First Metatarsophalangeal Joint Arthrodesis With Interposition Allograft Bone Block

Luk PC, Johnson JE, McCormick JJ, Klein SE
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Our disclosures are in the Final AOFAS Mobile App. We have no potential conflicts with this presentation.
Introduction

- First metatarsophalangeal joint arthroplasty has a high reported rate of failure.
- Conversion of a failed first MTP joint arthroplasty to arthrodesis is complex:
  - poor surrounding bone quality
  - limited bone healing capacity
  - significant preexisting bone loss and deformity
- Restoration of hallux length and alignment is challenging.
Purpose

- To present a technique of first metatarsophalangeal joint arthrodesis with interposition allograft bone block using a spherical reaming method
  - Additionally, we report the clinical, functional, and radiographic results of this technique

Methods

- Retrospective review of 15 patients (February 1997 – October 2013)
- Outcome measures:
  - Foot and Ankle Ability Measure (FAAM)
  - Visual analog pain scale (VAS)
  - Telephone questionnaire
- Radiographic criteria and successful fusion were evaluated
- Fusion determined by the presence of bridging bony trabeculae on radiographs
Radiographic Measures

- **AP view**
  - A: 1-2 intermetatarsal angle
  - B: hallux valgus angle
  - C: length of first ray from metatarsal base to distal phalangeal tip

- **Lateral view:**
  - D: dorsiflexion angle relative to first metatarsal
  - E: dorsiflexion angle relative to the floor
  - F: length of first ray from metatarsal base to distal phalangeal tip
Surgical Technique

1. Removal of implant (use prior incisions)

2. Initial joint debridement

3. Ream metatarsal and phalanx with typical reamers for primary fusion

4. Measure gap with traction on toe
Surgical Technique – bone graft shapes

- 2 reaming configurations were used:
  - **Type 1**: Bone loss on metatarsal and phalanx
  - **Type 2**: Bone loss on phalanx side only
- Surfaces reamed to match metatarsal and phalanx surfaces (size and shape)
Surgical Technique

5. Insert graft

6. Add adjuncts to promote healing (bone graft, bone marrow aspirate, BMP)

7. Adjust toe alignment

8. Final fixation
Results

- 15 patients identified (surgery between Sept 2004 and Oct 2013

<table>
<thead>
<tr>
<th>Patient Demographics</th>
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<tbody>
<tr>
<td>Average age</td>
<td>57 years (31-68)</td>
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<tr>
<td>Gender</td>
<td>15 female (100%)</td>
</tr>
<tr>
<td>Previous surgeries</td>
<td>2.4 (range 1-6)</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>2 (13%)</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>2 (13%)</td>
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<tr>
<td>Rheumatoid Arthritis</td>
<td>2 (13%)</td>
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<table>
<thead>
<tr>
<th>Causes of shortening</th>
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<tbody>
<tr>
<td>Failed implant</td>
<td>11</td>
</tr>
<tr>
<td>Failed hallux valgus procedure</td>
<td>3</td>
</tr>
<tr>
<td>Failed hallux rigidus procedure (other than implant)</td>
<td>1</td>
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</tbody>
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Results

• Fusion rate: 87% (13/15 patients)
• Average bone graft length: 18mm (range 10-25mm)
• Patient satisfaction rated on a 10-point scale: 11 very satisfied (scores 8-10), 2 satisfied (scores 5-7), 1 dissatisfied (score <5), 1 not available for survey
• 3 complications (no wound complications or infection):
  – 1 patient with asymptomatic pseudoarthrosis
  – 1 patient with nonunion identified at hardware removal, treated with revision fusion
  – 1 patient with CT-confirmed fusion developed stress fracture after symptomatic hardware removal

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<thead>
<tr>
<th>Parameter</th>
<th>Preoperative average and range</th>
<th>Postoperative average and range</th>
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<tbody>
<tr>
<td>1-2 intermetatarsal angle (degrees)</td>
<td>10.5 (4 – 17)</td>
<td>10.2 (4 - 15)</td>
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<tr>
<td>Hallux valgus angle (degrees)</td>
<td>12.2 (-28 – 30)</td>
<td>12.7 (4 – 22)</td>
</tr>
<tr>
<td>Dorsiflexion angle relative to 1\textsuperscript{st} metatarsal (degrees)</td>
<td>33.9 (15 – 71)</td>
<td>25.6 (16 – 40)</td>
</tr>
<tr>
<td>Dorsiflexion angle relative to floor (degrees)</td>
<td>15.8 (1 – 53)</td>
<td>8.7 (2 – 19)</td>
</tr>
<tr>
<td>Length of 1\textsuperscript{st} ray on anteroposterior radiograph (cm)</td>
<td>10.7 (9.2 – 11.7)</td>
<td>11.1 (9.3 - 12.1)</td>
</tr>
<tr>
<td>Length of 1\textsuperscript{st} ray on lateral radiograph(cm)</td>
<td>10 (8.8 – 11.1)</td>
<td>10.6 (9 – 12.7)</td>
</tr>
</tbody>
</table>
Discussion and Conclusions

• This technique maintains hallux length and restores alignment, correcting deformities in both the coronal and sagittal planes

• Dome-shaped joint preparation with reamers has multiple benefits:
  – ease of use
  – reproducibility of congruent joint surfaces to optimize fusion rates
  – ability to adjust toe positioning in multiple planes without additional bony cuts

• Our union rate is comparable to those of interposition arthrodesis with autograft bone and primary arthrodesis (87%)

• Clinical outcome measures:
  – Similar to interposition arthrodesis with autograft iliac crest bone¹
  – Performs better than repeat Keller resection arthroplasty⁴
References


