - Laterally flex table
Closing Restriction

- **Extension**
  - Deviation to contralateral side

- **Sidebending**
  - Limitation to the ipsilateral side

- **Combined Extension and Ipsilateral SB’ing**
Palpation

- Lumbar spinous process
- lumbar transverse process
- paravertebral muscles
- iliac crest
- ASIS
- PSIS
- pubic symphysis
- greater trochanter
- ischial tuberosity
- gluteals
- Piriformis
- sciatic notch and nerve
Boney Landmarks

- Spine of L1
- Spine of L2
- Transverse process L3
- Spine of L3
- Tip of transverse process L4
- Spine of L4
- Spine of L5
- Spinous tubercles of sacrum
- Articular tubercle
- Tip of coccyx
Facet Joints

- Zygapophyseal joint L1/L2
- Zygapophyseal joint L2/L3
- Zygapophyseal joint L3/L4
- Spine of L4
- Zygapophyseal joint L4/L5
- Spine of L5
- Zygapophyseal joint L5 and sacrum
Muscles to Palpate

- Quadratus lumborum
- Psoas major and minor
- Iliacus
- Erector spinae
- Quadratus lumborum
Special Tests

- SLR
- Kernig's
- Slump
- Valsava
- Milgram's
- Hoover's
- WSLR
- Spring
- PIVM
- Single leg stance
- Scoliosis
- Femoral Nerve
- Leseague's Test
Acute Lumbar Treatment

- Diagnosis Can Lead Intervention
- Classification Dictates Treatment
- Maximize Treatment Goals; In Clinic, Home, and Return to Play
Sacroiliac Joint

- Definition of the functional pelvic girdle

- Consists of 11 joints
  - One L4/L5 intervertebral joint
  - One L5/S1 intervertebral joint
  - Four L4-S1 facet joints
  - Two sacroiliac joints
  - Two hip joints
  - One symphysis pubis

- The pelvic girdle is a closed osetoarticualr ring
OSTEEOLOGY

- Innominate
  - ilium
  - ischium
  - pubic
- Sacrum

The pubic symphysis is a cartilaginous joint uniting the left and right pubic bones.
LIGAMENTOUS SUPPORT

- Intrinsic ligaments
  - Anterior SI ligament
  - Short posterior SI ligament
  - Long posterior SI ligament
  - Posterior interosseous
LIGAMENTOUS SUPPORT

- Extrinsic ligaments
  - sacrotuberous
  - Sacrospinous
  - Iliolumbar
- Pubic symphysis
Muscles that cause anterior rotation
- rectus femoris
- Sartorius
- hip adductors
- quadratus lumborum
- iliopsoas
MUSCLES

- Muscles that cause posterior rotation
  - hamstrings
  - glutes
MUSCLES

- Muscles that effect the sacrum
  - piriformis
  - glutes
Muscles
BIOMECHANICS

- Ilial motion:
  - GAIT:
    - heel strike - posterior
    - foot flat - neutral
    - midstance - anterior
    - pushoff - neutral
    - midswing - posterior
BIOMECHANICS

● Sacral motion:
  – flexion/extension
    (nutation/counternutation)
  – rotation
MECHANISMS OF INJURY

- Trauma
- Leg length
- Ligamentous laxity
- Muscular imbalance
- Altered gait
History

- Athlete may complain of:
  - unilateral SI or sulcus pain
  - pain with walking
  - pain with stairs
  - pain that does not go away with rest
  - pain with forward bending
Palpation

- Lumbar structures
- ASIS
- PSIS
- Sacral Sulcus
- ILA

- Sacral Borders
- Ischial Tuberosity
- Iliac ridge
- Pubic tubercle
Pelvic Assessment

- PSIS Symmetry in Sitting
- Standing Flexion Test
- Prone Knee Flexion Test
- Supine to Sit Test
Pelvic Assessment Results

- 3 of 4 Tests Composite
  - Reliability $k=0.88$
- If (-) Palpate Iliac Crest Heights
  - Correct difference with heel lift
- If (+) SIJ Manipulation Indicated
  - Manual Techniques
  - Manipulation
PSIS Levels

- One side higher or lower compared to the opposite side
STANDING FORWARD FLEXION TEST

- + restricted side moves first

- Palpate PSIS’s and ask athlete to bend forward slowly beginning with their head. Arms should be relaxed
SUPINE TO LONG SIT TEST

- anterior rotation -- leg will appear to shorten
- posterior rotation – leg will appear to lengthen

- Have athlete supine and lift buttock off of table. Passively assist athlete’s legs to a straight position. Palpate medial malleoli position. Have athlete sit up without using hands to a long sit position and assess relative position of medial malleoli.
Special Testing
Prone Knee Flexion Test

- **Prone Knee Flexion Test**
  - Start Position
- **In prone lying**
- **Palpate posterior to lateral malleoli**
- **Observe leg length**
Pelvic Assessment III

- Prone Knee Flexion Test
  - End Position
- Knee flexed to 90
- Positive Test
  - Observe change in heel position
  - Start to Finish
Other SI Tests

- Gillet’s
- Faber’s
- SLR
- Sitting Flexion Test
- Thomas Test
- Ober’s Test
COMMON INJURIES TO THE SI JOINT

- Anterior Innominate
  - Objective findings on the involved side:
    - ASIS inferior and posterior
    - PSIS superior and anterior
    - pubic tubercle inferior
    - Forward flexion test PSIS moves first and farther
    - Gillet’s test PSIS moves less
    - Supine to long sit: leg may shorten
Anterior Innominate

**CAUSES:**
- golf drives (right innominate rotates anteriorly at the end of the swing)
- traumas involving hypertension of the hip or lumbar spine
Objective findings on the involved side:
- PSIS inferior and posterior
- ASIS superior and anterior
- pubic tubercle superior
- Forward flexion test PSIS moves first and farther
- Gillet’s test PSIS moves less
- Supine to long sit: leg may lengthen
Posterior Innominate

- CAUSES:
  - repeated unilateral stance
  - fall on ischial tuberosity
  - leg length discrepancy
  - unilateral hamstring tightness