Subcutaneous Transposition of the Flexor Pollicis Longus: Does It Provide Increased Length for Tendon Repair? A Cadaveric Study

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Abstract

Background: Flexor pollicis longus (FPL) tendon lacerations typically occur via sharp mechanisms such as knife injury. When the injury is chronic, it may be difficult to perform a tension free repair, and tendon lengthening may be required. This article proposes a technique that transposes the proximal tendon stump over the thenar eminence subcutaneously, out of the carpal tunnel, in an attempt to gain additional tendon length by eliminating the sharp turn the FPL takes. **Methods:** A total of 17 cadaveric hands were used. The FPL tendon was identified and affixed to soft tissue in the distal forearm as well as at the thumb metacarpophalangeal (MP) joint with hypodermic needles. The tendon was then transected at the level of the MP joint of the thumb, removed from the carpal tunnel, and transposed on top of the thenar eminence to reach where it had been transected. The length gained by transposing the tendon was recorded by measuring the overlap of the tendon ends at the MP joint. **Results:** The mean amount lengthened was 7.6 mm with a standard deviation of 2.4 mm, ranging from as little as 5 mm to as high as 13 mm. **Conclusions:** To our knowledge, transposition of FPL tendon is a novel technique that has not been reported. Based on our cadaveric study, it can be used to bridge gaps between approximately 5 mm and 10 mm. Clinically, this amount of gap could potentially be more easily managed by simply making the repair tighter than usual as opposed to transposing the tendon.

Keywords: flexor pollicis longus, FPL, flexor tendon, tendon repair, tendon lengthening

Introduction

Flexor pollicis longus (FPL) tendon disruption can be seen in a variety of settings. It has been described in the context of rheumatoid arthritis,¹ scaphoid nonunion,² corticosteroid injection,³ and traumatic laceration. Because of the thumb's critical role in prehensile function, restoration of FPL tendon continuity is a high priority. Repair techniques including primary suture, tendon advancement to overcome short gaps, and free tendon grafting have been known and available to surgeons since the 1970s.⁴ Z-lengthening of the FPL tendon has also been described and is demonstrated to be biomechanically sound.⁵ However, a simple method of increasing length and decreasing tension on the repair by transposing the FPL tendon subcutaneously out of the carpal tunnel has not been described to the best of our knowledge.

Material and Methods

A total of 17 embalmed cadaveric hands were dissected. The FPL tendons were identified at the level of the thumb metacarpophalangeal (MP) and at the level of the distal

forearm. Traction on the tendon was used to ensure that the tendon was intact.

A 18-gauge needle was used to pin the FPL tendon to the surrounding soft tissues at the level of the MP joint of the thumb. This was repeated at the level of the distal forearm. This effectively locked in the length of the FPL tendon between the needles.

Next, the FPL tendon was transected sharply with a scalpel distally at the level of the MP joint of the thumb. The FPL tendon was then retrieved proximally by gently pulling it out of the carpal tunnel. A subcutaneous tunnel superficial to the thenar eminence was then created, directly in line with the first metacarpal. The proximal FPL stump was then passed to reach the MP joint of the thumb. This created a straight-line pull from the FPL in the distal forearm to the

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Figure 1. Method of subcutaneous transposition. Left panel show the FPL tendon being pinned, with black arrows indicating securing of the tendon to the surrounding soft tissue. Middle panel shows the tendon is transected sharply at the level indicated by the black arrow, at the level of the MP joint. Right hand panels show the proximal end of the transected tendon is retrieved from the carpal tunnel and rerouted subcutaneously over the thenar eminence. Black arrow here shows an enlarged view. The amount of overlapping distance, D, is measured between the pinned tendon end and the rerouted tendon end.

thumb, eliminating the acute bend it normally takes in the distal carpal tunnel to reach the thumb. The amount of tendon overlap between the 2 cut ends of the FPL at the MP joint level represented the amount of tendon length gained by the transposition.

This is illustrated in Figure 1.

Results

On average, 7.6 mm of length gain (range = 5-13 mm) was achieved with a standard deviation of 2.4 mm, as seen in Table 1. We used the right and left hands of 6 cadavers (FPL total), and the remaining 5 specimens were unilateral. We compared the amount of lengthening achieved between the left hand and the right hand of the paired specimens. In all cases, we found that the amount of lengthening achieved between the left and the right hand were within 1 mm of each other, suggesting that most of the variability was between cadavers.

Discussion

Transposition of FPL represents a novel technique that has not been previously described to the best of our knowledge. Removing the FPL from the carpal tunnel and rerouting it subcutaneously superficial to the thenar eminence creates a more direct line of pull that provides lengthening by eliminating the angled path through the carpal tunnel. Additional uses for this transposition technique include removing the FPL tendon from “rough” objects that may cause tendon rupture such as wrist fixation plates or prominent arthritic bone spurs as seen in rheumatoid arthritis.

Table 1. Increase in length achieved by subcutaneous transposition of the Flexor pollicis longus tendon.

Flexor pollicis longus lengthening achieved, mm		
Left	Right	Unilateral
8	7	9
13	13	7
7	8	5
6	6	8
5	5	9
7	7	

Note. The first 2 columns represent the amount of lengthening achieved for left and right hands belonging to the same cadaver. The third column represents the lengthening belonging to cadaveric hand samples, of which only one hand was available. Total of 17 hands were dissected and studied.

The amount of lengthening achieved appears to vary most from cadaver to cadaver, while the amount lengthened is fairly consistent within the same cadaver, regardless of the laterality.

Clinical concerns associated with subcutaneous transposition of the FPL tendon include potential risks of bow-stringing and impact on thumb strength and motion. We surmise that there will be no significant impact, as there are no pulleys proximal to the thumb MP joint and distal to the distal radial ulnar joint (DRUJ) for the FPL. As the transposed FPL will lie on top of the thenar eminence subcutaneously, it is also possible that transposition of the FPL in this location could be a potential opponensplasty procedure.

Second, there is also concern about stripping the blood supply by disrupting any vincula when FPL is retrieved out of the carpal tunnel at the level of the wrist, potentially preventing tendon healing. According to Azar et al,⁶ the vincula and arterial branches that supply the FPL are either at or distal to the level of the thumb MP joint, as well as at or proximal to the level of the DRUJ. As such, it would stand to reason this new technique is biologically friendly and should not impact the healing potential.

The clinical utility of this surgical technique is determined in the context of other techniques available. For primary repair of flexor digitorum profundus in other digits, it is known that advancing the free tendon ends by > 1 cm will demonstrate a deleterious effect known as quadriga.^{7,8} Similarly, it has been described that primary repair of FPL by simple advancement can be achieved for gaps equivalent to or smaller than 1 cm with acceptable outcome,⁹ but no study to our knowledge has looked at the upper limit to which the FPL can be advanced. In an effort to prevent undue tension at the repair site, techniques like interpositional tendon graft have been developed for gaps of 5 cm¹⁰ as well as step-cut lengthening for gaps of 2 cm.¹¹ It has traditionally been left to surgeon discretion regarding the optimal surgical technique for a given length gap without a clear consensus. This technique, while limited, is potentially another tool in a surgeon's armamentarium.

Conclusion

Subcutaneous transposition of the FPL tendon is a novel technique that can provide a modest increase in tendon length in cases where the repair is tight, such as in chronic cases.

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Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

This cadaveric study was carried out to a high ethical standard.

Statement of Informed Consent

No consent was needed for this cadaveric study.

Declaration of Conflicting Interests

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