

# A comparative study between closed reduction with external fixator & K-wires versus ORIF with buttress plating in intra-articular distal end radius fracture (AO classification type B & C)

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## Abstract

**Background:** The objective of the study was to compare the functional outcomes between treatment with external fixator and percutaneous k-wires versus ORIF with Buttress Plating of intra-articular distal end radius fractures (AO Type B and C) using the Modified Green O'Brien scoring system. **Materials and Methods:** This was a prospective randomized controlled observational study with a sample size of 50 patients, where 25 were treated with external fixation and k-wires and 25 were treated with ORIF and plating. Patients were followed up 2, 6, 10, 14 weeks and 6 months after surgery and final assessment was done for fracture union and patients were assessed for pain, wrist range of motion (ROM), grip strength and activity and scored according to the Modified Green O'Brien Scoring System. **Results:** At 6 months after surgery, we observed that the final outcome using the Modified Green and O'Brien scoring system wasn't significantly different in the two treatment modality groups with the external fixator group very slightly better than the plating group. **Conclusion:** Although there was no significant difference in the final outcome in both the study groups, assessed using The Modified Green O'Brien System, we preferred the treatment of intra-articular fractures of the distal radius (AO Type BandC) using the External Fixator and K-wires.

**Keywords:** Distal radius fractures, intra-articular, external fixation, buttress plating, Modified Green O'Brien.

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## INTRODUCTION

Fractures of lower end radius are the most common fractures of the upper extremity, encountered in practice and constitute 17% of all fractures and 75% of all forearm fractures.<sup>2</sup> Road traffic accidents causing high energy trauma have become a major mode of injury in the younger aged population while a fall on outstretched hand

in the older with osteoporosis being a major factor. Close reduction and cast immobilization used to be the mainstay of treatment of these fractures in the past but in recent times surgical treatment in order to restore anatomy has been widely used and recommended to provide better radiological and functional results. Closed Reduction with External Fixator and K-wires or ORIF with Buttress Plating have both been used in the past for treatment of intra-articular distal end radius fractures with good results, with still difference in opinions between different authors and surgeons. Both these techniques have significant differences in their surgical techniques and post-operative rehabilitation protocols.

Hence the purpose of this study is to evaluate which technique provides better surgical and functional outcomes for distal end radius intra-articular fractures.

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## MATERIALS AND METHODS

This study was performed at the Orthopaedic Department of MGM Medical College and Hospital, Aurangabad (Maharashtra) during the study period from September 2013 to July 2015 on a study group of 50 patients suffering from an intra-articular fracture of the distal end radius who were willing to participate in the study and continued follow-up for at least 6 months post-operatively. According to AO Classification only Type B and C<sup>1</sup> fractures were included in the study. Patients with open/compound fractures or with any accompanying (head, chest, abdominal) injuries were excluded from this study. Patients were randomized using the chit system after explaining treatment options and details of study to the patient and relatives and taking their informed written consents. The External Fixator and K-wiring group was named Group A and the ORIF with Buttress plating group was named Group B. In the external fixator and k-wiring group, we applied continuous mild traction to maintain alignment after the initial reduction maneuver. 3.5-mm Schanz pins were used for the radius and 2.5-mm pins for the metacarpal and connecting rod applied. Under fluoroscopic control, additional K wires were inserted and radiological parameters assessed making sure not to over distract the radio-carpal joint. Finger movements were permitted post operatively and wrist physiotherapy was begun after removal of external fixator after 6 weeks from surgery. In the ORIF with buttress plating group, the traditional FCR or the extended approach was used. After application of the plate and screws, the pronator quadratus was sutured. Hardware placement and fracture reduction was assessed under fluoroscopy control. Postoperatively, the patients with severe comminution were placed in a volar below elbow slab. Active finger exercises were started the day after surgery. Check dressing was done on post op day 2 to assess the status of the sutures site. Sutures were removed on the 12th post-operative day. The patients were placed in a removable splint for an additional 15 days. Physiotherapy was begun with active and passive exercises after suture removal. Type of Anesthesia was usually a Brachial Plexus Block (Supra-Clavicular, Infra- Clavicular, Axillary) or General Anesthesia wherever indicated. Patients of both groups were given strict limb elevation and finger movements were encouraged post operatively and Intravenous antibiotics were given for 2 days and oral antibiotic coverage (3rd generation cephalosporins) for a further of 3 days on discharge. Below-mentioned are the acceptable radiological criteria<sup>3</sup> kept in mind during the surgical procedures and were 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' check x-rays were also

evaluated for any loss of reduction since discharge.

1. Radial Length within 2-3mm of the contra-lateral wrist joint.
2. Palmar tilt: Neutral tilt (0degrees)
3. Intra-articular step-off of <2mm
4. Radial Angle: <5degree loss
5. Carpal Mal-alignment: Absent

All patients were followed up at 12-14 days for suture removal and fresh x-ray to check for any loss of reduction since fracture fixation, and further at 6, 8, 10 and 14 weeks and 6 months after surgery. At the 6 month follow-up final assessment was done for fracture union and patients were assessed for pain, wrist range of motion (ROM), grip strength and activity and scored according to the Modified Green O'Brien Scoring System.<sup>4</sup>

Statistical Methods Applied:

Results are tabulated in Microsoft excel and statistical analysis was done using SPSS version 20 for Windows 10. The statistical evaluation included descriptive statistics; frequencies and percentages were calculated for the data. Also the Chi-square test was applied for comparison of qualitative categorical variables. For quantitative data comparison of 2 means of parameters, t-test was applied. This quantitative data was also represented in the form of mean and standard deviation. Both, the qualitative and quantitative data were presented in the form of bar diagrams. P-value was checked at 5% level of significance (<0.05).

## RESULTS

The demographic profile suggested that 33(66%) patients were male and 17(34%) female, with the mean age at presentation for patients treated by External Fixator with K-wires being 39.44±12.26 (Range 21-60 years) and patients treated by ORIF with Buttress plating being 40.04±13.26 (Range 21-65).

In our study 33(66%) patients had a high velocity trauma mostly by Road Traffic Accidents and 17(34%) had a low velocity trauma predominantly by fall on outstretched hand, most of which were older osteoporotic patients.

Average duration of Hospital stay for patients in External Fixator + K-wires group was 3.68±0.63 and 4.24±0.78 in the Plating group with a t-value of 2.80 and a p-value of 0.007 proving its significance.

Average duration of surgery for the External Fixator + K-wires group was 48.00±10.60 minutes, whereas for the Plating group was 60.50±9.61 minutes with a t-value of 4.49 and a significant p-value of 0.000.

1 case in Group A (External Fixator + K-wires) had loosening of a Schanz Pin which required revision under sedation. 2 patients in Group A developed pin tract infection which was managed with oral antibiotics (3rd generation cephalosporins) and good pin-tract care. 3(6%)

patients developed stiffness of MCP joints (2 from Group A and 1 from Group B) which was treated with rigorous physiotherapy. 2 patients in Group A developed Neuropraxia of the Radial Nerve and were treated with NSAIDs, short course steroids and physiotherapy. All patients recovered completely. 4 patients developed CRPS (1 from Group A and 3 from Group B) and were managed with physiotherapy, short course steroids and Amitriptyline. 2 patients from Group B developed superficial Infection at the suture site and were managed with Oral Antibiotics (3rd Generation cephalosporins). The superficial infections healed completely. 1 patient in Group B developed deep infection, which did not subside with oral antibiotics. Implant removal was done in this case with thorough debridement and was then managed with an external fixator and k-wires. 1 patient in Group B developed Median Nerve Neuropraxia and was managed

with NSAIDs, short course steroids and physiotherapy (TENS). The patient recovered completely. External fixation neutralizes the axial load imparted by the physiologic load of the forearm musculature, while the use of percutaneous k-wires improves the stability of the external fixation and prevents loss of reduction. Duration of surgery was significantly lesser in the External Fixator + K-wires group with lesser surgical soft tissue trauma. There was a significant difference in the duration of hospital stay in the two study groups with the patients in the External Fixation and K-wiring group requiring a shorter hospital stay. Average time to fracture union for the External Fixator + K-wires group was  $10.36 \pm 2.39$  weeks, whereas for the Plating group it was  $10.00 \pm 3.36$  weeks, with a t-value of 0.433 and a p-value of 0.665, which was not significant.

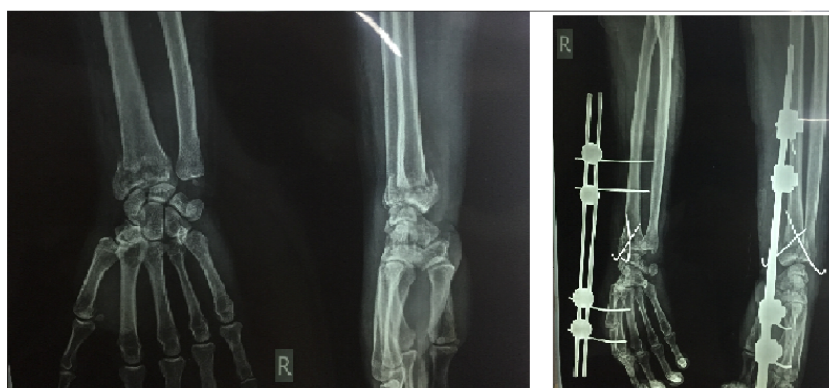


Figure 1(A)

Figure 1(B)



Figure 1(C)



Figure 1(D)



Figure 1(E)



Figure 1(F)





Figure 2(A)

Figure 2(B)



Figure 2(C)



Figure 2(D)



Figure 2(E)



Figure 2(F)

**Legend**

**Figure 1:** Pre-op and Post-op xrays of patient treated with external fixator and k-wires (AandB). Clinical pictures of the same patient showing range of motion in extension, flexion, supination and pronation (C,D,E and F)

**Figure 2:** Pre-op and Post-op xrays of patient treated with ORIF and buttress plating (A and B). Clinical pictures of the same patient showing range of motion in extension, flexion, pronation and supination (C,D,E and F)

**DISCUSSION**

Fracture of distal end of radius has a predominantly bimodal age distribution in our study, with young individuals between 21- 30yrs and older patients above the age of 40. The younger age group affected consisted more of male patients whereas the older age groups had a slight female predominance. Road traffic accidents were a major mode of trauma in the younger aged population while a fall on outstretched hand in the older. In Group A (External Fixator + K-wires) 10 (40%) patients had Excellent, 11 (44%) Good, and 4(16%) had Fair results, with no patient having Poor results. In Group B (ORIF with Plating) 8 (32%) patients had Excellent, 12 (48%) Good, 4 (16%) Fair and 1 (4%) patient had Poor results at the final 6 month assessment according to the Modified Green O'Brien Scoring System.<sup>4</sup> Chi-square test value came out to be 1.27 with a p-value of 0.737, which was not significant. Hence suggesting both surgical techniques predominantly provide excellent or good results as long as the radiological parameters are met and fixation achieved as early as possible with rigorous physiotherapy. These results were similar to a study conducted by Shukla *et al.*<sup>5</sup> on 110 patients where he concluded that 85.5 % of patients treated with external fixation and 73.3 % of patients treated with volar plating had

an excellent or good result. Kapoor *et al.*<sup>6</sup> reported 80 and 63 % with good or excellent results in external fixation and volar plating groups, respectively and recommend that displaced severely comminuted intra-articular fractures should be treated with an external fixator, while Gradl *et al.*<sup>7</sup> reported 100 and 97.5 % with good or excellent results in these two groups, respectively.

**CONCLUSION**

Early post-operative mobilization is possible in the patients treated with ORIF and plating but does not affect the final outcome with rigorous physiotherapy initiated in the patients treated with external fixator and k-wires once implant is removed. Rigorous physiotherapy is key to avoiding post-operative arthritis and achieving good range of motion in the external fixator group. Not crossing the watershed line landmark is crucial during the placement of hardware (plate) during the ORIF and plating procedure with care taken to prevent damage to the neurovascular structures (radial artery and median nerve) around the operative field. Care should be taken not to damage the superficial radial nerve while drilling for and inserting schanz pins in the radius during the procedure of external fixation. Over-distraction should be

prevented while using the external fixator and pin tract care is a must to avoid infection at pin-tract sites. Time to fracture union is similar in both study groups as long as the acceptable radiological criteria are met. There was no significant difference in the final outcome in both the study groups, assessed using The Modified Green O'Brien System. However, we preferred the treatment of intra-articular fractures of the distal radius (AO Type B and C) using the External Fixator and K-wires. Although open reduction and internal fixation has advantages such as direct visualization and manipulation of the fracture fragments, stable rigid fixation, and the possibility of immediate postoperative motion we preferred the use of external fixator with k-wires since it provides continuity of reduction under fluoroscopic control, improved reduction by ligamentotaxis, and the ability to protect the reduction until healing occurs, with advantages such as the relative ease of application, minimal surgical exposure, reduced surgical trauma, shorter hospital stay and easy removal of hardware.

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