CASE REPORT

Tailoring Tendon Transfer Surgery and Rehabilitation for a Musician: A Case Study

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Received: 27 March 2015 *Accepted: 9 May 2015*

Abstract

Tendon transfers in hand patients are a commonly performed procedure after extensor tendon rupture. However, the standard side to side technique is not applicable in every patient. We present a case of a musician with unique demands to demonstrate the option to customize surgical technique and therapy regimen to the unique needs of each patient. An extensor indicis proprius to extensor digitorum communis transfer was performed in a 73 year old musician. A controlled active motion therapy protocol was followed. The patients musical practice regimen was incorporated into the therapy. The patient was able to independently extend her ring and small fingers in order to play her instrument and resumed play within one month postoperatively.

A patient's functional goals including avocations need to be considered when selecting the appropriate surgical and therapeutic approach.

Keywords: Musician, Rehabilitation, Tendon, Transfer

Introduction

The extensor digitorum communis (EDC) tendons share a common tendinous origin and extend the digits by way of the extensor mechanism. They are interconnected on the dorsal aspect of the hand via the junctura tendinae. The index and small fingers are unique in that they each most commonly have a separate extensor tendon that can be used to extend the finger independently. The extensor indicis proprius (EIP) in the index finger and the extensor digitorum quintus (EDQ) in the small finger lie ulnarly to the adjacent common extensor tendon and have a more distal musculotendinous junction.

Spontaneous rupture of the finger extensor muscles may occur in patients with rheumatoid arthritis. This occurs most commonly in the ring and small extensors of the ring and small fingers. As described by Vaughan Jackson, rupture of the extensor tendons in rheumatoid patients is typically caused by attrition over a prominent distal ulna. While the small finger extensor is most commonly involved, attritional ruptures typically progress to more radial digits sequentially (1). When a single tendon rupture occurs, adjacent uninvolved tendon tenodesis is a treatment choice. When multiple tendons are involved, EIP, flexor tendon rerouting or free interposition tendon grafts may have to be used to compensate for the lack of available intact adjacent tendons.

Case Report

A 73 year old female community college professor and amateur clarinetist, with a history of rheumatoid arthritis, presented in the hand surgeon's office with complaint of inability to extend the small finger of her left hand. Symptoms developed three months prior and she presented for second surgical opinion. Although the patient was right handed, she wished to have independent small finger extension to play the clarinet. She plays in a local community orchestra and wished to

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Figure 1. Range of motion at final follow up.

participate in an upcoming concert.

Clinically, she was found to have a significant extensor lag at the metacarpophalangeal (MP) level. Sagittal bands were intact with no evidence of extensor tendon subluxation at the MP joint. Tenodesis testing revealed no passive extension of the small finger with wrist flexion. Neurologic exam, with specific attention to the radial and posterior interosseous nerve, was intact. Her vascular exam was benign and her skin was intact. Inspection of her contralateral hand was normal.

Radiographs were negative for acute findings. Ultrasound scan obtained prior to presentation revealed small finger EDC and EDQ rupture. She elected to undergo surgical intervention to restore digital mobility. To allow of independent small finger extension the EIP was found to be the most optimal donor tendon.

Surgical Technique

Through a dorsal incision the EIP tendon was harvested at the index MP level, brought through the proximal incision and then tunneled subcutaneously distal to the ulnardorsal aspect of the hand. A Pulvertaft weave using 3-0 Ethibond suture to the EDQ and the EDC of the small finger was performed, with the wrist and small finger in maximal extension for adequate tensioning. A splint with wrist and fingers extended was placed on the patient.

Postoperative Therapy

The patient was referred to hand therapy ten days postoperatively and attended twice weekly for approximately six weeks. A custom fabricated thermoplastic forearm based orthosis maintaining the wrist and fingers in extension was worn at all times except hygiene and during her exercises 3-4 times daily. She was advised to avoid making a full fist, gripping, carrying objects or lifting with her left hand.

At the initial therapy visit, ten days postoperatively, the patient had active range of motion with 20 degrees of wrist flexion, 35 degrees of wrist extension, 5 degrees of radial deviation, and 10 degrees of ulnar deviation. Total active motion of her digits of her left hand was: 185, 195, 185 and 140 respectively (index through small fingers) [Table 1].

Between 10 days and 3 weeks postoperatively active range of motion exercises of the wrist and fingers were performed as described by Evans, exercises included wrist flexion/extension in a tenodesis pattern, wrist radial/ulnar deviation with hand supported on table, finger abduction/adduction, active finger PIP/DIP flexion with MP and wrist in extension and active MP flexion with PIP and DIP joints extended (2, 3).

Gentle protective passive range of motion in to her left hand and wrist was performed by the hand therapist along with retrograde massage to decrease edema. Ultrasound modality was added at three weeks for scar management in addition to massage.

As range of motion increased and edema resolved, the patient was instructed in composite finger extension exercises. To accomplish this motion, the patient was instructed to rest her left hand on the table and lift all fingers together off the supporting surface, holding this position for several seconds. Once she could easily maintain composite finger extension without discomfort, approximately three weeks postoperatively, active finger extension of the index and small fingers together was begun. This exercise was used to retrain the donor muscle to fire in its new position as a small finger extensor.

Active composite EDC glides were also given to her to perform. She was able to extend her MP joints fully in this manner; however, when attempting to fully extend her small finger in isolation she had an extensor lag of ten degrees. The patient was taught to imagine extending her index finger when extending her small finger independently [Figure 1].

Between four and six weeks after surgery her active

Table 1. Initial and final digital range of motion

Initial Measurement (degrees)				
AROM	Index	Long	Ring	Small
MP	0-60	0-65	0-55	0-30
PIP	0-110	0-115	0-90	0-90
DIP	0-15	0-15	0-40	0-20
Final Measurement 15 months postop (degrees)				
AROM	Index	Long	Ring	Small
MP	0-60	0-65	0-90	15-100
PIP	0-110	0-110	0-100	0-90
DIP	0-60	0-60	0-65	0-75

(AROM= Active Range of Motion, MP=Metacarpophalangeal, PIP= Proximal Interphalangeal, DIP=Distal Interphalangeal)

Table 2. Initial and final active range of motion

	TAM: Total Active Motion	
	Initial Measurement	Final Measurement 15 months postop
Index	185°	270°
Long	195°	240°
Ring	185°	265°
Small	140°	250°

exercises were reinforced with muscle reeducation using neuromuscular electrical stimulation (Russian current 10 seconds on and 20 seconds off for ten minutes) to the EDC/EDQ at one month postop (4). She was instructed to attempt to extend her small finger with the stimulus to more effectively extend the small finger in isolation. After a few sessions, the patient was able to actively isolate finger extension of her small finger without an extension lag.

Gentle resistive finger flexion exercises using a light foam block were added at five weeks postoperatively. Fingering exercises on her clarinet were also begun at this time. These involved moving the digits in the patterns that would be used when playing a particular piece of music without actually blowing into the instrument. She was instructed to start practicing in short ten to fifteen minute intervals daily and keep a log of her progress.

Between five and six weeks postop, she was able to extend her small finger in isolation and was practicing scales, as well as complex opera pieces. She stated that she was "very happy that I can play". As Schkade and Schultz have described, evaluating the patient holistically and considering the patient's environment, role and occupation facilitates the patient's adaptation and ownership of treatment goals and progress (5-7). At six weeks, the patient was discharged to a home exercise program per her own request since she had met her functional goal

The patient was seen for follow up at 15 months postoperatively and active range of motion was found to be 75 degrees of wrist flexion, 70 degrees of wrist extension, 10 degrees of radial deviation, and 25 degrees of ulnar deviation. Total active motion of her digits of her left hand were: 270, 240, 265, and 250, respectively (index through small fingers) [Figure 1].

Her grip strength was 45 lbs on the right compared to 40 lbs on the left. She reported no pain and her DASH score was 7. Patient had returned to playing her clarinet on a regular basis at home and with her community orchestra [Tables 2; 3].

Discussion

Many surgical options exist for repairing injured structures in the hand. Vocational goals and patient wishes should be thoroughly evaluated before selecting any surgical intervention. Furthermore, it is paramount to address the possible limitations with any surgical

Table 3. Initial and final wrist range of motion

	AROM (degrees)	
	Initial Measurement	Final Measurement 15 months postop
Wrist Flexion	20°	75°
Wrist Extension	35°	70°
Wrist Radial Deviation	5°	10°
Wrist Ulnar Deviation	10°	25°

outcomes. An excellent outcome in the eye of the surgeon or the therapist may be disappointing for the patient if goals do not match. Furthermore, patient age may not be reflective of physical demands and requirements of daily living all patients.

Traditionally, with an isolated small finger extensor rupture, a side by side transfer to an intact extensor digitorum of the ring finger would be the treatment of choice. However, since our patient's avocation required independent digital extension, the EIP tendon was used as the donor tendon in a tendon transfer. Although a side by side transfer would suffice for the majority of patients with this diagnosis, our patient needed to have independent extension of her small finger in order to play her clarinet. Without taking this into consideration when choosing the surgical technique, the patient may have had a functioning hand, but unlikely would have been satisfied with the end result. Ultimately, she may not have fulfilled her prior roles.

Likewise, tailoring the exercises to incorporate the instrument into her therapy was vital to keeping the patient participating in the rehabilitation. She had a keen interest in returning to play and was willing to perform her home exercise program as it related to her personal goals. Her drive to return to playing her musical instrument was used as motivation to comply and participate in therapy. Integrating opportunities for patient-centered purposeful and occupation-based activity, as well as traditional preparatory activities led the patient to a successful outcome. The goals of the surgeon and the therapist may not always meet with the patient's goals initially. Without thorough understanding and tailoring of the surgical and rehabilitative protocol high functioning patients with unusual demands may not achieve their own aspirations. Shared decision making and clear objectives are helpful in choosing the right path to recovery.

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