Distal radioulnar joint injuries

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ABSTRACT
Distal radioulnar joint is a trochoid joint relatively new in evolution. Along with proximal radioulnar joint, forearm bones and interosseous membrane, it allows pronosupination and load transmission across the wrist. Injuries around distal radioulnar joint are not uncommon, and are usually associated with distal radius fractures, fractures of the ulnar styloid and with the eponymous Galeazzi or Essex-Lopresti fractures. The injury can be purely involving the soft tissue especially the triangular fibrocartilage or the radioulnar ligaments. The patients usually present with ulnar sided wrist pain, features of instability, or restriction of rotation. Difficulty in carrying loads is a major constraint for these patients. Thorough clinical examination to localize point of tenderness and appropriate provocative tests help in diagnosis. Radiology and MRI are extremely useful, while arthroscopy is the gold standard for evaluation. The treatment protocols are continuously evolving and range from conservative, arthroscopic to open surgical methods. Isolated dislocation are uncommon. Basal fractures of the ulnar styloid tend to make the joint unstable and may require operative intervention. Chronic instability requires reconstruction of the stabilizing ligaments to avoid onset of arthritis. Prosthetic replacement in arthritis is gaining acceptance in the management of arthritis.

Key words: Distal radioulnar joint, TFCC, distal radius fracture, DRUJ injuries, DRUJ arthroplasty

INTRODUCTION

The distal radioulnar joint (DRUJ) is part of the complex forearm articulation that includes proximal radioulnar joint (PRUJ), forearm bones, and interosseous membrane (IOM) allowing pronosupination. It is functionally and anatomically integrated with the ulnocarpal articulation of wrist.

The DRUJ has evolved from the primitive pectoral fin of early fish to the bipedal primate wrist to its current form in human wrist. From the syndesmotic DRUJ of brachiating primates with limited forearm rotation, three major changes occurred, (a) development of a distinctly separate DRUJ, (b) recession of the distal ulna from the ulnar carpus, and (c) development of a distinct ulnocarpal meniscus. Along with these changes, humans have moved over from a knuckle walking to brachiating arboreal lifestyle to erect bipedal posture with almost 180° of pronosupination.

Injuries of the DRUJ may occur in isolation, or along with fractures of the distal radius. These may present acutely or as chronic instabilities or painful arthritis of the DRUJ. The diagnosis and management of these injuries require a good knowledge of the anatomy and clinical evaluation. The joint is important in the transmission of load and its anatomic integrity should be respected in surgical procedures if normal biomechanics are to be preserved.

Anatomy

DRUJ is a diarthrodial trochoid synovial joint, consisting of two parts—the bony radioulnar articulation and soft tissue stabilizers.

The radioulnar articulation is formed by the lower end of ulna (seat) and the sigmoid notch (medial articular facet) of the distal radius [Figure 1]. The sigmoid notch of the radius is concave with a radius of curvature of approximately 15 mm. The ulnar head is semicylindrical, convex, with a radius of curvature of 10 mm. The shape of sigmoid notch is not uniform and has been classified into—1) flat face, 2) ski slope, 3) C type, and 4) S type—which influences the predilection to instability. The flat face type is most susceptible to injuries. The distal articular surface of the ulna (dome or pole) is mostly covered by articular cartilage. At the base of the ulnar styloid is a depression called fovea, which is
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devoid of cartilage. The differential arc of curvature of ulna and sigmoid notch suggests that pronosupination involves rotation as well as dorsopalmar translation at the DRUJ. In pronation, the ulna translates 2.8 mm dorsally from a neutral position; in supination, the ulna translates 5.4 mm volarly from a neutral position relative to radius. The soft tissue stabilizers are collectively referred to as ulnoligamentous complex or more popularly as the triangular fibrocartilaginous complex (TFCC). It consists of the triangular fibrocartilage (TFC or articular disk), meniscal homologue, ulnocarpal (ulnolunate (UL) and lunotriquetral) ligaments, the dorsal and volar radioulnar ligaments, ulnar collateral ligament, and the extensor carpi ulnaris (ECU) subsheath. The ECU subsheath is reinforced medially by linear fibers referred to as the linea jugata. The radioulnar ligaments (dorsal and volar) are the primary stabilizers of the DRUJ. The secondary stabilizers include the ECU subsheath, the UL and ulnotriquetral (UT) ligaments, the lunotriquetral interosseous ligament (LTIOL). The distal interosseous ligament also plays a role in stabilizing the DRUJ. The principal attachment of the TFC, the radioulnar and ulnocarpal ligament is the fovea [Figure 2a,b]. The secondary attachment of these structures are the ulnar styloid. A fracture involving the base of the ulnar styloid, therefore, can make the DRUJ potentially unstable. Injuries that destabilize the DRUJ result from disruption of the TFC along with the primary stabilizers, ulnocarpal ligaments, and ECU subsheath. The important function of the DRUJ in load bearing and its effects following injury has been well studied.

**Clinical Evaluation**

Patients most commonly complain of ulnar-sided wrist pain (USWP), especially on loading the hand and rotating the forearm, particularly following trauma, eg, a fall on the outstretched hand (FOOSH). There will be tenderness over the ulnar aspect of wrist, localized to the underlying anatomical structure. Persistence of USWP and stiffness following distal radius fractures (DRF) point to DRUJ involvement. Clicking sounds, obvious instability, and weakness on lifting objects are also common complaints.

Impingement sign is usually positive in TFC injuries, but is by no means exclusive to this condition. This test is done by supinating and pronating the ulnar deviated wrist with elbows resting at 90° on the table. Focal tenderness just distal to ulnar styloid is suggestive of TFCC tear, while at the volar or dorsal margins of distal ulna head point to radioulnar ligament injury. Instability must be checked in different positions of supination and pronation. The ulna fovea sign is useful in detecting foveal disruptions and UT ligament injuries, which are two common causes of USWP.

The piano-key test is positive when the ulna head is depressed volarly with the examiner’s thumb and released, and it springs back like a piano key, suggesting instability. The table top test is done by asking the patient to press both hands on a flat table with forearm in pronation. With DRUJ instability, the ulna is more prominent dorsally and appears to sublux volarly with increasing pressure, creating a dorsal depression.

The Grind test is done by compressing the distal ulna and radius with the examiner’s hand and...
producing a grinding motion, which elicits pain to suggest presence of DRUJ arthrosis.

**Radiological Investigations**

A standard posteroanterior (PA) and true lateral X-ray is mandatory. In the standard PA view, the groove for the extensor carpi ulnaris (ECU) tendon on the distal ulna must be visualized radial to the ulnar styloid [Figure 3a]. The ulnar variance is calculated by measuring the distance between a perpendicular drawn to the long axis of ulna at the distal articular surface and the perpendicular to the long axis of radius at the level of the volar distal articular margin. In a true lateral view, the volar surface of pisiform must be placed midway between the volar margins of the distal pole of scaphoid and capitate. A clenched fist PA view in forearm pronation to assess DRUJ gap and weighted lateral stress view in pronation [Figure 3b] is helpful in assessing instability, while routine lateral views is not.

Computed tomography is useful to delineate sigmoid notch fractures and DRUJ injuries. Ligament injuries can be assessed indirectly by assessing the radioulnar articulation in various positions and also by loading views. Normal views are taken in neutral, supination, and pronation. Both wrists are imaged simultaneously to provide comparative views to assess degree of ulna displacement and asymmetry. Subsequently, loaded views may be taken using weights held in the hand and the views repeated. Three-dimensional (3D) reconstructions are helpful in assessing spatial relationship between the radius and ulna.

Magnetic resonance imaging (MRI) is useful for assessment of DRUJ ligaments [Figure 4a,b]. With a 3-T MRI, the radioulnar ligaments, ulnocarpal ligaments, and TFCC with its foveal attachment to distal ulna can be adequately visualized with an 86% sensitivity for detection of TFCC tears.

**Arthroscopy**

Arthroscopy is the gold standard for evaluation of TFCC injuries. The TFC, foveal attachment, the radioulnar ligament (RUL) and ulnar collateral (UC) ligaments are well visualized with 3,4 portal and other ulnar portals. The volar and dorsal DRUJ portals also provide limited views of the structures. Arthroscopic debridement as well as repair of TFCC can be done [Figure 5a-d].

**DRUJ injuries**

The injuries of the DRUJ may involve purely soft tissues or fractures of the radius and/or ulnar styloid or, more rarely, isolated dislocations of the joint. Table 1 classifies various types of injuries of DRUJ.

**Triangular fibrocartilaginous complex injury**

Melone described the traumatic TFCC disruption as a continuum of injury beginning at the ulnar styloid and, with increasing force, extending to the midcarpal joints. It was classified into five stages of increasing severity. Stage I: detachment of TFC from ulnar styloid, stage II: ECU

| Table 1: Injuries of DRUJ and TFCC- A working classification |
|-------------------------------------------------------------|
| **DRUJ injuries**                                           |
| A. Acute TFCC injuries                                      |
| 1. Acute dislocations of DRUJ                               |
| 2. DRUJ injuries associated with fractures, fracture dislocations |
| B. Chronic DRUJ injuries                                    |
| 1. Chronic TFCC injuries                                   |
| 2. Ulnar Impaction syndromes                               |
| C. DRUJ Arthritis                                           |

Figure 3: (a) X-ray evaluation of DRUJ. True PA views should show the groove for ECU radial to the ulnar styloid (red arrow). True lateral view should show the palmar edge of pisiform (red dotted line) midway between palmar borders of distal pole of scaphoid and capitate (yellow lines); (b) Scheker-weighted lateral view with patient holding 3 lb weight in the hand showing dorsal instability of the distal ulna. Weighted views provide loading of the DRUJ, bringing out instability, which may not be visible in routine X-rays (Scheker-weighted PA view is useful for diagnosis of ulna impingement syndrome following Darrach procedure if there is instability). [Picture courtesy, with permission: Dr Luis Scheker, Christine M Kleinert institute of Hand Surgery and Microsurgery, Louisville, KY, USA]
subsheath injury, stage III: ulnocarpal ligament disruption, stage IV: lunotriquetral ligament injury, and stage V: midcarpal ligament injury.

Palmer classified TFCC tears into Type I (traumatic) and Type 2 (degenerative). It is further subclassified based on the location of the injury in Type I or the extent of degeneration in Type 2 (see Table 2 for description). Type IA lesions are central tears and are the most common type of traumatic tears. This is not associated with instability of the DRUJ. These injuries can be symptomatic when there is an unstable flap of tissue, which “catch” on the joint surface.

Type 1B lesions are tears of the TFCC from its insertion into the distal ulna, either ligamentous avulsions from the fovea or fractures through the base of the ulnar styloid. Here, there is usually associated instability of DRUJ. Type 1C injuries involve the tear of volar ulnocarpal ligaments. These are high-energy injuries associated with DRUJ instability. Type 1D lesions are detachments of the radial insertion of the TFCC with or without marginal sigmoid notch fractures. These are associated with DRUJ instability.

Treatment of TFCC injuries commences with non-operative measures such as splinting or AE cast, modification of activity, occupational therapy, and nonsteroidal anti-inflammatory drugs (NSAIDs). Steroid injections into the DRUJ may be tried. Gross instability or associated unstable

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**Table 2: Classification of TFCC Injuries**

| Type | Description |
|------|-------------|
| Type 1 | Acute traumatic tears |
| 1A | Central TFC perforation |
| 1B | Peripheral ulnar side TFCC tear (±ulna styloid fracture) |
| 1C | Distal TFCC disruption (disruption from distal UC ligaments) |
| 1D | Radial TFCC disruption (±sigmoid notch fracture) |
| Type 2 | Degenerative |
| 2A | TFCC wear |
| 2B | TFCC wear with lunate and/or ulnar chondromalacia |
| 2C | TFCC perforation with lunate and/or ulnar chondromalacia |
| 2D | TFCC perforation with lunate and/or ulnar chondromalacia with LTIOL perforation |
| 2E | 2D + ulnocarpal arthritis |

Adapted from Palmer AK Triangular fibrocartilage complex lesions: a classification. J Hand Surg Am 1989 Jul;14(4):594-606
ulna styloid fractures warrants surgical intervention. Similarly, TFCC tears that fail to clinically improve following conservative care requires surgical treatment. Arthroscopic and open techniques for TFCC debridement or repair have been described for the treatment of acute and degenerative tears based on the location and size of the tears. Type 1A injuries with central perforation can be treated by arthroscopic debridement. The unstable flap can be removed by debridement with clinical improvement of symptoms. It has been shown that up to 80% of the disc can be removed without ensuing instability. Central tears are not amenable to repair due to avascularity of the central zone of the TFCC, which precludes healing. Type 1B or peripheral ulnar sided tears involve the vascular zone of the TFCC and can be repaired either arthroscopically or by open technique. Various arthroscopic techniques of TFCC repair have been described, such as inside-out, outside-in, and all-inside techniques. Similarly, Types 1C and D are also amenable to arthroscopic repair using the technique described by Trumble and coworkers. The TFCC repair can be done by open technique also.

Three surgical approaches to the DRUJ are used—dorsoulnar, ulnar, and palmar. We prefer to expose the DRUJ by a linear incision about 4 cm, between the extensor digitii minimi (EDM) and ECU tendons centered over the ulnar head as described by Adams. The EDM sheath is incised and tendon retracted to expose the capsule of DRUJ. Using an L-shaped capsulotomy, the DRUJ is exposed, taking care not to damage the DRUL. In this way, the TFC, ulna head, and soft tissues can be exposed and inspected. A transverse ulnocarpal capsulotomy is made to expose the distal aspect of TFC. Depending on the level of tear, insertion into ulna at the fovea or direct repair is with 2-0 absorbable sutures.

Isolated DRUJ dislocations

These are uncommon injuries and result from FOOSH or, rarely, a blow to the ulnar aspect of the wrist. This can be dorsal or volar. DRUJ dislocation may be simple or complex (when there is soft tissue interposition, which prevents reduction). Failure to diagnose and treat a complex DRUJ dislocation will lead to chronic, persistent subluxation or dislocations, or both, and to symptomatic osteoarthrosis. The dorsal dislocation is more common with the ulna moving dorsally in relation to the radius following hyperextension of the wrist with hyperpronation forces. The TFCC is avulsed from its foveal insertion in these injuries. The secondary stabilizers of the DRUJ including the IOM, UC ligaments, and ECU subsheath provide sufficient stability to prevent instability following healing. Clinically, a prominent ulnar head is visible over the dorsal wrist. In our experience, closed manipulation and reduction under anesthesia is usually successful. Forcible supination of radius while pushing the ulna head volarwards reduces dorsal dislocation, while forcible pronation with dorsally directed pressure on the ulna head reduces dorsal and volar-ward DRUJ dislocations, respectively. Once the joint is reduced, stability must be verified by translating the ulna volar and dorsally. We immobilize dorsal dislocations in an above elbow plaster of Paris (POP) cast in supination, and volar dislocations in pronation for a period of 6 weeks. If instability persists after reduction, radioulnar pinning is done in reduced position to allow soft tissue healing. TFCC repair, either open or arthroscopic, needs to be also considered in case of severe disruptions. Soft tissue interposition can result in irreducibility. The ECU tendon is the most common culprit. In this situation, open reduction and release of the interposed tendon or ligamentous structure is required followed by pinning of the joint.

DRUJ injuries associated with fractures and fracture-dislocations

Distal radius fractures and ulnar styloid fractures

Forearm supination and pronation is important for optimum function and positioning of the hand in space. The most common cause of residual wrist disability after DRF is the DRUJ involvement. Three basic causes that result in radioulnar pain and limitation of forearm rotation are instability, joint incongruency, and unocarpal abutment. The last two entities initiate irreversible cartilage damage that eventually leads to degenerative joint disease. Early recognition and management in the acute stage aim at the anatomic reconstruction of the distal radioulnar joint including bone, joint surfaces, and ligaments in an effort to reduce the incidence of painful sequelae and functional deficit. Experimentally, it is found that severely displaced DRF result in disruption of TFCC in the absence of ulna styloid fractures. USF through the base results in DRUJ instability if the fragment involves the foveal insertion of the TFCC. Concurrent arthroscopic evaluation of patients with DRF requiring operative intervention for reduction revealed an incidence of TFCC injury in 43% of the cases. Similarly, fractures through the sigmoid notch produce stiffness and late onset arthritis of the DRUJ. The DRUJ can be injured in association with almost any fracture of the forearm or as an isolated phenomenon. Failure to recognize a simple or complex dislocation of the DRUJ associated with a fracture of the forearm may result in inappropriate or inadequate immobilization of the dislocated joint after internal fixation of the fracture. As a consequence, the injured TFCC may not heal, leading to recurrent postoperative instability. After either a simple or a complex dislocation of the DRUJ associated with a fracture of the forearm, the TFCC repair have been described, such as inside-out, outside-in, and all-inside techniques. Similarly, Types 1C and D are also amenable to arthroscopic repair using the technique described by Trumble and coworkers. The TFCC repair can be done by open technique also.

Assessment of DRUJ stability following DRF are best
done intraoperatively after fixation of the radius fracture by translation of the ulna in a dorsopalmar direction. If in doubt, we also compare it with the normal side. However, careful assessment of the preoperative X-rays can indicate a possibility of DRUJ instability. These include: 1) shortening of radius >5 mm relative to ulna, 2) fracture of the base of ulnar styloid, 3) widening of the DRUJ interval on PA view, and 4) dislocation of the DRUJ on lateral view.\textsuperscript{39,40} Computed tomography scans, especially axial views, can provide information regarding subluxation and fractures of the ligamentous margins of radius and ulna. DRF with fracture of the dorsal or volar ulnar margins can be unstable as these include insertion of the dorsal or volar RUL. Similarly, sigmoid notch fractures, especially shearing type of fractures, produce instability due to involvement of TFC radial insertion. Therefore, it is necessary to include these fragments in the fixation of the DRF, either with the plate itself or with additional screws or K-wires [Figures 6 and 7]. Fragment-specific fixation is helpful in these situations. About 61\% of DRF are associated with ulna styloid fractures.\textsuperscript{41} However, there are recent reports that did not find significant relationship between functional outcome and ulnar styloid fractures (USF), which were not fixed following stable fixation of distal radius fracture.\textsuperscript{42,43} In our practice, we tend to fix the unstable USF rather than not, commonly by open reduction and tension band fixation, when associated with DRF.

Ulna styloid fractures may also be seen in isolation. While styloid tip fractures are stable, basal fractures of the styloid are associated with DRUJ instability.\textsuperscript{44,45} Fixation of styloid fracture makes the DRUJ stable, provided the TFCC is not otherwise injured. We use various fixation techniques that has been described for styloid fractures including closed pinning, tension band wiring [Figure 6], compression screw fixation, suture anchor technique, etc.\textsuperscript{15} When symptomatic nonunions of styloid are seen, subperiosteal excision of the smaller fragments, or TFCC reattachment to the base with transosseous sutures and excision of larger fragments can be done.\textsuperscript{46} Comminuted, unstable, or displaced distal ulna neck fractures must also be fixed to maintain DRUJ stability and congruence.

\textit{Galeazzi fracture–dislocation} is a diaphyseal fracture of radius with associated DRUJ dislocation, with the fracture of radius seen 4-6 cm proximal to DRUJ. Palmer Type IB TFCC injury is classically seen. In the authors experience, operative fixation of the radius is necessary due to inherent instability.

\textbf{Figure 6:} X-ray of wrist with distal forearm and hand anteroposterior and lateral views showing (a) Ulnar styloid with DRUJ instability (b) treated by open reduction and tension band fixation. Joint was stable following union of fracture. (c) Pre- and postoperative X-rays of a patient with fracture of the ulnar head (d) treated by ORIF with screws
When the radius fracture is within 7.5 cm of the distal radius, DRUJ injury is highly likely. Other radiologic parameters of instability mentioned above may also be considered. About 80% of these injuries presented with complete dislocation of DRUJ. Once the radius is stabilized, the DRUJ usually falls into position in most cases (simple dislocations). Further, instability is checked and if present, the DRUJ is pinned [Figure 7]. If the DRUJ fails to reduce after radius fixation, interposition of soft tissue, especially the ECU tendon, must be suspected (complex dislocations). In these situations, open reduction with extraction of the interposed soft tissue and open repair of the TFCC is required.

**The Essex–Lopresti injury** is the eponymous injury with comminuted fracture of radial head associated with DRUJ dislocation. The injury is by an axial compression force resulting in longitudinal disruption of the proximal and distal radioulnar articulation and the IOM. Long-term longitudinal instability will persist if not adequately treated with proximal radius migration and distal ulna impaction. In suspected cases, radiographs of the elbow, forearm, and wrist must be taken. MRI and ultrasound evaluation of soft tissue damage of IOM is helpful. Excision of radial head is contraindicated in these injuries. A classification system has been proposed with suggested management options [Table 3]. The DRUJ stability is evaluated following fixation of radial head and if unstable, radioulnar pinning/TFCC repair may be necessary.

### Table 3: Classification of Essex–Lopresti classification and suggested management

| Type          | Radial head fracture                | Proposed treatment                               |
|---------------|------------------------------------|--------------------------------------------------|
| Type I        | Large fragments                    | ORIF                                             |
| Type II       | Comminuted                         | Radial head excision and prosthetic replacement  |
| Type III      | Chronic injuries with proximal migration of radial head | Radial head replacement and ulnar shortening osteotomy |

Modified from Edwards GS, Jr, Jupiter JB Radial head fractures with acute distal radioulnar dislocation. Essex-Lopresti revisited. Clin Orthop Relat Res. 1988 Sep(234):61-9

Persistent USWP and chronic DRUJ instability can result from fractures of the distal radius and ulna following inadequate treatment or malunions. If untreated, these lead to chronic pain and disability due to stiffness, decreased grip strength, and arthritis. The dynamic and static stabilizers of DRUJ may become dysfunctional or injured resulting in chronic instability. Acute instabilities that are unnoticed or poorly treated also become chronic. Poorly reduced DRF, especially increased dorsal tilt, reduced radial inclination and radial shortening results in DRUJ incongruity. There are reports suggesting that anatomical reduction of DRF is more critical in avoiding persistent DRUJ issues rather than associated fixing or union of ulna styloids fractures.

Management of chronic DRUJ instability depends primarily on the underlying cause. Length discrepancy between radius and ulna, malunions, and ulnocarpal impaction needs to be corrected primarily by osteotomy and bone grafting techniques [Figure 8a,b] before considering ligament reconstructions. Arthritis of DRUJ requires salvage procedures (discussed later). Soft tissue reconstruction of DRUJ is indicated in symptomatic patients in whom TFCC is irreparable and sigmoid notch competent. Various procedures directed at stabilizing the DRUJ, broadly considered under four main heads: 1) extrinsic radioulnar tether, 2) extensor retinaculum capsulorrhaphy, 3) ulnocarpal sling, and 4) reconstruction of volar and dorsal radioulnar ligaments.

### Chronic DRUJ instability

Extrinsic radioulnar tether was described by Fulkerson and...
Figure 9: Diagrammatic representation of Adams–Berger procedure for chronic DRUJ instability. The dorsal and volar radioulnar ligaments are reconstructed with a palmaris longus graft. (Adams BD, Berger RA. An anatomic reconstruction of the distal radioulnar ligaments for posttraumatic distal radioulnar joint instability. J Hand Surg Am. 2002 Mar;27(2):243-51)

TFCC, perforation to ulnocarpal arthritis. This should be differentiated from the ulna impingement syndrome due to an unstable ulnar stump painfully abutting the radius following a Darrach procedure. An acquired ulna plus variance caused by malunited distal radius fracture is the most common cause of this condition [Figure 10]. Typical clinical features are ulnar-sided wrist pain, especially on loading and rotation movement. The PA view demonstrates the ulna plus. MRI is useful for observing changes in the lunate and triquetrum [Figure 4b], and arthroscopy demonstrates the classical stages described by Palmer. The treatment include conservative management by splinting, NSAIDs, and modification of activities. Surgical treatment is required if symptoms continue and include wafer resection of the distal ulna as described by...
Feldon, which can be done arthroscopically or open, or an ulna shortening osteotomy as originally described by Milch. We prefer an ulna shortening osteotomy and compression plate fixation in this situation once conservative management fails to alleviate the symptoms.

**DRUJ arthritis**

DRF through the sigmoid notch or the distal ulna, malunions, chronic instability of DRUJ, and failed reconstruction of the DRUJ progress to arthritis, with pain and stiffness of the joint. Various options are available in the management of this situation.

**Surgical treatment DRUJ**

**Resection of distal ulna (Darrach procedure)**

This procedure removes the distal articular surface of the ulna, thereby relieving pain and improving supination and pronation. This is useful in the elderly and in patients with limited activity. However, reported problems of this procedure in a physically active patient include ulna impingement syndrome, loss of grip strength, and possible ulnar translation of carpus. To address the ulna instability following a Darrach procedure, FCU or ECU tendon slings have been fashioned to attach to the distal ulna. The authors reserve the use of the Darrach procedure in the older age group with less physical demands and routinely combine the excision of distal ulna with an ECU sling in an attempt to reduce the likelihood of impingement.

**Sauve-Kapandji procedure**

Originally described in 1936, this combines DRUJ arthrodesis and surgical pseudarthrosis of the distal ulna. This has the advantage of preserving the ulnar support of the wrist by retaining the distal ulna [Figure 11]. The indications and surgical technique is well described in other articles. The proximal pseudarthrosis allows supination and pronation. We prefer this procedure in young active adults with DRUJ arthrosis as compared to a Darrach procedure. However, painful instability of the proximal ulna stump can still remain a problem.

**Hemiresection–interposition arthroplasty**

Bowers described partial resection of the articular surface of ulna and interposing a capsular flap for DRUJ arthritis, while retaining the ulnar attachment of the TFCC. Interposition can be augmented by a tendon roll or allograft [Figure 12]. Ulnocarpal impaction is described as a relative contraindication of this procedure. The authors have used this procedure for treating DRUJ arthrosis with mild degree of ulna plus variance with good results.

**DRUJ implant arthroplasty**

Prosthetic replacement for the head of ulna has been described for primary DRUJ arthrosis and in failed DRUJ
surgery. Swanson and Herbert has developed prosthesis for distal ulna replacement. Scheker has described a semiconstrained modular implant for total replacement of the DRUJ (APTIS DRUJ prosthesis) [Figures 13 and 14]. This has a stainless steel radial implant, which articulates with an ultra-high molecular weight (UHMW) polyethylene sphere and an ulna stem. Though long term results are still awaited, the implant shows great promise in the management of DRUJ arthrosis providing a stable pain-free joint. While the implant is yet unavailable in the subcontinent, the author has been impressed by the functionality of this prosthesis on reviewing Dr. Scheker’s patients who had underwent this procedure.

**Conclusion**

The DRUJ injuries presents as ulna sided wrist pain resulting most commonly from traumatic episodes. Clinical
examination provide information regarding the anatomical structures injured. Investigations helping in diagnosis include plain X-rays and MRI. Arthroscopy is considered the gold standard in diagnosis. Treatment include splinting, ORIF of fractures and repair of torn ligaments and TFCC by arthroscopy or open methods. In late presentations, instability is addressed by various techniques which have been described. DRUJ arthroplasty is emerging as a treatment in cases of arthrosis of the joint.

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