Distal Ulna Hook Plate Fixation for Unstable Distal Ulna Fracture Associated With Distal Radius Fracture

SANG KI LEE, MD; KAP JUNG KIM, MD; JU SANG PARK, MD; WON SIK CHOY, MD

abstract

The significance of distal ulna fractures is often undermined, which can result in inadequate treatment compared with fractures of the radius, the ulna’s larger counterpart. However, little guidance exists in the current literature on how to manage distal ulna head or neck fractures and intra-articular ulna head fractures. Therefore, the purpose of this retrospective study was to evaluate the outcomes of distal ulna hook plate fixation for the treatment of an unstable distal ulna fracture associated with a distal radius fracture.

Twenty-five patients with unstable distal ulna fractures who underwent stable fixation for an associated distal radius fracture were included in the study. All patients achieved satisfactory reduction and bony union. Average final motion was as follows: wrist flexion, 72° (range, 60°-85°); extension, 69° (range, 65°-80°); pronation, 77° (range, 55°-95°); supination, 82° (range, 65°-90°); ulnar deviation, 35° (range, 15°-50°); and radial deviation, 24° (range, 10°-40°). Average postoperative grip strength was 28 kg (range, 22-30 kg) and was 91% (range, 71%-100%) in the cases in which the dominant hand was injured and 80% (range, 65%-100%) in the cases in which the nondominant hand was injured. Average postoperative modified Mayo wrist score and Disabilities of the Arm, Shoulder and Hand score was 87 points (range, 65-100 points) and 14 points (range, 0-54 points), respectively. Chronic instability of the distal radioulnar joint was not encountered in any patient. Thus, the study demonstrated that distal ulna hook plate fixation for the treatment of unstable distal ulna fractures can achieve healing with good alignment, satisfactory function, and minimal transient morbidity.

Figure: Anteroposterior (A) and lateral (B) photographs of the distal ulna hook plate showing that it is precontoured anatomically to facilitate easy fixation to the distal ulna. The plate has a pointed hook that grips to the ulna styloid. Posteroanterior (C) and lateral (D) photographs of the plate with the screw inserted showing that 2 distal holes are used to intercross the screws.

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Metaphyseal fractures of the distal ulna often occur with distal radius fractures. Unlike distal radius fractures, few reports exist in the medical literature of distal ulna neck or head fractures, and controversy remains over the treatment of such fractures. Several studies have suggested that distal ulna fractures associated with distal radius fractures realign and are considered stable once the radius is reduced and can achieve satisfactory outcomes with conservative treatment.\textsuperscript{4-7}

Many reports recommended nonoperative treatment for ulnar styloid process fractures not associated with posttraumatic distal radioulnar joint arthrosis.\textsuperscript{8-10} These reports validate conservative treatment for distal ulna fractures.

However, some studies have reported poor outcomes in unstable distal ulna fractures treated nonoperatively.\textsuperscript{11} Several reported that unstable or malaligned fractures of the ulnar head or neck can affect distal radioulnar joint function and diminish distal forearm stability, which can contribute to the risk of distal radius nonunion and callus encroachment of the distal radioulnar joint and leading to chronic pain and instability.\textsuperscript{1,3,12,13} Furthermore, intra-articular distal ulna head or neck fractures have been associated with disruption of the distal radioulnar ligament, resulting in a loss of structural support for the triangular fibrocartilage complex.\textsuperscript{11,14,15} For these reasons, several studies have recommended operative treatment when displaced or unstable intra-articular distal ulna fractures remain after reduction and firm fixation of the concomitant distal radius fracture.\textsuperscript{1,2,4,5}

Open reduction with internal fixation of the distal ulna fracture can allow secure fixation and early motion. However, small and often osteoporotic fracture fragments typically exist, and the short nonarticular arc of the ulnar head limits hardware placement, which can interfere with the distal radioulnar joint or the articular surface of the ulnar head.\textsuperscript{4} Nevertheless, locked distal ulna fixation is an attractive method to provide low-profile, stable fixation that allows early range of motion (ROM) and rehabilitation of the hand, wrist, and forearm.\textsuperscript{16,17} Thus, Dennison\textsuperscript{4} and Ring et al\textsuperscript{18} introduced the locked plate fixation technique for the treatment of distal ulna fractures and achieved relatively good outcomes. However, this technique has some limitations: if the fracture extends to the intra-articular neck or head portion, fixation and restoration of these plates can be difficult because the articular surface of the fixation area is not large enough.

Recently, the locking compression plate distal ulna hook plate was introduced for the treatment of distal ulna fractures. This plate is precontoured anatomically and has a slim design, rounded edges, and a polished surface, which limits the irritation of overlying soft tissues. In addition, it can be used to achieve angular stable fixation of the fragments regardless of the bone quality, and a lower risk of primary and secondary loss of reduction exists.

The purpose of this retrospective study was to investigate the clinical and radiographic outcomes of open reduction and locked internal fixation of unstable distal ulna (metaphyseal or articular) fractures using a distal ulna hook plate when an associated ipsilateral distal radius fracture is also treated operatively.

**MATERIALS AND METHODS**

**Study Design**

Between January 2009 and March 2011, twenty-five consecutive patients with distal ulna fractures were treated surgically with a distal ulna hook plate (Synthes, Oberdorf, Switzerland). Medical records and radiographs were reviewed to identify patient demographics, fracture type, union, alignment, ROM, grip strength, and complications. Inclusion criteria included unstable distal ulna neck or head fracture that was defined as angulation of more than 10°, or instability of the distal ulna fracture after stabilization of the radius fracture that displaced more than 50% of the ulnar metaphyseal diameter in any plane\textsuperscript{18-20}, skeletal maturity; and minimum follow-up of at least 1 year. The exclusion criteria included stable distal ulna fracture after distal radius fixation, pathological fracture, and previous surgery on the affected wrist. All procedures were performed by 1 surgeon (S.K.L.). The study protocol and consent forms were approved by the institutional review board of the authors’ institution.

**Patients**

A total of 20 women and 5 men (mean age, 62.3 years [range, 47-85 years]) were included in this study. Fourteen injuries were to the left wrist and 11 were to the right wrist. Mean follow-up was 15.2 months (range, 12-21 months).

Distal ulna fractures and distal radius fractures were classified according to the Q modifier of the Comprehensive Classification of Fractures (Table 1).\textsuperscript{21} Three patients had open fractures: 2 were grade I and 1 was grade IIIC, according to the criteria defined by Gustilo and Anderson.\textsuperscript{22} The grade I open fractures were treated with debridement and irrigation, and plate fixation was performed on the date of admission. The grade IIIC fracture was treated initially with irrigation and debridement, arthroirrhaphy for radial artery injury, and a temporary external fixator. Two weeks later, when the soft tissue and vascular conditions had improved, the external fixator was replaced with a distal ulna hook plate. Twenty-four of the 25 patients had concomitant distal radius fractures, that were treated with open reduction and internal fixation with a volar locked plate. One patient had a radial styloid fracture, that was treated with percutaneous Kirschner wire fixation. All patients underwent surgery within 5 days of injury and received a distal ulna hook plate.

**Implant Design**

The plates are precontoured anatomically and fit the distal ulna metaphysis...
properly. The shaft of the plate has pointed hooks that grip the ulnar styloid process and act as reference points for plate application. Intercrossing locking screws securely hold the distal ulna metaphysis. The plate has oblong holes that accept 2.0-mm cortex screws for ulna length adjustment, which potentially can offer good stability and allow early mobilization. Unlike the conventional form of a plate, the distal ulna hook plate merges locking screw technology with conventional plating techniques, providing angular stability and compression of the fracture regardless of bone quality and the presence of multiple fragments. Moreover, the relatively small-sized pointed hook of the distal ulna hook plate can act as a buttress, and has a grasping effect on small and comminuted fragments, such as the ulnar styloid process, and can achieve additional successful fixation of the far distal intra-articular extended fracture of the ulna metaphysis (Figure 1).

**Surgical Technique**

The distal radius fracture was reduced and securely fixated with a volar locked plate. Then, the elbow was flexed to 90° and an incision was made at the ulnar border of the wrist. The fracture was exposed, and the reduction was held temporarily with a temporary K-wire. The plate was applied on trial, and the hook was covered over the ulnar styloid and metaphysis. Compression force then was applied proximally to the fracture fragments and ulnar metaphysis until they were reduced to their desired alignment. Once adequate reduction was achieved, locking screws were placed into the metaphysis and diaphysis of the distal ulna to secure the plate to the bone. If the fracture was comminuted or the bone was osteoporotic, the bone defect was filled with autologous iliac crest bone or allogeneic bone graft substitute. The wound was closed layer by layer.

For postoperative rehabilitation, active finger motion was encouraged 1 day postoperatively. Patients were immobilized in a sugar-tong splint for 7 to 10 days postoperatively. Then, the splint was changed to a removable sugar-tong splint, and initiated wrist flexion and extension exercises were performed as tolerated. Between 4 to 5 weeks postoperatively, active wrist supination and pronation was initiated depending on the surgeon’s assessment of the overall stability of the fixation. Resistive exercises were delayed until advanced healing was present, usually 10 to 12 weeks postoperatively.

**Patient Assessment**

Postoperative radiographs were scheduled for 2, 4, and 6 weeks postoperatively and at monthly intervals thereafter as needed until final follow-up. Alignment was assessed by measurement of the angulation of the ulna metaphysis on anteroposterior radiographs with anatomical position (coronal plane) and lateral radiographs with 90° pronation (sagittal plane), as well as evaluation of ulnar variance, radial inclination, and volar tilt of the distal radius.

In addition, distal radioulnar joint arthrosis was assessed by follow-up radiographs.

Wrist function was evaluated with wrist ROM, modified Mayo wrist score, Disabilities of the Arm, Shoulder and Hand (DASH) score, and grip strength. Range of motion of the wrist and forearm (extension, flexion, supination, and pronation) was measured using a goniometer. Grip strength was measured using a dynamometer.

**Table 1**

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture side</td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>14 (66)</td>
</tr>
<tr>
<td>Right</td>
<td>11 (44)</td>
</tr>
<tr>
<td>Dominant side</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (66)</td>
</tr>
<tr>
<td>No</td>
<td>14 (44)</td>
</tr>
<tr>
<td>No. of F/M</td>
<td>20 (75)/5 (25)</td>
</tr>
<tr>
<td>Mean age (range), y</td>
<td>62.3 (47-85)</td>
</tr>
<tr>
<td>Mean follow-up (range), mo</td>
<td>15.2 (12-21)</td>
</tr>
<tr>
<td>Q modifier classification system</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>7 (28)</td>
</tr>
<tr>
<td>Q3</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Q4</td>
<td>6 (24)</td>
</tr>
<tr>
<td>Q5</td>
<td>8 (32)</td>
</tr>
<tr>
<td>Q1 with Q3</td>
<td>10 (40)</td>
</tr>
<tr>
<td>Q1 with Q4</td>
<td>3 (12)</td>
</tr>
<tr>
<td>Q1 with Q5</td>
<td>2 (8)</td>
</tr>
<tr>
<td>Gustilo and Anderson open fractures</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>2 (8)</td>
</tr>
<tr>
<td>IIIC</td>
<td>1 (4)</td>
</tr>
</tbody>
</table>

**Figure 1:** Anteroposterior (A) and lateral (B) photographs of the distal ulna hook plate showing that it is precontoured anatomically to facilitate easy fixation to the distal ulna. The plate has a pointed hook that grips to the ulna styloid. Posteroanterior (C) and lateral (D) photographs of the plate with the screw inserted showing that 2 distal holes are used to intercross the screws.
Distal Ulna Hook Plate Fixation | Lee et al

The radius was grasped by 1 hand of the examiner with the forearm in a neutral position and followed by 1 hand of the examiner with the forearm in a neutral rotation position while the distal end of the ulna, which was fixed by the contralateral hand of the examiner, was translated in dorsal and palmar directions with respect to the radius. Distal radioulnar joint instability was confirmed by a finding of more than 8 mm of palmar-dorsal translation of the ulna relative to the radius. Chronic instability of the distal radioulnar joint was assessed by physical examination. The radius was grasped by 1 hand of the examiner with the forearm in a neutral rotation position while the distal end of the ulna, which was fixed by the contralateral hand of the examiner, was translated in dorsal and palmar directions with respect to the radius. Distal radioulnar joint instability was confirmed by a finding of more than 8 mm of palmar–dorsal translation of the ulna relative to the radius. However, distal radioulnar joint instability was not determined if the distal radioulnar joint of the contralateral uninjured side was more noticeably translated without pain than the injured wrist.

**Statistical Analysis**

Statistical analysis was performed with SPSS version 20 software (IBM Corporation, Armonk, New York). An independent-sample Student’s *t* test was used to compare the pre- and postoperative radiographic assessments. Significance was set at a *P* value less than .05.

**RESULTS**

Satisfactory reduction (defined as within 20º of normal volar tilt, less than 2 mm of radial shortening, and less than 1 mm of articular incongruity) was achieved in all distal radius fractures. All distal ulna fractures also healed. All fractures united at an average of 12.5 weeks (range, 9-18 weeks), as determined by clinical examination and follow-up radiographs (Figure 2). One patient had delayed union. This patient was an older woman with severe osteoporosis who did not achieve union until 12 weeks with callus formation. She was treated conservatively with an additional period of wearing a short-arm removable splint. As a result, her fracture united at 6 weeks after the diagnosis of delayed union, with acceptable clinical outcome.

According to the mean radiographic data, all patients had a significant restoration of anatomic alignment, including ulnar variance, radial inclination, and volar tilt. A congruous radiocarpal joint (a step-off of less than 2 mm) and carpal alignment were restored in all patients. Twenty-three of 25 ulna fractures were reduced anatomically or with the ulnar shaft angulated less than 5º (range, 0.5º-4.5º; combined angulation on biplanar radiographs). Two patients had ulna angulation in the coronal plane of 8.5º and 9.5º. However, some differences between radiographs taken immediately postoperatively and those taken at last follow-up were not statistically significant (Table 2). Clinical examination showed an acceptable wrist ROM in all patients (Table 3). All patients were able to make a full composite grip and had full finger ROM.

Average modified Mayo wrist score was 87 points (range, 65-100 points), and average DASH score was 14 points (range, 0-54 points). One patient with a type IIIC open fracture experienced complications of skin defects and vascular problems, which led to muscle weakness, slightly limited activities of daily living, and a subsequently high DASH score. Four plates were removed at the patients’ request at an average of 13.2 months (range, 11-15 months).

No cases of infection, tendon rupture, loss of reduction, complex regional pain syndrome, malunion, or nonunion occurred. Four of 25 patients underwent bone grafting: 2 in Q3 fractures and 2 in Q5 fractures. One of these 4 patients received the autologous bone from the iliac crest, whereas the other 3 received allograft materials such as demineralized bone matrix. These 4 patients were women aged older than 65 years. One patient had paresthesia in the median nerve distribution without motor deficit, and another experienced mild paresthesia in the ulnar nerve dorsal sensory branch distribution. These 2 patients improved after 3 months without specific treatment.

Chronic instability of the distal radioulnar joint was not encountered in any pa-

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**Figure 2:** Preoperative radiograph of a 74-year-old woman with a distal ulna fracture (Q5) and an associated ulnar styloid fracture (Q1) showing intra-articular involvement and basal oblique fracture of the ulnar styloid (A). Postoperative radiograph showing satisfactory fracture reduction and internal fixation of the ulnar styloid and ulna neck fracture (B). Radiograph at 15 months postoperatively showing complete bony union and congruent joint surface (C).
tient. However, 2 patients had radiographic signs of distal radioulnar joint arthrosis and mild distal radioulnar joint pain during wrist pronation or supination without distal radioulnar joint instability. These 2 patients had postoperative increased ulnar angulation. Although both patients had pain in the distal radioulnar joint, neither had restriction in activities of daily living because their symptoms were not viewed as troublesome.

**Discussion**

This study demonstrates that good outcomes are achievable in unstable distal ulna fractures treated with a distal ulna hook plate. Fracture of the distal ulna occurs most commonly through the tip or base of the ulnar styloid process; however, some fractures occur through the ulnar head or neck.1,24 Most fractures of the distal ulnar metaphysis associated with the distal radius fracture are well aligned and stable once the distal radius has been realigned and secured and do not benefit from internal fixation.5 Thus, several studies report the outcomes of nonoperative treatment of these fractures. Biyani et al1 reported that the combination of distal ulna fracture with distal radius fracture was 6% (19/320) and that certain types of fractures were more problematic. Of the 19 ulna fractures treated nonoperatively, 2 comminuted distal ulna fractures had nonunions, 4 of 5 simple neck fractures had marked restriction of rotation, and 3 had fracture callus encroachment of the distal radioulnar joint that limited forearm rotation. Moreover, McKee et al3 reported an association of distal radius fracture nonunion with ulna fracture in elderly women. Fernandez et al2 and Ring29 also added to the understanding of potential pitfalls, especially nonunion of the radius, with combined distal radius and distal ulna fractures.

Because the aforementioned complications occurred after nonoperative treatment, several studies have emphasized surgical treatment of unstable distal ulna fractures after fixation of the associated distal radius fracture. However, when a fracture of the ulnar neck exists, the distal fracture fragment is small, metaphyseal, and covered with articular surface over a 270° arc, making internal fixation challenging.5 Therefore, in the past, because few proper operative procedures existed, the distal ulna fracture was likely to have poor outcomes, such as distal radioulnar joint arthrosis or instability and nonunion.

Thus, until recently, some reports suggested distal ulna salvage methods, such as the Darrach procedure30 or primary resection arthroplasty at the time of injury.11,13 These procedures have the advantage of diminished pain in the injured wrist and the disadvantages of decreased wrist and forearm ROM and grip strength weakness.11 Therefore, Berger and Cooney31 introduced primary ulnar head prosthesis replacement arthroplasty. However, the limitation of this procedure was difficulty in reconstructing the original biomechanics of the distal radioulnar joint by providing the radius with its distal support during forearm rotation and allowing a normal pressure distribution from the hand and wrist on both forearm bones.32

Fixation of distal ulna fractures remains technically challenging.16,17 Surgical man-

### Table 2

**Radiographic Outcomes**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Immediately Postoperatively</th>
<th>Final Follow-up</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to union, wk</td>
<td>12.5 (9 to 18)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Ulnar variance, mm</td>
<td>0.9 (–1.9 to 2.5)</td>
<td>0.4 (–2.2 to 1.2)</td>
<td>.16</td>
</tr>
<tr>
<td>Radial inclination, deg</td>
<td>23.9 (16.3 to 28.1)</td>
<td>22.7 (15.5 to 26.1)</td>
<td>.73</td>
</tr>
<tr>
<td>Volar tilt, deg</td>
<td>11.3 (7.2 to 16.5)</td>
<td>10.5 (5.2 to 15.4)</td>
<td>.36</td>
</tr>
<tr>
<td>Ulnar metaphyseal angulation, deg</td>
<td>1.8 (0.2 to 3.4)</td>
<td>4.7 (0.5 to 9.5)</td>
<td>.08</td>
</tr>
<tr>
<td>Sagittal plane</td>
<td>.8 (0.3 to 2.8)</td>
<td>2.4 (0.7 to 4.5)</td>
<td>.23</td>
</tr>
</tbody>
</table>

*Abbreviation: deg, degrees.*

### Table 3

**Clinical Results at Last Follow-up**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (Range)</th>
<th>Contralateral Side, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of motion, deg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexion</td>
<td>72 (60–85)</td>
<td>82</td>
</tr>
<tr>
<td>Extension</td>
<td>69 (65–80)</td>
<td>89</td>
</tr>
<tr>
<td>Pronation</td>
<td>77 (55–95)</td>
<td>93</td>
</tr>
<tr>
<td>Supination</td>
<td>82 (65–90)</td>
<td>94</td>
</tr>
<tr>
<td>Ulnar deviation</td>
<td>35 (15–50)</td>
<td>84</td>
</tr>
<tr>
<td>Radial deviation</td>
<td>24 (10–40)</td>
<td>89</td>
</tr>
<tr>
<td>Grip strength, kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominant</td>
<td>28 (22–30)</td>
<td>91</td>
</tr>
<tr>
<td>Nondominant</td>
<td>24 (22–26)</td>
<td>80</td>
</tr>
<tr>
<td>Modified Mayo wrist score</td>
<td>87 (65–100)</td>
<td></td>
</tr>
<tr>
<td>DASH score</td>
<td>14 (0–54)</td>
<td></td>
</tr>
</tbody>
</table>

*Abbreviation, DASH, Disabilities of the Arm, Shoulder and Hand; deg, degrees.*
management has been described using several methods, including percutaneous K-wires,\(^1\) condylar blade plating,\(^3\) intrafocal pin plating,\(^2\) and locked plating.\(^4\) However, each fixation method has complications. Percutaneous K-wire techniques provide support but have limited indications in comminuted or osteoporotic bone, require postoperative immobilization, and have associated morbidity related to pin-site irritation, infection, and migration or loosening.

When reduction is attempted using a mini-condylar locked plate or blade condylar plate, the thin cortical bone of the articular ulnar head often fragments under load, leading to further comminution and possible failure. In this respect, the indirect reduction method using a small angularly stable implant, such as the distal ulna hook plate, can be used to perform stable fixation of relatively small fragments. The distal ulna hook plate is best placed on the medial border of the ulna, directly in line with the ulnar styloid, and acts as a buttress for the fracture fragment of the ulnar styloid.

Information is contradictory regarding the significance of ulnar styloid fractures. Some reports claim that distal radius fractures with an associated ulnar styloid fracture have an increased incidence of distal radioulnar joint instability than do distal radius fractures without a concomitant ulnar styloid fracture.\(^7\) Current reports have concluded that no difference exists in overall functional results when comparing distal ulna fractures with or without an ulnar styloid fracture, regardless of displacement amount.\(^9,33\)

Concerns about instability of the distal radioulnar joint in patients with an ulnar styloid fracture originate from the anatomic feature that the radioulnar ligaments, a primary stabilizer of the distal radioulnar joint, attach to the base of the ulnar styloid.\(^34\)

Moreover, the potential factor of chronic distal radioulnar joint instability can depend on the site of the ulnar styloid fracture. Nakamura et al\(^15\) reported that, if the ulnar styloid fracture is basal oblique, it can produce up to 70% loss in distal radioulnar joint stability. In the current study, basal oblique ulnar styloid fractures can achieve satisfactory outcomes postoperatively using a distal ulna hook plate as a buttress. To the authors’ knowledge, no reports exist on the optimal management of concomitant ulnar styloid and distal ulna fractures. Ring et al\(^2\) used a combined method with a condylar blade plate and tension band wiring for fixation of the concomitant distal ulna and ulnar styloid fractures. The current authors were able to achieve secure fixation using only a distal ulna hook plate.

The number of patients in the current study (N=25) is larger than that in any other report; in this respect, the outcomes have significant meaning. Alignment of the ulnar shaft was anatomic or angulated to less than a combined angulation (on biplanar radiographs) of 5° in most patients. Two patients had more than 5° of angulation, but this was accepted at the time of fixation because good rotation and distal radioulnar joint stability existed, and single plane deformity was less than 10°.

This study had some limitations. First, the study lacked any comparative groups; a study comparing various fixation techniques would have been beneficial. Second, severely comminuted cases were excluded. In these cases, rigid plate fixation is difficult and may be unachieviable in comminuted distal ulna fractures. Third, mean follow-up was approximately 15.2 months, and some degree of radiographic change in distal ulna angulation existed at last follow-up. Therefore, developmental angulation changes may become more apparent with a longer follow-up period because some degree of collapse of the metaphysis existed.

**CONCLUSION**

The distal ulna hook plate is an anatomic plate contoured to fit to the distal ulna metaphysis. The good outcomes achieved in this study suggest that use of the distal ulna hook plate could be an alternative treatment method for intra-articular ulna neck or head fractures, as well as basal oblique ulnar styloid fractures.

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