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Abstract	Ulnocarpal abutment is the inversion of the distal radioulnar index with a positive ulnar variance (long ulna) and is most frequently secondary to distal radius fractures. The relative “shortening of the radius” leads to a conflict between the ulnar head and the proximal lunate (Fig. 13.1). The natural evolution of this condition is usually a central perforation of the TFCC. This lesion eventually leads to arthritis of the medial proximal lunate as well as that of the ulnar head. Persistence of the abutment may further lead to lunotriquetral dissociation (Fig. 13.2a–c).

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Ulnocarpal Abutment: State of the Art and the Role of Arthroscopy

13

Ch. Mathoulin

Introduction

Ulnocarpal abutment is the inversion of the distal radioulnar index with a positive ulnar variance (long ulna) and is most frequently secondary to distal radius fractures. The relative "shortening of the radius" leads to a conflict between the ulnar head and the proximal lunate (Fig. 13.1). The natural evolution of this condition is usually a central perforation of the TFCC. This lesion eventually leads to arthritis of the medial proximal lunate as well as that of the ulnar head. Persistence of the abutment may further lead to lunotriquetral dissociation (Fig. 13.2a–c).

There are many management options for the distal radioulnar component of distal radius malunions, that cause the most common ulnocarpal abutment, with the radius shortening associated with the dorsal tilt, and the choice depends on clinical evaluation and imaging of this joint. Arthroscopic treatment, when possible, remains the simplest and best solution for these patients.

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Indications

Clinical and Paraclinical Assessment

The clinician should differentiate between symptoms related to a pronosupination problem and those arising from proper wrist movements. It is crucial to determine whether the symptoms are caused by the distal radioulnar joint itself or by the ulnocarpal abutment that follows.

The evaluation of functional disability must take into consideration age, dominance, and nature of daily activities whether professional or sports.

Active motion is assessed on flexion-extension and pronation-supination.

Grip strength on both sides is measured using the Jamar.

Posteroanterior and lateral views are taken in neutral position (Fig. 13.3). It is very important to obtain strict PA views in neutral wrist position using radiotransparent plates that sandwich the wrist and forearm. Analysis allows the study of the radioulnar variance usually using the concentric circles of Palmer (1). The measurements must be comparative [AU2] as this index is extremely variable. It increases in pronation with a clenched fist and decreases with supination. Dynamic posteroanterior clenched fist views in pronation emphasize the signs of ulnolunate conflict (Fig. 13.4). A CT arthroscanner is useful for showing the state of the cartilage. MRI may also be useful for this purpose (Fig. 13.5).

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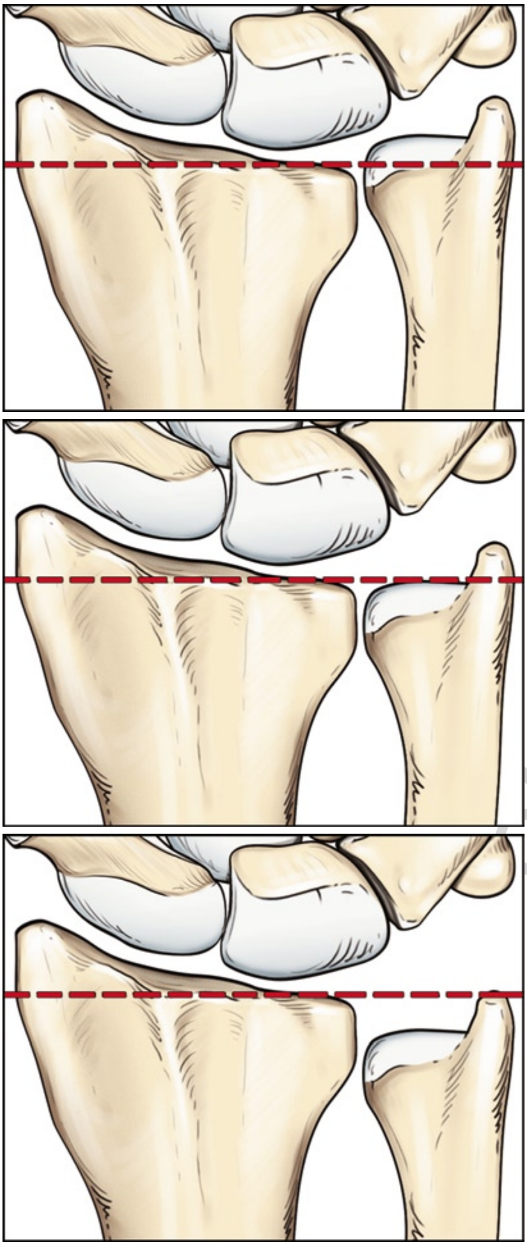

Fig. 13.1 Diagram showing the different relationship between the ulna and radius, measured in neutral position: long ulna, ulna normal, and short ulna

Classical Treatment

1. Ulnar Shortening Osteotomy (USO)
   Described by Milch in 1941, this is the most logical technique. An approach to the inner border of the forearm is required, as the shortening is diaphyseal (Fig. 13.6).

   A dorsoulnar incision is made on the distal one-third of the forearm. The dorsal sensory branch of the ulnar nerve is identified and protected. A 6-hole 3.5-mm DCP plate is positioned at the distal ulna, and the three metaphyseal holes are made. The fragment to be removed is marked using a diathermy blade, and the osteotomy is made using an oscillating saw at low speed under continuous irrigation. The osteotomy may be perpendicular, oblique, or Z shaped. Two parallel saw cuts are made. They are usually from 3 to 8 mm in order to correct the modification of the ulnar variance.

   Fixation and compression are achieved using a plate with 3.5-mm screws. The forearm is immobilized for 21 days postoperatively for pain relief. USO may be associated with radial osteotomy. The most frequent complication of this technique is nonunion.
2. Hemiresection of the Ulnar Head
   Described by Bowers, and modified by Fernandez, this technique involves the hemiresection of the ulnar head through a dorsal approach (Fig. 13.7). A 2-cm flap of the extensor retinaculum is raised over the fourth compartment toward the ulna, taking care not to open the ECU compartment. The EDM is retracted radially. The dorsal capsule of the DRUJ is raised from the sigmoid notch and dissected ulnarly to expose the ulnar head and the TFCC. The ulnar head is resected obliquely from the base of the styloid to the radial side of the neck of the ulna, taking care to preserve the insertion of the TFCC (Fig. 13.8). A musculotendinous flap is harvested using half the ECU, rolled over itself in an anchovy and sutured using absorbable sutures, and inserted into the space left by the resected head (Fig. 13.9). It is fixed to pronator quadratus as well as the dorsal border of the TFCC. The extensor retinaculum and dorsal capsule are closed in one plane using transosseous sutures onto the sigmoid notch (Fig. 13.10).

   Immobilization in a cast for 6 weeks is done, and physiotherapy is commenced afterward.
3. Total Resection of the Ulnar Head (Darrach's Technique)

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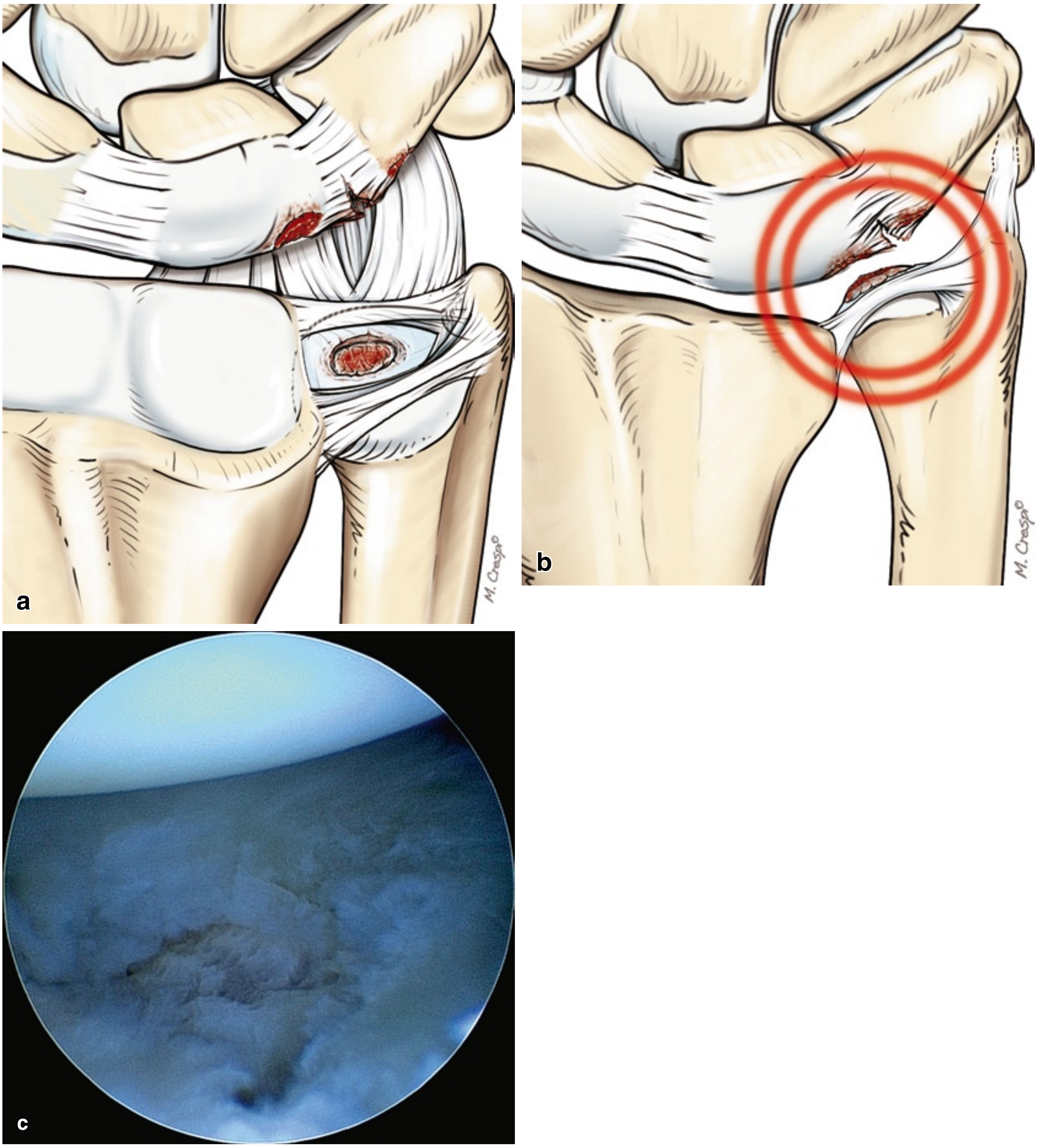

Fig. 13.2 (**a**, **b**) Diagram showing inversion of the distal radioulnar index with abnormal contact between the ulnar head and the internal radiocarpal aspect of the lunate. It is worthy of note that this type of conflict only occurs if the radius has been correctly reduced with a simple axial impaction. Malunions in radial deviation are certainly unsightly, but they protect the ulnar side of the wrist and avoid conflict. (**c**) Operating view showing the central perforation of TFCC with chondral change on ulnar head

This technique was first described by Darrach in 1912 for chronic posttraumatic dislocation of the ulna. The dorsal annular ligament is identified through a dorsal paramedian incision. It is incised on its ulnar border, and a rectangular flap is raised on a radial hinge until the fourth compartment. The capsule is carefully incised axially, identifying both flaps. The ulnar head is approached subperiosteally, preserving the median ligaments. The incision is made as radially as possible, preserving the pronator quadratus insertion. After modeling the ulnar stump to a rounded shape, stabilization

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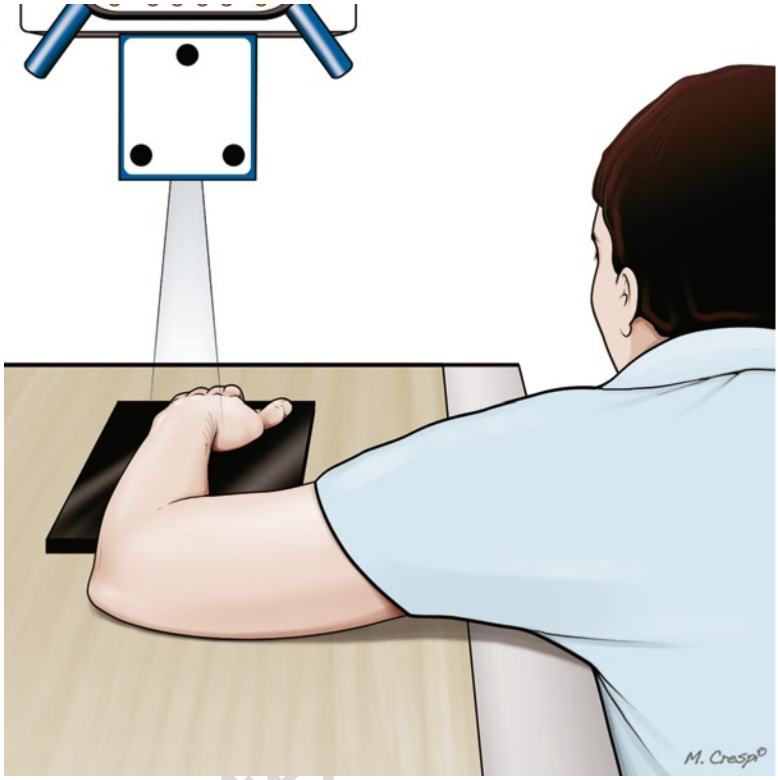

Fig. 13.3 To obtain a neutral pronation position, the arm is at 90° to the body axis with 90° elbow flexion and the hand on the radiology plate

Fig. 13.4 Dynamic view in radial deviation emphasizing the ulnolunate conflict

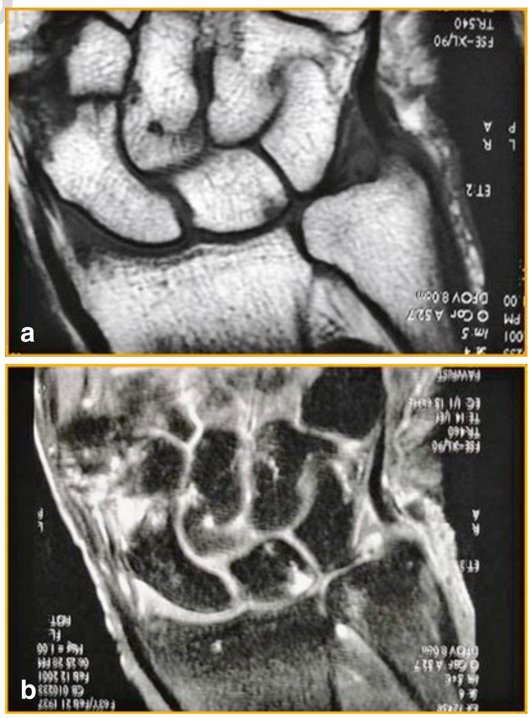

Fig. 13.5 MRI showing the reality of the ulnolunate conflict in two views with cartilage still preserved, but pathological aspect of the subchondral bone especially of the lunate

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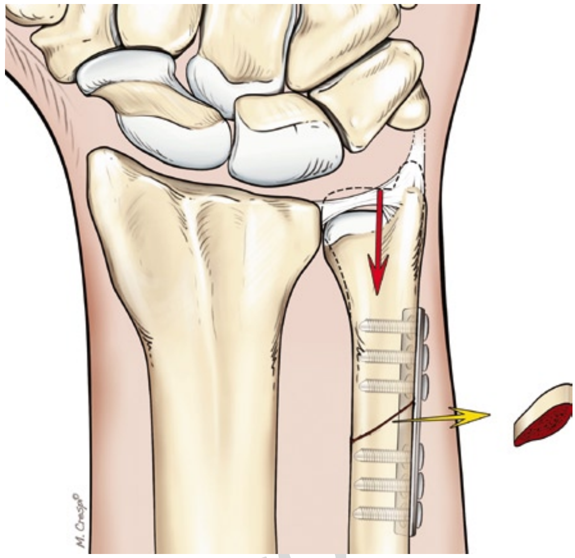
[AU3] **Fig. 13.6** Diagram showing the principle of Milch's ulnar shortening



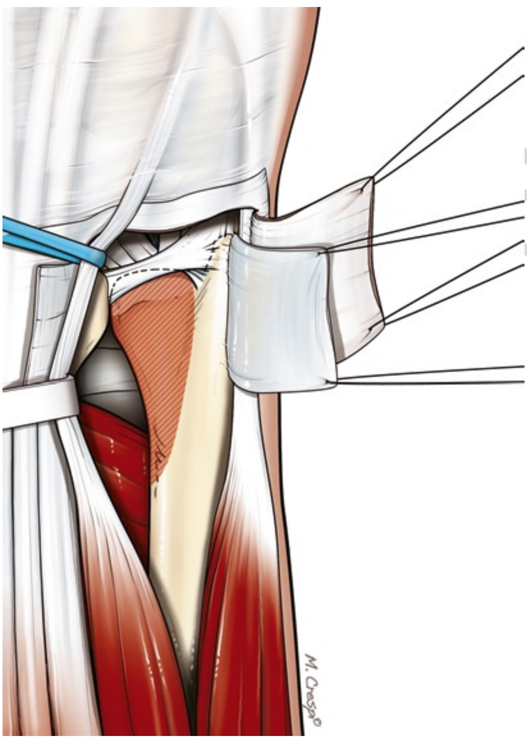


Fig. 13.7 Diagram showing the principle of Fernandez hemiresection

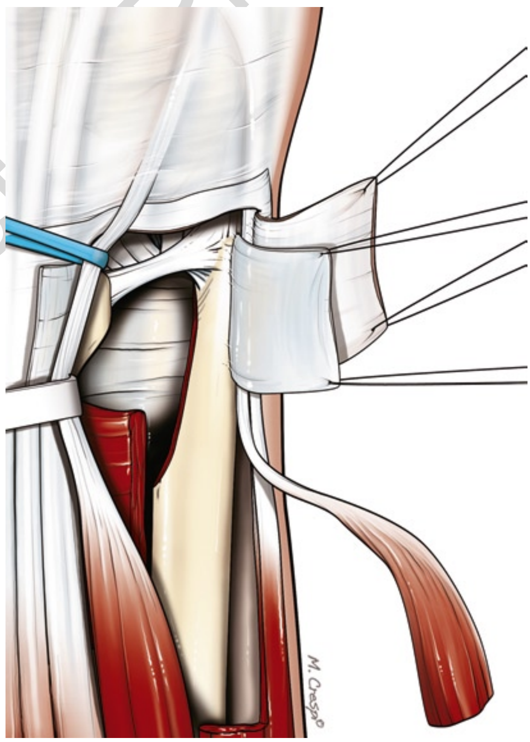


Fig. 13.8 Diagram showing the hemiresection preserving TFCC and harvesting half of ECU

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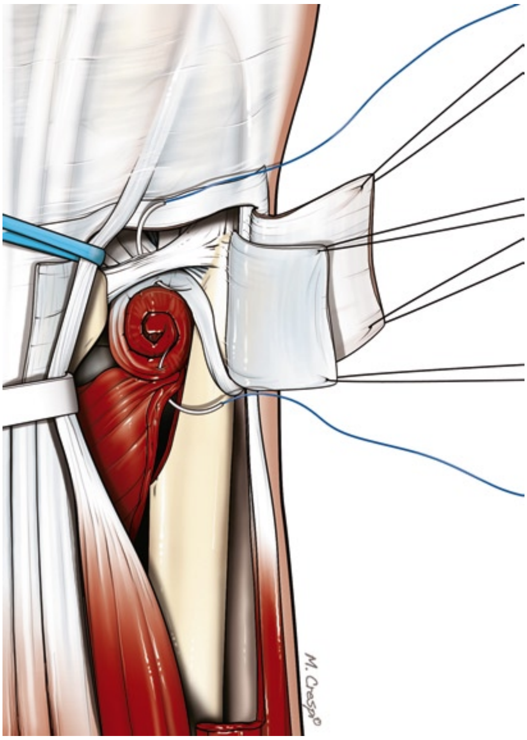

Fig. 13.9 Diagram showing half of ECU rolled over itself and inserted into the space left by the resected head

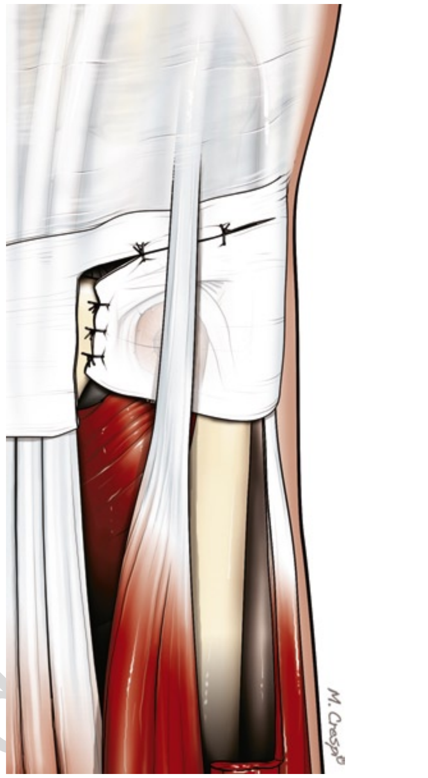

Fig. 13.10 Diagram showing the extensor retinaculum and dorsal capsule closed in one plane using transosseous sutures onto the sigmoid notch

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is done at several planes. The capsule is resected and sutured. The retinaculum is reinserted medially onto itself, adjusting the tension and passing below the ECU tendon which is dorsalized, lateralized, and stabilized by a retinacular flap. Stabilization may be easier using hemi-ECU which is passed across the distal ulna and fixed onto itself (Fig. 13.11a, b).

4. Sauvé-Kapandji Technique
   This was described in 1936 by Sauvé and Kapandji.Although described for distal radioulnar dislocations unstable after reduc tion, it can be used for ulnolunate conflict with radioulnar dislocation and is exceptional in pure ulnolunate conflict (Fig. 13.12).
5. Ulnar Head Prosthesis
   Ulnar head prostheses are actually rarely used but could potentially become a therapeutic option.

Arthroscopy in Treatment of Ulnolunate Conflict

Wrist arthroscopy, popularized by Whipple in 1986, has since become a routine examination.

Arthroscopy is the best tool for assessing the gravity of ulnolunate conflict; lesions of the cartilage can be seen directly. This is even more pertinent in early cases where the lesions can be detected only by arthroscopy and are limited to the conflict zone. Arthroscopy at this stage may also show associated lesions in detail especially TFCC lesions which are almost always present. An inversion of the radioulnar index smaller than 5 mm may be treated arthroscopically using Feldon's partial ulnar resection technique (6). [AQ4] This technique was first done using the same approach as for Bower's partial resection – but we prefer to do it arthroscopically to minimize postoperative pain.

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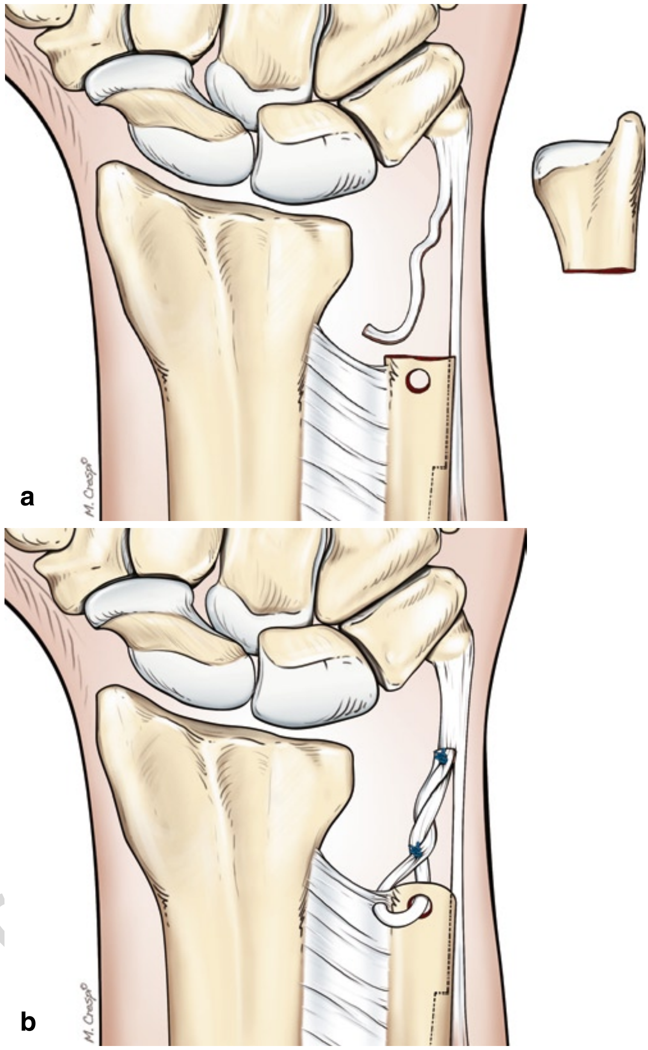

Fig. 13.11 (**a**, **b**) Diagram showing the ulnar head resection and the stabilization using hemi-ECU which is passed across the distal ulna and fixed onto itself

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Technique of Partial Resection of the Distal Ulna Under Arthroscopic Control

The patient lies supine with the arm flat and fixed to an arm table. At 90° elbow flexion, the forearm is under axial traction using the arthroscopy tower and Chinese finger traps. It is a day surgery under locoregional anesthesia and arm tourniquet. The scope is introduced through 3–4 portal, allowing exploration of the radiocarpal joint. A 6R portal allows treatment of lesions encountered and the ulnolunate conflict.

I use a 2.4-mm size arthroscope with a 3.o synovitomes and 3.o burr.

Usually, a central perforation of the TFCC is encountered with an ulnar head protruding into the radiocarpal joint. The cartilage on the ulnar head is assessed, and chondropathy is usually found (Fig. 13.13a–c) which is seldom seen on plain films at this stage. This chondropathy is also rarely seen even on arthrogram due to the small size of the lesion which is usually the cause of pain. It is at this stage where partial resection of the distal ulna resolves the ulnolunate conflict and the pain. After introduction of the scope through a 3–4 portal, and a microsuction forceps through

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Fig. 13.12 Clinical case showing long-term follow up of Sauvé-Kapandji osteotomy with interposition of a resected ulnar head fragment to preserve carpal breadth

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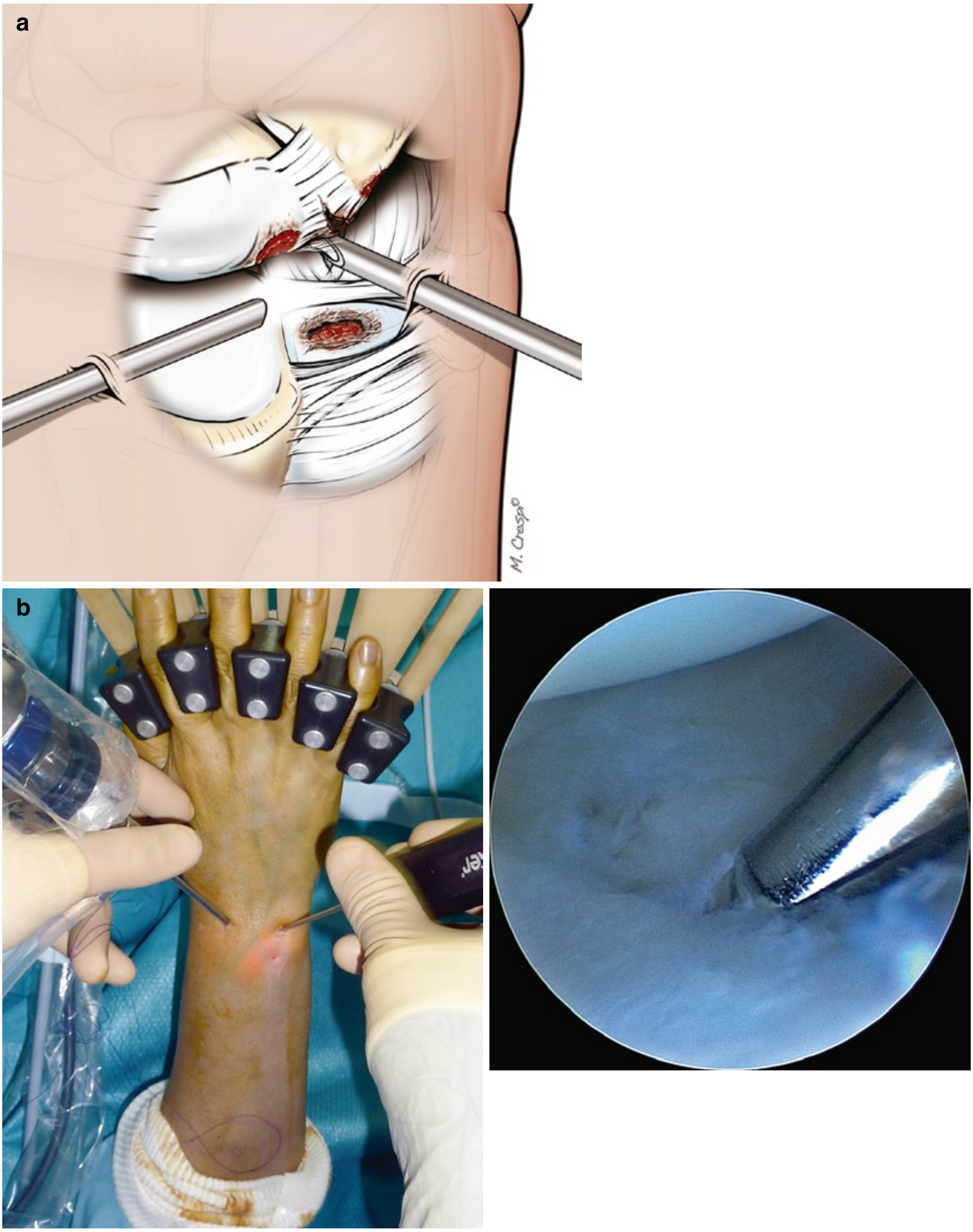

Fig. 13.13 (**a**) Diagram after traction, showing the TFCC central perforation, protrusion of the ulnar head, and cartilage lesions on the lunate. (**b**) Operating view showing the correct position of scope (3–4 radiocarpal portal) and shaver (6R radiocarpal portal). (**c**) Intra-articular operating view showing the central debridement of TFCC with a shaver

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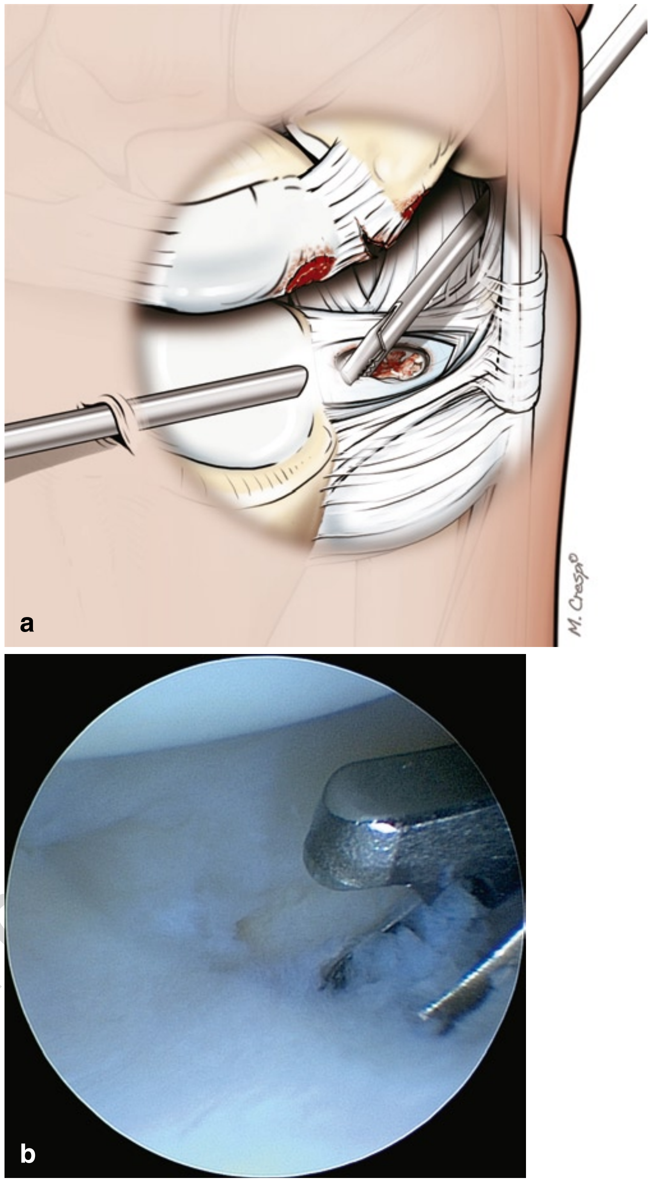

Fig. 13.14 (**a**) Diagram showing arthroscopic setup with central TFCC debridement using basket forceps. (**b**) Intra-articular view showing central debridement of TFCC with a basket forceps

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the 6R portal, the central TFCC perforation is first debrided and enlarged (Fig. 13.14a, b). The protruding part of the ulnar head is then resected using a burr under arthroscopic control (Fig. 13.15a, b). If the TFCC is intact, the arthroscope is introduced through the distal radioulnar joint and the burr directly onto the fovea distal and palmar to the ulnar styloid with the wrist in supination to avoid injury to the dorsal sensory branch of the ulnar nerve (see also Chap. 9).

Pronation-supination movements are made to ensure even resection of the anterior and posterior parts of the ulnar head respecting the distal radio ulnar joint (Fig. 13.16a–f).

The ulnar head is not perfectly spherical, and thus, these pronosupinatory movements allow tailored resection of the parts of the head protruding into the TFCC perforation. The resulting osteotomy is usually original, oblique, and helicoidal (Fig. 13.17a, b). This type of osteotomy is

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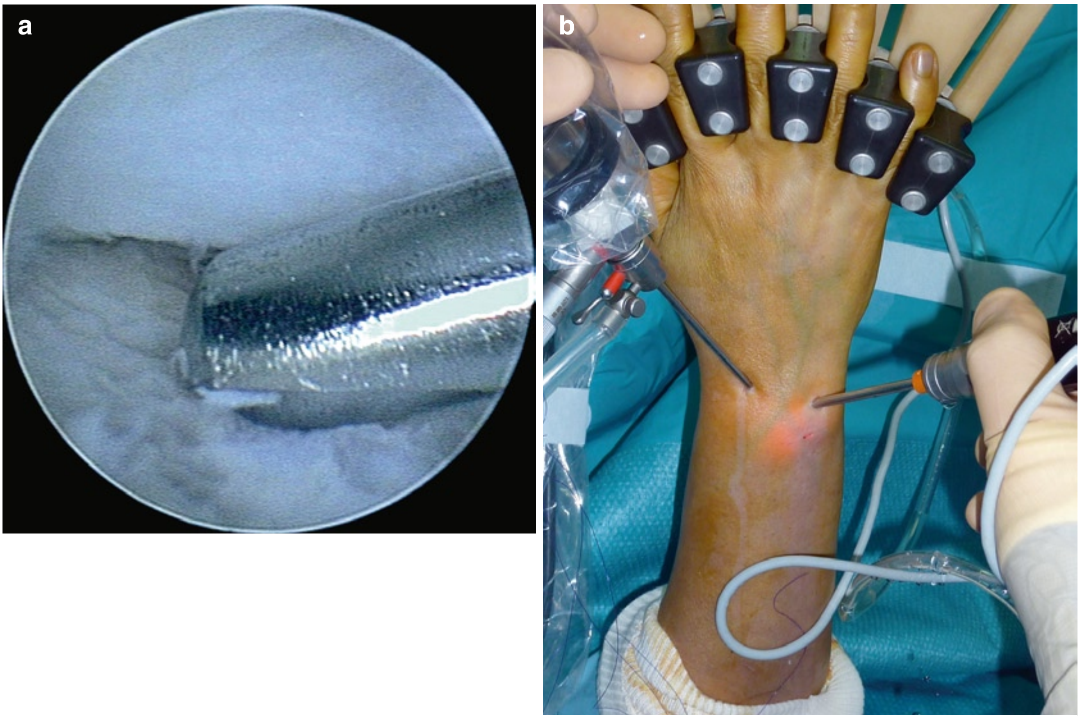

Fig. 13.15 (**a**) Arthroscopic view showing start of ulnar head resection using a burr. (**b**) Operating view showing the correct position of scope (3–4 radiocarpal portal) and burr (6R radiocarpal portal)

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not possible through a standard classic open approach using a straight osteotomy blade.

It is crucial to verify the integrity of the DRUJ at the end of the procedure (Fig. 13.18a–c).

Discussion

Ulnolunate conflict is the result of the inversion of the distal radioulnar index, most commonly following a distal one-fourth radius fracture with impaction in the axis of the distal radius. Ulnolunate conflict causes a central TFCC perforation with cartilage lesions of the distal ulnar head and the lunate. Clinical wrist examination reveals ulnar pain exacerbated in pronation and ulnar deviation of the wrist. This pain may be related to a long congenital ulna (rare lesion), TFCC lesion, lunotriquetral lesion, radioulnar ligament lesion, or chondrocalcinosis of the ulnar head. The variety of possible lesions warrants systematic standard films followed by sophisticated complementary investigations – arthrogram or arthroscopy. Standard bilateral wrist films in supination, pronation, clenched fist, and strict frontal allow an objective measurement of the distal radioulnar index as well as distal radioulnar articular congruency. Complementary arthrogram or arthroscopy accurately shows associated cartilage lesions. The earlier the treatment, the better the results in preventing the inevitable evolution to arthritis.

Between 1998 and 2010, 2,023 wrist arthroscopies including 126 distal ulnar resections (6.23 %) were performed. In three cases with no TFCC lesion, a distal radioulnar approach was used.

In this series, patients included 49 men and 77 women of average age 68 (between 42 and 87 years). All were distal one-fourth radius fractures with axial impaction and inversion of the distal radioulnar index. The ulnar variance was 2.6 mm on average (2–5.5 mm). The mean delay

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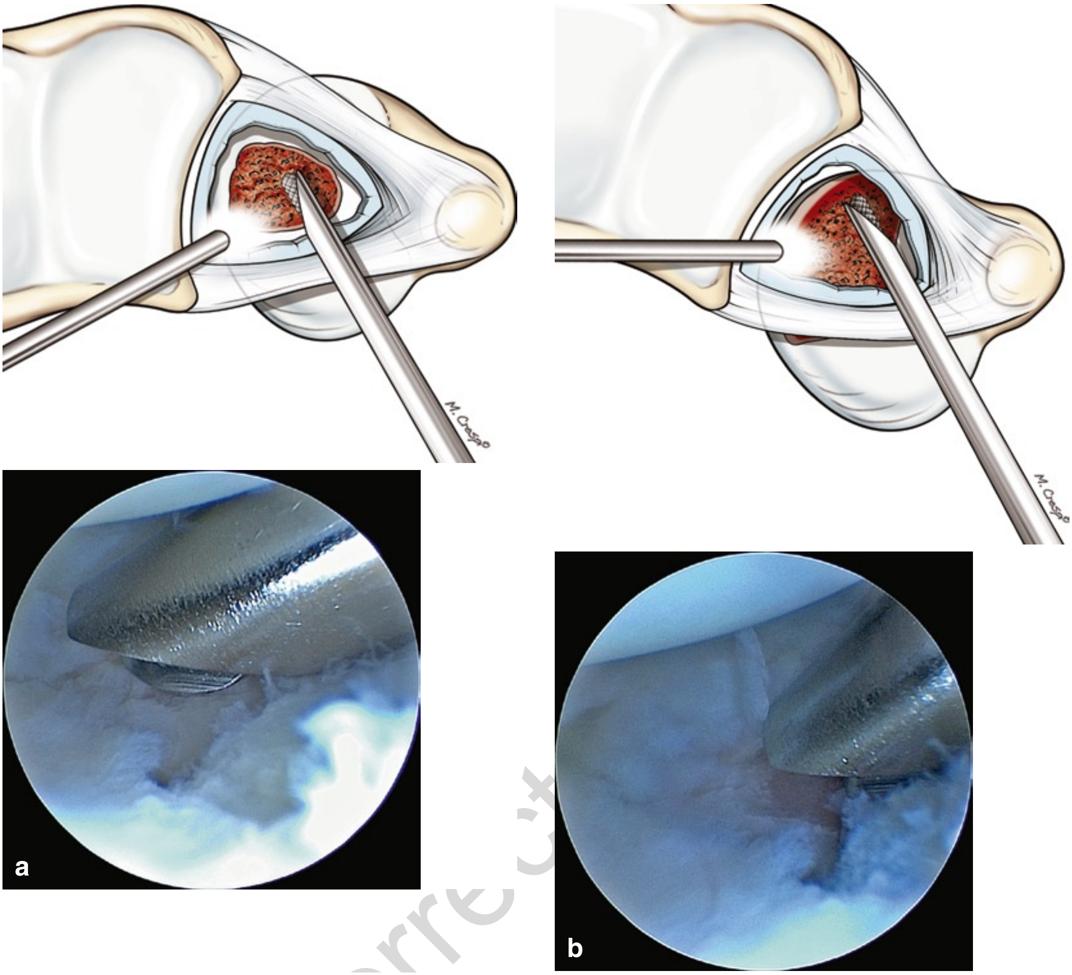

Fig. 13.16 (**a**–**f**) Diagram and intra-articular view showing arthroscopic resection of ulnar head using a burr with pronation-supination movements to ensure resection of the anterior and posterior parts of the ulnar head

between the fracture and the arthroscopic resection was 9.3 months (2–36 months). Arthroscopic resection was the only procedure performed in all cases. Pain was always present, permanent, and moderate in 80 cases and disabling in 46 cases. Force was diminished by more than half compared to the contralateral side. Mobility was already limited due to the often associated malunion of the distal one-fourth radius fracture. Pronosupination was less than 120° in 93 cases and less than 60° in 33 cases. None of the patients needed postoperative immobilization (Fig. 13.19a, b).

Our average follow-up is 35 months (12–97 months). Recovery of mobility was immediate in all cases with persistence of DRUJ pain in eight cases. In 71 cases, preoperative pain disappeared immediately postoperative. Force increased compared to preoperative values but never reached the value of the healthy contralateral side.

We observed three postoperative hematomas which resolved without treatment, residual limitation of pronosupination in 12 cases and 6 cases of CRPS which were diagnosed early, treated promptly, and recovered completely.

Conclusion

Arthroscopic treatment has proved its efficacy and its safety. It should nevertheless be limited to cases of inversion of small values (inferior

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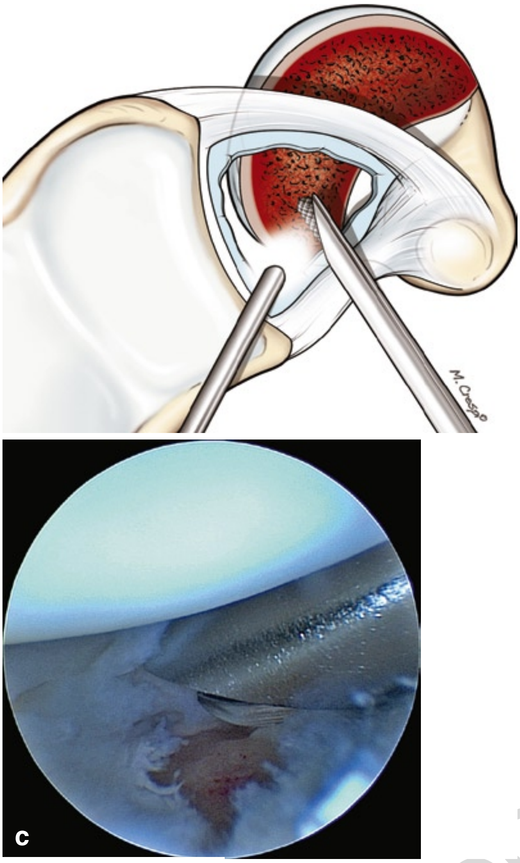

Fig. 13.16 (continued)

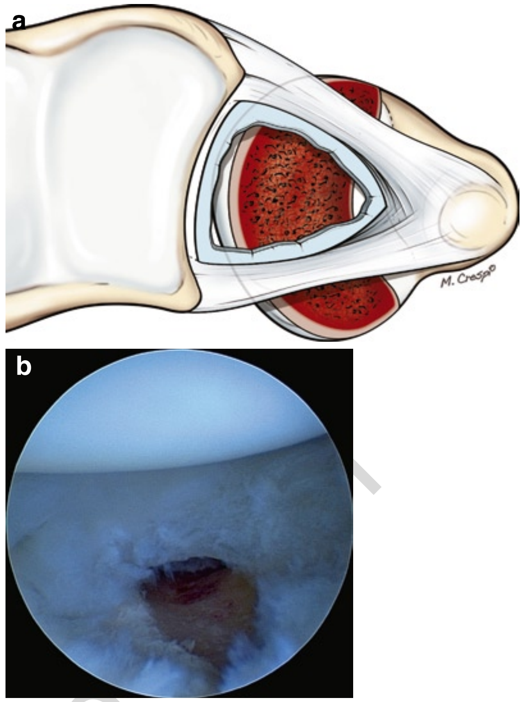

Fig. 13.17 (**a**, **b**) Diagram and intra-articular view showing the final resulting oblique and helicoidal osteotomy

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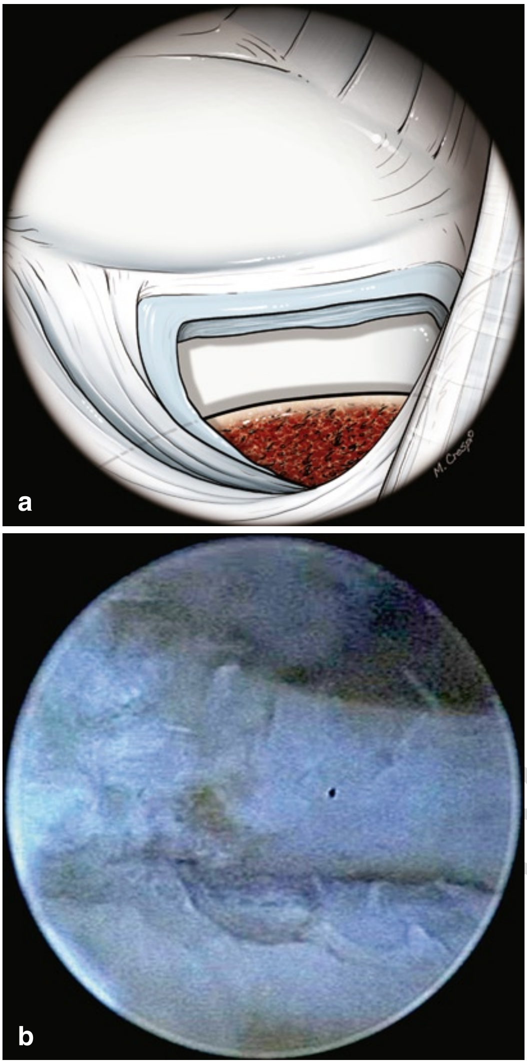

Fig. 13.18 (**a–c**) Diagram and arthroscopic views showing the whole DRUJ intact with arthroscope through 6R

to 5 mm). In greater ulnar variances, we prefer ulnar shortening osteotomy. Other techniques are reserved for cases with altered distal radioulnar joint.

Fig.13.19 (**a**) Case of ulnolunate conflict after distal radius fracture. (**b**) Plain views showing immediate postoperative results. The zone of conflict is eliminated with preservation of normal distal radioulnar joint and thus normal pronosupination

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