Statement of Purpose

**Aim #1:**
- Determine the necessity of primary deltoid repair in bimalleolar equivalent ankle fractures without primary deltoid repair
- Study Measure: FAOS Scores

**Rationale:**
- No study has quantified long-term medial clear space and talar varus after bimalleolar equivalent ORIF without primary deltoid repair
- There is no consensus regarding routine primary deltoid repair in literature

Methodology and Hypothesis

**Study Population:**
- 37 adult patients (age 19-75) who sustained a bimalleolar equivalent fracture and underwent ORIF without deltoid repair
- Follow-up requirement: ≥1 year
- Patients were selected from a raw database of equivalent surgical procedures performed at JPS Hospital from 2013-2017
- Parameters were controlled for by use of contralateral limb
- Inclusion: (1) all bimalleolar equivalent fractures with medial clear space >5mm on stress radiography, that (2) underwent fibula fracture ORIF (+/- syndesmosis repair) without primary deltoid repair, and (3) had follow up radiographs >1 year post-operatively

**Study Design:**
- Pre, Initial, and >1 year post op AP, and mortise view ankle films were used to evaluate MCS, Talar Valgus Angle.
- Statistical analysis via paired independent T-Test to contrast same variable sample means at variable sampling times
- Pathological markers: MCS >5mm (mortise), talar tilt in talus in comparison to contralateral limb (AP)
- FAOS scores obtained via phone/c clinical encounter

**Hypothesis:**
- We submit that fibular fixation (+/- syndesmosis repair) in bimalleolar equivalent fractures is alone sufficient, and primary deltoid repair is not necessary in maintaining MCS or rocker talus long term
- We also contend that successful long term outcomes can be achieved without primary deltoid repair (FAOS)

**Operative Protocol:**
- Surgical technique for bimalleolar equivalent fractures consists of a supine position, lateral incisional approach, careful dissection down to peristeum which is elevated to expose the fracture. Prior to fracture reduction, the syndesmosis is tested utilizing the hook test under fluoroscopy. Fibula fixation is then performed with either neutralization or buttress plating depending on the mechanism of injury. Fibula length is often ensured with comparative contralateral intra-operative images. Fixation of the syndesmosis is performed with direct evaluation of reduction utilizing a tri- or quadrilateral positional screw (or combination) if required.
- Routine post-operative protocol includes 2 weeks neutral dorsiflexion in splint, followed by 4 weeks NWB in CAM boot while allowing for sagittal plane ROM at therapy, followed by 4 weeks progressive WB from CAM boot to supportive tennis shoe. Symptomatic injuries typically require an additional 2 weeks of NWB in the CAM boot.

**Procedures:**
- Statistical analysis via paired dependent T-Test to contrast same variable sample means at variable sampling times
- Parameters were controlled for by use of contralateral limb
- No study has quantified long-term medial clear space and talar varus after bimalleolar equivalent ORIF without primary deltoid repair
- There is no consensus regarding routine primary deltoid repair in literature

**LITERATURE REVIEW**

- Bimalleolar equivalent ankle fractures, specifically fibular fractures with concurrent deep deltoid rupture, are injuries necessitating surgical intervention. The need for surgical repair is attributable to the loss of tibio-talar joint stability following such an injury, where instability predisposes arthritis due to non-uniform joint contact stress and subsequent cartilage degeneration (1-3).
- There are contrasting theories in regards to fixation in these injuries, specifically whether direct repair of the deltoid ligament is warranted. Some contend that fibula with or without transsyndesmotic fixation provides restoration of osteoligamentous anatomy laterally, which is sufficient for long term talocrural stability, while others assert that re-approximation without primary deltoid repair does not allow for direct end to end healing, thus leading to instability medially (4).
- Alternatively, some advocate for intra-operative scrutiny of the medial structures, basing primary repair of the deltoid ligament on either soft tissue impingement within the medial gutter or continued valgus angulation after fibular fixation (5,6).
- Baird et al found a 90% good to excellent result in 24 patients who underwent fracture fixation in bimalleolar equivalent fractures over a period of 2 years post-operatively (7).
- Hisu, Laureau and Anderson advocate for primary repair of the deltoid in their 12 patient population of NFL athletes explaining return to high level function in 83% of the population (8).
- Stromsoe and colleagues randomized 50 patients with functional bimalleolar fractures into a primary repair group and a fibula fracture only group and found no significant difference in outcomes long term (9).
- No current study to our knowledge assesses pre and long term outcomes for the medial clear space and tibial valgus in these injuries, though these radiographic markers are indicators for deltoid competency.

**RESULTS**

- In total, 37 patients were involved in the study, 62% female, for a mean follow up of 588 days.
- Linear mixed model used to determine statistical differences between time points in MCS and Talar Valgus Measures
- There was a significant improvement in MCS and Valgus from pre- to initial post-operative measurements.
- No so.
- There was not a statistically significant change between MCS and Valgus from initial to final follow up.
- FAOS score average was 84.32

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimated Difference</th>
<th>P-value</th>
<th>95% Confidence Interval</th>
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<tbody>
<tr>
<td>Talar Tilt (mm)</td>
<td>Pre op - initial post op</td>
<td>-0.21</td>
<td>0.12-0.31</td>
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<tr>
<td>Medical Clear Space (mm)</td>
<td>Pre op - initial post op</td>
<td>2.69</td>
<td>0.35-0.63</td>
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**ANALYSIS AND DISCUSSION**

- Our study illuminated no significant difference in MCS or tibial valgus when contrasting initial post-operative radiographs and those taken at greater than 1 year follow up, in patients who underwent fibular fracture fixation (+/- syndesmosis repair) without primary deltoid repair in bimalleolar equivalent ankle fractures.
- Furthermore, long term perceived functional outcomes were found to be good to excellent in our study subjects on average.
- Regarding surgical decision making, the study results concur with the findings suggesting against primary deltoid repair. In accordance with Baird and Stromsoe, not only are long term functional outcomes without significant difference, radiographic parameters such as MCS and tibial valgus, which when pathologic predispose the ankle to complications, are anatomically maintained in lateral fixation alone.

References: