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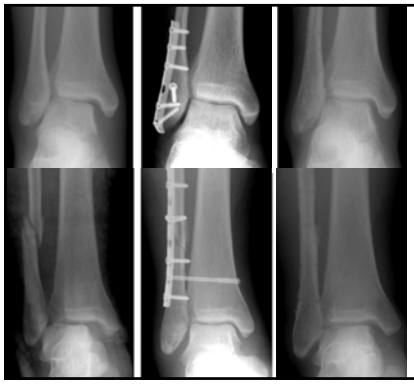
# Why Don't We Care About the Deltoid Ligament

**Sean T. Grambart DPM FACFAS**
**Assistant Dean of Academic Affairs, Des Moines University, College of Podiatric Medicine and Surgery**
**Past-President, American College of Foot and Ankle Surgeons**

## Disclosure

- Bespa Global, Partner
- Orthosolutions, Design Team
- ACFAS Speaker



## Why are we discussing deltoid repairs??

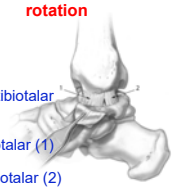
## Anatomy of the Deltoid Complex

**Superficial ligament**

- Originates primarily from the anterior malleolus
- Tibiocalcaneal (3)
- Tibiospring (2)
- Tibionavicular (1)

**Primary restraint to hindfoot eversion**

**Primary restraint to talar external rotation**



**Deep ligament**

- Confluent with the tibiotalar joint capsule
- Deep Anterior Tibiotalar (1)
- Deep Posterior Tibiotalar (2)

*Knee Surg Sports Traumatol Arthrosc (2013) 21:1316–1327*

## What Camp are You In??

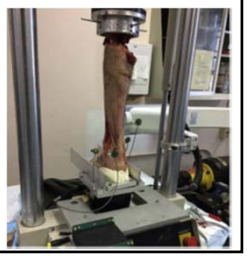
- No Reason to Repair the Deltoid
- Deltoid repair should be performed in all patients with bimalleolar equivalent ankle fractures
- Repair the deltoid only if medial-sided exposure is already required to clear soft tissue from the medial gutter
- Deltoid ligament repair among high-level athletes and only after arthroscopic confirmation of complete deltoid ligament rupture.
- Repair only among those who are intraoperatively unstable after ORIF


## What do we know biomechanically??

Deltoid ligament repair reduces and stabilizes the talus in unstable ankle fractures

Bennet A. Butler[b,*], Eric C. Hempen[a], Mauricio Barbosa[a], Muturi Muriuki[b], Robert M. Havey[b], Richard W. Nicolay[a], Anish R. Kadakia[a]

- 21 ankles were analyzed with a motion capture system
  - Uninjured ankles
  - Ankles with SER-IV injuries
  - Ankles with ORIF
  - Ankles with ORIF and deltoid repair



*Journal of Orthopaedics 17 (2020) 87–90*

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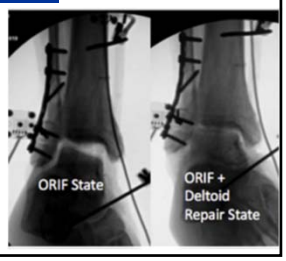
**Compared to the Intact State**

- ORIF state exhibited a significant increase in talar eversion, axial rotation, talar internal rotation with axial loading, and external rotation
- All of these rotational/translational issues were corrected in the ORIF **and** deltoid ligament repair

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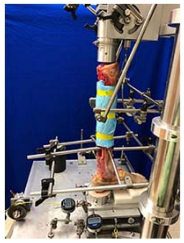
## Biomechanical Effect on Joint Stability of Including Deltoid Ligament Repair in an Ankle Fracture Soft Tissue Injury Model With Deltoid and Syndesmotic Disruption

**Purpose**

- Quantify the biomechanical effect of deltoid ligament repair in an ankle fracture soft tissue injury model

**Methods**

- 9 cadaveric specimens with each leg was tested under 5 conditions
- Intact, syndesmosis and deltoid ligament sectioned, syndesmosis fixed, deltoid repaired, both the syndesmosis and deltoid ligament repaired
- Anterior, posterior, lateral, and medial drawer and rotational stresses were applied to the foot and the resulting talus displacement was documented



*Mococain et al. Foot and Ankle International, 2020*

## Biomechanical Effect on Joint Stability of Including Deltoid Ligament Repair in an Ankle Fracture Soft Tissue Injury Model With Deltoid and Syndesmotic Disruption

| | Displacement, mm, Mean ± SD | | | |
|---|---|---|---|---|
| Operative Condition | Anterior Drawer | Posterior Drawer | Medial Drawer | Lateral Drawer |
| Intact | 4.3 ± 1.2 | 4.2 ± 0.9 | 4.1 ± 1.4 | 5.3 ± 1.6 |
| Both syndesmosis and deltoid transected | 7.7 ± 2.6 | 6.4 ± 2.8 | 4.7 ± 0.8 | 7.0 ± 2.2 |
| Syndesmosis fixation alone | 5.9 ± 2.1 | 5.4 ± 2.7 | 4.3 ± 1.4 | 5.8 ± 2.0 |
| Deltoid ligament repair alone | 4.7 ± 1.1* | 5.0 ± 1.8 | 4.6 ± 1.1 | 6.2 ± 1.9 |
| Both syndesmosis and deltoid stabilized | 3.9 ± 1.5* | 4.2 ± 1.0* | 3.92 ± 1.07 | 5.2 ± 2.0* |

*Mococain et al. Foot and Ankle International, 2020*

## But, what do we see clinically?

## Short-Term Results of a Ruptured Deltoid Ligament Repair During an Acute Ankle Fracture Fixation

Retrospectively evaluated 78 consecutive cases of a ruptured deltoid ligament with an associated ankle fracture

**All of the ankle fractures were treated with a plate and screw fixation**

Group 1: 37 fractures

- ORIF with syndesmotic fixation and no deltoid repair

Group 2: 41 fractures

- ORIF with syndesmotic fixation, **continued instability** of the deltoid that underwent repair of the deltoid

*Woo et al. Foot and Ankle International, 2018*

## Results

**Table 1.** Operative Information on the Patients in the 2 Groups.*

| Variable | Group 1 (n = 37) | Group 2 (n =41) | P Value |
|---|---|---|---|
| Sex | | | .360 |
| Male | 27 (73) | 26 (63) | |
| Female | 10 (27) | 15 (37) | |
| Age, y | 39.4 ± 14.3 | 41.6 ± 15.8 | .460 |
| Affected side | | | .780 |
| Right | 21 (57) | 22 (54) | |
| Left | 16 (43) | 19 (46) | |
| Causative trauma | | | .480 |
| Slip down | 34 (92) | 35 (85) | |
| Traffic accident | 3 (8) | 6 (15) | |
| Lauge-Hansen classification | | | .150 |
| SER | 32 (86) | 30 (73) | |
| PER | 5 (14) | 11 (27) | |
| Syndesmotic fixation | | | .080 |
| Nonfixation | 20 (54) | 14 (34) | |
| Fixation | 17 (46) | 27 (66) | |
| Time to operation, d | 3.1 ± 1.5 | 3.2 ± 1.6 | .730 |
| Operative time, min | 67.8 ± 6.8 | 84.5 ± 9.3 | .000 |
| Union, wk | 7.2 ± 1.6 | 7.6 ± 1.9 | .250 |
| Follow-up periods, mo | 17.8 ± 8.6 | 16.4 ± 8.0 | .260 |

**Table 2.** Comparison of Radiologic and Clinical Outcomes Between the 2 Groups.*

| Variable | Group 1 (n = 37) | Group 2 (n = 41) | P Value |
|---|---|---|---|
| Radiological outcomes | | | |
| MCS, mm | | | |
| Preoperative | 7.5 ± 3.4 | 8.2 ± 3.5 | .210 |
| Postoperative | 2.9 ± 0.4 | 2.7 ± 0.5 | .083 |
| Final follow-up | 3.7 ± 0.6 | 3.2 ± 0.5 | .000 |
| >4 mm at final follow-up | 11 (29.7) | 1 (2.4) | .001 |
| TFCS, mm | | | |
| Preoperative | 5.1 ± 2.3 | 5.4 ± 2.6 | .518 |
| Postoperative | 3.6 ± 0.6 | 3.4 ± 0.8 | .084 |
| Final follow-up | 4.4 ± 1.2 | 4.4 ± 1.2 | .906 |
| TFO, mm | | | |
| Preoperative | 4.5 ± 2.1 | 5.3 ± 2.8 | .218 |
| Postoperative | 5.9 ± 1.9 | 6.6 ± 1.9 | .071 |
| Final follow-up | 5.2 ± 1.9 | 5.7 ± 1.7 | .432 |
| Clinical outcomes | | | |
| AOFAS score | 91.6 ± 4.7 | 92.8 ± 3.9 | .805 |
| VAS | 6.9 ± 6.4 | 5.8 ± 4.8 | .271 |
| FFI | 15.4 ± 12.6 | 13.6 ± 7.9 | .706 |
| Medial side pain, No. (%) | 7 (18.9) | 2 (4.9) | .077 |

*Woo et al. Foot and Ankle International, 2018*

## Results

| Variable | Syndesmotic Fixation in Group 1 (n = 17) | Syndesmotic Fixation in Group 2 (n = 27) | P Value |
|---|---|---|---|
| Radiological outcome | | | |
| MCS, mm | | | |
| Preoperative | 8.2 ± 4.2 | 8.1 ± 3.2 | .230 |
| Postoperative | 2.9 ± 0.5 | 2.7 ± 0.5 | .640 |
| Final follow-up | 3.7 ± 0.7 | 3.1 ± 0.4 | .020 |
| >4 mm at final follow-up, No. (%) | 6 (35.3) | 0 (0.0) | .006 |
| TFCS, mm | | | |
| Preoperative | 5.9 ± 2.9 | 5.9 ± 3.0 | .480 |
| Postoperative | 3.7 ± 0.7 | 2.9 ± 0.5 | .280 |
| Final follow-up | 4.9 ± 1.3 | 4.4 ± 1.3 | .460 |
| TFO, mm | | | |
| Preoperative | 4.5 ± 2.1 | 5.3 ± 2.8 | .220 |
| Postoperative | 5.7 ± 2.2 | 6.6 ± 1.9 | .050 |
| Final follow-up | 5.2 ± 1.9 | 5.7 ± 1.7 | .430 |
| Clinical outcome | | | |
| AOFAS score | 89.8 ± 3.7 | 93.1 ± 3.9 | .020 |
| VAS | 9.4 ± 6.1 | 5.3 ± 4.9 | .040 |
| FFI | 21.4 ± 12.0 | 12.5 ± 7.2 | .020 |
| Medial side pain, No. (%) | 5 (29.4) | 1 (3.7) | .025 |

*Woo et al. Foot and Ankle International, 2018*

## Conclusion

- "Although the clinical outcomes were not significantly different between the 2 groups, we obtained a more favorable MCS and medial stability on the stress gravity mortise view at final follow-up in the deltoid repair group."
- "Therefore, in the case of **high-grade unstable fractures** of the ankle with syndesmotic instability, a direct repair of the deltoid ligament is adequate for restoring medial stability."

*Woo et al. Foot and Ankle International, 2018*

## Evaluation of Transsyndesmotic Fixation and Primary Deltoid Ligament Repair in Ankle Fractures With Suspected Combined Deltoid Ligament Injury

Kai Wu, MD [1], Jian Lin, MD [1], Jianhua Huang, MD [2], Qiugen Wang, MD [3]

Prospective study

- Compared the outcomes of syndesmotic fixation to deltoid ligament repair with suture anchor
- 59 ankle fractures with suspected deltoid ligament injury
- Deltoid ligament rupture were randomly assigned to 2 groups and treated with deltoid ligament repair with a suture anchor or with syndesmosis screw fixation


*JFAS, 2018*

Evaluation of Transsyndesmotic Fixation and Primary Deltoid Ligament Repair in Ankle Fractures With Suspected Combined Deltoid Ligament Injury

Kai Wu, MD [1], Jian Lin, MD [1], Jianhua Huang, MD [2], Qiugen Wang, MD [3]

- 26 cases in the syndesmosis screw group
- 22 cases in the deltoid repair group
- **No statistically significant differences** were found in the AOFAS ankle-hindfoot scale score, SF-36 score, or VAS score between the 2 groups.
- Malreduction rate in the syndesmosis screw group was 34.6% and that in the deltoid repair group was 9.09%

*JFAS, 2018*

## Posttraumatic Ankle Osteoarthritis After Ankle-Related Fractures

*Monika Horisberger, MD,* Victor Valderrabano, MD, PhD,* and Beat Hintermann, MD†*

- 20.4% incidence of posttraumatic ankle osteoarthritis in patients with an untreated deltoid ligament injury
- Between 20.9 year and 47 year latency between initial injury and end stage ankle OA

*J Orthop Trauma Volume 23, Number 1, January 2009*

## Definition of the "Highly Unstable" Ankle

- After the Fibular and Syndesmotic ORIF

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**Thank you!**