Case history #1

- 25 y/o male auto plant worker
- Wanting to train for weight lifting
- C/O upper/mid back symptoms with doing weighted squats
- Wants personal trainer advise on how to strengthen his upper back
- What would you do?

Deep squat movement pattern

What do you observe?
Case history #2

- 23 year old university student
- 6 months increasing anterior knee pain
- No history of: injury, locking, giving way
- Worse after step aerobic class
- Wants personal trainer to help strengthen quadriceps muscles
- What would you do?

What do you observe?

Hurdle step movement pattern

What do you observe?
What do you observe?

Case history #3

- 50 year old male accountant
- One year history increasing right-sided low back pain
- Described as general ache
- Worse with standing, walking, eased by sitting
- Wants personal trainer to work trunk core muscles
- What would you do?

In-line lunge movement pattern

What do you observe?
What do you observe?

With each of these cases

Functional movement loss

Functional Movement Loss

Tissue extensibility dysfunction

- Muscle shortening
- Trigger point activity
- Scarring and fibrosis
- Neural tissue
Functional movement loss

Tissue extensibility dysfunction

Joint mobility dysfunction

Obstruction

Restriction

Mechanical block

Contracted soft tissue

What do you do if pain is the functional barrier?
Case history #1

<table>
<thead>
<tr>
<th>Test</th>
<th>DAP Score</th>
<th>PDAP Score</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right ankle pain</strong></td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Poor control right stance</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where's the dysfunction?

Dysfunctional non-painful right stance

Where's the dysfunction?

Dysfunctional painful right
Analysis

• Dysfunctional and painful right ankle WB dorsiflexion
• Inability to squat due to loss of ankle dorsiflexion
• Mid-thoracic pain with weight lifting secondary to increased trunk flexion

Predicting short-term response to thrust and non-thrust manipulation and exercise in patients post inversion ankle sprain

• Whitman, Cleland, Mintken, Keirns, Bieniek, Albin, Magel, McPoil
• JOSPT, Vol 39, No 3, March 2009
• Step-wise logistic regression to determine the most accurate set of variable for prediction of treatment success

Accuracy statistics with 95% CI for individual predictors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
<th>+ve likelihood ratio (95% CI)</th>
<th>Post-test Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worse when standing</td>
<td>0.75</td>
<td>0.50</td>
<td>1.5</td>
<td>82%</td>
</tr>
<tr>
<td>Worse in evening</td>
<td>0.46</td>
<td>0.75</td>
<td>1.8</td>
<td>84%</td>
</tr>
<tr>
<td>Navicular drop ≥ 5.0 mm</td>
<td>0.77</td>
<td>0.48</td>
<td>1.4</td>
<td>81%</td>
</tr>
<tr>
<td>Distal tib-fib joint hypomobility</td>
<td>0.68</td>
<td>0.62</td>
<td>1.8</td>
<td>84%</td>
</tr>
</tbody>
</table>

MWM Ankle Dorsiflexion (NWB)

• Mobilization
  • Anterior glide distal tibia, talus fixated
• Movement
• Passive dorsiflexion
• Tips
  • Useful in irritable cases
  • Treatment plane is oblique med-lat.
The Initial Effects of a Mulligan’s Mobilization with Movement Technique on Dorsiflexion and Pain in Sub acute Ankle Sprains

- Collins, N., Teys, P., Vincenzino B.
- University of Queensland
- Double blind, randomized controlled trial
- Incorporated
  - Repeated measures
  - Cross over design
  - Subjects acted as their own control

Study Subjects

- 16 participants, 8 male, 8 female
- Recruited from: Queensland University sports medicine clinic
- Average age 28.25 yrs (SD 9.33 yrs)
- Grade II lateral ankle sprain
  - “Incomplete tear of the ATFL with mild laxity and instability and reduced function”
- Average duration 40 days (SD +/- 24 days)

Weight bearing ankle dorsi-flexion “lunge” measurement

Outcome measures

Mobility function
- Weight bearing dorsiflexion range

Pain
- Pressure pain threshold (PPT)
  - Over proximal 1/3 of tibialis anterior muscle belly
  - Directly distal to the lateral maleolus over the CFL
  - Directly anterior to the lateral maleolus over the ATFL
- Thermal Pain Threshold (TPT)
  - Over the proximal 1/3 of tibialis anterior muscle belly
  - Directly anterior to the lateral maleolus over the ATFL
Study Results: Dorsiflexion

- MWM Treatment group
  - A significant interaction treatment effect demonstrated for the MWM technique P=0.002
  - Average increase from 57.27 to 68.93 cm.

- Placebo group
  - Average increase from 60.17 to 62.07 cm.

- Control group
  - Average decrease from 58.29 to 56.42 cm.

Study Results: Pain

- Pressure Pain Threshold
  - No significant interactive effects demonstrated

- Thermal Pain Threshold
  - No significant effects demonstrated

Study Discussion

“MWM technique to patients with sub-acute lateral ankle sprains produced a significant immediate improvement in dorsiflexion but no initial effect on mechanical or thermal pain threshold”

“Current and previous research findings suggest the predominant mechanism of action for the dorsiflexion MWM technique is most likely mechanical rather than a direct hypoalgesic effect”

Talar subluxation
Initial changes in Posterior Talar Glide and Dorsi flexion of the Ankle After Mobilization with Movement In Individuals with Recurrent ankle sprain

- JOSPT Vol 36 No 7 July 2006
- Vincenzino B., Branjerdporn M., et. al.
- University of Queensland St. Lucia
- Double –blind randomized crossover study with repeat measures including a no-treatment control condition

### Outcome measures (dependent Variables)

- **Posterior Glide**
  - Method described by Denegar (JOSPT, 32: 166-173, 2002)
  - Manual glide of talus with firm capsular end-feel
  - Measurement of tibial angulation measured with inclinometer at end feel point
- **Weight Bearing ankle Dorsi-flexion**
  - Method described by Bennell (AJP 44(3): 175-80 1998)
  - Distance from tip of great toe to wall
  - All measures taken prior to and following intervention
  - All measures repeated 3 times

### Independent variables

**Weight bearing MWM (WB-MWM)**

- Subject in standing
- Mobilization belt produced posterior glide of talus
- 10 sec. hold at ERL
- 4 repetitions with 20 sec rest between
- 4 sets of 4 performed at each treatment session

**Non-Weight bearing MWM (NWB-MWM)**

- Mobilization applied manually, subjects in supine
- 10 sec. hold at ERL
- 4 sets of 4 performed at each treatment session

**No treatment group (control)**

- Standing in relaxed posture with no manual contact
- Same time as per treatment groups
Results (Posterior glide)

- Significant improvement in:
  - Posterior glide range for Rx groups
  - WB-MWM produced effect size of 0.8
  - NWB-MWM produced effect size of 0.9
  - Control produced non-significant effect size of 0.3
- Posterior glide deficit reduced by:
  - 50% with NWB-MWM
  - 55% with WB-MWM
  - Significantly different than control \((p=0.003)\)
- Post-hoc analysis revealed significant pre-to post application for WB-MWM and NWB-MWM \((p<0.001)\)

Results (Dorsi-flexion)

- Changes in dorsi-flexion
  - WB-MWM and NWB-MWM = 26%
  - Control = 9%
- Significant \((P=0.001)\) main effect for time (pre – post treatment)

Discussion

- Both WB and NWB MWM increased posterior talar glide and talocrural dorsi-flexion
- No major difference between WB-MWM and NWB-MWM outcomes
- Weight bearing is not required to achieve positive results with MWM dorsi-flexion
- Hypothesis of a “positional fault’ of anterior talar resting position is reduced by the application of the MWM procedure

Anterior talar subluxation

- Delahunt, Medicine Science in Sport, 2013
- Cosby, Athletic Training & Sports Health Care, 2011
- Wikstrom, Archive of Physical Medicine, 2010
- Hoch, J. Sport Rehabilitation, 2010
- Drews, J. Science and Medicine in Sport, 2009
- Reid, Physiotherapy Canada, 2007
- Hubbard, Physical Therapy in Sport, 2005
- Collins, Manual Therapy, 2004
- Green, Physical Therapy, 2001
MWM Ankle Dorsi-flexion (WB)

- Mobilization
  - Anterior glide distal tibia, talus fixated
- Movement
  - Patient lunges forward
- Tips
  - Progress from non to partial to full W/B
  - Track with dynamic treatment plane


Manual Physical Therapy and Exercise Versus Supervised Home Exercise in the Management of Patients With Inversion Ankle Sprain: A Multicenter Randomized Clinical Trial

- 74 subjects grade I, II inversion sprain
- No time limits, 3:10 NPRS, -ve Ottawa rules
- Home exercise program only (4 PT visits)
- MTEX + 4 OMT procedures (4 PT visits)
Case history #2

<table>
<thead>
<tr>
<th>TEST</th>
<th>RAW SCORE</th>
<th>FINAL SCORE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>JUMP/G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROLL-STEP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PELVIS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHOULDER CLOTHING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPPER LIMB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTIVITY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where’s the dysfunction?

Functional pain free  Dysfunctional painful

Where’s the dysfunction?

Functional non-painful
Analysis

- Dysfunctional and painful right hip
- Loss of hip internal rotation
- Increased mechanical stress on knee during step ups in aerobic class


- **Cluster one:**
  - Hip internal rotation < 15º
  - Hip flexion < 115º
  - Age > 50 years

- **Cluster two:**
  - If Hip internal rotation >/= 15º
    - Pain with hip internal rotation
    - Duration of AM stiffness of hip </= 60 min.
  - Age > 50 years

Hip internal rotation and knee OA and/or Pain

**Knee OA**
- Deyle An In Med 2000
- Deyle Phys ther 2005
- Cliborne JOSPT 2004
- Currier JOSPT 2007

**Anterior knee pain**
- Lowry JOSPT 2008
- Iverson Phys Ther 2008
- Mascal JOSPT 2003
- Cibulka JOSPT 2005
- Vaughn JOSPT 2000
- Powers JOSPT 2000
- Powers JOSPT 2003
- Powers JOSPT 2010

**CPR Currier JOSPT 2007,**
- Hip groin pain or paresthesia
- Anterior thigh pain
- Passive knee flexion <122 degrees
- Pain with hip distraction
- Passive hip internal rotation < 17 degrees.
- +ve LR if 1 variable = 5.1
Hip internal rotation and knee OA and/or Pain

CPR Currier JOSPT 2007,

- Hip groin pain or paresthesia
- Anterior thigh pain
- Passive knee flexion <122 degrees
- Pain with hip distraction
- Passive hip internal rotation <17 degrees.
- +ve LR if 1 variable = 5.1
- +ve LR if 2 variables = 12.9

Hip Pain and Mobility Deficits

- Interventions - Manual Therapy
  “Clinicians should consider the use of manual therapy procedures to provide short-term pain relief and improve hip mobility and function in patients with mild-hip osteoarthritis.”
- Based on moderate level evidence.

Clinical Practice Guidelines
Orthopaedic Section of APTA Cibulka 2009

“Clinicians should consider the use of manual therapy procedures to provide short term relief and improve hip mobility and function in patients with mild hip osteo-arthritis”

American College of Rheumatology Hockberg 2012

“Patients with hip OA should . . . Use manual therapy in combination with exercise under the supervision of a Physical Therapist”

Hip Internal rotation MWM

Mobilization
- Lateral glide femur

Movement
- Internal hip rotation

Tips
- May need anterior +/- inferior vector
- Control pelvis
- Ensure knee stable
Hip internal rotation MWM (closed chain)

Mobilization
- Lateral glide of hip via belt
- Fixate pelvis

Movement
- Internal rotation via patient twisting

Tips
- Control pelvis
- Ensure client is stabilized by holding a chair back or bed

Case history #3

<table>
<thead>
<tr>
<th>Test</th>
<th>Knee Score</th>
<th>Final Score</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight leg raise</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hamstring tension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip flexion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee flexion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microsymmetry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active straight leg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight leg raise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hamstring tension</td>
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<td></td>
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<tr>
<td>Hip flexion</td>
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</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where’s the dysfunction?

Hip Extension

Dysfunctional and non-painful
Thomas test +/- modifications

Bilateral lumbar extension

Unilateral lumbar extension

Analysis
- Functional painful lumbar extension
- Dysfunctional, non-painful loss of hip extension
- Increased stress on lumbar spine related to loss of hip extension in standing / walking
Hip extension MWM
open chain “thomas test”

Mobilization
• Lateral glide femur
• on stabilized pelvis

Movement
• Hip extension in Thomas test position

Tips
• Ensure to control pelvic tilt to avoid lumbar extension

• Freberg O, Spine 1983.
• Offierski C, Spine 1983
• Barbee-Ellison J, Phys Ther 1990.
• Chesworth B, Physio Can 1994
• Warren P, JMMT, 2003
• Vad J Sci Med sport 2003
• Hasseet Arth rhem, 2003
• Spioie, Scan J Scie2004
• Vad V, Amej Sports Med, 2004
• Hoeksa Hl Arth Rheum 2004
• Brown ,Clin Orth Res, 2004

MWM Hip Extension
(closed chain)

Mobilization
• Patient in step/stand
• Lateral glide femur

Movement
• Patient lunges forward

Tips
• Control pelvic tilt
• Consider rotation of femur
• Don’t pull patient over

• Childs J, Ann Int Med, 2004
• Macdonal, JOSPT, 2006
• Ben-Galin, Spine, 2007
• Wainer JOSPT 2007
• Van Dillen, Arch Phys Med, 2007
• Kirkos, Acta Orth Bel, 2008
• Sembrano, Spine 2009
• Reiman J Sport Rehab 2009
• Murray Phys Ther Sport 2009
• Schottles Clin Biomech 2009
• Van Middelkoop Eu Spine, 2010
• Parvisi Clin Orth Rel Res,2010
• Dagenais J, Spine 2010
• Stupar JMMT 2010
• Burns JMMT 2011


• Patient education
• Aerobic training and exercise
• Manual therapy
  • Lumbar spine
  • Hip
• Normalization of hip motion appears to be a key element for the successful treatment of patients with LSS
• “The ability to move the hip, especially into extension without concomitant lumbar extension is frequently necessary for pain free ambulation . . . ”
### The 2 X 2 function matrix

<table>
<thead>
<tr>
<th></th>
<th>Non-painful</th>
<th>Painful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>FN</td>
<td>FP</td>
</tr>
<tr>
<td>Dysfunctional</td>
<td>DN</td>
<td>DP</td>
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</table>

### The 2 X 2 function matrix

<table>
<thead>
<tr>
<th></th>
<th>Non-painful</th>
<th>Painful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td></td>
<td>Continue with wellness program</td>
</tr>
<tr>
<td>Dysfunctional</td>
<td></td>
<td></td>
</tr>
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</table>

### The 2 X 2 function matrix

<table>
<thead>
<tr>
<th></th>
<th>Non-painful</th>
<th>Painful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td></td>
<td>Specific motor control training</td>
</tr>
<tr>
<td>Dysfunctional</td>
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</table>

### The 2 X 2 function matrix

<table>
<thead>
<tr>
<th></th>
<th>Non-painful</th>
<th>Painful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dysfunctional</td>
<td>Soft tissue resets • Needling • ASTYM • Neural mobilization</td>
<td></td>
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</tbody>
</table>
### The 2 X 2 matrix

<table>
<thead>
<tr>
<th></th>
<th>Non-painful</th>
<th>Painful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dysfunctional</td>
<td>Functional manual therapy</td>
<td></td>
</tr>
</tbody>
</table>

### Take home message

- Use the SFMA to find the dysfunctional “driver” behind the symptoms
- Tissue extensibility drivers can often be self treated
- Joint mobility deficit drivers may require manual therapy
- Functional manual therapy treats the Dysfunctional / Painful clinical pattern

### Functional manual therapy

- Manual therapy is a safe and effective reset
- Functional manual therapy (FMT) incorporates the symptom provoking activity as treatment
- FMT allows you option a “functional engagement strategy”