RETRAINING OPTIMAL DYNAMIC FUNCTION OF THE HIP REGION

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Muscular System -
A Major Dynamic Support.

- Hides, 1997
- Hodges, 2000, 2004
- Panjabi, 1994, 1995
- Stige, 2004
- Vleeming, 2000
- McGill, 2004

Solving the puzzle of ongoing pain and dysfunction
- Underlying causes of injury.
- Diagnose source of dysfunction:
  - Motor control L/S, SIJ and hip.
  - Passive joint form closure +/- inflammation of the L/S, SIJ and /or hip.
  - Neural compromise/ hypersensitivity.
  - Bone, ligament, tendon compromise.
- Virtual body changes, including proprioception, postural sway, balance and beliefs/coping strategies.

Altered pelvic and breathing motor control strategies
- Subjects with SIJ pain displayed increased minute ventilation, decreased diaphragm excursion and increased pelvic floor descent.
- Pelvic stability was enhanced via manual compression thru the ilia, reversing these changes. (O'Sullivan et al. 2001a)
- ASLR a valid test combined with US to assess automatic pelvic floor function. (Lee, 2004)

Motor control of the lumbo/pelvic/hip complex
- Complex movement
- Interrelated kinematics
- Complex internal and external forces
- Stabilising muscles: tonic strength/ endurance, phasic muscles: finely tuned timing of activation and healthy tendons.
- Finely tuned coordination via the CNS.
- CNS must consider input from the periphery against internal model.

Proprioception driving muscle recruitment
(O'Sullivan et al. 2005)
Form closure for optimal pelvic/hip function. (Kapandji, 1974; Vleeming 1995; Exercises 1999; Lee 2001; Hungerford 2004)

The role of Proprioception in muscle control
- Muscle receptors play a significant / perhaps primary role in joint position sense (Taimela et al., 1999).
- Body sway important to balance reactions.
- Postural sway initially opposite direction to the reactive motion (Hodges 2004).

Lumbo pelvic link to groin pain.
- Delayed onset of TrA in chronic groin subjects (Cowan et al. 2004).
- Passive compression of SIJ adductor force in 39%, isometric adductor pain in 68% (Mans 2008).
- 89% athletes with pubic bone oedema returned to sport with lumbo pelvic program. (Verrall et al. 2007).

Pain adaptation model
(Lund et al. 1991)
- With pain, motor control will limit movement (Mose, 2007).
- Limitation of velocity and greater co contraction.
- Co contraction:
  - ↑ spine compressive forces
  - ↑ spinal stiffness
  (Hodges and Smiley 2009).

Groin pain and stability rehab.
- 2007, Br J of Sp Med; Holmich: Long standing Groin pain (65% football, 18% runners).

Stimulating postural equilibrium
- If absent, ↑ forces and co-contraction in the spine and harder to control dynamic stability. (Mose 2004; Hodges 2004)
- Induced LBP, ↓ L/S Movt compensated by ↑ hip and ankle movement. (Mose 2004; Hodges 2004)
Preprogrammed compensations in postural sway

- Hip strategy is complex CNS task.
- Dependency but also disturbance of visual cues.
- Hip strategy poor balance with small base and eyes closed (Mok et al. 2004 & 2007).

Thoraco Lumbar Fascia effects on Segmental Control.

- 10N of force thru Lat Dorsi and/or glut max increased stability to L/S and SIJ bilaterally (Bregg, 2004).
- 10% Glut Max co contraction with Multidus and pelvic floor increased stability of the SIJ three fold (Vleeming 1995).
- Superior glut max inserts into ITB and continuous with multifidus fascia.
- Glut max deep fibres cross SIJ to PSIS, lateral sacrum and ischial tuberosity.

Virtual body changes to protect against perceived threat of pain

- Inaccurate virtual body creates changes in muscle recruitment, balance reactions and less variable movement strategies.
- Decreased ability to perform reposition tasks and increased reaction time (Mok et al. 2007).

Global muscles aiding upright posture

- Compression forces required to control shear forces in the SIJ, provided by large global muscles working in discrete synergistic groups (Snijders et al. 1995, Vleeming, 1995 a&b, 2000).
- In subjects with LBP/SIJ pain, biceps fem early activation bilaterally, inhibited Glut max ipsilaterally (Hungerford, 2003; Gibbons, 2004).

Effects of beliefs & coping strategies on the virtual body

- Threat value of pain has the most direct impact on posture & motor control.
- Changes continue despite resolution of pain, anticipation of pain.
- Resolver/non resolver personality (Mokley et al. 2004).
- Possible reorganisation of sensory Cortex (Mokley and Holgers 2006).

Posterior longitudinal sling

(Sim, 1899)

- Multifidus
- Sacrotuberosus ligament
- Conjoined Tendon of Semitendinosus and Long Head of Biceps Femoris
- Semimembranosus

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**Posterior oblique sling** (DeRose, 2001)

- Latissimus dorsi
- Thoraco-lumbar fascia
- Gluteus maximus

**Dynamic stability is not rigidity**
- Traditional models ignored the importance of movement.
- ↑ Spinal stiffness may stimulate further trauma along the kinetic chain e.g. hip and lower limb.
- ↑ displacement of the whole body during reactive movements from the limbs. (Meesey and Hodges 2008)

**Gluteal amnesia**

- Occurs with L/S & SIJ dysfunction and results in ↓ SIJ compression (Cholewicki 1998).
- With ↑ Hams, ↑ psoas/fliacus activity to resist reaction forces (Mckee 2004).

**Changes in movement patterns with changes in speed**

**Walking:**
- Increasing speed
- ↑ Lumbo-pelvic movement, ↑ abdo and Mult. activity (Saunders et al. 2005).

**Running:**
- +3m/s:
  - ↑ Hip flexion, ↓ decreased hip extension.
  - (Gibbons et al. 1999)

**The anterior sling** (Lee, 1959)

- Internal and external oblique fascia
- Inguinal Canal and inferior fascia of external oblique
- Adductor Longus Fascia connects with fascia of Pubic symphysis and contra lateral antero lateral oblique's.

**Changes in motor programming with running speed**

**Running +3m/s:** TrA phasic while airborne, increased RA and EO activity.
EO concentric in walking, eccentric in running (Saunders et al. 2004 & 2005).
Retraining must be movt. and speed specific.
Functional training: aim to train movement, not a muscle

**Functional Goal**: Generate quick appropriate strength throughout complex movements patterns, while preserving balance, joint stability and avoid injury risks. (McGil 2004)

1) Intra muscular (I & II) fibre coordination.
2) Intermuscular coordination between muscle groups, utilising facial connections.

**Intervention for optimising proprioception and internal model**
- Retrain internal model or Virtual body.
- Retrain feed forward muscle recruitment by balance challenge.
- Retrain smooth concentric-eccentric transition.
- Utilise Video analysis/ mental practice to excite mirror neurons.

Functional training goals (contd)

3) Train the neuromuscular control systems in joint angle, speed and contraction specific postures.

4) Encoding motor patterns for ability to react to changing environment by balance challenges. Add cognitive loading.

5) Progress proprioception training to labile surfaces/loads. Plyometrics to develop speed. (McGil 2001)

A Functional Dynamic Graded Stability System. (Wisbey-Roth 1999)

Cognitive task loading

- Adding in cognitive tasks
  - e.g. repeating months of year backwards while doing motor control task.
  - task while juggling ball
  - partner tasks with ball/Theraband and talking.
  - when fatigued after training
  - Watching TV

Grade 1: Virtual exercises

- Long, gentle contraction of key stabilising muscles to retrain effective injury prevention muscle patterns.
- Exercises performed in static and stable postures so can be commenced early in rehab.
**Grade 2**
- Progress balance and functional control of core/spinal stabilisers.
- Building endurance of stabilising muscles while slowly moving arms or legs.
- Differentiation of hip from lumbo pelvic movement.

**Grade 3**
- Dynamic 3D stability of the spine and hypertrophy of muscle fibers.
- Retrain concentric/eccentric contraction transition with muscles working in dynamic slings.
- Retraining weight shift under load, to challenge balance.

**Grade 4**
- Dynamic, adaptable stability in loaded, joint angle and speed specific patterns.
- Retrain feed forward muscle recruitment by balance challenges
- Retrain ankle stability and lumbar movt. in postural sway and virtual body.

**Grade 5**
- Whole body functional postures under load to build dynamic endurance and performance enhancement for work and recreation.
- Ideal for injury prevention of leg, back, hip, shoulder for heavy manual workers.

**Eccentric and dynamic movement retraining.**
- Retrain eccentric function of key muscles in loaded, whole body movement and speed specific postures.

**Activation pattern fine tuning**
- Utilise Video analysis / mental practice to optimise technique driven muscle recruitment.
**Conclusion**
- Address proprioceptive and virtual body changes occurring with L/S & SIJ pain.
- A focus on rigid stability may result from trauma along the distal kinetic chain e.g. hip and lower limb.
- Inflammation or failure in passive structures may also need to be addressed.

**Grade 1 US retraining of Iliacus**

**Goal: Optimal dynamic function**

**Real Time US retraining of Iliacus**

**Iliacus and deep hip stabilisers/TFL**
- Grade 1a: isometric contraction sitting
- Grade 1b: Side lying concentric/eccentric

**Wisbey-Roth Core Stability Grading System**
- Retraining Hip-Lumbo-Pelvic control for standing, running activities.
Iliacus and deep hip stabilisers/TFL

Grade 2: 1 legged wall squat

Grade 3: 1/4 Squat position, hips stable, forward/back rotation with medicine ball.

Grade 4: 1 Legged stance, ball on wall at thigh level, foot closest to wall off ground. Leg movement back & forth.

Glut Max/Hamstrings

Grade 1a: Prone fig. 4 (hip extn.)
Grade 1b: Sitting (hip flexn.)

Glut Max/Hamstrings

Grade 2: Wall Squat
Glut Max/Hamstrings
Grade 3: ¾ squat, hips stable, forward/ back rotation with medicine ball

Multi/Ta
Grade 1a:
4 point kneeling
Grade 1b:
Sitting

Glut Max/Hamstrings
Grade 4: Lunges

Multi/TA
Grade 2: Squat with Ball
Grade 3: Supine weight shift side to side

Glut Max/Hamstrings
Grade 5: Russian Twist on single leg.

Multi/TA
Grade 4: 4pt kneel with resisted hip extension via theraband
Increased speed and joint angle specific.
Multi/TA
Grade 5: Theraband resisted kicks

Grade 1 In greater hip extension
Isometric contraction (min 10 sec) without compensatory movement of the core, in a position aimed to facilitate the stabilising role of key muscles.

Retrain Hip-lumbo-pelvic control for cycling.

Grade 2
in greater hip extension. Slow and controlled

Grade 1 Isometric control in sitting, hip flexion

Grade 2 Hip side to side movement in hip flexion.

Grade 3 3D movement of lumbo-pelvic hip region, requiring concentric-eccentric muscle activity
Grade 4 combining hip flexion and extension while performing joint angle, speed and contraction specific movements of the limbs.

Aim: Optimal dynamic function

Visit www.bbclasses.com.au

Grade 5 Eccentric and dynamic movement retraining.

Grade 5 Activation pattern fine tuning

For more information and resources select the "PROVIDERS" tab on:

www.bbclasses.com.au
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