



Review

Metatarsophalangeal Joint Instability of the Lesser Toes

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ABSTRACT

Metatarsophalangeal joint instability of the lesser toes is a common finding and a common cause of metatarsalgia. The clinical presentation can include swelling without digital deformity; however, often, this can progress to the development of coronal and transverse plane malalignment. In some cases, frank metatarsophalangeal joint dislocation can develop. The treatment regimen has historically focused on indirect surgical realignment using soft tissue reefing, soft tissue reefing, tendon transfers, and periarticular osteotomies. An improved understanding of the plantar plate has recently led to the development of a clinical staging system and surgical grading system of plantar plate attenuation. A dorsal surgical approach, using a Weil osteotomy, allows the surgeon to directly access and repair or advance the plantar plate to the base of the proximal phalanx. The addition of direct plantar plate repair could be a significant advancement in the reconstruction and realignment of metatarsophalangeal joint instability.

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Metatarsalgia due to metatarsophalangeal (MTP) joint instability is a common occurrence (1–3). Although the etiology of instability has been associated with both acute trauma and chronic inflammatory arthritis (4–8), more frequently, the cause is insidious and idiopathic. Attenuation and tearing of the plantar plate and collateral ligaments can eventually lead to sagittal and transverse plane instability of 1 or more MTP joints (6,9). The term “second crossover toe” was introduced by Coughlin (10) in 1987 to characterize this clinical deformity at the MTP joint. Despite the name, the malalignment does not always progress to crossing over or under the adjacent digit, and in the early stages, the toe might only have a subtle deviation. Although the second toe is most commonly involved, digits other than the second toe have routinely been seen to have the same clinical deformity (1,7,8,11–13). Nonetheless, the eponym “second crossover toe” has been widely accepted and repeatedly used in the published data when referring to this pathologic entity.

Lesser MTP joint instability can be associated with hallux valgus, hallux rigidus, interdigital neuromas, and hammertoe deformities (7,8,11). Deland and Sung (14) described dissection of a single crossover second toe in 2000, but only recently has plantar plate involvement in lesser MTP joint instability been thoroughly evaluated and classified (13–21). The development of a clinical staging system and surgical grading system has better defined the magnitude and

pattern of plantar plate tears and can assist in the preoperative planning of lesser MTP joint instability (13,18,20,21).

Demographics

Although MTP joint instability is frequently seen in older sedentary females, the same process developing in younger male athletes has been reported (1,22). Although originally described as unique to the second MTP joint (10), Nery et al (13) observed in a large series of 55 plantar plate tears (28 patients) that two thirds of the patients had second toe involvement and one third had involvement of the third or fourth toe.

Acute trauma can lead to instability of the lesser MTP joint (5,23,24); however, typically, an idiopathic onset is seen, with attritional changes leading to eventual plantar plate rupture (13). A long second metatarsal, hallux valgus, hallux rigidus, pes planus, and hallux varus have all been associated with this instability pattern (7,8,22,25). These pathologic processes likely alter the loading characteristics of the lesser toes and therefore contribute to the instability patterns. A high incidence of lesser MTP joint instability in older females has led some to suggest that the long-term use of high-fashion footwear might lead to chronic hyperextension forces of the MTP joint and eventual plantar plate insufficiency (7,8,13).

Pathoanatomy

From cadaveric and surgical findings and reports from other investigators (4,13,16,20,21,26), we believe that plantar plate insufficiency is the primary pathologic finding leading to instability. The

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Fig. 1. Schematic drawing showing drawer test.

collateral ligaments likely also contribute to both transverse and sagittal plane malalignment of the digit (20,26). During normal gait, at the end of the stance phase, the MTP joint hyperextends during toe-off. The plantar plate, along with the intrinsic musculature (lumbricals and interossei), resists this dorsiflexion force. With plantar plate deterioration, the proximal phalanx subluxates dorsally. The interossei tendon is displaced dorsal to the center of rotation and loses its capacity to flex the MTP joint. The lumbrical, located medially, is tethered by the deep metatarsal ligament and becomes a medial deforming force, adding an adduction deformity to the toe (20,21,27,28).

History and Physical Examination

The clinical findings that can be associated with MTP joint instability include the following: digital swelling, swelling exclusively on the plantar aspect of the MTP joint, neuritic symptoms, and MTP joint malalignment (8,13,14,20,21). The primary cause of ill-defined metatarsalgia can often be difficult to determine (29). An acute onset of pain and deformity is less commonly seen than the typical pattern of insidious pain and malalignment. Focal pain located at the plantar aspect of the forefoot at the base of the second toe is the most common complaint at patient presentation. Tenderness can be isolated to the plantar base of the proximal phalanx, where the transverse plantar plate tears typically occur. Sometimes the toe will appear swollen when comparing it to the adjacent digits. Although in the early stages, only plantar swelling at the MTP joint occurs, with time, sagittal and coronal plane deviation will develop, with continued attenuation of the plantar plate and collateral ligaments. The development of a gap between the adjacent toes or medial deviation of a toe is a frequent finding (1,7,9,20). A hyperextension deformity will be seen in later

stages, and, as the deformity progresses, the pathologic toe might cross over or under the adjacent digits (22). Chronic pain and malalignment often lead to the development of an associated hammertoe deformity at the proximal interphalangeal joint (3,7).

Some patients have described radiating pain or numbness into the toes, and this should raise the awareness of a possible adjacent neuroma (30). Coughlin et al (12) reported the concomitant presence of an interdigital neuroma in nearly 20% of patients with lesser MTP joint instability. Compression of the transverse metatarsal arch in the presence of joint instability typically does not illicit a “Mulder click” or numbness and pain radiating into the toes, which can be typical in the presence of an interdigital neuroma (22,30,31). However, differentiating a symptomatic interdigital neuroma from an unstable lesser MTP joint can be difficult, especially in the early stages. The use of sequential injections in adjacent MTP joints and intermetatarsal spaces can help lead to an accurate diagnosis (7,22,32).

A positive drawer test is a pathognomonic finding associated with MTP joint instability (13,22,33). This test is performed by grasping the proximal phalanx of the involved digit and applying a vertical stress in a dorsally oriented direction. This maneuver can reproduce the patient’s pain, and, often, the examiner will feel the MTP joint subluxate or dislocate (Fig. 1). The plantar flexion strength of the digit could be decreased, and this can be quantified using the “paper pull-out test” (4). A strip of paper (1 cm × 6 cm) is placed plantar to the affected toe tip. While the patient plantar flexes the affected digit to grasp the paper, the examiner pulls the paper strip out from beneath the toe (Fig. 2). A positive test is seen when no digital purchase is present and the paper strip is pulled out intact without tearing. All these clinical examination findings can be correlated to provide a reliable method for diagnosing plantar plate tears. Sung et al (34) found a high degree of clinical accuracy in the preoperative physical examination findings compared with the findings of both advanced



Fig. 2. View of paper pull out test.

Table 1

Clinical staging of examination findings for second metatarsophalangeal joint instability

Grade	Alignment	Physical Examination Findings
0	No MTP joint malalignment; prodromal phase with pain but no deformity	MTP joint pain, thickening or swelling of the MTP joint, diminished toe purchase, negative drawer test result
1	Mild malalignment of MTP joint; widening of web space, medial deviation	MTP joint pain, swelling of MTP joint, reduced toe purchase, mildly positive drawer test result (<50% subluxated)
2	Moderate malalignment; medial, lateral, dorsal, or dorsomedial deformity, hyperextension of MTP joint	MTP joint pain, reduced swelling, no toe purchase, moderately positive drawer test (>50% subluxated)
3	Severe malalignment; dorsal or dorsomedial deformity; second toe can overlap hallux; might have flexible hammertoe	Joint and toe pain, little swelling, no toe purchase (can dislocate MTP joint), flexible hammertoe

Abbreviation: MTP, metatarsophalangeal.

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