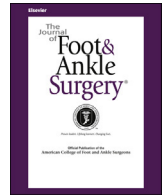




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Original Research

A Suture-Button Technique for Stabilization of the Plantar Plate and Lesser Metatarsophalangeal Joint

Molly S. Judge, DPM¹, Gina Hild III, DPM²¹Surgeon, Department of Surgery, Mercy Foot & Ankle Residency Program, Cleveland, OH²Postgraduate Year 3, Department of Surgery, Mercy Foot & Ankle Residency Program, Cleveland, OH

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ABSTRACT

We retrospectively evaluated the use of a suture-button technique to stabilize the plantar plate and lesser metatarsophalangeal joint (MTPJ) to alleviate pain and dysfunction due to failed digital surgery with lesser MTPJ dysfunction. Eight consecutive patients (8 feet, 13 rays) were studied, including 2 males (25%) and 6 females (75%). Their median age was 56.5 (range 25 to 72) years, and the median follow-up duration was 28 (range 21 to 36) months. Of the 8 patients, 7 (87.5%) underwent concomitant adjunct procedures. A 10-increment (equal intervals) pain score and the Bristol foot score (BFS) were used to assess subjective satisfaction and foot-related quality of life before and after surgery. The median preoperative pain score was 8 (range 5 to 10). Postoperatively, the median pain score was 0 (range 0), and the difference was statistically significant ($p = .0106$). The median preoperative and postoperative BFS was 53 (range 32 to 70) and 20 (range 18 to 34), respectively. The difference was also statistically significant ($p = .018$). One patient (12.5% of patients, 7.7% of rays) experienced wound dehiscence. All the patients indicated they would undergo the procedure again. From these findings, we believe the described suture-button technique is a useful method to stabilize the plantar plate and MTPJ after failed digital surgery.

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The inciting factors for chronic and recalcitrant forefoot pain often include, but are not limited to, a long second metatarsal, instability of the second metatarsophalangeal joint (MTPJ), a short first metatarsal, and hypermobility of the first ray. Acute forefoot trauma with resulting plantar plate rupture, subluxation or dislocation of the MTPJ, and a floating toe are also potential causes of forefoot pain (1). Additionally, the complications associated with hallux abductovalgus (HAV) surgery, such as iatrogenic shortening of the first ray with resultant overload of the lesser MTPJs, could warrant surgical correction of the HAV and stabilization of the affected lesser MTPJs.

To address digital instability with metatarsalgia, a number of procedures have been described in published reports. The use of the long flexor tendon transfer was described as early as 1925 (2), with numerous variations reported since then (3–10). By the mid-1980s, Helal and Greiss (11) suggested that the excess length of any given metatarsal could be addressed using telescoping osteotomy. In the same decade, Cracchiolo and Kitaoka (12) described their technique of

inserting a double-stemmed silicone implant into the subluxated lesser MTPJ in an effort to stabilize the joint. Later, Daly and Johnson (13) suggested resection of the involved phalangeal base and partial webbing of the unstable digit to an adjacent, stable toe, as a method to stabilize the subluxated lesser MTPJ. In 1994, Mulier et al (14) described the use of extensor digitorum longus (EDL) transfer to the metatarsal neck (Jones suspension) combined with arthrodesis of the proximal interphalangeal joint (PIPJ) to treat metatarsalgia associated with an unstable MTPJ. Subsequently, Ruch (15) described transfer of the extensor digitorum brevis tendon as a method to stabilize the MTPJ in complex hammertoe repair. Investigators have also described other methods to achieve multiplanar correction of the subluxated MTPJ since then (16,17).

With the continued interest in dysfunctional digits and lesser metatarsalgia came a focus on the anatomic constraints of the lesser MTPJ. In particular, the nature of the plantar plate and its influence on MTPJ function and stability gained the attention of many foot and ankle surgeons, and the function of the lesser MTPJ plantar plate was likened to that of the first MTPJ sesamoid apparatus. With this focus on the plantar plate, surgical procedures were devised to alter the metatarsal length pattern and stabilize the MTPJ structures to achieve a congruous joint and restore musculotendinous balance by stabilizing the plantar plate (18–25). To the best of our knowledge it was not until 2005 that direct repair of the plantar plate using a plantar incision

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Address correspondence to: Molly S. Judge, DPM, 140 Brookside Drive, Oak Harbor, OH 43449.

E-mail address: mjudgemolly@aol.com (M. Judge).



Fig. 1. (A) Preoperative clinical appearance 10 years after failed reconstructive forefoot surgery that resulted in flail toes 2 to 4 in the left foot. Barefoot activities and simple toe rise maneuvers were intolerable preoperatively. (B) View of fissures separating the compartments of the plantar fat pad of the left foot. During the previous 10 years, this patient had experienced pain and dysfunction owing to the failed forefoot reconstruction. (C) At 8 months after suture-button stabilization of the lesser metatarsophalangeal joints, the plantar fat pad had reorganized and the digits were stable and able to bear weight without pain. (D) At 1 year postoperatively, the patient had returned to her usual daily activities, and the chief complaint of forefoot pain had resolved. At 3 years after the suture-button procedure for digits 2 to 4 of the left foot, she was able to perform the toe rise test without pain, in contrast to the preoperative findings when that maneuver was intolerable.

was advocated by Jolly (26). Jolly promoted the use of small soft tissue anchors to repair the lateral collateral ligament, with release of the medial collateral ligaments, as adjunctive repair in crossover toe deformity. Over time, the combined use of internal fixation, specialized soft tissue anchors and suture materials and purpose-built instrumentation aimed at lesser MTPJ repair became popular. Thus, what seemed to many surgeons to be straightforward lesser MTPJ and plantar plate surgery entered the realm of high technology and relatively expensive specialized instrumentation and implants.

Chronic lesser MTPJ wear and tear and failed lesser toe surgery or trauma can lead to plantar plate attenuation or rupture. Patients with this condition will commonly present with lesser MTPJ instability and toe misalignment in the sagittal, transverse, and frontal planes. In addition, patients can develop degenerative joint disease of the lesser MTPJ, chronic MTPJ, and digital edema, hammer toe, or other interphalangeal contracture. Also, in many cases, a painful plantar keratosis will develop at the level of the metatarsal head, all of these factors contribute to lesser metatarsalgia (Fig. 1). The etiology of plantar plate disruption can be divided into 2 basic groups: patients in whom lesser digital surgery has failed; and patients with MTPJ predislocation syndrome (PDS). In cases of failed digital surgery, it could be that pre-existing plantar plate dysfunction was overlooked, resulting in a poor functional outcome with continued pain. Such patients often report an unsatisfactory outcome after traditional PIPJ fusion or arthroplasty with or without temporary MTPJ transfixation using a Kirschner wire (K-wire).

Just as with many painful musculoskeletal conditions, failure of the condition to satisfactorily respond to nonoperative treatments often results in surgical intervention. In the present report, we have described a series of 8 consecutive patients who experienced chronic

forefoot pain subsequent to lesser MTPJ subluxation and/or failed digital surgery. All 8 patients underwent shortening metatarsal osteotomy, combined with a suture-button technique, to stabilize the involved lesser MTPJs. The aim of the present analysis was to determine whether the suture-button technique, combined with osteotomy, could provide satisfactory pain relief for these conditions and to provide preliminary outcome measures related to this technique. To the best of our knowledge, no previous studies have reported on metatarsal shortening osteotomy combined with the MTPJ suture-button method described in our report.

Patients and Methods

In this prospective case series, each patient presented to the senior author (M.S.J.) for consultation regarding chronic intractable forefoot pain due to chronic MTPJ subluxation and/or failed previous digital surgery. On presentation, the patients were considered for inclusion in the present study and informed of the investigation. After the patients had provided informed consent, the pertinent data were collected. Only patients who had presented with chronic forefoot pain associated with subluxation of the MTPJ, recalcitrant to conservative therapy, and after previous digital surgery, were considered for the present review. These patients were identified and enrolled in the series consecutively and were followed up as a group thereafter. To be included, the patients had to experience intractable pain in the forefoot, with swelling and the inability to satisfactorily load bear on the symptomatic MTPJ. In addition, the patients had to display antalgic favoring of the painful foot as a consequence of the intractable pain and swelling. Moreover, to be included, the patients had to have reported that they could not continue their usual daily activities because of their foot pain. Still further, conservative treatment efforts, including the use of metatarsal sling pads and prescription orthotic devices, had to have failed. A total of 11 patients were identified as potentially eligible when they presented; however, 3 patients (27.3%) were excluded because they had had the following exclusion criteria. Of these 3 patients, 1 (33%) had diabetes mellitus and was involved in a litigation claim related to the previous digital surgery, 1 (33%) displayed peripheral neuropathy (33%), and 1 (33%) could not complete the foot-related quality of life questionnaire owing to cognitive impairment.

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