

Double Fusion Technique For Combined 1st MTP and 1st TMT Joint Pathology

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Purpose

Arthrodesis in the foot and ankle has many benefits, and can be a solution to a variety of joint pathology. The purpose of this retrospective case series is to report on the outcomes of double fusion of the 1st MTP and 1st TMT joints, and complication rate of these combined procedures.

Literature Review

The first tarsometatarsal joint (TMTJ) fusion procedure is a well-known solution to many conditions, such as first ray hypermobility, hallux limitus, hallux valgus, medial column stabilization with pes planus and arthrosis of the first TMTJ (1). The consequences of these conditions often affect not only the TMTJ but the 1st metatarsophalangeal joint (MTPJ) as well. Many etiologies of 1st MTPJ destruction are directly related to 1st TMTJ pathology, such as, hypermobility, pes planus foot type, hallux valgus and hallux rigidus (2,3). First MTPJ arthrodesis alone allows for an effective correction of both the hallux abductus angle (HAA) and intermetatarsal 1-2 angle (IMA 1-2). However, in feet with a severely increased IMA 1-2, 1st MTPJ arthrodesis alone might not be sufficient to adequately address the deformity. Undercorrection of a wide IMA 1-2 after correction of the HAA alone can result in a persistently wide forefoot with potential issues in normal footwear and a cosmetically unaesthetic gap between the first and the second toes. In a retrospective case series of 18 feet with 1st MTPJ and additional proximal correction (Mau osteotomy or 1st TMTJ arthrodesis) for severe hallux valgus, Rippstein et al. found that the IMA 1-2 significantly improved from a mean of 18.8 degrees to 4.6 degrees postoperatively and the HAA from a mean of 49.9 degrees to 9.7 degrees (4). These procedures are not commonly performed in conjunction with one another, and to our knowledge, there is no other substantial literature reporting results of the double fusion (5).



Methods

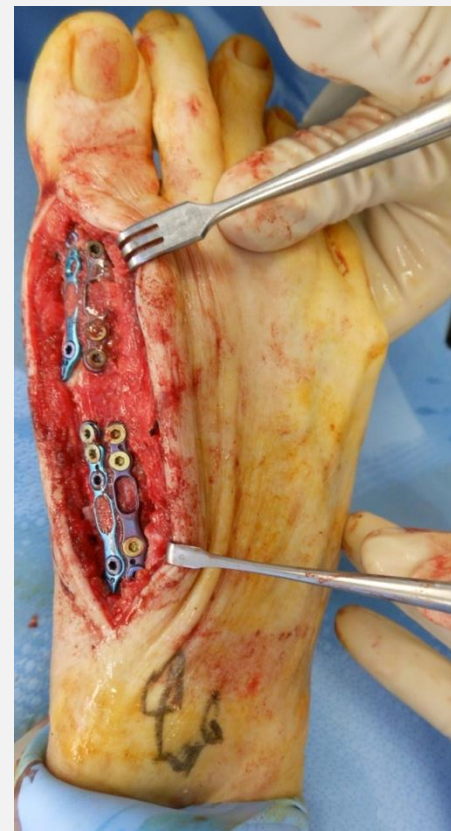
A retrospective chart review was performed on 47 patients who underwent primary double fusion of the 1st MTP and 1st TMT joints. The average age of our patients was 53 years. The average follow up time was 24 months with a range of 24 to 120 months. The methods used to determine factors in complications were smoking status, body mass index (BMI), medical comorbidities, graft versus non-graft, previous surgery, time to radiographic union and return to shoe gear and full weight bearing. Preoperative and postoperative radiographic findings were assessed by two board certified surgeons for IPJ arthritis, hallux extensus, mal-union, mal-position, nonunion, and time to radiographic union. The complications assessed for the double fusion procedure were amputation, osteomyelitis, nonunion, mal-position, mal-union, failed hardware, superficial and deep infection, hematoma/seroma, dehiscence, metatarsalgia and IPJ arthritis. We divided the complications into major and minor categories. Major complications were defined as amputation, osteomyelitis, and nonunion. Minor complications were defined as mal-position, mal-union, failed hardware, superficial/deep infection, hematoma/seroma, dehiscence, metatarsalgia, and hallux IPJ arthritis. All complications were gathered from chart review and radiographic review. ACFAS scores were recorded preoperatively and at 12 and 24 months postoperatively. Pain analogue scores were recorded preoperatively and 24 months postoperatively.

Procedure

A fusion of the 1st TMTJ was performed in conjunction with a 1st MTPJ fusion in patients with a variety of combined pathology in these respective joints. The selection and type of fixation construct was dependent on bone quality, body mass index, patient compliance, and ability of patient to maintain non-weightbearing status.

Results

Of the 47 patients reviewed, four were smokers and had smoked throughout the postoperative period. The average BMI was 24.5, four patients had Down syndrome, five had rheumatoid arthritis, two had diabetes and two had posttraumatic arthritis. Twenty-six patients received a bone graft, six patients had previous first ray surgery, eight patients had prior hallux extensus or IPJ arthritis. The average time to radiographic union and return to full weightbearing was 12.2 weeks with overall union rate of 89%. Of the complications reviewed, seven had malposition, five non-unions, ten mal-unions and six failed hardware. There were no superficial or deep infections, one hematoma, three had a wound dehiscence, nine with lesser metatarsalgia and eight with IPJ arthritis. Overall, 42.9% of patients had no complications. 50% of the smokers and diabetic patients had no complications. 60% of rheumatoid and 50% of post-trauma patients had no complications. 64.3% of patients had no osseous complications. 10% of patients resulted in acquiring hallux IPJ arthritis. Only 6.4% of patients had a major complication, that being a nonunion. Patients who received bone graft had a 3.8% (1/26) non-union rate while those who did not had a non-union rate of 9.5% (2/21). Patients who had a graft placed also had a decreased incidence of mal-union, mal-position, IPJ arthritis and failed hardware. There was a significant difference ($p < 0.05$) noted between pre and postoperative ACFAS scores at both 12 and 24 months. The mean preoperative score was 64.9 while 12 and 24 month postop scores were 82.1 and 85.3, respectively. There was also a significant difference ($p < 0.05$) noted between preoperative (mean=8.6) and 24 months postoperative (mean=2.3) pain analogue scores. 45 out of 47 patients (95.7%) would have the operation again.



Discussion

The double fusion technique resulted in only 6.4% of patients having a major complication, that being a nonunion. 85% of patients were free of any soft tissue complication. No amputations or cases of osteomyelitis were found. These combined procedures require meticulous and careful dissection to preserve the blood supply of the first metatarsal. Additionally, optimal positioning is vital to a successful outcome and a functionally painless foot (6). We understand that positioning in this procedure is difficult. Historically, placing the TMTJ in a slightly plantarflexed, laterally reduced and neutral position and MTPJ in a slightly dorsiflexed, abducted and neutral position has been difficult with the various foot types surgeons encounter (7). We have found that there is not one optimal position that fits all feet. Rearfoot alignment and forefoot positioning, including rigidity and laxity of the foot need to be taken into consideration when final placement is chosen to accommodate a double fusion. The presence of surrounding joint arthrosis must also be considered. The authors prefer to position the TMTJ followed by the MTPJ. When a joint is fused in the foot, we often find the formation of arthritis in adjacent joints. The authors were pleased to find that only 10% of the patients developed hallux IPJ arthritis, after two proximal fusions along the medial column. When comparing patients who received bone graft versus those who did not, the patients with bone graft had a decreased incidence of non-union, mal-union, mal-position, IPJ arthritis, and failed hardware. All but two patients were pleased with their overall outcomes and would undergo the double fusion again. We acknowledge the limitations to this study. The fixation constructs of the arthrodesis varied from patient to patient. Variations existed in whether the graft was used in one or both joints and also the type of graft used (allograft vs. autograft). Literature on these two fusions performed at the same time is also minimal, which made it difficult to compare findings with current research. We conclude that a double fusion technique of the 1st MTPJ and 1st TMTJ can be an effective solution to multiple painful pathologies, and should be performed with bone graft for optimal results. We also appreciate that this is not a primary procedure of choice for most pathology, and that this procedure should be reserved for more severe pathology and revision surgery.

References

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