Hallux Valgus Deformity and Treatment

A Three-Dimensional Approach: Modified Technique for Lapidus Procedure

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KEYWORDS

• Hallux valgus • Modified technique for Lapidus procedure • Classification system • CORA • Triplane correction • Lapidus • Bunion

KEY POINTS

- It is without any doubt that the importance of triplane (transverse, sagittal, and frontal) correction of the hallux valgus (HAV) has become among the greatest improvements in bunion surgery.
- Triplane correction can be achieved reliably via first tarsometatarsal joint arthrodesis, the anatomic center of rotation of angulation (CORA) of the HAV deformity.
- Modified technique for Lapidus procedure (Treace Medical Concepts, Inc, Ponte Vedra Beach, FL, USA) is a surgical technique designed to incorporate triplane correction at the CORA of the HAV.
- A new classification system has been developed incorporating new three-dimensional computed tomography findings of HAV pathomechanics. It is hoped that this framework will provide further interest in research and discussion.
- The modified technique for Lapidus procedure can be used in a variety of HAV conditions and severities, and the early results suggest a powerful correction can be maintained.

INTRODUCTION

In a hallux valgus (HAV) or bunion deformity, the fundamental problem is deviation of the hallux at the metatarsophalangeal (MTP) joint and deviation of the first metatarsal at the tarsometatarsal (TMT) joint. Traditionally, anterior-posterior (AP) radiograph findings are prioritized, such as the intermetatarsal angle (IMA), the HAV angle (HVA), the tibial sesamoid position (TSP), and the joint surface angle known both as the distal metatarsal articular angle (DMAA) and the proximal articular set angle. It is vital to recognize

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that, because the AP radiograph is a two-dimensional representation of the true three-dimensional anatomy, deviation in the other planes, such as frontal plane rotation of the first metatarsal, can substantially change all visible cues on an AP radiograph. Pronation of the first metatarsal changes the appearance of the DMAA, the TSP, the medial eminence, and the shape of the lateral metatarsal head. To identify and characterize the contribution of the frontal and sagittal plane deviations to the radiographic cues on the AP radiograph, different landmarks must be identified and the anatomy on axial and lateral radiographic views must be studied. This observation is important if one considers that the most prevalent methods recommended to correct the deformity (metatarsal osteotomy) are, in fact, altering a deviated but intrinsically straight metatarsal and are almost exclusively altering the transverse plane. Using only the traditional AP radiographic measurements to determine the surgical procedure is a potential primary factor driving poor outcomes and recurrence because the AP radiograph is not able to fully define the deformity. If most of the most popular osteotomy procedures are analyzed, it is clear that correction priority is in a single plane (transverse), with most procedures either angulating or sliding the first metatarsal in the transverse plane while failing to address either the frontal or sagittal planes to a meaningful degree.

In addition to recognizing the individual planar components, attention must be focused on the corrective procedure on the apex of the deformity or the anatomic center of rotation of angulation (CORA).[1] The apex of the metatarsal component of the deformity in a bunion has been described by many surgeons and researchers as being at the TMT joint, not in the metatarsal joint.[2–8] A published description of the frontal plane component of the first ray deformity dates back to the 1950s.[9] There are many current publications illustrating the effect that frontal plane rotation has on common paradigms of preoperative bunion evaluation and the selection of corrective procedure. In these studies, frontal plane rotation has consistently been observed to be in the direction of eversion (valgus or pronation are equivalent), having a significant and dramatic effect on the alignment of the first MTP joint, including the sesamoids.

The triplane TMT joint corrective arthrodesis, or modified technique for Lapidus procedure (Treace Medical Concepts, Ponte Vedra Beach, FL, USA), uses all 3 planes to both evaluate and correct the deformity. Interestingly, when this multiplanar technique is implemented, the traditional radiographic measurements become less useful. The idea that all bunions are different, and must be treated as such, is based on severity scales that are derived from AP radiographic measurements such as the IMA, the TSP, and the HVA. Using a triplane framework for evaluation and procedure selection, and focusing on the apex of the deformity, all bunions can be approached in a consistent manner. Specifically, the modified technique for Lapidus procedure can be performed regardless of the degree of deformity and always includes triplane correction. Big or small deformities become irrelevant when using this framework.

CLASSIFICATION

Classification systems for the HAV have historically been based on expert opinion with low levels of evidence and have focused mainly on two-dimensional radiographic observations. The angular measurements attempted to identify the degree of severity of the deformity and suggest possible corrective surgical measures. Classic radiographic findings such as the IMA, the HVA, and the sesamoid position have been identified by Laporta and colleagues.[10] These findings have all been substantiated in classic HAV textbooks.[11–15] Transverse plane considerations were also discussed by Meyr and colleagues.[16] In 2002, Condon and colleagues[17] described classic considerations in the HAV, referencing the IMA as normal (<9°), mild (9°–11°), moderate (11°–16°), and severe