Plantar Plate Tears: A Review of the Modified Flexor Tendon Transfer Repair for Stabilization

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KEYWORDS

• Plantar plate tear • Metatarsal-phalangeal joints • Forefoot
• Flexor tendon • Dislocation toe • Flexor tendon transfer
• Girdlestone procedure • Hammertoe

Forefoot pain is one of the most common presenting problems in a foot and ankle practice. One of the most common presenting problems, yet most commonly missed problems, is a plantar plate tear. Often the problem is considered to be potential neuroma, fat pad atrophy, or a generalized diagnosis of metatarsalgia or metatarsal head overload. Unfortunately, not enough attention is placed on the plantar and medial/lateral ligamentous structures of the metatarsal-phalangeal joints (MPJ). This lack of attention results in poor diagnosis, lack of care, treatment for the wrong condition, and ultimate frustration for the patients and doctor.

ANATOMY OF THE PLANTAR PLATE AND CAUSE OF INJURY

The plantar plate is a thick, rectangular to trapezoidal structure mostly made up of collagen type I that proximally attaches just distal to the metatarsal flare and distally attaches to the plantar surface of the proximal phalanx, which turns out to be the stronger of the two attachments.[1–3] It gets thicker and broader under the metatarsal head as it provides attachments for collateral ligaments, deep transverse metatarsal

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ligaments, intraosseous tendons, and the fibers from the plantar aponeurosis. It provides a smooth gliding surface for the metatarsal head and flexor tendons. Accordingly, it is one of the primary stabilizers of the MPJs[1] and also plays an important role in the windlass mechanism.[4,5] The plantar plate is therefore the most important stabilizer to prevent hyperextension at the MPJ with its ligamentous and muscle-tendinous attachments.[1,2,4,6]

Although the actual cause of plantar plate injury may be from multiple reasons, the most common causes are associated with chronic repetitive mild overload or acute traumatic overload. Deland and colleagues performed cadaveric studies and determined that transverse deviation or crossover toes were associated with an abnormal position of the long and short flexor tendons on the involved foot versus central position of the flexor tendons in the uninvolved foot.[5,7] Although any MPJ can be injured, the most common injury is associated with the second MPJ. The frequency of second MPJ plantar plate injury may be caused by inflammation and pain from overload secondary to first ray hypermobility and hallux abducto valgus causing overload of the second MPJ. A long second metatarsal, short first metatarsal, forefoot varus, forefoot overload secondary to equinus deformity, neuromuscular imbalance, and systemic or inflammatory arthritidies have also been common sources for plantar plate injury. Although all of the previously mentioned sources have been found by the authors, it is still unclear why the problem occurs in some patients and not others with similar conditional findings.

PATIENT WORKUP

Subsecond metatarsal pain can be difficult to diagnose. Common findings that must be ruled out include capsulitis, synovitis, lesser metatarsal stress fracture, Freiberg's infarction, second interspace neuromas, inflammatory arthropathy, degenerative joint disease, or simple joint overload. Commonly, patients will present with a generalized forefoot swelling and most local pain in the associated joint. If the treating physician is not careful, they may confuse the pain in the MPJ with interspace pain. In the second MPJ, the pain is most commonly plantar and lateral, which can easily be confused with a neuroma. There may be an associated hammertoe deformity that is caused by the weakness of the plantar ligamentous structures resulting in a flexor and extensor imbalance. It is essential to not get confused with the cause of MPJ pain being from the hammertoe contracture as missing the plantar plate tear and just correcting the hammertoe is destined for failure. A keratotic lesion under the associated metatarsal is rare in plantar plate tear cases and is more commonly associated with a hammertoe contracture that is causing symptomatic retrograde metatarsal head pressure. Probing patients for type of pain and associated timing of pain is critical for differential. Most patients with plantar plate pain do not complain of sharp shooting or tingling pain. The pain is commonly a dull ache with ambulation, chronic in nature, and better with a stiff shoe and cushioning. Patients will also suggest that the pain is fairly consistent and not different with differing activity. As the plantar plate tear advances, patients will suggest a medial shift in their toe position and gapping from the lateral toes. This finding is most common on the second toe, which moves medial and dorsal toward the great toe (**Fig. 1**).

Clinically you can evaluate second MPJ sagittal plane instability with the modified Lachman test, or the anterior/dorsal drawer test, originally described by Thompson and Hamilton and Thompson and Deland (**Fig. 2**).[8–10] Although difficult to judge, a noted sign of plantar plate tear in the literature has been a dorsal drawer of more than 2 mm or 50% or greater dorsal displacement.[4,11] It should be noted that false positives can result in patients with ligamentous laxity. Another widely accepted