ATFL Repair Alone versus Combined Repairs of ATFL and CFL: A Biomechanical Comparison of Repair Techniques

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I (and/or my co-authors) have something to disclose.

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Relevant:
Project Funded by ISAKOS Grant
Implants Donated by Zimmer-Biomet
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 ($r=0.77$)
Stiffness

• We found an 11.7% increase in stiffness in combined repairs, and only a 1.6% increase in ATFL-only repairs.
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*
Motion Capture

• **Medial translation** of the calcaneus relative to the talus was significantly less after ATFL and CFL repairs.
Motion Capture

• **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.

- Intact
- ATFL and CFL release
- ATFL repair
- ATFL and CFL repair

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<tr>
<th></th>
<th>Intact</th>
<th>ATFL and CFL release</th>
<th>ATFL repair</th>
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<td>Inversion angle of <strong>Ankle Joint</strong></td>
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<td>5.98</td>
<td>6.20</td>
<td>NS 5.59</td>
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Summary

• 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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