

# A Case Series of Functional and Radiological Outcome of Comminuted Distal Radius Fractures Treated with Bridging External Fixator with Optional Percutaneous K-wires

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## Learning Point of the Article:

Using external fixators may be a viable alternative for intra-articular distal fractures.

## Abstract

**Introduction:** Comminuted intra-articular distal radius fractures are complex injuries often resulting from high-energy trauma, requiring precise reduction and stable fixation. Spanning external fixation, with optional K-wire augmentation, has emerged as a minimally invasive technique offering reliable stabilization through ligamentotaxis while reducing operative time, blood loss, and infection risks.

**Case Series:** This case series evaluated patients with AO Type C3 distal radius fractures treated using spanning external fixators with optional K-wire supplementation. Functional outcomes were assessed using the disabilities of arm, shoulder, and hand score, and radiological outcomes were evaluated using the Sarmiento radiological score over a 1-year follow-up period. Almost all patients achieved excellent results on both scoring systems, with minimal complications and no significant functional limitations reported.

**Conclusion:** Spanning external fixation, with or without K-wire support, is an effective alternative to open reduction methods for complex intra-articular distal radius fractures. It offers the advantages of simplicity, reduced operative duration, less blood loss, and a lower risk of infection, making it a reliable option for managing these challenging injuries.

**Keywords:** Distal radius fracture, spanning external fixator, intra-articular fracture, K-wire augmentation, disabilities of arm, shoulder, and hand score, Sarmiento radiological score, AO type C3, ligamentotaxis.

## Introduction

Comminuted intra-articular distal radius fractures [Fig. 1] present a significant challenge due to their complexity and the need for precise anatomical restoration [1-5]. These fractures often result from high-energy trauma and require stable fixation to achieve optimal functional outcomes [6,7]. While open reduction and internal fixation (ORIF) is widely considered the standard of care, spanning external fixation-with optional K-wire

augmentation [Fig. 2] has emerged as a minimally invasive and reliable technique [8-17]. It facilitates ligamentotaxis, reduces operative time, minimizes blood loss, and lowers infection risks [18]. This study evaluates the functional and radiological outcomes of such treatment.

## Materials and Methods

This prospective observational study included 30 adult patients

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## Author's Photo Gallery



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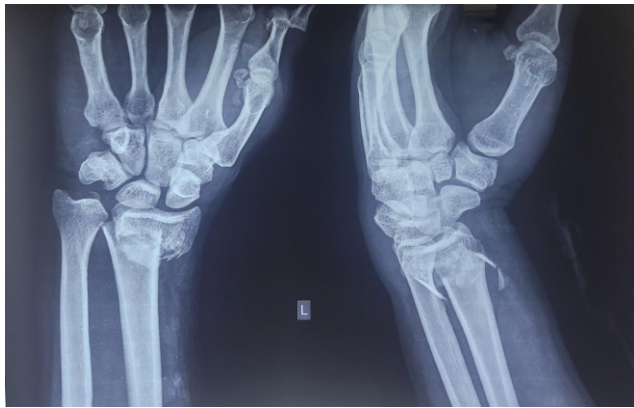
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**Table 1:** Functional outcome

The DASH scoring among 30 patients	
The DASH scoring	Number of patients
Excellent	28
Good	2
Fair	0
Poor	0
<b>DASH:</b> Disabilities of arm, shoulder, and hand	

**Table 2:** Radiological outcomes

Sarmiento radiological score among 30 patients	
Number of patients	
Excellent	29
Good	1
Fair	0
Poor	0

**Figure 1:** Pre-operative X-rays of AO classification 2R3 C3-complete articular simple, metaphyseal multifragmentary fracture of distal radius.

with AO Type C3 distal radius fractures treated with spanning external fixation and optional K-wire augmentation [Fig. 2]

### Sample size calculation

The sample size was calculated based on an expected improvement of 15 points in the disabilities of arm, shoulder, and hand (DASH) score with a standard deviation of 20, a power of 80%, and alpha error of 5%, yielding a minimum sample size of 27. We enrolled 30 patients to account for potential dropouts or loss to follow-up.

### Inclusion criteria

- Adults aged 18–65 years

- Closed, comminuted intra-articular distal radius fractures (AO type C)
- Fractures treated within 7 days of injury
- Willingness to participate and comply with 1-year follow-up.

### Exclusion criteria

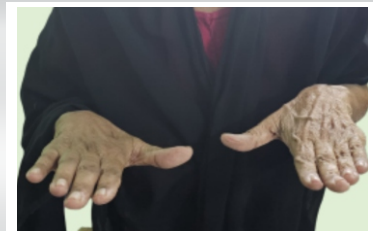
- Open fractures
- Associated neurovascular injury
- Previous wrist pathology or fracture on the same limb
- Bilateral wrist fractures
- Patients unfit for surgery or general anesthesia.

### Operative technique

Under regional or general anesthesia, closed reduction was attempted under C-arm guidance. A spanning external fixator was applied between the radius and the second metacarpal, ensuring appropriate distraction and alignment. Optional K-wire fixation was added based on the level of comminution and fracture stability. Typically, 1–2 K-wires were used to transfix the fracture fragments. Postoperatively, patients were advised to perform finger range-of-motion exercises while maintaining the external fixator for 6–8 weeks.

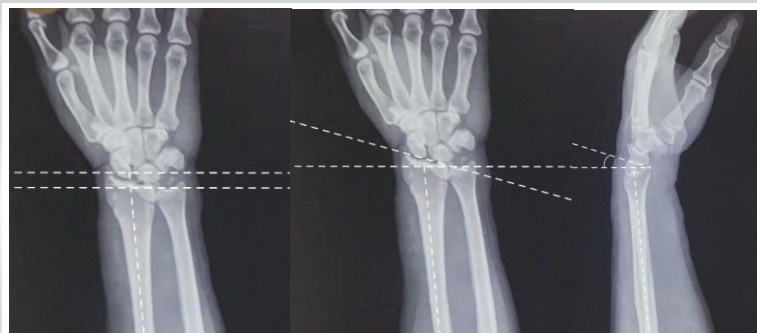
### Functional outcome assessment

Functional outcomes were evaluated using the Disabilities of Arm, Shoulder, and Hand (DASH) score at regular intervals post-operatively. As shown in Table 1, 28 patients (93.3%) had excellent outcomes, and 2 patients (6.7%) had good outcomes,

**Figure 2:** Immediate post-operative X-ray.**Figure 3:** Extension range of movement.**Figure 4:** Flexion range of movement.**Figure 5:** Pronation range of movement.



**Figure 6:** Supination range of movement.



**Figure 7:** Post-operative X-ray of the patient at 6- month follow- up (a) Radial height (b) radial inclination (c) volar tilt.

with no fair or poor results.

### Radiological outcome assessment

Radiological results were assessed using the Sarmiento radiological score. As presented in Table 2, 29 patients had excellent results, and one had a good outcome.

### Statistical analysis plan

Data were analyzed using the Statistical Package for the Social Sciences Version 25. Continuous variables like DASH scores were presented as mean  $\pm$  standard deviation. Categorical outcomes (e.g., radiological grading) were expressed as percentages. Paired t-tests were used to compare DASH scores over time.  $P < 0.05$  was considered statistically significant.

## Discussion

Our findings align with previous studies by Ju et al. [17] and Chen et al. [18], showing good-to-excellent outcomes using external fixators with K-wire augmentation. This technique offers advantages over ORIF in cases of severe comminution or compromised soft tissue.

As in prior studies [19,20], we observed no major complications such as infection or CRPS. Compared to volar plating, external fixation is less technically demanding and more adaptable in high-volume trauma settings.

### Interpretation of our results

In our study, the majority of patients achieved excellent functional and radiological outcomes using external fixation with optional K-wire augmentation. DASH scores improved significantly over the follow-up period, indicating substantial restoration of upper-limb function. Radiologically, most patients maintained near-anatomical alignment per the Sarmiento score. These results suggest that external fixation, with careful patient selection and proper technique, is a reliable alternative for managing complex distal radius fractures.

### Relation to research objective

The primary objective of this study was to assess the

effectiveness of external fixation (with optional K-wire pinning) in managing comminuted intra-articular distal radius fractures. Our findings support the hypothesis that external fixation provides good to excellent outcomes [Fig. 3-7] in cases where ORIF may pose technical difficulties, longer operative time, and higher soft tissue morbidity.

### Comparison with other studies

Our findings are consistent with several national and international studies that support the use of external fixation for unstable distal radius fractures. Kapoor et al. and Rozenal et al. reported comparable DASH score improvements and radiological maintenance using external fixators [15, 16]. In contrast, some studies favor ORIF for early mobilization and slightly better range of motion outcomes. However, these differences may stem from variability in fracture patterns, surgical expertise, or post-operative rehabilitation protocols. In severely comminuted cases, the challenges of anatomic reduction and risks of surgical morbidity make external fixation a more pragmatic option.

### Order of importance in findings

1. Excellent functional outcomes (DASH score): Restoration of upper-limb function was consistently observed [Fig. 3-6]
2. Radiological maintenance (Sarmiento score): Near-anatomical alignment was preserved in most cases [Fig. 7]
3. Minimal soft tissue complications: Compared to open methods, no significant soft tissue compromise or infections were noted
4. Reduced operative time and blood loss: Especially important in elderly or high-risk patients
5. Ease of technique: Suitable for surgeons in resource-limited or high-volume trauma settings.

### Limitations of our study

- Small sample size: With only 30 patients, results may not be generalizable to all populations
- Lack of a control group: We did not directly compare external



fixation with ORIF in the same setting

- Short-term follow-up: A 1-year follow-up may not capture long-term complications like late arthritis or loss of reduction
- Single-center study: Surgical outcomes may vary with different teams and settings.

### Suggestions for future research

Larger, multicentric randomized controlled trials comparing external fixation and ORIF in various fracture subtypes could provide more definitive guidance. Long-term studies with follow-ups beyond 2–3 years would help assess post-traumatic arthritic changes, range of motion deficits, and patient satisfaction. Comparative cost-effectiveness analyses would also benefit healthcare systems in determining the best surgical option.

### Results

A total of 30 patients with comminuted intra-articular distal radius fractures were included in the study. The mean age of the patients was 42.6 years (range: 25–65 years). All patients were treated with external fixation, with optional K-wire augmentation depending on the fracture pattern.

The mean follow-up duration was 12 months, during which both functional and radiological outcomes were assessed.

### Functional outcome (DASH score)

- Excellent results were observed in 28 patients (93.3%), with a significant reduction in DASH scores over the follow-up period
- Good results were recorded in 2 patients (6.7%), primarily due to stiffness and delayed rehabilitation
- No patients were graded as fair or poor

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil    **Source of support:** None

- The mean DASH score at the final follow-up was 14.2 (lower scores indicate better function).

### Radiological outcome (Sarmiento score)

- According to the Sarmiento radiological scoring system:
    - Excellent outcomes were observed in 29 patients (96.7%)
    - Good outcome in 1 patient (3.3%).
  - The one patient with a good score had a minor loss of radial length and palmar tilt but retained functional use.
- No cases of pin tract infection, complex regional pain syndrome, or loss of reduction were noted during the follow-up period.

### Conclusion

We concluded that spanning external fixation is a good option for the treatment of AO-type C3 distal radius fractures. The good outcomes of this study suggest that use of the spanning external fixators could be an alternative treatment method for intra articular distal fractures, as it is easier, needs less operation time, decreases amount of blood loss, and decreases risk of infection in comparison with spanning bridging plate or locked distal radius plates.

### Clinical Message

Spanning external fixation is a valuable treatment option for AO-type C3 distal radius fractures. This technique offers advantages such as simplicity, reduced operative time, minimized blood loss, and a lower risk of infection compared to spanning bridging plates or locked distal radius plates. It serves as an effective alternative for managing intra-articular distal fractures.

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**Conflict of Interest:** Nil

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**Consent:** The authors confirm that informed consent was obtained from the patient for publication of this case report

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