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Why Don't We Care About the Deltoid Ligament

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Disclosure

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



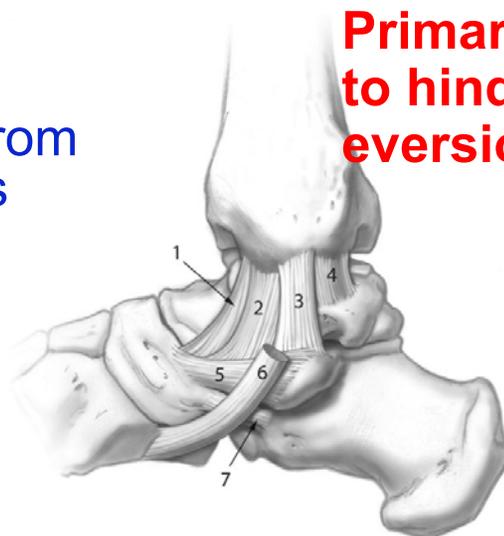


Why are we discussing deltoid repairs??

Anatomy of the Deltoid Complex

Superficial ligament

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

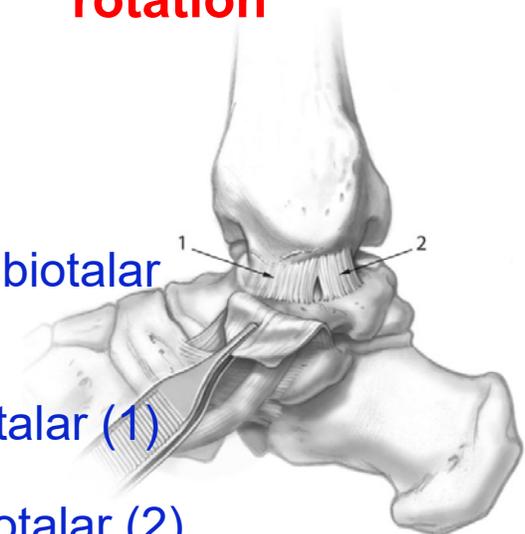


Primary restraint to hindfoot eversion

Primary restraint to talar external rotation

Deep ligament

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



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^{a,*}, 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

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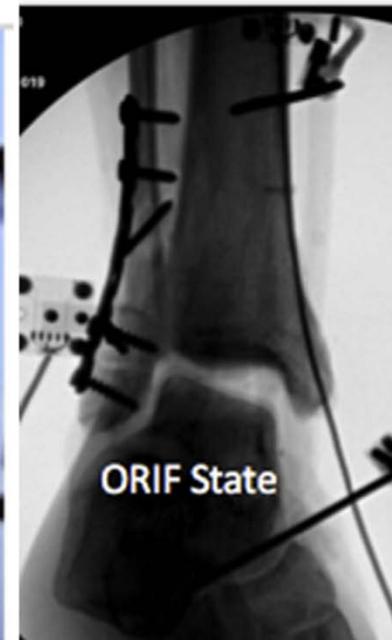
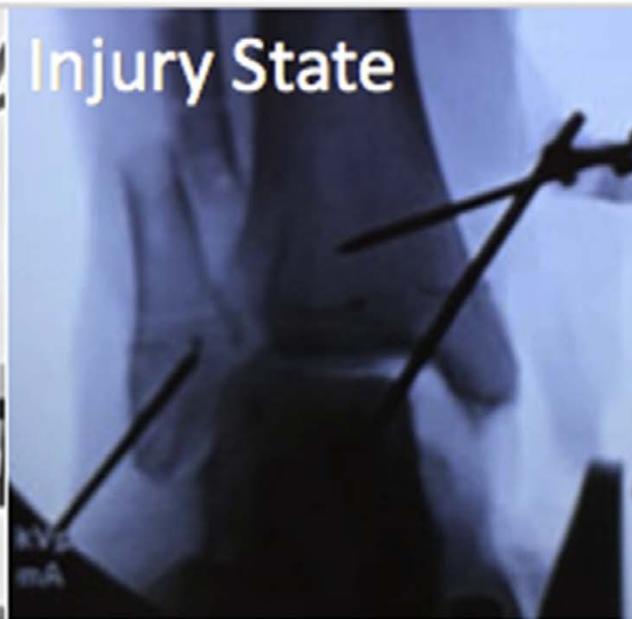
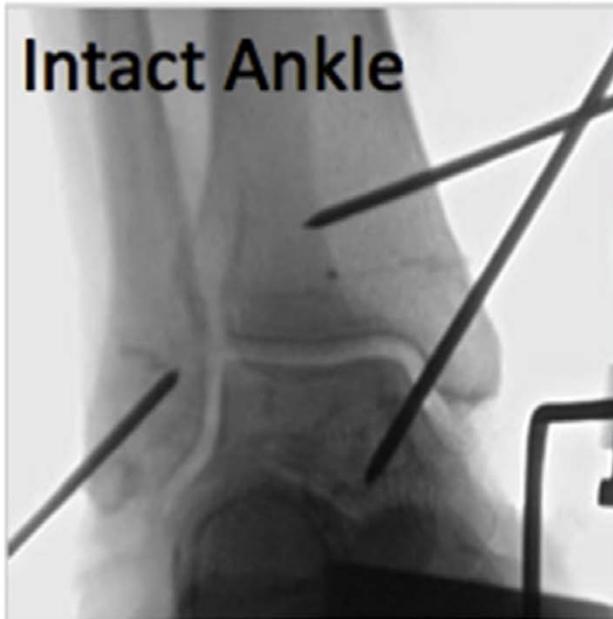


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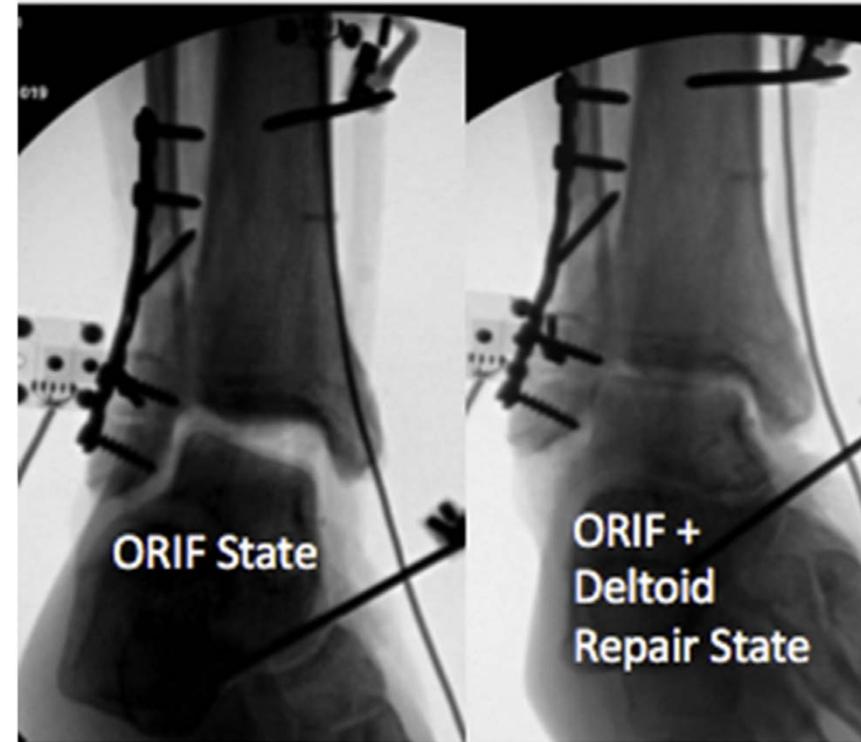
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Compared to the Intact State

- 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



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



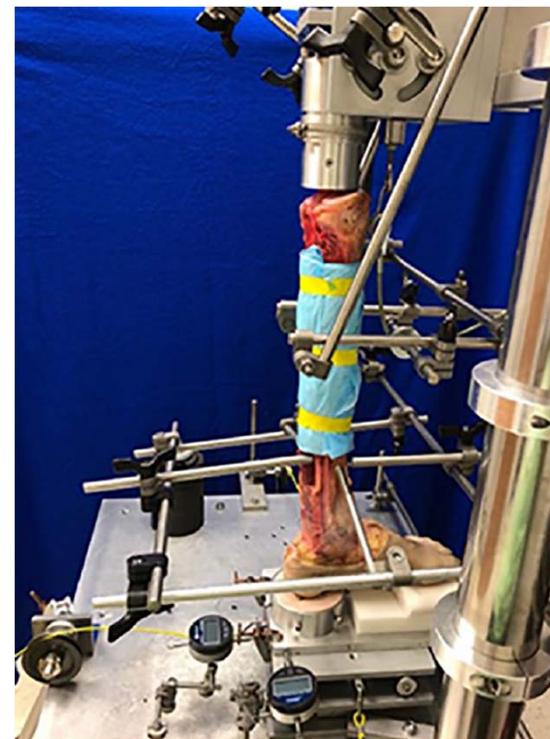
Purpose

- 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



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

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

Results

Table 1. Operative Information on the Patients in the 2 Groups.^a

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.^a

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



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.”

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

Kai Wu, MD¹, Jian Lin, MD¹, Jianhua Huang, MD², Qiugen Wang, MD³



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



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- 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%



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

Definition of the “Highly Unstable” Ankle

- After the Fibular and Syndesmotic ORIF



Definition of the “Highly Unstable” Ankle

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Thank you!



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