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Technical tip

Dynamic correction for forefoot varus in stage II-A adult flatfoot: Technique tip☆

Jose Antonio Veiga Sanhudo

Head Foot & Ankle Department, Hospital Moinhos de Vento (HMV), Av. Praia de Belas 2124/701, Porto Alegre, RS, Brazil

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ABSTRACT

Posterior tibial tendon dysfunction (PTTD) is a progressive disorder and a common cause of adult acquired flatfoot deformity, and forefoot varus is a frequent component in advanced cases. The author proposes peroneus brevis-to-longus transfer as an additional step to correct the forefoot varus component of stage II-A posterior tibial tendon dysfunction. We have performed this dynamic correction of forefoot varus in 12 patients at our institution, and observed promising clinical and radiographic improvement. It is a soft tissue procedure that avoids additional incisions and represents a favorable alternative to more demanding techniques, such as osteotomy or arthrodesis.

1. Introduction

Posterior tibial tendon dysfunction (PTTD) is a progressive disorder and a common cause of adult acquired flatfoot deformity. Johnson and Strom described three stages in 1989, and Myerson added the fourth stage in 1997 [1,2]. In 2007, Bluman et al. described a refined classification including stage II-A, in which medial longitudinal arch collapse and hindfoot valgus are associated with forefoot varus [3–5]. Nonoperative treatment of this disorder is unsuccessful in many cases, and surgery is an option for these patients. The most-often performed procedure for stage II disease is flexor digitorum longus (FDL) tendon transfer combined with a medializing calcaneal osteotomy [6,7]. This procedure, however, may not adequately correct the forefoot varus component of the flatfoot deformity. The previously described treatments for persistent forefoot varus in stage II-A are gastrocnemius recession, a plantar closing wedge or dorsal opening wedge medial cuneiform osteotomy (Cotton osteotomy), or medial cuneiform-first metatarsal joint arthrodesis [8–13]. In this tip, we propose peroneus brevis to longus transfer as an additional step to correct the forefoot varus component of stage II-A posterior tibial tendon dysfunction.

2. Operative technique

After general or regional anesthesia, the patient is placed in a supine position, prophylactic antibiotic is administrated, the lower extremity is exsanguinated, and a thigh tourniquet is inflated to 300 mmHg. A medial incision is performed at the height of the posterior tibial tendon (PTT) attachment. The PTT is exposed and inspected for degeneration. If there is advanced tendinosis, the distal segment of the tendon is removed, but if the tendon is simply elongated without significant volume enlargement, it is ignored. The FDL is approached inferior to the navicular, with careful avoidance of the surrounding neurovascular structures, and cut as distally as possible. A dorsoplantar bone tunnel 4.5 mm in diameter is then created, through which the FDL will be passed to the navicular.

The foot is then rotated to expose the lateral aspect. An oblique incision or mini L-shaped lateral approach (the author prefers the latter) to the calcaneus is performed, and the lateral wall is exposed at the desired level for osteotomy [14]. After Koutsogiannis osteotomy, the distal fragment of the calcaneus is displaced 10 mm medially and fixation is achieved with two or three 4.5-mm cannulated screws [15]. The peroneal tendons are approached. The peroneus brevis (PB) is completely transected; the proximal part of the tendon is advanced 10 mm, and a tenodesis to the peroneus longus (PL) is performed using 2-0 absorbable sutures (Vicryl) with the foot in plantarflexion and eversion, enough to allow tensionless suture. The distal part of the peroneus brevis tendon is ignored (Fig. 1A,B). The subcutaneous tissue is closed with 3-0 absorbable sutures (Vicryl), and the skin, with nonabsorbable monofilament nylon Donati sutures.

☆ Level of Evidence: V, Expert Opinion.

E-mail address: jsanhudo@ceotrs.com.br (J.A.V. Sanhudo).

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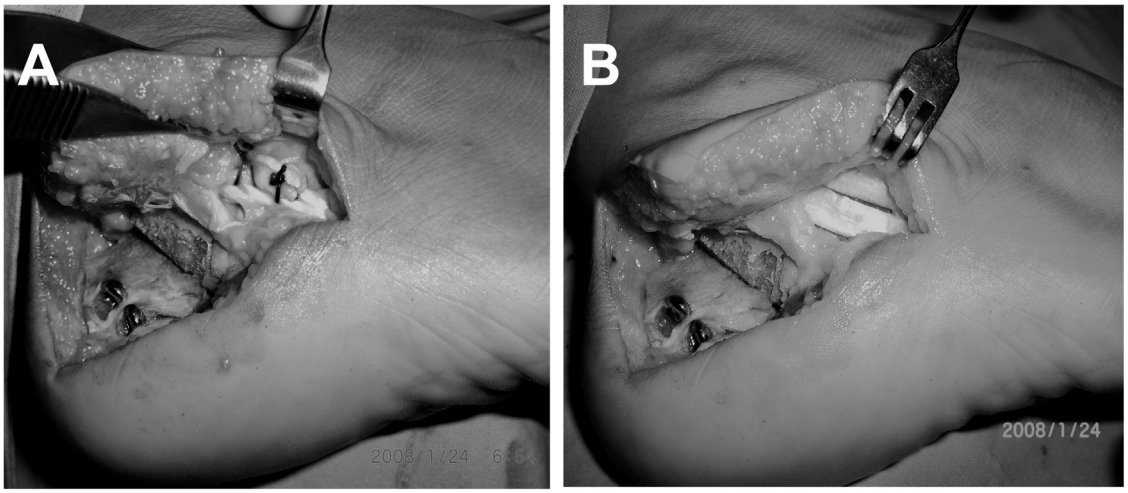

Fig. 1. A) Intraoperative view of the mini L-shaped approach for calcaneal osteotomy and to the peroneal tendons. **B**) Intraoperative view after peroneus brevis tenotomy had been performed and the proximal part advanced 10 mm and sutured to the peroneus longus tendon. The distal part of the peroneus brevis tendon was ignored.

To complete the FDL transfer, the FDL is passed through the navicular tunnel and sutured onto itself, as well as to the remaining insertion of the PTT. The subcutaneous tissue is closed with a 3-0 absorbable sutures (Vicryl) and the skin is closed with mono-nylon nonabsorbable Donati sutures.

3. Discussion

The current options for surgical correction of forefoot varus in stage II PTTS are plantar closing wedge osteotomy (Cotton osteotomy), dorsal opening wedge osteotomy of the medial cuneiform, or first tarsometatarsal or naviculocuneiform arthrodesis [4–12]. All of these techniques require either an additional incision or prolongation of the medial incision, and all are associated with a risk of nonunion (up to 12%) or implant-related complications (occurring in approximately 10% of cases) [4,11,13].

In the treatment of planovalgus deformity, PB transfer has been described as an augmentation technique in cases in which the FDL or flexor hallucis longus are too small or too thin, as well as in revision surgery [16,17].

Good results have been obtained with PL-to-PB transfer as a means of elevating the first metatarsal for treatment of cavovarus deformity [18,19]. Analogously, the objective of PB-to-PL transfer is to decrease hindfoot valgus tension, reduce forefoot abduction, and lower the first ray, thus helping restore the medial longitudinal arch. A combination of PB-to-PL transfer and lateral column lengthening has been used successfully for planovalgus foot correction in children [20]. In adults, this technique has been described as a tendon-balancing method to oppose midfoot supination after transmetatarsal amputation in diabetic patients [21]. Hansen described PB-to-PL tenodesis for the treatment of planovalgus deformity, but without the objective of correcting forefoot varus [22]. As one of the essential actions of the PL tendon is plantarflexion of the first ray, elevation of the medial longitudinal arch and correction of forefoot varus make up the rationale behind the procedure.

This technique avoids an additional incision or prolongation of the medial incision and it is a soft tissue procedure, without risk of nonunion, malunion, or hardware irritation, as may occur in medial-column osteotomies or first-ray arthrodesis. Mizel et al. reported that patients with peroneal nerve palsy who underwent PTT transfer to the midfoot did not develop the typical deformity associated with PTT deficiency, and hypothesized that this condition will not occur if peroneal nerve function is absent. They suggested that procedures which weaken the hindfoot valgus and midfoot abduction functions of the peroneus brevis could theoretically limit flatfoot progression, and might relieve mechanical demands on a repaired or replaced PTT [23]. As hypothetical

Fig. 2. Clinical aspect of the foot A) before and B) after PTTD correction through FDL transfer, calcaneal osteotomy, and peroneus brevis to longus tenodesis.

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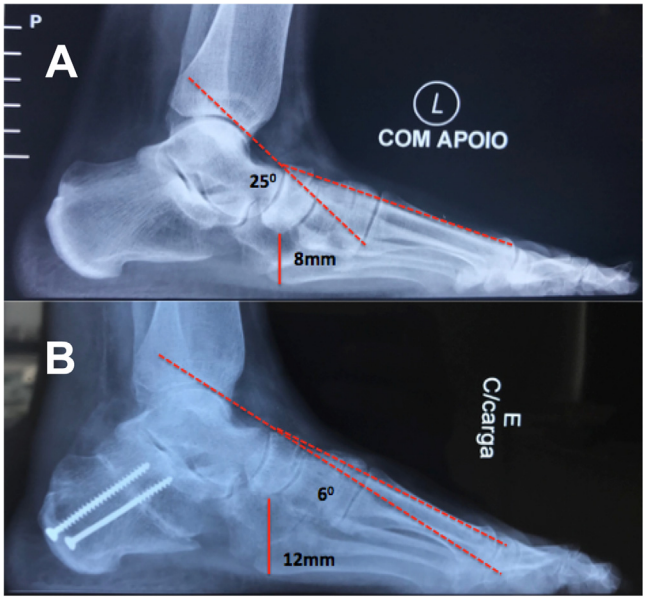

Fig. 3. A) Pre- and B) postoperative lateral radiographs of a foot treated by FDL transfer, calcaneal osteotomy, and peroneus brevis to longus tenodesis. Observe the talus-first metatarsal angle correction from 26° to 6° and improvement in navicular-fifth metatarsal distance from 8 to 12 mm.

advantages, PB release decreases valgus tension on the hindfoot and protects the FDL transfer, while the PB-to-PL tenodesis decreases abduction forces on the forefoot and strengthens the PL function of plantarflexion of the first ray, dynamically correcting the forefoot varus. However, the technique is not able to correct rigid forefoot varus deformity.

We have performed this dynamic correction of forefoot varus in 12 patients at our institution and observed promising clinical and radiographic improvement (Fig. 2A,B and Fig. 3A,B). The procedure is simple and a good alternative to more demanding techniques, such as osteotomy or arthrodesis.

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Conflict of interest

None.

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