

Flexor Digitorum Superficialis Tenodesis for Traumatic Amputation at the Level of the Proximal Phalanx

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Objectives

Traumatic amputation of the digit requiring revision amputation at the level of the proximal phalanx provides the opportunity to improve flexor function via **tenodesis of the remaining FDS tendon**.

The rationale for salvage of remaining FDS and performing flexor tenodesis to the proximal phalanx is to **allow for increased flexion at the metacarpophalangeal (MCP) joint** which can ultimately improve hand function postoperatively.

This series reviews FDS tenodesis in proximal phalanx amputations, outlining its surgical technique with clinical and functional outcomes.

Methods

An Institutional Review Board (IRB) approved retrospective study was performed of all cases of FDS tenodesis for amputation at the level of the proximal phalanx. At latest follow up, data including range of motion, grip strength, complications and need for revision surgery were recorded.

Surgical Indications

Amputation at the level of the proximal phalanx with intact extensor insertion but **loss of FDS and FDP** attachment is the primary indication for FDS tenodesis. Loss of extensor insertion would preclude tenodesis as FDS would overpower the extensor function resulting in a fixed flexion deformity.

This technique can be used in open wounds once a satisfactory debridement of devitalized tissues has been performed. Open physes are not a contraindication. This procedure is contraindicated in patients where there is active infection present.

Operative Technique

The amputation is designed as a "fish mouth" incision with equal palmar and dorsal flaps. Alternatively, the incision can be fashioned with a larger palmar flap to ensure that the thicker palmar skin covers the bony surface. Skin is incised and extensor tendon cut.

On the palmar surface, the neurovascular bundles are identified and the digital vessels isolated and cauterized. The digital nerves are dissected proximally and then cut under tension so they retract proximally. All devitalized or infected tissue is debrided.

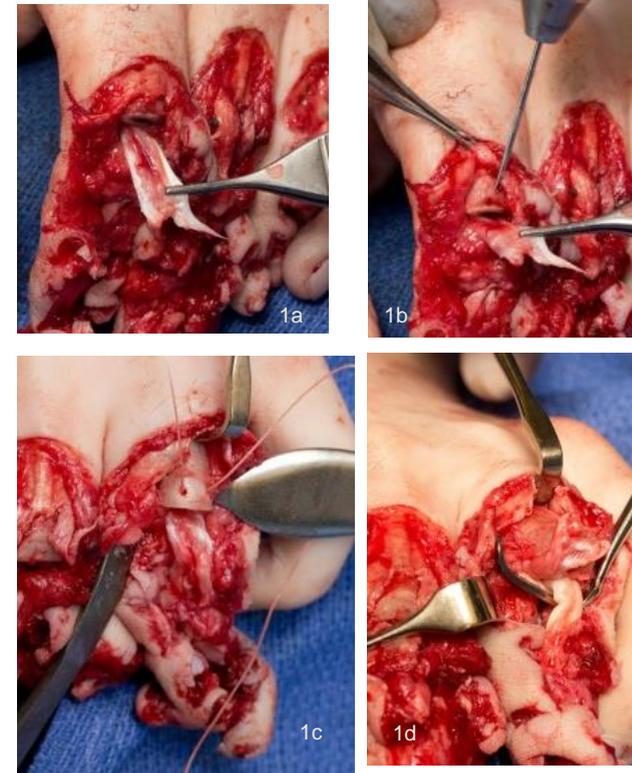
Operative Technique (Continued)

The FDP tendon is cut under tension and allowed to retract proximally. In cases where the amputation is performed proximal to the FDS insertion, the proximal phalanx is cut using a reciprocating saw and the ends smoothed with a rasp. The remaining proximal segment is under motor control of the intrinsic muscles and the extensor digitorum communis. This provides active MCP joint flexion of approximately 45°. The remaining segment will participate in gripping and help keep small objects in the palm.

To improve flexion at the MCP joint, the FDS tendon is then tenodesed to the end of the proximal phalanx. Kirschner wire holes are made through the distal end of the proximal phalanx and the FDS tendon sutured at its resting length to the phalanx, which provides almost 90° of flexion with grasp. The tourniquet is deflated, hemostasis obtained and the wounds closed with a 4.0 non absorbable suture. A soft dressing is applied and range of motion encouraged. Edema control and desensitization exercises are initiated

Figures 1(abcd) illustrate operative technique.

Drill holes are created through the dorsal cortex of the proximal phalanx (1a), FDS tendon is isolated (1b), nonabsorbable suture is passed through the drill holes and attached to remaining FDS tendon (1c), resulting in secured flexor tenodesis (1d).



Demographic Data

No. total patients : No. total digits	8 : 12
No. digits involved per patient in injury (avg, range)	3 (1-5)
Gender (Male : Female)	7 : 1
Follow up (months, avg, range)	15 (2-25)
Age (years, avg, range)	57 (15-92)
Dominant side involved (n, %)	4 (50%)
Smoker (n, %)	2 (25%)
Worker's Compensation (n, %)	2 (25%)

Outcomes

MCP flexion-extension arc (degrees, avg, range)	82 (45-95)
Grip strength, % of unaffected side (avg, range)	70% (50-100%)
Major Complications (return to OR) (n, %)	0 (0%)
Minor complications (did not return to OR) (n, %)	1 (13%)

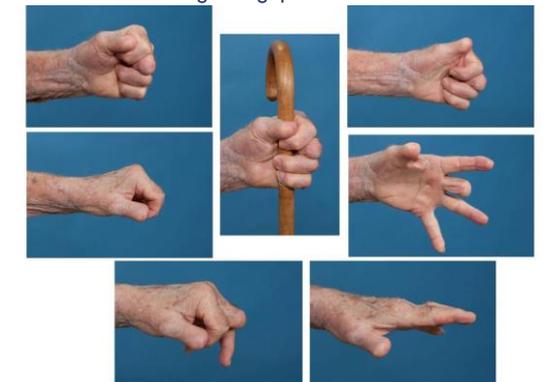
Results

The series includes 12 digits in 8 patients (7 male, 1 female) with an average age at surgery of 57 (range 15-92) (Demographic Data). All patients sustained open, traumatic amputations to the digits that were not replantable. Average number of digits involved in trauma was 3.

Average flexion-extension arc of affected MCP was 82 degrees and average grip strength was 70% of unaffected extremity (Outcomes). No patients required revision surgery or revision amputation. One patient had a wound cellulitis that was treated with oral antibiotics.

Clinical Results

Postoperative motion of 92 year old male 4 years after sustaining a table saw injury to the hand. Note the ability to make composite fist to contribute to overall strength of grip.



Conclusions

FDS tenodesis is a reliable motion preserving procedure for patients with amputations at the level of the proximal phalanx to maintain flexion at the MCP joint. In this series, MCP flexion-extension arc measured 82 degrees on average at 8 months postoperatively with no major complications noted. The significance of these results better enable surgeons to utilize FDS tenodesis in digital amputations at the PIP level to preserve flexion at the MCP joint for improved hand function after devastating traumatic injuries.