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Research Article

OPEN REDUCTION AND INTERNAL FIXATION WITH PLATING VERSUS EXTERNAL FIXATOR IN DISTAL END RADIUS FRACTURES: A COMPARATIVE STUDY

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ABSTRACT

Objectives: The purpose of this study is to compare the external fixation and locking plate fixation of intraarticular fractures of the distal radius in terms of functional outcome and complications. The study aims to assess the patients for fracture union, wrist range of motion (ROM), grip strength, pain, and activity among the locking plate and external fixator group.

Methods: This study aimed to compare distal end radius external fixator to distal end radius plating regarding functional outcomes. This is an observational type of study where 40 patients were included in the study, among them, 20 were treated with external fixator/k wire and 20 with distal radius plate. The study was conducted in a tertiary care institute during the study period.

Results: The most patients were males >50 years of age, with injury caused by a fall on an outstretched hand. In the present study, we got excellent functional results according to the G and O'Brien system in 11 (55%) of patients treated with the plating group, good results in 5 (25%), fair results in 4 (20%), and poor (0%) in the plating.

Conclusion: Plating provides better functional outcomes, as assessed by Green and O'Brien's score, as compared to external fixation. It allows for an early post-operative ROM exercises compared to an external fixator and better anatomical positioning of the fracture segments.

Keywords: Intraarticular fracture distal radius, External fixator, Volar plating, Modified green and O'Brien score.

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INTRODUCTION

The distal radius fracture (DRF) is an injury that predates our species, with a significant milestone in our evolution being the transition to bipedal ambulation by *Australopithecus* [1]. The chances of unfavorable outcomes after an intra-articular fracture of the distal radius increase with the occurrence of malunion and stiffness of the wrist joint; surgical corrections are often needed to achieve a functionally acceptable outcome and anatomical position [2]. It is the most common upper extremity fracture, with an average incidence of 17.5% of fractures per year and has a bimodal distribution in children and older people. Non-surgical management remains the main line of management; however, various treatment options are available for unstable fractures, including external fixation, percutaneous pinning, and internal fixation. Good functional outcome requires restoring the disrupted radial anatomy and maintaining accurate and stable reduction.

METHODS

This study aimed to compare distal end radius external fixator to distal end radius plating regarding functional outcomes. This is an observational type of study where 40 patients were included, and among them, 20 were treated with external fixator/k wire and 20 with distal radius plating on whom the survey was conducted. Adult patients above the age of 18 years with AO Type B and C were included in the study. Patients with open/compound pathological fractures were excluded from the study. Below are the acceptable radiological criteria kept in mind during the surgical procedures and assessed intra-operatively after reduction was achieved under image intensifier guidance and on immediate post-operative X-rays. After discharge on the first follow-up, patients' X-rays were also evaluated for any loss or reduction. Radial length within 2–3 mm of the contra-lateral wrist joint. Palmar tilt: Neutral tilt (0°) Intra-articular step-off of <2 mm Radial Angle: <5° loss Carpal Mal-alignment: Absent At the 12-month follow-up, the final assessment was done whether fracture was united and patients were assessed for wrist range of motion (ROM), grip strength, pain, and activity. The study was conducted after taking proper consent from patients.

Surgical technique (external fixator)

In the prone position on the simple operating table, under regional block anesthesia (brachial block) or general anesthesia, the patient was placed with the tourniquet applied over the arm. The forearm and hand were scrubbed with Betadine and saline, then painted with Betadine and draped. The operating forearm was placed on a radiolucent arm-board to achieve closed reduction under the C-arm. This technique, 5 mm incisions were made for 4 Schantz pins, 2 in the middle third of the radius on the dorso lateral aspect about 10–12 cm from the distal end and 2–3 cm apart. Another two incisions over the base of the second metacarpal on the dorso lateral aspect about 1–2 cm apart were done. 3-mm shank pins were inserted in the radius, and 2.5-mm shank pins were inserted in the second metacarpal. Then, fixator pins were secured with clamps and external fixator rods mounted to shank pins. The clamps were loosened; longitudinal traction was given with manual moulding of the fracture fragments back into a more normal alignment, and gentle flexion and ulnar deviation were maintained. Through an image intensifier, the reduction was confirmed, and then the external fixation device was locked into place. The image intensifier demonstrated the tension across the wrist generated by the external fixator device, which provides enough ligamentotaxis. Postoperatively, the fixator was kept in place for approximately 6 weeks. Finger ROM was encouraged from the immediate postoperative period. A supportive removable splint is prescribed, and pin care is initiated.

Surgical technique (plating)

Volar approach (Henry's Approach) is used, with the forearm in supination, a 6–7 cm longitudinal incision, beginning on the ulnar

aspect of thenar eminence till the flexion crease of the wrist is reached and then curving it slightly toward the ulnar side of the forearm so it does not cross the flexion crease at a right angle over the interval between radial artery and flexor carpi radialis. Retract the tendon toward the ulna and identify the median nerve.

The nerve lies closer to the palmaris longus, so the median nerve is retracted medially.

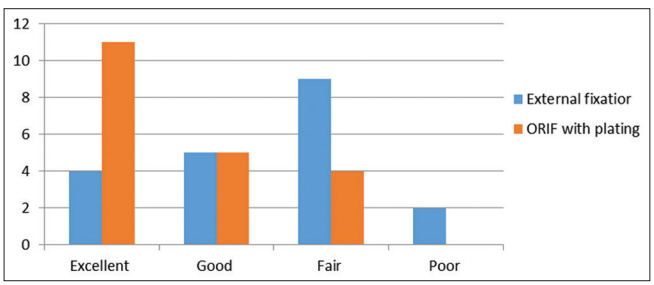
Expose the pronator quadratus muscle and elevate it to expose the volar surface of the distal radius. Do not release the volar capsule or ligamentous insertions because carpal instability may result. The fracture site is reached by elevating the periosteum around the fracture site. With reduction clamps and bone-holding clamps, the reduction is achieved and augmented by K-wire fixation. The position of the volar buttress plate is confirmed under the image intensifier, and fixation is secured with screws. Tourniquet is released. Hemostasis is achieved. Closure is done at the subcutaneous layer, and skin stitches are applied. A pressure bandage followed by a crepe bandage is applied below the elbow slab, and elevation is given. A post-operative X-ray is taken on the night of surgery. The dressing was done on the second post-operative day. Usually, stitch removal is done on the 12th day after the removal of the slab, and mobilization is done.

RESULTS AND DDISCUSSION, DATA ANALYSIS

The demographic profile suggested that 23 (57.5%) patients were male and 17 (42.5%) female, with the mean age at presentation for patients treated by external fixator with K-wires being 38 and patients treated by ORIF with Buttress plating being 43. The majority of patients, 16 (40%), were between the 51 and 60 age group and between the 21 and 30 age group – 14 (35%), showing a bimodal distribution. In the present study, out of 40 patients, 23 (57.5%) patients had left-side involvement, and 17 (42.5%) patients had right-side involvement. Left-side involvement was more common than right-side involvement. In the present study, a fall on the outstretched hand was the common mechanism of injury seen in 21 (52.5%) patients out of 40. Out of 40 cases, 02 (5%) cases were AO type B1, 07 (17.5%) were B2 type and 11 (27.5%) were B3 type. In the type C fracture pattern, 06 (15%) cases were C1 type, 10 (25%) were C2 and 04 (10%) were C3 type. The majority were B3 type followed by C2. Additional K wire fixation was done in five patients.

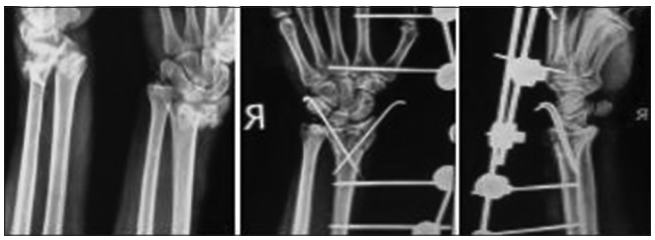
Treatment	Green and O'Brien point system functional results			
	Excellent	Good	Fair	Poor
External fixation, n (%)	4 (20)	6 (30)	8 (40)	2 (10)
Plating, n (%)	11 (55)	5 (25)	4 (20)	-

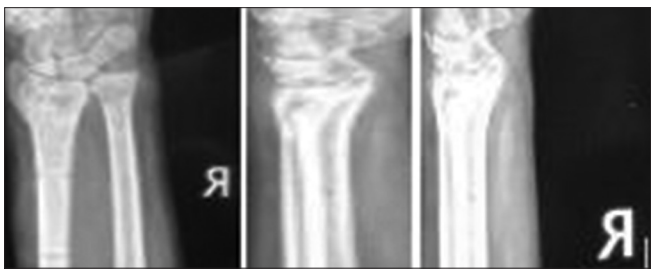
RESULTS IN TWO TREATMENT MODALITIES



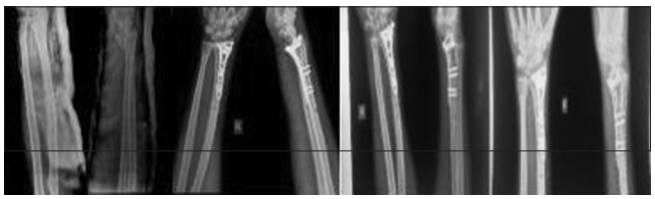
In the present study, we got excellent functional results according to the G and O'Brien system in 11 (55%) patients treated with ORIF in the plating group compared to 4 (20%) patients in the external fixation group. We got good results in 5 (25%) patients in the Plating group compared to 6 (30%) in the external fixation group. We got fair results in 08 (40%) patients with the external fixator group as compared to 4 (20%) patients in the ORIF group and poor results in 2 (10%) patients of the external fixation group and none in the plating group. Our series found that the ROM (Flexion-extension, suspension-pronation, radial, and ulnar deviation) was better in the plating group than the external fixation group. In the external fixation group, the ROM improved over the follow-up period, being comparable to the plating group at the end of the 12-month follow-up. The grip strength was significantly better in the Plating group in the initial follow-up period (6 weeks, 3 months) but later improved in the external fixation group. The Functional score of G and O Brien was considerably better in the plating group in the initial part of the follow-up, which later improved in the external fixation group over 12 months of follow-up.

PRE-OPERATIVE POST-OPERATIVE 1 MONTH 6 MONTHS





FOLLOW-UP



In the present study, we got excellent functional results according to the G and O'Brien functional scoring system in 11 (55%) patients treated with plating as compared to 4 (20%); eight patients in the external fixator group, good results in 5 (25%) patients in the plating

group as compared to 06 (30%) patients in the external fixator group. Bone healing was determined across the fracture and clinically by the fracture site being non-tender to palpation [3]. The fixator was removed at a mean interval of 7.2 weeks (6–8 weeks). A goniometer was used to check the rotation of movement, and grip strength measurements were done using the Jamar dynamometer. Patients were evaluated for pain, grip power, ROM around the wrist joint and activity and then system used for scorecard according to the modified Green and O'Brien scoring system at 3- and 6-month post-operative [4]. External fixation often requires supplementation with K wires, bone grafting, or stabilization of the radioulnar joint to assist in and maintain the reduction in complex fractures [5] Chung *et al*. in their study on the treatment of unstable DRFs with volar locking plates stated that the volar plating system appears to provide adequate fixation in such cases [2] Fu *et al*. conducted a meta-analysis of nine published randomized controlled trials (RCTs) with 776 patients of DRFs treated with either a volar locking plate or external fixation and concluded that volar plating gives better clinical results in the early post-operative period with better DASH scores even at 12-month follow-up and hence supported the use of volar plating for the management of DRFs [6] We got fair results in 8 (40%) patients in the external fixator group as compared to 4 (20%) patients in the Plating group. Kapoor *et al*. concluded in their RCT on the displaced intra-articular fractures of the distal radius that cases treated with internal fixation were least likely to develop articular complications due to better restoration of anatomy. However, severely comminuted fractures may present a poorer functional result due to unstable fixation by locking plates [7]. We got poor results in 2 (10%) patients in the external fixator group and none in the plating group. There was a difference in the mean value of the result in the plating group (76.5) compared to the external fixator group (89.5). Karantana A *et al*. found internal and external fixation to have comparable outcomes. Wei *et al*. found that internal fixation yielded a significantly better functional outcome, anatomical restoration, and forearm supination, but external fixation resulted in better grip strength and wrist flexion and concluded external fixation to be a suitable surgical alternative [8] the radial height, tilt, and radial inclination well maintained. The results at 6 months and 1 year showed no differences between these two kinds of fixation. Complication rate was higher in the external fixation group. Furthermore, the complication rate was less than that of the external fixator in the plating group, as seen in our study.

The only difference is that they used the fragment-specific wrist fixation system TriMed as a method of internal fixation compared to the non-locking plate used in our study.

In such cases, external fixation may lead to superior results by better maintaining radial Length using sustained traction according to the principle of ligamentotaxis. Kartana *et al*. have advocated using the combined approach of open reduction followed by internal and external fixation for severely comminuted AO type C fractures, which provided a satisfactory restoration of anatomy and functional outcome [8]. Our study shows no significant difference in pain, available, and grip scores. The subjective assessment of plate fixation was better than that of external fixation. Complications and reoperations were fewer for both plate and external fixation groups.

CONCLUSION

Orif with Plating provides better functional outcomes as assessed by Green and O'Brien's score compared to external fixation. It allows for an early post-operative ROM exercises compared to an external fixator and better anatomical positioning of the fracture segments. The grip strength is better in the plating group external fixation group. In patients treated with an external fixator, the grip strength gradually improves after frame removal and physiotherapy sessions, and longer follow-up is comparable to the plating group. Limitations of the study were the small number of patients and the duration of the follow-up. A larger group of patients with longer follow-ups would be more conclusive.

AUTHORS' CONTRIBUTION

All authors have declared that they are interested in the submitted work and have contributed to journal work.

CONFLICTS OF INTEREST

All authors have no conflict of interest.

AUTHORS FUNDING

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