The use of Teno Fix tendon repair device in a patient with multiple flexor tendon ruptures

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Abstract Flexor tendon laceration repairs remain challenging despite numerous advances in hand surgery. Although progress on this vital subject matter has been achieved, there continues to be discussion over which surgical technique produces the optimal result. Currently there are several recommended surgical repair options for the lacerated flexor tendon. However, these repairs continue to have possible significant complications including adhesions, decreased range of motion, gapping, and post operative rupture. Stainless steel suture has long been known as an option for flexor tendon repair. Stainless steel suture demonstrates one of the highest tensile strength sutures. However until recently, stainless steel suture placement for flexor tendon repairs was technically problematic. This case study discusses an additional option for repairing lacerated flexor tendons using an advanced stainless steel tendon repair system.

Keywords Flexor tendon rupture · Teno Fix · Flexor tendon repair

Introduction

Case report

A 44-year-old right hand dominant male presented to the emergency department with injuries sustained to his left hand owing to a table saw laceration across his palm. His exam and operative findings noted the following: fractures of the index and small finger proximal phalanges, zone III flexor digitorum superficialis and profundus tendon lacerations to the index, zone III flexor pollicis longus tendon laceration, and zone III flexor tendon injuries to the small finger. Concurrent injuries also included digital nerve lacerations to the thumb, index, and small finger. There were vascular lacerations of the digital artery to the small and index fingers.

His past medical history is significant due to an ongoing neurological dysfunction from a prior traumatic injury. This prior injury relegated the patient with intermittent diffuse muscle spasms. His pre-injury medications included neurontin 600 mg four times a day, baclofen 20 mg three times a day, morphine 30 mg three times a day and celebrex 200 mg twice a day. Despite this regiment of medications, he describes ongoing symptoms of muscle spasm including his injured left extremity. His past surgical history includes a prior left middle finger amputation through the level of the middle phalanx.

Initial emergent operative management involved irrigation and debridement along with repairs of the tendon lacerations to the thumb, index and small fingers. Tendon repairs were carried out using a 4-strand core suture technique using 3–0 ethibond suture augmented with a 6–0 prolene epitendinous suture. The bony fractures were stabilized with 0.045 crossed Kirshner wires. Direct primary repairs to the lacerated digital nerves and arteries were also performed. Subsequent to repair of the skin lacerations, a protective short arm dorsal block plaster splint was applied.

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The patient was examined post operatively in a routine fashion. An early active range of motion exercise program was prescribed with continued use of a dorsal block. This was performed under the care and guidance of an experienced hand therapist. Unfortunately, while at rest in bed, the patient described an uncontrollable muscle spasm with acute complaints of pain and loss of active flexion ability and finger cascade to the index finger despite usage of his protective dorsal block splint. Re-exploration was performed. The intra-operative findings revealed ruptures of the previously repaired superficialis and profundus tendons to the left index finger. As there was little tendon retraction, the profundus tendon was re-repaired with a 4-strand core technique using 4–0 fiberwire and 3–0 ethibond. The repair was again augmented with a 6–0 prolene epitendinous repair. The flexor digitorum superficialis tendon tissue was of poor quality and not repaired in an attempt to minimize potential adhesions and scar formation.

A passive range of motion protocol was implemented post operatively but, again, felt a sharp contracture in his forearm on post operative day six with subsequent loss of active flexion in his left index. The patient stated that these spasms were unrelated to his hand therapy and usually were more uncontrollable at night during sleep. Even though he was compliant with his dorsal block splint, it was suspected that the nightly muscle spasms were causing the tendon rupture due to the patient's inability to counteract their force while sleeping.

With uncontrolled upper extremity muscle contractions continuing from his underlying neurologic condition, a repeat tendon repair seemed likely to have a similar dismal outcome. Alternatives to repeated tendon repair surgery were discussed. With the assumption that sufficient tendon length would permit, the patient opted for tendon repair. Again the index finger flexor digitorum profundus tendon rupture was addressed surgically, now three weeks after initial surgical repair. Intra-operative observations displayed insufficient length to allow proper tendon repair. Therefore, it was decided to place the Teno Fix system. The system is composed of two stainless steel anchors that are placed in an intratendinous, longitudinal position. There is a single monofilament suture that connected the two anchors and the two tendon ends were pulled until the correct tendon approximation and tension were achieved. An epitendinous monofilament suture was placed circumferentially. Final intra-operative findings displayed a tendon repair with good strength and appropriate passive range of motion of the digit.

A dorsal block splint was applied intra-operatively and maintained in the post-operative period. Hand therapy was re-initiated post operative day one with no re-rupture of the tendon. The patient had not reported the forceful muscle spasms that were previously encountered, and had been able to actively flex his digits. No additional surgery

has been necessary. The patient has been seen in follow-up for over two years and continues to have proper range of motion of the affected tendon.

Discussion and literature review

The primary goal of flexor tendon repair is to obtain a repair with enough strength to allow post operative therapy to initiate and healing to proceed. Optimal surgical results of flexor tendon repairs are influenced by numerous factors such as patient age, co-morbidities, severity of injury, surgical technique and patient compliance. Early initiation of therapy in a compliant patient stimulates quicker and stronger tendon healing [1]. Early initiation of hand therapy has been shown to decrease flexor tendon adhesions while allowing proper gliding patterns to develop [2, 3]. A 4-strand core repair augmented with an epitendinous repair has demonstrated enough strength to accomplish this goal [3]. However a stronger repair technique, which can also withstand early active finger motion, is available when faced with a flexor tendon laceration [4].

The Teno Fix technique allows the surgeon to place a strong stainless steel system in a quick and efficient manner. Although the Teno Fix has been shown not to confer a mechanical advantage over two commonly used suture techniques, the ease of its placement may supersede other techniques in flexor tendon repairs [5, 6]. In the past, one of the drawbacks of using stainless steel as a tendon restoration material was the bulk from the stainless steel repair. This bulk actually increased the tendon mass and subsequently resulted in adhesion formation or tendon rupture. The Teno Fix system has alleviated this by using a unique locking system which does not rely on hand thrown sutures [7]. This system also allows the surgeon the ability to control the final tension, decreasing gapping or bulk, and as a result lowering the risks of complications [8].

This case involves an injury to the hand of a patient with a history of intermittent forearm muscle spasms. Subsequently, due to the patient's previous upper extremity muscle spasms, repeated flexor tendon repair ruptures occurred until a Teno Fix repair was performed. The patient has not required any additional surgical interventions for the repaired tendon and is now actively flexing all digits. The Teno Fix flexor tendon repair system was employed in this difficult case with success. This case demonstrates the wide variability of the Teno Fix, even when multiple traditional modalities have failed.

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