Case Report

Pseudotendon Formation after a Type III Flexor Digitorum Profundus Avulsion

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Abstract

Background Avulsion of the flexor digitorum profundus tendon is a common injury to the hand that virtually always requires surgical repair for restoration of normal finger function.

Case Description We report a case of a Type III flexor digitorum profundus tendon avulsion in which the patient refused surgery yet attained nearly full active ROM and an excellent functional result via the formation of a pseudotendon, as observed on MRI obtained 2.5 years after the initial injury.

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

Each author certifies that his or her institution approved the reporting of this case report and that all investigations were conducted in conformity with ethical principles of research.

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Literature Review There are no reported cases of restoration of normal finger function after pseudotendon formation in a flexor digitorum profundus tendon avulsion injury.

Purposes and Clinical Relevance This case shows the potential for pseudotendon to not only form but have adequate tensile strength to restore function in certain types of flexor tendon injuries.

Introduction

Avulsion of the flexor digitorum profundus (FDP) tendon, known more commonly by the eponym “jersey finger,” is a frequently encountered problem in hand surgery. It often is caused by forced extension of the distal interphalangeal joint (DIP) during active flexion. The injury classically occurs when one grabs an opponent’s jersey with the tip of the finger and the opponent accelerates. The classification system for this injury originally was defined by Leddy and Packer [4] and is based on the degree of tendon retraction. Retraction is an important consideration in these flexor tendon injuries because it provides information regarding the fate of the vincula, which provide nutritional support and blood supply to the FDP tendon distal to the proximal interphalangeal (PIP) joint. Without an adequate blood supply, the FDP tendon will necrose, particularly at the proximal stump [7].

It is well-accepted that most FDP avulsions require prompt diagnosis and surgical treatment to avoid functional deficits [3, 6]. Factors influencing the outcome of FDP avulsions include the extent of tendon retraction, the time between injury and repair, and the presence of a bony fragment [3]. We present a case in which a patient with a clearly operative FDP avulsion refused surgical treatment yet was able to attain nearly full active ROM at the DIP joint via formation of a pseudotendon.

Case Report

A 52-year-old right-hand-dominant male ophthalmologist presented to our clinic with a chief complaint of pain and swelling on the volar aspect of his right ring finger and inability to actively flex the DIP joint. He described trauma to the finger 1 week earlier in which a lawnmower starter was abruptly ripped from his hand. Before this event, the patient denied prior injury or difficulty with the digit. His medical history was unremarkable. On physical examination of the involved finger, ecchymosis was noted on the volar surface of the middle phalanx. No palpable masses were seen. Exquisite tenderness was present over the volar DIP joint. The patient exhibited no active DIP flexion but had full passive flexion. The ring finger metacarpophalangeal and PIP joints had full active ROM, as did all other joints of the hand. Radiographs of the finger suggested the presence of a small bony fragment in the region of the middle phalanx. Subsequent MRI indicated a complete tear of the FDP tendon with retraction of the tendon to the midaspect of the middle phalanx (Fig. 1). At this initial office visit, surgery was recommended, but the patient declined. Second and third opinions also recommended surgical repair; however, the patient refused. The patient's finger was immobilized in a finger-based splint in mild DIP and PIP flexion for the next 6 weeks. No active or passive motion was allowed during that period. Passive motion was started after 6 weeks to prevent stiffness.

At his 6-week and 3-month followups, the patient continued to have full passive but no active flexion of the DIP joint. At 6 months, he still lacked active DIP flexion but now was reporting increased PIP stiffness, for which he

was prescribed occupational therapy focusing on ROM exercises. After 2 months of therapy, a total of 8 months from the time of injury, the patient reported a gradual return of active DIP flexion. It is unclear exactly why active DIP flexion returned at this point, but one theory would be that the occupational therapy helped to break up adhesions in the flexor sheath. One year after the injury, the patient had nearly full active DIP flexion and full active extension.

A MR image obtained 2.5 years after the initial injury showed reconstitution of the distal aspect of the FDP tendon in the region of the gap left after the initial avulsion (Fig. 2). Despite having the same appearance as normal tendon on MRI, we believed the FDP was reconstituted via pseudotendon, given the knowledge that normal tendon does not regrow in these types of injuries [2].

His most recent examination more than 5 years after injury showed DIP flexion of 0° to 70° (Fig. 3) compared with 0° to 80° in the contralateral digit. He also is able to make a full composite fist (Fig. 4). Grip strength using the JAMAR® dynamometer (Asimov Engineering, Santa Monica, CA, USA) Position III was 80 pounds bilaterally. He denies pain and has no difficulty performing his daily activities as an ophthalmologist.

Fig. 1A–B (A) T1- and (B) T2-weighted sagittal MR images show FDP avulsion with retraction to the midaspect of the middle phalanx.

Fig. 2A–B (A) T1- and (B) T2-weighted MR images taken 2.5 years after injury show reconstitution of the distal FDP tendon with pseudotendon at the site of the previous FDP avulsion.

Fig. 3 A photograph shows a nearly full flexion of the isolated DIP joint at the most recent followup.

Fig. 4 A photograph shows the full composite fist at the most recent followup. The ring finger sustained the initial FDP avulsion injury.

Discussion

Leddy and Packer [4] originally described three types of FDP avulsions. Since that time, several variations of the injury have been reported that describe five types of injury [7]. Additions to the Leddy and Packer classification were

made because there were FDP injuries seen that did not fit perfectly into one of the original three types. Properly classifying them is important to the hand surgeon because it helps to determine treatment of the patient and timing of surgery [1]. In Type I avulsions, which are the most rare, the tendon retracts proximal to the A1 pulley. Long and short vincula are ruptured, resulting in compromised blood supply to the involved tendon. It generally is recommended that these injuries be repaired acutely within 7 to 10 days [3, 4]. Type II injuries, the most common, involve tendon rupture with retraction to the level of the PIP joint. The short vinculum is ruptured, but the long vinculum remains intact with some preservation of the blood supply. Some believe this injury may be repaired in delayed fashion (> 3 weeks) owing to this intact blood supply. Type III injuries retract to the middle phalanx and may have a bony fragment that catches on the A4 pulley, limiting retraction. Both vincula remain intact in this injury. Type IV injuries also involve avulsion of a large bony fragment; however, they differ from Type III injuries in that the tendon is pulled away from the fragment and lies at the level of the PIP joint or palm [1]. Type IV injuries should be treated within 7 to 10 days [1]. Finally, Type V injuries denote those in which an osseous fragment with attached tendon is pulled away from the distal phalanx and there is a substantial extension of the fracture into the distal phalanx. Type V injuries are subdivided into Types Va and Vb based on whether the distal phalanx fracture is intraarticular versus extraarticular, respectively [1]. Ideally, these injuries should be treated within 2 weeks, especially if intraarticular or displaced [1].

The patient discussed here falls into the category of a Type III avulsion owing to tendon retraction to the middle phalanx. The mainstay of treatment for this injury is surgery [3–5]. Prompt repair is recommended to avoid necrosis of the tendon stump and subsequent finger contraction deformity. Chronic avulsions, detected well after the injury, may be associated with problems, such as finger stiffness, pain in the palm, weak pinch, hyperextension of the DIP joint, and loss of dexterity [3, 5].

Three separate board-certified hand surgeons evaluated the patient and recommended operative repair. Our patient chose nonoperative management. Surprisingly, he was able to obtain full active DIP flexion with no pain and full passive ROM. How was this result possible? An MRI obtained 2.5 years after the initial injury showed reconstitution of the distal aspect of the FDP tendon with pseudotendon filling in the gap left after the initial avulsion (Fig. 2). This pseudotendon is what enabled active DIP flexion.

Kulick et al. [2] described the formation of pseudotendon after flexor tendon injuries. They reported three separate cases of flexor tendon injury in which direct

surgical exploration revealed the formation of pseudotendon ranging from 10 to 13 cm in length and an average of 0.8 cm in diameter. Histologically, they noted, on hematoxylin and eosin staining, normal tendon and pseudotendon were indistinguishable, with both having fibrocytes and collagen fibers. However, when stained for elastic fibers, pseudotendon contained only a paucity of these fibers as compared with normal tendon. Although they could not be certain, Kulick et al. surmised, based on their intraoperative findings, pseudotendon formed in these cases because the integrity of the flexor tendon sheath was preserved and there was minimal peritendinous damage from the initial injury [2]. They also commented pseudotendon differed visually from normal tendon by the former's light gray color and absence of a glistening surface. Finally, it was noted pseudotendon lacked the tensile strength of a normal tendon and should be replaced by a tendon graft or a tendon transfer to adequately restore hand function. However, they acknowledged pseudotendon may be suitable for function in areas where less forceful tendon tension is required, such as extensor tendons on the dorsum of the hand (eg, as in a mallet finger) [2].

How does our patient's outcome via the formation of pseudotendon compare with the published outcomes for operative repair of this problem? Despite the relative frequency of Zone 1 flexor tendon injuries, there are few series documenting the results of surgery. In their classic 1977 article involving 36 patients who underwent flexor tendon avulsion repair, Leddy and Packer [4] reported, on average, one can expect postoperatively a 10° to 15° loss of DIP extension, good return of DIP flexion, and equivalent grip strength to the contralateral hand. In contrast, Moiemmen and Elliot [5] reported, of nine patients with Types II and III FDP avulsions treated by primary repair, 66% had poor DIP joint ROM postoperatively. As our patient currently has nearly full active DIP flexion with full extension, no pain, and no difficulty in his profession as an ophthalmologist, one might argue his outcome is similar to those typically achieved with operative repair.

This case report draws attention to the formation of pseudotendon as a real entity after tendon injury. In most cases, the pseudotendon formation may not be sufficient to restore normal function [2]. However, in our case, the patient regained full function. It is not clear what percentage of Type III FDP avulsions have the potential to heal in such a manner and what specific characteristics of this injury enabled such abundant pseudotendon formation. Perhaps the limited retraction of the tendon (and therefore preservation of the long and short vincula) or the retained integrity of the flexor sheath were key factors in this outcome. Nevertheless, we do not intend to suggest with this case report that all flexor tendon avulsions should be given a trial of nonoperative treatment because patients might regain full function via formation of pseudotendon. We only hope to shed light on the potential for pseudotendon to have adequate tensile strength to restore function in certain types of tendon injuries, such as that presented here. Clearly, future research into the biomechanics of pseudotendon and its capacity to form in certain types of tendon injuries is required before any substantial, practice-changing conclusions can be drawn.

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