



Is it Better to Use 2.7mm Fragment Specific Fixation Plates as Compared to 3.5mm Volar Locking Plates for Distal End Radius Intra-Articular Volarly Displaced Fracture? - A Clinical Study

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Abstract

Introduction: Fractures of the distal radius continue to be one of the most common skeletal injuries treated by orthopedic or trauma surgeons. The optimal management of distal radius fractures has changed dramatically over the previous two decades from almost universal use of cast immobilization to a variety of highly sophisticated operative interventions like distraction plating, a combination of external fixator and volar plating, and fixed angle locking volar plating.

Material and Methods: A Retrospective study was carried out at GAIMS, Bhuj during the period of March 2023 to March 2024. Patients included in the study consisted of Intra-articular Volarly displaced fracture of the distal end radius (AO type 2R3B and 2R3C), Age >18 years, Closed fracture and type 1 Modified Gustilo and Anderson open fracture and those excluded consisted of Extra-articular fracture of distal end radius (AO type 2R3A), Patients with distal neurovascular deficit, Pathological fractures, Grade 2 and 3 Modified Gustilo and Anderson open injury and Polytrauma patients.

Results: Out of total 43 patients majority of patients had intra-articular Volarly displaced Distal end radius. Male to female ratio was 2.3:1. Most common age group was 41-50 yrs. Most common mode of injury was road traffic accident. The results for Sarmiento's Modification of Lindstrom Criteria showed 50% patients showed Excellent results in Group-A whereas Group-B showed 47.37%, Mayo Wrist Score result indicated 57.89% excellent results in Group-B where as in Group-A it was 54.16% and Gartland and Werley Score were assessed showing 54.16% Excellent results in Group-A and 52.63% in Group-B.

Conclusion: The decision on which plate to use should be based on a thorough assessment of the fracture characteristics and fracture configuration. 2.7mm fragment specific plate is more useful in certain specific fractures where comminuted fragments are there whereas 3.5mm volar locking plate can be used in volarly displaced intra articular fractures where large fragments are there.

Keywords: Distal End Radius; Functional Outcomes; Locking Plates

Abbreviations

AO: Arbeitsgemeinschaft für Osteosynthesefragen; Avg: Average; Deg: Degrees; DER: Distal end Radius;

LCP: Locking Compression Plate; Mm: Milimeter

Introduction

Fractures of the distal radius continue to be one of the most common skeletal injuries treated by orthopedic or trauma surgeons. In fact, these injuries account for approximately one-sixth of all fractures seen and treated in emergency rooms [1]. These are most common fractures of the upper extremity.

The most common cause of this type of fracture is a fall on an outstretched hand. In young adults this fracture is the result of moderate to severe force such as a fall from a significant height or a motor vehicle accident. The risk of injury is increased in patients with osteoporosis and other metabolic bone diseases.

However, several issues remain regarding treatment considerations for patients with this injury. The optimal management of distal radius fractures has changed dramatically over the previous two decades from almost universal use of cast immobilization to a variety of highly sophisticated operative interventions like distraction plating, a combination of external fixator and volar plating, and fixed angle locking volar plating. The methods which are commonly practiced are closed manipulation and plaster cast, pins and plaster, percutaneous pinning, external fixation and open reduction and internal fixation with or without bone graft [2].

The purpose of the present study was to compare the results of 3.5mm Volar Locking plate [3] for distal end radius intra-articular volarly displaced fracture as compared to 2.7mm Fragment specific plate [4]. The two treatment groups were compared with use of standardized clinical and radiographic measures.

Materials and Methods

This is a retrospective study for the result of 3.5mm Volar locking plate for distal end radius intra-articular volarly displaced fracture as compared to 2.7mm Fragment specific plate, total 43 patients were evaluated, in the time frame of 1 year starting from

March 2023 till March 2024 at Gujarat Adani Institute of Medical Sciences, Bhuj in the Department of Orthopaedics. All the patients were classified as per the AO classification terminology [5]. All the patients were followed post operatively up at regular intervals of 4-6 weeks till 6 months. Patients included in the study consisted of Intra-articular Volarly displaced fracture of the distal end radius (AO type 2R3B and 2R3C), Skeletally mature adult patient above 18 year of age, Closed fracture and type 1 Modified Gustilo and Anderson open fracture [6] and those excluded consisted of Extra-articular fracture of distal end radius (AO type 2R3A), Patients with distal neurovascular deficit, Pathological fractures, Grade 2 and 3 Modified Gustilo and Anderson open injury and Polytrauma patients. Pre operatively local, clinical and radiographic assessment is done. Pre-op written consent was taken in their known language. The affected limb is completely shaved and prepared. Regional Anaesthesia was given for induction. During the procedure, the patient is Placed supine on an operating table with hand resting on hand table. The C-arm is strategically positioned to ensure optimal imaging in both AP and lateral views. Plating is done using Modified Henry Approach [10]. Fracture reduction and implant position was checked under fluoroscopic imaging. Post-op patient were given Below elbow splint for 4-6 weeks and were followed at an interval of 1 week, 4 weeks, 8 weeks, 3 months, 6 months, depending on the case and time of operation. Pre-op and Post-op Radiological evaluation was done using following parameters.

Normal radiographic relationships:

- Radial inclination: 13-30 deg. (avg.23 deg.)
- Radial length: 8-18mm (avg. 11mm)
- Palmar (volar) tilt: 0-28 deg. (avg. 11-12 deg.)

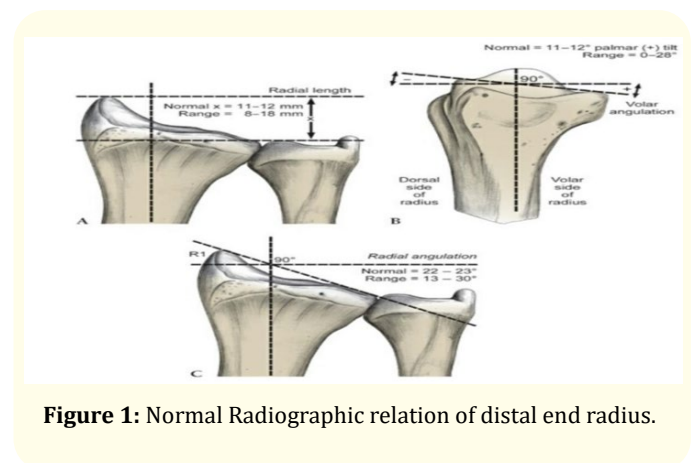


Figure 1: Normal Radiographic relation of distal end radius.

Anatomic Evaluation was done using Sarmiento’s Modification of Lindstrom’s Criteria [7].

The functional outcome of the patients was evaluated with Mayo Wrist Score [8].

Clinical outcome of patients will be measured using Gartland and Werley Score [9].

Patients operated using 3.5mm Volar locking Plate were classified as Group A and those operated using 2.7mm Fragment Specific plate were classified as group B.

Age (in years)	No of patients	Percentage (%)
20-30	8	18.60
31-40	12	27.91
41-50	14	32.56
51-60	5	11.63
61-70	4	9.30
Total	43	

Table 1: Age distribution of Patients.

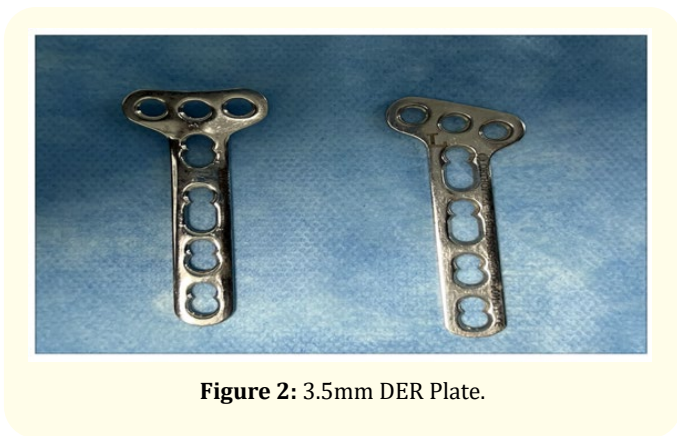


Figure 2: 3.5mm DER Plate.

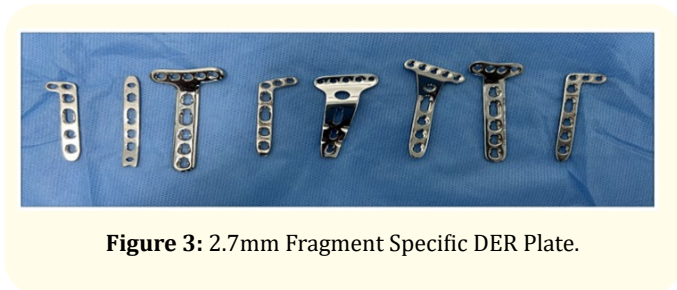
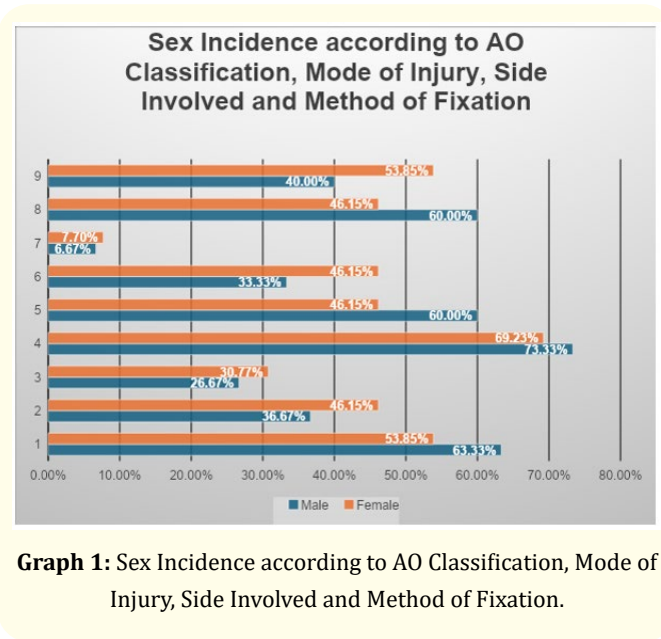


Figure 3: 2.7mm Fragment Specific DER Plate.

In the study majority of the patients belonged to the age group of 41-50, with more occurrence of distal end radius fracture in Males, more affected on Right side. The main mode of injury was Fall down either at home, work or from height. Majority of the patients had AO Classification 2RB type and most of the patients treated by 3.5 mm Volar locking plate.



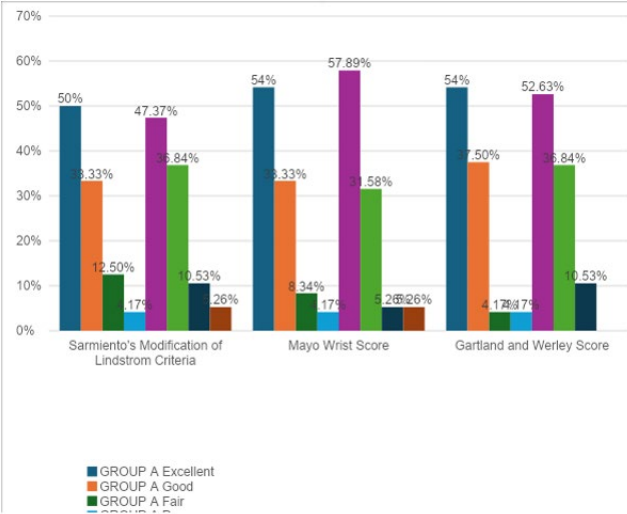
Graph 1: Sex Incidence according to AO Classification, Mode of Injury, Side Involved and Method of Fixation.

Results and Discussion

Results

We have evaluated total 43 cases of lower end radius fractures and found following observations.

The results for Sarmiento’s Modification of Lindstrom Criteria showed 50% patients showed Excellent results in Group-A whereas Group-B showed 47.37% , Mayo Wrist Score result indicated 57.89% excellent results in Group-B whereas in Group-A it was 54.16% and Gartland and Werley Score were assessed showing 54.16% Excellent results in Group-A and 52.63% in Group-B.

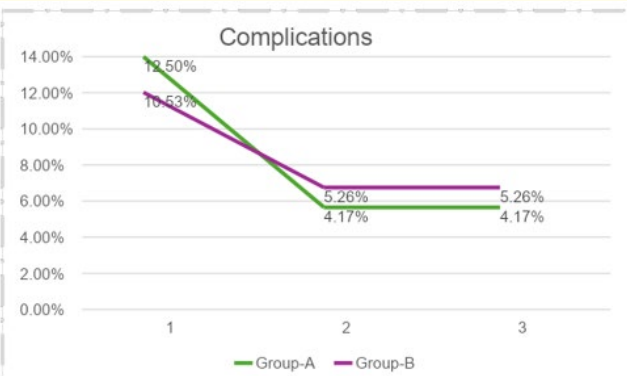


Graph 2: Results according to Sarmiento's Modification of Lindstrom Criteria, Mayo Wrist Score and Gartland and Werley Score.

Post Procedure various complications can occur like Infection, Osteomyelitis, Non-union, Malunion, Restriction of movements, Joint stiffness, Arthritis, etc.

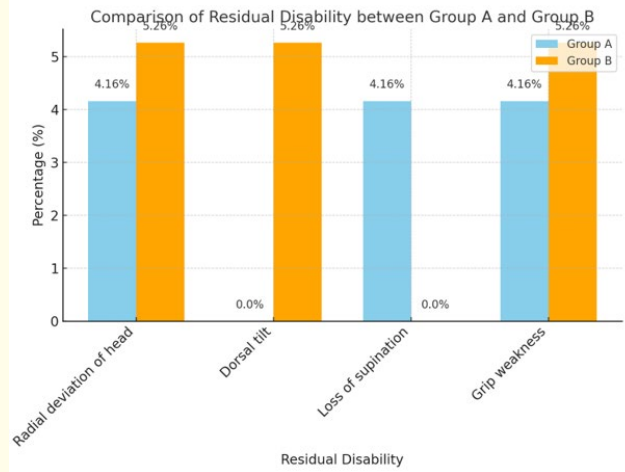
Graph 4 shows complications during the follow up period in which out of all the patients Stiffness was the one of the common complication with 12.5% incidence in Group-A as compared to 10.53% in Group-B.

Our average time of union was 14 weeks. In our study the shortest time for union was 12 weeks and longest time for union was 17 weeks.



Graph 3: Complications.

Group-A had 12.48% Residual deficit incidence compared to Group-B having 15.79%.



Graph 4: Residual Deficit.

Discussion

It is known to us that fracture of the distal radius requires perfect restoration of the anatomy and articular congruity. The correlation between incongruity and post traumatic arthritis is well established. Decreased range of motion and grip strength as well as instability has been seen due to mal-alignment [11]. Internal stabilisation of distal radius fractures provides a better restoration of the radial length as well as the volar tilt. Locking plates provide a better technique to fix osteoporotic bones.

Our study has demonstrated that there is little difference in the palmar tilt, radial inclination and the radial height in the immediate post operative and the last follow up. This highlights the fact that the fracture reduction that was achieved in the immediate post operative period is maintained throughout the follow up duration. The results are in strongly matches with other studies conducted using a volar LCP fixation although not the 3.5 mm volar LCP as used in our study. Rozental TD, et al. [12], and Konstantinidis L, et al. [13], found good post operative radiological outcomes with use of LCP for distal radius fracture. Small amount of studies have been conducted in the Indian subcontinent. Pradhan U, et al. [14], in their study concluded that treatment with open reduction and internal fixation for intra articular fractures of distal end of radius

provides good radiological results. Volar plate fixation provides an overall decreased rate of complications when compared to external fixation. Moirangthem V., *et al.* [15], in their retrospective analysis of volar plating of distal radius fractures stated that with proper patient selection and accurate surgical techniques, volar plating continues to be a useful method of treatment for distal end radius fractures with minimal complications and allowing early return of patients to normal activities. Khan MS., *et al.* [16], also found the use of volar LCPs for intra-articular distal radius fracture to show good results especially in comminuted distal radius fractures.

The 3.5 mm volar LCP is designed for fixation of complex fracture patterns especially in comminuted fractures and in the presence of osteoporosis. The 3.5 mm plate provides a stable fixation, which is crucial for allowing early mobilization and reducing the risk of malunion or nonunion [17]. This stability helps in maintaining the correct anatomical alignment of the radius, which is important for the function of the wrist and hand. The 2.7 mm smaller size of the plate and the locking screws help in addressing individual fracture fragment. Since the plates are much smaller, they can be placed more distally allowing sub-chondral fixation and reduced tendon and soft tissue irritation.

The advantage of our study was that all the cases were operated at same hospital and by the same qualified orthopaedic surgeon keeping the idea and method of fracture fixation constant. The follow up examination was also done by the same team of orthopaedic surgeons. We believe this study has effectively demonstrated that the use of 3.5mm volar locking plate for distal radius fracture fixation achieves good results in terms of radiological outcomes.

Conclusion

Both 3.5 mm and 2.7 mm distal radius plates have their respective advantages and are suitable for different types of fractures at distal radius and patients. The decision on which plate to use should be based on a thorough assessment of the fracture characteristics and fracture configuration. 2.7mm fragment specific plate is more useful in certain specific fractures where comminuted fragments are there whereas 3.5mm volar locking plate can be used in volarly displaced intra articular fractures where large fragments are there. Although our early results are promising for 3.5 mm plate's use but larger multicentric trials are warranted.

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