



The Effect of Long Arm Cast and Thumb Spica Arm Cast in the Treatment of Patients with Distal Radius Fractures: A Randomized Clinical Trial

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Abstract

Background: Distal radius fracture is among the most common fractures of the long bones that are seen in all age groups. Treatment of these fractures in simple cases with displacement or intra-articular fractures is immobilization, and if the fracture has dislocation, surgery may be required.

Objectives: The aim of the study is a comparison of treatment efficacy and satisfaction in the methods of a long cast and thumb Spica cast in the patients with distal radius fractures without displacement.

Methods: This study is a randomized clinical trial with a non-blinded parallel design. Eighty patients with distal radius fractures without displacement were randomly assigned to long cast and thumb Spica cast groups. Patients were randomly using a random number table assigned to one of two long cast and thumb Spica cast methods. Both groups were examined at weeks 4 and 5 and after six weeks plaster was opened and after one week they were evaluated by DASH questionnaire. Performance (limitation of motion, grip strength) and patients' satisfaction was assessed in the two groups.

Results: The mean age of patients was 49.87 ± 13.81 years. There were no significant differences between two groups regarding age ($P = 0.84$). In thumb Spica group 60% and in the long cast group 55% were male. There was no significant difference in sex distribution between treatment groups. The DASH scores in all subjects were 11.68 ± 5.53 . Average total DASH score in thumb Spica cast group was 7.19 ± 6.80 and in the long cast was 16.02 ± 6.23 . The mean of total DASH score in thumb Spica cast group was significantly higher than long cast group that presented better performance (limitation of motion, grip strength) in thumb Spica cast group respect to long cast group ($P < 0.001$). Satisfaction was similar between two groups ($P = 0.40$).

Conclusions: Regarding better performance and treatment, thumb Spica cast is recommended as the preferred treatment for distal radius fractures without displacement.

Keywords: Thumb Spica Cast, Long Arm Cast, Distal Radius Fractures

1. Background

Distal radius fracture is among the most common fractures of the long bones that are seen in all age groups (1-3). Treatment of these fractures in simple cases with displacement or intra-articular fractures is immobilization, and if the fracture has dislocation may surgery be required.

It can cause a noticeable disability that has an influence on patients' life and productivity (4). Because of its large incidence, the effect on patient's life and cost of national health support, its appropriate management is very important (5).

The optimum therapy of distal radius fracture should recover hand function with minimal post-treatment com-

plications at a low cost and high patient satisfaction. Therefore, different treatment options that include closed reduction and casting, external fixation, pin fixation and open reduction and internal fixation have been proposed (6, 7).

While all of these treatments can be considered based on the clinical condition and physician's decision, closed reduction and cast immobilization have traditionally been considered as the most accepted treatment modality for a stable form of this fracture (8).

As sufficient immobilization is required for healthy union and optimal functional outcomes, the form of the casting such as its location and its length have been dis-

cussed for a long time (9).

There are some studies that have confirmed that a short arm cast has the same treatment effects with lower complications and more patient satisfaction. Therefore, there is still controversy regarding the administration of long or short arm casts (10-12).

2. Objectives

To our best knowledge, there are few studies comparing long and short arm casts (12-15). The aim of the study is a comparison of effectiveness and satisfaction in the application of a long cast and thumb Spica cast in the patients with distal radius fractures without displacement.

3. Methods

3.1. Study Design

This study was a single-center randomized, one-to-one, case-controlled clinical trial (non blinded and parallel design). The IRCT registration code is: IRCT20190128042524N1.

3.2. Study Population and Data Gathering

The method of data gathering was convenience sampling. Eighty patients with distal radius fractures without displacement who were referred to the Emergency Department of Baqiyatallah Hospital from July 1, 2016, to December 30, 2017 were included. We tried matching between two groups in terms of sex, age, fracture status and osteoporosis.

3.3. Sample Size Determination

The calculation of sample size was based on a presumed medium effect size of equal 0.57, a statistical power of 80%, and a type I error of 5%, which required 39 patients per group. For more confidence though, at least 40 subjects were considered in this study.

3.4. Inclusion Criteria

All patients with distal radius fractures without displacement were included.

3.5. Exclusion Criteria

Exclusion criteria were: age over 70 and under 20 years, unstable fractures, Intra-articular fractures of distal radius, fractures greater than 20 degrees of dorsal angulation, fractures associated with other organ damage, open fracture of patients with severe deformity, patients who did not follow the treatment twice consecutively, previous severe deformity of the affected limb, diabetes and severe osteoporosis.

3.6. Blinding

Blinding was not applicable to this study.

3.7. Concealment

Concealment of patients' allocation was done by unmarked, security-tinted, sealed envelopes generated by a random number table.

3.8. Randomization

Patients randomly using a random number table one-to-one, simple randomization assigned to one of two long cast and thumb Spica cast methods. All fractures were type A2 according to the AO classification.

3.9. Intervention

We considered fractures with dorsal angulations of more than 20 degrees, radial shortening of more than 10 millimeters and extensive cortical comminution as unstable fractures.

Most of the fractures were reduced under local anesthesia but general anesthesia or regional block were performed for select patients.

Both groups were examined at weeks 4 and 5 and after six weeks, the plaster was opened and after one week they were evaluated by DASH questionnaire.

3.10. Outcomes

The Quick-DASH questionnaire with 11 items is a collection of questions for assessing the complications of treatment of upper limb fractures. Questions were based on the motor limitation of joints, grip strength, pain and satisfaction rate that was measured by scoring. In order to measure the DASH questionnaire, the use of a goniometer, gauge and photographic radiology is required. Each question has five category options and, from the question scores, questionnaire scores are computed, extending from 0 (no disability) to 100 (most intense disability). The questionnaires were completed about a week after opening the plaster. The length of time to open the plaster was about 6 weeks. All patients are followed in the fourth and sixth weeks and again after six weeks in plaster and then after a week, DASH criteria were assessed by questionnaire.

3.11. Ethical Consideration and Patients' Consent

The protocol of the study was confirmed in ethical committee of Baqiyatallah University of Medical Sciences (ethical code is IRB.BMSU.RC.1396.344). Informed consent form was received from all cases.

Figure 1 shows flow diagram of the included patients.

3.12. Statistical Analysis

After recording patient data, statistical data analysis with Mann Whitney and the chi-square test was performed with SPSS V. 20 software. The P value of less than 0.05 were considered significant.

4. Results

Eighty eligible patients were included in the study. The mean age of the patients was 49.87 ± 13.81 years. The mean age in the thumb Spica cast group was 13.79 ± 50.40 and the long cast was 14.16 ± 49.35 . There was no significant difference between the two groups in mean age ($P = 0.84$).

In the thumb Spica cast group, 60.0% and the long cast 55.0% were males. There was no significant difference between gender distribution in the two groups ($P = 0.749$).

The mean of DASH score for all patients was 11.68 ± 5.53 . The mean DASH score in the thumb Spica cast group was 7.19 ± 6.80 and in the long cast group, it was 16.02 ± 6.23 . The mean of DASH scores in the thumb Spica cast group was significantly lower than that of the long cast group, which showed better performance (limitation of joints, grip strength) in this group compared with the other group ($P < 0.001$) (Table 1).

Questions 1 - 6 related to limitation of joints and grip strength of patients. The mean scores of DASH in the thumb Spica cast group in questions 1, 2, 5 and 6 were significantly lower than those in the long cast group, which showed better performance in motor limitation. The joints and grip strength of this group are higher than the long cast group ($P < 0.05$) (Table 1).

Questions 7 and 8 were related to daily tasks of patients. The mean scores of DASH in the thumb Spica cast group were significantly lower in questions than in the long cast group, which indicates better performance in doing routine tasks in this group than the long cast group ($P = 0.014$, and $P = 0.001$) (Table 1).

Questions 9, 10, and 11 relate to the severity of pain in patients. The mean scores of DASH in the thumb Spica cast group in questions 9 and 11 were significantly lower than those in the long cast group, indicating that the pain severity was lower in this group than in the long cast ($P = 0.019$ and $P = 0.047$) (Table 1).

Table 1 shows the mean satisfaction score in the two groups. There was no significant difference in satisfaction mean in the two groups ($P = 0.40$). Thus, satisfaction was similar between two groups (Table 1).

5. Discussion

In this study, we aimed to compare the effectiveness and satisfaction in the methods of a long cast and thumb

Spica cast in the patients with distal radius fractures without displacement. The results have shown that performance (limitation of motion, grip strength) in thumb Spica cast group was significantly higher than long cast group. However, patients' satisfaction was similar between the two groups.

Fractures of the distal end of the forearm can be managed using casting (15). Since the appropriate and well-molded cast is required for achieving an optimal functional outcome, the type of cast is very meaningful (12-15).

Physicians have implemented long arm casts because of the sufficient elbow immobilization, but casting complications such as blister formation and limitation of ROM encouraged some physicians to use short arm casts (7, 8).

Some studies concluded that short arm casts can have the same functional outcomes with lower complications and more patient satisfaction (10, 16, 17). In the current study, both long and thumb Spica casting were employed to analyze the outcomes. The results showed that satisfaction was similar between two groups.

The long and short casts have often been compared regarding the progress of therapy. Some investigations have shown that the results of the long and short cast were similar (13, 17, 18).

In the present study, desirable ROM, patient's satisfaction, disabilities, and the pain were evaluated. We observed that ROM, patient's satisfaction, disabilities, and the pain by thumb Spica as short arm cast was improved in comparison to long arm casts.

Kachooei et al. showed the range of elbow flexion and extension and forearm supination and pronation in short arm casts were significantly higher than long casts (19).

The casting method of the cast has an important role in the maintenance of the reduction (20). The point of immobilization is also a controversial subject (19).

There is also a challenge regarding the selection of immobilization in internal rotation (pronation) or external rotation (supination) of the forearm. Sarmiento suggested the immobilization in external rotation (supination) position to decrease the brachioradialis deforming force (21), but Whalstrom emphasizes on the immobilization in internal rotation (pronation) area. He concludes that the pronator quadratus muscle is the advance agent of displacement (22). A prospective research achieved same outcomes in various positions of immobilization. They ultimately showed that the point of immobility plays a small role in the result (23). Casting complications such as pain, stiffness, limitations of ROM and blister formation are important factors, which impact patients' satisfaction and function (19, 24, 25). The time of casting and the length of the cast are two causes that impact the incidence of complications. Prolonged immobilization may lead to

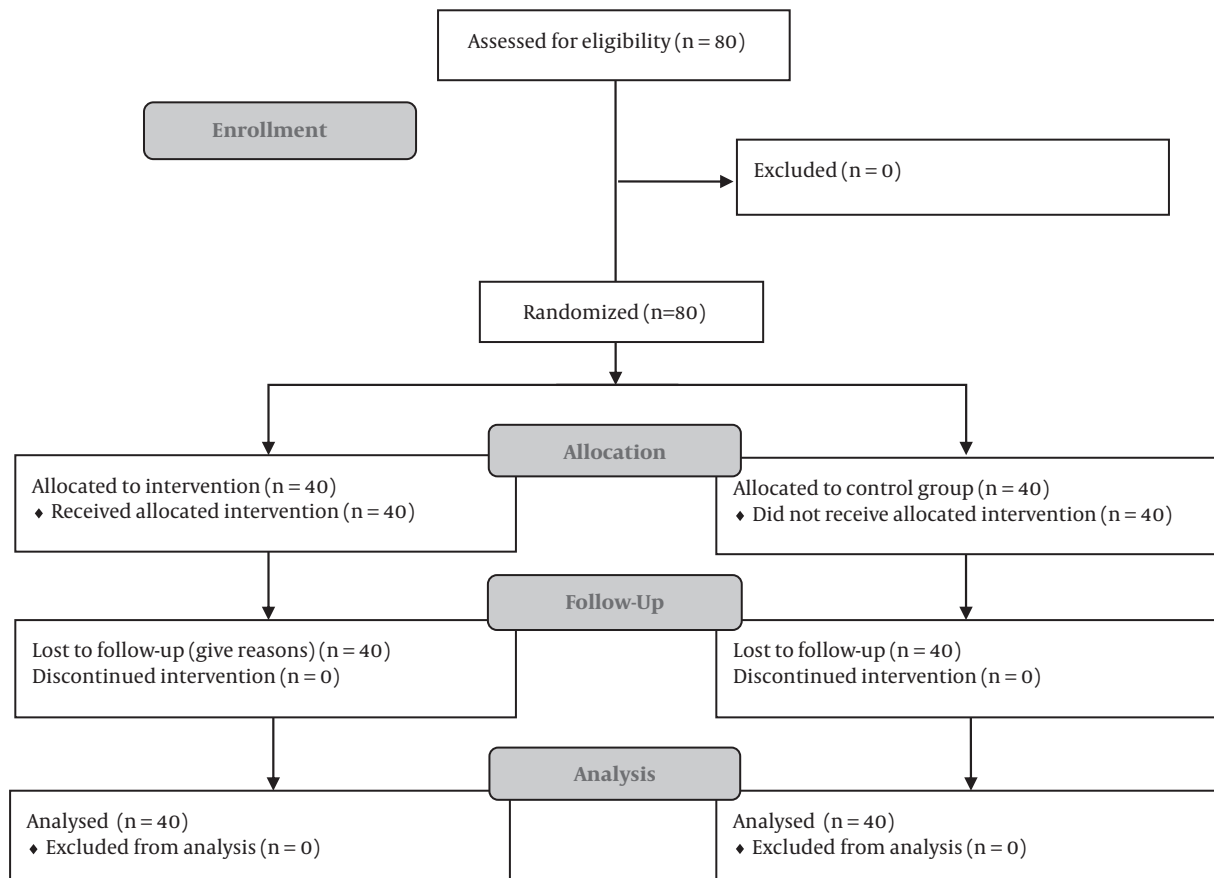


Figure 1. The flow diagram of the subjects

Table 1. Comparison of Variables Between Two Groups^a

Groups	Thumb Spica Cast	Long Cast	P Value
Item 1	6.25 (13.75)	13.75 (12.76)	0.081
Item 2	13.75 (15.12)	18.75 (11.10)	0.0253
Item 3	18.42 (14.04)	22.50 (11.18)	0.411
Item 4	10.00 (12.56)	17.5 (11.75)	0.108
Item 5	10.00 (12.56)	22.50 (7.69)	0.006
Item 6	7.50 (11.75)	21.25 (9.15)	0.006
Item 7	0.0 (0.0)	11.25 (12.76)	0.014
Item 8	5.00 (13.07)	20.00 (10.25)	0.001
Item 9	6.57 (11.31)	17.50 (11.75)	0.019
Item 10	1.31 (5.73)	3.75 (9.15)	0.323
Item 11	1.31 (5.73)	7.50 (11.75)	0.047
DASH	7.19 (6.80)	16.02 (6.23)	< 0.001
Satisfaction	75.00 (0.0)	91.66 (14.43)	0.40

^aValues are expressed as mean (SD).

joint contracture, muscle atrophy and weakness, disuse osteopenia and possibly functional hardship that affect the

patient's function (26). Edmonds et al. compared the duration of immobilization that is required for good align-

ment of the fracture line in the short cast with the long cast (27). They noted that there was no difference between two groups in time of casting. In the current study, the period of cast immobilization in both groups was the same. A study showed the complications of casting such as the blisters in the elbow together with muscle weakness were significantly lower in short casts compared to long casts (19).

Regarding the limitation of ROM and muscle weakness, it seems that physical therapy is much more needed after long cast removal. Consequently, the cost and duration to return to work will be decreased in short arm cast.

Most of the literature supports use of long arm casts to treat fractures of the distal third of the forearm in children (17). The present study demonstrated better outcomes in short casts rather than long casts used for these fractures. Thus, either a long or a short arm cast can be used, but proper molding of either is mandatory. Long arm casts, however, can result in less inconvenience to the patients.

The main limitation of this study was the lack of extended follow-up.

5.1. Conclusions

Regarding better performance and treatment, thumb Spica casting is recommended as the preferred treatment for distal radius fractures without displacement.

Footnotes

Authors' Contribution: Study concept and design: Sadrollah Mahmoudi, Hassan Goodarzi. Acquisition of data: Sadrollah Mahmoudi, Hamid Hesarikia, Hassan Goodarzi. Analysis and interpretation of data: Sadrollah Mahmoudi, Mohammad Reza Ghane, Hamid Reza Javadzadeh, Hamid Hesarikia, Hassan Goodarzi. Drafting of the manuscript: Sadrollah Mahmoudi, Mohammad Reza Ghane, Hamid Reza Javadzadeh, Hamid Hesarikia, Hassan Goodarzi. Critical revision of the manuscript for important intellectual content: Sadrollah Mahmoudi, Mohammad Reza Ghane, Hamid Reza Javadzadeh, Hamid Hesarikia, Hassan Goodarzi. Statistical analysis: Sadrollah Mahmoudi, Hamid Hesarikia, Hassan Goodarzi. Administrative, technical, and material support: Sadrollah Mahmoudi, Hamid Hesarikia, Hassan Goodarzi. Study supervision: Sadrollah Mahmoudi, Hamid Hesarikia, Hassan Goodarzi.

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Conflict of Interests: There is not any conflict of interest.

Ethical Approval: The protocol of the study was confirmed in ethical committee of Baqiyatallah University of Medical Sciences (ethical code: IRB.BMSU.RC.1396.344).

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Patient Consent: Informed consent form was received from all cases.

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