TECHNIQUE

Arthroscopic Foveal Repair of Triangular Fibrocartilage Complex Peripheral Lesion With Distal Radioulnar Joint Instability

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ABSTRACT

There is still controversy regarding the value of arthroscopic suture of triangular fibrocartilage complex (TFCC) peripheral tears compared with open transosseous repair because only the latter method restores foveal insertions of TFCC in case of distal radioulnar joint (DRUJ) instability. Five classes of TFCC peripheral tears are recognized in a treatment-oriented algorithm based on arthroscopic findings, and indications to proper treatment are set accordingly. Complete repairable tears (class 2) and proximal repairable tears (class 3) are associated with DRUJ instability and require foveal reattachment of the TFCC. We describe a new arthroscopic technique to repair the foveal attachment of the TFCC with the use of a suture anchor, which is indicated for class 2 and 3 TFCC peripheral tears, instead of an open repair. This technique requires a dedicated working portal to approach the fovea ulnaris. This Direct Foveal portal is used to prepare the ligament and bone and to drill and insert a suture anchor loaded with a pair of sutures. Under arthroscopic vision, a suture is passed through each limb of the ligament and tied using a small knot-pusher. This arthroscopic technique restores original TFCC anatomy and adequate DRUJ stability with less morbidity and potentially accelerated rehabilitation compared with open repair.

Keywords: arthroscopy, distal radioulnar joint, instability, triangular fibrocartilage complex, repair

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HISTORICAL AND ANATOMIC PERSPECTIVE

According to the classification of Palmer and Werner,[1] disorders of the triangular fibrocartilage complex (TFCC) are divided into 2 basic categories, traumatic (class 1) and degenerative (class 2), which are further subdivided into different types depending on the location of the tear and the presence or absence of associated chondromalacial changes. Class 1 traumatic lesions are subdivided into 4 types, and Type 1-B injuries are peripheral tears located on the ulnar side of the TFCC. Recent histology and functional anatomy research demonstrates that the ulnar side of the TFCC is arranged in a complex 3-dimensional manner and separated into 3 components: the proximal triangular ligament, the distal hammock structure, and the ulnar collateral ligament (UCL).[2] Although the existence of an UCL is still debated,[3,4] it is considered to be a part of the extensor carpi ulnaris (ECU) sheath floor.[5,6] However, from a functional standpoint, the UCL can be associated with the distal hammock structure because they both share the same function of supporting and suspending the ulnar carpus.[2] The distal hammock structure and the UCL are considered to make up the "distal component of the TFCC (dc-TFCC),"opposite to the "proximal component (pc-TFCC)," represented by the proximal triangular ligament (Fig. 1). The proximal triangular ligament originates from the fovea ulnaris and spans to the ulnar corners of the distal radius with 2 limbs, palmar and dorsal. It is considered to be the true radioulnar ligament that stabilizes the distal radioulnar joint (DRUJ).[7] Depending on the intensity and direction of the applied

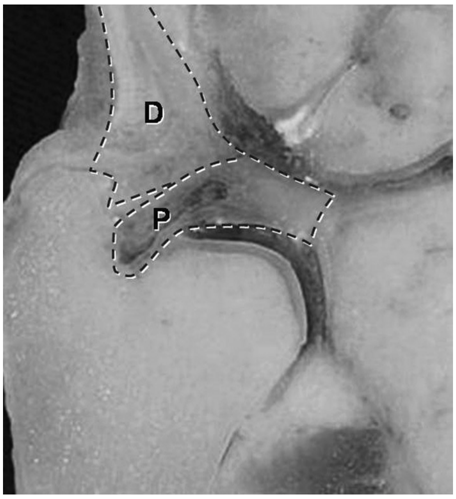


FIGURE 1. Coronal slice of the ulnar wrist. The TFCC is outlined. It is composed of the "distal component of the TFCC" (D), formed by the UCL and the distal hammock structure, and of the "proximal component" (P), the distal radioulnar ligament that originates from the ulnar fovea and basistyloid and stabilizes the distal radioulnar joint.

traumatic force, either the dc-TFCC or pc-TFCC or both may be torn. Clinical DRUJ stability is still preserved in cases of dc-TFCC isolated laceration. Conversely, when a type 1-B TFCC tear involves the disruption of the pc-TFCC, the DRUJ becomes unstable and results in ulnar-sided pain, reduced grip strength, decreased forearm rotation, and clinical signs of DRUJ instability. Controversy still exists as to which is the best treatment for type 1-B TFCC tears associated with DRUJ instability.

Multiple arthroscopic techniques have been proposed that suture the torn TFCC to the dorsal ulnocarpal joint capsule and the ECU tendon subsheath.[8–17] These techniques restore TFCC tautness by direct suture of the lacerated dc-TFCC and thus improve the patient's symptoms.

However, when TFCC tears involve the pc-TFCC and the DRUJ is clinically unstable, traditional arthroscopic suturing may be of limited efficacy to provide adequate joint stability because it fails to repair the pc-TFCC foveal attachments.[18,19]

In these instances, open repair is generally recommended because it is still considered the only technique that allows for restoration of the preinjury anatomy by the direct reattachment of the TFCC's proximal component to its foveal insertion.[19,20] Although good results have been documented with open repair, a careful and rather extensive exposure of the distal radio-ulnocarpal joint[20–22] is required to perform the TFCC reattachment via either transosseous sutures[18,21] or bone anchors.[23]

Continuous advances in understanding wrist intraarticular anatomy and kinematics and the relentless research in finding new surgical techniques to provide improved surgical accuracy with successful functional outcome and potentially accelerated rehabilitation time for the patient has contributed to the development of an "all-arthroscopic" attitude toward ulnar-sided wrist disorders.[24–26]

Along this line, new arthroscopic techniques have been introduced for the treatment of repairable TFCC peripheral tears associated with DRUJ instability.

CLINICAL PRESENTATION OF TYPE 1-B TFCC TEAR WITH DRUJ INSTABILITY

The typical patients experiencing a peripheral TFCC tear associated with DRUJ instability complain of ulnar-sided wrist pain usually after a fall on the outstretched hand or a violent traction and twisting injury of the wrist or forearm. The wrist spontaneously gives way when trying to open a bottle, rotate a steering wheel, turn a door handle, or hold an object in their hand during forearm rotation.

The diagnosis is made by eliciting the ulnar foveal sign[27] of point tenderness over the ulnar capsule just palmar to the ECU tendon. Pain is also exacerbated by passive forearm rotation and may be associated with a "click" or intraarticular grinding sensation. Active and passive motion of the wrist and DRUJ are usually preserved, although resisted forearm rotation is often weak and can reproduce painful symptoms.

Distal radioulnar joint laxity is evaluated by passive anteroposterior translation of the ulna on the radius in neutral rotation and in both full supination and pronation. Greater laxity is evident in the painful wrist as compared with the opposite side when the forearm muscles are relaxed.

The amount of radioulnar translation grades DRUJ laxity as Slight when less than 5 mm, Mild when 5 to 10 mm, or Severe when greater than 10 mm. If translation is abnormal in full supination, the dorsal limb of the pc-TFCC is either ruptured or overstretched. On the contrary, when translation is abnormal in full pronation, laceration of the pc-TFCC's palmar limb is expected.

Furthermore, clinically unstable DRUJ demonstrates a "soft" end-field resistance to translation compared with the "firm" end-field resistance felt in the uninjured DRUJ.[28]

However, hypertonicity of the DRUJ's muscle stabilizers may mislead the clinician into making a false-negative diagnosis; thus, it is recommended that DRUJ stability should be confirmed under anesthesia just before the operation.

Radiographs are usually of limited diagnostic help but may reveal an associated ulnar styloid fracture/nonunion or positive ulnar variance. The value of magnetic resonance imaging (MRI), even with intraarticular gadolinium, is controversial. An MRI arthrogram may diagnose a tear but may not accurately assess the size and location of the tear.[29] Studies comparing specificity and sensitivity of arthrography, MRI, and arthroscopy confirm that arthroscopy is the criterion standard for definitive diagnosis.[30,31]

ARTHROSCOPIC ASSESSMENT OF TYPE 1-B TFCC TEARS: A TREATMENT-ORIENTED CLASSIFICATION

Tear assessment requires arthroscopic evaluation of both the proximal and distal components of the TFCC with a radiocarpal joint arthroscopy to evaluate the dc-TFCC and a DRU arthroscopy to evaluate the pc-TFCC.

With the scope in the standard 3-4 portal, the tear is visualized during radiocarpal arthroscopy in the dorsoulnar corner of the TFCC and probed through the 6-R portal. The TFCC tension is evaluated by the trampoline test[18] and the hook test. The trampoline test assesses the TFCC's tautness by applying a compressive load across it with the probe. The test is positive when the TFCC is soft and compliant and suggests a peripheral TFCC tear. The hook test consists of applying traction to the ulnar-most border of the TFCC, with the probe inserted through the 4-5 or 6-R portal. The test is positive when the TFCC can be pulled upward and radially toward the center of the radiocarpal joint (Fig. 2). It is a reliable maneuver for detecting the foveal disruption of the pc-TFCC. Furthermore, specific traction on the palmar or dorsal TFCC can help detect which limb of the pc-TFCC is ruptured.

Distal radioulnar arthroscopy is the only method that permits to see ligamentous pc-TFCC laceration or avulsion of the foveal attachments. It is required when there is a positive hook test and/or when the TFCC tear is associated with clinical DRUJ instability. For a simple assessment of the pc-TFFC, an 18-gauge hypodermic needle is used to probe the pc-TFCC's foveal insertion. Distal radioulnar arthroscopy allows the cartilage to be examined for chondromalacia.

Arthroscopy of the radiocarpal and DRU joints allows assessment of a combination of findings that should be considered the key factors in the decision-making process for the appropriate treatment of a TFCC tear, namely, the lacerated component, the healing potential, and the status of the ulnar head and sigmoid notch's surrounding cartilage.

Lacerated Components of the TFCC

The distal (dc-TFCC) and proximal (pc-TFCC) components of the TFCC both need evaluation because they may be involved either separately or together.

Three different types of ligamentous damage are possible. For isolated tear of the distal component, the trampoline test is positive but the hook test is negative. Integrity of the foveal attachments of the pc-TFCC is confirmed by DRU arthroscopy. For complete tear of both distal and proximal components, a tear of the dc-TFCC is visible during RC arthroscopy, and a pc-TFCC avulsion is demonstrated by DRU arthroscopy. Both trampoline and hook tests are positive. Finally, for isolated tear of the proximal component, this can only be confirmed by DRU arthroscopy. Standard RC arthroscopy looks normal, but both trampoline and hook tests are positive and suggest this diagnosis.

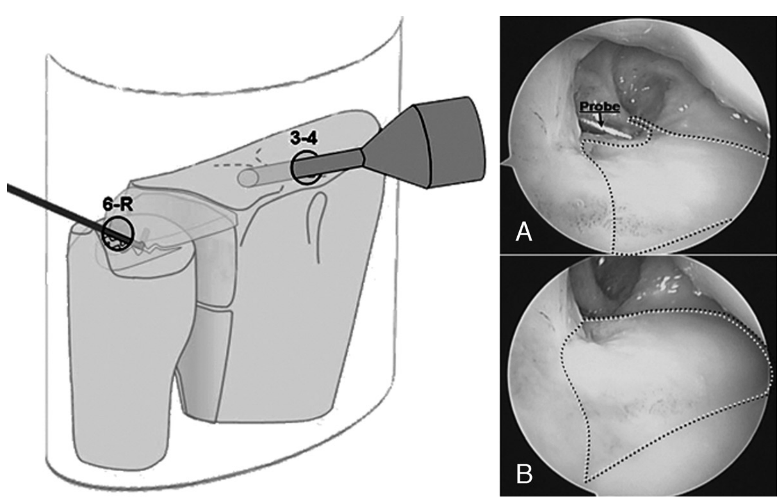


FIGURE 2. The hook test. A, The probe is inserted through the 6-R portal, and traction is applied to the ulnar-most border of the TFCC (outlined by the dotted line). B, The test is positive when the TFCC can be pulled upward and radially, when the pc-TFCC is detached from the fovea.

Surgical treatment varies according to which TFCC component is lacerated. In case of a proximal or complete tear, a TFCC reinsertion onto the fovea ulnaris is recommended. However, in case of a distal tear, arthroscopic suturing of the TFCC to the dorsal ulnocarpal joint capsule and the ECU tendon subsheath is appropriate.

Healing Potential of the TFCC Tear

Chronic midsubstance ligamentous tears may show necrotic edges that cannot be debrided back to a well-vascularized area; therefore, direct repair is unlikely to provide adequate healing. Poor healing can also be expected when degeneration or retraction of the ligamentous remnants prevents proper closure of the TFCC tear repair or only permits reapproximation of the avulsed ligament under tension. In the previously mentioned conditions, or after a failed repair of an elongated and frayed ligament, direct repair is unlikely to be successful. Congenital dysmorphism of the styloid and in the foveal area of the ulna head (eg, styloid hypoplasia, flattened ulnar head) can also be associated with poor healing.

DRUJ Cartilage Status

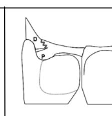
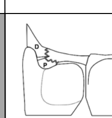
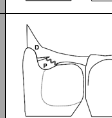
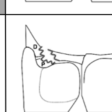
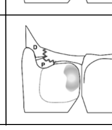
Well-preserved articular cartilage is a "sine qua non" for ligament repair or reconstruction of the DRUJ. A cartilage defect over the ulnar head and sigmoid notch may have been produced at the initial time of a high-energy impact trauma. Alternatively, degenerative chondromalacia may be the consequence of altered joint kinematics, resulting in chronic DRUJ instability. When DRU arthroscopy shows a chondral lesion, salvage options are recommended.

Based on these arthroscopic findings, 5 classes of TFCC peripheral tears are recognized, and guidelines for specific treatment can be considered: repair by either suture or foveal insertion, reconstruction with tendon graft, or salvage procedures (arthroplasty or joint replacement; Table 1).

■ INDICATIONS/CONTRAINDICATIONS

When pain and impaired function show no improvement after a trial of conservative treatment, surgical treatment is considered for type 1-B TFCC injuries in the Palmer classification.

TABLE 1. *Triangular Fibrocartilage Complex Peripheral Tear Classification*

		Clinical DRUJ Instability	Involved TFCC Component		TFCC Healing Potential	Status of DRUJ Cartilage	Treatment
			Distal	Proximal			
Class 1 Repairable *Distal Tear*		None or Slight	Torn	Intact	Good	Good	<u>REPAIR</u> *Suture (Lig-to-capsule)*
Class 2 Repairable Complete Tear		Mild or Severe	Torn	Torn	Good	Good	<u>REPAIR</u> *Foveal Refixation*
Class 3 Repairable Proximal Tear		Mild or Severe	Intact	Torn	Good	Good	
Class 4 Non-Repairable		Severe	Torn	Torn	Poor	Good	<u>RECONSTRUCTION</u> *Tendon Graft*
Class 5 Arthritic DRUJ		Mild or Severe	§	§	§	Poor	<u>SALVAGE</u> *Arthroplasty or Joint Replacement*

Novel classification based on arthroscopic findings provides guidelines for treatment of different TFCC peripheral tears. The first column reports findings of clinical instability of the DRUJ. Class 1 are repairable tears that should be treated by suture. Class 2 and 3 are repairable tears associated with DRUJ instability that require foveal reattachment. Class 4 are nonrepairable lesions that should undergo reconstruction by tendon graft. Class 5, whose main characteristic consists of DRUJ cartilage degeneration, includes different conditions (§). It should be treated by salvage procedures, that is, resection arthroplasty or prosthetic joint replacement.

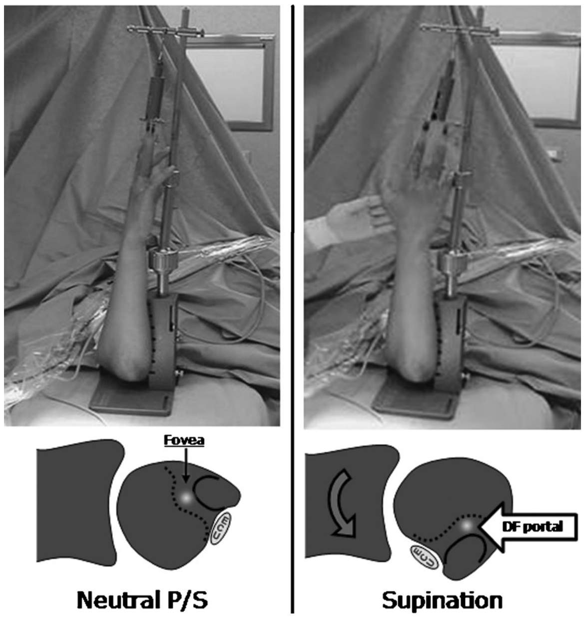


FIGURE 3. Full forearm supination is required to create the DF portal. After supination, the ulnar styloid and the ECU tendon displace dorsally, and the fovea and the ulnar-most area of the distal ulna become subcutaneous.

Indications to TFCC repair or reconstruction are systematized according to the author's proposed arthroscopic classification (Table 1). Both complete (class 2) and isolated proximal repairable tears (class 3) with DRUJ instability require foveal reattachment of the TFCC.

Apart from osteoarthritis, repair is contraindicated in a chronic Essex-Lopresti interosseous membrane injury, previous soft-tissue infection, osteomyelitis, or severe osteoporosis of the ulnar head. A positive ulnar variance with secondary ulnar impaction, carpal chondromalacia, and hypoplasia of the palmar or dorsal sigmoid notch are relative contraindications.

■ TECHNIQUE

Operative Setup and Diagnostic Arthroscopy

The patient is positioned supine with the affected arm on a hand table, and a padded tourniquet is placed on the proximal arm. After a brachial plexus block has been administered, DRUJ laxity is assessed under anesthesia before starting the arthroscopic procedure. Complete forearm muscle relaxation after anesthesia may reveal previously undetected DRUJ instability. The upper limb is exsanguinated, and the tourniquet is inflated to 250 mmHg.

A standard wrist arthroscopy is conducted.[32] The wrist is suspended by finger traps using a wrist traction tower with approximately 10 to 15 lbs of traction depending on the size of the extremity. Joint distension by saline infusion is usually not required to obtain a full visual joint field. We prefer to use a dry technique,[33] which benefits arthroscopic repair.[34,35]

A 2.7-mm arthroscope is used routinely, reserving the 1.9-mm arthroscope for smaller wrists. The wrist is systematically evaluated by RC arthroscopy, with the scope in the 3-4 portal. Care is taken to detect any associated disorders of the ulnar carpus.

Tears of the dc-TFCC are seen on the dorsal-ulnar aspect and are frequently covered by hypertrophic synovitis or fibrovascular granulation tissue, which is removed with a shaver. A probe is inserted in the 6-R portal to assess the tension of the TFCC using the trampoline test and the hook test.

If tests are positive and the TFCC is lax, pc-TFCC attachment is assessed via DRU arthroscopy.

DRUJ Arthroscopy

The DRUJ is explored through the distal DRUJ portal, with the forearm supinated and traction reduced. In smaller wrists, a volar ulnar portal is used.[36] Because the DRUJ is a very narrow and tight joint, DRU arthroscopy

FIGURE 4. The DF portal is located approximately 1 cm proximal to the 6-U portal. It is a working portal to provide access to the ulnar styloid and fovea. With the scope in the distal DRUJ portal, small shaver or curette is inserted through the DF portal to debride the torn or avulsed ligament and the fovea.

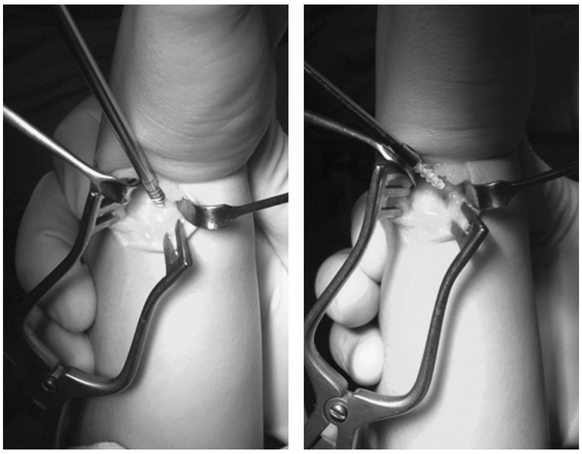


FIGURE 5. Screw/anchor drilling and insertion are performed as a mini-open procedure through the DF portal.

may be difficult to perform when the pc-TFCC is still intact. However, when the pc-TFCC is torn, scope insertion is easier because the articular disk is loose and more space is available for DRUJ exploration. For a preliminary assessment of pc-TFCC tautness, an 18-gauge needle is inserted percutaneously approximately 1 cm proximal to the 6-U portal with the forearm held in full supination. It will enter the joint close to the fovea and may be used to lift the articular disk, thus enlarging the visual field, and to palpate the pc-TFCC. Distal radioulnar arthroscopy shows the ligamentous laceration or avulsion of the pc-TFCC from the fovea. When a TFCC Palmer type 1-B tear is associated with DRUJ instability, the most common finding is the combination of a dc-TFCC tear and a pc-TFCC avulsion (complete TFCC tear, class 2). Less frequently, a pc-TFCC tear is present as an isolated finding (pc-TFCC tear, class 3). In the latter case, a standard RC arthroscopy reveals a normal TFCC appearance, which may be misdiagnosed as a normal TFCC, because the pc-TFCC tear can only be demonstrated by DRU arthroscopy. For this reason, DRU arthroscopy is considered mandatory in cases of a suspected TFCC tear that is associated with DRUJ instability.

Repair of the foveal insertion of the TFCC is performed by reattachment of the pc-TFCC with a suture anchor or screw. Arthroscopic reattachment of the foveal insertion of the TFCC require a separate portal to provide access to the fovea ulnaris.

Direct Foveal Portal

A dedicated working portal named the direct foveal (DF) portal has been devised to remove ligamentous remnants, prepare the bone, and to drill and insert the suture screw or anchor. It is located approximately 1 cm proximal to the 6-U portal and is performed with the forearm in full supination because this produces dorsal displacement of the ulnar styloid and the ECU tendon and uncovers the palmar aspect of the distal ulna (Fig. 3).The fovea and the ulnar-most area of the distal ulna become subcutaneous and can be easily exposed. The DF portal is easier than the volar ulnar portal,[36] but is only used as a working portal, to introduce instruments in the area of the ulnar styloid and fovea (Fig. 4). After confirming the 6-U portal with an 18-gauge needle, a 2- to 2.5-cm longitudinal skin incision is made between the ECU and the flexor carpi ulnaris that extends proximally the 6-U portal. The dorsal sensory branches of the ulnar nerve (DSBUN) are identified by subcutaneous dissection and protected. The risk of damaging the nerve is further reduced by forearm supination because the nerve is displaced palmarly.

The extensor retinaculum is exposed and split along its fibers. The DRUJ capsule is incised longitudinally to reach the distal articular surface of the ulnar head under the TFCC. The fovea is located palmarly at the base of the ulnar styloid, just lateral to the capsule as an area of soft bone. With the scope in the distal DRUJ portal, DF portal permits the use of a small shaver or curette to debride the torn or avulsed ligament back to healthy tissue, remove the inflammatory fibrovascular tissue from the

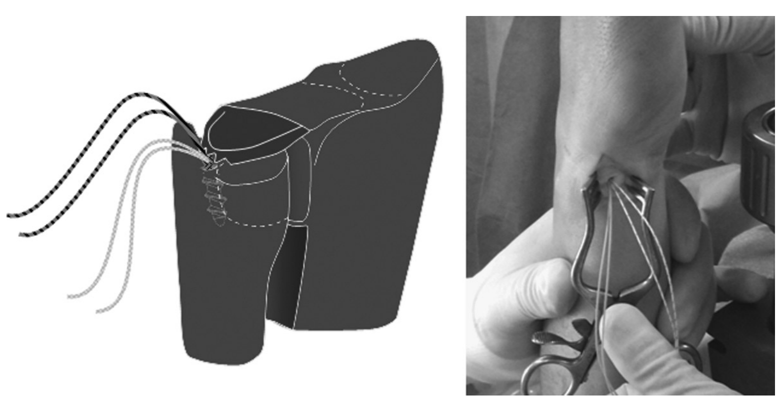


FIGURE 6. Once the screw is in place, sutures should exit the DF portal from underneath the TFCC. When the wrist is placed back in neutral pronosupination, the screw's head is brought under the TFCC.

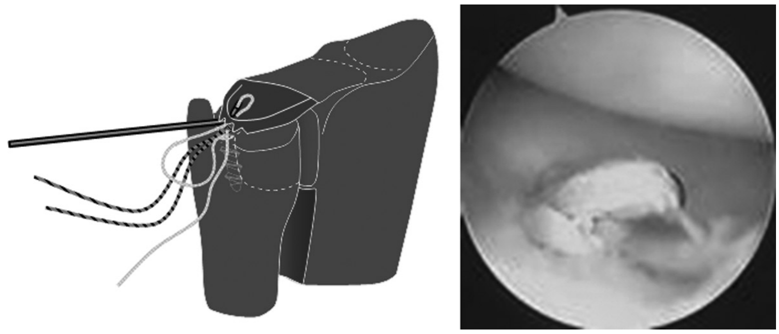


FIGURE 7. With the scope in the 3-4 portal, the end of the first suture is inserted into the tip of a 25-gauge Tuohy needle and is passed through the TFCC via the DF portal in an outside-in fashion.

fovea, and prepare it for suture screw or anchor insertion. Curettage of the fovea can also be performed as a mini-open procedure. Drilling and insertion of the screw or anchor is also done through the DF portal as a mini-open procedure (Fig. 5). Neither a power drill nor intraoperative fluoroscopy is required, although the latter may be advisable for the less experienced surgeon.

Suture Anchor Foveal Repair

A screw or anchor with a pair of sutures is preferred so that a suture can be passed through each limb of the radioulnar ligament. This will also improve the strength of the repair by recreating a broader footprint of the pc-TFCC, analogous to a rotator cuff repair in the shoulder.[37] We prefer to use a 3.7-mm absorbable screw with 2 preloaded 2-0 Fiberwire sutures (Small Joint Bio-Corkscrew Suture Anchor, ref. AR-1923BNF; Arthrex Inc, Naples, Fla) (Fig. 5). Once the screw is in place, sutures exit the DF portal from underneath the TFCC (Fig. 6). Then the forearm is placed back in neutral rotation so that the screw's head is located under the TFCC's ulnar-most part.

The suture ends are then inserted into the tip of a 25-G needle or a Tuohy needle. With the scope in the 3-4 portal, the first suture is inserted in an outside-in fashion from the DF portal, close to the TFCC's palmar edge, to hold the palmar limb of the radioulnar ligament (Fig. 7). A grasper is introduced through the 6-U portal to retrieve the suture from the RC joint (Fig. 8). The same procedure is repeated to suture the dorsal limb of the radioulnar ligament.

Wrist traction is released while an assistant maintains the ulnar head in a reduced position with the forearm in neutral rotation. The sutures are tied under arthroscopic vision using a small knot-pusher, assuring adequate pc-TFCC compression against the distal ulna (Fig. 9). Knots should be located at the prestyloid recess or just outside the DRUJ capsule (Fig. 10).

Complete tear closure is confirmed. Even in larger class 2 TFCC peripheral tears, it is seldom necessary to apply any further ligament-to-capsule sutures to close off the repair.

The DRUJ is assessed for forearm rotation range of motion and residual laxity. The DRUJ capsule and the opening between retinaculum fibers are approximated with 2 PDS 4/0 stitches, and the skin is closed.

Postoperative Treatment

For the first week, the patient is placed in a long arm splint in neutral forearm rotation that is substituted by a short arm splint that extends to the epicondyle, allowing elbow flexion and extension but no pronation or supination ("Münster-type splint") for another 3 weeks. Full wrist flexion/extension is started at 3 weeks. During the first week of rehabilitation, progressive forearm rotation is allowed, but the splint is still worn between exercises.

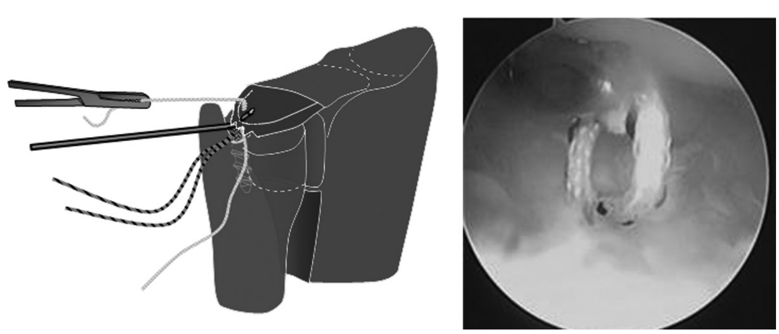


FIGURE 8. A grasper is inserted through the 6-U portal and used to retrieve the suture from the radiocarpal joint so that 1 end of both sutures exits from the 6-U portal and the other one from the DF portal.

Scar mobilization and gliding techniques are initiated at this time by the therapist to prevent the formation of underlying adhesions that may prevent complete pain-free wrist range of motion recuperation due to scar pulling. During the next 6 weeks, resisted wrist and elbow movements are not permitted. Progressive resisted wrist and hand-strengthening exercises and propriocetive reeducation are begun after the sixth week until the patient is able to bear weight on the operated wrist. Sport and heavy work activities are allowed only after 3 months.

COMPLICATIONS

Although arthroscopic foveal repair of the TFCC peripheral tears is an advanced procedure requiring specific training and experience, few complications should be encountered provided the described surgical technique is performed with careful application of standard arthroscopic principles. The most serious complication is injury to the DSBUN, which depends on the surgeon's experience. Transient neurapraxia of the DSBUN usually recovers spontaneously in 3 to 4 months. The surgical scar of the ulnar side of wrist may adhere to deeper structures and become painful during the first stages of physiotherapy, especially after prolonged immobilization.

As in other arthroscopic procedures, infection remains a risk, which is usually prevented by a prophylactic dose of parenteral antibiotics before initiating the procedure.

The dry technique of joint exploration[33] is recommended to reduce soft tissue infiltration and swelling by the continuous leaking of saline through the portals.

RESULTS

We started our clinical experience with arthroscopic-assisted repair of the foveal insertion of the TFCC in 2001.[34]

In a control series study, 18 patients (13 men and 5 women; mean age, 34.2 years) were reevaluated after a minimum follow-up of 1 year (mean, 18 months; maximum, 37 months). All patients had a history of trauma and complained of pain in the ulnar fovea with clinical signs of slight (10 patients) to mild (8 patients) DRUJ instability. Although radiographs showed an ulnar-positive variance in 3 patients, there were no detectable signs of ulnocarpal impaction or carpal chondromalacia. Arthroscopy revealed a Palmer type 1B ulnar avulsion of the TFCC in all patients. Fourteen were complete TFCC peripheral tears (class 2), and 4 were proximal tears (class 3).

FIGURE 10. At the end of the procedure. The knots of both sutures are located in the prestyloid recess or just outside the DRUJ capsule at the level of the 6-U portal.

At follow-up, the patients had an increased range of motion (from 90.7% to 96% of the contralateral side) and grip strength (from 73% to 90% of the contralateral side). Pain perception decreased from 8.3 to 1.2 on a 10-point visual analog scale. Grip strength and pain changes reached statistical significance ($P < 0.005$). The Modified Mayo Wrist Score was excellent in 14

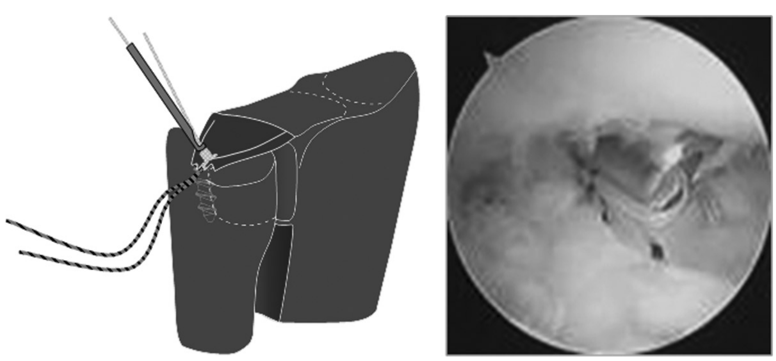


FIGURE 9. The suture is tied under arthroscopic vision using a small knot-pusher. The pc-TFCC is pushed forcefully against the distal ulna after the wrist traction is released, the forearm is held in neutral rotation, and the ulnar head is reduced by an assistant. The same technique is used for the other suture.

patients, good in 3, and fair in 1. A total of 94.4% of the results scored excellent and good. The disabilities of the arm, shoulder, and hand score was an average of 10.5. Fifteen patients (83.3%) resumed their previous work and recreational activities, whereas 3 patients (16.7%) had restricted function.

CONCLUSIONS

During the last decade, arthroscopy showed continuous advancement in the management of TFCC peripheral tears. Increased experience with radiocarpal and DRU arthroscopy allows a more accurate definition of TFCC tear characteristics. The suggested classification of TFCC peripheral tears places due emphasis on the laceration of the proximal component of the TFCC and leads the surgeon to a systematic research of clinical and arthroscopic signs of pc-TFCC involvement. When preoperative DRUJ laxity test, arthroscopic hook test, and DRU arthroscopy are performed routinely during evaluation of TFCC peripheral tears, pc-TFCC detachment may be found more frequently than expected. During the last 3 years, in the authors' 2 institutions, the incidence of class 2 and 3 TFCC peripheral tears sums up to more than 70% of repairable tears, and treatment of these tears by the arthroscopic-assisted foveal repair technique is demonstrated to be reliable and successful. During the last three years, the Authors have come across a rate of class 2 and 3 TFCC peripheral tears greater than 70%. These tears were treated using the arthroscopic-assisted foveal repair technique, which has proved to provide both reliable and successful outcomes. This technique benefits from the use of a dry technique, thus reducing intraoperative complications that can be provoked by saline dispertion. Not only is DSBUN identification and protection easier, but the nonswollen TFCC is able to retain a better suture hold onto the bony repair.

The arthroscopic-assisted foveal repair technique upholds the potential to surpass open surgery results in the treatment of DRUJ instability. It improves surgical accuracy due to intraarticular magnification. Although being less invasive, it requires limited incisions and allows preservation of the extensor retinaculum so that postoperative pain and the duration of rehabilitation are usually reduced.

Future technical advances and increased expertise in DRU arthroscopy will lead to the development of a completely arthroscopic foveal repair. However, the limited approach to the ulnar wrist is currently recommended instead of a simple DF portal to prevent nerve damage and also for proper preparation of the fovea and the pc-TFCC and for anchor insertion, especially in class 3 tears, in which the dc-TFCC is still preserved.

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