

## A Study of Functional Outcomes of Distal End Radius Fractures Treated With Static External Fixators

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### Abstract

**Introduction:** Fractures of the distal end of radius are amongst the most common fractures. They occur in middle-aged and elderly women commonly. It also occurs in young men with high velocity injury though less in number. With increase in longevity and activity in middle-aged to elderly population, there is increase in number of these fractures. Various surgical interventions are currently available, like percutaneous pinning, intra-focal pinning, external fixator and plate fixation. The present study management of fractures of distal end of radius by external fixators using the principle of ligamentotaxis was undertaken in the Department of Orthopedics at our institute to study functional outcomes.

**Materials and Methods:** With distal end radius fracture treated with external fixator were recruited from the orthopedics OPD and casualty, HSK hospital, based on the inclusion/exclusion criteria and diagnosed as per Frykman classification. Research study was conducted for 18 months from April 2022 to October 2023. The research study was supported by primary data source. Primary source of data: The material for the present study is from patients with distal end radius fracture treated with external fixator. To meet the objectives of our study, a primary source of information technique was adopted with direct interview method using pre-tested semi-structured. Secondary source of data Secondary data source was used to estimate the sample size and also to frame the questionnaire. The sources of secondary data were multiple- journals, academic books, research articles and review articles, all of which are listed in the bibliography.

**Result:** Present case series study was to done for a period of 18 months among 30 patients with distal end radius fracture treated with external fixator who visits Orthopaedics OPD and casualty of S. Nijalingappa Medical College and Research Centre, Bagalkot to study the functional outcome of distal end radius fractures treated with static external fixators. There was consistent improvement in ROM over time for all movements. Pre-operatively, initial ROM was severely limited in all directions. Pronation had the highest initial ROM ( $24.8 \pm 3.2^\circ$ ), followed by supination ( $19.9 \pm 3.2^\circ$ ). Flexion ( $14.8 \pm 3.2^\circ$ ) and extension ( $10.5 \pm 2.3^\circ$ ) were the most restricted. At 1 year, maximum ROM achieved for all movements. Supination and pronation both reached about  $85^\circ$  ( $84.9 \pm 3.2^\circ$  and  $84.8 \pm 3.2^\circ$ ). Flexion improved to  $79.9 \pm 3.2^\circ$ , and extension to  $69.9 \pm 3.2^\circ$ .

**Conclusion:** In conclusion, our study demonstrates that static external fixation is an effective treatment option for distal end radius fractures, offering good functional outcomes, high patient satisfaction, and an acceptable complication rate. While our results are promising, further large-scale, comparative studies are warranted to definitively establish the role of static external fixators in relation to other treatment modalities for distal end radius fractures.

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### Introduction

Fracture of the distal end of radius is one of the most common fractures. It occurs in middle aged and elderly women commonly. It also occurs in young men with high velocity injury though less in number. With increase in longevity and activity in middle aged to elderly population, there is increase in number of this fractures. [1] Various surgical interventions are available presently, like

percutaneous pinning, intra focal pinning, external fixator and plate fixation. The present study management of fracture of distal end of radius by external fixator using the principle of ligamentotaxis was undertaken in department of orthopedics at our institute to study fracture healing and functional outcome. One of the most frequent fractures is to the distal end of the radius. It

frequently affects middle-aged and older women. Although they are less common, young men with high velocity injuries might also experience it. Fractures are becoming more common as middle-aged and older people live longer and engage in more activities. One there are now several surgical options available, including plate fixation, external fixators, intra-focal pinning, and percutaneous pinning. In order to investigate fracture healing and functional result, the orthopedic department at our institute conducted the current study on the care of distal end of radius fractures by external fixator utilizing the ligamentotaxis concept. One of the most frequent fractures is to the distal end of the radius. It happens in middle age.

### Material and Method

Patients with distal end radius fracture treated with external fixator were recruited from the Orthopaedics OPD and casualty, HSK hospital, based on the inclusion/exclusion criteria and diagnosed as per Frykman classification.

**Study Time:** Research study was conducted for 18 months from April 2022 to October 2023.

### Inclusion Criteria

- All Distal End Radius fractures
- Age > 18 years
- Patients of both sexes
- Patients fit for surgery

### Exclusion Criteria

- Patients who refused surgery

- Pathological fractures
- Compound fractures
- Polytraum

**Sample size:** Sample size estimation was done using Medcalc software. At 95% confidence level,  $A$  (two-tailed) = 0.050 and at 95% confidence level. The standard normal deviate for  $\alpha=Z\alpha=1.960$  Formula used  $n= [DEFF*Np (1- p)]/[(d2/Z21-\alpha/2*(N-1)+p*(1-p)]$

**Method of data collection:** After obtaining approval and clearance from the institutional ethics committee, the individuals fulfilling the inclusion criteria were enrolled for the study after obtaining informed consent (Annexure – 1)

To collect the required information from the study subjects the “Direct interview method” of Primary source of information technique was used. The patients were interviewed for collection of necessary information using the pre-tested, semi structured questionnaire method. The questionnaire was prepared by a thorough review of literature

### Results

Present case series study was to done for a period of 18 months among 30 patients with distal end radius fracture treated with external fixator who visits Orthopaedics OPD and casualty of S. Nijalingappa Medical College and Research Centre, Bagalkot to study the functional outcome of distal end radius fractures treated with static external fixators.

**Table 1: Distribution of Patients According To Age**

Age(in years)	Frequency	Percentage
20-30	2	6.7%
31-40	7	23.3%
41-50	6	20%
51-60	7	23.3%
>60	8	26.7%
Total	30	100%

**Table 2: Distribution of Patients According To Gender**

Gender	Frequency	Percentage
Female	16	53.3%
Male	14	46.7%
Total	30	100%
Gender	Frequency	Percentage

**Table 3: Distribution Of Patients according To Fracture Type [Frykman's Classification]**

Fracture type	Frequency	Percentage
I	5	16.7%
II	6	20%
III	5	16.7%
IV	5	16.7%
V	3	10%

VI	3	10%
VII	2	6.7%
VIII	1	3.3%

**Table 4: Distribution of Patients According To Range Of Movements at Different Intervals**

ROM(Mean±SD)	Flexion	Extension	Supination	Pronation
Preoperative	14.8±3.2	10.5±2.3	19.9±3.2	24.8±3.2
At 6 weeks	29.9±3.2	24.9±3.2	39.9±3.2	44.8±3.2
At 3 months	49.7±3.3	44.9±3.2	59.9±3.2	64.8±3.2
At 6 months	69.9±3.2	59.9±3.2	74.9±3.2	74.8±3.2
At 1 year	79.9±3.2	69.9±3.2	84.9±3.2	84.8±3.2

**Table 5: Distribution of Patients According To Q-Dash Scores**

DASH scores	At 6 weeks	At 3 months	At 6 months	At 1 year
Mean±SD	52.6±2.4	24.5±2.8	5.4±2.4	3.6±2.04

**Table 6: Distribution of Patients According To Patient Satisfaction Scores**

Patient satisfaction scores	
Mean±SD	8.2±1.2

**Table 7: Distribution of Patients According To Complications**

Complications	Frequency	Percentage
Pin tract infection	3	10%
Malunion	1	3.3%
CRPS	2	6.7%
Absent	24	80%
Total	30	100%

**Table 8 - Mean Sf-12 Scores at Different Time Intervals**

Time Intervals	Mean SF-12scores
At 6 weeks	41.3
At 3 months	43.7
At 6 months	45.5
At 1 year	47.7

## Discussion

Distal radius fractures are among the most common fractures encountered in orthopedic practice, accounting for approximately 17% of all fractures treated in emergency departments. These fractures can occur in all age groups but are particularly prevalent in the elderly population due to osteoporosis and in younger individuals due to high-energy trauma. The management of distal radius fractures has evolved over the years, with various treatment options available, including cast immobilization, internal fixation, and external fixation. External fixation has gained popularity as a treatment modality for distal radius fractures, especially in cases of comminuted or unstable fractures. Static external fixators, in particular, offer several advantages, including minimal soft tissue dissection, the ability to maintain reduction, and early mobilization of adjacent joints. However, the functional outcomes and complications associated with this treatment method require

further investigation. Our study aimed to evaluate the functional outcome of distal end radius fractures treated with static external fixators in patients presenting to the Orthopaedics OPD and casualty of S. Nijalingappa Medical College and Research Centre, Bagalkot.

By assessing range of motion, Q-DASH scores, patient satisfaction, and complications over an 18-month period, we sought to contribute to the existing body of knowledge on this treatment modality. Age and Gender Distribution: Our study found a mean age of 47.54±5.9 years, with the largest age group being over 60 years (26.7%). This aligns with findings from other studies, such as that by Gradl et al., who reported a mean age of 59.1 years in their study of external fixation for distal radius fractures. Mahadevaiah PK et.al. also reported majority (40%) were aged 41 to 50 years. The slight predominance of female patients (53.3%) in our study is also consistent with the literature, as noted by Diaz- Garcia et al. in their

systematic review. In contrast Mahadevaiah PK et.al. Reported male preponderance (73%) Fracture Type Distribution: We observed that Type II fractures were the most common (20%), followed by Types I, III, and IV (16.7% each). This distribution differs somewhat from that reported by Wei et al. who found a higher prevalence of Type III fractures in their series. Mahadevaiah PK et.al. Also reported 50% of cases as type III. This variation could be attributed to differences in patient populations and injury mechanisms.

Range of Motion: Our study demonstrated a consistent improvement in range of motion (ROM) over time for all movements. At one year post-operation, mean flexion reached  $79.9 \pm 3.2^\circ$ , extension  $69.9 \pm 3.2^\circ$ , supination  $84.9 \pm 3.2^\circ$ , and pronation  $84.8 \pm 3.2^\circ$ . These results are comparable to those reported by Kapoor et al., who found the average loss of the arc with plaster was 370 in comparison with 190 by external fixator. Cooney et al. reported an average loss of 170 by external fixator with loss of 108 if pronation and supination and loss of 140 of radial and ulnar deviation. With the external fixator loss of pronation and supination was 230 and radial and ulnar deviation 130. However, our patients showed slightly better supination and pronation outcomes.

Q - DASH Scores: The Q-Disabilities of the Arm, Shoulder and Hand (DASH) scores in our study showed significant improvement over time, from a mean of  $52.6 \pm 2.4$  at 6 weeks to  $3.6 \pm 2.04$  at 1 year. This trend is similar to that observed by Grewal et al.

### Conclusion

This study on the functional outcome of distal end radius fractures treated with static external fixators has provided valuable insights into the efficacy of this treatment modality.

Over the 18-month study period, we observed significant improvements in patient outcomes across multiple parameters. The consistent enhancement in range of motion across all movements - flexion, extension, supination, and pronation - demonstrates the effectiveness of static external fixators in facilitating functional recovery.

The gradual improvement observed from the immediate post-operative period to the one-year follow-up underscores the importance of patient compliance with rehabilitation protocols and the need for long-term follow-up in these cases. The progressive decrease in Q-DASH scores over time, from a mean of 52.6 at 6 weeks to 3.6 at 1 year, reflects a substantial improvement in upper limb function and a reduction in disability. This trend indicates that patients treated with static external fixators can expect significant functional gains,

particularly in the first few months' post- surgery, with continued improvement up to one year.

The high mean patient satisfaction score of 8.2 out of 10 is particularly encouraging. It suggests that despite the initial discomfort and limitations associated with external fixators, patients generally perceive the treatment as successful and are satisfied with their outcomes. This high satisfaction rate may be attributed to the good functional outcomes and the relatively low incidence of complications. Speaking of complications, the overall complication rate of 20% in our study, with pin tract infection being the most common at 10%, is within acceptable limits for this type of procedure.

The low incidence of more severe complications such as malunion (3.3%) and complex regional pain syndrome (6.7%) further supports the safety profile of this treatment approach. In conclusion, our study demonstrates that static external fixation is an effective treatment option for distal end radius fractures, offering good functional outcomes, high patient satisfaction, and an acceptable complication rate. While our results are promising, further large-scale, comparative studies are warranted to definitively establish the role of static external fixators in relation to other treatment modalities for distal end radius fractures.

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