



Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Is it really necessary to restore radial anatomic parameters after distal radius fractures?



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ARTICLE INFO

Keywords:

Distal radius fractures
Volar plating
Anatomic radiographic parameters

ABSTRACT

Small variations within normal range of radiographic parameters, except ulnar variance and volar tilt, do not influence the final functional outcome in distal radius fractures.

Introduction: There are many reports in the literature on the relationship between radiographic variables and their influence on the final outcome of distal radius fractures. Most authors report that a good functional result depends on anatomical restoration of the articular surface and extra-articular alignment. The aim of this study was to verify if it is really necessary to restore anatomic radiographic parameters to obtain satisfactory functional outcome in distal radius fractures treated with volar plate.

Materials and methods: We retrospectively evaluated 51 patients treated with volar locked plate for articular unstable distal radius fractures from December 2006 to March 2009. Each fracture was evaluated according to the AO classification. The average follow-up was 40.5 months. Radiological measurements were performed considering radial height, radial inclination, volar tilt and ulnar variance, both preoperatively and postoperatively, to estimate the correction value. We examined range of motion (ROM), grip strength with a Jamar[®] dynamometer and Disabilities of the Arm, Shoulder and Hand (DASH) score. The τ Student test was performed for statistical analysis.

Results: The persistence of articular step-off was assessed in 35.3% of patients. Normal radial inclination (21–25°) was restored in 74.5% of patients (range 15–27.5°). Normal radial height (10–13 mm) was restored in 66.6% of patients (range 6.8–17.3 mm). Normal volar tilt (7–15°) was achieved in 90.2% of patients (range 3–17°). Normal ulnar variance (0.7–1.5 mm) was restored in 86.3% of patients (range 0.7–4.1 mm). There was a statistically significant difference between the preoperative and postoperative radiographic values ($p < 0.01$). The majority of patients showed complete recovery of ROM, with no statistically significant difference ($p > 0.05$) in extension, flexion, supination and pronation compared with the contralateral hand. Eight patients who had postoperative volar tilt and/or ulnar variance out of range had a statistically significant difference ($p < 0.05$) in ROM compared with the non-operated side. At final follow-up, all patients had a statistically significant difference ($p < 0.05$) in grip strength compared with the contralateral side, even with good strength values. The mean DASH score was 12.2 (range 0–61).

Discussion and conclusion: Our experience suggests that ulnar variance and volar tilt are the most important radiographic parameters to be restored to obtain good functional outcome in distal radius fracture. Small variations of other radiographic parameters seem to not affect the final outcome at minimum 3 years' follow-up.

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Introduction

Distal radius fractures are the most common fractures in the upper limb and represent 17% of all fractures [1,2] and 75% of forearm fractures [3]. Nowadays a higher incidence of these events in young adult males and older women has been assessed [4,5]. ORIF procedure with plating is a reliable choice of treatment

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Fig. 1. Extra-articular fracture with displacement >1 cm.

for displaced intra-articular distal radius fractures [6–8] defined as unstable according to stability criteria described in the literature [9]. Since the last decade, dorsal plating is no longer considered the best management of unstable dorsal displaced fractures [6,10]. This is because of complications such as extensor tenosynovitis and tendon ruptures [11,12]. The use of volar plates has seldom been associated with flexor tendon problems because the anatomy of the volar aspect of the wrist offers more cross-sectional area and the implant is separated from the tendons by the pronator quadratus [13]. There is a wide consensus among surgeons [14–16] regarding the importance of restoring preoperative radiographic parameters. On standard antero-posterior and lateral radiographs, five measurements can be easily used to evaluate the distal radius profile: volar tilt, radial inclination, ulnar variance, radial height, and articular step-off. Abnormalities in the anatomy of the wrist joint can be deleterious. Malunited displaced distal radius fractures (Figs. 1 and 2) can lead to radiocarpal and radioulnar pain, radiocarpal and distal radioulnar joint instability (carpal-ulnar deviation, triangular fibrocartilage overload), loss of strength and range of motion (ROM), and osteoarthritis.

The aim of this study was to verify if it is really necessary to achieve anatomic radiographic parameters in distal radius fractures treated with volar plate and which of these parameters are important to obtain satisfactory functional outcome at short-term follow-up. The study hypothesis is that it is not crucial to restore all radiographic measurements to the normal ranges to obtain good functional results at short-term follow-up, and that small variation of radiographic parameters can still be associated with good functional results.

Materials and methods

Study group

We retrospectively reviewed the records on all distal radius fractures treated with volar plating that were performed

from December 2006 to March 2009 in our Hand Surgery Unit. The study protocol was approved by the Hospital Ethics Committee before the beginning of the evaluation. Inclusion criteria were unstable fracture according to Jupiter [17] (i.e. dorsal tilt > 20°, initial displacement > 1 cm, intra-articular disruption) also after close reduction and secondary displacement in plaster cast. Exclusion criteria were AO/ASIF B2 fractures (Barton fracture), open fractures, bilateral wrist fractures, concurrent major traumas, association with percutaneous techniques, growth plates opening and previous wrist fractures. Patients were not excluded on the basis of age or bone quality. Sixty-one wrists in sixty patients met the criteria and were included in the study. For this retrospective review, all patients were contacted and were offered a free consultation and radiographic examination. Fifty-one patients returned for a clinical evaluation and radiographic examination. Four patients had died. There were 27 men and 24 women in the study. The mean age at the time of injury was 52.8 years. Six patients refused to return for a follow-up visit. The mean age of the patients was 52.8 years (range 35–64 years) at time of surgery. Thirty-nine patients (76.5%) had involvement of the non-dominant arm. Each patient was classified on the basis of preoperative X-rays according to the AO/ASIF system [18]. There were four type A3 fractures, one type B1, four type B3, twelve type C1, eight type C2 and twenty-two type C3. The fractures were treated with ORIF with volar plate (Acu-loc by Acumed[®]) by the same surgeon.

Clinical assessment

Patients were evaluated by the same observer for the determination of active and passive wrist ROM and the Disabilities of the Arm, Shoulder and Hand (DASH) score. Grip strength was measured with a Jamar[®] dynamometer. In addition, the patients were asked to grade the subjective result as very satisfied, satisfied, uncertain, or disappointed.

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