

# Chapter 4

## Minimally Invasive Achilles Tendon Reconstruction Using the Peroneus Brevis Tendon Graft

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### 4.1 Introduction

Minimally invasive peroneus brevis reconstruction for the Achilles tendon (AT) overcome the problems with an open procedure, namely difficulty with wound healing because of the tenuous blood supply and increased chance of wound breakdown and infection. In this chapter we presented a technique which uses two para-midline incisions preserving skin integrity over the site most prone to wound breakdown.

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This minimally invasive technique allows reconstruction of the Achilles tendon using the tendon of peroneus brevis preserving skin integrity over the site most prone to wound breakdown, and can be especially used to reconstruct the Achilles tendon in the presence of gap less than 6 cm.

The ideal candidate to minimally invasive semitendinosus tendon graft augmentation is a patient with a chronic tear of the Achilles tendon with a gap, during surgery less than 6 cm with the ankle kept in maximal plantar flexion and traction on the AT stumps [7]. This technique is designed to preserve skin cover of the reconstruction site, and, although reconstruction is always risky, it may extend the indications for surgery to patients prone to wound complications such as those with peripheral vasculopathy and diabetes who present with a tendon gap. Gap greater than 6 cm are better managed with semitendinosus transfer [3].

There are no specific contraindications exist for minimally invasive ipsilateral tendon transfer. Obviously this is not possible in patients previously undergone peroneus tendon harvesting for other procedure.

## 4.2 Surgical Technique

The patient is positioned prone with a calf tourniquet. Skin preparation is performed in the usual fashion, and sterile drapes are applied. Pre-operative anatomical markings include the palpable tendon defect, both malleoli, and the base of the fifth metatarsal.

Three skin incisions are made, and accurate hemostasis by ligation of the larger veins and diathermy of the smaller ones is performed. The first incision is a 5 cm longitudinal incision, made 2 cm proximal and just medial to the palpable end of the proximal stump. The second incision is 3 cm long and is also longitudinal, but is 2 cm distal and lateral to the distal stump. Care is taken to prevent damage to the sural nerve by making this incision as close as possible to the anterior aspect



FIGURE 4.1 The distal Achilles tendon stump is mobilized, freeing it of all the peritendinous adhesions

of the lateral border of the Achilles tendon to avoid the nerve. At the level of the Achilles tendon insertion, the sural nerve is 18.8 mm lateral to the tendon but, as it progresses proximally, the nerve gradually traverses medially crossing the lateral border of the tendon 9.8 cm proximal to the calcaneum. Thus, the second incision avoids the sural nerve by being placed on the lateral side of the Achilles tendon but posterior to the nerve. The third incision is a 2 cm longitudinal incision at the base of the fifth metatarsal.

The distal Achilles tendon stump is mobilized, freeing it of all the peritendinous adhesions, particularly on its lateral aspect (Fig. 4.1). This allows access to the base of the lateral aspect of the distal tendon close to its insertion. It should be possible to palpate the medial tubercle of the calcaneum. The ruptured tendon end is then resected back to healthy tendon, and a Number 1 Vicryl (Ethicon, Edinburgh) locking suture is run along the free tendon edge to prevent separation of the bundles.

The proximal tendon is then mobilized from the proximal wound, any adhesions are divided, and further soft tissue release anterior to the soleus and gastrocnemius allows

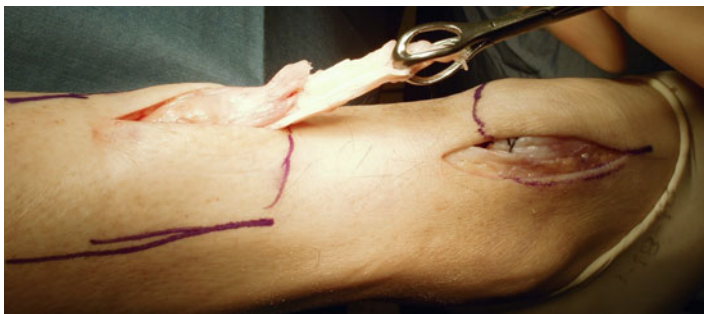


FIGURE 4.2 The proximal tendon is then mobilized from the proximal wound, any adhesions are divided, and further soft tissue release anterior to the soleus and gastrocnemius allows maximal excursion, minimizing the gap between the two tendon stumps

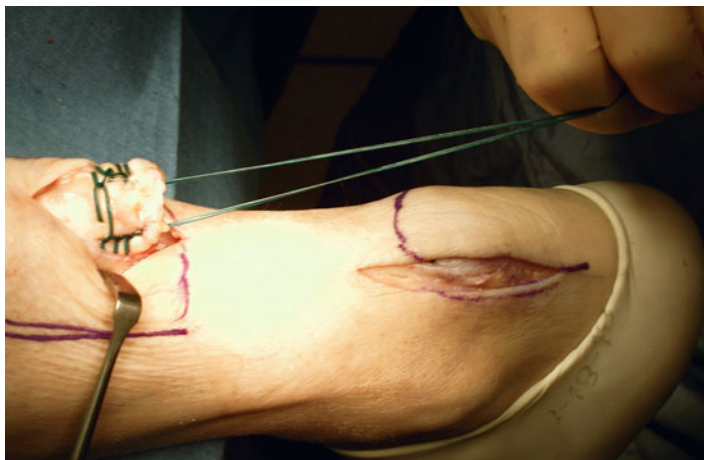


FIGURE 4.3 A Vicryl locking suture is run along the free tendon edge to allow adequate exposure and to prevent separation of the bundles

maximal excursion, minimizing the gap between the two tendon stumps (Fig. 4.2). A Vicryl locking suture is run along the free tendon edge to allow adequate exposure and to prevent separation of the bundles (Fig. 4.3).

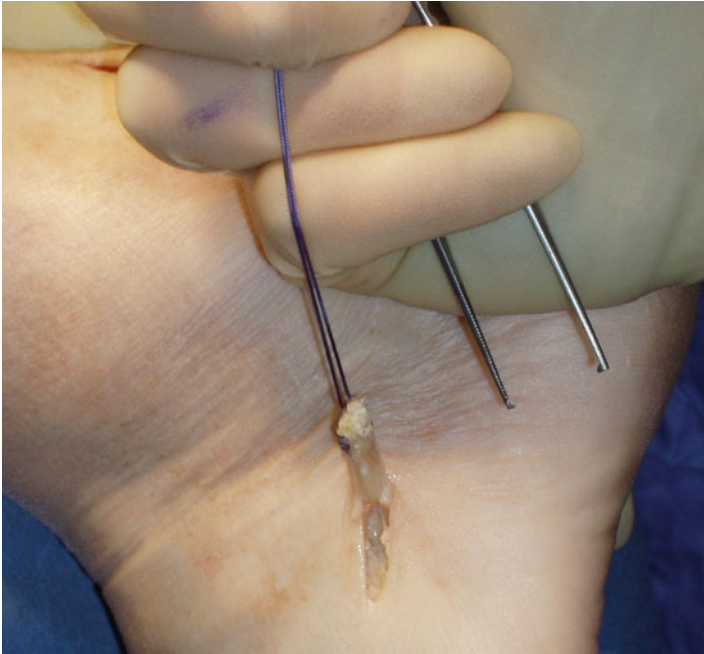


FIGURE 4.4 The tendon of peroneus brevis is harvested

The tendon of peroneus brevis is harvested (Fig. 4.4). The tendon is identified through the incision on the lateral border of the foot at its insertion at the base of the fifth metatarsal. The tendon is exposed, and a No.1 Vicryl locking suture is applied to the tendon end before release from the metatarsal base. The tendon of peroneus brevis is identified at the base of the distal incision of the Achilles tendon following incision of the deep fascia overlying the peroneal muscles compartment. The tendon of peroneus brevis is then withdrawn through the distal wound (Fig. 4.5). This may take significant force, as there may be tendinous strands between the two peroneal tendons distally. The muscular portion of peroneus brevis is then mobilized proximally to allow increased excursion of the tendon of peroneus brevis.



FIGURE 4.5 The tendon of peroneus brevis is then withdrawn through the distal wound

A longitudinal tenotomy parallel to the tendon fibers is made through both stumps of the tendon. A clip is used to develop the plane, from lateral to medial, in the distal stump of the Achilles tendon, and the peroneus brevis graft is passed through the tenotomy (Fig. 4.6). With the ankle in maximal plantar flexion, a No.1 Vicryl suture is used to suture the peroneus brevis to

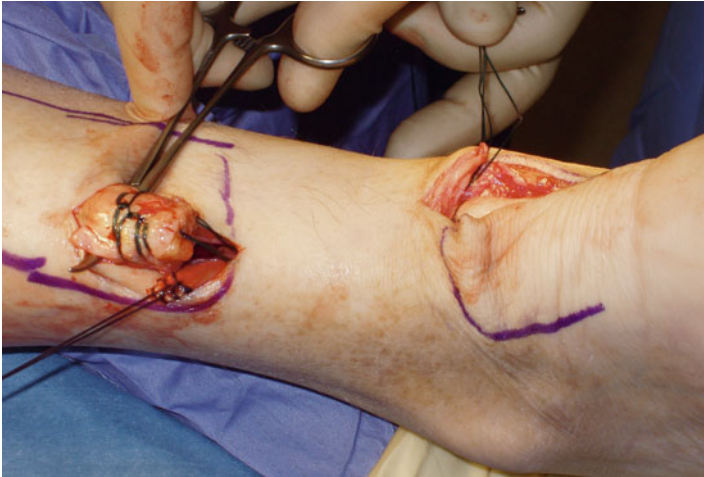


FIGURE 4.6 A clip is used to develop the plane, from lateral to medial, in the distal stump of the Achilles tendon, and the peroneus brevis graft is passed through the tenotomy

both sides of the distal stump. The tendon of peroneus brevis is then passed beneath the intact skin bridge into the proximal incision, and passed from medial to lateral through a transverse tenotomy in the proximal stump, and further secured with No 1 Vicryl. Finally, the tendon of peroneus brevis is sutured back onto itself on the lateral side of the proximal incision. The reconstruction may be further augmented using a Maxon (Tyco Health Care, Norwalk, CT) suture.

The wounds are closed with 2.0 Vicryl, 3.0 Biosyn (Tyco Health Care, Norwalk, CT) and Steri-strips (3M Health Care, St Paul, MN), taking care to avoid the risk of post operative hematoma and minimize wound breakdown. A previously prepared removable scotch cast support with Velcro straps is applied.

### 4.3 Postoperative Management

Post operatively, patients are allowed to weight bear as comfort allows with the use of elbow crutches [9, 10]. It would be unusual for a patient to weight bear fully at this stage. After

2 weeks, the back shell is removed, and physiotherapy is commenced with the front shell *in situ* preventing dorsiflexion of the ankle, focusing on proprioception, plantar-flexion of the ankle, inversion and eversion [9, 10]. During this period of rehabilitation, the patient is permitted to weight bear as comfort allows with the front shell *in situ*, although full weight bearing rarely occurs on account of balance difficulties and patients usually still require the assistance of a single elbow crutch as this stage. The front shell may be finally removed after 6 weeks. We do not use a heel raise after removal of the cast, and patients normally regain a plantigrade ankle over 2 or 3 weeks [9, 10].

## 4.4 Discussion

The main complication the surgeon may encounter is sural nerve injury. Care is taken to prevent damage to the sural nerve. At the level of the AT insertion, the sural nerve is 18.8 mm lateral to the tendon but, as it progresses proximally, the nerve gradually traverses medially crossing the lateral border of the tendon 9.8 cm proximal to the calcaneum [13]. Thus, the second incision avoids the sural nerve by being placed medial to the nerve.

Wound breakdown is a challenging complications in AT reconstruction surgery, with open techniques having a 9 % superficial infection rate [12]. The great advantage of this technique is that it allows to perform a peroneus brevis tendon augmentation in a minimally invasive fashion, preserving skin integrity. In patients with chronic ruptures, the skin over the gap retracts over several weeks, and remains so until the operation. In open surgery, this skin is incised, and is then stretched out in a relatively acute fashion to accommodate the reconstructed tendon [1]. Therefore, following the reconstruction, the skin over the gap may well be stretched so much that its vascular supply is impaired [11]. The reconstructed gastro-soleus AT complex will stretch with increased loading and range of movement exercises during rehabilitation [2].



Preservation of skin cover during reconstruction procedures is clearly an advantage, as the skin is not injured by the operation, and protects the reconstruction beneath [4–6, 8]. As with all surgery performed through minimally invasive incisions, this procedure is technically demanding. Careful incision placement is required together with skin retraction to allow visualization of the tendon ends and to permit the reconstruction. This technique is designed to preserve skin cover of the reconstruction site, and, although reconstruction is always risky, it may extend the indications for surgery in patients prone to wound complications such as vasculopathy and diabetics who present with a tendinous gap.

In conclusion, this technique allows minimally invasive reconstruction of the AT using peroneus brevis tendon preserving skin integrity, and can be especially used to reconstruct the AT in the presence of gap less than 6 cm.

**Competing Interests** The authors declare that they have no competing interests.

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