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Special Issue Review

Current concepts in the treatment of metatarsophalangeal joint instability of the lesser toes: Review, surgical technique, and early outcomes

Aktuelle Therapiekonzepte der Metatarsophalangealgelenkinstabilität: Literaturübersicht, Operationstechnik, erste Ergebnisse

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Instabilität;
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Kleinzehen

Summary

Metatarsophalangeal (MTP) joint instability has been become recognized as a common cause of metatarsalgia. This disease process commonly presents as pain on the plantar aspect of the forefoot and as it progresses, it can create the development of coronal and transverse plane misalignment, even developing dislocation. Clinical staging and anatomic grading methods have been developed to guide treatment as surgeons have developed an improved understanding of how plantar plate tears relate to MTP joint instability. Direct repair of the plantar plate has been described and early clinical results suggest that this may be an option for reconstruction and realignment of plantar plate tears and associated MTP joint instability.

Zusammenfassung

Die Instabilität des Metatarsophalangeal- (MTP-) Gelenks ist eine wesentliche Ursache der Metatarsalgie. Häufige Beschwerden sind plantare Vorfußschmerzen mit bei Progredienz auftretenden additiven Kleinzehdeformitäten in der koronaren und transversalen Ebene bis hin zur Dislokation im MTP-Gelenk. Durch ein besseres Verständnis des Einflusses der Schädigung der plantaren Platte auf die

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MTP-Gelenkinstabilität konnten klinische und anatomische Stadieneinteilungen eingeführt werden, die dem Operateur bei der Therapieentscheidung helfen. Die chirurgische Refixation der plantaren Platte ist beschrieben und erste klinische Ergebnisse weisen auf deren Potential zur Rekonstruktion der plantaren Platte und des damit einhergehenden positiven Einflusses auf die MTP-Gelenkinstabilität hin.

Introduction

Although there are many causes, metatarsalgia is a common clinical problem encountered by the practicing foot and ankle surgeon [1—3] (Table 1). The term "second crossover toe", was first described by Coughlin in 1987 in order to characterize the clinical deformity of the second toe extending at the MTP joint, and crossing over the great toe medially [4]. Early in the disease process, however, the toe does not always cross over the great toe. In fact the patient may notice pain at the base of the proximal phalanx, swelling at the MTP joint, or subtle deviation of the toe at the level of the MTP joint. The second toe is the most commonly involved although the deformity can occur in the other lesser toes [1,5—9]. Although these other toes may be involved, the eponym second crossover toe has been widely accepted and used when referring to this particular pathology. The cause of MTP instability is unknown but is likely multifactorial and may have an acute or insidious clinical course. In recent years, in order to assist the clinician in the treatment of MTP joint instability, new clinical and surgical grading systems have been developed to further define the pattern of plantar plate tears as well as quantify the magnitude of the disease process [9—12].

Importance of the plantar plate

It is increasingly acknowledged that the plantar plate plays a key role in MTP instability [13]. The plantar plate, a stout ligamentous structure, originates on the plantar metatarsal head just proximal to the articular surface and inserts distally onto the plantar base of the proximal phalanx [2,14,15]. The function of the plantar plate is to provide cushioning to the MTP joint during weight bearing and to be the primary restraint against tensile loads in the sagittal plane [3,7].

By careful dissection of the second MTP joint, it has been shown that the plantar plate itself is a major stabilizing structure of the lesser toe. This is likely because of it's central and plantar location and multiple attachments [3,16,17]. Multiple studies have demonstrated a link between the integrity of the plantar plate and instability of the MTP joint [1,10,18—21]. Additionally, it is thought that plantar plate insufficiency as well as collateral ligament dysfunction may lead to sagittal and transverse plane instability and deformity [22,23]. The disease process within the plantar plate has been noted to be located at its insertion near the base of the proximal phalanx [2,10,14,16,18,19,24,25]. The relationship between anatomy and MTP stability is complex. Chalayon et al performed a study examining the sagittal plane stability of the intact MTP joint compared to a plantar plate disruption, a Weil osteotomy as treatment for the plantar plate disruption, and a flexor to extensor tendon transfer (FTT) as a treatment for the plantar plate disruption [13]. From a biomechanical perspective, they noted that the plantar plate significantly contributed to the MTP joint sagittal stability. They noted that a Weil osteotomy alone created further instability and that a FTT increased stability in light of a plantar plate tear and even more in combination with a Weil osteotomy. Based on this data, they conclude that the development of an improved technique to directly repair the torn plantar plate is needed to restore the mechanics of the MTP joint.

During the terminal stance phase of gait, the MTP joint dorsiflexes. The plantar plate provides the passive resistance, along with the intrinsic muscles of the foot which prevents hyper-dorsiflexion. With plantar plate disruption, the proximal phalanx is able to sublux dorsally. This subluxation of the joint displaces the interossei dorsal to the axis of

Table 1 Differential diagnosis of forefoot pain.

- Instability of the lesser MTP joints
- Freibergs infraction
- Degenerative arthritis of lesser MTP joints
- Systemic arthritis with involvement of lesser MTP joints
- MTP joint synovitis
- Metatarsal stress fracture
- Interdigital neuroma
- Synovial cyst formation