

Distraction Arthrodesis of First MTPJ with Calcaneal Autograft

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Statement of Purpose

We present a case series of revisional first metatarsal phalangeal joint (MTPJ) surgeries treated with distraction arthrodesis using bicortical calcaneal autograft.



Literature

First MTPJ arthrodesis is a surgical treatment option for failed first MTPJ procedures (1-12). Removal of failed implants and necrotic bone can cause shortening and biomechanical insufficiency of the first ray (13). Salvage arthrodesis can be performed using structural bone graft to maintain first ray length (14).

Surgical solutions for failed first MTPJ procedures include implant revision, excisional arthroplasty and arthrodesis (15-17). In cases of failed implant arthroplasty, patient function and satisfaction scores have been shown to be lower in repeat arthroplasty and higher in distraction arthrodesis (17). Distraction arthrodesis has been previously described as a successful procedure by several authors (18-22).

Level of Evidence

Level 4, Retrospective Therapeutic Case Series

Study Methodology

- 13 feet in 12 patients
- Revisional first MTPJ procedures by single surgeon with distraction arthrodesis of the first MTPJ with bicortical calcaneal autograft.
- Measured Radiographs:
 - Time to union
 - Pre and postoperative 1-2 Intermetatarsal Angle (IMA)
 - Pre and postoperative Hallux Abductus Angle (HAA)
 - Pre and postoperative 1st ray length -distal tuft to met base
- Patient Questions:
 - Were you satisfied with the procedure?
 - Would you have the procedure again?
 - Do you have pain at your heel graft site?



Operative Technique

1. Remove implants, necrotic bone and fenestrate arthrodesis site.
2. Harvest bicortical calcaneal autograft using sagittal saw and osteotome.
 - +/- 1 cm length graft is obtained from calcaneus posterior to the subtalar joint and anterior to the Achilles tendon. Medial cortex is preserved via a lateral approach
 - Backfill bone void in calcaneus with structural allograft.
3. Insert autograft into first MTPJ and pack hollow medullary canals with allograft bone.
4. Position MTPJ and apply dorsal locking plate.



Results

- 100% osseous union rate
- Median time to union 12.3 (range 6.1-25) weeks
- Insignificant change in first ray length from pre to postoperative (P=0.2402)
- Significant reduction in pre to postoperative intermetatarsal angle (P=0.0156)
- Significant reduction in pre to postoperative hallux abduction angle (P=0.0068)
- Median autograft length 10 (range 5-14) mm
- Seven out of 8 (88%) patients with available subjective follow up were satisfied with the outcome of the procedure and would have the procedure again. No patients reported pain at the graft harvest site.

Patient Number	Reason for MTPJ arthrodesis with autograft	Further first ray procedures required	Length of graft (mm)
1	Painful hallux varus with silicone implant	Extensor hallucis tendon lengthening	10
2	Painful hallux extensus with previous Mayo procedure	-	12
3	First ray deformity with silicone implant and nonunion closing base wedge	-	8
4	Painful first MTPJ after 2 previous silicone implants	-	8
5	Avascular necrosis of first met head after bunion procedure	Repositional osteotomy of fusion site to medialize and elevate hallux, followed by exostectomy plantar first MTPJ	8
6	Painful first MTPJ with silicone implant	-	5
7	Painful first MTPJ with silicone implant	-	8
8 (right)	Hallux extensus with silicone implant	-	10
8 (left)	Painful first MTPJ with silicone implant	-	8
9	Painful first MTPJ after 2 previous silicone implants	-	10
10	Nonunion first MTPJ fusion after failed bunionectomy	-	12
11	Flail hallux after previous Mayo	-	14
12	Painful MTPJ after synthetic cartilage (polyvinyl alcohol) implant	-	10

Conclusion

All patients in our study required removal of implants and/or nonviable bone. By anatomic positioning of the first MTPJ and using structural autograft we achieved an insignificant change in first ray length and a significant reduction in IMA and HAA .

The reported nonunion rate for first MTPJ distraction arthrodesis with autograft ranges from 0-21.9% (19-21). Our nonunion rate was 0%. Time to union for first MTPJ distraction arthrodesis has been reported to range from 27-33 weeks (20,22). Our median time to union as 12.3 weeks. One patient had a delayed union at 25 weeks. Higher union rates and faster time to union could be due to the greater proportion of vascular cancellous bone present in bicortical calcaneal autograft as compared to tricortical grafts.

Distraction arthrodesis for failed first MTPJ arthroplasty has been shown to improve patient satisfaction and functional scores (14,20,22-24). In our case series, 7/8 patients, with available subjective data, were satisfied with the results of the procedure and would undergo the procedure again. Patient 8 was dissatisfied and ultimately underwent surgery to reposition the arthrodesis site. This highlights the importance of applying the principles of first MTPJ arthrodesis positioning even when using structural bone graft.

Our results indicate that first MTPJ distraction arthrodesis with bicortical calcaneal autograft is a viable option for failed first MTPJ procedures.

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