Evaluation of Lumbopelvic/Core Stability
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Overview and Objectives
• Focus is on examination/assessment of lumbopelvic/core stability
• Define core instability, stability
• Examine and assess the local and global stabilization systems
• Evidence based exam for clinical signs of instability
• Determine if stabilization treatment necessary/beneficial

What is Core Instability?
• Previously described as ligamentous laxity that produced excessive movements in an intervertebral joint at endrange

Radiographic Instability
• Age <37 years
• Total extension > 26 degrees
• Any hypermobility of the lumbar spine
• Lack of hypomobility of the lumbar spine*
• Lumbar flexion >53 degrees*
  • +L.R. =12.8; -L.R. =.72
  • Fritz et al. Eur Spine J 2005

Clinical Instability: Panjabi
• Neutral zone of Z joint stability: “a measure of spinal laxity in the vicinity of the neutral position.” Abnormal increase in size of the neutral zone leads to pain secondary to strain
• Inability of the spine under physiological loads to maintain its normal pattern of displacement to avoid neurological damage or irritation, development of deformity, and pain

Clinical Instability: Panjabi’s Model of Core Stability
Goal: Maintain/recover neutral zone after trunk perturbation during activity both anticipatory and reflexively reactive
Stability of the SI joint

• Closed pack position: sacral flexion and posterior innominate rotation
• Max ligamentous tension and joint congruency
• Facilitates maximum load bearing and load transfer
• Combination of this and muscular control creates a self locking mechanism

Local Stabilization System

• Pelvic Floor
• Transversus Abdominus
• Multifidus
  - rapid atrophy within 24 hrs of pain onset/recovery not automatic
  - Multifidus fat infiltration and atrophy strongly associated with LBP
  - Delayed firing in deep core with arm movements with h/o LBP
  - Higher recurrence rates of LBP in a control vs stab group at 2-3yr f/u.

Local Stabilization System

• Diaphragm
• Psoas
• Internal Oblique
• Rotatores, Musculi Interspinalis, Intertransversarii mediales and laterals

Global Stabilization System

• Long erector spinae
• Rectus Abdominus
• External Oblique
• Longissimus thoracis

Hip Musculature Contributions

• Gluteus maximus
  - stab pelvis/trunk through tension in thoracolumbar fascia
• Gluteus medius
  - frontal plane stability
• Hip Ers:
  - precise eccentric control with gait to control IR moments
• Assist with SI locking for load transfer

Clinical Signs of Instability

• Lumbar CPR: Stability Classification
  1. Age < 40
  2. Aberrant movement present
  3. SLR > 91 average
  4. (+) Prone instability test
  - K= .80, ICC.94
  - responding to stab program: +LR 1.7, -LR .48
  5. FABQ PA>8
  6. Segmental hypermobility
  ≥3 findings = +LR 18.8
Clinical Signs of Instability
1. Lumbopelvic rhythm
2. Pattern of SB/rotation toward paraspinal bulk
3. Passive hip ROM
4. Active leg raise(sagittal)
5. Active leg raise(frontal)
6. Bent knee fall out

3/6 + findings used as criteria for stab training with sig improvements in pre-post testing pain and disability¹⁰,¹¹

Subjective Examination
• Age <40, FABQ PA > 8
• H/o chronic, recurrent LBP with frequent episodes of acute attacks
• Inconsistent symptoms
• C/o giving away, catching, locking episodes
• Manipulation provides short term relief only
• Poor outcomes with general exercise

Subjective Examination
• Increased symptoms with:
  -sustained wbing positions
  -static positions
  -sharp pain with quick movements
• Decreased symptoms with:
  -manipulation-short term
  -NWB or external support

Objective Examination: Inspection
• Paraspinal fullness greater then 1/2in on one side
  -pain and limited SB toward and increased rotation towards bulk
• Reversal/Alteration of lumbopelvic rhythm
• Aberrant movement
  +(++) Gowers sign
  -hinging, fulcruming

Objective Examination: Inspection
• Single leg squat test (repetitive)
• Compression test
  -superior to inferior force applied to spine through shoulders
  -look for points of hinging
• Decreased pain with deep contraction during provocative movement
  (ex: SLR, Fabers, quadrant)

Objective Examination: AROM
• Forward flexion test
  -standing flexion, PSIS best palpated at endrange
  -cranial PsIS on painful side indicates fixation
  -cranial PsIS on nonpainful side indicates hypermobility of involved side
  -K= .32-.55

Winkel et al. 1997
Objective Examination: AROM

- **Stork Test**
  - resting standing position
  - palpate PSIS on stance leg and sacral base/L5, patient completes uninvolved hip flexion
  - PSIS should move posterior and slightly laterally on stance leg
  - positive test: PSIS moving ant-sup.
  - denotes sacral unlocking and altered load transfer

(+) Stork Test with Unlocking

(-) Stork Test with Sacral Locking

Objective Examination: AROM/PROM

- **PROM hip flexion**
  - positive if pain before 120 flexion
- **SLR for average ROM:** >91
- Motion control testing
  - ASLR, BKFO
  - SL SLR
  - Prone SLR
  - With and without compression

Objective Examination: AROM/Motion Control Testing

- **Active SLR**
  - supine, complete active SLR 8 inches from table without compression
  - assess: stability of pelvis and difficulty/provocation for lifting
  - reliability: ICC .83
  - validity: ID post pelvic pain since pregnancy sn .87, sp .94
  - altered kinematics of diaphragm and pelvic floor present with + test

Objective Examination: AROM/Motion Control Testing

- **Active SLR**
  - retest adding compression: (+) is dec difficulty/pain
  - anterior ilium: pelvic floor and TA
  - posterior ilium: sacral multifidus
  - pubic ramus: hip add and/or rectus abdominus
  - thorax to pelvis: obliques
Objective Examination: AROM/Motion Control Testing

- Bent knee fall out
  - supine hooklying
  - eccentric lowering into hip abduction/ER
  - positive test: pelvic rotation during first 50% motion
  - if symptoms increased, pelvic stab. should improve pain
  - reliability: K=.38-.60

Sidelying SLR Poor Form Video Clip

Objective Examination: AROM/Motion Control Testing

- Sidelying SLR
  - sidelying position with bottom leg slightly flexed, top leg extended
  - test is hip abduction with 10 degrees hip extension and slight ER
  - look for substitutions: flexing hip and rolling or hiking of pelvis early in motion

Objective Examination: AROM/Motion Control Testing

- Prone SLR
  - prone position, lift leg 8-10 inches off table
  - assess neutral spine and firing pattern: TA, ipsilateral glut/H5, contralateral multifidus f/b ipsilateral, contralateral ES f/b ipsilateral
  - k=.72-.76 for agreement on deviation in frontal, transverse, sagittal plane
  - gluteus maximus time to contract reduced with compression

Prone SLR Bad Form Video Clip
Objective Examination: PROM

- Lumbar and SI PA glides
  - reliability: poor agreement K=.04 with MRI
  - ID of osseous structures K=.53
  - motion assessment K=.17
  - pain assessment K=.42
  - determining hypomobility K=.71
  - determining hypermobility K=.29

Objective Examination: PROM

- Prone Instability Test
  - prone with hips over edge of plinth, feet on floor.
  - 2 parts: PA glide, repeat PA glide with feet off floor
  - positive if second test less painful
  - reliability: K=.80, ICC =.94
  - validity: likelihood of pt responding to stab. program
    - (+)LR= 1.7, -LR .48

Objective Examination: PROM

- Prone Instability Test Part I and II

Objective Examination: PROM

- SI provocation testing cluster
  - immediate pain=inflammation, systemic condition, hypermobility
  - delayed pain = stiffness, up to 2 min hold
Objective Examination: Motor Control and MMT

• Assess the local system
  - for volitional activation and endurance
  - if volitional control noted then check for reflexive co-contraction

Objective Examination: Motor Control and MMT

• Pelvic Floor
  - pt in hooklying palpate for activation with ulnar aspect of hand
  - cue for kegels, stopping flow of urine

Objective Examination: Motor Control and MMT

• Transversus Abdominus
  - pt in prone, stabilizer set to 70mmHg
  - inferior edge of stabilizer at level of ASISs
  - drawing in with relaxed normal breathing
  - stop test if inability to hold x10 sec for 10 reps at a given level
  - goal ≤ 64mmHg (range 68-60mmHg)

Objective Examination: Motor Control and MMT

• Multifidus
  - same position as TA test, palpate in the gutter just adjacent to spinous process (check different levels)
  - cues include: swelling, attempt to extend the back without moving, cone concept
  - if they cannot activate...try unilateral isometric HS activation near full extension engage

Objective Examination: Motor Control and MMT

• Check the Reflex
  - if volitional contraction noted, check pelvic floor-TA and TA-multifidus reflexive activation

Objective Examination: Motor Control and MMT

• Assess the global system***athletes
  - trunk endurance testing (McGill)
  - sit up sustained, Biering-Sorensen, side bridge, compare to norms and ratios
Objective Examination: Motor Control and MMT

- Hip adductor/abductor MMT
  - normal testing method
  - disproportionate weakness of adductors to abductors indicative of hypermobility (irritation/displacement) of pubic symphysis
- Gluteus maximus and hip ER MMT

References


