Hip Strength Compensations in ACL Reconstructed Patients with Quadriceps Deficits

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ACL Injuries

- 250,000 individuals per year (Flynn 2005)
- Medical costs: Diagnosis, reconstruction, postoperative rehabilitation = $3 billion (Brophy 2009)
- Knee Osteoarthritis causes
  - Biochemical process (Pelletier 2001)
  - Biomechanical alterations (Kaufman 2001)
  - Deficits in neuromuscular function (Kessler 2008)
Gap / Purpose

- **Gap**: limited understanding of hip strength changes/compensations after ACL Reconstruction

- **Purpose**: To determine if quadriceps strength influences hip muscle strength in ACL reconstructed patients

Selection Criteria

- From Larger Database of ACLR subjects
  - Primary ACL reconstruction
  - “Healthy” limb to test
  - ACLR + Meniscus (no additional ligament surgery)

Subjects

<table>
<thead>
<tr>
<th>55 ACLR Patients</th>
<th>Limb Symmetry Index = Reconstructed Limb / Healthy Limb X 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Quad: LSI ≤ 85%</td>
<td></td>
</tr>
<tr>
<td>F = 17</td>
<td>F = 31</td>
</tr>
<tr>
<td>M = 1</td>
<td>M = 6</td>
</tr>
<tr>
<td>Age = 18.7 ± 1.6 yrs</td>
<td>Age = 19.1 ± 1.6 yrs</td>
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<tr>
<td>IKDC = 73.3 ± 6.7%</td>
<td>IKDC = 74.5 ± 7.9%</td>
</tr>
<tr>
<td>22.6 ± 10.6 months from surgery</td>
<td>34.9 ± 19.0 months from surgery</td>
</tr>
<tr>
<td>BPTB = 6</td>
<td>BPTB = 20</td>
</tr>
<tr>
<td>Hamstring = 6</td>
<td>Hamstring = 10</td>
</tr>
<tr>
<td>Allograft = 2</td>
<td>Allograft = 7</td>
</tr>
</tbody>
</table>

High Quad: LSI ≥ 90%

7 Patients: >85% + <90%

Additional Tests:

- Knee Flexion (Hamstring) Strength
- Hip Internal Rotation Strength
- Hip External Rotation Strength
- Single Hop for Distance
- Triple Hop for Distance
Wisconsin Injury in Sport Laboratory

Statistical Approach

• Repeated Measures ANOVA
  – Limb (Healthy vs reconstructed)
  – Group (High vs Low Quad)
  – Controlling for time from surgery
  – SPSS

Results

• Quad Strength
  – The reconstructed limb in the Low Quad group was weaker than the reference limb & both limbs of the High Quad group. This indicates our grouping strategy was successful.

• Hip Extension Strength (Glute Max)
  – Glute Max strength was stronger in the Low Quad Group (both limbs)

• Hip Abduction Strength (Glute Med)
  – Tended to be greater in the Low Quad group compared to the High Quad group (both limbs)

Results

• No differences were observed in normalized single hop for distance or triple hop for distance.

• No differences were observed in:
  – Hamstring strength
  – Hip internal rotators / external rotator strength

Discussion

• ACLR individuals with poor between limb quadriceps strength symmetry have increased hip extension (Glute Max) and abduction (Glute Medius) strength

• Compensation to counteract quadriceps weakness

• These compensations may explain why SHD and knee function was not different

• Agrees with previous research (Schmitt 2012 & 2014)
Limitations

- Unable to control:
  - Rehabilitation protocols
  - Insurance plans
  - Surgeons

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