ABSTRACT

Purpose. To report the outcome of fusion of the first metatarsophalangeal joint (MTPJ) using the Fyxis plate and compression screws.

Methods. Medical records of 12 men and 39 women (54 feet) aged 28 to 74 (mean, 58) years who underwent primary fusion of the first MTPJ using the Fyxis plate and compression screws for hallux rigidus (n=38), severe hallux valgus (n=8), or rheumatoid arthritis (n=8) were reviewed. The outcome measures included the fusion rate, time to fusion, complication rate, hallux valgus angle, dorsiflexion angle, and the American Orthopaedic Foot and Ankle Society (AOFAS) scale.

Results. The mean follow-up was 14.8 (range, 12–20) months. The mean time to fusion was 3.2 months. 48 feet achieved complete fusion at 3 months, 5 at 6 months, and one had non-union at 12 months, which was treated with revision surgery. The mean hallux valgus angle improved from $23^\circ$ to $12^\circ$. The mean dorsiflexion angle improved from $22^\circ$ to $23^\circ$. The mean AOFAS scale score improved from 31 to 86. 98% of the feet achieved a score of >72. One patient with non-union had a score of 59. Two feet developed superficial wound infection, which resolved with antibiotic treatment. Two other feet developed numbness over the medial aspect of the great toe, which persisted after one year.

Conclusion. The outcome of fusion of the first MTPJ using the Fyxis plate and compression screws was good.

Key words: arthrodesis; bone plates; hallux rigidus; hallux valgus; metatarsophalangeal joint

INTRODUCTION

Fusion of the first metatarsophalangeal joint (MTPJ) has been used for severe hallux rigidus, salvage of previously failed surgeries, severe and/or recurrent hallux valgus, inflammatory arthritis, and neuromuscular instability. Many different techniques and osteosynthesis implants have been used, including cross screws fixation, fixation with locking...
or non-locking plate and screws with or without lag screws and staples.\textsuperscript{1–7} This study reports the outcome of fusion of the first MTPJ using the Fyxis plate and compression screws.

MATERIALS AND METHODS

Medical records of 12 men and 39 women (54 feet) aged 28 to 74 (mean, 58) years who underwent primary fusion of the first MTPJ between June 2007 and June 2011 by a single surgeon, using the Fyxis plate and compression screws for hallux rigidus (n=38), severe hallux valgus (n=8), or rheumatoid arthritis (n=8) were reviewed. Patients treated for previous failed surgery were excluded.

The outcome measures included the fusion rate, time to fusion, complication rate, hallux valgus angle, dorsiflexion angle, and the American Orthopaedic Foot and Ankle Society (AOFAS) hallux metatarsophalangeal-interphalangeal scale entailing components of pain (40 points), function (45 points), and alignment (15 points).

The Fyxis plate is a low-profile (1.3-mm thick) plate, made of titanium alloy, pre-bent to 5° dorsiflexion to enable 20° to 25° dorsiflexion of the great toe. The landmark line on the plate enables precise positioning of the plate. The oblong hole proximal to the landmark line enables sliding during compression. The attached phalangeal arm enables insertion of a screw across the arthrodesis site for additional fixation. Eight anatomic sizes are available: 4 for the left foot and 4 for the right foot, with a 5-holed plate in 40- and 45-mm widths and a 6-holed plate in 50- and 55-mm widths. Self-tapping screws (2.7 mm) were used.

The patient was placed in a supine position, and an ankle tourniquet was applied. A medial incision was made over the first MTPJ, and the dorsal cutaneous nerve was retracted. A longitudinal capsular incision was made to expose the joint and excise the bunion. A 1.5-mm Kirschner wire was inserted into the metatarsal head, which was reamed using a concave reamer until maximum bone surface contact was obtained.\textsuperscript{8} The Kirschner wire was then inserted into the proximal phalanx, which was reamed with a convex reamer until maximum bone surface contact was obtained.\textsuperscript{8} If the subchondral bone was hard, additional multiple holes were made using the Kirschner wire. After opposing the prepared joint surfaces, an appropriate size plate was selected. The landmark line on the plate was placed at the level of the arthrodesis, and temporary fixation was achieved with 1-mm Kirschner wires and bone-holding forceps. A 1.5-mm Kirschner wire was placed across the arthrodesis site through the screw hole in the phalangeal arm of the plate, while aligning the arthrodesis site with 15° valgus and 10° dorsiflexion. A 2.7-mm screw was placed after drilling through the oblong hole on the plate. The second screw was introduced distally into the base of the proximal phalanx nearest the arthrodesis site. The third screw was then placed on the most distal hole in the plate. The oblique screw across the arthrodesis site was then placed through the phalangeal arm of the plate. The screw was not fully tightened at this stage. All the Kirschner wires were removed, and the screw in the oblong hole was loosened to enable the plate to slide as compression took place when the oblique screw was tightened. The most proximal screw was inserted and the screw in the oblong hole was tightened. The position of the implant and the alignment of the arthrodesis were confirmed using an image intensifier. Additional procedures performed included Weil osteotomy of the second toe (n=5) and proximal interphalangeal joint fusion of the third toe for hammer toe deformity (n=2).

Postoperatively, mobilisation using heel weight bearing shoes was allowed. At 6 weeks, full weight bearing mobilisation using normal footwear was encouraged. Patients were followed up at weeks 6 and 12, and months 6 and 12.

Figure Non-union after fusion of the first metatarsophalangeal joint.
RESULTS

The mean follow-up was 14.8 (range, 12–20) months. No patients were lost to follow up. The mean time to fusion was 3.2 months. 48 feet achieved complete fusion at 3 months, 5 at 6 months, and one had non-union at 12 months (Fig.), which was treated with revision surgery.

The mean hallux valgus angle improved from 23º (range, 14º–45º) to 12º (range, 11º–13º); 15 feet were >40º at baseline. The mean dorsiflexion angle improved from 22º (range, 18º–26º) to 23º (range, 21º–25º). The mean AOFAS hallux metatarsophalangeal-interphalangeal scale score improved from 31 (range, 23–44) to 86 (range, 59–90). 98% of the feet achieved a score of >72. One patient with non-union had a score of 59.

Two feet developed superficial wound infection, which resolved with antibiotic treatment. Two other feet developed numbness over the medial aspect of the great toe, which persisted after one year.

DISCUSSION

For fusion of the first MTPJ, plate fixation results in significantly fewer non-unions than single-screw fixation,2 with a success rate of 98.7%. The time and rate of fusion are similar after fixation using a static plate, static plate with lag screw, locked plate, or locked plate with lag screw.3 In the present study, fixation with the Fyxis plate and compression screws achieved a fusion rate of 98%. The mean time to fusion was 7.6 weeks after fixation with memory staples,4 and 3.1 months after fixation with a dorsal plate and a compression screw.5 In the present study, the mean time to fusion was 3.2 months. Success depends on fusion of the first MTPJ in a satisfactory position. The dorsiflexion angle was 20º to 25º after fixation with a dorsal titanium contoured plate,6 and 22º after fixation with titanium staples.7 In the present study, the dorsiflexion angle was 23º after fixation with the Fyxis plate. The 5º dorsiflexion pre-bent in the Fyxis plate helped to achieve these good results.

In one study, the mean AOFAS score improved from 39 to 85 at the one-year follow-up. The AOFAS scores at 3 and 6 months showed considerable variation. The mean results tended to converge at 12 months, suggesting a greater reliability in prognosis.8 In the present study, the mean AOFAS score improved from 31 to 86, and 98% of feet had a score of >72.

In a study of 58 feet undergoing MTPJ fusion using plate fixation, there were one delayed union and one non-union with plate breakage.9 In 233 MTPJ fusions, 3 developed non-union and one had broken screws.10 In the present study, there was no implant failure. One of the patients with non-union eventually achieved fusion after revision. Re-fusion for non-union is suggested.11

CONCLUSION

The Fyxis plate enabled rigid internal fixation and adequate compression at the fusion site, because the compression screw was placed through the phalangeal arm of the plate and did not interfere with the other screws. The plate was pre-bent to 5º to achieve optimal dorsiflexion angle, compared to methods using straight plates or screws.

DISCLOSURE

No conflicts of interest were declared by the authors.

REFERENCES


