The Journal of Foot & Ankle Surgery ■■ (2018) ■■–■■

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Case Reports and Series

Short-Term Results of Flexor Hallucis Longus Transfer in Delayed and Neglected Achilles Tendon Repair

Hamza Ozer, MD [1], Yilmaz Ergisi, MD [2], Gulcan Harput, PT, PhD [3], Mehmet S. Senol, MD [4], Gul Baltaci, PT, PhD [5]

[1]*Professor, Department of Orthopaedics and Traumatology, University of Gazi, Ankara, Turkey*
[2]*Medical Doctor, Department of Orthopaedics and Traumatology, Sungurlu Hospital, Corum, Turkey*
[3]*Assistant Professor, Department of Physiotherapy and Rehabilitation, Hacettepe University, Ankara, Turkey*
[4]*Medical Doctor, Department of Orthopaedics and Traumatology, Gazi University, Ankara, Turkey*
[5]*Professor, Department of Physiotherapy and Rehabilitation, Private Guven Hospital, Ankara, Turkey*

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
Achilles injuries
ankle joint
rehabilitation
surgery

ABSTRACT

Flexor hallucis longus (FHL) tendon transfer to the calcaneus in the repair of delayed or neglected Achilles tendon (AT) injuries is a viable and dynamic option. Nineteen patients (18 males, 1 female; mean age 47.4 ± 12.4, range 24 to 74, years; body mass index 27.5 ± 4.5, range 23.2 to 38.9, kg/m^2; interval from injury to surgery 40.8 ± 11.6, range 28 to 60, days) with delayed or neglected repair of AT rupture were included in the present study. FHL transfer to the calcaneus through a single incision and repair of the defect with native tendon lengthening or a tendinous turndown flap was performed. American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot and hallux scale scores, balance and jump performance, ankle dorsiflexion range of motion, and lower extremity concentric and eccentric strength were evaluated 6 months postoperatively. Student's *t* test was used to compare the outcomes between the operated and nonoperated sides. AOFAS hindfoot and hallux scale scores were 93.83 and 86.9, respectively. No significant difference was found in vertical jump ($p = .60$), forward jump ($p = .68$), or balance performance ($p > .05$). However, less ankle dorsiflexion on the operated side was recorded compared with the nonoperated side ($p = .008$). Concentric/eccentric muscle strength between the operated and nonoperated side was similar ($p > .05$). The concentric strength of the operated side reached 92% and eccentric strength reached 101.7% of the nonoperated side's strength. All the patients were satisfied with their results and return to preinjury daily activities. AT repair of a delayed and neglected injury using FHL transfer to the calcaneus in a dynamic fashion provided excellent outcomes.

The Achilles tendon (AT) is the largest and strongest tendon in the lower extremity. Acute ruptures of the tendon occur commonly in middle-age men (1–4). Although the first complication was reported by Homer in Greek mythology, the death of Achilles, many researchers have reported complications such as wound dehiscence, infection, repeat rupture, and nerve injuries after surgical treatment of AT ruptures (ATRs) (5–8). Therefore, conservative treatment protocols have been advocated to treat ATR (9). Currently, patients with medical comorbidities who have major risks for surgery and patients who do not accept surgery are treated conservatively (9–12). However, fibrous tissue developing between the ruptured ends in conservatively treated AT injuries could yield without much stress during a forceful trauma, and re-injury might occur with ease. In addition, complaints such as pain, poor mobilization, swelling, and repeat rupture have been reported after conservative treatment of ATR (13,14). Surgery is recommended for missed or neglected ATR to restore function and diminish complaints.

End-to-end repair can be performed if small gaps have formed after debridement of unhealthy tendon tissue (15). However, augmentation with viable and nonviable tissue can be required when large gaps have resulted after debridement. Tendon transfers can be applied in selected cases to reconstruct the defect and restore plantarflexion function dynamically with viable tissue (15–22). Hansel (17) described flexor hallucis longus (FHL) transfer through tendinous structure in the treatment of chronic AT problems. Wapner et al (18) described the technique of FHL tendon transfer through an osseous tunnel created in the calcaneus transversely. However, DeCarbo and Hyer (19) modified the fixation of FHL tendon with an interference screw through a single posterior incision technique.

Financial Disclosure: None reported.
Conflict of Interest: None reported.
Address correspondence to: Hamza Ozer, MD, Department of Orthopaedics and Traumatology, University of Gazi, Konya Yolu Besevler, Ankara 06500, Turkey.
E-mail address: hamzaozer@gazi.edu.tr (H. Ozer).

1067-2516/$ - see front matter © 2018 by the American College of Foot and Ankle Surgeons. All rights reserved.
https://doi.org/10.1053/j.jfas.2018.03.005

In the present study, we documented the short-term results of surgical treatment of delayed and neglected ATR with the FHL tendon through a single posterior incision in a dynamic fashion.

Patients and Methods

Patients

A total of 19 patients with delayed ATR were treated by a single orthopedic surgeon (H.O.). The patients included 18 males (94.7%) and 1 female (5.3%). Their mean age was 47.4 ± 12.4 (range 24 to 74) years. The mean body mass index was 27.5 ± 4.5 (range 23.2 to 38.9) kg/m^2. The interval from injury to surgery was 40.8 ± 11.6 (range 28 to 60) days. All patients were examined in an outpatient office visit by the primary investigator (H.O.) who diagnosed the ATR. Patients with acute ATR, systemic and/or neurologic problems, or contralateral lower extremity injury ≥6 months from the evaluation were excluded from the present study.

In the 19 patients, 13 injuries (65%) were on the left and 7 (35%) were on the right. One patient had bilateral ATR. The major complaints of all 19 patients were the inability to perform heel rise, weakness during stair climbing, and fatigue during daily activities. A calcaneal gait was also observed in all patients. The Thompson "squeeze" test findings were negative in 4 patients (21%) and were positive in 15 patients (79%). The gap was palpable in 4 patients (27%) with positive Thompson test findings, with hyperdorsiflexion of the ankle joint present compared with the contralateral healthy side. One patient had similar dorsiflexion on both sides; however, bilateral ATR had been diagnosed (Table 1).

Table 1
Patient characteristics (N = 20 feet in 19 patients)

Characteristic	Value
Sex (n)	
Male	18 (94.7)
Female	1 (5.3)
Age (y)	
Mean ± standard deviation	47.38 ± 12.43
Median	46
Range	24 to 74
Dominant extremity (n)	
Right	11 (57.9)
Left	8 (42.1)
Side (n)	
Right	5 (25)
Left	15 (75)
Body mass index (kg/m^2)	
Mean ± standard deviation	27.5 ± 4.5
Median	25.8
Range	23.2 to 38.9
Interval from injury to surgery (days)	
Mean ± standard deviation	40.8 ± 11.61
Median	36
Range	28 to 60
Follow-up period (days)	
Mean ± standard deviation	250.31 ± 90.06
Median	280
Range	183 to 2250
AOFAS hallux scale score	
Mean	86.91
Range	81 to 97
AOFAS hindfoot scale score	
Mean	93.83
Range	86 to 100

Abbreviation: AOFAS, American Orthopaedic Foot and Ankle Society.

Surgical Technique

All procedures were performed with the patient in the prone position under general anesthesia. A longitudinal incision just medial to the AT was created. The skin and subcutaneous tissue was dissected sharply without damaging the skin edges. The thickened paratenon was incised carefully and retracted (Fig. 1*A*). Nonviable tissue filling the proposed rupture site and thickened tendon was palpated. Approximately 3 to 3.5 cm of scar tissue was excised until healthy AT was reached (Fig. 1*B*). In 1 patient, hypertrophied plantaris muscle tendon was observed (Fig. 1*A*). Approaching anteriorly, the deep posterior crural fascia was incised longitudinally, and FHL muscle belly was approached. The tendon of the FHL muscle was identified with flexion and extension of the hallux. The FHL muscle belly was pulled proximally while plantarflexing the foot. The tendon was tenotomized as distally as possible while preserving the neurovascular structures under an army retractor. Heavy synthetic suture in a baseball stitch fashion was placed at the distal end of the harvested tendon. A socket, adjusted to the tendon diameter, was created with a cannulated reamer just anterior to the insertional site of AT in the calcaneus. The FHL tendon was pulled into the osseous tunnel with the help of sutures placed at the distal end of the tendon through the heel using a beath pin. The tendon was secured with an interference screw in the tunnel while pulling the traction suture plantarly with adequate tension (Fig. 2*A*). Proper tension of the transferred tendon was adjusted to match the contralateral healthy side.

To close the gap, lengthening of the native tendon with a V-Y plasty was added after the FHL transfer was performed (Fig. 2*B*). Additionally, weaving of the FHL muscle belly through the AT was also applied to construct a united structure.

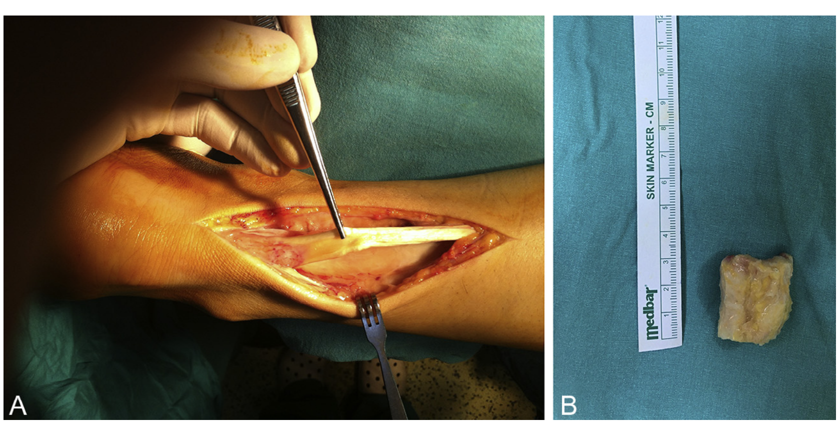

Fig. 1. (*A*) The paratenon was incised, and the hypertrophied plantaris tendon was identified. (*B*) Photograph showing excised 4-cm-long fibrous scar tissue.