### Background

1 in 6 adults over 50 years old have foot osteoarthritis
7 million experience talonavicular joint arthritis (> 50 years of age)
11,000 talonavicular arthrodesis annually
20% failure in talonavicular joint fusions

### Objective

Design a device to successfully secure the talonavicular joint and improve patient outcomes

### Solution

Our innovative solution uses device designs from successful rotator cuff repairs and will allow stability for patients

(A) Three screws are inserted into one bone and compression is applied using a suture → no backing out
(B) Sutures are screwed into place using screw caps → reduced surface prominence, patient comfort, less/smaller incision sites

### Existing Solutions & Limitations

<table>
<thead>
<tr>
<th>Existing Solution</th>
<th>Limitation</th>
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<tbody>
<tr>
<td>Staple</td>
<td>Does not achieve as much compression as some of the other solutions</td>
</tr>
<tr>
<td>Post &amp; Screw</td>
<td>Tapered screws can become removed from bone.</td>
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<tr>
<td>Variable angle compression screw</td>
<td>Inconsistencies in bone purchase between anchors</td>
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<tr>
<td>Clip and plate</td>
<td>Device is bulkier and requires a more invasive surgery</td>
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### Constraints

1. **Time:** 34 weeks
2. **Resources:** Bone Blocks and Biomechanics Lab
3. **Budget:** $800
4. **Policies:** IRB and IACUC approval, Drexel environmental health and safety plan, Drexel clinical safety plan
5. **Size:** Limited by anatomy around region
6. **Biocompatible Material:** To not be rejected by body
7. **Thread Size:** Optimized for bone purchase
8. **Bit Type:** ASTM F116-12

### Requirements

1. **Displacement:** 0-30° variation, uniform compression
2. **Insertion Torque:** 50% or less of the torsional strength
3. **Torsional Yield Strength:** > 8 Nm
4. **Tensile Strength:** Experimentally determined using Bose ElectroForce 3200
5. **Resistance to Fatigue:** > 411K cycles/steps

### Design & Build

1. **Anchor Screw**
   - Optimized threads for bone purchase
2. **Capture Channel**
   - Passage for thread
3. **Set Screw**
   - Secure tether to screw