

All-arthroscopic Reconstruction of Chronic Foveal Triangular Fibrocartilage Complex Tears with a Tendon Graft

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Abstract

Chronic foveal triangular fibrocartilage complex (TFCC) tear can lead instability of the distal radioulnar joint. In cases of irreparable TFCC tears, reconstruction of the TFCC using tendon graft is advised. Numerous techniques are proposed for the reconstruction with satisfactory outcome. As the use of wrist arthroscopy becoming more popular, we propose an arthroscopic technique for the reconstruction of chronic foveal TFCC tears. The preliminary result is comparable to the open methods.

Keywords: Triangular fibrocartilage complex, Distal radioulnar joint instability, Tendon graft, Reconstruction, Wrist arthroscopy.

Introduction

As the bony architecture of the distal ulnar and the sigmoid notch of the distal radius provides a marginal structural congruity for the distal radioulnar joint (DRUJ), the DRUJ depends mainly on its surrounding soft tissue, especially the triangular fibrocartilage complex (TFCC) [1] for stability.

TFCC is made up of the palmar and dorsal radioulnar ligaments, of which each ligament subdivides into superficial and deep components, with reference to the ulnar attachment. While the role of each component has been discussed in response to forearm rotation [2-4] study has shown that gross instability of the DRUJ is a result of the disruption of both ligaments [5]. Thus, in cases of symptomatic chronic DRUJ instability, of which the TFCC is irreparable, reconstruction of both limbs of TFCC, is regarded as the preferential treatment [6].

Review of Literature on TFCC Reconstruction

TFCC reconstruction is traditionally performed in an open manner. However, as the use of wrist arthroscopy has gained popularity, arthroscopic assisted techniques have also been advocated. Adam and Berger described the anatomic reconstruction of both palmar and dorsal radioulnar ligaments using palmaris longus (PL) tendon graft in an open manner [6,7]. Satisfactory results were noted with 12 out of 14 patients had relief in both pain and instability symptoms at 1-4 years. The range of wrist movement and grip strength also improved. Meanwhile Tse et al. [8] described similar reconstruction under arthroscopic guidance [8]. The proposed advantages are smaller incisions with less soft tissue dissection and accelerated rehabilitation. Comparable outcomes were noted with statistically improvement in both pain and mayo wrist score in 14 patients at an average of follow-up of 7 years. The wrist range of movement

and grip strength also showed an improvement trend though not statistically significant.

As both these techniques involved the creation of both radial and ulnar bone tunnels, they are technically demanding. Bain and Nakamura proposed simpler methods of TFCC reconstruction by making use the remnant of native TFCC for cases of which only foveal tear was found [9,10]. Both techniques involved passing the tendon graft through the remnant of TFCC before inserting into the fovea. As a result, the creation of radial tunnel is spared. Both advocated to reconstruct the TFCC in an open manner, of which Bain used the PL tendon as free graft, while Nakamura made use of a distally based ½ slip extensor carpi ulnaris (ECU). Bain reported that an improvement of his 9 patients with reference to the pain score. All had stable DRUJ. Meanwhile, Nakamura reported that 21 out of his 24 patients had no pain and good range of wrist movement. All patients had a stable DRUJ at an average follow-up of 3 years. We likewise prefer the use of TFCC remnant in the cases of which only fovea tear is found, causing DRUJ instability. While our technique is similar to Bain's, we advocate the use of wrist arthroscopy to attain the TFCC reconstruction.

Our Preferred Technique

Indication

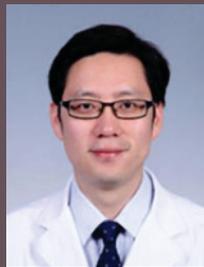
This technique is reserved for patients with significant DRUJ instability due to a chronic foveal TFCC tear (i.e., >6 months after the

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Fig 1. The guide wire is drilled from the metaphysis of distal ulnar bone toward the fovea.



Figure 2: Two ends of the graft are pulled via the bone tunnels down to the incision at the distal ulna.

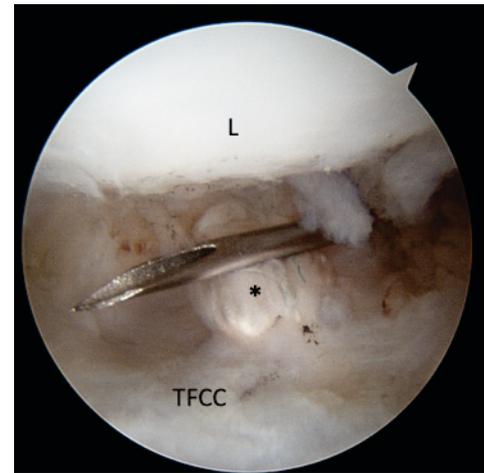


Figure 3: Tensioning of the graft will pull a segment of the TFCC down onto the foveal footprint. L, lunate; *, the tendon graft through the shaver

initial injury). Clinically patients should have a positive DRUJ ballottement test, and then, confirmed on MRI. The foveal tear of the TFCC is then confirmed on arthroscopy with an abnormal trampoline test and hook test, and the tear is regarded as irreparable on wrist arthroscopy and the radial attachment at the sigmoid notch must be intact.

In cases of which positive ulnar variance was found, a concomitant ulnar shortening is advised to restore an ulnar neutral variance.

Contraindication

This technique is contraindicated in patients with destruction of combined radial and ulnar attachment of TFCC, or with DRUJ arthritis.

Surgical technique

The patient is anesthetized, a tourniquet applied and the hand is suspended from finger traps and a traction tower.

A standard wrist arthroscopy is performed through 3/4 and 4/5 portals. The TFCC is visualized and probed to obtain a detailed understanding of the tear configuration and its reparability.

The “trampoline test” is usually positive, with loss of the normal tension. The hook test is also positive with signify the avulsion of the foveal attachment.

The stability between the TFCC and the sigmoid notch is needed to be assessed by probing because if there is a significant radial-sided tear or instability between the

TFCC and the radius, our technique is contraindicated.

In cases of ulnar positive variance and TFCC foveal tear, ulnar shortening should be done before the reconstruction.

Distal ulnar preparation

A 2 cm longitudinal incision is made at the border of the distal ulna. Dissection is made to bone with the protection of the dorsal branch of ulnar nerve. Under fluoroscopic and arthroscopic guidance, one guide wire is drilled from the metaphysis of distal ulnar bone toward the volar edge of the fovea and pierces the volar edge of the ulnar part of the TFCC (Fig. 1).

Similarly, another guide wire is drilled toward the dorsal edge of the fovea and pierces the dorsal edge of the ulnar part of the TFCC. A cannulated 2.9 drill is then used over the two guide wires, respectively, to create two bone tunnels for the graft.

Placement of the graft

PL tendon graft is harvested from the volar wrist. In patients without PL, plantaris tendon can be used instead. Grasping sutures are placed in each end of the graft. A grasper is introduced into the fovea through the ulnar volar bone tunnel. It then pierces the volar edge of the TFCC under arthroscopic guidance. One end of the tendon graft is passed into the wrist joint through the 4/5 portal. The grasper catches the suture end and brings the suture and one end of the graft down through the bone

tunnel. The process is then repeated with the grasper introduced through the dorsal tunnel and pierces the dorsal edge of the TFCC under arthroscopic guidance. It catches the other suture end of the graft within the wrist joint and brings another end of the graft down again through the dorsal bone tunnel (Fig. 2).

Tensioning of the graft

Once the sutures and graft are advanced, the graft will pull a segment of the TFCC down onto the foveal footprint (Fig. 3). With the forearm in neutral rotation, the graft is then stabilized and tensioned through an Interference fit screw into the ulnar proximal to the two drill holes.

Rehabilitation

An above elbow thermoplastic splint with forearm in neutral rotation is applied postoperatively for 6 weeks. At 4th week, semi-supination and semi-pronation exercise, both active and gentle passive, is advised out of the splint under therapist supervision 3 times a day. At 7th week, no immobilization is required. Supervised active and gentle passive out of splint exercise can be given by hand therapists, aiming to full range rotation. Strengthening exercise is started at 9th week. Heavy lifting should be avoided for 3 months in total.

Tips and tricks

Care must be taken to protect the dorsal cutaneous branch of the ulnar nerve during



Figure 4: Full pronation and supination was achieved in a 36 years old patient underwent the all-arthroscopic reconstruction of chronic foveal TFCC tears.

the dissection of the distal ulna. Ulnar styloid fracture can be resulted if the entry point of the bone tunnel is very distal, creating a small bone bridge. We advise to have a bone bridge of at least 1.5-2cm from the ulnar styloid to the drill hole.

Results

Four patients with an average age of 27 (range, 24-36) with chronic foveal TFCC tear underwent arthroscopic TFCC reconstruction. The average time between injury and surgery was 17.5 months (range, 12-27 months). The average follow-up was 14 months (range, 12-16 months). Pain was totally absent in 2 patients and 2 patients had mild pain on exertion

postoperatively. Visual analog scale pain score improved from 3.75 (range, 1-6) to 0.5 (range, 0-1). DRUJ was stable in all 4 patients on ballotment test.

Postoperatively, the average pronation was 85° (range, 80-90°) and supination was 88° (range, 85-90°) (Fig. 4). The patient-rated wrist evaluation score improved from 26 (range, 18-34.5) preoperatively to 10 (range, 5-13) postoperatively.

All patients were satisfied with the surgery. No complication was noted.

<H1>Discussion

Chronic foveal TFCC tear may lead to DRUJ instability of which patients will present with wrist pain, a decrease in grip strength, a sense of instability on exertion. In patients who have irreparable TFCC, anatomical reconstruction with tendon graft is advocated [6,11]. This can be either free graft, for example, PL [7-9] or distally based ½ slip of ECU tendon [10]. While TFCC reconstruction is traditionally performed in the open manner, as wrist arthroscopy gaining more popularity in recent decades, wrist arthroscopic assisted techniques are being advocated. The use of wrist arthroscopy enables us to perform TFCC reconstruction with minimal soft tissue dissection over the dorsal and volar wrist. This has the theoretical advantages of

having less scarring as well as less adhesion of the wrist joint when compared with an open surgery. In turn early recovery and better range of movement can be achieved. Our early results of arthroscopic TFCC foveal reconstruction were promising with minimal morbidity noted. The drawback of this technique is that it can be technically demanding. Steep learning curve may be noted. Thus, it is advised to be adopted only by hand surgeons who are familiar with the use of wrist arthroscopy.

What to Learn

Reconstruction of the TFCC using tendon graft is advised in cases of irreparable TFCC tears. Previous reported open or arthroscopic procedures involve the dissection of the volar or dorsal aspect of the wrist joint, which may lead to scarring and joint stiffness. The proposed all-arthroscopic reconstruction of chronic foveal TFCC reconstruction has the advantages of smaller incisions, less soft tissue dissection and accelerated rehabilitation. Early results of this technique were promising with minimal morbidity noted.

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