Current Concepts in Muscle Patterning Instability

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Glenohumeral Instability

A fine balance between the static & dynamic structures

Muscles can contribute to instability as well as stability

Muscle Activation

• Pectoralis Major & Latissimus Dorsi activity results in anterior translation (Labriola et al 2005; Malone et al 2006; Konrad et al 2006)

• Different role for the lower & upper portions of subscapularis in anterior instability (Gerber et al 2008)

• Abnormal patterns in Deltoid, rather than the rotator cuff in MDI compared to normal subjects (Morris et al 2004)

• Inappropriate activation of Pectoralis Major & infraspinatus in MDI (Barden et al 2005)
Stanmore Triangle

- Capacity for complexity
- Continuum of different aetiologies
GHJ Instability

• Abnormal muscle activation can act in the presence of normal structure and vice a versa (Malone et al 2004)

• II/III Axis proves a challenge
  – Is abnormal muscle patterning cause or effect?

• Rotator cuff strengthening regimes alone are not sufficient to restore stability (Malone et al 2004)

• Rehabilitation of the kinetic chain appears to eliminate inappropriate muscle activation
Inappropriate Muscle Patterning

**Multifactorial**

- Environmental – sport/age/occupation
- Biomechanics – laxity/muscular imbalance/scapula-humeral rhythm congenital anomalies
- Genetics – Heritable connective tissue disorders (HCTs)
- Hormones – females > males
- Psychological – fear/avoidance, stress, anxiety
Muscle patterning
“A Symptom not a Diagnosis”

Peripheral generators
Mechanoreceptors / JPS
Pain, structural damage,
Muscle imbalance
(Myers & Lephart 2002)

Neural control
Central postural mechanism
Higher cortical control
(Barrett et al 2000)

Psychological
Fear / avoidance
Stress, anxiety
Principles of Treatment

• Regain normal motor patterns prior to strengthening

• Correcting posture and trunk stability helps eliminate inappropriate pec major & lat dorsi activation (Hodges et al 1999, Kibler 2001, McMullen & Uhl 2000)

Sensory Feedback

• Motor learning can be enhanced with sensory feedback, biofeedback techniques can be more effective than strengthening alone (Beall et al 1987, Reid et al 1996, Kiss et al 2001, Magarey & Jones 2003)

• Biofeedback techniques can help to voluntary influence muscle activity (Simons & Mense 1998)

• Techniques can include mirrors, EMG, pressure, audible feedback.
Scapula Dyskinesis

- Recognising the importance of scapula to humeral and trunk orientation.

- Is dyskinesis primary or secondary?

- Scapula inclination may be cause for humeral instability

- Pure inferior displacement a challenge (Central deltoid/RC inhibition)

- Bi-directional displacement easier, tends to be more postural/scapula related.
Complexity of Cases

- **Collagen deficiency** – HCTs (EDS/JHS)
- **Complex pain** - neurogenic, arthrogenic, myogenic, psychogenic
- **Central control** - involuntary muscle spasm, dystonias
- **Persistent displacement** - Over activation of more than one muscle, central inhibition of RC & Deltoid.
The Role of Botulinum Toxin

• Initial experience shows the role of BoTox to be effective in resistant cases (Sinha et al 1999, Gibson et al 2004, 2008).

• Helps in inhibiting the overactive muscle tone. However can reduce function if reliant on abnormal tone.

• Not so useful where the problem is more of central RC and deltoid tone rather than over activation of muscles

• May help with pain relief & allows a window of opportunity to re-pattern the shoulder.

It is important not to recognise it as an end solution as it may not restore cortical re-mapping.
Aims of Treatment

- **A MDT approach**
  - Neuro-musculoskeletal/psychosocial approach

- **Diagnostics**
  - Arthroscopy
    - To assess for structural aetiology
  - Electrophysiology
    - Evaluate inappropriate muscle activation
  - Pain review
    - LA into GHJ, BOTOX, guanithedine/neuropathic drugs

- **Therapeutic Interventions**
  - Sensory feedback/central postural control/BOTOX/Pain management strategies
MDT Assessment

- Paediatricians
- Electrophysiology
- Pain Clinic
- Physio
- Psychology
- O.T
- Orthotics
- Arthroscopy
- Imaging
Future Work

Understanding the III/II Axis – which cases should we operate?

Understanding pain – how do we differentiate the source?

Understanding muscle activation when does it play a role in Pathology?

Understanding scapula dyskinesis – classifying it further?

Does specificity of muscle activation matter?
Evolution

(or is it?)

THANK YOU