

A rare case of Adhered Flexor Tendons at the Site of the Proximal Phalangeal Fracture - A Case report and Literature Review

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Abstract

The proximal phalanx base is a location of common fractures in hand injuries. Such fractures are rarely reported due to flexor tendon adhesion at Zone II flexor tendon of the hand. As we know that Zone II begins at the origin of the fibro-osseous flexor sheath in the distal aspect of the palm, and extends to the distal aspect of the insertion of the flexor digitorum superficialis (FDS) tendon. In this case report we describe a patient who sustained a united fracture of the proximal phalanx on the right fifth finger with flexor tendon adhesion after treatment of the fractures with closed reduction and K-wires fixation (CRPP). A 32-year-old male came to the clinic following a bicycle accident a few hours ago and presented emergency with a dorsal small open skin wound over the knuckle joint, and the flexion limitation in his small finger on the right hand was recorded. During physical examination, the patient felt enormous pain,

significantly deformity of the little finger (LF) with mal-rotation but the neurovascular structures were intact. However range of motion (ROM) in his small finger was significantly limited. Plain radiographs displayed a comminuted base of proximal phalanx fracture with significant angulation and malrotation. CRPP under general anesthesia (GA) was performed after debridement of the dorsal little finger open wound routinely, the wound was closed, and LF was immobilized with a thermoplastic splint in "Posi" position for 4 weeks then started assisted passively ROM of IP joints. 6 weeks post CRPP surgery, all K wires were removed in outpatient clinic and the radiographs showed fractures were healed well with 100% apposition and anatomical alignment. 5 months later, he presented in clinic with injured little finger stiffness and unable to flexion interphalangeal joints (IP) at all. Comminuted base proximal phalanx fracture was healed with visible callus formation. The

second surgery of tendon release surgery was arranged and during the operation, it was found that the severe adhesion of the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) around the base of the proximal phalanx. Next day after the operation, the patient was permitted the IP joint motion. Twice daily hand physiotherapies for the first two weeks were carried out. At the 10-months, 2.5 years postoperative follow-up, the patient had regained full ROM with no discomfort and the proximal phalanx fracture was fully healed with normal alignment.

Introduction

The proximal phalanx is a common hand fractures. Most of these fractures may be managed using closed means, which require immobilization for 3 to 4 weeks or managed with CRPP. However, there are only three reports of the surgical outcomes of flexor tendon tenolysis after phalangeal fractures [1-3]. We reported on a 32-year-old male with comminuted base of proximal phalanx fracture managed with CRPP but developed flexor tendons adhesion. As we know that the proximal phalangeal fracture stability is crucial for the initiation of early and effective exercises designed to recover digits and especially proximal interphalangeal joint motion. Usually passive and active digital flexion and extension exercises are implemented by synergistic wrist motion. Hand physiotherapists knew that early controlled mobilization option for potentially unstable, nondisplaced, nonarticular hand fractures or after closed reduction and internal fixation cases. Early controlled mobilization of tissues surrounding a healing fracture has the potential to enhance the quality and rate of fracture healing and patient functional recovery. Adhered flexor tendons are an

uncommon complication following closed reduction and K wires fixations of Proximal Phalangeal (PP) fractures. However, failure to recognize this association will result in significant long-term digital stiffness and disability. Flexor tendons can become adhered with bone or tendons following phalangeal fracture because the flexor tendons lie intimately aligned to the phalanges of the finger. Injury to the synovial lining of the tendons can result in inflammation and scarring. Callus formation may also cause adherence of tendons to bone. Our case is presented in which both flexor tendons are adhered at the proximal phalanx following four weeks immobilization after fracture managed with CRPP. Subsequently the treatments are involving a technique of a surgical tenolysis of the flexor tendons and early hand physiotherapy. Following exercises and edema control, the patient was discharged home after twice daily hand therapy with no restriction on range of movement of the affected finger after flexor tendon adhesion release surgery.

Case Presentation

A 32-year-old man came to the clinic following a bicycle accident a few hours ago. He presented in emergency with a dorsal open wound over the knuckle of the little finger with flexion limitation in his small finger on the right hand. There were localized swelling, bruising, and tenderness, with significant deformity. He had received and finger splint from emergency without closed reduction. During physical examination, the patient felt severe pain with the open wound oozing blood, however the neurovascular structures were intact. The Range of Motion (ROM) in his small finger was limited, the Metacarpophalangeal (MP) joint had a 45 degree fixed extension and 0 degree flexion, the Proximal

Interphalangeal (PIP) joint was fixed at 30 degree flexion and the Distal Interphalangeal (DIP) joint was fixed at 0 degree flexion (**Figure 1 B**). Plain radiographs displayed proximal phalanx base had

communitated fractures with apex palmar angulation about 45 degrees and malrotation deformity of the little finger of the right hand due to “scissoring” of the fingers (**Figure 1A and B**).



Figure 1: Initial injury after fell off a bike, proximal phalanx base communitated fractures with apex palmar angulation about 45 degrees and malrotation of the little finger of the right hand (white arrows).

With the patient under general anesthesia a few hours after injuries, debridement of the dorsal knuckle wound routinely and Closed Reduction and Percutaneous K wire fixation (CRPP) was performed with intraoperative fluoroscopy guidance. Anatomical reduction and secured fixation was

confirmed on intraoperative fluoroscopic images and postoperative radiographs (**Figure 2A and B**). Right little finger was immobilized with a thermoplastic splint in “Posi” position for 4 weeks then started with assisted passively ROM of IP joint.



Figure 2: A week after injury, Closed Reduction and Percutaneous K wire fixation (CRPP) was performed. Anatomical reduction and secured fixation was confirmed on postoperative radiographs.

Unfortunately hand physiotherapist did very hard work on his little finger ROM but did not improve much, even worse with time. At three months postoperative follow up, his little finger PIP joint only had 15 degree flexion, there was no motion in DIP joint but MCP joint was able to do full flexion

and extension. However gradually, his little finger lost all motions in PIP and DIP joints but kept MCP joint supple. Lost tenodesis effect while flexion/extension of the ipsilateral wrist was documented (**Figure 3A-C**).



Figure 3: Six weeks post CRPP surgery, all K wires were removed in outpatient clinic and the radiographs showed fractures were healed well with 100% apposition and anatomical alignment (arrows).

Five months after index surgery, MRI study showed adhesions between FDS and FDP (**Figure 4C**), and between flexor tendons and fracture site healing callous (**Figure 4A and B**). The flexor tendons

adhesion on healing callous (**Figure 5A**), on the right, normal finger flexor tendons were free sliding on proximal phalanx, space available between

proximal phalanx and flexor tendons and space

between FDS and FDP (Figure 5B).



Figure 4: MRI images showed that adhesions between FDS and FDP (a white arrow in C), and between flexor tendons and fracture site healing callous (a yellow arrow in B).

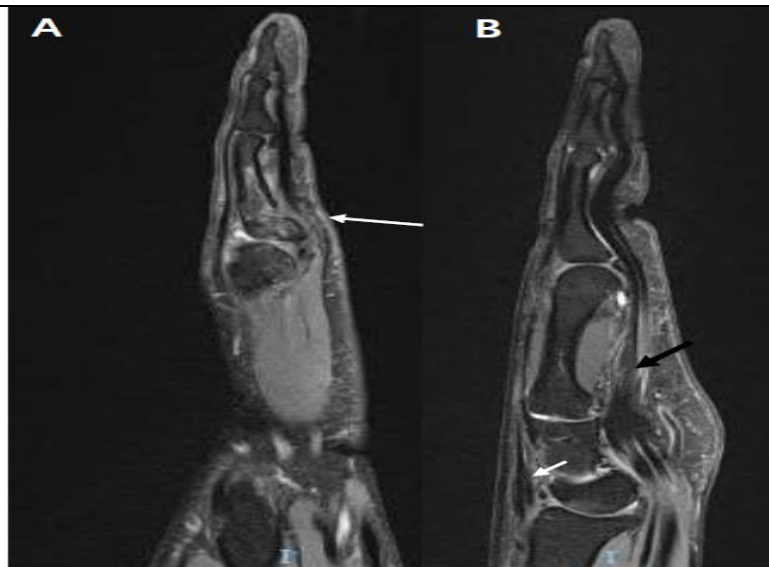


Figure 5: On the left side MRI showed flexor tendons adhesion on healing callous (a white arrow in A and B), on the right, normal finger flexor tendons were free sliding on proximal phalanx, space available between proximal phalanx and flexor tendons and space between FDS and FDP (a white arrow in C).

Open surgical release adhesion of the flexor tendons was performed. Palmar little finger Brunner's skin incisions from DIP to MCP joints was made and excision of scar tissues at PIP joint capsule and

between FDS and FDP was meticulously performed, and all scar tissues around the flexor tendons and A2 A3 A4 pulley were carefully resected with a sharp knife and a pairs of the scissors. After completely

release scar tissues, we kept A2 A4 pulley intact, and found FDP sliding through integrity of chiasm of FDS. Early mobilization promotes tendon excursion/sliding, reducing adhesions and improving functional outcomes. Early passive motion helps reduce joint edema and stiffness, minimizing peritendinous adhesions. Active mobilization being started from the distal interphalangeal joint, this is achieved by placing the wrist at neutral, extension and the metacarpophalangeal joints at 30° flexion. It may be kept in a neutral position of metacarpal

phalangeal joint, or in slight flexion or extension, provided that the patient is comfortable. Therefore, most active flexor tendon protocols currently recommend a position with less flexion of the wrist and the metacarpophalangeal joints, leaving interphalangeal joints in extension.

Next day after the operation, the patient was permitted the IP joint motion ([video 1](#)). Twice daily hand physiotherapies for the first two weeks were carried out ([video 2](#)).



video 1.mov

Video 1: Day one postoperatively, the patient with hand physiotherapist under oral analgesics started assisted active and active ROM of IP joints of his little finger.



video 2.mp4

Video 2: Two weeks postoperatively, the patient has achieved full ROM of his little finger with pain.

At the 3-months and 10-months follow-ups, the patient had regained full ROM with no discomfort and the proximal phalanx fracture was fully healed with normal alignment ([Figure 2](#)).

Discussion

There are only three reports of the surgical outcomes of flexor tendon tenolysis after phalangeal fractures [1-3]. Tenolysis is a surgical option that may improve the range of motion after hand trauma [1,3-6]. It

releases the adhesions around the tendon and joint capsule, and fracture healing callous so as to restore the tendon gliding and range of motion. However, there are only a few papers investigating the outcome of tenolysis after hand fracture [3-6]. Biomechanical studies have shown that the proximal phalanx experiences forces approaching 25 Newton during common activities, such as jar opening [7]. The interosseous muscles insert onto the base of the proximal phalanx and flex the proximal fracture

fragment, leading to an apex volar deformity [8]. The flexor and extensor tendons impart a longitudinal compression force that shortens the phalanx and extends the distal fragment which is repeated in our case. An unstable fracture is the one where otherwise insignificant forces would likely cause displacement or where a closed reduction has been unsuccessful. In this situation, additional stability imparted by surgical fixation is required [9].

In most cases, if the closed reduction method is unsuccessful for the treatment of phalangeal fracture, open reduction and internal fixation including K-wire fixation is usually a most preferred choice. In respect of bone fixation, the anterior surface of the proximal phalanx forms the floor of the flexor tendon sheath and allows the tendon to glide properly with early return to normal function. Stable anatomical reduction and fixation is required. However in our case, the callous was adhered to flexor tendons firmly which stopped tendon gliding in flexor tendon sheaths. In our case the base of the proximal phalanx communitated fractures in Zone II area is proximal to A3 pulley. Zone II consists of the region between pulley A1 and the beginning of zone I. This zone includes the osteofibrous tunnel and Camper's chiasm, known as Bunnell's no man's land, due to the high risk of complications after tendon injuries, such as adhesions and re-ruptures [10] which are challenges for surgeons. K-wire fixation is particularly valuable in the management of proximal third fractures, where the extensor tendon passes this region, the permanent plates may cause adhesions [11]. K-wire fixation is also associated with finger stiffness, tendon adhesions, and pin site infections [12,13]. We strongly recommended that early ROM exercises of the finger for a stable, intact bones and joints are necessary, freeing the flexor tendons at

fractured site where callous formation is present, to release adhesion. Success hinges on striking a delicate balance between safeguarding the surgical release for tendon adhesion and initiating early rehabilitation to minimize the formation of tendon re-adhesions, and maximize functional recovery.

In summary when treating a proximal phalangeal base fracture, the possibility of flexor tendon adhesion should be considered and early assisted/active ROM IP joints is recommended.

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