Effect of anterior deltoid ligament on ankle stability of isolated lateral malleolar fracture

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< Tae Hoon Lee >

My disclosure is in the Final AOFAS Mobile App.
I have no potential conflicts with this presentation.
Introduction

• **Deep deltoid ligament**
  - primary stabilizer of the ankle
  - prevents lateral talar shift and external rotation of the talus

• **In cadaver model**
  - transected superficial deltoid ligament did not allow for widening of the medial clear space and talar translation

• **If the medial lesion is solely ligamentous after lateral stabilization, no repair is necessary**

*Motion of the ankle in a simulated supination-external rotation fracture model*
Michelsen JD, Ahn UM, Helgemo SL. J Bone Joint Surg Am. 1996
Introduction

• But... really?

1. Stability of isolated lateral malleolar fracture according to deltoid ligament integrity

2. Result of deltoid ligament repair in unstable isolated lateral malleolar fx.
Material & Method

• June 2006 ~ June 2013

• 25 patients
  - Isolated lateral malleolar
  - agree with MRI scan
  - exclusion: open fracture, stable group, syndesmosis instability

• Treatment according to our protocol

• Valgus stress x-ray at POD #3 months
Study protocol

1. Isolated lateral malleolar fx.
2. MRI
   - No: Short leg cast application → Stable group
   - Yes: Valgus Stress test Instability?
3. Yes: Lateral malleolar fixation
4. No: Valgus stress test Instability?
   - Yes: Anterior deltoid ligament repair
   - No: Done
5. High grade unstable group
6. Low grade unstable group
7. Valgus Stress x-ray After 3 months
Evaluation of medial stability

• Pre op
  - Deltoid ligament integrity by MRI (Review by musculoskeletal radiologists)
  - Divided into anterior deltoid, posterior deltoid

• Intra op
  - Manual valgus stress under fluoroscopy
  - Instability: uneven joint space & > 2° talar tilt angle *


• Post op
  - Valgus stress radiogram by 150N on post operative 3 months
  - Measure medial clear space
Statics analysis & Result

- **Mann-Whitney U test** (Compare low-grade to high grade group)
  - Anterior deltoid integrity grade
  - Posterior deltoid integrity grade
  - Medial clear space

- **Wilcoxon signed rank test** (Compare uninjured to injured extremity in one patient)
  - Post operative medial clear space

- **Mean age** - 41.6 years old (16-67)

- **Sex**
  - Men: 16 cases
  - Women: 19 cases

- **Fracture type** - Supination external rotation injury, weber B

- **Two groups**
  - Low grade unstable: 10 cases
  - High grade unstable: 15 cases
Result

- **Compare low grade to high grade group**

<table>
<thead>
<tr>
<th></th>
<th>Mean Anterior deltoid ligament grade</th>
<th>Mean Posterior deltoid ligament grade</th>
<th>Mean injured medial clear space (mm)</th>
<th>Mean uninjured medial clear space (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low grade unstable group</td>
<td>1.8(1~2)</td>
<td>1.8(1~3)</td>
<td>4.34 (2.82~6.15)</td>
<td>4.41 (3.4~5.79)</td>
</tr>
<tr>
<td>High grade unstable group</td>
<td>2.6(2~3)</td>
<td>2.2(1~3)</td>
<td>4.91 (2.93~6.53)</td>
<td>4.56 (3.07~6.43)</td>
</tr>
<tr>
<td>P-value</td>
<td><strong>0.004</strong></td>
<td>0.285</td>
<td>0.08</td>
<td>0.892</td>
</tr>
</tbody>
</table>
Result

- Compare uninjured to injured extremity in one patient

<table>
<thead>
<tr>
<th></th>
<th>Post operative mean injured medial clear space (mm)</th>
<th>Post operative mean uninjured medial clear space (mm)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low grade unstable group</td>
<td>4.34 (2.82~6.15)</td>
<td>4.41 (3.4~5.79)</td>
<td>0.241</td>
</tr>
<tr>
<td>High grade unstable group</td>
<td>4.91 (2.93~6.53)</td>
<td>4.56 (3.07~6.43)</td>
<td>0.650</td>
</tr>
</tbody>
</table>
Discussion

- The superficial deltoid ligament, taking its origin from the anterior colliculus, does not contribute to medial stability of the ankle

  McConnell T, et al. Stress examination of supination external rotation-type fibular fractures. JBJS 2004
  Michelsen JD, et al. Motion of the ankle in a simulated supination-external rotation fracture model. JBJS1996
  Pankovich AM Acute indirect ankle injuries in the adult. JOT 2002

- Our study
  1) Anterior deltoid ligament tear - Significant higher in high grade unstable group

  2) Compare post operative medial clear space of uninjured extremity to injured extremity - No significant difference

  3) Mean medial clear space in both group - less than 5mm (within normal range)
Limitation

- Small sample size
- Short term follow up
- Only Radiologic(x-ray, MRI) assessment for pre, post-operatively medial stability
- No compare of deltoid ligament non-repair group
Conclusion

- Anterior deltoid ligament integrity is a major factor for high grade unstable isolated lateral malleolar fx. stability

- Anterior deltoid ligament repair is a good treatment modality in high grade unstable isolated lateral malleolar fx.
Thank you for your attention