

A Clinical Study of Precontured Palmer Plating In the Management of Distal Radius Fractures with Dorsal Displacement

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Abstract

Background: Fractures lower end of radius are most common fractures of upper extremity, constituting 17% of all fractures & 75% of all forearm fractures. Elderly patients are at high risk because of low mineral bone density. Among all fractures of distal end of radius, about 50% of them involves the articular surface of either the radiocarpal joint or distal radio ulnar joint and displacement of the fracture fragments, impairs the articular congruity attained by the reduction technique and lead to post traumatic osteoarthritis. Extensor tendon rupture and irritation caused by implants when a dorsal approach is used. To prevent complications, the dorsally displaced fracture of the distal radius are treated using a palmar approach.

Material and Methods: The present study was a prospective study consisted of 30 adult patients with fresh unstable fractures of distal end of radius with dorsal displacement that were treated with Precontured Palmer plating at ASRAM Medical college, Eluru, West Godavari district, Andhra Pradesh between September 2019 to October 2021.

This study was to evaluate the functional results of unstable fractures of distal end of radius with dorsal displacement managed with Precontoured Palmer plating. All 30 patients were followed up at regular intervals.

Results: In our study we achieved 73.2% excellent results, 19.8% good results, 6.6 fair results.

Conclusion: Palmar plating can be safe and effective for treatment of dorsally displaced fracture of distal radius with good functional outcome. It prevents complications like tendon rupture and irritation caused by implants when dorsal approach is used

Keywords: Precontoured Palmar Plating, Dorsally displaced fractures of distal radius.

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I. Introduction

Fractures lower end of radius are most common fractures of upper extremity, constituting 17% of all fractures & 75% of all forearm fractures. There appears to be a bimodal distribution with majority of fracture in older population are due to fall, while in younger these fractures are due to motor vehicle accidents. Elderly patients are at high risk because of low mineral bone density. Most common cause of distal radius fracture is fall on an outstretched hand. Among all fractures of distal end of radius, about 50% of them involves the articular surface of either the radiocarpal joint or distal radioulnar joint and displacement of the fracture fragments, impairs the articular congruity attained by the reduction technique and lead to post traumatic osteoarthritis. Extensor tendon rupture and irritation caused by implants or surgical intervention are serious complications in the treatment of fracture of the distal radius when a dorsal approach is used. To prevent complications, the dorsally displaced fracture of the distal radius was treated using a palmar approach. Palmar plating can be safe and effective for treatment of a dorsally displaced fracture of the distal radius.

II. Materials & Methods

From September 2019 to October 2021, 30 cases of dorsally displaced fractures of distal radius were treated at Alluri Sitarama Raju Academy of Medical Sciences, Department of Orthopaedics, by surgical intervention.

Inclusion criteria:

- Adults (aged over 18 years) both male and female with unstable displaced fractures of distal end of radius. □
- Both intraarticular and extraarticular fractures are included.
- Patients who give consent for the study and are willing for follow up.

Exclusion criteria:

- Patients aged below 18 years.
- Patients who are not medically fit for surgery. □
- Patients who doesn't give consent and are not willing for long term follow up

OPERATIVE TECHNIQUE

In our study, Precontoured Palmer plate is used for dorsally displaced fractures of distal radius by using modified Henry's approach



FIG :1 Regional Anaesthesia (Left Supra clavicular block)FIG: 2 Modified Henry's approach



FIG 3 : Fracture provisionally fixed with K wire



FIG :4 Surgical wound after volar locking plate fixation

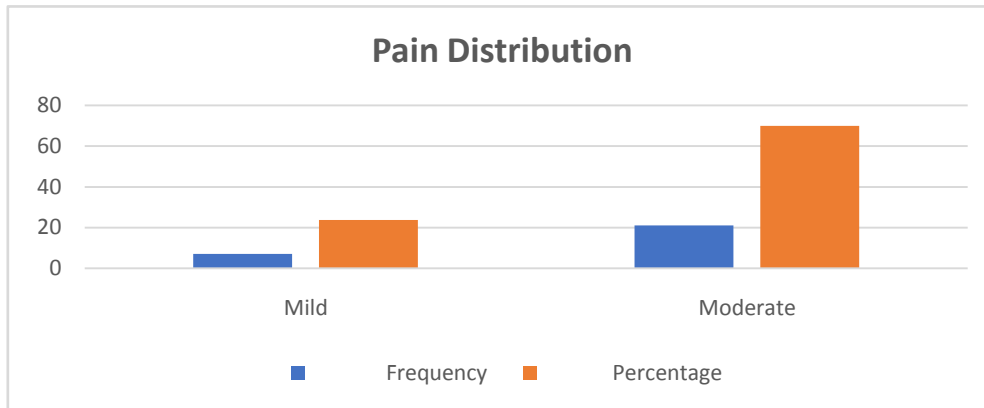
III. Results

30 patients were enrolled in our study. Of them 18 were males and 12 were females. The age groups from 20 to 50 years were taken in our study. High incidence between 41-50years with male predominance of 60%. Mode of injury is accidental fall in 60% of population.

The results were analyzed based on Modified Mayo Wrist score (MMWS)

Table :1 Frequency Distribution of pain

S.no	Pain	Frequency	Percentage
1	Mild	5	16.7
2	Moderate	2	0.7



In our study about 82.6% of patients has no pain at one year follow up.

Table :2 Frequency distribution of functional status/ Satisfaction score

S.no	Functional Status	Frequency	Percentage
1	Working	28	93.3
2	Restricted working	2	6.7

In our study 93.3% patients were working without any functional disability.

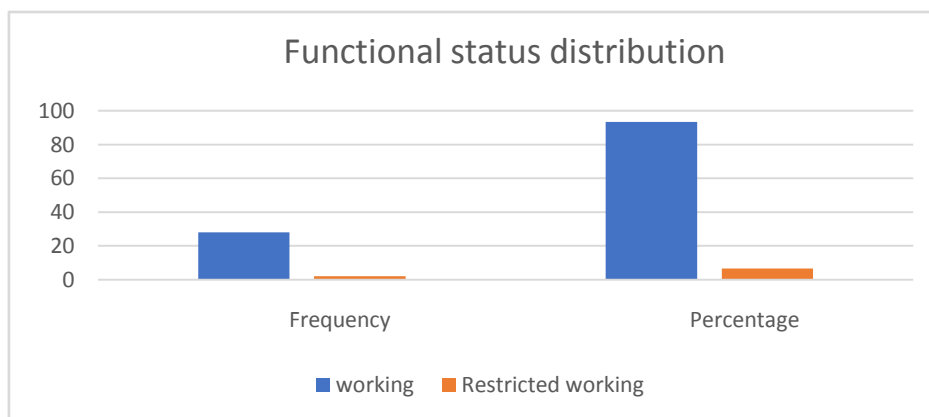
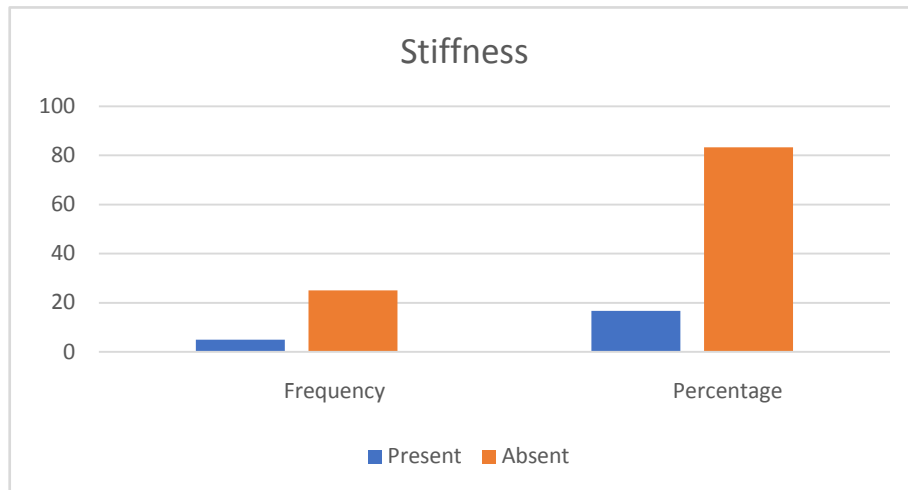


Table : 3 Frequency distribution of range of motion

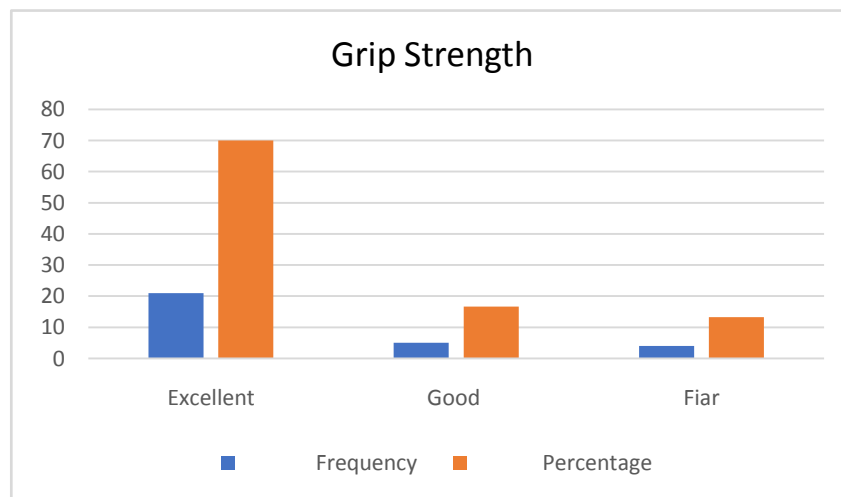
S.no	Stiffness	Frequency	Percentage
1	Present	5	16.7
2	Absent	25	83.3



In our study about 83.3 % were able to work without any stiffness .

Table : 4 Grip strength score

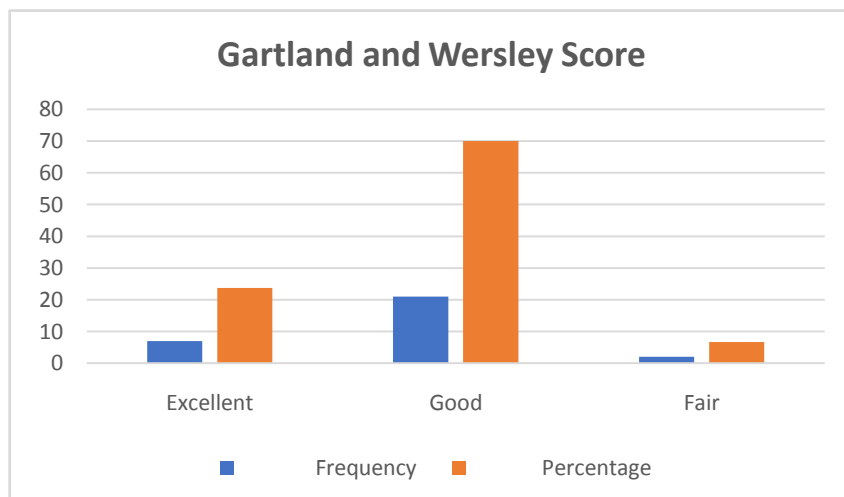
Grip Strength	Frequency	Percentage
Excellent	21	70
Good	5	16.7
Fair	4	13.3



In our study at one year follow up finger grip strength was measured and compared with patients normal hand. About 70 % of patients had excellent grip strength in volar plating.

Functional grading

Gartlandand Werley score	Frequency	Percentage
Excellent	7	23.7
Good	21	70
Fair	2	6.7



By functional grading in volar plating, 23.3% of patients had excellent results

IV. Discussion

The importance of restoring the anatomical alignment and articular congruity is well observed in the management of distal radial fractures¹. Lafontaine in his study of 112 consecutive patients with fracture of the distal end of the radius suggested that the distal radius fractures with dorsal comminution are highly unstable and tend to suffer re-displacement following closed reduction². Mackenney et al. reported that early instability was six times more common in fractures with any form of dorsal comminution³.

Open reduction and internal fixation which allow better restoration and preservation of distal radius radiological parameters are recommended for this subset of unstable distal radius fractures.

Though dorsal approach allows for direct articular visualization and placement of internal fixation as a dorsal buttress, allowing earlier return to activity, the outcomes tend to level off with time⁴. Prominent dorsal implant, extensor tenosynovitis, and rupture have been reported as complications after dorsal plating plate. Moreover, dorsally placed implants have increased thickness of the plate, raised screw heads, and they lack the ability to contour the plate to fit the bone⁵.

The volar anatomy of the wrist presents an obvious advantage over the dorsal aspect because there is more space between the volar cortex and the flexor tendons. In the volar approach, the pronator quadratus acts as a barrier by covering the distal edges of the plate, thereby minimising irritation to flexor tendons. As the volar cortex is relatively broad and flat as compared to the dorsal cortex of the distal radius, application of the volar locked plate is easy. The pronator quadratus separate this structures, preventing soft tissue complications and allowing application of larger implants.

Under some circumstances a volar plate fixing a dorsally displaced fracture is subject to higher loads than a dorsal plate. The bending strength of our plate was therefore augmented by increasing its cross sectional area. Secondary displacement with loosening and toggling of the distal screws had been observed frequently with the use of conventional T-plates, particularly in osteopenic bone.

In a biomechanical study on dorsally comminuted extra-articular distal radial fractures comparing dorsal T-plate with volar locking plate, it was inferred that there was no difference in any of the biomechanical parameters, namely, 60 stiffness, fragment displacement at 500 cycle-intervals, and axial load to failure between these constructs⁶.

Othman et al published in year 2009 ,studied seventeen consecutive fractures in 16 patients. Eighty-eight percent of the fractures were rated as good or excellent according to the Disability of the Arm, Shoulder, and Hand scoring system, and the Gartland and Werley score, whereas 76.4% were rated as good or excellent according 61 to the Scoring system of Jakim et al. This report supports the view of using volar plating for the unstable dorsally displaced distal radius fractures⁷.

Paritosh Gogna published in the year 2013 studied in 33 consecutive patients with dorsally comminuted fractures of the distal end of the radius were treated by open reduction and internal fixation with AO 2.4 mm ()/3.5 mm () volar locking distal radius plate.). They concluded Volar locking plate fixation for dorsally comminuted distal radius fractures gives good to excellent results⁸.

Valerio Pace et al conducted a retrospective observational study in a Patients/Participants: 230 patients (122men, 108women) who sustained a dorsally displaced distal radius fracture. Close reduction procedures attempted; below elbow cast applied. Follow-up: Pacetti's line used on true 62 AP and lateral view xrays after reduction and casting (T0) and at 7-14 days (T1-T2)The Pacetti's line seems to represent a very useful tool providing simple, feasible, efficient and reliable information on DRFs characteristics and natural course⁹.

The function of this implant as an internal fixator in combination with the preservation of the vascularity to the dorsal comminuted area accounts for the rapid restoration of the anatomic continuity of the dorsal cortex, despite the infrequent use of bone graft. Similarly subchondral buttressing of anatomically reduced intra-articular fragments with the fixed-angle principle accounts for the absence of secondary displacement of articular fracture components. Comminuted intra articular fractures of the distal radius are one of the most 63 common fractures in day to day orthopaedic practice and facing much difficulty in producing a satisfactory outcome.

The goals of treatment in unstable distal radius fractures should be :-

- Restoration of the normal anatomy and congruency of the articular surface of the distal radius
- Stable fixation of the fracture fragments.
- Early rehabilitation of the wrist and hand and early return to work.

Rozenthal in 2006 studied 41 patients with a mean age of 53 years concluded patients with unstable, dorsally displaced fractures of the distal radius treated with volar fixed-angle devices have good or excellent functional outcomes despite a high complication rate. When compared with previous reports on dorsal plating volar plates appear to have a higher incidence of 64 fracture collapse but a lower rate of hardware-related complications. Complex fracture patterns thus mandate a careful and individualized approach¹⁰.

In our study, functional and anatomical results of 30 patients with intra articular fractures of distal radius treated with

- Open reduction & Volar plating,
- Our functional analysis is based on Gartland and Werley demerit system, 23.3% of patients in volar plating had excellent score.
- In our study, anatomical grading is based on Lindstrom and Frykman system, 86.7% patients in volar plating had grade I result i.e. no significant deformity.
- Mode of injury by accidental fall (60. %) were more common than vehicular 68 accidents (40%) .
- In volar plating 5 patients had wrist stiffness.

Regarding grip strength when compared with patients normal hand about 70% has good to excellent results in volar plating. Restoration of normal anatomy is important for restoration of function. Normally 82% of the compressive load across the wrist is borne by distal radius and remaining by distal ulna. With 2.5mm loss of radial length, ulna bears 42% load and at 20 degree dorsal angulation, ulna bears 50% load.

Preservation of radial length is the most important factor for preservation of function. Loss of radial length can lead to ulnar impaction or dysfunction of Distal Radio Ulnar Joint, with limited range of motion in pronation and supination, depending on the volar or dorsal subluxation of the ulnar head within the sigmoid notch. Residual dorsal angulation can precipitate ulnar impaction, mid carpal instability and altered stress concentration which may lead to early arthritis.

Union was achieved in all the patients. Radiological Parameters including palmar tilt, radial inclination, radial length, ulnar variance have been maintained since the operation. according to rating scale of Gartland & werley, excellent, good for result. There were no extensor tendon injuries that occurred during use of palmar approach. Palmar plating can be safe & effective for treatment of dorsally displaced fractures of distal radius.

Rozental and Blazer compared their results of locked volar plating with those of dorsal plating for comminuted distal radius fractures. They identified that the overall complication rate in the volar plate group was 22% as compared to 32% in the dorsal plate group. Further, the volar plate cohort had a 10% rate of loss of reduction while the dorsally plated patients did not experience any loss of reduction, malunion, or nonunion. They found a statistically significant difference in the rate of soft-tissue complications between the 2 groups; the volar plate group had a 7% rate of hardware removal secondary to tendon irritation while the dorsal plate group had a 32% rate of hardware related tendon complications.

This method represents a valuable treatment modality for the most frequent types of unstable fractures of the distal radius in young and elderly patients. The surgical approach is simple and can be extended depending on the complexity of the fracture.

The biomechanical features of the DVR plate in combination with preservation of the vascularity of the dorsal comminuted area rendered additional bone grafting rarely necessary except for unusual cases of important dorsal and volar comminution seen with high-energy injuries.

V. Conclusion

Dorsally comminuted fractures are highly unstable, and closed reduction results in unsatisfactory outcome . There has been a consensus on open reduction and internal fixation of these fractures so as to restore the distal radius anatomy and regain early return to activity . Dorsal approach allows direct articular visualization and placement of plate as a dorsal buttress; however, a high incidence of hardware-related problems has culminated in a recent trend towards volar plates .

Volar locking plate provides stable fixed angle support that permits early active wrist rehabilitation, direct fracture reduction, and fewer soft tissue and tendon problems. Extensor tendon rupture & irritation caused by implants or surgical intervention are serious complications in treatment of fracture of distal radius when a dorsal approach is used. Restoration of normal anatomy is important for restoration of function.

Normally 82% of the compressive load across the wrist is borne by distal radius and remaining by distal ulna. With 2.5mm loss of radial length, ulna bears 42% load and at 20 degree dorsal angulation, ulna bears 50% load. To prevent complications, dorsally displaced fracture of distal radius was treated using palmar approach. Union was achieved in all patients. Radiographic parameters maintained postoperatively.

There were no extensor tendon injuries that occurred during use of palmar approach. Palmar plating can be safe and effective for treatment of dorsally displaced fracture of distal radius with good functional outcome

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