

# A Novel Technique of Triplane Tarsometatarsal (TMT) Joint Corrective Arthrodesis in Hallux Valgus

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## Introduction

Hallux valgus is a slowly progressing complex three-dimensional biomechanical process. The horizontal and vertical components of this deformity have been widely explored in conventional weight-bearing radiographs and also are routinely taken into account in the various procedures of surgical correction. The frontal rotation component, in contrast, has been generally overlooked.<sup>1,3</sup> Advanced imaging with weight bearing computed tomography (WBCT) scans allow better understanding of its true three-dimensional anatomy, especially first metatarsal pronation and sesamoid position.<sup>2</sup>

Among the available surgical techniques, the 1<sup>st</sup> tarsometatarsal (TMT) joint fusion (Lapidus) is a procedure that can correct the deformity close to the center of rotation of angulation (CORA)<sup>3</sup>. The traditional surgical technique involves deformity correction by biplanar wedge resection of the 1<sup>st</sup> TMT joint followed by fixation with a dorsal plate or two cross screws or a combination of plate and screw. Correction of pronation, however, is not routinely included and weight-bearing may be delayed for up to 3 months to avoid the risk of nonunion. In addition, 1<sup>st</sup> TMT joint fusion can result in shortening of the 1<sup>st</sup> metatarsal due to bone resection with a further risk of transfer metatarsalgia.<sup>3</sup>

Recently we have begun utilizing a modified technique of 1<sup>st</sup> TMT joint fusion performed with special instrumentation (Lapiplasty - Treace Medical Concepts, Ponte Vedra Beach, FL, USA).<sup>1</sup> It allows precise correction of the pronation of 1<sup>st</sup> metatarsal. In addition, the available cutting guides simplify the performance of a biplanar wedge resection with minimal bone sacrifice. Finally, stabilization of osteotomy with two locking plates oriented in 90-90 configuration permits early weight-bearing ambulation with assistive devices. Thus, this modified technique can effectively circumvent the problems encountered with traditional Lapidus procedure.

## Pre-operative Evaluation

Preoperative evaluation requires a thorough history and physical exam. The appropriate candidate should have pain at the first metatarsophalangeal joint or other problems associated with the hallux valgus deformity. Standard weight-bearing radiographs should

be obtained. These include anterior-posterior (AP), oblique and lateral views. Radiographic evaluation includes measurement of hallux valgus angle (HVA), intermetatarsal angle (IMA), distal metatarsal articular angle (DMAA), hallux valgus interphalangeus angle (HVI) and tibial sesamoid position (TSP). This procedure is chosen for those patients with larger 1-2 intermetatarsal angle (usually >15 degrees) (Figure 1), 1<sup>st</sup> TMT joint instability, or 1<sup>st</sup> metatarsal rotational instability.

## Surgical Technique

### Exposure

The surgery is performed as a day care procedure under nerve block anesthesia. A



**Figure 1.** Preoperative weight-bearing AP radiograph of a 68-year man with significant right hallux valgus deformity (HVA 33° and IMA 18°) and displacement of sesamoids.

tourniquet is applied to the calf and a mini C-arm is used throughout. A standard lateral release of the 1<sup>st</sup> MTP joint is performed through a small incision in the 1<sup>st</sup> webspace. The 1<sup>st</sup> TMT joint is then exposed subperiosteally by a direct longitudinal incision placed just medial to the EHL and the joint is freed from its periosteal attachments.

### **Surgical steps**

A derotation pin is placed on the medial side of 1<sup>st</sup> MT to gain rotation control. At this point, the 1<sup>st</sup> metatarsal can be manipulated under fluoroscopy to obtain adequate correction in all planes. If not, then additional release at the 1<sup>st</sup> metatarsophalangeal or tarsometatarsal joint may be necessary. A fulcrum is inserted between the bases of 1<sup>st</sup> and 2<sup>nd</sup> metatarsals followed by the application of a bone positioner clamp that aids in bringing the 1<sup>st</sup> metatarsal to the 2<sup>nd</sup> metatarsal and closing the IM angle. At the same time the derotation pin helps to achieve proper metatarsal rotation. Once the deformity correction is obtained in all 3 planes, it is secured with a temporary holding pin through the bone positioner clamp. A joint “seeker” is placed in the 1<sup>st</sup> TMT joint and then a special cutting guide is placed over this “seeker” and employed to remove thin bone wedges around the 1<sup>st</sup> TMT. There are several cutting guides available that allow varying amounts of bone resection and angulation of the bone cuts. A compression/distraction device is then utilized to distract the joint and remove the bone wedges. The fusion surfaces are further prepared by drilling with a 2.0 mm drill and leaving the drillings as autograft. The joint is subsequently compressed with the same device taking care to maintain appropriate correction of the metatarsal position in all planes. Temporary fixation may be achieved by two crossed olive wires if one desires to remove the compression/distraction device to make plating easier. Final fixation is completed by the placement of two 4-hole locking plate construct in 90-90 configuration (Figure 2). Medial eminence resection and capsulorrhaphy can be performed as per the need. However, our experience has been that up to 50% of patients do not need such ancillary procedures once the rotational deformity has thoroughly been addressed. All wounds are copiously irrigated and closed meticulously followed by a standard bunion dressing.

### **Post op care and follow up**

The operated extremity is placed in a controlled ankle motion boot. The patient is discharged with crutches and followed up in the office at regular intervals. Sutures are removed in 2 weeks and gradual weight bearing ambulation is commenced as soon as tolerated. Weight-bearing radiographs are performed at 6 weeks (Figure 2) and all the assistive devices are then weaned as indicated. Regular supportive footwear is encouraged and permitted to increase activity as tolerated. Radiographs are again checked at three months postoperative to ensure successful arthrodesis.



**Figure 2.** Postoperative weight-bearing AP radiograph of the same patient at 8 weeks showing dual plates at 1<sup>st</sup> TMT joint. Healing of fusion can be noted along with anatomical restoration of angles (HVA 11° and IMA 5°) and position of sesamoids. He also had 2<sup>nd</sup> metatarsal shortening osteotomy and bunionette correction done at the same time.

### **Conclusion**

This modified technique of 1<sup>st</sup> TMT joint fusion using modern reproducible instrumentation is a reliable procedure to achieve tri-plane correction of hallux valgus close to the CORA. This technique has allowed early weight-bearing and consistent results with a classically challenging technique that previously required prolonged non weight-bearing.

### **References**

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