CASE REPORT

Redirection Using Double Pulley Technique for Snapping Triceps Tendon: A Case Report and Technique Note

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Background: Snapping triceps tendon is an increasingly recognized clinical entity, which is associated with a variety of pathologic factors. The causative factors include inherited structural or developmental variations, post-traumatic malalignment, and other reasons. The main complaint of patients with snapping lateral triceps are the snapping sensation, mild muscle weakness of elbow extension, with or without tenderness in distal triceps tendon. Many treatment options have been reported previously, including tendon resection and redirection.

Case presentation: We present the case of a 19-year-old boy with post-traumatic distal lateral head of triceps tendon dislocation who complained of extension weakness and snapping sensation in his left elbow. Then, we used two-strand-overhand locking (TSOL) knot combined with double pulley technique to redirect the snapping triceps tendon.

Conclusion: The patient recovered well after the operation without complaining of discomfort. This fixing and redirection tendon technique, described previously for repairing rotator cuff tears, may be applied in a similar fashion for the snapping triceps tendon with promising clinical results.

Key words: Dislocation; Double-pulley technique; Snapping triceps tendon; TSOL knot

Introduction

Snapping triceps tendon is a dynamic condition. When a patient bends their elbow, a portion of the distal triceps dislocates over the medial or lateral epicondyle. The causative factors include inherited structural or developmental variations, post-traumatic malalignment, and other reasons[1]. Snapping triceps are found more in men than in women at a mean age of 32 years[2]. Compared with snapping medial triceps, which can be associated with ulna nerve subluxation and ulna nerve symptoms, snapping lateral triceps are relatively rare. The main complaint of patients with snapping lateral triceps is the snapping sensation, mild muscle weakness of elbow extension, with or without tenderness in distal triceps tendon[3–5].

To attain a precise diagnosis and appropriate evaluation of the snapping triceps, physical examination and radiographic imaging is essential. Ultrasound examination (US) and magnetic resonance imaging (MRI) have been used. After failure of conservative treatment, surgery can be considered[4]. Surgical options include resection of the triceps edge, transposition of the tendon, transposing an associated ulnar nerve, and correction of cubitus varus.

Only few surgical techniques for the snapping lateral triceps have been described in literature. If patients have bony deformity such as cubits varus, and the T angle increases in a medial direction, then both the bony and soft tissue procedures should be considered to restore the normal

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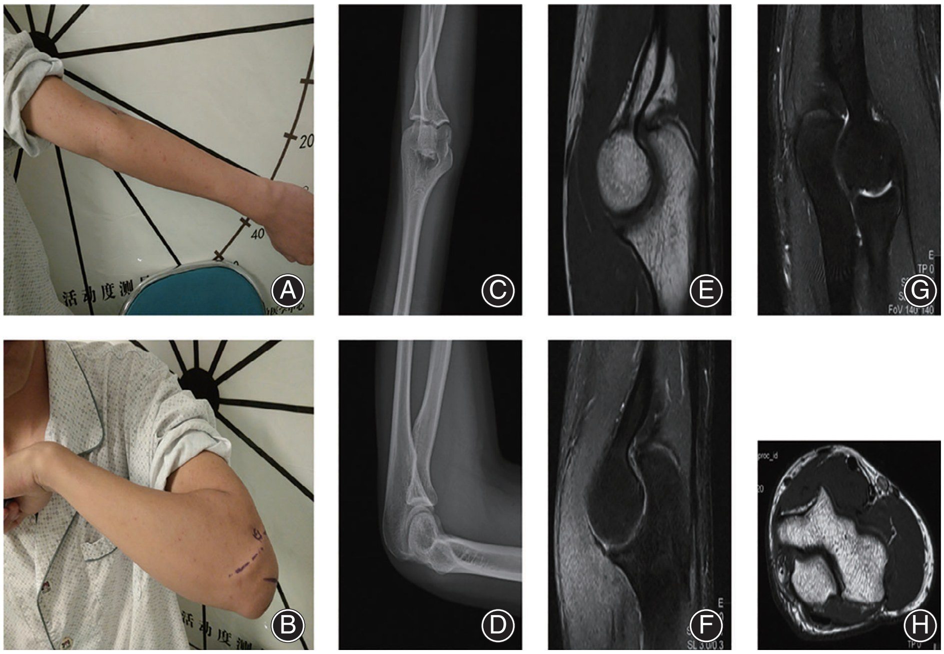

Fig. 1 Summary of patient's preoperative status. (A, B) The lateral snapping triceps tendon is visible and palpable at the lateral epicondyle at 70°elbow flexion. (C–H) images of left elbow showed distal triceps tendon dislocation.

triceps biomechanics[1]. The dislocated parts of the tendon should be resected or redirected to achieve the normal tracks. In this article, we introduce a novel method using two-strand-overhand locking (TSOL) knot combined with double pulley technique to redirect the snapping triceps tendon.

Case Presentation

Patient's Preoperative Status

A 19-year-old boy presented at our clinic department in July 2019, complaining of extension weakness and snapping sensation on his left elbow. Previous medical records showed he fell to the ground on his left elbow during sport activity 3 months before coming to the clinic. After the injury, he went to the emergency department with severe pain and swelling in his left elbow. Immobilization and ice compression were applied to reduce pain, X-ray examination demonstrated no fracture or joint dislocation sign, and the patient was asked to be followed up. Three months later he presented at our clinic with painless elbow with normal range of motion (ROM), complaining of extension weakness and snapping sensation. Physical examination revealed no deformity and tenderness around left elbow, ROM was 145°–0°–5°, left forearm ROM were full without crepitus. Both elbows were stable to varus and valgus stress. The lateral snapping triceps tendon is visible and palpable at the lateral epicondyle at 70° elbow flexion. Both elbows had carrying angles of 15° valgus. Neurologic examination was normal and provocative tests for radial tunnel syndrome and lateral epicondylitis were negative. MRI images of left elbow (Fig. 1) and anatomical diagram (Fig. 2) showed distal triceps tendon dislocation. The patient underwent surgery for triceps tendon redirection, to restore strength of extension.

Surgery of Tendon Redirection

The patient laid laterally on his right side with his arm in a flexed position. His left upper extremity was draped free so that his elbow could be manipulated comfortably. A localized posterior longitudinal incision was made and the triceps tendon was exposed. After isolating the dislocated part of triceps in the myofascial tissues, the snapping process could be reproduced when left elbow was flexed and extended passively (Fig. 3). The dislocated part of the tricep was isolated and pulled back to identify the anatomic position of tendon insertion. A 1.5 cm incision was made to expose the bone bed, and abrasion drill was applied to prepare a 1.5×2 cm^2 rebuild tendon insertion on olecranon. To refresh bone bed of tendon insertion, several 1 mm diameter holes were made by bone drill. Then the dislocated lateral head of triceps was pulled back to normal position with straight forceps, maintaining the elbow to 90° flexion to hold the appropriate tension. A sterile marker pen was used to mark the position of fixing area on triceps tendon (Fig. 4). Two 3.5 mm suture anchors were placed in the bottom line of rebuild insertion, parallel to shaft of ulna. Another two anchors were placed in the other side, pointed to the tip of olecranon (Fig. 5). To make sure maximum tendon contact area and rigid fixation, two-strand-overhand locking (TSOL) knots were used in our double-pulley horizontal suture configuration (Fig. 6). Finally, reduced tendon was wrapped around by split triceps tendon, and the sutures were made with the elbow flexed at 90°. Before the incision was closed, proper tendon fixation

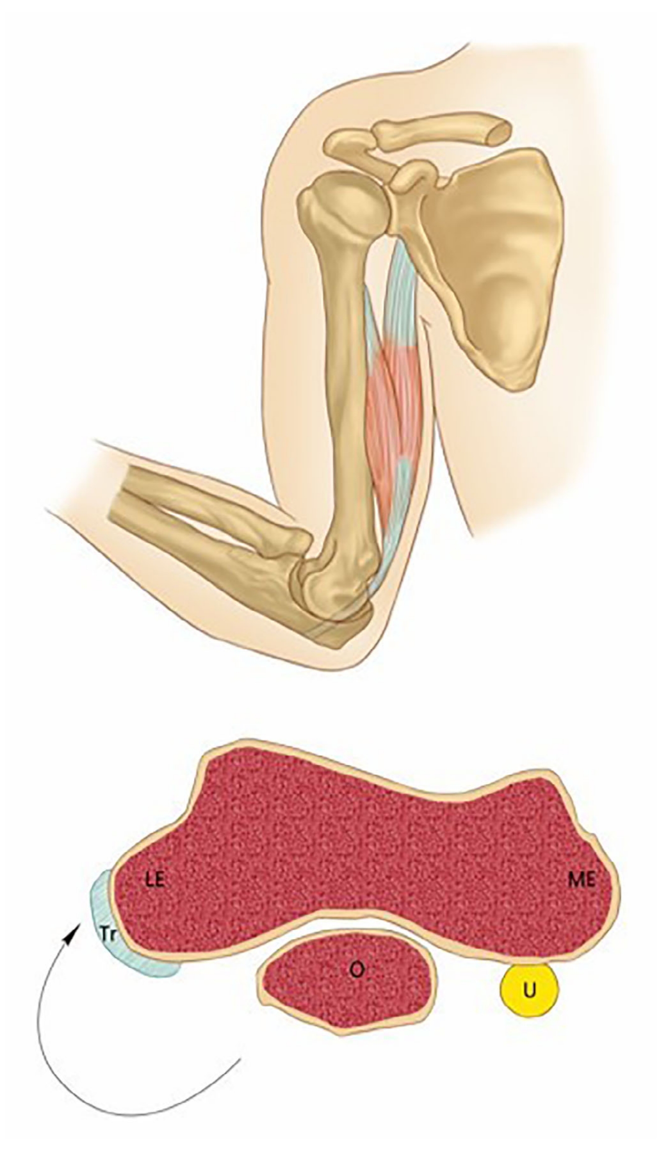

Fig. 2 Anatomical diagram: Patient's preoperative anatomy. The lateral snapping triceps tendon is visible and palpable at the lateral epicondyle at 70°elbow flexion. LE, lateral epicondyle of humerus; ME, medial epicondyle of humerus; O, olecranon; Tr, triceps tendon; U, ulnar nerve.

and muscle tension was confirmed by full range of elbow flexion and extension (Fig. 7).

Patient's Postoperative Status

The patient was immobilized by a sling immediately postoperation, and began full range of flexion and extension exercises passively at 1 week postoperative. Active elbow motion was allowed in the range of 0° to 90° after that. Resistance exercise was started gradually at 2 weeks postoperative. Three weeks later after the operation, the patient was back to our clinic for follow-up X-ray exam. It showed four anchors had stayed in good positions (Fig 8). Physical examination showed no reproduced dislocation of lateral head of triceps. The patient did not complain of obvious discomfort, and was asked to repeat the elbow exercise in the first 3 weeks .

Discussion

Snapping triceps tendon is an increasingly recognized clinical entity, which is usually presented as a portion of the distal triceps tendon. During elbow flexion, the snapping part of the tendon may dislocate either medially (typically with the ulnar nerve) or laterally[1, 3, 4, 6]. Ulnar neuropathy frequently accompanies medial triceps snapping, and patients with lateral triceps snapping may be asymptomatic or may have snapping sensation and localized elbow pain. In most cases, anatomic variations were frequently noted, including supernumerary head, prominent or hypertrophied medial triceps, cubitus varus, hypoplastic medial or lateral epicondyle, and so on[5]. If apparent bony angular malalignment exists, osteotomy procedures were considered. Spinner introduced T angle to describe the alignment of the triceps and its biomechanics. In clinical practice, excision or redirection of the involved portion of the triceps can be performed in the patient without bony deformity.

Several surgical techniques have been described for treating snapping triceps tendon, but few lectures focus on the fixing tendon techniques. In conditional fix method, tendon was sutured to the bone surface by means of square knot, which is point-to-point contact. Furthermore, the strength of conditional suture is largely affected by bone mass[7]. Suture anchors with a double-pulley horizontal suture configuration are widely accepted in arthroscopy surgery. It securely fixes the tendon between the two suture anchors, thus providing a large footprint of healing on the rebuild insertion. Moreover, the horizontal configuration of the double-pulley technique minimizes the amount of suture material in direct contact with bone surface and the risk of knot migration[7]. The two-strand-overhand locking (TSOL, two-strand-overhand locking) knot was first reported by Zhao in 2013 on JBJS (The Journal of Bone & Joint Surgery) where he demonstrated that TSOL knot provided superior holding strength and stiffness compared with square knots regardless of suture material[8]. The TSOL knot is beneficial to reduce the rate of tendon rupture and gap formation, and it is suitable for suturing soft tissue under tension.

In this case, TSOL knot combined with double pulley technique was used to create a larger contact area between tendon and rebuild tendon insertion (Fig. 9). The placement of suture anchors should avoid going through the articular surface, and their direction should be pointed to the tip of olecranon (two anchors) and be parallelled to the shaft of ulna with two anchors. The angle between anchors and bone surface is decided according to the suture tension, keeping an acute angle to minimize the risk of anchor pull out. After redirecting and fixing of triceps tendon, the tendon was wrapped around by split muscle to ensure optimum healing and contraction track.

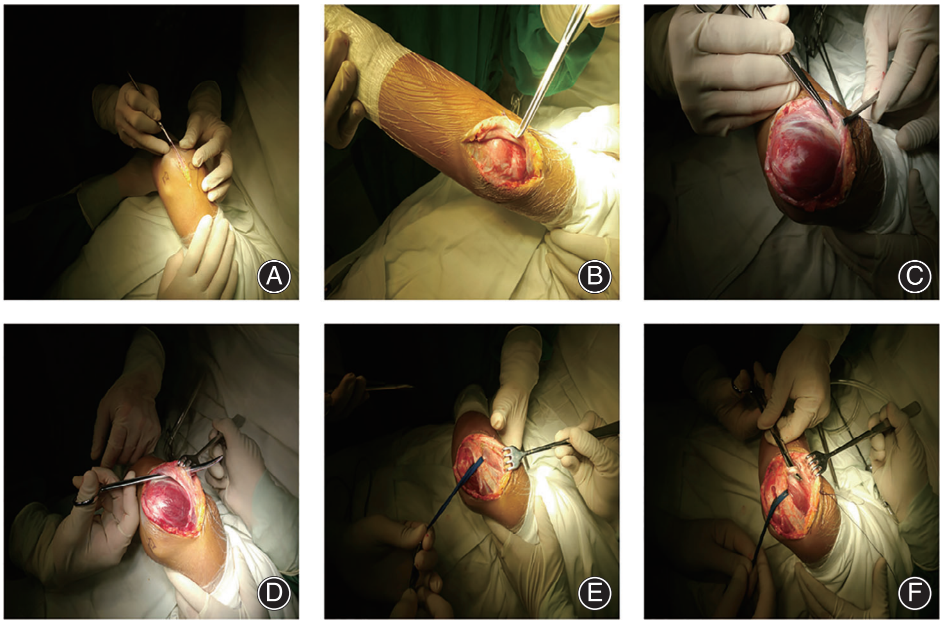

Fig. 3 Overview of dissection of snapping part of triceps tendon. (A) A localized posterior longitudinal incision. (B, C) Expose the triceps tendon. (D–F) isolate the dislocated part of triceps in the myofascial tissues.

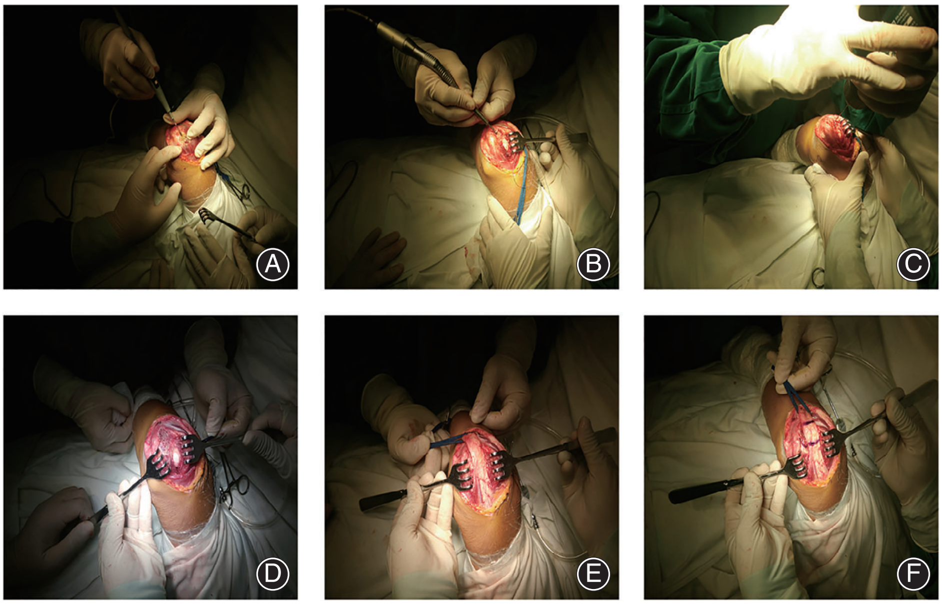

Fig. 4 Overview of preparation of tendon insertion. (A) Expose the bone bed. (B) Prepare a 1.5 × 2 cm 2 rebuild tendon insertion. (C) Several 1 mm diameter holes were made by bone drill. (D–F) Mark the position of fixing area on triceps tendon.

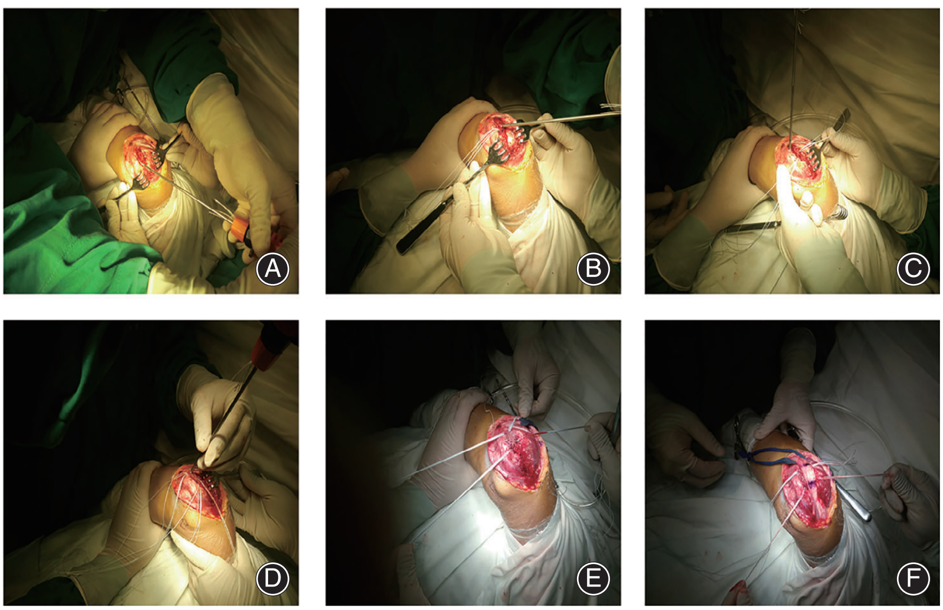

Fig. 5 Overview of suture anchors placement. Two 3.5 mm suture anchors were placed in the bottom line of rebuild insertion, be parallel to shaft of ulna. Another two anchors were placed in the other side, pointed to the tip of olecranon.

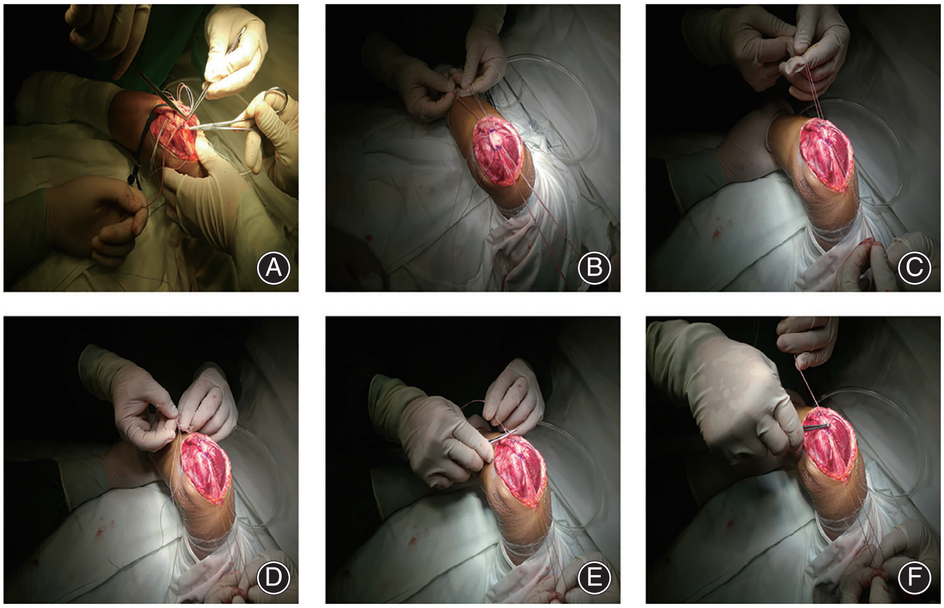

Fig. 6 Overview of using TSOL knot technique. Two-strand-overhand locking (TSOL) knot were used in double-pulley horizontal suture configuration to make sure maximum tendon contact area and rigid fixation.

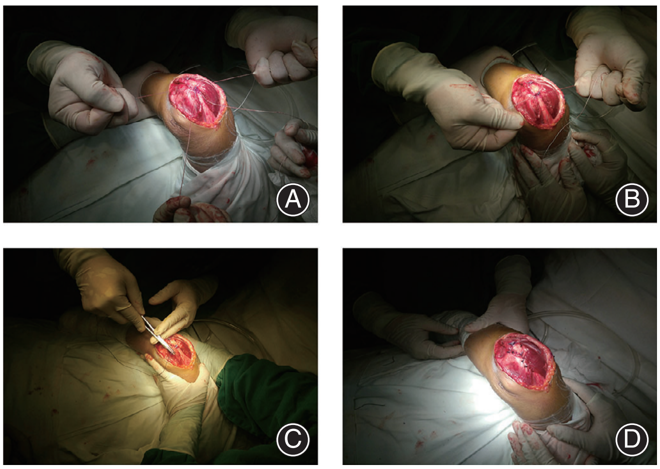

Fig. 7 Overview of completion of tendon redirection. (A, B) Reduced tendon was wrapped around by split triceps tendon. (C, D) The sutures were made with the elbow flexed at 90.

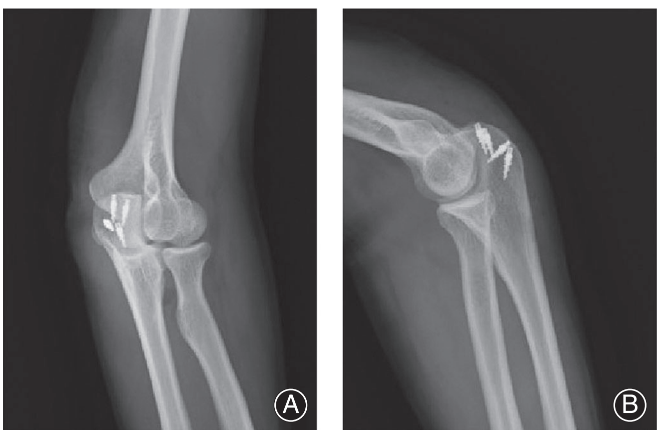

Fig. 8 Summary of patient's postoperative status. (A, B) X-ray shows four anchors were placed in the olecranon.

The technique described here is easy to carry out in the procedure of tendon redirection. Because of rigid fixation and larger heal area, the patient was encouraged to early rehabilitation. The patient achieved active extension of the elbow without obvious pain 3 weeks after the operation.

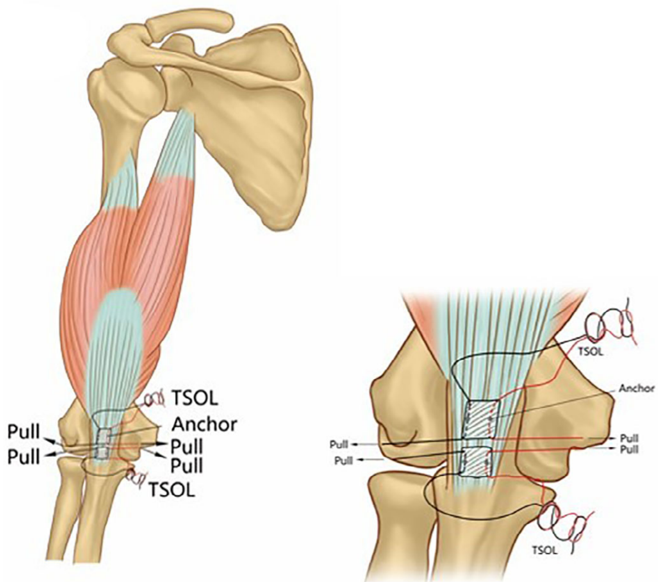

Fig. 9 Anatomical diagram: Using TSOL knot technique. Two 3.5 mm suture anchors were placed in the bottom line of rebuild insertion, be parallel to shaft of ulna. Another two anchors were placed in the other side, pointed to the tip of olecranon. To make sure maximum tendon contact area and rigid fixation, two-strand-overhand locking (TSOL) knot were used in double-pulley horizontal suture configuration. TSOL:Two-strand-overhand locking.

Although it is a rare injury with less prospective studies, the technique described above seems to be a good option for cases of lateral distal triceps tendon dislocation.

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