

## Reconstruction of The Flexor Pollicis Longus Tendon Ruptured, But Untreated, During Infancy

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We treated 3 patients who had ruptured the flexor pollicis longus (FPL) tendon during infancy and which had not been repaired. A two-stage surgical procedure, using a silicone rod, was performed to reconstruct the tendon, and favorable thumb flexion was obtained. A favorable outcome was obtained, even if the gliding of the silicone rod had been poor after the first stage procedure. When the scar of the tendon sheath is available, it should be used as a pulley. When the tendon sheath has completely disappeared, it should be reconstructed. At the second stage of surgery, the flexor digitorum superficialis muscle of the injured finger can be used as a motor source when the muscle is conserved in good condition because its distal stump adheres to the bone. If the muscle is not in good condition, transfer of the flexor digitorum superficialis muscle of the ring finger should be performed.

**Key words :** tendon, flexor pollicis longus, untreated tendon injury, reconstruction, two stage procedure

### INTRODUCTION

Thumb disorders are serious because the thumb is involved in 60% of hand functions. Although opposition is the most important function of the thumb, disorders of flexion and extension severely affect the grasping function of the hand. During infancy, rupture of the flexor pollicis longus tendon is sometimes left untreated because infants do not use their fingers to any great extent and are often unaware of any impairment in hand function and because their family also overlooks the rupture [4].

We treated 3 patients who had ruptured the flexor pollicis longus (FPL) tendon during infancy and which had not been repaired. This paper reports the favorable outcome of reconstruction using a two-stage procedure with a silicone rod, the surgical technique, and functional prognosis.

### MATERIALS AND METHODS

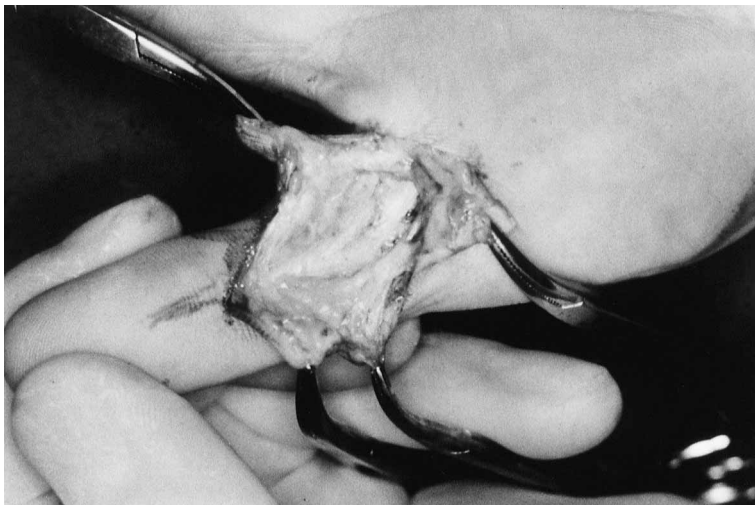
#### Case 1: 15-year-old male

The patient was cut at the distal site of the left proximal thumb crease when he was one year old. Thereafter, he did not feel handicapped. However, he found that he could

not grasp things well when he was around 11 years old, and visited our hospital when he was 13. At the first presentation, the interphalangeal (IP) joint was extended and the distal thumb crease was barely seen (Fig. 1). No active flexion was observed, although passive flexion was normal without hyperextension. Based on these findings, he was diagnosed as having old FPL rupture, and surgery was performed. A zigzag incision was made and we found that the FPL and its tendon sheath had scarred, and that tendon-like tissue was adherent to the base of the proximal phalanx (Fig. 2). The FPL tendon appeared normal in the distal forearm. The metacarpophalangeal (MP) joint flexed when the tendon was pulled. Therefore, a two-stage procedure using the original FPL as a motor source was planned. After the scar tissue was removed, a tendon passer was passed between both sesamoid bones of the MP joint through the carpal tunnel to the forearm and a silicone rod 3mm in diameter was inserted. A half slip from the distal end of the remnant FPL was used to make an oblique pulley (Fig. 3). A graft of the tendon of the palmaris longus muscle was performed 3.5 months later. The excursion



**Fig. 1** The IP joint is extended and active flexion is not possible. The distal thumb crease has almost disappeared.



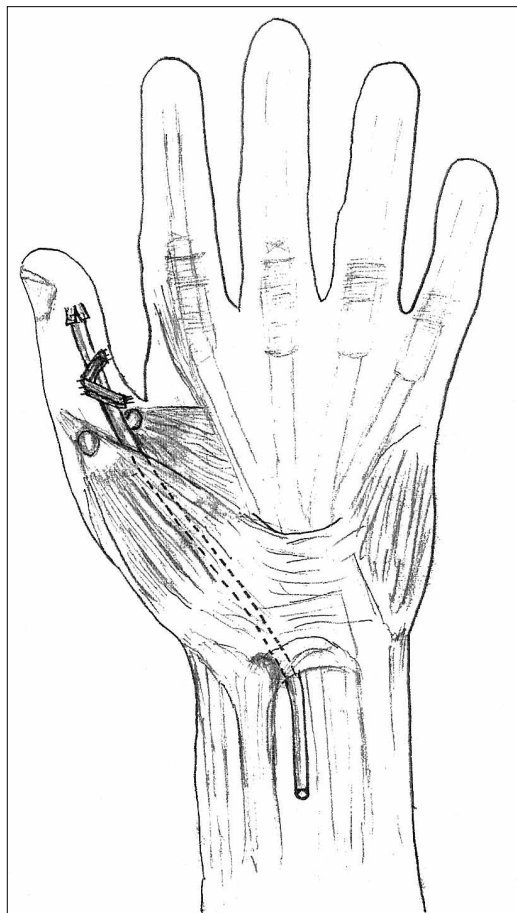
**Fig. 2** The tendon of the flexor pollicis longus muscle and tendon sheath are joined by scarring.

amplitude of the FPL was 2 cm and a good range of motion,  $12^\circ$  of extension and  $72^\circ$  of flexion, was obtained for the IP joint 21 months postoperatively. The thumb became usable.

**Case 2: 25-year-old male**

The patient received a cut over the left thumb proximal crease from a tin plate when he was 5 years old. Although he did not feel inconvenienced for several years, he found that he could not pick up small things well when he was around 11 years old. He visited our hospital when he was 22. At the

first presentation, the IP joint was extended and the active flexion was about  $20^\circ$ . These findings led to the diagnosis of FPL insufficiency and adhesion, and surgery was performed. The distal part of the FPL was scarred, and the tendon and muscle of the FPL could not be found in the forearm. Therefore, it was thought that the FPL tendon had become atrophied and had disappeared due to long-term disuse. A two-stage procedure, using the tendon of the flexor digitorum superficialis muscle (FDS) of the ring finger as a motor source, was planned.



**Fig. 3** A silicone rod is passed between both sesamoid bones of the MP joint through the carpal tunnel to the forearm. An oblique pulley is formed.

The scar was removed except for the part used to make an oblique pulley. A silicone rod 4 mm in diameter was inserted the same way as in Case 1. The rod did not glide during passive flexion. The FDS tendon of the ring finger was transferred about 6 months later. A range of motion of  $-10^{\circ}$  of extension and  $66^{\circ}$  of flexion was obtained for the IP joint 2 years and 7 months postoperatively. The patient was now able to pinch and grip things firmly.

#### **Case 3: 14-year-old female**

The patient received a wound on the left thumb from a fragment of a milk bottle when she was 3 years old. After that, she did not recognize any disorder. When she was around 12 years old, her mother found a flexion disorder of the IP joint. The patient visited our hospital when she was 13 years

old. The findings obtained at the first presentation included the fact that the left thumb was slightly smaller than normal, the crease of the IP joint had disappeared, and an inability to flex the joint. She was diagnosed as having an old FPL rupture. Based on the diagnosis and the experiences of Cases 1 and 2, a two-stage surgical procedure was planned. Since her FPL was found to be in almost the same condition as Case 2, a silicone rod 3mm in diameter was inserted in the same fashion. The FDS tendon of the ring finger was transferred about 3 months later. A range of motion of  $0^{\circ}$  of extension and  $40^{\circ}$  of flexion has been achieved 1 year and 5 months postoperatively.

## **DISCUSSION**

### **Reconstruction technique**

**Silicone rod:** The distal end of the ruptured FPL had scarred together with the tendon sheath and so the scarred portions of the FPL tendon and tendon sheath had to be removed in all the cases. This caused an extensive wound to the gliding floor, resulting in exposure of the bone. The gliding pathway of the tendon in the thenar also had become closed due to scarring. Even in this condition, adhesion of the grafted or transferred tendon was prevented by inserting the silicone rod to form a pseudosheath.

Rupture of the FPL is similar to congenital FPL deficiency. In fact, one of our cases was initially misdiagnosed as having congenital FPL deficiency at another hospital. FPL tendon deficiency, first reported by Fromont [2], has since seldom been reported [1, 6, 7, 8]. Although most patients with the deficiency have been successfully treated with a primary FDS transfer in the presence of the remnant tendon scar, they are completely different from our series. Therefore, a two-stage procedure using a silicon rod was considered necessary for our cases [3, 9]. Although Hunter [3] stated that the proximal end of the rod had to glide, the rod did not perform well after the first stage surgery in our series. However, it was then shown in several reports that the rod performed well after the second operation even though it did not glide well after the first operation. This indicates that the two-stage procedure will provide a favorable outcome even when the rod does not glide well immediately after the

first surgery.

**Reconstruction of the pulley:** The thumb has annular and oblique pulleys, which are important for preventing bowstring. Case 1 had a wound of the oblique pulley. Since advanced scarring of the pulley was noted, the pulley was reconstructed. In Cases 2 and 3, however, fibers considered to be the remnant of the oblique pulley were used because they had wounds at slightly more proximal sites. All the cases had a favorable outcome without bowstring.

**Selection of a motor source:** In Case 1, it was considered that the FPL had served as the flexor of the MP joint almost normally for a long time because its distal stump had adhered to the proximal phalanx. In such a condition, the FPL is considered to be reusable. Since no remnant of the FPL was observed in Cases 2 and 3, the FDS of the ring finger was used as a motor source. The transfer of the FDS tendon is desirable, because it provides power, is synergistic with the FPL, and because it is so long that a tendon graft is unnecessary.

**Indication and prognosis:** Injury to the FPL had occurred during infancy and was left untreated in all our cases. Although the patients experienced insufficient flexion of the IP joint, they did not receive an examination when they were young children because they did not complain of any inconvenience. Later, they sought medical assistance because they had begun to need precision movement of the fingers. The two-stage surgical procedure provided them with the most satisfactory results. As Kilgore [5] explained, the major role of the FPL is to pick up small things by pinching them with the finger tips. However, even when the FPL tendon has been ruptured, some patients

may not recognize a disorder of flexion and pinching unless the IP joint has been hyperextended. It is therefore necessary to prevent additional disorders, such as flexion or adduction contracture and pain, by repairing the ruptured FPL tendon. The surgical correction of an old rupture of the FPL tendon should be performed on patients who have been fully informed of the procedures, with rehabilitation monitored by physicians.

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