Traumatic closed index extensor tendon rupture at the musclotendinous junction: a report of two cases

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Abstract This report describes two cases of traumatic closed index extensor tendon rupture at the musclotendinous junction. Both patients were injured when their work gloves were caught in the revolving parts of machines, and both were treated surgically. One of the patients completely ruptured the index extensor digitorum communis (EDC) and the extensor indicis proprius (EIP) tendons at the musclotendinous junction of dorsal forearm. In this patient, the distal stump of the index EDC tendon was sutured to the middle EDC tendon in an end-to-side juncture. The other patient completely ruptured the EIP tendon and partially ruptured the index EDC tendon at the musclotendinous junction. In this patient, tendon transfer of the extensor digiti minimi (EDM) to the EIP tendon and plication of the index EDC tendon were performed. In both cases, surgical intervention enabled the patients to extend their index fingers almost normally; however, the former complained of inability to extend his index finger independently. Tendon transfer of the EDM in cases of index extensor tendon rupture at the musclotendinous junction is a good method to restore ability to independently extend the index finger. However, consideration should be given to anatomical variation in the little finger. The EDC tendon is sometimes absent leaving the EDM tendon as the only extensor tendon to the little finger.

Keywords Extensor digitorum communis · Extensor indicis proprius · Rupture · Musclotendinous junction · Indirect injury

Introduction

The common causes of closed extensor tendon rupture are osteoarthritis, rheumatoid arthritis, and distal radius fracture [5, 7]. Traumatic closed extensor tendon rupture at the musclotendinous junction is rare [4–7]. However, it can occur due to hyperflexion force inflicted upon the finger due to injury such as when a work glove is caught in a machine or a gymnast's grip is entangled in the high bar [5, 7]. It is rarely possible to repair directly and is usually treated by splinting, side-to-side juncture, or tendon transfer [4–7]. This report describes two cases of traumatic closed index extensor tendon rupture at the musclotendinous junction that were treated with different methods.

Case Report

Case 1 A 67-year-old man injured his right thumb and index finger when his work glove became caught in machine with revolving parts. He experienced an open fracture of the metacarpal bone of his thumb and a fracture of the distal phalanx of the index finger. In addition, the patient complained of being unable to extend his index finger, and of pain and swelling in his dorsal forearm. Rupture of the index extensor tendons was suspected. Six days after the injury, surgery was performed. First, percutaneous pinning was performed for the metacarpal fracture of the thumb. Second, the extensor tendons of the index finger were exposed. Complete rupture of both the extensor indicis proprius (EIP) and the index extensor digitorum communis (EDC) tendons at the musclotendinous junction of the dorsal forearm were confirmed, and the distal stump of the index EDC was sutured to the middle EDC in an end-to-side juncture (Fig. 1). A postoperative splint holding the wrist at 20° of extension and the index to the small fingers in extension was applied for

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Fig. 1 The EIP tendon is indicated by the *white arrow* and the index EDC tendon by the *black arrow*. The index EDC and EIP tendon was completely ruptured at the musculotendinous junction

3 weeks. Six months after the operation, the active range of the index metacarpalphalangeal (MP) joint motion was improved, but there was a slight extension lag of the index MP joint ($\sim 5^\circ$). The patient complained of being unable to extend his index finger independently in typing keyboard and pushing a button.

Case 2 A 50-year-old man injured his right thumb and index finger when his work glove became caught in a machine with revolving parts. This caused a fracture of the distal phalanx of his thumb and loss of his index finger beyond the distal phalanx. The patient underwent distal interphalangeal joint amputation stump plasty of the index finger and received conservative treatment for his thumb fracture. A few days later, the patient was unable to extend his index finger and complained of pain and swelling in his dorsal wrist. Fourteen days after the injury, further surgery on the index finger was performed. Complete rupture of the EIP at the musculotendinous junction and loosening of the index EDC tendon were confirmed (Fig. 2). Muscle contractility of the index EDC remained, therefore the index EDC was diagnosed as partially ruptured. Tendon transfer of the extensor digiti minimi (EDM) to the EIP and plication of the index EDC were performed. Postoperative treatment followed the same course as in case 1. At 3-month follow-up, the patient showed complete independent extension of the index MP joint (Fig. 3). Moreover, no extension disturbance of the little finger was observed. The patient was satisfied and had no complaints.

Discussion

The musculotendinous junction is prone to strain injury in the tendon and muscle structures, with possibility of rupture

Fig. 2 The EIP tendon is indicated by the *white arrow* and the index EDC tendon by the *black arrow*. The EIP tendon was completely ruptured, and the index EDC tendon was incompletely ruptured at the musculotendinous junction

at the point [3]. Few studies have reported closed extensor tendon rupture of the index finger at the musculotendinous junction [5–7]. In many cases, sudden forceful wrist and finger flexion led to tendon ruptures, sometimes when gloves became caught in revolving machines. Usually, a stretching force applied to contracting muscle resulted in indirect tendon injury [6, 7]. For specific motion at work such as pitch and release between thumb and index finger and pushing with the index finger which are achieved with independent extension of the index finger, the index finger

Fig. 3 Postoperative photos illustrating range of motion of case 2. *Top*, all fingers fully extended. *Bottom*, independent extension of index finger

may be more prone to this type of injury to the extent that it is employed more often than other fingers. Takami [7] reported five cases of index finger tendon rupture among ten cases of closed extensor tendon rupture at the musculotendinous junction. Four cases were treated surgically, one case underwent tendon transfer of EDM and three others underwent side-to-side juncture to the middle EDC. One case was treated conservatively with a splint. Stuart [5] reported one case of complete rupture of the EIP and incomplete rupture of the index EDC. The patient underwent an end-to-side juncture, where the distal stump of the EIP was tenodesed to the intact communis slip. Sunagawa [6] reported one case of a complete rupture of the EIP and the index EDC tendons at the musculotendinous junction. The patient underwent an end-to-side juncture (the index EDC to the middle EDC) and an end-to-end suture of the EIP. All of these surgical methods provided good functional results and restored extension range of motion, though satisfactory postoperative outcome was not reported in every case. Here, EDM tendon transfer in case 2 enabled independent extension of the index finger, whereas side-to-side juncture to the middle EDC in case 1 did not. The choice of donor tendon would need to be individualized with respect to the patient's vocational and avocational activities. For active and manual worker patients, independent extension is an important factor for satisfactory postoperative outcome. Therefore, tendon transfer of EDM is the preferable method for treating an index extensor tendon rupture at the musculotendinous junction.

However, consideration should be given to anatomical variation in extensor tendons to the little finger. Anatomical variation has been reported in extensor tendons where the

EDM had several slips (from one to three) but was never absent, while the little EDC tendon was absent in 24–68.5% of patients [1, 2, 8]. If all of the EDM slips were transferred in cases where the little EDC tendon and juncture tendinum were absent, the patient would be unable to extend the little finger [2]. To avoid such accidents, possible extensor tendon variation should be evaluated with ultrasound echo or 3D-computed tomography imaging before tendon transfer, and the tendons to the little finger should be identified carefully in operation.

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