Arthroscopic Wafer Procedure for Ulnar Impaction Syndrome

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Abstract: Ulnar impaction syndrome is abutment of the ulna on the lunate and triquetrum that increases stress and load, causing ulnar-sided wrist pain. Typically, ulnar-positive or -neutral variance is seen on a posteroanterior radiograph of the wrist. The management of ulnar impaction syndrome varies from conservative, symptomatic treatment to open procedures to shorten the ulna. Arthroscopic management has become increasingly popular for management of ulnar impaction with ulnar-positive variance of less than 3 mm and concomitant central triangular fibrocartilage complex tears. This method avoids complications associated with open procedures, such as nonunion and symptomatic hardware. The arthroscopic wafer procedure involves debridement of the central triangular fibrocartilage complex tear, along with debridement of the distal pole of the ulna causing the impaction. Debridement of the ulna arthroscopically is taken down to a level at which the patient is ulnar neutral or slightly ulnar negative. Previous studies have shown good results with relief of patient symptoms while avoiding complications seen with open procedures.

Ulnar impaction syndrome is abutment of the ulna on the lunate and sometimes the triquetrum seen with increases in stress and load across the joint. The continuum of findings includes ulnar-positive variance, triangular fibrocartilage complex (TFCC) tear, and lunate-triquetrum ligament tear. Small changes in variance can dramatically affect loads across the joint. Palmer and Werner showed that a neutral wrist has 18% of its load through the ulna whereas 42% of the load crosses the ulna in a 2-mm ulnar-positive wrist and 4% in a 2-mm ulnar-negative wrist. Common associated findings are TFCC tears, lunotriquetral ligament tears, scapholunate ligament tears, and radial shortening from previous trauma. Presenting symptoms include pain over the dorsal and ulnar wrist, with ulnar deviation and with axial loading. Findings on radiographs include ulnar-positive variance and sclerosis of the lunate and/or ulnar head. Conservative measures involve immobilization, anti-inflammatory medications, and corticosteroid injections. Surgical options include isolated TFCC debridement and ulnar shortening procedures including open or arthroscopic wafer procedures, as well as diaphyseal or distal metaphyseal osteotomies.

The arthroscopic wafer procedure is an effective method to debride TFCC tears, along with decompressing ulnar-positive wrists. It has been found to have equivalent results to an open procedure, with fewer complications. This technique avoids hardware complications and the risk of nonunion associated with ulnar shortening osteotomy. Indications for the wafer procedure are failed nonoperative treatment for at least 3 months, central TFCC tear, and less than 3 mm of ulnar-positive variance.

Surgical Technique

The patient is placed in the supine position after undergoing general or regional anesthesia and receiving appropriate preoperative antibiotics. Video 1 illustrates the procedure. The involved extremity is placed into longitudinal finger-traps for traction, and a brachial tourniquet is used. A skin marker is used to draw out the bony and tendinous anatomy, and the standard 3-4 arthroscopic wrist portal is made (between the third and fourth extensor compartments dorsally). By use of a dry arthroscopic technique, the radiosaphoid joint and articular cartilage are examined for any pathology. The long and short radiolunate ligaments and radioscapohapitate ligaments are identified and examined. The intramembranous portion of the scapholunate ligament is examined.

The camera is then directed ulnarly to visualize the TFCC; at this point, we use a needle under direct
visualization to establish a 4-5 portal. From the 4-5 portal, the central TFCC tear can be probed and debrided with a Stryker small joint sucker/shaver and biter (Stryker, Kalamazoo, MI). The inflow is turned on at this point. Once the ulnar head can be visualized through the central tear and the TFCC is taken back to stable edges, a 6U portal (just ulnar to the extensor carpi ulnaris tendon) is established. Alternatively, a 6R portal can be used. The lunotriquetral interval can be viewed from this portal. Debridement of the TFCC tear is again addressed with a biter and sucker/shaver (Stryker Formula Full Radius Cutter, 2.5 mm). Next, the ulnar head is resected through the central TFCC defect with a 2.0-mm burr (Stryker Hooded Aggressive Burr and 2.5-mm Aggressive Cutter). Alternatively, a distal radioulnar joint portal beneath the TFCC can be used for this step. Fully pronating and supinating the arm at this point is critical to ensure adequate resection. This is a key component to the success of the procedure, especially because there is an increase in relative ulnar-positive variance in pronation. Fluoroscopy is used to ensure adequate resection (Fig 1).

Next, standard radial (1 cm distal to the 3-4 portal between the extensor carpi radialis brevis radially and extensor digitorum communis ulnarily [i.e., the soft spot between the distal pole of the scaphoid and proximal capitate]) and ulnar (1 cm distal to the 4-5 portal, 1.5 cm ulnar to the radial portal, and in line with the ring metacarpal) midcarpal portals are made to evaluate the articular cartilage and ligamentous stability of the midcarpal joints (Fig 2). After the arthroscopy is complete, the finger-traps are let down and the distal radioulnar joint is tested by the shuck test for stability in full pronation, supination, and neutral. The tourniquet is let down, and the incisions are closed. A sterile dressing and short arm splint are applied for 2 weeks (Figs 3 and 4).

Discussion

Ulnar abutment syndrome can be treated by a variety of nonsurgical and surgical methods. These range from anti-inflammatory medications, immobilization, and corticosteroid injections to TFCC debridement, ulnar shortening osteotomies, and arthroscopic wafer procedures. It has been shown that debridement of TFCC tears alone in ulnar-positive wrists has provided incomplete relief in up to 25% of patients.7 Tomaino and Shah8 in 2001 showed good results when combining TFCC debridement with the arthroscopic wafer procedure in patients who were ulnar positive. Constantine et al.6 in 2000 compared ulnar-shortening osteotomies with the arthroscopic wafer procedure, showing that both were effective at relieving pain but that the arthroscopic wafer procedure was not complicated by hardware and
nonunion problems. Beredjiklian et al.\textsuperscript{9} described complications of wrist arthroscopy after looking at 211 patients and found a 5.2% rate of complications, which included stiffness, ganglion formation, dorsal ulnar sensory neurapraxia, and superficial portal-site infection, as well as 1 first-degree burn from a hot arthroscope. Overall, arthroscopy is a safe procedure and avoids other complications seen with open ulnar shortening procedures. The arthroscopic wafer procedure is a good option to consider in patients in whom conservative treatment for ulnar abutment syndrome has failed with less than 3 mm of ulnar-positive variance (because more than 2 to 3 mm is difficult to remove arthroscopically) and TFCC tears (Table 1).

Table 1. Summary of Indications, Advantages, and Disadvantages of Arthroscopic Wafer Procedure

| Indications                   | Advantages               | Disadvantages               |
|------------------------------|--------------------------|-----------------------------|
| Failed conservative management | No hardware complications | Resection of only 2-3 mm of bone |
| <3 mm ulnar-positive variance  | No bony healing          |                             |
| TFCC tears                   | Treatment of TFCC tears   |                             |

Fig 3. Preoperative radiograph of a 36-year-old patient with ulnar impaction syndrome with ulnar-sided wrist pain in whom nonoperative measures of immobilization and corticosteroid injection failed.

Fig 4. Postoperative radiograph in patient from Fig 3 after arthroscopic wafer resection of distal ulna, creating an ulnar-negative wrist.

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