

Metatarsal Osteotomies

Complications



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KEYWORDS

• Complications • Metatarsal • Osteotomy • Weil • Helal • Proximal • Distal

KEY POINTS

- Proximal metatarsal osteotomies can create a significant change in position of the metatarsal head and must be used judiciously to prevent transfer metatarsalgia.
- Proximal osteotomies have a higher incidence of nonunion and malunion when done without internal fixation.
- The Weil osteotomy has a high rate of union but is prone to a floating toe and recurrent metatarsalgia.

INTRODUCTION

Metatarsal osteotomies are the primary surgical tool used to deal with metatarsalgia and problems related to the lesser metatarsals. The goal of the osteotomy is to decrease the pressure underneath the respective metatarsal head during the different phases of gait. The metatarsals experience significant amounts of force during flat stance and even more so during toe-off. The first metatarsal absorbs most of the load during these phases of stance and can contribute to the disorders of the lesser metatarsal heads. This article focuses on the lesser metatarsals and the complications of the osteotomies used to address the disorders of the lesser rays.

ANATOMY

The anatomy of the lesser metatarsals is important to understand the potential complications that can arise from metatarsal osteotomies. They form a parabola that is one of the key elements to the distribution of force through the forefoot during gait. The ideal parabola is described as the second metatarsal longer than the first and greater than the third. The third metatarsal is greater than the fourth and the fourth is greater

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than the fifth metatarsal.¹ Although length is important, the plantar position of the metatarsal heads is also very important to determining the amount of force experienced by each head during gait. Specific foot position such as cavovarus deformities can increase or pes planovalgus deformities can decrease the declination of the metatarsals and subsequent pressure under the heads. The central metatarsals are more rigid in their position and most commonly contribute to metatarsal disorders.²

CLINICAL EVALUATION

Patients most commonly present with forefoot pain and overload on physical examination. Plantar tenderness that increases with gait can be localized to the offending metatarsals. The presence of intractable plantar keratosis is another sign of overload. They can be explained by the forces that travel through the forefoot during gait. As pressure is transferred from the hindfoot to the forefoot, the metatarsal heads bear an increasing load. Lesions directly underneath the metatarsal heads signify increased pressure during the stance phase of gait. A lesion distal to the metatarsal head indicates dysfunction during the toe-off phase of gait.³ The difference between the two is important because it delineates the problem that needs to be corrected. Lesions directly underneath the metatarsal head are a sign of excess plantar pressure during stance phase and need to be alleviated by raising the metatarsal head. Lesions distal to the metatarsal heads are an indication of excessive length and correction is achieved by shortening the metatarsal length.⁴

Over the years many different types of osteotomies have been proposed and described. In general, they can be divided into 2 categories: proximal or distal. With each type of osteotomy come specific complications (**Fig. 1**).

PROXIMAL OSTEOTOMIES

Osteotomies based on the proximal aspect of the metatarsal are very powerful. A small amount of proximal resection or angulation of the metatarsal results in significant amount of shortening and elevation of the metatarsal heads. Thus preoperative planning is critical to achieve a favorable result. Traditionally the osteotomies have been described without internal fixation creating a higher incidence of nonunion and malunion (**Table 1**). (Further detail regarding the technique and images of these described osteotomies is given in Emily C. Vafek and Simon Lee's article, "[Treatment of Metatarsalgia with Proximal Osteotomies](#)," in this issue.)

STEP-CUT OSTEOTOMY

The step-cut osteotomy, described by Giannestras,⁵ is a resection osteotomy and shortens the metatarsal by approximately 2.5 cm (1 inch). In the original study of 40 procedures, 37 had good or excellent outcomes. Four patients (10%) developed transfer metatarsalgia. The osteotomy is powerful, with a significant amount of shortening. Care must be taken to respect the parabola because overshortening leads to a higher incidence of transfer metatarsalgia.⁵

PROXIMAL SEGMENTAL OSTEOTOMY

The proximal segmental osteotomy resects a tubular segment of the proximal metatarsal, resulting in both shortening and elevation of the metatarsal head. Originally described without fixation, it had a very high rate of complication. Transfer metatarsalgia occurred in 18% of the study's patients and 7% of the patients experienced recurrent metatarsalgia. The most common complication, however, was the development

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