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Two-Stage Flexor Tendon Reconstruction for Finger Contracture Secondary to Phlegmon: A Case Report

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Abstract **Case Report**

Flexor tendon reconstruction is a complex surgical procedure that requires great precision and specialized expertise. It remains a preferred treatment for patients with neglected lacerations of the digital flexor tendon and after the failure of flexor tendon repair. Improvements in tendon repair methods and follow-up techniques have enhanced outcomes after flexor tendon grafting. ***Case Presentation*:** A 14-year-old girl with a history of a phlegmon of the 4th finger of the right hand, treated with antibiotics and drainage. The evolution is marked after 2 years by the progressive development of a flexion contracture of the proximal interphalangeal (PIP) joint. On examination, there is a flexion attitude and an inability to extend the PIP joint without vascular or nervous disorders. A two-stage reconstruction was performed using the palmaris longus tendon as a graft. With a follow-up of 3 years, the girl has recovered complete flexion and has limited extension to 25° at the PIP joint. An arthrolysis was proposed, but the girl refused, and she is satisfied with the results.

Keywords: Phlegmon, Flexor Tendon, Hunter's Technique, Two-Stage Reconstruction, Tendon Graft.

INTRODUCTION

The reconstruction of old flexor tendon injuries represents a challenge due to the technical complexity of the surgical intervention, the rigorous demands of postoperative rehabilitation, and the variability of clinical outcomes achieved [1].

The reconstruction of scarred flexor tendons in the hand is a significant challenge for hand surgeons, as healing tendons tend to adhere to their fibro-osseous tunnel. Zone 2, often referred to as 'no man's land' by Bunnell, is particularly problematic due to the poor range of motion (ROM) outcomes after tendon repair in this region. The results are even more unfavorable in the presence of untreated injuries.

The two-stage flexor tendon reconstruction technique is widely accepted for patients with a poor prognosis. This method, first described in 1971 by Hunter and Salisbury, involves using a tendon spacer during the first procedure, followed by a free tendon graft through the pseudo-sheath formed around the silicone rod during the second procedure

CASE PRESENTATION

A 13-year-old girl was referred to our hospital for a flexion contracture of the fourth finger of the right hand; she was unable to extend at the proximal interphalangeal joint (Figure 1).

She had a history of a phlegmon of the 4th finger treated with antibiotic therapy and drainage; the evolution is marked by the development of a progressive flexion contracture of the finger. On physical examination, there is a flexion posture of the PIP joint of the 4th finger without vascular or nerve impairment (Figure 2).

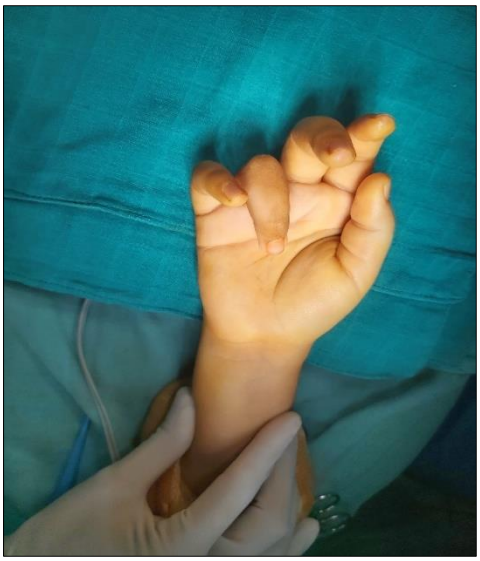

Figure 1

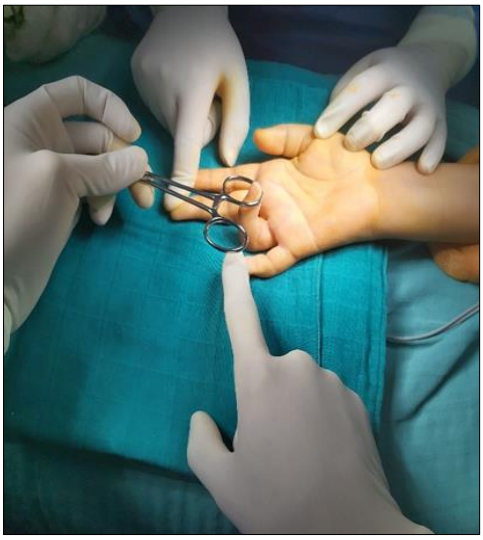

Figure 2

The girl underwent reconstructive surgery after 2 years. The initial lesion assessment revealed a collapse of the digital canal and incompetence of the pulley system. We reconstructed the digital canal and rebuilt the A2 and A4 pulleys using the ipsilateral flexor digitorum superficialis (Figure 3). A gastric tube rod was placed (Figure 4).

Figure 3

Figure 4

Passive mobilization to maintain mobility began immediately, under the protection of a splint for 6 weeks.

The second stage is performed after 12 weeks using the palmaris longus as a graft, with its free distal end fixed to the deep distal stump as well as to the periosteal soft tissue of the distal phalanx after adjusting the appropriate tension.

Postoperative rehabilitation is maintained.

With a follow-up of 3 years, the girl achieved full flexion and limited extension of 25° at the proximal interphalangeal joint (joint contracture). An additional procedure, such as arthrolysis, was proposed, but she declined, finding these results satisfactory (Figures 5 and 6).

Figure 5

Figure 6

Operative Technique

Initially, the flexor tendons are exposed through a Bruner zigzag incision extending into the palm [2]. Scar tissue and distal tendon remnants are excised. The proximal stumps of the FDS and FDP of the injured finger are retrieved, freed from adhesions, and sutured end-to-end using a modified Kessler technique at the lumbrical origin. The A-2 and A-4 pulleys are either preserved or reconstructed using a tendon graft from the excised tendons or the palmaris longus tendon. A silicone rod, with a diameter equivalent to that of the FDS, is inserted into the pulley system and sutured distally to the distal stump of the FDP. The proximal end of the implant is left free in the palm at the lumbrical origin, allowing uninhibited movement.

In cases of severe trauma, an arthrolysis of the distal interphalangeal joint is sometimes necessary to restore joint extension. The objective was to achieve complete passive flexion of the metacarpophalangeal and interphalangeal joints.

The objective of this second stage is to replace the silicone rod with the definitive graft, without re-intervening in zone 2. Depending on the case, a palmaris longus tendon is used if present, a plantaris tendon if not, or even a toe extensor if the first two are absent.

A first incision is made at the level of the distal interphalangeal joint (DIP), following the distal part of the Bruner incision used in the first step. Through this incision, the distal part of the tendon spacer, still attached to the distal stump of the flexor digitorum profundus, is accessed. A second incision is made at the level of the distal palmar crease, in the palm, allowing access to the proximal end of the spacer.

The tendon graft is then sutured to the proximal end of the tendon spacer with a non-absorbable suture, allowing the spacer to be used as a guide to introduce it into the fibrous sheath.

One end of the tendon graft was temporarily sutured to the distal end of the probe and pulled proximally through the pseudo-canal formed around the implant to exit distal to the A4 pulley. The distal end of the tendon graft was sutured to the distal stump of the flexor digitorum profundus tendon using the modified Kessler tendon suture technique [4].

The proximal end of the graft was sutured using the Pulvertaft technique [3]. At this stage, it is necessary to test the path of the graft in its new digital sheath by flexing and extending the wrist to ensure there is no blockage or jumping, and thus confirm the length of the graft. This is done by placing the wrist in a neutral position and restoring the natural cascade of the long fingers in semi-flexion. Generally, the posture of the grafted finger should be approximately the same as the adjacent ulnar finger, and for the fifth finger, a slightly greater flexion than that of the fifth finger of the opposite hand. A dorsal splint is applied to maintain the wrist in approximately 40° flexion and the finger in an intrinsic position. One week after surgery, patients begin a controlled mobilization program (passive flexion, active extension) [5]. Active ROM exercises are initiated at 3

weeks, and unprotected digital movement is allowed at 6 weeks.

DISCUSSION

Two-stage flexor tendon reconstruction is a surgical technique used to repair damaged tendons, often in cases of old ruptures or destruction of the digital canal.

Advantages of Two-Stage Flexor Tendon Reconstruction:

1. **Optimal Site Preparation:**

The first stage involves the insertion of a silicone rod, which prepares the graft site by creating an adequate gliding space. This promotes better integration of the tendon graft during the second stage.

2. **Reduction of Adhesions:**

The use of a silicone rod helps minimize the formation of scar adhesions, which is crucial for maintaining tendon mobility and function.

3. **Improvement of Tendon Function:**

By allowing for progressive and controlled preparation, this technique increases the chances of long-term functional success, with a more complete recovery of finger flexion.

4. **Flexibility in Graft Choice:**

The technique allows for the use of tendon grafts from various sources, such as wrist or foot tendons, providing more flexibility based on the specific needs of the patient.

Preservation and reconstruction of the pulleys are essential for a good functional outcome. It is crucial to preserve not only the A2 and A4 pulleys but also the flexor sheath as much as possible. The pulley system plays an important role in preventing bowstringing, improving effective tendon excursion, and reducing flexion contractures [6-8].

Wehbe *et al*., [7], demonstrated a clear association between the number of intact pulleys and the final degree of flexion contractures.

The initial rehabilitation after the first stage is relatively simple, focusing mainly on maintaining passive flexion mobility of the finger. Active flexion is impossible due to the absence of proximal fixation of the rod.

The immediate use of a dynamic extension device is permitted to help maintain or improve the passive extension capabilities of the affected finger. There is no formal justification for strict immobilization of the operated finger.

Rehabilitation after the second stage is carried out following the main principles of early mobilization of a repaired flexor tendon [10, 11]. The goal is to achieve excursion movement of the tendon graft without generating excessive tension on the anastomoses, while allowing the maintenance of joint flexibility.

CONCLUSION

Two-stage flexor tendon reconstruction is a surgical technique used to repair damaged flexor tendons, often due to old injuries or the destruction of the digital canal. This technique restores continuity between a still-functional motor muscle and its effector site, improving hand function after severe injuries.

To successfully perform a flexor tendon graft reconstruction, close collaboration between the surgeon, the rehabilitator, the physiotherapist, and the patient is essential. The patient plays a central role in a prolonged care protocol.

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