

Retrospective Review of First Metatarsophalangeal Joint Arthrodesis Utilizing a Contoured Plate with Integrated Interfragmentary Compression

Statement of Purpose & Literature Review

Arthrodesis is well documented as being the gold standard in treating multiple irregularities of the first metatarsophalangeal joint¹ (MPJ). However, controversy still exists as to which fixation modality leads to greater stability and fusion rates. Dorsal plate and cross screw fixation are currently the most common techniques with the former coming into favor most recently⁴. Plate fixation with a lag screw has demonstrated superior mechanical stability⁴. Historically, nonunion rates of 1st MPJ arthrodesis have been reported upwards of 10%, however, in a large systematic review the incidence was found to be 5.4% utilizing modern osteosynthesis techniques².

There has been a trend for anatomically specific plates with integrated compression screws. Gross et al. and others in a small series (15) have reported a nonunion rate of 31% utilizing dorsal plate with PocketLock fixation¹. Latif et al. and others, report a union rate of 100% utilizing anatomic plate with interfragmentary compression (40)⁵. Despite these drastic differences in outcomes, some authors report no significant differences in time to fusion or fusion rates between different dorsal plate configurations³. The purpose of this retrospective case series was to review the results of 1st MPJ arthrodesis utilizing, anatomically contoured plates with integrated sagittal plane lag screw design (Stryker, In2Bones, Wright Medical, Paragon) to determine rate of fusion.

Methodology

Records were reviewed to identify patients who underwent first metatarsophalangeal joint (MPJ) arthrodesis between August 2012 to September 2017. Inclusion criteria was established to include only those patients that received dorsal plate fixation with integrated sagittal plane interfragmentary screw. Patients who underwent surgery failed all conservative treatments. Underlying pathologies necessitating 1st MPJ arthrodesis ranged from hallux rigidus, hallux abducto valgus, hallux varus, primary osteoarthritis, and revision of 1st MPJ arthrodesis non-union. Procedures were performed in isolation or in conjunction with procedures of the lesser digits (i.e., PIPJ arthroplasty, PIPJ arthrodesis, etc.). Those patients who underwent 1st MPJ arthrodesis by means of any other fixation modalities such as k-wire, isolated screw fixation, dorsal plate fixation without integrated interfragmentary compression, etc. were excluded from this study. A total of 71 cases were reviewed of which only 51 met inclusion criteria.

Postoperatively, patients were non-weight bearing for 4-weeks in a bivalve below the knee cast. At 4-weeks status post, patients were placed in a CAM boot for 2-weeks and allowed to weight bear as tolerated. Patients returned to full weight bearing status at the 6-week mark. Patients were followed postoperatively for a minimum of 6-weeks with serial x-rays (AP, MO, and Lateral) taken to demonstrate boney consolidation across the fusion site. The senior author evaluated each radiograph and documented all findings. We defined successful fusion as boney bridging observed across 2 cortices. Once fusion was achieved patients were followed at 6-months and 1-year post operatively before being discharged.

Surgical Technique

A dorsomedial incision approximately 6cm in length was made just medial to the extensor hallucis longus tendon extending over the 1st metatarsophalangeal joint and onto the base of the proximal phalanx. Dissection was performed in layers down to joint capsule ensuring to protect neurovascular structures. A periosteal and capsular incision was made down to bone over the 1st MPJ in line with the skin incision. Capsule and periosteum were sharply reflected around the 1st MPJ to expose the joint. Joint preparation was performed via a combination of Rongeurs and football burr to denude all articular cartilage of the 1st MPJ down to subchondral bone plate ensuring to maintain the natural contour of the joint. Further resection was performed in the same manner past the subchondral bone plate to expose bleeding, cancellous bone which was then fenestrated with a 2.0mm drill. The desired position was achieved and temporarily fixated with a K-wire inserted percutaneously from distal medial to proximal lateral across the joint. Intraoperative fluoroscopic images were obtained to assess the position of the fusion site. A footplate was also utilized to mimic loading of the foot and clinically assess proper positioning of the hallux. Dorsal plate fixation was applied in classical AO technique (Fig. 1). Final position was verified clinically and fluoroscopically ensuring excellent boney apposition across the fusion site prior to closure (Fig. 2). Joint capsule was sutured over the hardware and closure in layers was performed. Standard dressings were applied, followed by a bivalve below the knee cast. Patients were instructed to non-weight bear for 4-weeks followed by partial weight bearing in a CAM boot. Patients were allowed full weight bear by the 6-8 week mark in normal shoe wear.

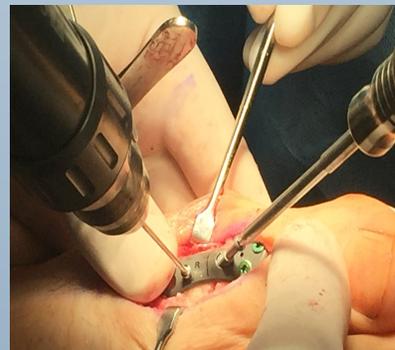


Figure 1. Application of contour plate with interfragmentary compression screw per protocol

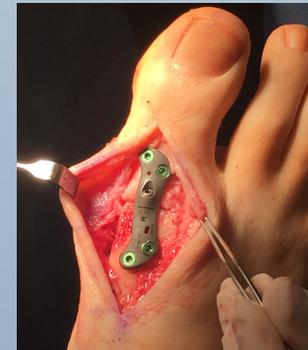


Figure 2. Final construct of contour plate in combination with interfragmentary compression screw with excellent bone apposition.

Results

A total of 51 first metatarsophalangeal joint arthrodesis cases were reviewed and included in this study. Fifty of fifty-one patients went on to successfully fuse. Only one patient demonstrated a non-union (1.9%).



Figure 3. Standard AP View



Figure 4. Standard MO View



Figure 5. Standard Lateral View

Figures 3-5: Three standard radiographic views status post 1st MPJ fusion via contour plate with integrated interfragmentary compression.

Analysis & Discussion

Arthrodesis is an effective technique used to treat multiple pathologies of the first MPJ that can alleviate pain and improve quality of life. Results vary amongst techniques, however, new low profile dorsal plates with integrated lag screw design show promise with excellent fusion rates. In this review, low profile dorsal plates with integrated sagittal plane interfragmentary compression has demonstrated a very high rate of fusion and we recommend their use.

References

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