—Short Communication—

Quick Arthroscopic Repair of Ulnar-Sided Triangular Fibrocartilage Complex Tears: Technical Note

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Triangular fibrocartilage complex (TFCC) tears can cause ulnar-sided wrist pain. Arthroscopy is important in treatment and diagnosis, and arthroscopic repair of TFCC tears is indicated after failure of nonsurgical treatments such as cast immobilization, splinting, and administration of nonsteroidal anti-inflammatory drugs for more than 3 months. Several arthroscopic procedures have been described, including inside-out, outside-in, and all-arthroscopic techniques. However, these arthroscopic procedures are time-consuming and technically demanding. This article presents a straightforward technique of arthroscopic inside-out repair that uses double-loop sutures for ulnar-sided TFCC tears.

(J Nippon Med Sch 2020; 87: 104–108)

Key words: triangular fibrocartilage complex, ulnar-sided tear, TFCC 1B tear, arthroscopic repair technique, inside-out suture, technical note

Introduction

The triangular fibrocartilage complex (TFCC) is the main structure for stabilizing the wrist at the distal radioulnar joint (DRUJ). Traumatic TFCC tears can lead to DRUJ instability and are a main cause of ulnar-sided wrist pain[1]. TFCC tears typically cause pain during activities involving forearm rotation, gripping, and axial loads on the wrist, and traumatic TFCC tears are commonly associated with distal radius fracture[2]. Furthermore, the risk of TFCC tear is relatively high in athletes performing repeated pronation/supination, radial/ulnar deviation, and axial loading of the forearm and wrist.

TFCC tears are diagnosed by using magnetic resonance imaging[3], arthrography, computed tomography, and arthroscopy[3]. Recently, arthroscopy plays an important role in therapy. Both open and arthroscopic repair of TFCC tears have resulted in good improvement in pain, grip strength, and function[4]. Several arthroscopic procedures have been described for the repair of TFCC tears, including inside-out[5], outside-in[4], and all-arthroscopic techniques[6]. However, these procedures are time-consuming, complicated, technically demanding, and require specific instruments. This article presents a straightforward technique for arthroscopic inside-out repair that uses pull-out mattress sutures for ulnar-sided TFCC tears.

Indications

The present technique is indicated for traumatic injuries that continue to cause ulnar wrist pain localized to the fovea, pain during wrist rotation, and occasional "painful clicking", despite nonsurgical treatment for at least 3 months. The surgical indications for this arthroscopic inside-out technique include acute and chronic DRUJ instability due to ulnar-sided TFCC tear (Palmer classification 1B) or TFCC 1B tear associated with other tears[7]. Traumatic TFCC tears are categorized as class 1B when there is ulnar avulsion with or without distal ulnar fracture, which may involve the proximal or distal lamina (either the foveal or styloid attachment, or both)[7].

The present technique is also indicated for patients with distal radius fractures with acute TFCC tears diagnosed by arthroscopy and for those with ulnar-side pain and a positive fovea sign. Provocative testing includes the ulnar head ballottement test and ulnocarpal stress test[8]. All patients with suspected TFCC tears undergo radiographic evaluation, including neutral rotation pos-

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https://doi.org/10.1272/jnms.JNMS.2020_87-209
Journal Website (https://www.nms.ac.jp/sh/jnms/)

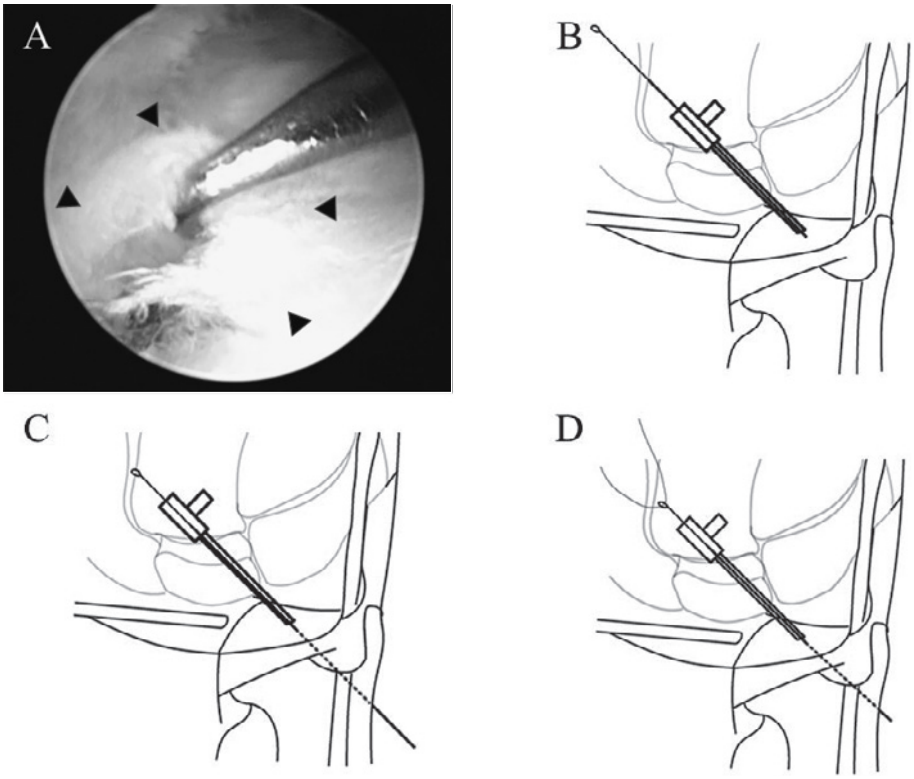

Fig. 1 Quick arthroscopic repair technique (1).
(A) Arthroscopic view of a right wrist with a Palmer class 1B tear combined with a 1D tear (arrowheads).
(B) A passing wire is passed to the ulnocarpal joint through the 4-5 portal and pierces the articular disc proper of the triangular fibrocartilage complex via the ulnar side of the wrist joint.
(C) The wire is drilled through the fovea of the ulna to the ulnar edge of the ulnar head. The 2-0 Fiberwire is threaded through the eye of a passing guide and advanced into the joint.
(D) The Fiberwire is cut and separated into two strings with surgical forceps.

teroanterior and lateral radiographs. Magnetic resonance imaging is also performed to identify TFCC tears and ulnar head subluxation.

The present technique is contraindicated in TFCC 2B tears induced by ulnar variance, ulnar abutment syndrome, and irreparable TFCC 1B tears (including those with TFCC defects or a completely worn disc proper).

Surgical Technique

The patient is placed in supine position. After induction of general or regional anesthesia, a pneumonic tourniquet is applied. To provide countertraction, the arm is anchored to a hand table with a strap. A finger-trap vertical traction tower (Linvatec, Largo, FL, USA) is applied and set to approximately 15 pounds.

A 30° 2.3- or 1.9-mm arthroscope and a 2.0- or 2.9-mm shaver are used to debride the edge of the tear, which is then repaired with a suture passing guide pin (AR-8914 K; Arthrex, Naples, FL, USA) or a passing pin (003B-001-16150; MEIRA Corp., Nagoya, Aichi Pref, Japan). A 2-0 polyethylene-based braided suture material (Fiberwire; Arthrex, Naples, FL, USA) is used to suture the TFCC through the eye of the passing guide. Diagnostic arthroscopy is performed by using a 1.9- or 2.3-mm 30° arthroscope through a 3-4 portal (between the extensor pollicis longus tendon and extensor digitorum communis tendon) and a 4-5 portal (between the extensor digitorum communis tendon and extensor digitorum minimi tendon). The 6U portal (just ulnar to the extensor carpi ulnaris tendon) is used as an outflow portal. After routine inspection of the radiocarpal joint, a shaver is used to remove the synovium and scar tissue around the TFCC before the condition of the TFCC is inspected. TFCC tears are identified and classified (**Fig. 1A**)[7]. The trampoline effect and hook test of the TFCC disc proper is performed with a probe[9]. If an ulnar-sided TFCC 1B tear or a 1B tear associated with another tear is recognized, a 1-2-cm

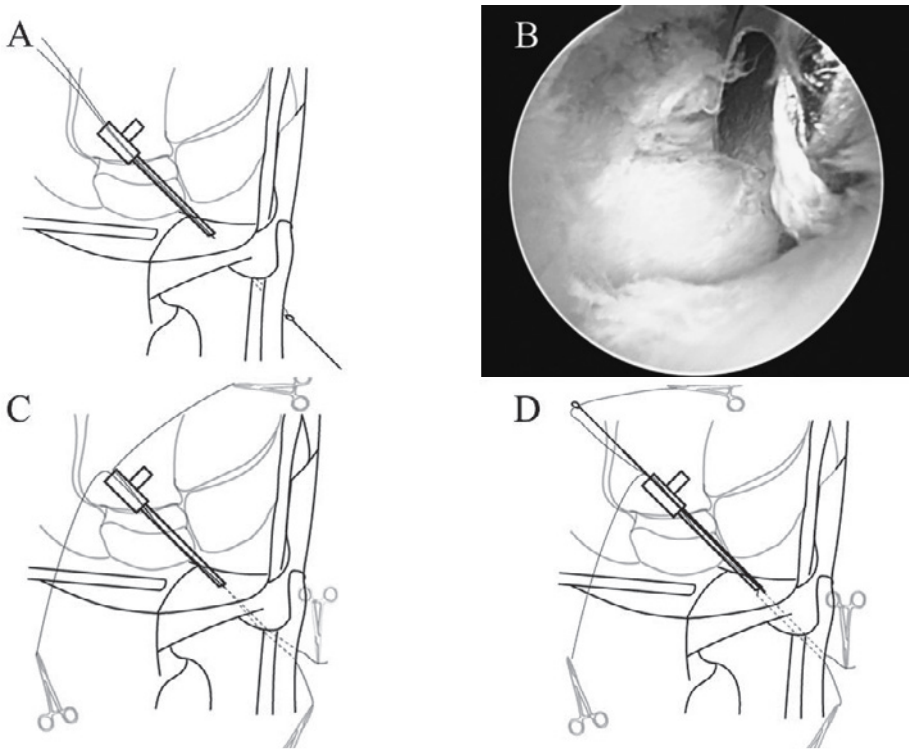

Fig. 2 Quick arthroscopic repair technique (2).
(A) The Fiberwire is cut and separated into two strings with surgical forceps.
(B) The cannula is in the 4-5 portal with the first suture, which has pierced through the triangular fibrocartilage complex (TFCC) disc proper to the distal ulna.
(C) The cannula is moved to the volar or dorsal side, and the passing wire is loaded into the cannula in the 4-5 portal and drilled through the TFCC disc proper and the fovea of the ulna to the ulnar edge of the ulnar head.
(D) A Fiberwire is threaded through the eye of a passing guide and advanced into the joint.

longitudinal incision is made on the ulnar side of the wrist just volar to the extensor carpi ulnaris. Blunt dissection is performed to expose the ulnar surface while protecting the dorsal ulnar sensory nerve.

Initially, the subluxated ulna is reduced to the DRUJ and temporarily fixed with 1.5- or 2.0-mm Kirschner wire. With the arthroscope in the 3-4 portal, another cannula or a drill guide with a blunt rod is inserted into the 4-5 portal as a working portal. A passing wire is passed to the ulnocarpal joint through the 4-5 portal, to pierce the articular disc proper of the TFCC via the ulnar side of the wrist (**Fig. 1B**). The wire is then drilled through the fovea of the ulna to the ulnar edge of the ulnar head. The 2-0 Fiberwire is threaded through the eye of the passing wire and advanced into the joint (**Fig. 1C**). The passing wire and the 2-0 Fiberwires are pulled out with pliers to the ulnar edge of the ulna (**Fig. 1D**). Subsequently, the Fiberwire is cut and separated into two strings with surgical forceps (**Fig. 2A, 2B**).

The cannula is moved to the volar or dorsal side, and the passing wire is loaded into the cannula in the 4-5 portal and drilled through the TFCC disc proper and the fovea of the ulna to the ulnar edge of the ulnar head (**Fig. 2C**). A Fiberwire is again threaded through the eye of a passing guide and advanced into the joint (**Fig. 2D**), and the passing wire and 2-0 Fiberwires are pulled out with pliers to the ulnar edge of the ulna before the Fiberwire is separated with surgical forceps (**Fig. 3A, 3B**). Another Fiberwire is loaded and the previous steps are repeated for the second pull-out suture. The ends of the two Fiberwires are sequentially rerouted so that the knot lies directly on the ulna, with no interposed subcutaneous tissue, including potential nerve branches and the extensor carpi ulnaris. The two separated Fiberwires are tied rigidly to stabilize the ulna to the DRUJ (**Fig. 3C, 3D**). The previous steps are repeated for the second pull-out suture on the dorsal side.

After the double-loop sutures are tied rigidly, the temporary Kirschner wire is removed. If the proper extensor retinaculum of the extensor carpi ulnaris was dissected, the dissected extensor retinaculum is repaired with 4-0 polydioxanone monofilament synthetic absorbable suture

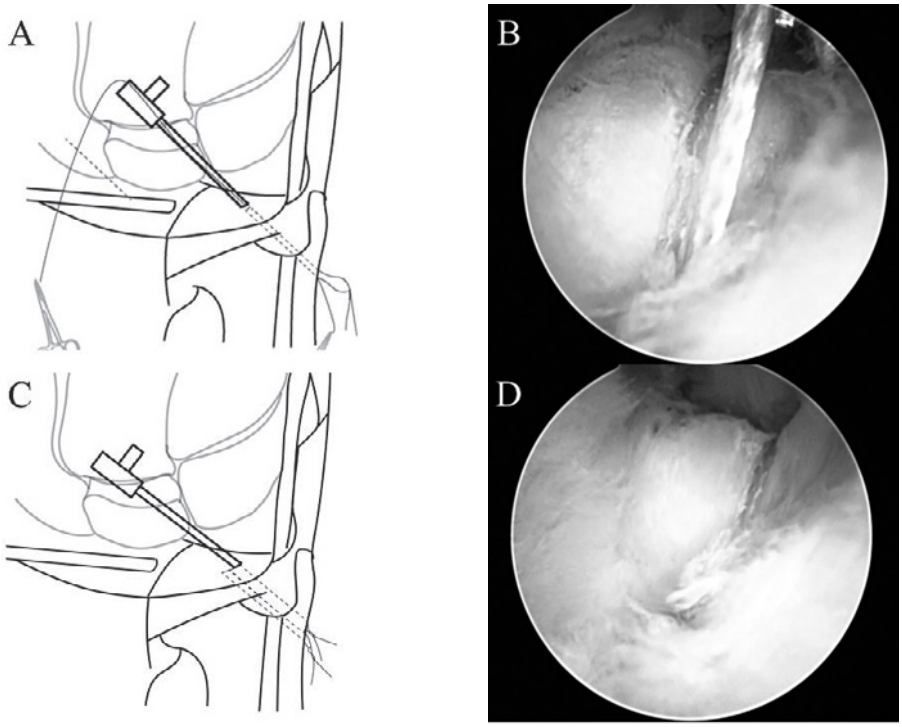

Fig. 3 Quick arthroscopic repair technique (3).
(A) The passing wire and 2-0 Fiberwire are pulled out with pliers and hammered to the ulnar edge of the ulna before the string of the Fiberwire is separated with surgical forceps.
(B) Two sutures are placed to repair the triangular fibrocartilage complex (TFCC) tear from the distal ulna.
(C) Another Fiberwire is loaded and the previous steps are repeated for the second pull-out suture. The ends of the two Fiberwires are sequentially rerouted so that the knot lies directly on the ulna, with no interposed subcutaneous tissue. The two separated Fiberwires are tied rigidly to stabilize the ulna to the distal radioulnar joint.
(D) The two sutures are tightened to repair the TFCC tear from the distal ulna.

(4-0 PDS II VIOLET; Ethicon, Somerville, NJ, USA), followed by closure of the ulnar skin incision and arthroscopy portals.

Postoperative Management

Patients stay overnight in the hospital if they received general anesthesia, while those who received regional anesthesia are discharged on the day of surgery. Active range of motion of the wrist is encouraged, but passive forearm rotation is prohibited for 3 weeks. From 3 weeks postoperatively, patients are permitted to freely move the wrist and rotate the forearm. Patients are encouraged to rotate the forearm to its full range of motion by 6 weeks postoperatively. After 6 weeks postoperatively, patients can grip with full strength and return to sport as tolerated. Return to heavy manual labor and sport is generally started from 12 weeks postoperatively.

Discussion

As compared with open surgery, minimally invasive surgery reduces operation time and shortens recovery time; thus, arthroscopic TFCC repair is attractive to surgeons and patients. Moreover, arthroscopic repair relieves symptoms in most patients[4].

A number of arthroscopic repair procedures have been reported, including inside-out repair using zone-specific cannulas or Tuohy needles[5], outside-in repair using Mulberry knots[4], and all-inside repair using a meniscal fastener[6]. Although these arthroscopic procedures yield satisfactory outcomes for repair of TFCC tears, there are several concerns. Some procedures are time-consuming and technically demanding, some do not obtain stable anchoring to the ulnar fovea, and others require expensive surgical instruments.

Inside-out repair procedures are the most widely accepted for repair of ulnar-sided TFCC tears. The inside-out technique involves piercing the TFCC via the ulnar side of the wrist and pulling it out to the distal part of the ulna[5]. The inside-in techniques vary in relation to instrumentation and subtle surgical modifications[6].

Our technique has many advantages: it is straightfor-

ward, quick, does not require expensive equipment, and achieves stable anchoring of the TFCC disc proper to the ulnar fovea. Moreover, the possibility of suture cut-through is very low because of the use of abrasive-resistant, multistrand, long-chain ultra-high molecular weight polyethylene. However, the disadvantages of our technique include the presence of palpable knots underneath the skin, which might annoy patients, and the risk of injury to the dorsal sensory branches of the ulnar nerve[10]. Although further evaluation is needed, our arthroscopic inside-out repair technique for acute and chronic TFCC 1B injuries may be an alternative treatment for DRUJ instability due to TFCC 1B tear.

Acknowledgements: We thank Kelly Zammit, BVSc, from Edanz Group (www.edanzediting.com/ac), for editing a draft of this manuscript.

Conflict of Interest: The authors declare no conflicts of interest.

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(Received, November 25, 2019)
(Accepted, January 21, 2020)
(J-STAGE Advance Publication, February 20, 2020)