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Original Article

Comparison of Early Rehabilitation (2 Weeks) of Distal Radius Fracture versus Late Rehabilitation (6 Weeks) in Patients Treated with Percutaneous Pinning: A prospective Randomized Study

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Abstract

Background & Aims: Distal radius is the most common site of fracture in the upper extremity. To assess the clinical controversy of the duration of the immobilization period, we conducted a prospective study. The aim of this study was to compare early rehabilitation (two weeks of short-arm cast immobilization) versus the mean regular period of immobilization of 6 weeks in patients with distal radius fractures (DRF). We hypothesize that 2 weeks of immobilization lead to better or same patient-reported outcomes compared with 6 weeks of immobilization and that this treatment does not lead to more complications.

Materials & Method: In this prospective study, 84 patients with an isolated DRF were treated by reduction and percutaneous fixation. 43 patients were randomly assigned to the 2-week group and 41 patients were randomly assigned to the 6-week group. The types of fractures were the same in both groups. At 6 weeks and 12 weeks after surgery, Disability of the arm, shoulder and hand (DASH) questionnaire, patient-rated wrist evaluation (PRWE), and Mayo score were analyzed.

Results: The 2-week group had significantly higher Mayo scores at 6 weeks. According to Mayo score questionnaire, the 2-week group reported significantly less pain and more functional outcome than the control group at the 6-week follow-up and no significant differences in grip strength and range of motion scores were found at 6 weeks. Although patients who were treated with 2 weeks of cast immobilization showed better results based on PRWE score and DASH score, the difference between the groups was not statistically significant. There were no significant differences between groups at 12-week follow-up based on the PRWE, DASH, and Mayo score.

Conclusions: There is no difference between short-term immobility and long-term immobility. However, in the rapid onset of active movements, better results are seen in short-term evaluations. As a result, it can be said that performing active movements early in patients with DRF can be safe, as long as these movements do not cause complications and treatment failure.

Keywords: early rehabilitation, distal radius fracture, outcome, immobilization period

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Introduction

The distal radius is the most common site of fracture in the upper extremity. It is about one-sixth of all fractures treated in the emergency department of the United States(1). Previous studies have reported 10% to 25% prevalence, with consequences such as high costs of health care, impaired physical function, impaired mental health, and long-term work absence(2-4).

Treatment of distal radius fractures (DRF) varies from an elastic bandage to an open surgery. The choice of treatment in each case depends on the characteristics of the fracture and the patient. Recent studies have made major changes in the treatment of DRFs in the last two decades. The overall rate of use of surgical procedures has increased, with a significant increase in the use of internal plate fixation as well as a reduction in the use of percutaneous fixation(5, 6).

The main therapeutic principles should be exact reconstruction of the articular surface, stable internal fixation, and early mobilization(7). The duration of immobility following a DRF varies. Several studies suggest that shorter immobilization leads to quicker recovery in wrist function, without the increased risk of secondary displacement(8-10). In contrast, some studies found no difference in function of wrist or complication following surgery between early and late mobilization(11, 12). Also, the guidelines of the American Academy of Orthopedic Surgeons do not recommend early wrist mobilization on a routine basis after stable fixation(13) and a different guideline proposes an early wrist mobilization depending on the type of osteosynthesis and achieved stability(14).

To assess the clinical controversy of the duration of the immobilization period, we conducted a prospective study. The aim of this study was to compare early rehabilitation (two weeks of short-arm cast immobilization) versus the mean regular period of immobilization of 6 weeks in patients with DRF. We hypothesize that 2 weeks of immobilization lead to better or same patient-reported outcomes compared with 6 weeks of immobilization and that this treatment does not lead to more complications.

Materials and Methods

We performed a randomized prospective study at Imam Khomeini Hospital, Urmia University of Medical Sciences in which patients who underwent closed reduction and percutaneous fixation in DRFs were screened for inclusion. The types of fractures were same in both groups(A or B).

Inclusion Criteria:

- Age>18 years
- Unilateral fracture
- Type A and B fractures (AO classification)
- No opium addiction

Exclusion Criteria:

- Open fractures
- Fracture of the contralateral arm
- Preexistent abnormalities of the fractured distal radius
- Multi-trauma patient
- Pathological fractures

Randomization and Blinding:

Patients were informed about this study at the emergency department, after checking the above-mentioned inclusion and exclusion criteria. After obtaining informed consent, using a block envelope randomization, patients were assigned into the intervention group (2 weeks of short-arm cast immobilization) or the control group (6 weeks of short-arm cast immobilization). A random person not involved or familiar with the study was chosen to select an arbitrary envelope. The envelope was opened after surgery; thus, the surgeon was blinded for the group choice of the patient during the operation.

Owing to the design of the study, blinding was not possible in all aspects of the study. Surgeons and therapists, as care providers, were not blinded in respect to the treatment allocation, but they were unaware of the group allocation of the patient during surgery. Clinical examination was performed by an independent examiner, who was blinded to the method of treatment and participants were asked not to reveal the duration of immobilization to assessors.

Follow-up and Outcome Evaluation:

Follow-up examinations were performed 6 weeks and 12 weeks after surgery. At each examination, range of motion and grip strength of the injured and uninjured sides were measured. Self-assessment by patients was registered on the Quick Disability of the Arm, Shoulder and Hand (Quick- DASH) questionnaire(15), the Patient-rated Wrist Evaluation (PRWE)(16), and Mayo score(17). Radiological evaluations were not performed in this study.

Sample Size:

The MCID of the PRWE score is 11.5 points(18). Based on a difference of 11.5 points, a sample size of 38 patients per treatment group was calculated with a power (1–β) of 80% and a type I error (α) of 5%, allowing a 10% drop-out. In total, 84 patients were included in the study, 42 in each group.

Statistical Methods:

Descriptive analysis was performed to compare the baseline characteristics. For continuous data, the mean and standard deviation for parametric data or medians and interquartile ranges (IQRs) for nonparametric data were calculated. The results in grip strength and range of motion, and questionnaire scores were normally distributed according to the appearance on histograms and the Shapiro–Wilk's W test (>95%). Means with 95% confidence intervals (CIs) were used for graphic presentations for each treatment group and Student's t-test was conducted to determine differences between the treatment groups at follow-ups and in baseline characteristics. When the data was not normally distributed, the active and control groups were compared using the Mann–Whitney U test. Chi-square test (Fisher test if necessary) was used to compare the frequency of qualitative variables. Paired t-test (for parametric data) and Wilcoxon test (for nonparametric data) were used to assess the improvement trend in each group.

Results

A total of 92 patients were included in this study, and 84 patients completed the 12-week follow-up evaluation (43 patients in case group and 41 patients in control group). Demographic data are reported in Table 1.

Table1- Demographic Information of Groups

	2 weeks immobilization	6 weeks immobilization	Total	P-Value
Male(n)	22	21	43	0.61
Female(n)	18	23	41	
Median Age(y) ± standard deviation	42.49±13.41	40.44±11.83	41.49±12.63	0.46

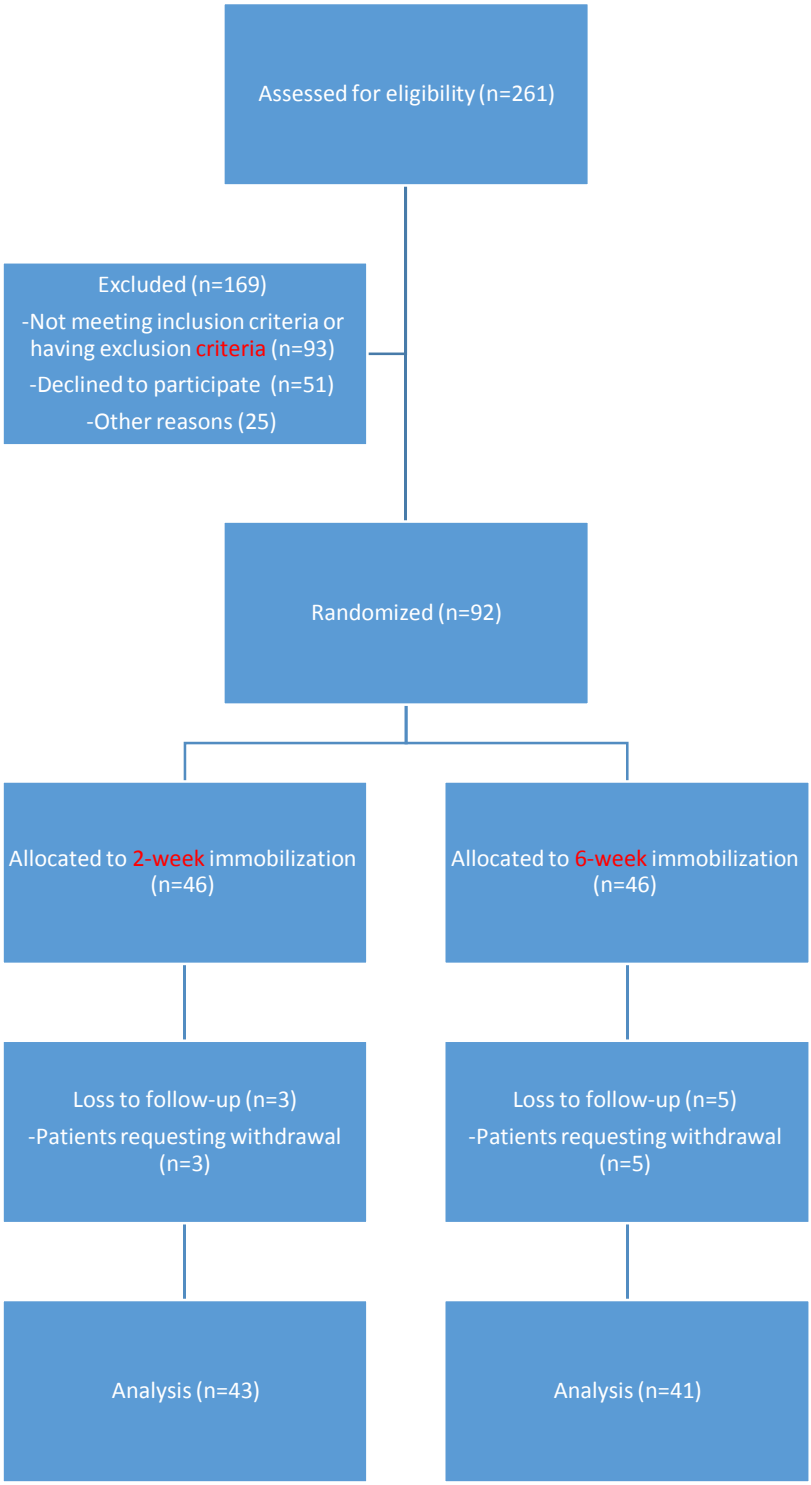

Figure.1

In Table 2, the results of functional outcome after 6 and 12 weeks for both groups are listed. The 2-week group had significantly higher Mayo scores (less disability) ($p = 0.001$) at 6 weeks. According to Mayo score questionnaire, the 2-week group reported significantly less pain and more functional outcome than the control group at the 6-week follow-up ($p < 0.001$ and $p=0.04$), and no significant differences in grip strength and range of motion scores were found at 6 weeks ($p=0.12$ and $p=0.72$). Although patients who were treated with 2 weeks of cast immobilization showed better results based on PRWE score and DASH score,

the difference between the groups was not statistically significant (p=0.29 and p=0.07). There were no significant differences between groups at 12-week follow-up based on the PRWE, DASH, and Mayo score.

In Fig.2, Fig.3, and Fig. 4, the improvement trend from the 6-week to the 12-week for both groups are shown. In both group, there is a significant improvement based on the PRWE, DASH, and Mayo score.

During the study period, there were no complications in fracture healing. In both groups, no cases of nonunion or CRPS were noted. In both groups, patients did not need reoperation.

Table 2. Outcome Measures According to Immobilization Period at 6 Weeks and 12weeks after Treatment

		6-week			**12-week**		
		Case (2 weeks immobilization)	Control (6 weeks immobilization)	P	Case (2 weeks immobilization)	Control (6 weeks immobilization)	**p**
PRWE Score		40.91±14.41	49.52±25.62	0.29	14.65±9.37	16.17±14.75	0.57
	Pain	19.62±8.10	28.63±20.97	0.26	7.09±5.11	8.09±7.34	0.9
	Function	38.54±16.72	36.75±15.55	0.08	13.67±9.48	13.11±11.27	0.44
Mayo Score		59.07±9.08	51.36±13.41	0.001	83.95±14.21	84.00±17.88	0.75
	Pain	20.46±2.13	15.63±5.94	<0.001	23.83±2.13	23.24±3.89	0.66
	Function	18.02±4.51	15.85±6.5	0.04	23.48±2.32	23.02±3.81	0.83
	ROM	10.35±2.76	10.73±5.07	0.72	18.02±5.68	18.48±6.26	0.66
	Grip	10.23±3.07	9.14±3.33	0.12	18.60±6.20	19.24±6.34	0.67
DASH Score		34.41±11.62	38.69±12.78	0.07	9.51±8.94	9.20±10.59	0.75

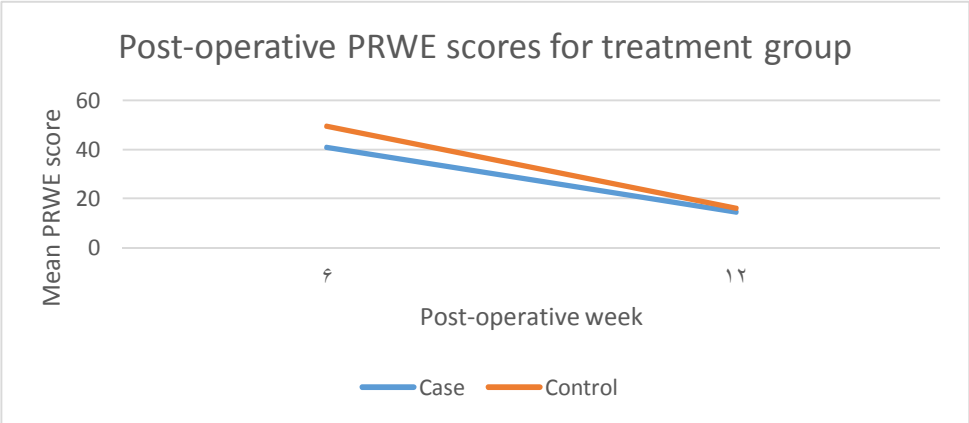

Figure 2.

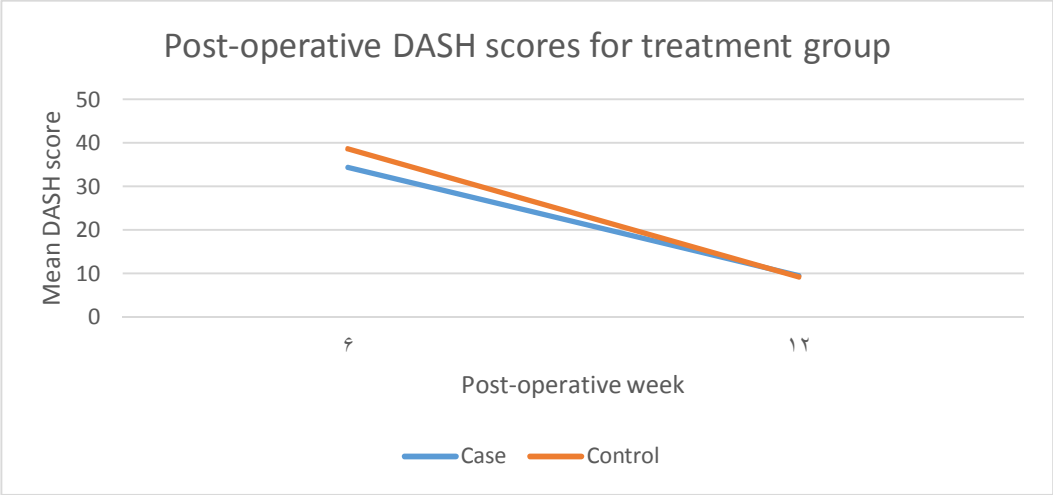

Figure 3.

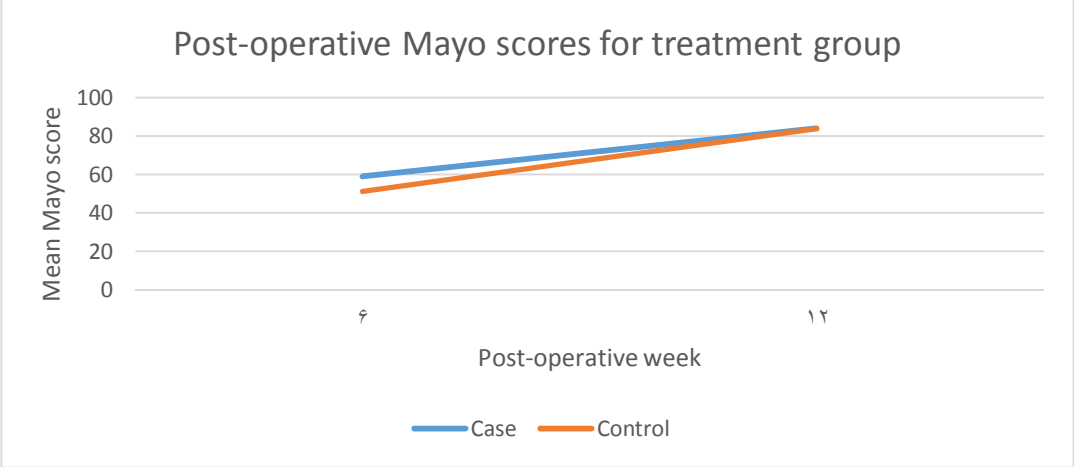

Figure 4.

Discussion

As mentioned, DRFs are the most common fractures of the human skeleton, and due to the increase in population in industrialized countries, it is predicted that by 2030 we will see a 50% increase in the incidence of distal radius fractures(19). The goal of surgically treated DRF should be anatomical reconstruction of the articular surface, stable fixation, and early mobilization of the wrist and forearm(20). Ever since Colles warned his colleagues about the potential risk of wrist disability following prolonged immobilization, as well as the significant impact of the first 2 months of recovery after surgery on outcome, the need for protocols and treatment plans for recovery as well as determining the duration of wrist immobilization is considered essential.

In our study, we evaluated whether the duration of immobilization period in patients with DRFs could be reduced to 2 weeks and 2 weeks of immobilization lead to better or same patient-reported outcomes compared with 6 weeks of immobilization. The difference in functional outcome was measured using PRWE, Mayo, and DASH; all three are scores specific for functional outcome of the upper extremities. In our study, 2-week groups had significantly better outcomes than the 6-week group for the Mayo score at 6 weeks following surgery. Although, there was no statistically significant

difference between the groups except for the Mayo score, averaged across all assessment points at 6 weeks, the 2-week group performed better than the 6-week group with respect to the PRWE, Mayo, and DASH. We found that 2-week immobilization group was not significantly superior to 6-week group with respect to outcomes at 12 weeks following surgery. In the study of Narelle Watson et al.(10), which was performed between three groups with 1, 3 and 6-week immobilization, there was a significant difference between the groups only in the 6th-week of evaluation, but in the 12th and 26th-week evaluations, no difference was reported between the studied groups. In this study, 1-week group and 3-week group had better results in terms of PRWE and Quick DASH. Bentohami, A et al. performed a study in which patients with DRFs were immobilized for 3 and 5 weeks. Comparison between groups at 6 and 12 weeks and 6 months after surgery showed no difference between groups with respect to the PRWE and Quick DASH. The same result was reported in the other two studies(9, 11).

The 2-week group performed significantly better in terms of function (Mayo) than the 6-week group. According to Mayo score questionnaire, the 2-week group reported significantly less pain than the control group at the 6-week follow-up and no difference was observed at 12-week follow-up. This result is in accordance with the existing literature, a few studies have reported decreased pain in early mobilized groups during the early treatment phase (21-23), whereas other studies have shown equal levels of pain during the early treatment phase (9-11, 24). Almost all studies reporting pain after early mobilization in DRFs have observed similar pain levels between the groups over time and only two studies have reported persistent lower pain in the active group at a 1-year follow-up: one of these studies was made on undisplaced fractures(22) and one on slightly displaced and reduced fractures(23).

No difference was noted between the two treatment groups in ROM at any follow-up. Narelle Watson et al.(10) performed a study that showed, the groups that underwent casting for 1 and 3 weeks had better extensions than the group that underwent casting for 6 weeks but there was no difference in the late assessments as well as other movements. Lozano-Calderon et al. found no difference in range of motion between the study groups(11).

In our study, no difference in grip strength between the groups at the 2 follow-ups was noted. In accordance with our results, in the study of Christersson et al.(24) and the study of Narelle Watson et al.(10) no difference in grip strength was reported. One study reported that patients who underwent 3 weeks of casting had more grip strength than patients who underwent 5 weeks of casting(23). Also, several studies on DRFs have reported early improved grip strength after early mobilization, but there was no difference in the long-term assessment(25-27).

The results of this study are in accordance with the existing literature on this topic. The big difference is that in this study we do not have the rehabilitation program and the impact of this difference on outcome is unknown. It is possible that the rehabilitation program in other investigations facilitated improvement in outcome for the early mobilization group. Other differences between current investigation and other studies are different types of fractures and different treatment methods.

This study showed that shortening the period of cast immobilization is safe in these patients. A higher rate of possible complications that might occur after earlier cast removal, such as an increased number of secondary displacements of the fractures or increased pain sensation, was not found in this study.

The most important conclusion is that, not only there is no difference between short-term immobility and

long-term immobility, rather, in the rapid onset of active movements, better results are seen in short-term evaluations. As a result, it can be said that performing active movements early in patients with DRFs can be safe, as long as these movements do not cause complications and treatment failure.

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