

Maintenance of Correction of the Modified Lapidus Procedure with a First Metatarsal to Second Metatarsal Screw Technique: A Preliminary Report

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INTRODUCTION

The Lapidus procedure is a common procedure for correcting moderate to severe HAV. Recently, there has been discussion of intercuneiform instability when fusing the 1st tarsometatarsal joint (TMTJ).¹ Galli et al described a modified construct with additional fixation from plantar medial first metatarsal to intermediate cuneiform which decreased motion at the 1st TMTJ arthrodesis site.² The addition of a screw from the 1st metatarsal base to the 2nd metatarsal base allows for increased stability and can help create a “spot weld” between the metatarsal bases to prevent loss of deformity correction. Fusion between the 1st and 2nd metatarsal bases adds stability and can lower the chance of recurrence.¹ The additional screw construct is termed the intermetatarsal screw (IMS) in this study. The purpose of the current study is to determine the long-term maintenance of angular correction of the 1st and 2nd intermetatarsal angle (IMA), hallux abductus angle (HAA), and tibial sesamoid position (TSP) after undergoing a 1st TMTJ arthrodesis with the addition of the IMS.

MATERIALS AND METHODS

A retrospective, single-center chart and radiographic review was performed of 17 consecutive patients who underwent primary HAV correction with a 1st TMTJ arthrodesis using the IMS fixation by the senior author. The study period was from January 1, 2017 to May 14, 2018. Three observers independently reviewed radiographic data including preoperative weight bearing, 1st weight bearing, and final weight bearing plain film radiographs. Preoperative films were used if they were within 3 months of the surgery and the radiographic time line for the post-operative intervals were at 12 ± 2 weeks, 18 ± 4 weeks, 26 ± 4 weeks, 52 ± 12 weeks, and the final follow-up visit. Radiographic data evaluated were initial improvement and long term maintenance of IMA, HAA, and TSP.



SURGICAL TECHNIQUE

The procedure begins with a small 2 cm incision placed in the first web space with the dissection taken down to the lateral 1st metatarsalphalangeal joint (MTPJ). The sesamoidal complex is identified and the lateral sesamoid suspensory ligament is transected to allow for correction of TSP. Attention is then directed to the 1st TMTJ where a dorsal medial incision is made. The joint is exposed and prepped in standard fashion with curettage. Decortication of the opposing surfaces of the base of the 1st and second metatarsal is performed in order to achieve the spot weld. Calcaneal autograft and/or bone marrow aspirate is placed in the arthrodesis site. Using the previous 1st interspace incision, a tenaculum reduction clamp is placed around the head of the 1st and 2nd metatarsal heads. The Windlass mechanism is used to slightly plantarflex the 1st ray and any frontal plane deformity is also corrected. Temporary guidewire fixation is placed from the base of the first metatarsal, across the 1st TMTJ and into the intermediate cuneiform. The screw is placed in lag fashion. A guide wire is then placed from the base of the 1st metatarsal into the base of the second metatarsal. The screw is placed in lag fashion if further IMA reduction is needed, or non-lag fashion to maintain the achieved IMA correction. A dorsal locking plate is then placed across the 1st TMTJ. A medial based incision is then made at the level of the 1st MTPJ and dissection carried down through skin and subcutaneous tissue avoiding any neurovascular structures. An elliptical capsulotomy is performed and any hypertrophic medial eminence is resected. Any further soft tissue release or adjunctive procedures can be performed to address residual HAV or sesamoid position. Standard layered closure is then performed.

| Continuous numeric variable | Mean ± standard deviation |
|--------------------------------|---------------------------|
| Preop IMA (°) | 16.05 ± 2.34 |
| Preop HAA (°) | 33.05 ± 6.24 |
| Preop TSP | 5.77 ± 0.9 |
| First Weight bearing IMA (°) | 6.65 ± 2.32 |
| First Weight bearing HAA (°) | 11.65 ± 5.35 |
| First Weight bearing TSP | 1.82 ± 0.73 |
| Final Weight bearing IMA (°) | 7.67 ± 2.0 |
| Final Weight bearing HAA (°) | 15.79 ± 8.31 |
| Final Weight bearing TSP | 2.47 ± 1.07 |
| Initial improvement IMA (°) | 9.41 ± 2.13 |
| Initial improvement HAA (°) | 21.39 ± 7.26 |
| Initial improvement TSP | 3.94 ± 1.14 |
| Final improvement IMA (°) | 8.38 ± 2.21 |
| Final improvement HAA (°) | 17.25 ± 8.21 |
| Final improvement TSP | 3.29 ± 1.36 |
| Loss of IMA (°) | -1.03 ± 1.24 |
| Loss of HAA (°) | -4.14 ± 5.34 |
| Loss of TSP | -0.65 ± 0.86 |
| Duration of follow up (months) | 8.12 ± 3.68 |

RESULTS

17 consecutive patients were identified for review that underwent a 1st TMTJ arthrodesis with the IMS fixation construct for correction of HAV deformity. Mean follow up time was 8.12 months (SD ± 3.68). Bony union was achieved in all patients. There was 1 symptomatic recurrent bunion, 1 case of symptomatic hardware, and 1 case of transient neuritis. Average preoperative IMA was 16.05° (±2.34), HAA was 33.05° (±6.24), and tibial sesamoid position was 5.77 (±0.9). Average IMA improvement was 8.38° (±2.21), HAA improvement was 17.25° (±8.21), and TSP improvement was 3.29 (±1.36) positions. Average loss of IMA was 1.03° (±1.24), HAA was 4.14° (±5.34), and TSP was 0.65 (±0.86) positions. Wilcoxon signed rank test showed statistical significance in all radiographic parameters; both in initial improvements and loss of correction ($p < 0.005$).

DISCUSSION AND CONCLUSION

Arthrodesis of the 1st TMTJ has become a common and well established means of correcting moderate to severe HAV deformities. Recurrence and non-union continue to be a concern when performing 1st TMTJ arthrodesis.¹⁻³ The current study found the addition of 1st metatarsal base to 2nd metatarsal base screw had a significant improvement in radiographic parameters with minimal loss of correction. This is comparable to previously reported loss of correction rates for 1st TMTJ arthrodesis and better than reported rates for other 1st metatarsal base procedures.³ The current study had a 100% union rate with the added stability of the proposed construct. A larger comparative study is needed to evaluate this construct's effect on union rate. In conclusion, the current study shows that application of the IMS construct has good clinical and radiograph results. The authors plan to continue this research and report on a larger number of patients in a comparative study in the future.

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