

# Oblique Ulnar Styloid Osteotomy—A Treatment for Ulnar Styloid Impaction Syndrome

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**Purpose** We report a series of 5 patients (mean age, 41 y) presenting with ulnar styloid impingement syndrome (USIS) and treated by an oblique ulnar styloid osteotomy. The purpose of the study was to determine whether the osteotomy is an effective method for treating USIS.

**Methods** The diagnosis of USIS was made based on a history of ulnar-sided wrist pain supported by clinical and radiological findings. Clinical assessment included provocative tests to differentiate USIS from pain associated with ulnocarpal impaction syndrome. The ulnar styloid length was assessed with a posteroanterior X-ray using the methods of Garcia-Elias and Biyani. The ulnar styloid was deemed excessively long if the ulnar styloid process index was greater than 0.21 or if the overall styloid length was greater than 6 mm. Ulnar variance was recorded. All wrists were assessed by computed tomography arthrography and magnetic resonance imaging studies to rule out any associated soft tissue abnormalities, including ligamentous injuries. Preoperative and postoperative pain levels were recorded using a pain scoring system.

**Results** Patients were followed up for a mean of 46 months. Before surgery, the mean styloid length was 10 mm, and the ulnar styloid process index was 0.32. The reported pain score was significantly reduced following surgery and all patients, except one, returned to pre-morbid levels of activity.

**Conclusions** Oblique ulnar styloid osteotomy is an effective means of relieving impaction of the ulnar styloid while preserving the integrity of the intrinsic ulnar styloid ligaments. (*J Hand Surg* 2011;36A:1785–1789. Copyright © 2011 by the American Society for Surgery of the Hand. All rights reserved.)

**Type of study/level of evidence** Therapeutic IV.

**Key words** Styloid osteotomy, ulnar impaction, wrist pain.

ULNAR-SIDED WRIST PAIN is associated with many conditions that can be difficult to differentiate and that are challenging to treat effectively due to the anatomical and biomechanical complexity of this region.<sup>1,2</sup> The differential diagnoses range from ligamentous injuries (triangular fibrocartilage complex [TFCC], and lunotriquetral), arthritis of the distal radio-

ulnar joint (DRUJ) or pisotriquetral joint, DRUJ instability, ulnar styloid nonunion, and extensor carpi ulnaris tendinitis. Ulnar styloid impaction syndrome (USIS) is a relatively unusual cause of ulnar-sided wrist pain that can mimic impaction of the ulnar head (ulnocarpal impaction syndrome) but occurs much less frequently. Although symptoms are similar, radiological findings

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demonstrate an excessively long or hypertrophic ulnar styloid and a neutral or negative ulnar variance. Furthermore, USIS is associated with chondromalacia, affecting the proximal pole of the triquetrum and the ulnar styloid rather than the lunate and ulnar head. Treatment includes partial or complete ulnar styloidectomy with preservation of the fibers that anchor the TFCC to the base of ulnar styloid<sup>3-6</sup> as described by Palmer.<sup>7</sup>

Oblique ulnar styloid osteotomy (OUSO) is a technique aimed at relieving ulnar styloid impaction while avoiding damage to the ulnar stylocarpal components of the TFCC (ulnolunate, ulnotriquetral, and ulnar collateral ligaments) or removal of the distal radioulnar joint (DRUJ) stabilizing ligaments.<sup>8</sup> In this article, we describe our approach to ulnar styloid osteotomy and report the clinical outcomes of 5 patients.

## MATERIALS AND METHODS

We conducted a retrospective clinical review of patients diagnosed with USIS treated by OUSO in a single hand surgery center. The diagnosis of USIS was made based on a history of ulnar-sided wrist pain supported by clinical and radiological findings. Clinical assessment included a provocative test to differentiate USIS from pain associated with ulnocarpal impaction syndrome.<sup>6</sup> The test involved positioning the patient's wrist in flexion and ulnar deviation, the forearm in pronation, and the elbow flexed to 90° with the arm internally rotated. Provocation of ulnar-sided wrist pain was indicative of USIS. Conversely, pain elicited on repetition of the test with the forearm supinated suggested a TFCC tear, because forearm supination causes recession of the ulnar head and subsequent loss of contact between the volar aspect of the triquetrum and the dorsally located ulnar styloid.

The ulnar styloid length was assessed with a posteroanterior X-ray using the methods of Garcia-Elias<sup>9</sup> and Biyani.<sup>2</sup> The ulnar styloid was deemed excessively long if the ulnar styloid process index (USPI) was greater than 0.21 or if the overall styloid length was greater than 6 mm (the published values of the normal population).<sup>2,9</sup> The USPI was calculated on X-rays by subtracting the ulnar variance from the length of the ulnar styloid process and dividing by the transverse diameter of the ulnar head. Ulnar variance was also recorded. All wrists were assessed by both computed tomography arthrography and magnetic resonance imaging studies to rule out any associated soft tissue abnormalities, including ligamentous injuries. Preoperative and postoperative pain levels were recorded using a pain scoring system (Table 1).

**TABLE 1. Pain Scoring System**

Pain Score	Features
0	No pain
1	Mild pain; no pain medication (PM)
2	Slight, intermittent pain; occasional nonprescription PM
3	Slight to moderate, intermittent pain; frequent nonprescription PM
4	Moderate, intermittent pain; occasional prescription PM
5	Severe, constant pain; frequent prescription PM

The study group consisted of 5 patients (1 man and 4 women; Table 2) diagnosed with USIS. The duration of symptoms ranged from 9 to 24 months, and the mean patient age at surgery was 41 years (range, 20–71 y). Patients were followed up for a mean of 46 months (range, 15–96 mo).

A history of trauma was noted in 1 case but not in the other 4. The right wrist was affected in 3 cases and the left in 2. The dominant extremity was involved in 2 cases.

All patients diagnosed with USIS were initially prescribed a trial of nonsurgical treatment, including splinting, activity modification, oral nonsteroidal anti-inflammatory agents, and local steroid injections. If conservative measures failed, we offered the patients an OUSO.

The radiological findings are shown in Table 3. All wrists had negative ulnar variance (mean, 2 mm; range, 0 to 3 mm) and all patients demonstrated an excessive ulnar styloid length (mean, 10 mm; range, 7–12 mm).<sup>2</sup> The mean USPI was 0.32, and in each case, it exceeded the published normal range.<sup>9</sup> All patients had a hypertrophic ulnar styloid bilaterally (based on USPI calculation) and chondromalacia involving the ulnar styloid tip and proximal triquetrum (observed intraoperatively). An associated TFCC lesion was demonstrated on computed tomography arthrography of patient 1. At surgery, this lesion was found to be a degenerative triangular ligament central tear that required just debridement). Magnetic resonance imaging demonstrated bone edema in all affected wrists (Fig. 1).

Data are described in terms of the mean. A Mann-Whitney test was used to assess differences between preoperative and postoperative pain scores.  $P < .05$  was considered statistically significant.

**TABLE 2. Patient Demographics**

Case	Gender	Age (y)	Job	Injury	Affected Side	Dominant Side	Duration of Symptoms Before Treatment (mo)
1	Female	42	Accountant	Y	Left	Right	24
2	Female	71	Retiree	N	Right	Right	12
3	Female	47	Designer	N	Right	Right	12
4	Male	27	Baker	N	Left	Right	9
5	Female	20	Tennis player	N	Right	Left	14

**TABLE 3. Ulnar Styloid Morphology**

Case	Ulnar Variance (mm)	Ulnar Styloid Length (mm)	USPI
1	-3	12	0.32
2	0	9	0.32
3	-2	7	0.29
4	-3	12	0.33
5	-3	8	0.33



**FIGURE 1:** Preoperative magnetic resonance image, demonstrating opposing areas of bone edema, secondary to the contact between the ulnar styloid tip and the triquetrum.

**Surgical technique**

The procedure, developed by the senior author (E.R.), is conducted under axillary block and upper-arm tourniquet. The forearm is positioned in full pronation. Access is gained through an axial incision between the fifth and sixth dorsal compartments. The dorsal sensory

**FIGURE 2:** Preoperative posteroanterior radiograph of a hypertrophic ulnar styloid associated with USIS.

branch of the ulnar nerve is identified and protected. The extensor carpi ulnaris sheath is left intact, and the extensor digiti minimi is laterally retracted. The wrist capsule is opened longitudinally, exposing the ulnar styloid. The integrity of the TFCC is left undisturbed. The ulnar styloid is cut obliquely with a sharp osteotome. Proximally, the first cut begins at the base of the styloid, just distal to the TFCC insertion, and proceeds distally and laterally at 45°, but it is not completed. A second cut is parallel and distal and allows for resection of a few millimeters of the ulnar styloid. Sufficient bone is resected to reduce the styloid length to less than 6 mm, according to the value of the normal population published by Biyani. It is easiest to complete the distal cut first. A K-wire then temporarily secures the shortening osteotomy. Intraoperative radiographs confirm complete resolution of the impingement between the triquetrum and ulnar styloid while the wrist is in maximal ulnar deviation and the forearm is in pronation and then in supination. A 1.5-mm compression screw placed perpendicular to the osteotomy from the



**FIGURE 3:** Postoperative **A** posteroanterior and **B** lateral radiographs, demonstrating the decompression obtained by the OUSO.

tip of the ulnar styloid to the inner cortex of the ulna then secures the fixation (Figs. 2, 3).

The ulnar wrist capsule and extensor retinaculum are approximated, and the skin is closed. We apply a light soft bandage and initiate early therapy to recover full motion.

## RESULTS

Patients were followed up for a mean of 46 months (range, 15–96 mo). At follow-up, there was no impaction on testing in any patient.

The mean preoperative pain level (4.8) was significantly reduced following surgery (postoperative score, 0.6,  $P = .006$ ). Two patients were completely pain-free, and the other 3 reported only intermittent mild pain, including patient 1 who had a TFCC tear that might have confounded interpretation.

Subjectively, all patients reported an improvement in symptoms following surgery. All patients returned to their previous level of activities and work without restriction, except 1 patient (patient 3) who was receiving workers' compensation benefits at the time of surgery. At final review, reported satisfaction was excellent in 4 patients and good in 1 patient (patient 3). All patients would recommend the procedure to other patients in similar circumstances.

On follow-up examination, there was no clinical or radiographic DRUJ instability or nonunion. Objective evidence of styloid disimpaction was demonstrated by increased styloid-triquetral distance on X-ray (from 8 mm before surgery to 13 mm after surgery). Follow-up ranges of motion and grip strengths equaled or exceeded preoperative levels. Primary wound healing and radiographic bone union was achieved without complication in each patient.

## DISCUSSION

Ulnar styloid impaction is a recognized cause of ulnar-sided wrist pain that is typically associated with a short ulna and a long styloid.<sup>3–6</sup> In the early stages of USIS, the TFCC is intact, although persistent impingement can result in a TFCC tear. Prolonged bone-on-bone contact between the ulnar styloid tip and the triquetrum also leads to chondromalacia of the opposing articular surfaces, synovitis, and pain.<sup>6</sup> Impaction over a long period can lead to lunotriquetral instability, secondary to a lunotriquetral ligament attrition.<sup>3</sup>

Ulnar styloid impingement syndrome can be challenging to manage. Accepted treatment of refractory cases includes ulnar styloidectomy, which can relieve pain effectively but risks weakening important ligamentous structures that can lead to DRUJ instability. This

study demonstrates that OUSO is an effective and reproducible method of treatment of cases of stylocarpal impaction syndrome that have failed to respond to non-surgical measures. In this series, a shortening osteotomy of the ulnar styloid resulted in both noteworthy pain reduction and functional improvement without complication. The clinical outcomes were supported by objective radiological evidence of ulnar styloid disimpaction. One of the critical steps in management is accurate diagnosis.<sup>2,9,10</sup> All patients were subject to a rigorous assessment, requiring symptomatic, clinical, and radiological characteristics of USIS to be identified before the diagnosis was made. Occasionally, patients can present with both stylocarpal and ulnocarpal impaction.<sup>4</sup> In these circumstances, a conventional ulnar shortening osteotomy is appropriate.

The OUSO preserves all ligamentous attachments of the TFCC to the ulnar styloid, rather than just those at the base of styloid process, in contrast to other treatments. In this way, the anatomical structures that maintain joint stability are undisturbed. In selected cases,

ulnar styloid osteotomy is a safe and effective means of treating ulnar styloid impaction syndrome.

## REFERENCES

1. Taleisnik J. Pain on the ulnar side of the wrist. *Hand Clin* 1987;3: 51–68.
2. Biyani A, Mehara A, Bhan S. Morphological variations of the ulnar styloid process. *J Hand Surg* 1990;15B:352–354.
3. Topper SM, Wood MB, Ruby LK. Ulnar styloid impaction syndrome. *J Hand Surg* 1997;22A:699–704.
4. Tomaino MM, Gainer M, Towers JD. Carpal impaction with the ulnar styloid process: treatment with partial styloid resection. *J Hand Surg* 2001;26B:252–255.
5. Bain GI, Bidwell TA. Arthroscopic excision of ulnar styloid in stylocarpal impaction. *Arthroscopy* 2006;22:677, e1–3.
6. Zahiri H, Zahiri CA, Ravari FK. Ulnar styloid impingement syndrome. *Int Orthop* 2010;34:1233–1237.
7. Palmer AK, Werner FW. The triangular fibrocartilage complex of the wrist—atomy and function. *J Hand Surg* 1981;6:153–162.
8. Nakamura T, Takayama S, Horiuchi Y, Yabe Y. Origins and insertions of the triangular fibrocartilage complex: a histological study. *J Hand Surg* 2001;26B:446–454.
9. Garcia-Elias M. Dorsal fracture of triquetrum—avulsion or compression fracture? *J Hand Surg* 1987;12A:266–268.
10. van der Heijden B, Groot S, Schuurman AH. Evaluation of ulnar styloid length. *J Hand Surg* 2005;30A:954–959.