

# Evaluating the Outcome of Volar Plating Assisted External Fixator for Intra-Articular Distal End Radius Fractures

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**Abstract:** **Background:** Distal radius fractures represent a common orthopedic challenge, and their treatment has evolved significantly over the past three decades. This study aimed to assess the efficacy of volar locked plating assisted external fixation in the management of intra-articular distal radius fractures. **Methods:** A comparative study involving 25 patients with intra-articular distal radius fractures was conducted in the Department of Orthopedics at Dr Vaishampayan Memorial Government Medical College and Civil Hospital Solapur. Ethical approval was obtained, and patients were randomly assigned to receive either volar locked plating or plating assisted external fixation. Clinical parameters including pain, range of motion, grip strength, and activity levels were assessed over a six-month follow-up period. The Green and O'Brien scoring system was used for evaluation. **Results:** Patients treated with volar plates assisted external fixation exhibited significant improvements over time. Pain levels decreased from 10.21 at 1 month to 20.87 at 6 months, with  $p$ -values  $<0.001$ . Range of motion improved from 11.24 to 18.74, grip strength increased from 09.54 to 17.89, and activity levels improved from 13.20 to 22.55, all with  $p$ -values  $<0.001$ . The final functional score increased from 44.19 at 1 month to 80.05 at 6 months, with a  $p$ -value  $<0.001$ . These findings indicate the effectiveness of volar locked plating assisted external fixation in promoting functional recovery. **Conclusion:** This study underscores the importance of individualized care in treating distal radius fractures. Volar locked plating assisted external fixation appears to be a highly effective treatment option, providing significant pain relief, improved range of motion, increased grip strength, and enhanced activity levels. Further research with larger and more diverse patient populations is warranted to validate these findings. Nevertheless, this study contributes valuable insights to the evolving field of orthopedics and offers a promising approach to enhance patient outcomes in the management of intra-articular distal radius fractures.

**Keywords:** Distal Radius Fractures, Volar Locked Plating, External Fixation, Intra-articular Fractures

## 1. Introduction

Over the last thirty years, the treatment of distal radial fractures has evolved significantly. Initially, it involved applying a cast, but it has since expanded to encompass various surgical approaches, including closed reduction with external fixation and open reduction with the use of locking plates [1]. In addition to factors such as gender, age bracket, ethnic background, family medical history, and experiencing early menopause, reduced bone mineral density is also considered a contributing risk factor for fractures occurring at the distal end of the radius [2]. Intra-articular fractures of the distal radius are intricate and unstable fractures typically stemming from significant trauma. Gaining insight into the underlying pathology and mechanics of these injuries reveals a range of challenges experienced by patients. These

challenges encompass pain, swelling, muscle weakness, restricted range of motion, and the development of joint arthritis. Furthermore, instability can persist when there is a failure to achieve proper alignment of bone fragments and the associated ligaments [3].

Distal radius fractures account for 44% of all kinds of the forearm and hand fractures, which is the most familiar kind of upper limb fractures and lead to a serious problem of public health [4]. The articular surface of the radius is triangular, with the apex of the triangle at the radial styloid. It slopes in a volar and ulnar direction with a radial inclination of 23° (range 13-30°), a radial length of 12 mm (range 8-18 mm), and an average volar tilt of 12° (1-21°) [5]. Anderson and O Neil were first to maintain fracture reduction with an external fixator using the principle of ligamentotaxis [6].



These fractures are often treated with closed reduction and immobilization with cast but the difficulty here is the possibility that displacement may persist even in the least complex fractures [3]. Other problem with this method is immobilization of wrist and forearm for at least 6 weeks and the further time required to regain the functions of forearm, wrist and hand by physiotherapy. During this entire time duration, patient's ability to carry out day to day activities is hampered. Numerous other methods of treating injuries of this nature like closed percutaneous pinning, external fixation, buttress plating have enjoyed recognition from time to time, testifying the fact that there is no ideal modality of treatment [3].

The successful outcome of treating distal radius fractures depends on two key factors: achieving a precise anatomical alignment of the joint surface and ensuring proper alignment of the non-joint portion of the radius. Plating is a method that directly restores the anatomy and provides internal fixation, allowing for quicker recovery of wrist function. While plates help stabilize fractures that involve the joint, concerns remain regarding the need to protect the fracture until it heals and the risk of losing the achieved alignment. To address these concerns, more stable locking plates have been developed. The aim of this study was to compare the efficacy of external fixation with volar locked plating treatment in intra-articular distal radius fractures [3].

## 2. Material and methods

This comparative study was conducted on 25 patients and in the —Department of Orthopaedics, Dr VM Government Medical College and Civil Hospital from September 2022 to February 2023. Ethical committee approval was obtained. Patients with intraarticular distal radius fractures were randomly taken and was treated with external fixation with volar locking plate in intra-articular distal radius fractures.

**Inclusion Criteria:** Patients in the age group >18 years, Patients with distal radius fractures with intraarticular extension following road traffic accident or slip or fall on outstretched hand or assault, Closed fractures and Comminuted fractures with or without bone loss

**Exclusion Criteria:** Open fractures, Patients with head injuries and who are comatose, associated ulnar diaphyseal fractures or carpal bone fractures and associated neurovascular injuries.

## Statistical analysis

All data were entered in SPSS 20.0 (IBM SPSS Inc. USA). The mean values of scores were compared by one way ANOVA and scores at different intervals within the same group.

In the volar locked plating assisted external fixation technique, firstly the external fixator was applied and fracture distracted then the skin was incised longitudinally along the course of the flexor carpi radialis (FCR) tendon. The FCR sheath was opened and the tendon retracted to the radial side to expose the ulnar corner of the distal radius (this can be extended into a carpal tunnel release). The FCR tendon was also retracted to the ulnar side to expose the radial styloid and scaphoid fossa. Great care was taken to avoid pressure on the median nerve. Underneath the FCR sheath lies the flexor pollicis longus (FPL) tendon. This was retracted ulnarly revealing the pronator quadratus (PQ) muscle. The PQ muscle was elevated from its radial origin and reflected ulnarly to expose the distal radius. If the fracture was very distal, it was not necessary to completely elevate this muscle. The palmar extrinsic radiocarpal ligaments should not be detached from the radius to expose the joint surface as this may destabilize the wrist. Palmar fragments were often comminuted and impacted. Each fragment was identified, elevated, and reduced. As the palmar surface of the distal radius is originally flat, the application of a flat implant onto this surface usually corrects any malrotation of the fracture fragments. The C-arm was used to check for screw placement and reduction. Radiographs of the wrist joint were taken after surgery. The applied casts did not allow free mobilization. The patients of both groups were discharged 2 days after surgery after checking the suture line under proper antibiotic coverage (3rd generation cephalosporin for 3 days) and active finger movements were advised [3].

All the patients were followed for 6 months (1 month, 3 months and 6 months) after surgery and assessed for pain, grip strength, wrist range of motion (ROM) and activity, and scored according to the Green and O'Brien scoring system. Score 65 were considered poor, and scores between 65 and 79, between 80 and 89, and between 90 and 100 were considered fair, good and excellent, respectively.

## 3. Results

25 patients (14 females and 11 males) with distal radius fractures were recruited into the study. The average age of the patients who received volar plate assisted external fixation for their treatment was 38.95 years, with a standard deviation of 13.24 years. Among these patients, 11 were male, and 14 were female. The mean age for male patients was 36.87 years, with a standard deviation of 11.35 years, while the mean age for female patients was 39.57 years, with a standard deviation of 10.57 years (Table 1).

**Table 1: Demographic profile of patients**

Parameter	Volar plate
Age	38.95 ± 13.24
Gender (Male/female)	11/14
Means age in males	36.87 ± 11.35
Mean age in females	39.57 ± 10.57

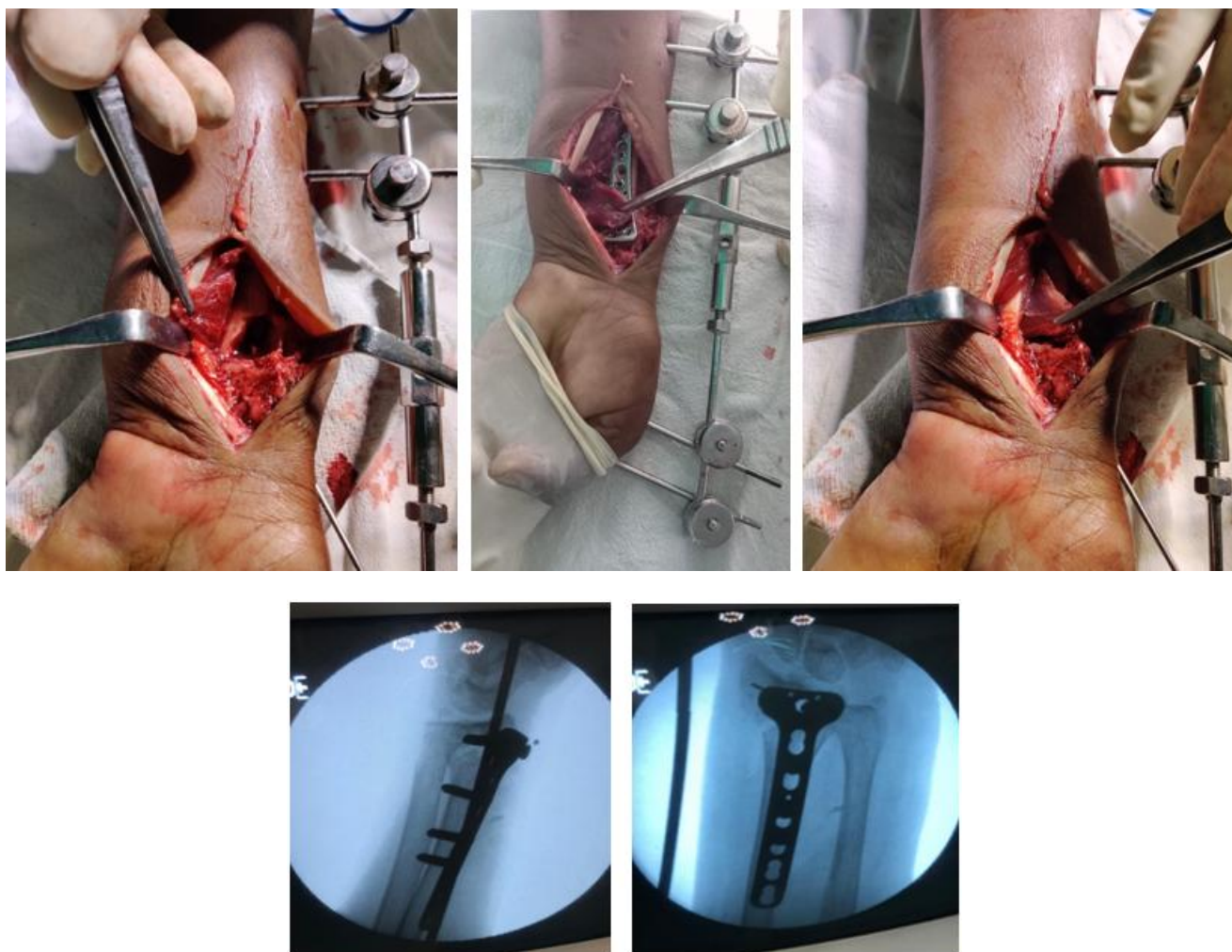
**Table 2:** Comparison of Green and O'Brien score after 1 month, 3 months and 6 months follow-up in treated patients

Parameters	Volar plate			
	1 month	3 months	6 months	p-value
Pain	10.21 ± 04.21	15.47 ± 03.54	20.87 ± 05.12	<0.001
ROM	11.24 ± 05.24	14.23 ± 05.44	18.74 ± 04.69	<0.001
Grip Strength	09.54 ± 04.71	13.24 ± 05.22	17.89 ± 05.11	<0.001
Activity	13.20 ± 04.88	17.25 ± 04.44	22.55 ± 06.51	<0.001
Final score	44.19 ± 19.04	60.19 ± 18.64	80.05 ± 21.43	<0.001

\* One way ANOVA

The results for patients treated with volar plate assisted external fixation showed significant improvements in various parameters over time. Pain levels decreased from 10.21 at 1 month to 20.87 at 6 months. Range of motion (ROM) improved from 11.24 to 18.74, grip strength increased from

09.54 to 17.89, and activity levels improved from 13.20 to 22.55, all with p-values less than 0.001. The final functional score increased from 44.19 at 1 month to 80.05 at 6 months, also with a p-value less than 0.001 (Table 2).



#### 4. Discussion

Fractures in the distal radius can vary based on the wrist anatomy and the forces applied from different directions. Treating these fractures effectively may require different approaches and materials, as a one-size-fits-all approach may not yield successful results. Although the mechanical properties of the chosen fixation materials are crucial, the precise positioning of these materials in the treatment strategy can be even more critical, especially in the case of fractures involving the joint surface [7].

The selection of the most suitable treatment approach for various fracture types can involve a comparison of different methods. External fixation stands out as a versatile option for managing both intra-articular and extra-articular fractures, yielding satisfactory functional outcomes. The rationale for opting for external fixation assisted plating includes the ability to maintain precise alignment under fluoroscopic guidance, achieving better alignment through the use of ligamentotaxis, and the capacity to safeguard the alignment during the healing process. The benefits of external fixation include its comparatively straightforward application, minimal surgical exposure, and reduced surgical trauma [8].



The study involved a cohort of 25 patients with distal radius fractures, and it primarily focused on evaluating the outcomes of treatment with volar plate assisted external fixation. Several key findings emerged from the study:

### Patient Demographics

The patient population consisted of 11 males and 14 females, with an overall average age of 38.95 years. Notably, female patients tended to be slightly older, with a mean age of 39.57 years, while male patients had a mean age of 36.87 years. These demographic factors provide a baseline understanding of the study population.

- a) **Improvements Over Time:** The results of the study demonstrated significant improvements in various parameters over a six-month period for patients treated with volar plates. These improvements included:
  - b) **Pain Reduction:** Patients experienced a substantial decrease in pain levels from an average of 10.21 at the 1-month mark to 20.87 at the 6-month mark. This is a noteworthy improvement and suggests effective pain management following the treatment with volar plates.
  - c) **Range of Motion (ROM):** The range of motion of the wrist improved significantly, with values increasing from 11.24 to 18.74. This indicates that patients regained functional mobility in their wrists, a crucial factor in their overall quality of life.
  - d) **Grip Strength:** Grip strength is essential for performing daily activities. The study revealed a remarkable increase in grip strength from 09.54 to 17.89, demonstrating the restoration of wrist and hand function.
  - e) **Activity Levels:** Patients' activity levels also saw substantial improvements, as reflected in the increase from 13.20 to 22.55. This suggests that patients regained the ability to engage in a broader range of activities, improving their overall functionality.
  - f) **Final Functional Score:** The final functional score, based on the Green and O'Brien scoring system, exhibited significant improvement, increasing from 44.19 at 1 month to 80.05 at 6 months. These scores are indicative of the effectiveness of the volar plate assisted external fixation in promoting functional recovery.

## 5. Conclusion

In conclusion, this study provides valuable insights into the outcomes of treating distal radius fractures with volar plate assisted plating. The results suggest that this treatment

approach is highly effective in achieving positive patient outcomes. Patients experienced significant pain reduction, improved range of motion, increased grip strength, and enhanced activity levels over the six-month follow-up period.

These findings underscore the importance of utilizing volar plate assisted external fixation as a viable treatment option for distal radius fractures. This method not only aids in anatomical realignment but also facilitates rapid functional recovery, allowing patients to regain their wrist and hand functionality sooner.

While these results are promising, it's essential to acknowledge potential limitations, such as the relatively small sample size and the need for further research to confirm these findings across a more extensive and diverse patient population. Nonetheless, this study contributes to the growing body of knowledge in orthopaedics and offers an encouraging approach for healthcare providers when treating distal radius fractures. Individualized care that considers the unique characteristics of each patient remains critical in achieving optimal outcomes in orthopaedic practice.

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