Arthroscopically Guided Osteotomy for Management of Intra-Articular Distal Radius Malunions

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Purpose A malunion with a step-off of 1 mm or more after an intra-articular distal radius fracture may cause pain and arthritic changes at midterm follow-up. We present our technique for treating intra-articular distal radius malunions by carrying out an osteotomy from inside the joint outward under arthroscopic guidance using the dry arthroscopy technique, with emphasis on the clinical and radiologic outcomes.

Methods We performed surgery on 11 patients for intra-articular malunion of the distal radius 1 to 5 months after the injury. Preoperative step-offs ranged from 2 to 5 mm (average, 2.5 mm) on plain radiographs. Original fracture patterns involved 1 radial styloid fracture, 1 radiocarpal fracture–dislocation, and 9 comminuted intra-articular fractures. In 5 cases an anterior-ulnar or radial styloid fragment was repositioned. In the rest, more than 1 fragment (up to 3) was osteotomized. In 1 patient the articular osteotomy was combined with an ulnar shortening osteotomy.

Results Follow-up ranged from 12 to 48 months. Step-offs were reduced in most cases to 0 mm; however, localized gaps (<2 mm) and cartilage defects were commonly seen intraoperatively because the fragments did not accurately fit. According to the Gartland and Werley score, there were 4 excellent and 7 good results (mean score of 2.8). The Modified Green and O'Brien system achieved a mean score of 83, with 3 excellent, 5 good, and 3 fair results. One patient showed radiolunate narrowing on follow-up radiographs.

Conclusions Arthroscopically assisted osteotomy permits direct visualization of the osteotomy site with good midterm clinical and radiologic outcomes. The technique can be used in irregularly defined fragments. *(J Hand Surg 2010;35A:392–397. © 2010 Published by Elsevier Inc. on behalf of the American Society for Surgery of the Hand.)*

Type of study/level of evidence Therapeutic IV.

Key words Wrist arthroscopy, radius malunion, distal radius osteotomy, dry arthroscopy.

Unfavorable results and degenerative arthritis may be expected when anatomical reduction is not achieved after distal radius fractures.[1–3] Several authors have pointed out that the goal is anatomical reduction, or at worst a step-off of less than 1 mm.[4–6]

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Management of the young and/or active patient with a step-off after a malunited distal radius fracture includes intra-articular osteotomy, which is nonetheless hampered by limited vision. For volar shearing type malunions, the joint is approached volarly, the external callus is removed, and the osteotomy is directed toward the joint, with the intent that the osteotome follows the original fracture line.[7–9] For other types of intra-articular malunion, the approach is through a dorsal capsular window.[8–12] Fernández[10] considered this technique appropriate only for single line fractures, whereas others[8,12] used it for the more complex 4-part fracture configurations.

We investigated the possibility of direct arthroscopic manipulation of the displaced fragments by working

TABLE 1. Demographics

Case	Age	Gender	Dominance	Fracture AO	Delay (wk)	Previous Treatment
1	46	M	D	C.3.1	5	Cast
2	32	W	ND	C.3.1	12	K-wire + external fixator
3	42	M	ND	C.3.1	4	Cast
4	45	M	D	B.1.1	5	Cast
5	45	M	ND	C.3.1	11	K-wire
6	25	M	D	C.3.1	7	Volar plate
7	49	M	D	C.3.1	4	External fixator
8	32	M	D	C.3.1	12	Cast
9	27	M	ND	B.2.3	21	K-wire
10	61	M	D	C.3.1	12	K-wire + external fixator
11	53	W	D	C.3.1	13	K-wire

D, Dominant side; ND, Non-dominant side.

inside the joint.[13] We found that the dry procedure without fluid distension of the joint is preferable.[14] In our previous report we showed that the technique was feasible; in this report, we present results of this surgery.

The purpose of this retrospective study was to assess the clinical and radiographic outcomes in the management of intra-articular distal radius malunions with an arthroscopically assisted osteotomy.

MATERIALS AND METHODS

From 2004 to June 2008, we operated on 11 consecutive patients with intra-articular distal radius impacted fractures or malunions with an articular step-off of 2 mm or more measured on plain x-rays using an arthroscopically assisted osteotomy technique.[13] Patients were observeded for at least 12 months after the surgery (mean, 32 mo; range, 12–48 mo) (Table 1).

There were 9 men and 2 women with a mean age of 42 years (range, 25–61 y). All except 1 (case 8) occurred under workers' compensation coverage. Four patients were involved in heavy work; all the rest were performing less demanding manual activities. The dominant hand was affected 7 times. One had a radial styloid fracture, 1 a volar radiocarpal fracture–dislocation, and the rest different types of comminuted intra-articular fractures (C31 of the AO classification).[15] Two of the authors measured step-offs and gaps in millimeters with a metric ruler on preoperative plain radiographs. The most displaced fragment was used as a reference when several fragments were involved. Preoperative step-offs ranged from 2 to 5 mm (average, 2.5 mm). Gaps varied from 0 to 3 mm (average, 0.73 mm). Time from the original injury to surgery was 9.6 weeks on average (range, 4–21 wk).

All patients had been managed initially elsewhere. Original treatment consisted of closed reduction and cast immobilization in 4 patients, K-wires and cast in 3 patients, closed reduction and external fixator in 1 patient; K-wire and external fixator in 2 patients, and a volar locking plate in 1 patient. Immobilization time ranged from 4 to 6 weeks, except in the patient with the plate (number 6), who started therapy immediately after the surgery.

The technique of osteotomy has been described previously (Fig. 1).[13,14] An arthroscopic arthrolysis is first carried out to create working space, as the joint is scarred and unyielding. To cut the bone, we used a shoulder periosteal elevator (of 15° and 30° angles; Arthrex AR-1342-30° and AR-1342-15°; Arthrex, Naples, FL) and also straight and curved osteotomes (Arthrex AR-1770 and AR-1771). Instruments with different angles were required. To avoid damaging the cartilage or cutting the extensor tendons, the osteotome should have a double 90° twist on its way to the joint cavity. First, it was introduced horizontally in the direction of the skin incision, then it was twisted 90° in the subcutaneous tissue to avoid the extensor tendons, and finally it was rotated again inside the joint itself. Stabilization of the fragments was carried out with volar locking plates when several fragments were mobilized; screws or buttressing plates were used when only one fragment needed to be addressed.

Evaluation

The patients were seen at varying intervals until discharge by the treating surgeon. For the purpose of this study, they