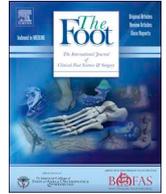




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Case Report

Mini thigthrope® fixation of unstable bony avulsion of the extensor hallucis longus tendon

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ABSTRACT

Reports of isolated avulsion fracture of the distal phalanx of the hallux that comprise the functionality of the extensor hallucis longus tendon (EHL) are scarce and treatment for such injury has only been described in isolated single case reports. Two patients with an unstable avulsion fracture of the distal phalanx treated with reinsertion of the EHL with a Mini ThighRope® system are presented in this paper.

Two patients whom suffered an extreme plantarflexion mechanism sought attention in our clinic. Plain x-rays depicted a displaced and angulated bony avulsion fracture of the base of the distal phalanx of the hallux. The interphalangeal joint was in a slightly plantarflexed position and the patient was not able to perform active extension upon request.

Surgical fixation performed with Mini ThighRope® system without transarticular immobilization of the interphalangeal joint.

In the two patients the Mini ThighRope® system provided adequate reduction of the displaced articular fragment, restored the extensor function and allowed early postoperative mobilization of the IP joint. Removal of the implants was not necessary and patients were able to resume their previous activity levels.

Level of Evidence: IV

1. Introduction

Reports of isolated avulsion fracture of the distal phalanx of the hallux that comprise the functionality of the extensor hallucis longus tendon (EHL) in the adult population are scarce, although indoor barefoot stubbing injuries to the great toe are relatively common in children [1,2]. The incidence and treatment of such injury has only been described in isolated single case reports [3, 5, 9–12]. There is no agreed method of fixation and techniques described have been modeled after fixation of mallet finger injuries. Two patients with an unstable avulsion fracture of the distal phalanx treated with reinsertion of the EHL by means of a Mini ThighRope® (Arthrex, Naples, Florida) system are presented.

2. Case report

Two female patients, 37 and 42 years old respectively, sought attention due to edema and pain in the left great toe, accompanied by dorsal hematoma extending to the nail bed. They both reported an extreme plantarflexion mechanism (one while jumping and landing and the other one caught her left great toe on the leading edge of a step).

Upon referral to the orthopedic clinic, standard lateral and dorsoplantar (Fig. 1) radiographs were obtained and revealed a bony avulsion fracture of the base of the distal phalanx of the hallux. In both cases the avulsed fragment was displaced with dorsal angulation of 30 degrees, the interphalangeal joint was in a slightly plantarflexed position and the patient was not able to perform active extension upon request. Surgical treatment was elected on the basis of the EHL incompetence and the position of the avulsed fragment in order to prevent related to the presence of a juxta-articular fragment, in two active young patients.

2.1. Surgical technique

Surgery was performed under local block anesthesia. A tourniquet was applied to the ankle level. The hallux interphalangeal joint (IPJ) was approached through a U-shaped incision. The fragment was carefully detached from the dorsal capsule with the remaining EHL attachment intact. Care was taken in order not to damage the proximal limit of the nail matrix. Two 1.1 mm tapered suture passing K-wire were gently advanced through the avulsed fragment and then through the base of the distal phalanx in a dorsal–plantar to proximal–distal manner leaving through the plantar skin. Trajectory while advancing

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Fig. 1. Standard lateral and anteroposterior radiographs of the foot, which depicted a bony avulsion of the dorsal aspect of the distal phalanx of the great toe.

the two K-wire was confirmed under fluoroscopy. Each one of the single strand of the Mini Tightrope® were placed into the Nitinol loop of the K-wire. The opposite end of the suture passing K-wire was pulled out, bringing the suture completely through and exiting the plantar cortical of the distal phalanx and then the suture was pulled in order to bring the oblong button to contact the dorsal side of the phalanx, just above the avulsed fragment. The suture was cutted on the plantar side to create two strands of FiberWire® and the second oblong button was load onto the suture. The avulsed fragment was then reduced into the desired anatomic resting position by applying axial traction and slight extension of the interphalangeal joint. One provisional knot was tied and range of motion checked clinically and under fluoroscopy to confirm full motion and no impingement. Then approximately five knots were tied over the plantar cortical button to lock the construct into place. Surgical wound was closed in standard fashion (Fig. 2 a–c).

The patient was then fitted in a rigid-soled sandal (Darco International, Inc.; Huntington, WV) to prevent plantarflexion of the toe. Self-directed home physical therapy was started at the third post operative week, with passive dorsiflexion and plantarflexion exercises of the first metatarsophalangeal joint and the IPJ.

At 12-weeks follow up both patients were able to perform everyday activities using regular shoes. Return to light sport activities was allowed during the fourth month following surgery. Radiographs re-

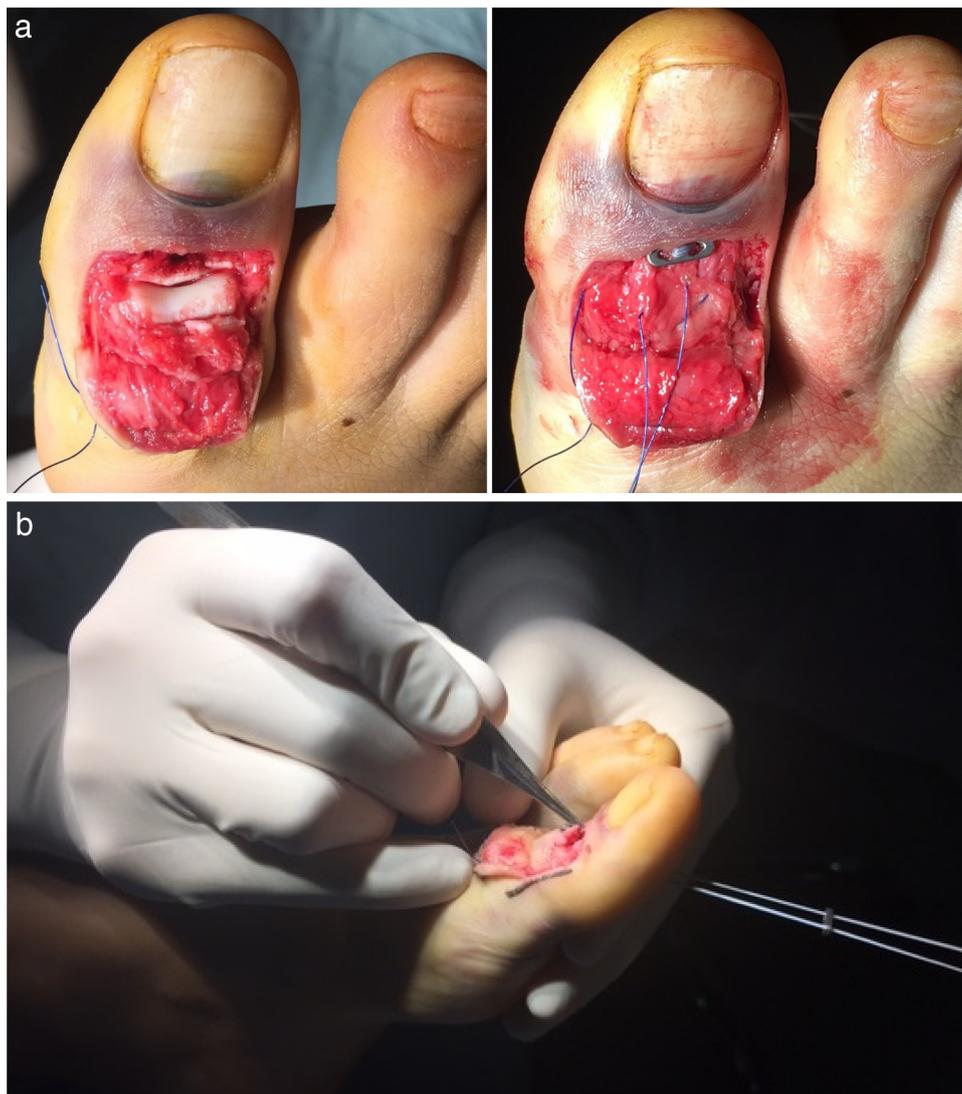


Fig. 2. (a) Dorsal U-shaped incision with the IP joint explored and avulsed fragment elevated. (b) Mini ThighRope® being inserted into the fracture bed and (c) FiberWire suture secured over the avulsed fragment.



Fig. 3. Postoperative placement of the mini Mini ThighRope®.

vealed bone bridging and congruous joint in both cases. Active extension against resistance was similar to the uninjured side (Figs. 3 and 4). At two year follow up both patients were able to perform activities of daily living normally and light sport activities without pain. None of them needed any special insole and were able to wear commercial shoes.

3. Discussion

There is a paucity of data regarding the incidence of this type of injury and the treatment for such injury has only been described in isolated single case reports.

As there is a lack of previous evidence when treating this type of injury a parallel can be drawn to its hand counterpart, the mallet finger, when it comes to decision making. The nonsurgical treatment (extension splint) of the mallet finger is well known [6], as are the indications for open reductions [7,8]. Namely, when the avulsed fragment is displaced and approximately 30% of the joint surface is involved, or when the distal fragment is subluxed volarly and cannot be held in a reduced position with a closed technique, then an open reduction is indicated. Surgical treatment in our two patients was elected on the basis of the EHL incompetence and the position of the avulsed fragment. Only



Fig. 4. Four months follow up showing no extensor lag and full, symmetric range of motion.

isolated single case reports have been reported on this injury [3, 5, 9–12].

Rapoff et al. reported a case of isolated fracture of the extensor insertion of the distal phalanx of the hallux treated conservatively with a rigid soled sandal [3]. Hennessy and Saxby reported a similar case describing the use of dorsal extension thermoplastic splint for a traumatic mallet toe injury with success but the patient experienced flexion deformity and extensor lag of the hallux [9].

Surgical fixation of the bony mallet injury of the hallux was described by 3 authors in the recent years and they used fixation similar to mallet finger injuries [10–12]. Nakamura described closed reduction and percutaneous pinning of the bony avulsion injury with good hallux IP joint range of motion on follow up [11]. More recently, Wada and Yui reported the use of extension block method with 2 Kirschner wires. They reported good bony union at 8 weeks [12]. Martin et al. reported open surgical fixation of the bony mallet injury of the hallux in a 16-year-old man with Kirschner wires. The patient had good recovery with bone healing seen at 5 weeks postoperatively. At 6 months postoperatively, the patient had full range of motion similar to the opposite side without extensor lag [10]. All 3 single case reports involved trans articular fixation of the IP joint with a Kirschner wire for immobilization.

As previously reported immobilizing the IP joint with transarticular pinning could lead to IP joint stiffness [5]. Hong et al. reported two cases fixated with a bio-absorbable suture anchor with functional results avoiding the need of implant removal.

Some technical note regarding the open treatment, knowledge of the proximal limit of the matrix is essential during operative exposure to avoid permanent nail deformity. The extensor tendon, in particular, continues from its bony insertion to envelope the dorsal aspect of the distal phalange, and the collateral ligaments form an integrated network on the sides of the joint, thereby helping to anchor the nail margins [4].

In the two patients the mini Tightrope® system provided adequate reduction of the displaced articular fragment, restored the extensor function and allowed early postoperative mobilization of the IP joint. Removal of the implants was not necessary and patients were able to resume their previous activity levels.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Informed consent

Informed consent was obtained from all individual participants included in the study.

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