Evaluation of Plantar Medial Approach Utilizing Locking Plate for the Lapidus

Olivia Stransky, DPM PGY-3; Allison Dozeman, DPM PGY-3; Jessica Nugarten, DPM PGY-3; Maria Pacheco, DPM PGY-3; Paul Stone, DPM1; Michael Gentile, DPM2; Richard Derner, DPM3; John Levin, DPM4

1 Podiatry St. Luke’s Village Residency Program, Denver, CO
2 Legacy Footcare Residency Program, Portland, OR
3 INOVA Foot and Ankle Institute, Fairfax, VA
4 JFK Residency Program, Palm Beach, FL

Introduction

Isolated first tarsometatarsal (TMT) arthrodesis (modified Lapidus arthrodesis) is an accepted method of correcting varying degrees of hallux abductus varus, or a bunion deformity. The Lapidus arthrodesis was introduced as a procedure in 1934 (1) and has since been performed utilizing various internal fixation methods, including solid bone screws (cortical and/or cancellous), cannulated screws, as well as with various types of plate fixation. The optimal implant selection and fixation type for first TMT fusion has yet to be determined. Previous criticisms of the modified Lapidus procedure have been prolonged convalescence, unacceptable rerotation rates, shortening and dorsal drift of the first ray, and transfer metatarsalgia (2). Non-union rates have been reported from 0% to 12% with revision rates for symptomatic non-unions ranging from 0% to 15%. Factors that may influence such complications include fixation type, fixation technique and orientation, joint preparation, weight-bearing protocols, and medical comorbidities.

We present a retrospective study to evaluate the clinical results of a locking plate with a novel construct that sits below the neutral axis of the first metatarsal. The hypothesis is the locking plate will have a significantly lower rate of non-union than current fixation methods.

Materials and methods

This was a longitudinal multi-center study conducted at four institutions conducted by four Board Certified foot and ankle surgeons. Each institution was approved by local Institutional Review Boards. The study ran between the months of October 2013 to October 2015 with a total of 49 patients, females and males, average age years (range 15-79). Inclusion criteria comprised patients undergoing Lapidus procedure with one of the Flower Orthopedic plate, with at least 12 months of follow-up. Patients were excluded if they had a previous surgery at the site, OA or RA, or a bunion deformity. The Lapidus arthrodesis is generally used to correct hallux abducto valgus, or a bunion deformity. The Lapidus arthrodesis is generally used to correct hallux abducto valgus, or a bunion deformity.

Results

The study began with 59 potential subjects from the four offices, after exclusion criteria 49 eligible patients were followed through healing process, and 29 were available for a 12 month follow up. The average age 54.6 years (range 15-79), with 38 females and 11 males.

The average pre-operative IMA, with a post-operative IMA, this represents an 8 degree reduction in deformity. The average pre-operative HAV with a post-operative HAV. The pre-operative MPO 2.6mm and a post-operative MPO 3.5mm. This is an average of 1mm shortening of the first metatarsal in relation to the second metatarsal, it is important to note that lesser metatarsal shortening osteotomies were performed in many of the cases. Radiographic values are shown in Table 1.

One non-union developed. This patient was not a smoker and was not on prednisolone or DMARDs. The patient underwent a revision surgery with crossing screws, and healed uneventfully.

26 out of 49 (53%) had a pre-operative first metatarsal elevatus, post-operative only 26 out of 49 (53%) patients had a first metatarsal elevatus. 3 out of 26 were new first ray elevatus, 1 of which was a plantar flexed first ray preoperatively.

The 29 patients available for 12 month follow up x-rays showed no change in radiographic angles.

Discussion

The modified Lapidus procedure can achieve excellent results in hallux valgus deformity associated with metatarsal varus and first ray hypermobility. Traditional post-operative management includes keeping patients non-weight bearing and heavy immobilization. A modified radiographic technique is shown in the radiographs of non-union associated with the procedure. Current fixation methods include; crossing screws, dorsal plate and lag screw, and medial plate with lag screw. Studies have demonstrated superior results using locking plates, however, the optimal implant selection and implant configuration for the procedure, and that locking plates allow for early weight bearing without an increase in complications. 

Recent literature demonstrates non-union rates have decreased to 3-12% due to improved fixation methods. (6, 7, 9) Locking plate designs have been introduced that allow for early weight bearing, that act to increase the fusion rate due to early weight bearing. Early weight bearing can increase the fusion rate due to the mechanical load of the construct, this also can increase the anatomic insertion of the fibrous posterior tibialis tendon. Most of the changes associated with locking plate designs concern the anatomy of the fusion site. (23) The technique in this study allows the entire construct to bear the mechanical load of the ankle. Early weight bearing has been shown to be a post-operative management. (1, 3, 4)

Conclusion

The modified Lapidus procedure can achieve excellent results in hallux valgus deformity associated with metatarsal varus and first ray hypermobility. Traditional post-operative management includes keeping patients non-weight bearing and heavy immobilization. A modified radiographic technique is shown in the radiographs of non-union associated with the procedure. Current fixation methods include; crossing screws, dorsal plate and lag screw, and medial plate with lag screw. Studies have demonstrated superior results using locking plates, however, the optimal implant selection and implant configuration for the procedure, and that locking plates allow for early weight bearing without an increase in complications. 

Recent literature demonstrates non-union rates have decreased to 3-12% due to improved fixation methods. (6, 7, 9) Locking plate designs have been introduced that allow for early weight bearing, that act to increase the fusion rate due to early weight bearing. Early weight bearing can increase the fusion rate due to the mechanical load of the construct, this also can increase the anatomic insertion of the fibrous posterior tibialis tendon. Most of the changes associated with locking plate designs concern the anatomy of the fusion site. (23) The technique in this study allows the entire construct to bear the mechanical load of the ankle. Early weight bearing has been shown to be a post-operative management. (1, 3, 4)

Materials and methods

This was a longitudinal multi-center study conducted at four institutions conducted by four Board Certified foot and ankle surgeons. Each institution was approved by local Institutional Review Boards. The study ran between the months of October 2013 to October 2015 with a total of 49 patients, females and males, average age years (range 15-79). Inclusion criteria comprised patients undergoing Lapidus procedure with one of the Flower Orthopedic plate, with at least 12 months of follow-up. Patients were excluded if they had a previous surgery at the site, OA or RA, or a bunion deformity. The Lapidus arthrodesis is generally used to correct hallux abducto valgus, or a bunion deformity.

Results

The study began with 59 potential subjects from the four offices, after exclusion criteria 49 eligible patients were followed through healing process, and 29 were available for a 12 month follow up. The average age 54.6 years (range 15-79), with 38 females and 11 males.

The average pre-operative IMA, with a post-operative IMA, this represents an 8 degree reduction in deformity. The average pre-operative HAV with a post-operative HAV. The pre-operative MPO 2.6mm and a post-operative MPO 3.5mm. This is an average of 1mm shortening of the first metatarsal in relation to the second metatarsal, it is important to note that lesser metatarsal shortening osteotomies were performed in many of the cases. Radiographic values are shown in Table 1.

One non-union developed. This patient was not a smoker and was not on prednisolone or DMARDs. The patient underwent a revision surgery with crossing screws, and healed uneventfully.

26 out of 49 (53%) had a pre-operative first metatarsal elevatus, post-operative only 26 out of 49 (53%) patients had a first metatarsal elevatus. 3 out of 26 were new first ray elevatus, 1 of which was a plantar flexed first ray preoperatively.

The 29 patients available for 12 month follow up x-rays showed no change in radiographic angles.

Discussion

The modified Lapidus procedure can achieve excellent results in hallux valgus deformity associated with metatarsal varus and first ray hypermobility. Traditional post-operative management includes keeping patients non-weight bearing and heavy immobilization. A modified radiographic technique is shown in the radiographs of non-union associated with the procedure. Current fixation methods include; crossing screws, dorsal plate and lag screw, and medial plate with lag screw. Studies have demonstrated superior results using locking plates, however, the optimal implant selection and implant configuration for the procedure, and that locking plates allow for early weight bearing without an increase in complications. 

Recent literature demonstrates non-union rates have decreased to 3-12% due to improved fixation methods. (6, 7, 9) Locking plate designs have been introduced that allow for early weight bearing, that act to increase the fusion rate due to early weight bearing. Early weight bearing can increase the fusion rate due to the mechanical load of the construct, this also can increase the anatomic insertion of the fibrous posterior tibialis tendon. Most of the changes associated with locking plate designs concern the anatomy of the fusion site. (23) The technique in this study allows the entire construct to bear the mechanical load of the ankle. Early weight bearing has been shown to be a post-operative management. (1, 3, 4)

Conclusion

The modified Lapidus procedure can achieve excellent results in hallux valgus deformity associated with metatarsal varus and first ray hypermobility. Traditional post-operative management includes keeping patients non-weight bearing and heavy immobilization. A modified radiographic technique is shown in the radiographs of non-union associated with the procedure. Current fixation methods include; crossing screws, dorsal plate and lag screw, and medial plate with lag screw. Studies have demonstrated superior results using locking plates, however, the optimal implant selection and implant configuration for the procedure, and that locking plates allow for early weight bearing without an increase in complications. 

Recent literature demonstrates non-union rates have decreased to 3-12% due to improved fixation methods. (6, 7, 9) Locking plate designs have been introduced that allow for early weight bearing, that act to increase the fusion rate due to early weight bearing. Early weight bearing can increase the fusion rate due to the mechanical load of the construct, this also can increase the anatomic insertion of the fibrous posterior tibialis tendon. Most of the changes associated with locking plate designs concern the anatomy of the fusion site. (23) The technique in this study allows the entire construct to bear the mechanical load of the ankle. Early weight bearing has been shown to be a post-operative management. (1, 3, 4)

Materials and methods

This was a longitudinal multi-center study conducted at four institutions conducted by four Board Certified foot and ankle surgeons. Each institution was approved by local Institutional Review Boards. The study ran between the months of October 2013 to October 2015 with a total of 49 patients, females and males, average age years (range 15-79). Inclusion criteria comprised patients undergoing Lapidus procedure with one of the Flower Orthopedic plate, with at least 12 months of follow-up. Patients were excluded if they had a previous surgery at the site, OA or RA, or a bunion deformity. The Lapidus arthrodesis is generally used to correct hallux abducto valgus, or a bunion deformity.