Arthroscopic assisted foveal repair of triangular fibrocartilage complex injuries associated with distal radioulnar joint instability

Mahmoud M. Kamaleldin, Saeed M. Shekedaf

Alexandria University, Egypt

Correspondence to Mahmoud M. Kamaleldin, MD, El-Hadra University Hospital, Alexandria University, Alexandria 21648, Egypt
Tel: 01006564801;
e-mail: dr.mkamal2011@gmail.com

Received: 14-Mar-2023
Revised: 12-Jun-2023
Accepted: 22-Jun-2023
Published: 13-Sep-2024

The Egyptian Orthopaedic Journal 2024, 59:221–226

Introduction
Foveal tears of tfcc are common causes of ulnar sided wrist pain. They are usually associted with druj instability. Reattachment using either arthroscopic or open techniques is considered the best treatment in acute settings. This is a retrospective study to evaluate clinical and functional results of arthroscopic assisted technique.
Patients and methods
20 patients were enrolled in the study. 13 males and 7 females. Mean age was 26 years.
Technique involved arthroscopic reattachment of the tfcc to its foveal foot print using direct foveal portal as described by Atzei *et al.*
Results
The mean follow-up period was 14 months ranging from 8 to 20 months No pain was recorded in 13 patients, mild pain in 4 patients, and moderate pain in 3 patients. The mean VAS score was 3.2. The mean Mayo score was 70%.
Conclusion
Arthroscopic assisted technique using direct foveal portal is a valuable technique with good reproducible results.

Keywords:
arthroscopic, druj instability, fovea, Tfcc

Egypt Orthop J 2024, 59:221–226

1110-1148

Introduction

Triangular fibrocartilage injuries are considered the most common cause of ulnar sided wrist pain [1]. They can be traumatic resulting from fall on outstretched hand with the wrist in forced extension and or supination, or can be degenerative due to overuse and usually being associated with positive ulna variance and ulnar impaction syndrome [2].

Traumatic tears range in severity from minor injuries which cause ulnar sided wrist pain and discomfort to major injuries associated with DRUJ instability resulting in pain, clicking and reduced hand grip, and may result in disability if left untreated and may end with DRUJ arthritis [3].

The hallmark of major injuries of TFCC is foveal detachment of the distal radioulnar ligaments (deep part of the TFCC) which are considered the primary stabilizer of DRUJ [4].

Treatment of major injuries of TFCC involves reattachment of the TFCC to its foveal footprint in acute setting while reconstruction of DRUJ ligaments is reserved for chronic neglected cases [5].

Reattachment of the TFCC to foveal foot print could be done using open or arthroscopic techniques, where arthroscopic techniques offer the advantages of minimal incision, less post operative pain, earlier rehabilitation and quicker recovery, less post operative stiffness and better functional results [6–8].

The aim of this retrospective cohort study is to evaluate the clinical and functional results of arthroscopic assisted foveal reattachment of TFCC injuries associated with distal radioulnar joint instability.

Patients and methods

All patients gave their informed consent prior to being included in the study. The study was authorized by the local ethical committee.

In the period between 2017 and 2021, 20 patients who presented with posttraumatic TFCC injuries associated with DRUJ instability have been treated using arthroscopic assisted foveal reattachment technique. All the patients enrolled in the study had traumatic injuries resulting from fall on the out stretched hand

in 15 case, and twisting injury of the wrist in 5 cases. The study included 13 males and 7 females. Age ranged from 16 to 36 years with the mean age 26 years. Dominant wrist was involved in 12 patients.

All the patients complained of ulnar sided wrist pain, clicking, reduced hand grip and sense of instability. The complaints did not resolve with a period of conservative treatment in the form of NSAIDs, splinting and local injection. The period of conservative treatment ranged from 2 to 6 months with a mean of 2.5 months. Clinical examination included positive fovea sign (tenderness of the ulnar snuff box between extensor carpi ulnaris and flexor carpi ulnaris), positive piano key sign, positive Ballottment test in pronated and supinated position compared with the other side. Instability was recorded as slight when less than 5 mm, mild when 5 to 10 mm, or severe when greater than 10 mm, or the DRUJ is subluxed [7]. And negative shake hand test which indicates negative ulnar impaction syndrome.

All the patients had radiograph of the wrist to demonstrate fractures of the ulnar styloid, ulnar variance, DRUJ subluxation and other associated injuries. Ulnar styloid fracture was present in three cases and the size of the fragment was too small to be fixed surgically. All the patients had MRI of the wrist which confirmed avulsion of the TFCC from the fovea in all cases involved in the study. Figure 1.

TFCC injuries were classified according to palmer classification, where palmer type 1B denoting peripherl ulnar tears were further classified according to Atzei classification [9,10].

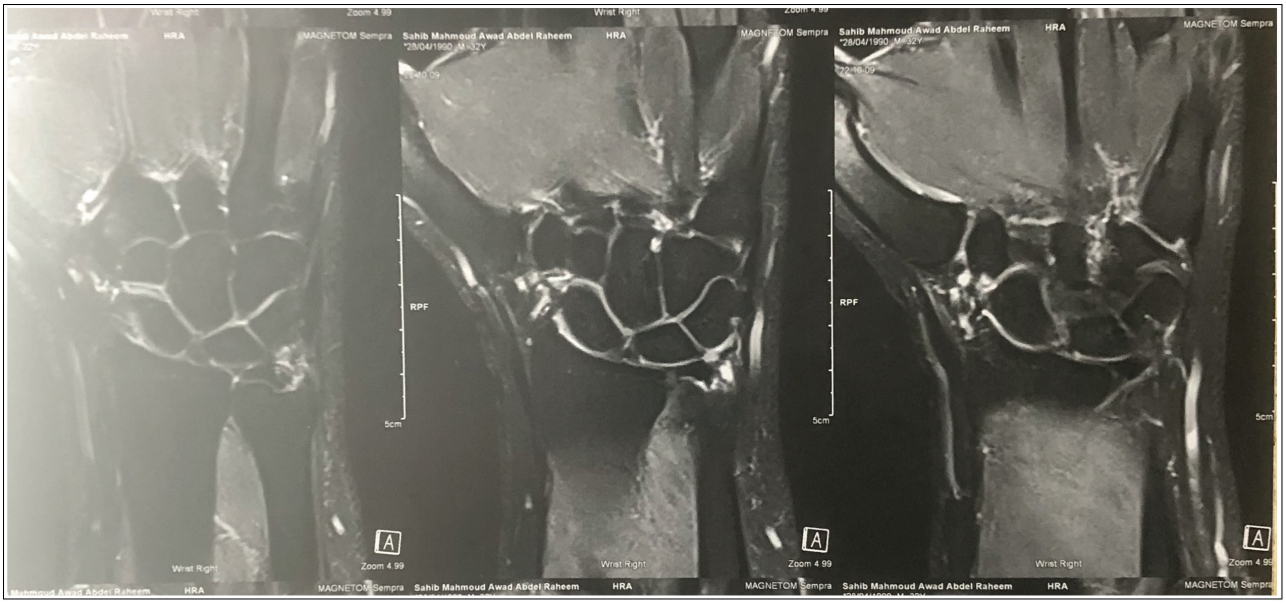
Atzei grade 2 or 3 were considered for foveal reattachment using arthroscopic assisted technique. Exclusion criteria included presence of associated fracture like distal radius fracture, TFCC injuries which are distal or minor and not associated with DRUJ instability, neglected chronic cases more than 9 months in duration from onset or presence of calcium deposits along TFCC attachment where these patients were best treated by DRUJ ligament reconstruction, and presence of DRUJ arthritis or systemic arthritis [9,10].

All patients had routine laboratory examination before surgery.

Surgical technique

All surgeries were done under General anesthesia and or regional block anesthesia. Position was supine with the shoulder abducted to 90 on hand table and elbow flexed to 90 where the hand was put in commercially available hand traction system and 8 kg counter traction was used. High arm tourniquet was inserted. Examination under anesthesia was performed confirming positive ballottment test with soft end point in supinated and/or pronated positions. We started first with diagnostic dry wrist arthroscopy. 3/4 portal was used as viewing portal, while 6/R portal was established by inside out technique and was used as working portal. Small shaver was inserted through 6/R portal to debride any synovitis and scar tissue. Probe was inserted in 6/R

Figure 1



MRI showing TFCC avulsion from the fovea.

portal to evaluate the TFCC where Trampoline test and Hook test were performed to diagnose TFCC lesion. Laxity of TFcc central desk dictate positive Trampoline teat and is indicative of distal injury of the TFCC. Positive hook test which involved putting the probe through prestyloid recess and trying to elevate the TFcc in a radial direction is highly sensitive to foveal detachment. Direct viewing of the TFCC fovea using DRUJ portal was unnecessary because hook test is highly sensitive in detecting foveal detachment, furthermore, DRUJ portal requires 1.9 mm arthroscope which is not available in our institution. This portal was done in 6 patients only. Once diagnosis of TFcc avulsion was made using positive hook test, decision was made to make foveal reattachment using direct foveal portal.

A small incision about one and half to two centimeters is made longitudinally volar to ECU tendon. Dorsal cutaneous branch of ulnar nerve was dissected and protected, then extensor retinaculum between ECU and FCU was incised and dissected to expose the capsular tissue. Two portals were created, the 6U portal was developed by inside out fashion and was used to deliver the sutures, while, direct foveal portal was developed under tfcc according to Atzei *et al*. and was used for insertion of the anchor after preparation of the fovea by curette. Figure 2.

After preparation of the fovea, the mini anchor 2.9 mm loaded with double sutures was inserted while the wrist is supinated to make the fovea superficial and then, the sutures were inserted from below the tfcc using tuohy needle which were delivered using grasper or haemostat from 6U portal. Traction was released and sutures were tied in a sliding fashion while the wrist was kept in neutral mid prone position. Figures 3,4 Once stability was confirmed by ballottment test and hook test, capsular rent was closed and extensor retinaculum was closed. The closure of the incision in layers was performed.

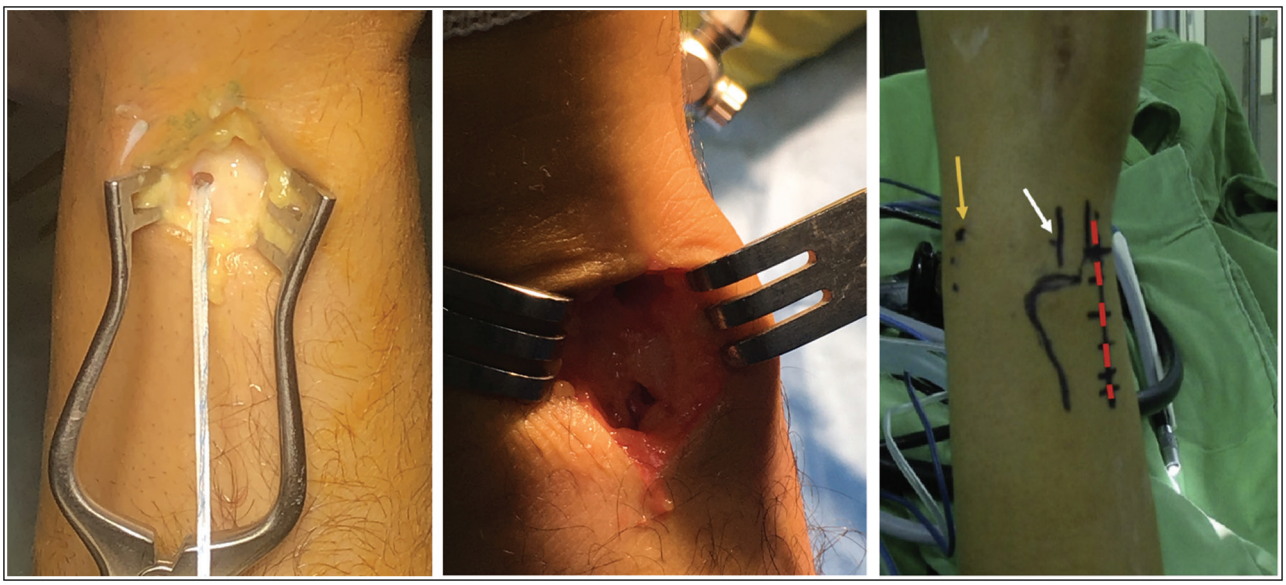
Rehabilitation included putting above elbow cast for 3 weeks then splint was put for another two weeks. Then, physiotherapy began until regaining full passive and active range of motion. Recreational activities and work were permitted after 3 months from the index surgery.

Follow-up and outcome included checking of stability by ballottment test, pain level using visual analogue score, wrist function assessed using modified Mayo score, range of motion and grip strength were recorded and compared with preoperative findings Figure 5.

Results

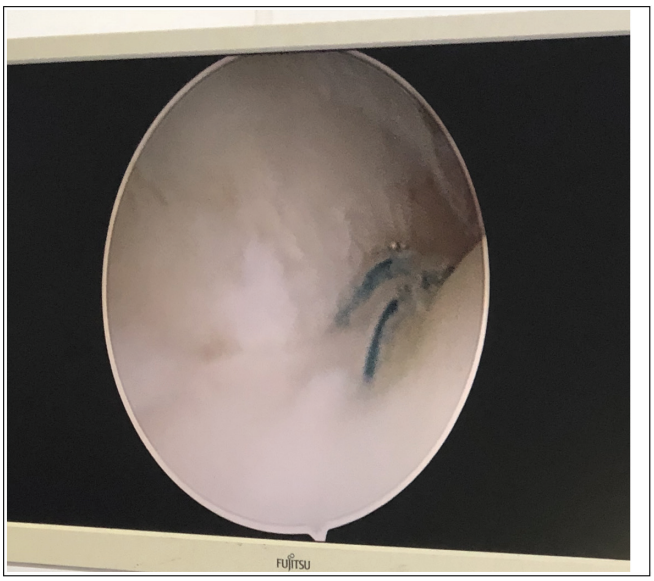
The mean follow-up period was 14 months. At final follow-up, 18 patients achieved no to slight instability at follow up, where 2 patients had moderate instability. According to Mayo score, 17 patients achieved excellent results. Three patients had fair to poor results. First one complained of clicking and moderate pain where radiography showed loosening and pulling out of the anchor which was removed 6 month after the procedure

Figure 2



Incision for anchor placement. direct foveal portal. direct foveal portal and 6U portal

Figure 3



Sutrues passed through the tfc.

Figure 4

Final repair of tfc.

and the patient continued to have mild discomfort and pain. Later on, the patient had diagnostic arthroscopy which showed healing of the TFCC. However, patient continued to suffer from pain and discomfort at the ulnar side. The second one developed neuritis of the dorsal cutaneous branch of ulnar nerve which resolved with medical treatment in the form of neurotonics 4 weeks after removal of the cast. The third one had

Figure 5

Anchor in place.

recurrent instability, patient continued to have pain and sense of weakness of the hand. Patient was treated by DRUJ ligament reconstruction one year after the procedure.

No complications related to wound healing, and no cases encountered irritation from anchor sutures in our series.

The mean follow-up period was 14 months ranging from 8 to 20 months No pain was recorded in 13 patients, mild pain in 4 patients, and moderate pain in 3 patients. The mean VAS score was 3.2. The mean Mayo score was 70%. 18 patients returned to previous activity while two continued to have symptoms. The range of motion was normal compared with other side in 17 patients while 3 had some limitation of pronosupination movement.

Discussion

Tfcc injuries are considered a common cause of ulnar sided wrist pain Nakamura and colleagues, Tomaino and Weiser [1,11]. Traumatic injuries usually result from fall on outstretched hand and like meniscal tear of the knee they have good blood supply along the periphery and so become amenable to repair in peripheral tears which correspond to palmer type 1b Atzei [12].

Peripheral tears are classified according to Atzei, where, major tears classified as Atzei 2 and 3 are usually associated with DRUJ instability because they include avulsion of DRUJ volar and dorsal ligaments from the foveal foot print Hanker, Moskal and Savoie [13,14].

So reattachment of the foveal tears is considered the ideal treatment of theses major injury in acute or subacute setting Atzei and Luchetti [15].

This can be performed using open or arthroscopic techniques. Open techniques are considered the standard treatment because they allow direct and accurate insertion of the tfcc in the fovea isometric footprint. However, they are blamed for longer incision, caposulotomy of the ulnocarpal and druj capsule which may lead to stiffness and postoperative pain with late rehabilitation and hence late recovery Pederzini and colleagues, Fulcher and Poehling [16,17].

Arthroscopic technique have the advantages of minimal capsulotomy incision, less post operative pain and hence earlier recovery of the range of motion and more accurate assessment of tfcc lesion. Furthermore, it allows diagnosis of associated injuries once present. However the potential problem of arthroscopic techniques is the ideal insertion site of the detached tfcc in its isometric point Atzei and colleagues [18].

Atzei and colleagues [19] have developed the direct foveal portal which allow direct visualization of the fovea and direct repair of the tfcc to its foot print, beside, it allows thorough preparation of the fovea to create optimized field for healing of the tfcc.

We believe that making an incision along the volar aspect of ECU is important to preserve the dorsal cutaneous branch of ulnar nerve and hence preventing painful neuroma.

Atzei and colleagues have reported their results in 12 patients, where, Mayo score improved to 88% and VAS score improved to 2, and druj was stable in all patients in their series. Their results are better than results obtained to our study [19].

Many studies have reported their results of arthroscopic technique using various methods of fixation as interoseeous tunnels by Nakamura, single interosseous tunnel by park *et al.*, all inside technique using swivel lock anchor or using pushlock anchor in the distal ulna. They reported good to excellent results comparable to our results Atzei and colleagues, del Pinal and colleagues [20–22].

Luchetti and colleagues [23] compared between open and arthroscopic assisted foveal tfcc repair for druj instability and reported better results using the arthroscopic technique.

Many authors reported results of open reattachment of the tfcc. Hermansdorfer and Kleinman, Nakamura and colleagues reported 11 patients of open tfcc repair, where excellent results obtained in 8 patients while 3 patients had unsatisfactory results. Chou and colleagues reported 3 out of 8 had excellent results. Nakamura and colleagues reported 56 patients with excellent results [24–26].

We used mini anchor device in the foveal foot print to allow direct repair of tfcc and we think it is easier and less demanding than using interosseous tunnel.

The single most important factor for successful foveal reattachment is the ability of tfcc to heal to its foot print by Sharpeys fibers Nakamura and colleagues [27]. We think that direct foveal portal allow direct preparation of the foveal with removal of scar tissue and curettage till bleeding surface which may make the ideal field for healing of the tfcc.

We did not use druj portal to assess foveal site because we think that hook test performed through radiocarpal arthroscopy is sensitive to foveal detachment, and druj portal needs 1.9 mm scope which is not available in our institution.

The main drawback of our study is the retrospective nature, small number of patients and absence of comparison with other techniques.

Conclusion

Arthroscopic assisted technique for reattachment of tfcc to fovea in major tears associated with druj instabilty is considered a valuable technique with minimal complications and good function and allow early return of function and range of motion.

ID	Age	Gender	Dominant hand	Prevas	Premayoscore	Onset	Handgrippre	Handgrippost	Postvas	Postmayoscore	Duration
1	20	1	1.00	8.00	25.00	4.00	30.00	75.00	2.00	80.00	14.00
2	26	1	1.00	7.00	40.00	2.00	25.00	70.00	1.00	70.00	12.00
3	32	2	1.00	8.00	20.00	2.00	39.00	66.00	2.00	70.00	16.00
4	16	1	1.00	8.00	25.00	6.00	30.00	65.00	2.00	70.00	8.00
5	36	1	2.00	7.00	40.00	1.00	20.00	65.00	2.00	100.00	20.00
6	19	1	1.00	8.00	40.00	1.00	20.00	50.00	3.00	80.00	14.00
7	33	1	2.00	7.00	40.00	1.00	20.00	70.00	4.00	80.00	14.00
8	22	2	2.00	6.00	25.00	2.00	25.00	70.00	4.00	50.00	12.00
9	30	2	1.00	9.00	35.00	3.00	25.00	65.00	3.00	80.00	16.00
10	26	2	1.00	8.00	35.00	2.00	30.00	50.00	7.00	30.00	14.00
11	32	1	1.00	7.00	40.00	2.00	30.00	75.00	3.00	50.00	14.00
12	18	1	1.00	9.00	20.00	2.00	30.00	70.00	3.00	70.00	12.00
13	27	2	2.00	6.00	25.00	4.00	25.00	65.00	3.00	70.00	16.00
14	25	1	2.00	8.00	20.00	1.00	25.00	40.00	4.00	70.00	12.00
15	25	2	1.00	7.00	40.00	1.00	25.00	50.00	3.00	70.00	16.00
16	27	2	2.00	5.00	25.00	2.00	25.00	55.00	3.00	80.00	14.00
17	26	1	1.00	6.00	25.00	1.00	30.00	60.00	3.00	70.00	14.00
18	29	1	1.00	6.00	25.00	5.00	20.00	70.00	3.00	70.00	10.00
19	23	1	2.00	6.00	40.00	6.00	20.00	70.00	3.00	70.00	18.00
20	26	1	2.00	7.00	20.00	4.00	20.00	60.00	4.00	70.00	14.00

Financial support and sponsorship
Nil.

Conflicts of interest
The authors declare that they have no conflict of interest related to the study.

References

1 Nakamura T, Yabe Y, Horiuchi Y. Functional anatomy of the triangular fibro cartilage complex. J Hand Surg [Br] 1996; 21:581–586.

2 Palmer AK Triangular fibrocartilage complex lesions: a classification. J Hand Surg [Am] 1989; 14:594–606.

3 Palmer AK, Werner FW. The triangular fibrocartilage complex of the wrist— anatomy and function. J Hand Surg [Am] 1981; 6:153–162.

4 Adams BD, Holly KA. Strains in the articular disk of the triangular fibrocartilage complex: a biomechanical study. J Hand Surg [Am] 1993; 18:919–925.

5 Kauer JMG. The distal radioulnar joint: anatomic and functional considerations. Clin Orthop 1992; 275:37–45.

6 Atzei A, Luchetti R, Garcia-Elias M. Lesioni capsulo-legamentose della radio-ulnare distale e fifi brocartilagine triangolare. In: Landi A, Catalano F, Luchetti R, (eds). Trattato di Chirurgia della Mano. Italy: Verduci Editore Roma. Italy: 2006. pp. 159–187.

7 Kleinman WB. Stability of the distal radioulnar joint: biomechanics, pathophysiology, physical diagnosis and restoration of function. What we have learned in 25 years. J Hand Surg [Am] 2007; 32:1087–1106.

8 Garcia-Elias M, Smith DE, Llusa M. Surgical approach to the triangular fibrocartilage complex. Tech Hand Up Extrem Surg 2003; 7:134–140.

9 Nakamura T, Nakao Y, Ikegami H, Sato K, Takayama S. Open repair of the ulnar disruption of the triangular fifi brocartilage complex with double three-dimensional mattress suturing technique. Tech Hand Up Extrem Surg2004; 8:116–123.

10 Chou KH, Sarris IK, Sotereanos DG. Suture anchor repair of ulnar-sided triangular fifi brocartilage complex tears. J Hand Surg [Br] 2003; 28:546–550.

11 Tomaino M, Weiser R. Combined arthroscopic TFCC debridement and wafer resection of the distal ulna in wrists with triangular fifi brocartilage complex tears and positive ulnar variance. J Hand Surg [Am] 2001; 26:1047–1052.

12 Atzei A. New trends in arthroscopic management of type 1-B TFCC injuries with DRUJ instability. J Hand Surg [Eur]2009; 34:582–91.

13 Hanker GJ. Management of ulnar impaction syndrome. In: Geissler WB (ed). Wrist Arthroscopy. New York: Springer-Verlag; 2005. pp. 63–71.

14 Moskal MJ, Savoie FHIII. Management of lunotriquetral instability. In: Geissler WB, (ed). Wrist Arthroscopy. New York: Springer-Verlag; 2005. pp. 94–101.

15 Atzei A, Luchetti R. Clinical approach to the painful wrist. In: Geissler WB, (ed): Wrist Arthroscopy. New York: Springer-Verlag; 2005. pp. 185–195.

16 Pederzini L, Luchetti R, Soragni O, Alfarano M, Montagna G, Cerofolini E, *et al*. Evaluation of the triangular fifi brocartilage complex tears by arthroscopy, arthrography, and magnetic resonance imaging. Arthroscopy 1992; 8:191–197.

17 Fulcher S, Poehling G. Th e role of operative arthroscopy for the diagnosis and treatment of lesions about the distal ulna. Hand Clin 1998; 14:285–296.

18 Atzei A, Rizzo A, Luchetti R, Fairplay T. Arthroscopic foveal repair of triangular fibrocartilage complex peripheral lesion with distal radioulnar joint instability. Tech Hand Up Extrem Surg 2008; 12:226–235.

19 Atzei A, Luchetti R, Fairplay T. Arthroscopic foveal repair of tfcc peripheral lesion with druj instability. Tech in hand and upper extremity surg 2008; 12:226-35.

20 Atzei A, Luchetti R, Borelli PP. Arthroscopic TFCC reconstruction by tendon graft. Riv Chir Mano 2006; 43:370–376.

21 Atzei A, Luchetti R, Sgarbossa A, Carità E, Llusà M. Set-up, portals and normal exploration in wrist arthroscopy. Chir Main 2006; 25:S131–S144.

22 del Piñal F, García-Bernal FJ, Pisani D, Regalado J, Ayala H, Studer A. Dry arthroscopy of the wrist: surgical technique. J Hand Surg [Am] 2007; 32:119–123.

23 Luchetti R, Atzei A, Cozzolino R, Fairplay T, Badur N. comparison between open and arthroscopic assisted foveal tfcc repair for post-traumatic distal radioulnar joint instability. j hand surg Eur 2014; 39:845–55.

24 Hermansdorfer JD, Kleinman WB Management of chronic peripheral tears of the triangular fibrocartilage complex. J Hand Surg [Am] 1991; 16:340–6.

25 Chou KH, Sarris IK, Sotereanos DG. Suture anchor repair of ulnar sided triangular fibrocartilage complex tears. J hand surg [Br] 2003; 28:546–50.

26 Nakamura T, Sato K, Okazaki M, Toyama Y, Ikegami H. repair of foveal detachment of the triangular fibrocartilage complex: open and arthroscopic transosseous techniques. Hand Clin 2011; 27:281–90.

27 Nakamura T, Takayama S, Horiuchi Y, Yabe Y. origins and insertions of the triangular fibrocartilage complex: a histological study. J hand surg [br] 2001; 26:446–54.