Treatment of running injuries using gait analysis

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Running Injuries

- 50% of runners get injured each year
Most Common Injuries

Patellofemoral Pain (PFP: runner’s knee)
Iliotibial Band Syndrome (ITBS)
Plantar fasciitis
Shin Splints (medial tibial stress syndrome)
Achilles tendinitis
Overall Paradigm

- Biomechanics
- Strength
- Alignment
- Flexibility

INJURY
Evidence-Based Approach

1. Obtain measurement value
2. Compare to Mean (SD)
3. Transform to Z-score
4. Transform to Percentile Rank
Foot Mechanics

Typical Foot Mechanics

Reduced

M: 3.6° – 10.0°
F: 1.8° – 8.2°

Excessive
Arch Structure

Stiff (cavus)

Typical Arch Height/Mobility

Flat (planus)

AHI: 0.30 – 0.39
Biomechanical Assessment
Strength

Flexibility
Anatomical Alignment
Chapter 8 - Interpretation

Knee Abduction (Genu Valgum)

Excessive

- Strength
- Flexibility
- Anatomical

Reduced

- Strength
- Flexibility
- Anatomical
Free Moment

- Summation of axial rotational of the body
- Measured via force plate
Torsional Forces

- Heel whip
- Surrogate to free moment  
  (Macdonald, 2013)
Torsional Forces

- Heel whip
- Surrogate to free moment

(Macdonald, 2013)
Other Clinical Clues
Case Study (Chapter 6) - Torsional Forces

- Pain/symptoms past 2 months
  - Assn with increase in mileage
- Retro and latero-patellar pain near 7km
- Increased crepitus w/ patellar grind test
- Negative patellar apprehension test
- VMO atrophy not visually observed

- Posted orthoses as treatment
Evaluation

Strength Measures

- Tibialis Posterior
- Hamstring
- Vasti
- Gluteus Medius
Evaluation
Evaluation

Knee and Hip Biomechanics

Excessive

Ideal

Reduced

Knee Abduction  Knee Internal Rotation  Hip Adduction  Hip Internal Rotation  Pelvic Drop
# Chapter 8 - Interpretation

## Excessive Peak Hip Adduction

<table>
<thead>
<tr>
<th>Anatomical alignment</th>
<th>Increased Q-angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>Weakness of gluteus medius muscle</td>
</tr>
<tr>
<td>Flexibility</td>
<td>—</td>
</tr>
</tbody>
</table>
| Biomechanics         | 1. Associated with excessive peak knee abduction and contralateral pelvic drop  
                        2. Can be associated with excessive peak hip internal rotation and excessive or prolonged rearfoot eversion |

## Excessive Peak Hip Internal Rotation

<table>
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<tr>
<th>Anatomical alignment</th>
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<tbody>
<tr>
<td>Strength</td>
<td>Weakness of hip abductor and external rotator muscle</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Increased hip internal rotator range of motion</td>
</tr>
</tbody>
</table>
| Biomechanics         | 1. Associated with increased heel whip and foot progression angle  
                        2. Associated with excessive peak hip adduction and tibial or knee internal rotation |
Clinical Hypothesis

- Excessive rotational forces = aetiology
- Strengthen rotator musculature
Other Clinical Clues

- Evidence-based assessment
- Atypical mechanics during squat, running, and jumping

Willson et al., 2008
Treatment

Earl et al., 2010
Recent Research

Ferber et al., JAT; 2014

![Graph showing the amount of pain in centimeters for Hip and Knee over the weeks of rehabilitation. The graph indicates a significant decrease in pain for both body parts, with Hip pain showing a more rapid decrease.]
Treatment

- Strengthening everyday - 3 sets of 10 reps
  - Gluteus medius
  - Hamstring

- Always AFTER a run or workout

- Footwear recommendation: Neutral shoe
  - Discontinue orthoses gradually
  - Switch to non-posted orthoses

- Limit mileage to max 7km/run for next 2 weeks
Foot Mechanics

- Reduced
- Typical Foot Mechanics
- Excessive
Footwear Prescription

Neutral Shoe

85%

Stability 13%

Motion Control 2%
Foot Mechanics

- Abduction
- Eversion
- Dorsiflexion (collapse)
- Internal Rotation
Rearfoot Eversion

- Strong predictor of free moment
  
  (Macdonald, 2013)
Foot-Shank Coupled Motion
Summary

- Torsional forces should be considered for PFPS pain and symptoms
  - Research to support this clinical hypothesis and measurements 
    (Noehren et al. 2010; Ferber et al. 2010; Ferber et al., 2014)

- Objective assessment to determine root cause of injury

- Treatment based on the data
What can we conclude from this?

- Evidence-based approach necessary to understand pathomechanics
- Optimal treatment based on current literature
- “Running Mechanics and Gait Analysis”
  - >260 references
  - 33 video clips
Thank you!

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