Positional Fault
Fact or Fiction?

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Evolution of Man

Evolution of Orthopaedic Manual Therapy

MWMs …
Manual Therapy Concepts

- Explanations for treatment success?
- In the relatively short history of the field of manual therapy, there are many examples

Neuromuscular models & ‘Joint’ dysfunction models

- “trigger point / myofascial release” Travell
- “Strain/ Counterstrain” Jones
- “central sensitization” Woolf 91
- “tracking problems” McConnell
- “displaced instantaneous axis of rotation” White-Sahrmann
- “pseudomyostatic contractures” Cummings 85
- “Obstruction/ restriction” – Cyriax
- intervertebral disc derangement phenomenon – McKenzie
- vertebral subluxation theory - Palmer

‘Hard working’ Vicenzino (Toby Hall 2009)

Neurophysiological
and / or
Biomechanical

Vicenzino Chicago 2009

Biomechanical

Positional fault hypothesis ??
Positional fault hypothesis

Mulligan’s Theory

- Positional fault theory Mulligan 95
  - Joint alignment alteration due to injury or chronic/poor arthokinematics
  - Inconsistent bony congruencies that occur after strain or injury
  - Minor / subtle: Neither palpable nor evident on imaging?
  - Movement restrictions - pain results
  - Responsible for movement restricted and painful joints

Positional fault hypothesis

• MWM relocates joint in correct alignment
• Therefore immediate improvements in pain and ROM
• Mulligan’s explanation … Is it that simple?

Positional fault hypothesis

PFH - Evidence

- Clinical success warrants its use (Mulligan)
- Mulligan encouraged others in the field to investigate its merit
- Adequate in substantiating the PFH?

Positional fault hypothesis

PFH - Evidence

- Clinical efficacy of MWMs underpinned by reasonable level of evidence (as Bill mentions!)
- Less evidence to support the presence of positional faults
- Is there evidence that practitioners are able to detect positional faults in their clinics with current level of technology?
Investigation of PF

To date the direct MWM research has focused on the inferior tibiofibular joint.

The proposal that the fibular exhibits an anterior (or posterior) positional fault

Articles grouped by mode — method of measuring positional fault

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Investigation of PF ankle sprain / fibula

Fig. 1. Anterior Malleolar Index (AMI) for determination of fibular position. Distal AMI values correspond to over-caudal fibular position.

Berkowitz & Kim 2004

Histogram demonstrating bimodal distribution of AMI values in instability and control groups.

AMI values in patients with ankle instability cluster around 20°.

AMI values in control subjects cluster around 10°.
Investigation of PF ankle sprain / fibula

- Differences in methodology of measuring fibular position

- Axial malleolar index – false impression of posterior fault due to variation of position of talus versus

- Relationship of fibula to tibia

- Recommendation: fibula position should be described in relation to tibia

(Hubbard 2008)

Investigation of PF ankle sprain / fibula

Anteriorly positioned fibula

- Injured 14mm vs Normal 16mm

- As Bill mentioned 2-4mm difference & reliable method

- Thus injured more anterior

(Kavanagh 1999)

Support for positional fault of fibula

- Versus Posteriorly positioned fibula (Eren 2003, Berkowitz 2004)

- Inconsistent with Mulligan’s PFH versus

Investigation of the position of the fibula in relation to the tibia by using fluoroscopy, CAT and MRI in patients with sub-acute ankle sprain and chronic ankle instability is available.

There are discrepancies in the findings:
- anteriorly positioned fibula
- posteriorly positioned fibula
- no positional fault

These discrepancies appear to be largely due to the method of measurement used, i.e., the studies reporting an anteriorly positioned fibula have used fluoroscopy and measured the distance between the anterior edge of the lateral malleolus and the anterior edge of the tibia from a lateral view, whereas the studies reporting mixed or no positional displacement of the fibula used CAT and MRI derived indices of fibular position.

Investigation of PF
Patellofemoral pain syndrome

The concept of mal-tracking or lateral displacement of the patella, which is arguably an example of a positional fault, appears to have become widely accepted clinically as a factor in patellofemoral pain syndrome.

**Methods**
- Radiograph
- MRI
- Clinical measure

Investigation of PF
Patellofemoral pain syndrome

- Patella ‘positional fault’ considered when:
  - PFCA > +58 mm
  - LPFA = 18 mm
  - LPD = 1 mm

Crossley et al 2000

LPD quantifies position of patella in the frontal plane relative to the medial femoral condyle (Ingersoll and Knight 1991)

Subjects with PFPS had 2mm more LPD than healthy controls (Macintyre 2007)

Investigation of PF
Patellofemoral pain syndrome

- a) Lateral patellar displacement (LPD)
- b) Patello-femoral congruence angle (PFCA)
- c) Lateral patellofemoral angle (LPFA)

Crossley et al 2000
Investigation of PF
Patellofemoral pain syndrome

Clinical measure

• Influence of:
  - Patellar width?
  - Tibiofemoral rotation angle?
... on contact area between patella and femur

accounts 46% of variance on contact area

• Patella contact area appears to be an interesting area for future research, particularly with respect to the Mulligan concept, as the Mulligan technique used to manage PFPS attempts to change tibiofemoral rotation rather than patella alignment directly.

(Salsich et al 2007)

Investigation of PF
1st MCP joint

Positional fault of 4 deg pronation 1st MCP

Hsieh et al 2002

Investigation of PF
Sacroiliac joint dysfunction

Hungerford et al 2004

The Shoulder

- Measurement with ultrasound
  - Posterior view
  - Anterior view
  - Superior view
Alternative imaging views in the literature

- Assessment of PA / AP translation
  - Posterior view – humerus and posterior glenoid
  - Anterior view – greater tuberosity and anterior glenoid

- Assessment of inferior translation
  - Superior view – acromiohumeral distance

Posterior view

Jerosch et al 1991

Anterior view

landmarks:
- Dorsal glenoid rim
- Dorsal edge of humerus

affected vs non-affected arm (patients with anterior instability)

Significant side differences:
dominant vs non-dominant arm

(p < 0.0001)

Borsa et al 2005

Baseline; no force
15 dN anteriorly directed force

y-axis: distance of humeral head from x-axis

Anterior translation

Posterior translation

Posterior view

Assessment of glenohumeral laxity

Borsa et al 2005

Posterior view

Anterior translation of humerus

Borsa et al 2005

Posterior view

Assessing glenohumeral laxity

position of the humeral head in relation to the glenoid

Flat segment of scapula
Conclusion Posterior view

- Literature shows that dynamic ultrasound is a repeatable and valid method for measuring glenohumeral laxity.
- Therefore may be used as a viable replacement for stress radiography.

Anterior view

- Anterior humeral translation

Landmarks: Portion of scapular neck and greater tuberosity.

Anterior humeral translation baseline: Anterior translation of humerus with passive force.

Krarup et al 1999

Superior view

- Acromial humeral distance (AHD)
- Multidirectional instability

Landmarks: Acromion, Humeral head.

150 healthy subjects
57 patients with instability

Baseline: Passive inferiorly directed force.

Jerosch et al 1991
Acromiohumeral Distance AHD

- It has been shown that the AHD ↓ during shoulder abduction using MRI
- AHD decreased with shoulder impingement syndrome (SIS)

Hebert et al 2003

Acromio-Humeral Distance = AHD
Tangential distance between the humeral head surface and the lateral tip of the acromion

7 patients with SIS
13 healthy subjects
Measurements at rest, 45° and 60° abduction


Definitive pattern of narrowing of the AHD with arm Abd
AHD values at rest tended to be higher in SIS group than in healthy group, while
More pronounced narrowing occurred between 0° - 45°
Excessive superior translation of humeral head 0° - 45°


Sonography of Ssp tendon young overhead athletes (basketball) in correlation with the main pathologic model of secondary SIS
Measurement of SAD
Dynamic anterior impingement test (passive)


10 professional basketball players with sh pathology
10 non-athlete controls
lateral view acromion - humeral head arm behind back position
Cutoff point < 7 mm: defined as decreased SAD (based on normative data derived from US and MRI)
Significant difference between groups only in SAD


57 patients with symptoms of unilateral SIS.
72 healthy control subjects.
Bilateral examination in all subjects
Arm in neutral rotation

Cholewinsky et al (2008)
AHD and RC thickness smaller in SIS versus non affected shoulder (p<0.001)

AHD significantly smaller in SIS vs control group (p<0.001)

AHD of more than 2.1mm in comparison to the unaffected joint may point to the dysfunction of RC muscles

AHD enables measurements of superior translation of the humeral head

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**Conclusion**

There is both direct research into the PFH as it relates to the MWM concept

Predominantly research has not focused on the MWM concept but do describe investigations into minor positional ‘incongruencies’ that highlights key aspects of the PFH