Frontal plane rotation of the sesamoid apparatus during the Lapidus procedure: A novel approach

Lawrence A. DiDomenico, D.P.M., F.A.C.F.A.S., Ramy Fahim, D.P.M., Jobeth Rollandini, D.P.M.

Introduction and literature review

Lapidus popularized the first metatarsocuneiform arthrodesis in 1934 as he believed that the majority of the deformity was due to a lack of development of the first metatarso-cuneiform joint, creating a metatarsus primus varus deformity (1). The technique has evolved from those originally proposed by the Lapidus to include modifications by several authors to improve the outcomes and types of deformity being treated. The purpose of this paper is to examine the results of frontal plane rotation pre and postoperatively and to suggest that the majority of the deformity was due to an arrest in development of the first metatarso-cuneiform joint and medial column position (2). The study is able to predictably rotate the toe, while preserving length and strength of the hallux.

Numerous surgical indications have been shown through surgical adaptations of the Lapidus procedure. Through the evolving modifications of the Lapidus, several improvements have been made to decrease complications and maximize post-surgical outcomes. However, the position of the sesamoids is often overlooked. The results of three-dimensional kinematic analysis in a cadaver model demonstrated that the sesamoid apparatus plays a significant role in the biomechanical function of the first metatarso-cuneiform joint (3). Correct rotation of the sesamoid apparatus could be advanced congruency fusion with less recurrence (4).

Kost et al. described four primary factors necessary for normal function during the operation of the planar projection of gait, one of which was normal rotational position (3). The anatomy of the sesamoids is just as complex as their function: housed within an array of ligaments, tendons, and capsule structures, all of which function collectively about the first metatarsophalangeal joint (5). With this in mind, any deformity which exists, or is awaiting surgically among the sesamoids, adds additional positional correction is the reason for our treatment.

A 6 cm incision is made over the metatarsal cuneiform joint and the tarsal wedge-shaped osteotomy is performed. The plantar tarsal metatarsal joint and allows for the first metatarsal to dorsiflex and plantarflex, while remaining parallel to the lesser metatarsals. Once the hallux, isometric, and metatarsal are rotated to a neutral position, the metatarsal sagittal plane is corrected, the surgeon can use his thumb against the plantar plate and plantarflex and dorsiflexing, while remaining parallel to the lesser metatarsals. Once the hallux, thereby providing both stability and deformity correction. The frontal plane is addressed by de-rotating the hallux out of valgus in order to make the real plane parallel to the ground. This allows for the arthrosis of the first metatarsal-cuneiform joint and medial column stability (2). The plate functions as a "large washer" in reducing the IM angle, thereby providing both stability and deformity correction.

Frontal plane manipulation of the great toe under fluoroscopy. Note the great toe is manipulated into a neutral position and the sesamoids follow. Established frontal plane correction of the sesamoids with manual manipulation of the hallux on the MTPJ. Pre-and Post-operative correction of the sesamoids with improved alignment at the first MTP joint. Note valgus correction of the toe and sesamoids.

Discussion and Analysis

We report an expanded concept in the surgical procedure of the Lapidus to address the frontal plane rotation with respect to the sesamoids. A deformity is more effectively corrected at its origin (3). The Lapidus arthrodesis is a predictable and biomechanically sound procedure. The interplay between first ray anatomy and surrounding structures emphasizes the importance of proper anatomical alignment when performing first ray procedures such as the Lapidus.

The resulting correction of the first metatarsal head over the sesamoid apparatus allows the plantar fascia to stabilize the medial column of the foot (1). A correction of metatarso-cuneiform arthritis, thereby maintaining the functional length and realignment of the metatarsal head and the sesamoid apparatus (3).

A controlled prospective study examining radiographic and long-term clinical outcomes with regard to frontal plane rotation of the sesamoids after a Lapidus procedure would be most favorable to fulfill our study. In addition, this study would also benefit from objective measurement to accurately assess the precise improvement of frontal plane rotation pre-post-operatively.

Pre-and Post-operative frontal plane correction – Note the valgus correction of the great toe.