ATFL repair alone versus combined repairs of ATFL and CFL: A Biomechanical Comparison of Repair Techniques

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Disclosures

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Background

- Ankle Ligament Injuries are common
- Higher energy injuries result in injury to both AFTL and CFL
- Arthroscopic ATFL repair techniques have become increasingly popular
  - Most arthroscopic techniques do not address the CFL
  - The impact of CFL repair is not well understood
Objective

- The purpose of this study was to assess the impact of repairing the ATFL alone compared to repairing both the ATFL and CFL
- Simulated arthroscopic technique
- Cadaver model
Objective

• We hypothesized that repairing ATFL and CFL will improve ankle and subtalar joint stability during weight-bearing ankle inversion compared to ATFL repair alone.
Methods

- Ten matched pair fresh frozen human cadaveric ankles were mounted to an Instron in 20° plantarflexion
- Body weight load applied
- Inverted to 20° for three cycles
- **Torque, stiffness and displacement** recorded
- ATFL and CFL were sectioned
Methods

• Specimens randomly assigned to **ATFL only repair** using two all-soft anchors, or combined **ATFL and CFL repair**

• Testing was repeated after repair, followed by load-to-failure (LTF)
Data Collection and Analysis

• Instron:
  • Stiffness
  • Change in torque
  • Load at failure

• Motion capture
  • Medial displacement
  • Inversion angle
Results

- The predominant mode of failure was tissue/suture
  - No anchors pulled out of bone
- Strong correlation between stiffness of intact specimen and stiffness after repair ($r=0.77$)
We found an 11.7% increase in stiffness in combined repairs, and only a 1.6% increase in ATFL-only repairs.

Stiffness During Inversion

- Intact: 0.67
- ATFL and CFL Injury: 0.489
- ATFL Repair: 0.496
- ATFL and CFL Repair: 0.552

p = 0.079
Load to Failure

- CFL failed first in all specimens
  - 28 degrees inversion
  - 13.4 N*m torque
- ATFL failure
  - 43.7 degrees Inversion
  - 20.8 N*m torque
- Higher failure torques*

*Giza et al, 2015, Foot Ankle Int
• **Medial translation** of the calcaneus relative to the talus was significantly less after ATFL and CFL repairs.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Medial Translation (mm)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>8.22</td>
<td></td>
</tr>
<tr>
<td>ATFL and CFL tear</td>
<td>9.96</td>
<td></td>
</tr>
<tr>
<td>ATFL Repair</td>
<td>10.41</td>
<td>0.03</td>
</tr>
<tr>
<td>ATFL and CFL Repair</td>
<td>9.16</td>
<td></td>
</tr>
</tbody>
</table>
• **Medial translation** of the calcaneus relative to the talus was significantly less after ATFL and CFL repairs

• Ankle Inversion angle increases after ligament injury
  • Not restored with either repair

• Subtalar Inversion angle of the increases after ligament injury
  • Partially restored with combined repair
CFL repair has advantages during load bearing inversion:
- Increases stiffness
- Reduces medial translation of subtalar joint

No clear advantage to CFL repair with ankle or ST inversion angle

Important Considerations:
- We tested full load bearing
- We tested repair only without healing
Summary

• CFL failed first during weight-bearing inversion
• ATFL failed at a higher torque than previous study of Arthroscopic Brostrom technique*
  • Complimentary contribution of CFL
• A specimen’s inherent tissue laxity or stiffness was a predictor of stiffness after repair

*Giza et al, 2015, Foot Ankle Int
Conclusions

• Restoring CFL plays a relevant role in lateral ligament repair
  • However, sufficient time for ligament healing should be allowed before inversion stresses are applied
• More study is needed to investigate the clinical results of CFL repair vs ATFL repair alone
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