

Do Distal Radius Fractures Shift After External Fixation?

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Background/Purpose: The factors that predict the final position of distal radius fractures treated nonoperatively, as well as the change in position after cast removal, have been well studied. However, no data exist on those factors that influence the final position of those treated with external fixation, nor is there information available regarding the change in position from the initial postoperative radiographs to the final well-healed state. The purpose of this study was to evaluate these two questions in a large series of unstable distal radius fractures treated with external fixation.

Methods: We evaluated 77 patients with unstable distal radius fractures treated with external fixation. 57 patients (31 M, 26 F), average age of 49 years (range, 22-89) with 59 fractures had complete radiographs available and were followed radiographically for an average of 149 days. All patients had unacceptable initial closed reductions. All external fixation spanned the wrist and was performed by a trauma or hand attending surgeon; accessory pins were standard. We tabulated the following parameters as potential predictors of final alignment: dorsal comminution (defined as having a loss of the dorsal cortex of ≥ 5 mm by 1/3 of the metaphyseal depth), intra-articular fracture, ulnar styloid fracture, volar cortical alignment, and initial dorsal tilt $>20^\circ$. In addition to these factors, age, sex, the number of Lafontaine criteria present, and the McQueen equation value were used in the statistical analysis. On the immediate postoperative and final radiographs (at discharge from follow-up) we measured the volar tilt, radial height, radial inclination, and ulnar variance. A PhD statistician performed univariate and multivariate analyses to determine which of the fracture or patient factors were associated with final alignment. The change in each of the radiographic parameters was calculated from the initial postoperative to the final follow-up films.

Results: The results of the univariate analysis demonstrated that the McQueen value predicted final ulnar variance. The total number of Lafontaine criteria met predicted radial inclination. Dorsal comminution predicted radial inclination and height. Age predicted radial height and ulnar variance and sex predicted ulnar variance. Interestingly, no factor correlated with volar tilt. Based on the univariate analysis, a multivariate analysis was performed to isolate which patient and fracture characteristics had the greatest effect on final radiographic position. The findings of the multivariate analysis demonstrated that dorsal comminution, age, and sex were the factors that most influenced the final radiographic alignment (Table 1).

Table 1. Factors That Were Statistically Significant in the Multivariate Analysis ($P < 0.05$)*

	Volar Tilt	Radial Height	Radial Inclination	Ulnar Variance
Final alignment	--	DC, S	DC	DC, S, Age

*S = sex, DC = dorsal comminution.

The difference in radiographic parameters from the immediate postoperative radiographs to those at an average of 145 days demonstrated that the reductions were maintained after frame

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removal. The overall alignment and the shift over time is seen in Table 2; each difference is within measurement error indicating maintenance of position through the well-healed state.

Table 2. Final Position and Change From Initial Postoperative Films

	Volar Tilt	Radial Height	Radial Inclination	Ulnar Variance
Final alignment	$2.4^\circ \pm 9^\circ$	12.4 ± 3.5 mm	$24.6^\circ \pm 6.5^\circ$	1.0 ± 2 mm
Δ to final follow-up	-1.8°	0.1 mm	-0.5°	-1.1 mm

Conclusion: For patients with unstable distal radius fractures treated with external fixation, dorsal comminution was the most influential factor influencing the final radiographic position. It was associated with radial height, inclination, and ulnar variance. Additionally, we found almost no change in position from the initial postoperative radiographs to the final films (average 145 days). As opposed to fractures treated closed, the initial reduction with external fixation was well maintained over time.