

COMPLICATIONS OF FIRST METATARSOPHALANGEAL JOINT ARTHRODESIS

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INTRODUCTION

Arthrodesis of the first metatarsophalangeal joint (MTPJ) is one of the oldest orthopedic procedures described for first ray and medial column pathology. These pathologies include degenerative and traumatic affections of the first MTPJ, medical conditions destroying part or all of the first MTPJ, e.g., gouty arthritis, rheumatoid arthritis, status post malposition following hallux valgus surgery, tumors, aseptic necrosis, failed implant arthroplasty, infection, weak and unbalanced muscle/tendon function.¹ Conservative treatments most commonly include accommodative shoe gear, stiffening of the shoe shank and symptomatic treatment as needed.^{1,2}

DISCUSSION

Arthrodesis of the first metatarsophalangeal joint maintains length of the first ray, decreases intermetatarsal angle, and stabilizes the medial column to accomplish weightbearing of the first ray and assist in propulsion through the toe-off phase of gait. The position of fusion is usually 15-20 degrees of abduction in the transverse plane or in line with the lesser digits, 15-25 degrees dorsiflexion to allow for toe-off, and rectus with respect to varus or valgus.^{3,7} The procedure allows for hallux shortening in patients who have long proximal or distal phalanges.

Complications and morbidity arise as a result of technical factors, compensatory biomechanical changes, hardware problems and patient routines that test the normal accepted post-fusion course such as abnormal activities and shoe wear excesses. Yu and Gorby stated that the single most important intraoperative consideration made when performing a first MTPJ arthrodesis is the position of fusion.³ They also noted that it is the position of fusion that ultimately determines effective function with most complications following first MTPJ arthrodesis relating to a malposition of fusion.^{3,8} When the hallux is positioned in too much extension, the distal dorsal aspect of the hallux can abut the dorsal distal aspect of the shoe.^{3,7,9} Subungual pressure ensues and subungual bleeding and hematoma can occur. Onycholysis results and subungual

exostosis can occur (Figure 1). This is particularly noted when the toe box of the shoe is too small.

Another problem that can arise is not paying attention to the position of the lesser digits during fusion of the first MTPJ. If the first MTPJ is fused in the normal 15 degrees abduction and 15-20 degrees extension, problems can occur when the patient bears weight. It is not unusual for the second metatarsophalangeal joint to adduct during stance. Upon weightbearing, the second toe moves medially and abuts the hallux causing interdigital pressure resulting in hyperkeratotic formation between the hallux and second digit. Nicholas found that fusion of the first MTPJ in greater than 20 degrees of abduction resulted in an increased lateral second MPJ deviation.¹⁰ It behooves the surgeon to load the foot in surgery to observe the second metatarsophalangeal joint position and fuse the first metatarsophalangeal joint so that the hallux will not impinge upon the second toe (Figure 2).

Infrequently, hardware problems can cause morbidity. If screw heads, K-wires, and plates are not properly buried and positioned they can become prominent postoperatively once the edema has subsided. This can be especially irritating in the very thin patient and in those who persist in wearing very tight dressy shoes. Subtalar sesamoid problems can occur when the MTPJ is

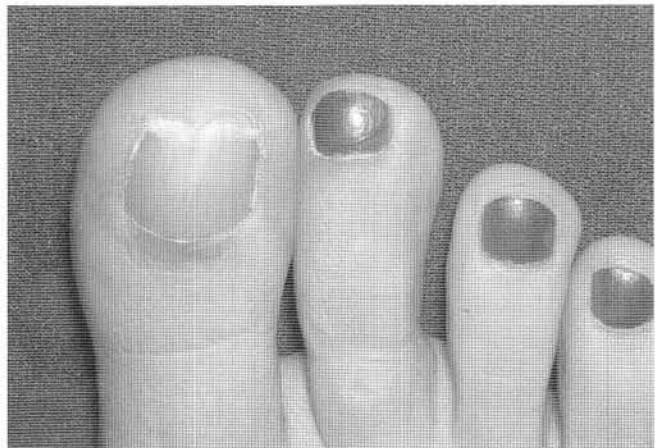


Figure 1. Two years post first metatarsophalangeal joint arthrodesis. This patient's toenail has been irritated from using a shoe that was too tight. Note distal 1/3 thickening of nail plate.

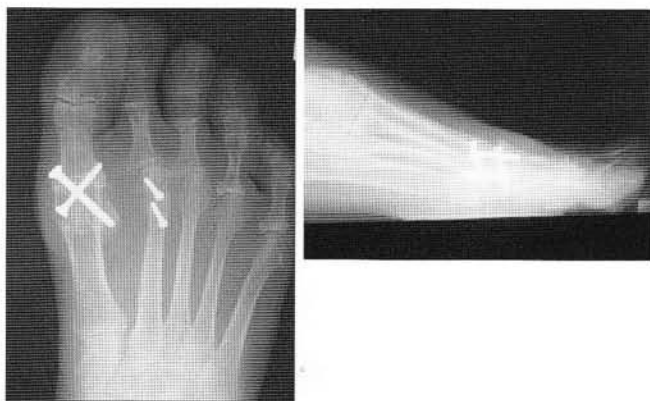


Figure 2A. 4.5 months postoperative view of first metatarsophalangeal joint fusion and relocation of second MTPJ reveals that second digit has lost correction into adduction.

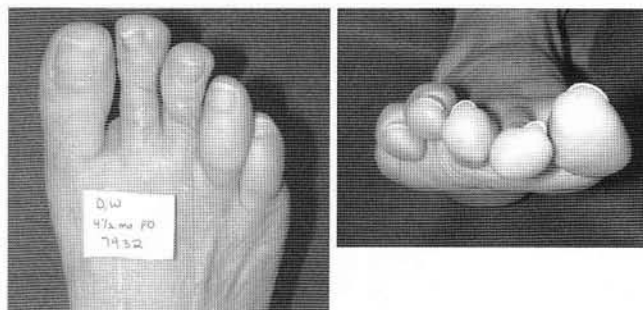


Figure 2B. Clinical view 4.5 months postoperative.



Figure 2C. Weightbearing reveals the second digit abutting the hallux. This has caused irritation between the hallux and 2nd digit.

fused in too much extension. The retrograde forces on the tibial and/or fibular sesamoids can cause painful hyperkeratoses and/or ulcer formation. Repositioning the fusion in less extension will alleviate this problem (Figure 3A). As some patients get older, the fat pad underneath the metatarsals may diminish causing similar problems. To alleviate this condition, tibial sesamoid planning, tibial sesamoidectomy, or “take down” of the fusion may be necessary (Figures 3B-3G). Occasionally, degenerative joint disease of the hallux interphalangeal joint ensues as this joint takes up some of the flexor function lost by the fused first MTPJ. Literature supports that fusing the first MTPJ in greater than 20 degrees of abduction significantly increases the incidence of hallux IPJ arthritis.^{10,11}

Osteophytic lipping, osseous hypertrophy and limitation of function may occur causing shoewear problems. In this setting, modified hallux IPJ cheilectomy, arthroplasty or arthrodesis may help reduce symptoms. Another problem that can occur is compensatory lateral forefoot symptomatology with development of subfourth and/or subfifth metatarsal head lesions as patients attempt to unload the medial column secondary to sub first metatarsal and/or hallux pain (Figure 4). Another less commonly recognized

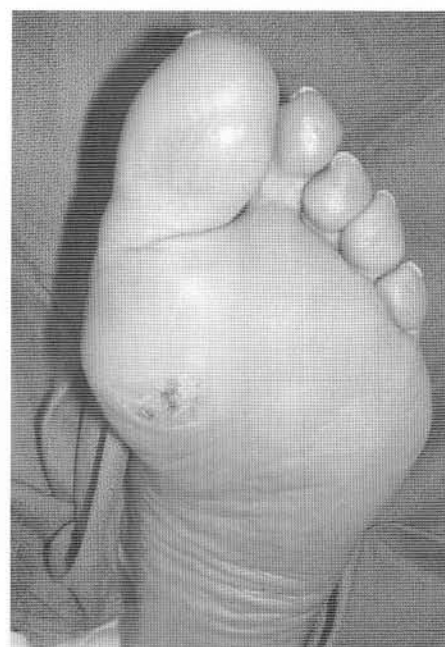


Figure 3A. Six years post-first metatarsophalangeal joint arthrodesis. Patient has developed subtibial sesamoid joint lesion as a result of fat pad atrophy.

complication of first MTPJ fusion is dispersion of weight-bearing stresses to other areas of the foot. These transferred forces can lead to stress fractures along the medial column or lesser metatarsals (Figure 5).

Nonunion of the fusion site may occur. Although the literature indicates that 20% of all first MTPJ fusions go onto a fibrous nonpainful, nonunion, a painful unstable nonunion may occur. In symptomatic malpositioned nonunions, autogenous and/or allogeneic bone block grafting may be necessary to regain length of the first metatarsal, maintain position and re-establish weight-bearing function of the first metatarsophalangeal joint.



Figure 3B. Radiographs 6 years postoperatively identifying internal fixation devices that are to be removed.

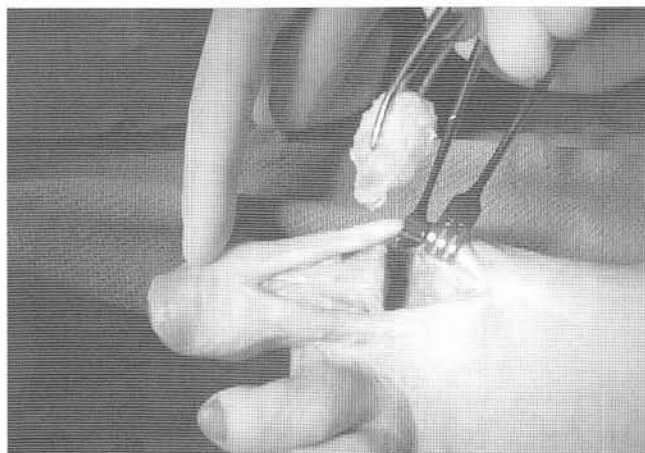


Figure 3C. Resection arthroplasty "take-down" of the fusion.

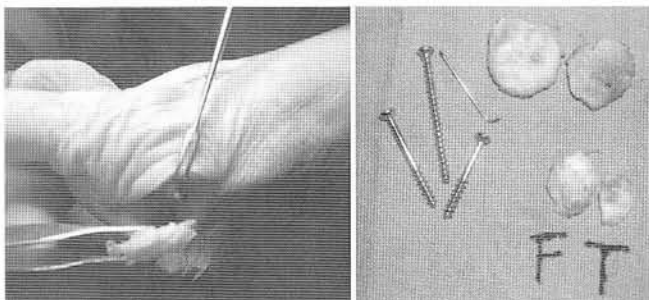


Figure 3D. Sesamoidectomies (tibial and fibular) and removal of internal fixation devices following resection arthroplasty.



Figure 3E-G. Immediate postoperative x-rays.



Figure 3F. Postoperative 4.5 month radiograph.

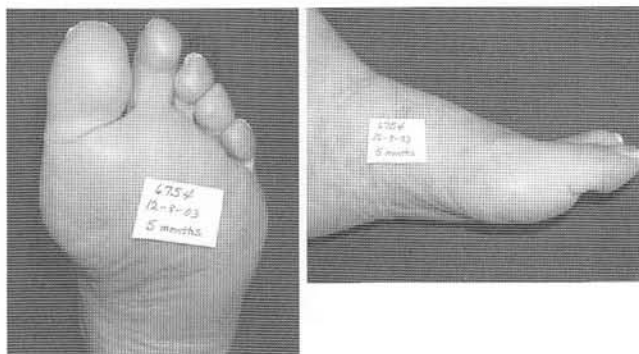


Figure 3G. Note excellent resolution of hyperkeratosis on 5 month clinical photograph.

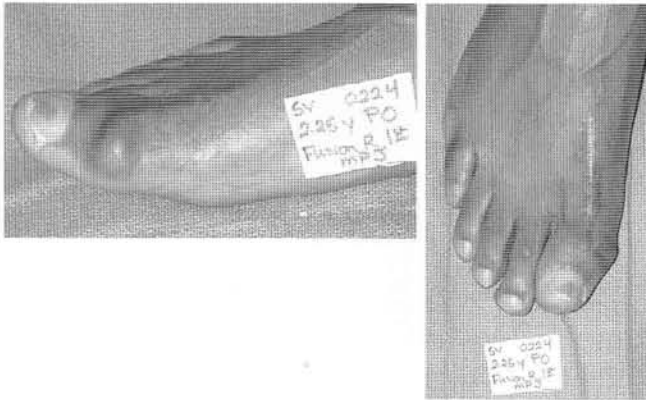


Figure 4A. Dorsal medial hypertrophy of hallux interphalangeal joint is noted.



Figure 4C. DP and MO x-rays reveal IPJ degenerative joint disease and osseous hypertrophy.

It is important to consult with the patient regarding postoperative shoe wear. Shoes with small toe boxes and/or too high a heel can cause pressure problems leading to blisters, etc. Shoes with heel heights that exceed the recommended height or activities, e.g., running, tennis, etc., can stress the first metatarsophalangeal joint and hallux, creating increased pressure leading to pain and stress fractures.

SUMMARY

As historically supported, first metatarsophalangeal fusion, can have very satisfying results. Morbidity and complications arise when technical, compensatory biomechanical changes, and hardware problems arise. Extended patient activities and shoe gear not consistent with the normal postoperative routine can cause complications. Most patients find that fusion is compatible

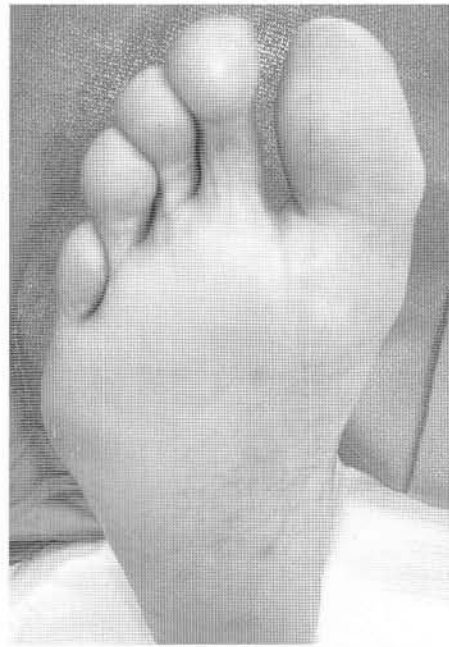


Figure 4B. Sub-fifth metatarsal lesion as a result of supinatory compensation for symptomatic medial column.

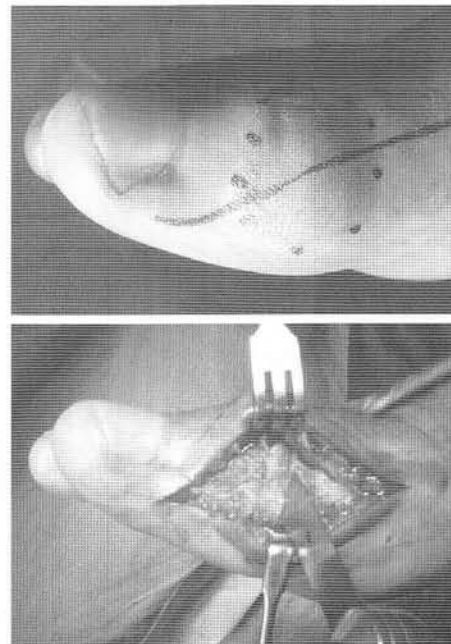


Figure 4D-F. Series of intra-operative arthrodesis and remodeling of hallux IPJ with K-wire fixation.

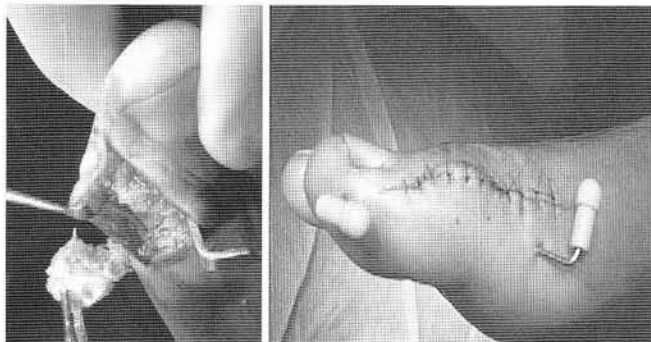


Figure 4E. Intraoperative HIPJ remodeling and arthrodesis with final clinical photograph.

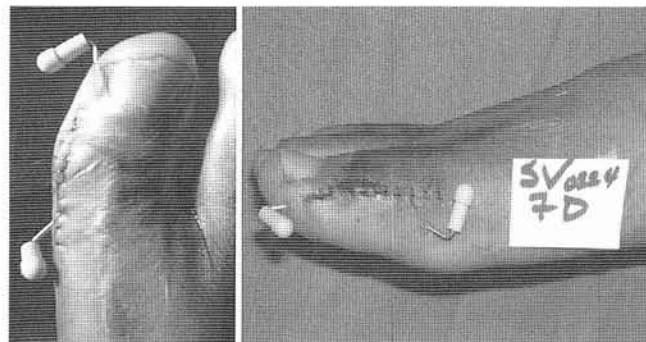


Figure 4F. Seven days status post HIPJ remodeling and arthrodesis.



Figure 5A, B. Immediate postoperative arthrodesis first MTPJ



Figure 5C, D. Seven months postoperative x-ray revealed fracture (arrow) first metatarsal as new stresses are transferred away from first MTPJ arthrodesis site to the first metatarsal shaft.



Figure 5E, F. 18-months postoperative following conservative treatment (bone stimulator and fracture boot), the first metatarsal has reconsolidated reflecting new weightbearing position.

with an active lifestyle and in many cases it has allowed for a higher level of function in everyday life and recreational activities.^{8,12} Nonunion, although reported in 15-20% of cases of first metatarsophalangeal fusion, can be very painful, limiting function which can result in a major surgical reconstruction. As most authors have agreed, success of the fusion is highly dependent on position and surgical approach.^{1,3,8,12} We have found that first MTPJ arthrodeses has proven to be a reliable and time-honored procedure.

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