Plantar Structure Damage from Plantar Approach Retrograde Intramedullary Screw Insertion: A Cadaveric Study

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Our disclosures are in the Final AOFAS Mobile App. There is a potential conflict with this presentation due to: Research grant, DJO Global (CFH,GCB,TMP)
Statement of Purpose

• The plantar approach for medial column retrograde intramedullary fixation of Charcot midfoot deformity allows for easy access to the ideal starting point on the metatarsal head.
• This approach is supported by good clinical outcomes data.
Statement of Purpose

- The primary argument against its use is iatrogenic damage to the plantar structures of the metatarsophalangeal joint (MTPJ).
- This damage could cause tendon imbalances resulting in hallux deformity. Such complications have very rarely been reported in the clinical outcomes literature.

Figure: Demonstrates hallux extensus following plantar approach retrograde medial column intramedullary fixation
Statement of Purpose

• Based on available literature, it is unclear what the types of plantar structure injury are and with what relative frequencies they occur.

• The purpose of this study was to describe plantar first metatarsophalangeal joint structure damage caused by plantar approach retrograde intramedullary fixation.
Study Methods

• 10 fresh-frozen cadaveric below knee specimens
• A 6.5mm cannulated screw system was used for plantar approach retrograde medial column intramedullary fixation.

<table>
<thead>
<tr>
<th>Number of Specimens</th>
<th>10</th>
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<tbody>
<tr>
<td>Mean Age at Time of Death (years)</td>
<td>69.9</td>
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<tr>
<td>Female Gender</td>
<td>5</td>
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<tr>
<td>Right Side</td>
<td>5</td>
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<tr>
<td>Mean BMI at Time of Death</td>
<td>22.68(±5.35, 13.31-28.29)</td>
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</table>

Table 1: Demographic data of the 10 below knee cadaveric specimens.
Study Methods

• This entailed using fluoroscopy to percutaneously localize a 2.8 millimeter (mm) guide wire to the center-center position on the first metatarsal head and then advancing it into the center of the medial cuneiform.

• The screw was placed per standard technique and inserted until it recessed beneath subchondral bone.
Study Methods

- The specimens were then dissected to evaluate damage to the plantar structures of the 1st MTPJ.
- Damage to named structures were categorized as none, <50%, >50% and 100%.
## Results

<table>
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<tr>
<th>Specimen ID</th>
<th>Plantar Plate Involvement</th>
<th>FHL Width</th>
<th>FHL Depth</th>
<th>FHB Medial</th>
<th>FHB Lateral</th>
<th>Sesamoid Medial</th>
<th>Sesamoid Lateral</th>
<th>Phalanx Erosion</th>
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</table>
Results

Figure 1: The lacerated portion of the FHL tendon was firmly tenodesed into the first metatarsal head by the screw.

Figure 2: Damage to the distal portion of the medial sesamoid after screw insertion.

Figure 3: Damage to the base of the proximal phalanx extending through the plantar central aspect of the articular cartilage and into the 1st MTPJ.
Conclusions

• No structures were completely transected and high grade damage (>50%) was infrequent, occurring in only two FHL tendons. Low grade damage (<50%) was frequently observed to involve the FHL, medial sesamoid, and plantar plate.

• The relative distribution of low grade damage to plantar structures may partially explain the low rate of hallux complications associated with this approach.

• Based on the current findings, an FHL splitting or preserving approach is advisable to avoid high grade damage.
References