



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2023; 9(1): 371-379
© 2023 IJOS

<https://www.orthopaper.com>

Received: 12-11-2022

Accepted: 16-12-2022

Dr. Yamik Narsinhbhai Damor
Department of Orthopaedics,
Medical College Baroda and SSG
Hospital, Maharaja Sayajirao
University, Vadodara, Gujarat,
India

Dr. Viswanath H Chavali
Professor, Department of
Orthopaedics, Medical College
Baroda and SSG Hospital,
Maharaja Sayajirao University,
Vadodara, Gujarat, India

Dr. Tejas D Leuva
Department of Orthopaedics,
Medical College Baroda and SSG
Hospital, Maharaja Sayajirao
University, Vadodara, Gujarat,
India

Dr. Ashish A Damor
Department of Orthopaedics,
Medical College Baroda and SSG
Hospital, Maharaja Sayajirao
University, Vadodara, Gujarat,
India

Dr. Manmohan Negi
Department of Orthopaedics,
Medical College Baroda and SSG
Hospital, Maharaja Sayajirao
University, Vadodara, Gujarat,
India

Corresponding Author:

Dr. Yamik Narsinhbhai Damor
Department of Orthopaedics,
Medical College Baroda and SSG
Hospital, Maharaja Sayajirao
University, Vadodara, Gujarat,
India

A study of functional outcome of distal end radius fractures treated by dorsal radius plating

Dr. Yamik Narsinhbhai Damor, Dr. Viswanath H Chavali, Dr. Tejas D Leuva, Dr. Ashish A Damor and Dr. Manmohan Negi

DOI: <https://doi.org/10.22271/ortho.2023.v9.i1f.3319>

Abstract

Aims: To identify the current pattern of distal end radius fractures (presenting to this institute) requiring internal fixation with dorsal radius plating.

To determine the outcome of fixation of distal end radius fractures using dorsal radius plating.

To study complications following fracture surgery and to assess possible risk factors for complications

Objectives: To study patient characteristics, mechanism of injury and fracture morphology of fractures requiring internal fixation using dorsal radius plating.

To analyze outcome factors like functional score, surgical complications, radiological parameters, union status and union time of distal end radius fractures.

To establish possible patient, fracture and implant characteristics that could contribute to the outcome.

This study is an attempt to evaluate 44 cases of dorsal radius plating in case of distal end radius fracture and to assess the functional outcomes of dorsal radius plating. To ascertain whether modifiable characteristics like timing of surgery, implant positioning etc. contribute significantly to the outcome of distal radius fractures treated using dorsal radius plating. In our study out of 44 patients, 27 male and 17 female patients enrolled in study with mean age of 44 years (range 19-70). All patients had union at the final follow up at 3 months. Our study has a male preponderance with 61.36%. In our study dominant side is involved 65.90%. In our study based on AO classification we had 14(31.81%) of type A fracture, 10(22.72%) of type B and 20 (45.45%) of type C fractures. At final follow up 3 patients had less than 60 degree palmar flexion and 5 patients had less than 60 degree dorsiflexion. No patients had difficulty in radial and ulnar deviation. 1 patient had movement restriction as a late complication. In our study average duration of fracture union was 7 weeks. Dorsal radius plating remains the standard treatment in dorsally displaced distal end radius fractures. Dorsal plates are used in all age groups, including osteoporotic fractures. Dorsal plating does not significantly increase operative time. Dorsal plating has a significantly low hospital stay. Functional range of motion are achieved for the patients even to continue activities involving labor work. Complications of dorsal plating are minimal and are comparable to any other orthopaedic surgical procedure. Proper reduction of fracture and surgical exposure is required for better outcomes of such fixations. Use of dorsal plates in distal radius fractures provides good to excellent results with correction and maintenance of distal radial anatomy.

Keywords: Radius fractures, plating, distal end radius, internal fixation

Introduction

Distal end radius fracture are common in all age group sustaining fall on outstretched hand. Fracture of distal end radius are the most common fractures of upper extremities, making 1/6th of fractures encountered in emergency department [1, 2]. These fractures have a bimodal distribution with high energy fractures most commonly occurring in a young men and low energy fractures occurring in elderly women. However patterns are different. Distal radius fractures are the second most common fractures in the elderly and incidence in female is higher than males by a factor of two or three [3].

In young patient intra-articular fractures are common.

Intra-articular fractures are of three types.

- Volar
- Dorsal
- Mixed

As the consensus prevails, the vast majority of the distal radius fractures are intra-articular injuries resulting in disruption of both radio-carpal and radio-ulnar joints.

The management of distal radius fractures has undergone an extraordinary evolution over the preceding two decades. Options are: Universal cast treatment, Neutralization with bridging external fixators, Percutaneous pinning with or without cast application, Dorsal buttress plating & Volar locked plating.

Essentially, we know that elderly patients will tolerate more displacement (and close treatments) than younger patients, but some still have poor outcomes.

Both clinical outcome and biomechanical studies demonstrated the most important factors in obtaining good result. These factors are:

- Palmar Tilt (normally- 11 to 14 degrees)
- Radius Height (normally- 10 to 13 mm)
- Radius Inclination (normally- 20 to 25 degrees) &
- Ulnar Variance (normally- +/-2mm)

The close treatment options are associated with high incidence of

- Prolonged immobilization
- Joint stiffness & Deformity
- Decreased Grip strength & Endurance
- Malunion & Cosmetic problems (young patient particularly)
- Flexor tendon problems
- Articular incongruity & Arthritis
- Limited motion & Radio-carpal instability
- Sudeck's osteodystrophy

Open Reduction and Internal Fixation is an alternative but definitively valid treatment option for displaced intra-articular and extra-articular distal radius fractures, which cannot be taken care of with close manipulation, ligamentotaxis & casting or external fixation.

Restoration of the radio-carpal joint stability anatomically, radiologically and restoration of the functions clinically is the prime desire.

Operative treatment with internal fixation is increasingly becoming popular as it provides direct control & maintenance of the physio-anatomical parameters, prevents the collapse and spares the bridging of the wrist joint.

Volar plating has been common. However dorsal plating was previously not well accepted as prominence of implants could cause friction injuries to the overlying tendon. With introduction of low profile locking plate & fragment specific Plates, It has been now possible to plate distal radius fracture dorsally.

Materials and Methods

This prospective cohort study was carried out at the Department of Orthopaedics in 1500 bedded, state run, tertiary care hospital attached to a post graduate teaching institute located in central Gujarat, from 28TH December 2021 to August 31ST 2022 after obtaining the permission from institutional Ethics committee.

Study Population

Patients of the Department of Orthopaedics enrolled under study of distal end radius fractures treated with Dorsal Radius plating and consented to participate in the study defined by inclusion and exclusion criteria.

Sample size

Total 44 patients operated for Dorsal Radius Plating were identified to be included in study.

Inclusion criteria

All the following criteria were required to be fulfilled for inclusion in the study. Or nerves, p

- Traumatic distal end radius fractures fixed with dorsal radius plates.
- Adults (>18 years)

Exclusion criteria

Any distal end radius fracture

- Showing signs of infection at the time of presentation.
- More than 3 weeks old at the time of presentation.
- Pathological
- With history of Previous surgery in the same bone for other reasons
- In a Mentally challenged patient with poor communication skills.
- In Patients with local bony deformities or soft tissue contractures.

Follow-up Period

We followed up the patients for a minimum of three months at every four weekly interval. At every follow-up, patients were assessed clinically for pain, swelling, mobility at fracture site, joint stiffness, signs of infection, wound status etc. and radiologically for union status, alignment and implant status.

Functional outcome was assessed at final follow up on basis of quick DASH score.

We considered the fracture united when plain radiographs showed bridging bone across the fracture in both orthogonal views and the patient was able to perform all functions with that limb without any pain.

Results

Analysis in relation to quick dash score

Table 1: Gender based analysis

Grading	Excellent	Good	Fair	Total
Male	25	1	1	27
Female	15	1	1	17
Total	40	2	2	44

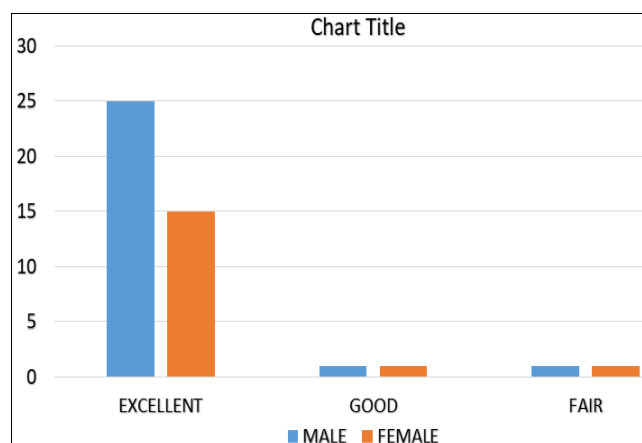


Fig 1: Gender based analysis

Table 2: Dominant and non-dominant side

Grading Side	Excellent	Good	Fair	Total
Dominant	30	1	2	33
Non dominant	10	1	0	11
Total	40	2	2	44

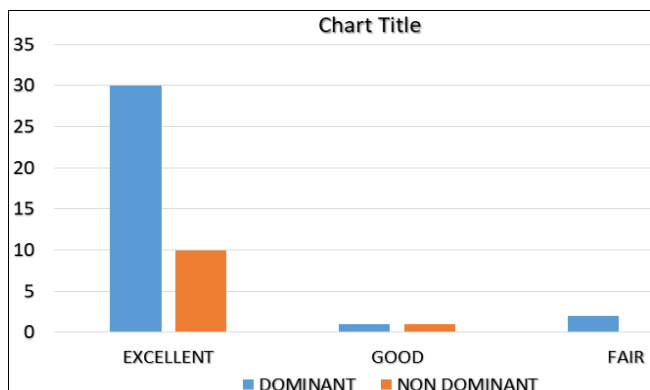


Fig 2: Dominant and non-dominant side

Table 3: Type of fracture based analysis in rektion to quick dash score:

Grading Type of Fracture	Excellent	Good	Fair	Total
Simple	14	0	0	14
Comminuted	26	2	2	30
Total	40	2	2	44

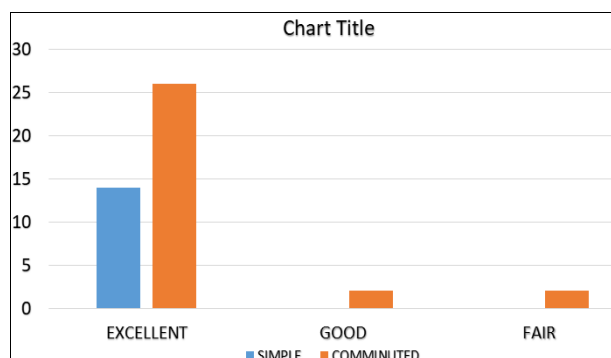


Fig 3: Type of fracture based analysis in rektion to quick dash score

Table 4: Types of fracture according to articular surface

Grading Types of fracture	Excellent	Good	Fair	Total
Extra articular	14	0	0	14
Part of joint	9	1	0	10
Intraarticular	17	1	2	20
Total	40	2	2	44

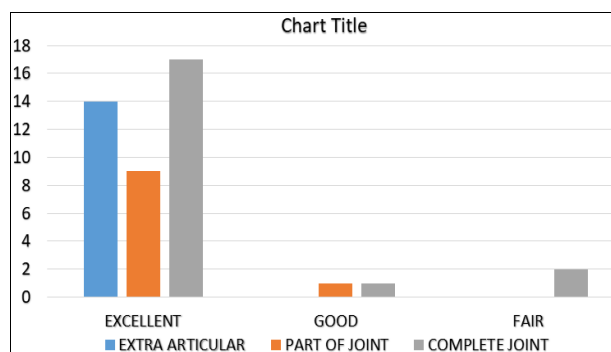


Fig 4: Types of fracture according to articular surface

Table 5: Type of fixation

Grading Fixation	Excellent	Good	Fair	Total
Fragment specific (>1 plate)	10	1	2	13
Single fixation (1 plate)	30	1	0	31
Total	40	2	2	44

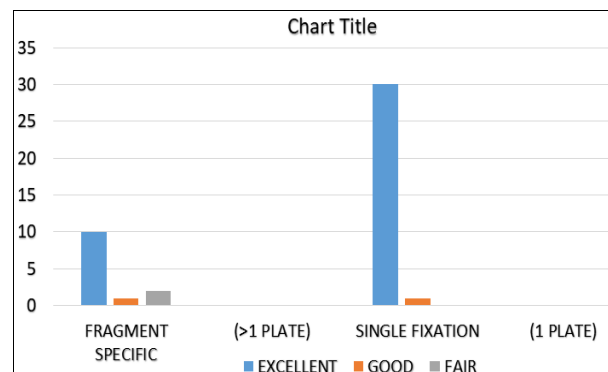


Fig 5: Type of fixation

Table 6: Immediate post op radiological radial angulation

Grading Radial Angulation	Excellent	Good	Fair	Total
<13°	0	0	0	0
13-30°	40	2	2	44
>30°	0	0	0	0
TOTAL	40	2	2	44

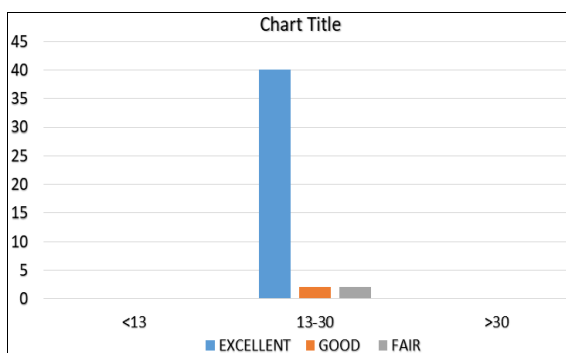


Fig 6: Immediate post op radiological

Table 7: Immediate post op radiological ulnar variance

Grading Ulnar Variance	Excellent	Good	Fair	Total
Positive	0	0	0	00
Neutral	2	2	1	05
Negative	38	0	1	39
Total	40	2	2	44

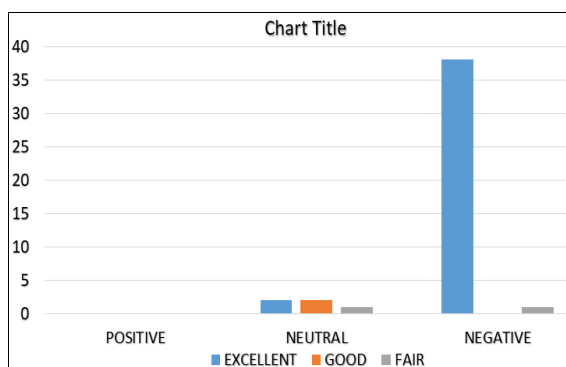


Fig 7: Immediate post op radiological ulnar variance

Table 8: Immediate post op radiological palmar tilt

Grading Palmar tilt	Excellent	Good	Fair	Total
<8°	0	0	0	00
8-18°	40	2	2	44
>18°	0	0	0	00
TOTAL	40	02	02	44

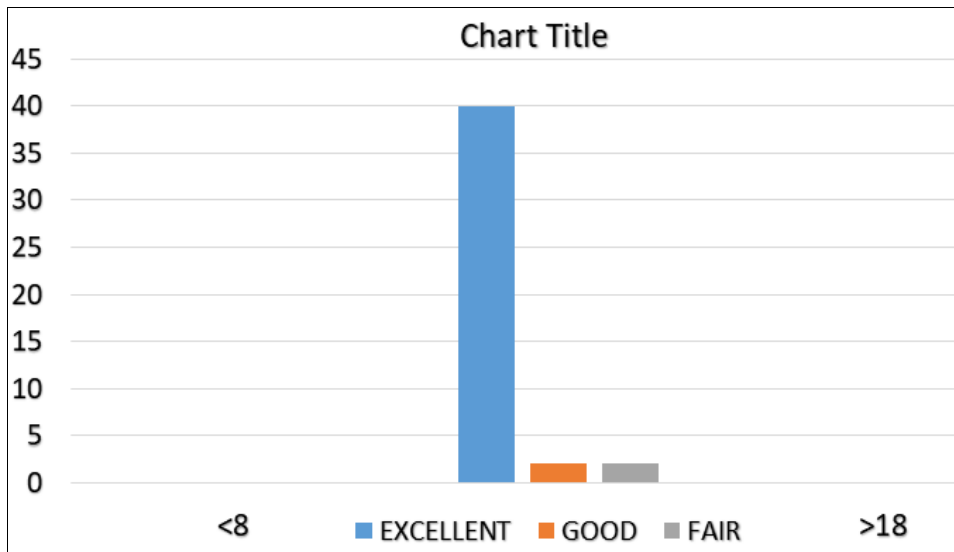


Fig 8: Immediate post op radiological palmar tilt

Clinical and radiological results

Case no. 1: 19 Year/F

Closed fr distal end radius with intraarticular extension left

Fracture type (AO Classification) – 23A1

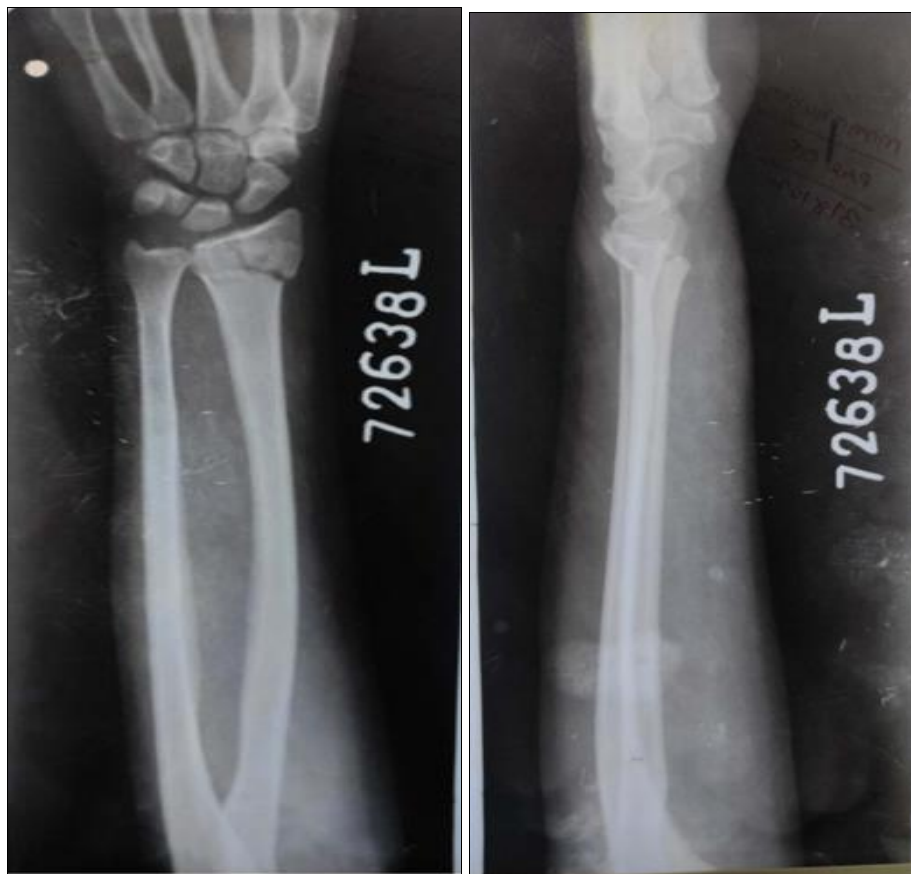
Average union time – 7 weeks

Wrist ROM- full

Complications – No

Outcome (Quick dash score)- Excellent

Pre-op x-rays



AP view

Lateral view

Immediate post op



AP view



Lateral view

1 Month follow up



Lateral view



AP view

2 Months follow up



AP view



Lateral view

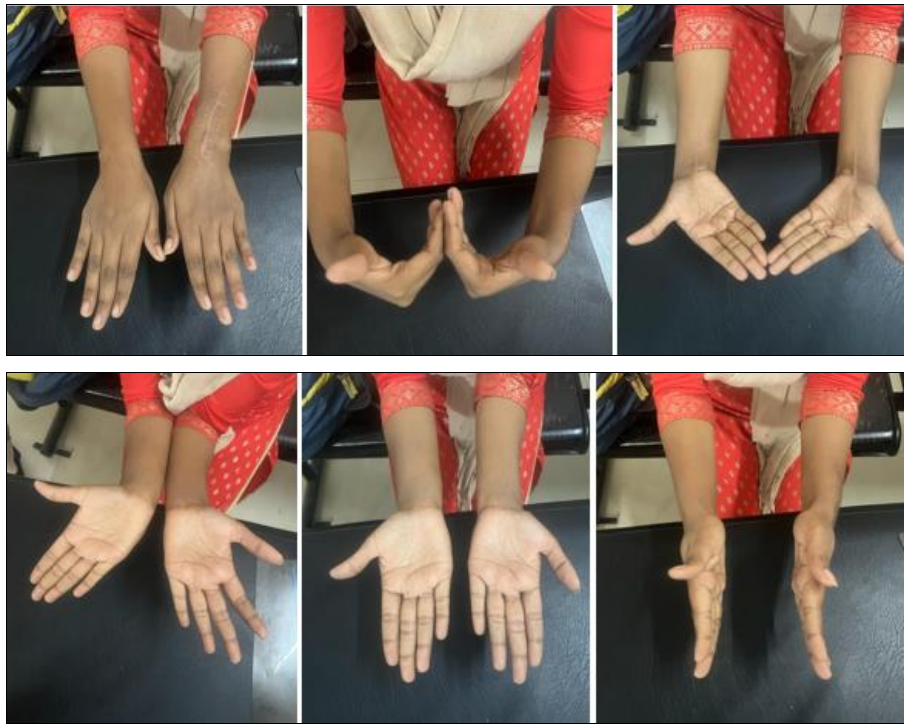
3 Months final follow up



AP view



Lateral view

At final follow up**Fig 9:** Movements at final follow up**Discussion**

This study is an attempt to evaluate 44 cases of dorsal radius plating in case of distal end radius fracture and to assess the functional outcomes of dorsal radius plating.

More than 200 years have passed since Colle's described the fracture of the distal end of the radius. It is remarkable that this common fracture remains one of the most challenging of the fractures to treat. There is no consensus regarding the ideal classification and appropriate treatment of these injuries. Distal radius fractures are the most frequently seen upper extremity fractures. The main objective of its treatment is the re-establishment of the anatomic integrity and functioning. In unstable intra-articular fractures, re-establishment of intra-articular integrity of the wrist and maintaining the radial length are often not possible with close methods. A better understanding of wrist anatomy and functioning through the studies conducted in recent years, as well as the increasing expectations of patients have expanded the borders of surgical treatment. Besides, improvements in fixation materials have provided new opportunities.

Due to their intra-articular and unstable nature, B and C type of AO system distal radius fractures are treated surgically. Today open reduction and plate fixation are widely recognized surgical methods. Locked plates are in the progress of replacing conventional buttress plates. While facilitating the positioning, those anatomical plates with screw plate interlocking fracture have more biomechanical strength against forces applied on the fracture surfaces. Because of their biomechanical strength, locked plates are preferred in osteoporotic and multiple fragmentary fractures.

The present study was undertaken to assess the functional outcome of distal end radius fracture treated by dorsal radius plating.

We have evaluated our results and compared them with those obtained by various other studies utilizing different modalities of treatment.

Fractures of the distal radius treated by internal fixation and early function**A prospective study of 73 consecutive patients**

M. Jakob, D. A. Rikli, P. Regazzoni From the Kantonsspital, Aarau, Switzerland

Between November 1994 and June 1997, they treated 76 consecutive patients with 77 fractures of the distal end of the radius, by open reduction and internal fixation using two 2.0 mm titanium plates.

There were 21 men and 52 women with a mean age of 60 years (20 to 86). The dominant wrist was fractured in 38 (52%) and Primary internal fixation was carried out in 52 patients (71%) and secondary fixation, after the failure of conservative treatment in 21. Of the latter, 12 had been managed in plaster, 4 by percutaneous pins and plaster and 5 by external fixation.

According to the classification of Müller, there were two simple extra-articular fractures (A2), 18 extra-articular fractures with metaphyseal comminution (A3), three partial articular fractures (1 B2, 2 B3), 11 simple articular fractures (C1) and 40 complex articular fractures (C2 and C3).

The injuries were sustained in domestic falls (42%), in traffic accidents (38%), at work (12%) or at sport (8%). Volar splinting was discontinued when the wound was healing satisfactorily after one to two weeks. Load-bearing was allowed after six weeks. Review at six weeks, six months and one year after operation included standard assessments of pain, functional disability, range of movement and grip strength.

Standard AP and lateral radiographs of the fractured wrist were taken and compared with the postoperative views.

Result

All 74 fractures united without infection. At one year, 55 patients (75%) were free from pain, 11 (15%) had occasional pain during heavy work, five (7%) had constant pain with heavy work and two (3%) had occasional pain during the

minor activities of daily living. Of the 73 patients, 71 (97%) had resumed their previous work and daily activities after a median 25.9 weeks (6 to 44), but two with multiple injuries had continued disability because of head injuries. We compared the range of movement with that of the uninjured side in the 68 patients with unilateral fractures. There were statistically significant improvements in dorsiflexion, palmar flexion, supination and pronation between six weeks and six months ($p < 0.001$) and in dorsiflexion and palmar flexion between six months and one year ($p < 0.05$). The grip strengths in the same 68 patients, revealed statistically significant increases in grip strength between six months and one year ($p < 0.01$).

The final anatomical results were excellent in 90%, good in 8% and fair in 2%. There was no later loss of reduction, no loss of radial angle and no residual intra-articular incongruity.

Outcomes of dorsal plating for selected distal radius fractures

Nader Paksima, Adam Driesman, Julie Johnson, Christopher Kim, Kenneth Egol

From the NYU Hospital for Joint Disease, New York, USA
Between October 2004 and November 2015 more than 800 patients who sustained a distal radial fracture presented to NYU Hospital for joint disease, New York. This population was retrospectively examined and all patients who were treated with a dorsal locking plate were extracted for this study. The indications for use of a dorsal locking plate were significant dorsal comminution, delayed presentation, dorsal shear fractures and/or concomitant carpal injuries. Another indication was for those fractures that presented with dorsal angulation between 4 and 6 weeks post trauma and required takedown of the immature callous.

Forty patients with a total of 41 distal radial fractures were identified. Exclusion criteria included age less than 18 years, less than 3 months of follow up, incomplete radiographic follow up, and any other concomitant fixation of the distal radius with the exception of Kirschner wires (K-wires). Thirty-three patients with a total of 34 distal radial fractures met inclusion criteria.

Result

There were 18 males and 15 females in this study with a mean age of 50.5 years (range 19 to 78 years). The average time to follow up was 14 months (range 3 to 48 months). All patients had radiographs with adequate fracture healing. Hand dominance was not recorded in two patients. Six patients had a delayed presentation greater than 4 weeks. Their patient population included 17 (50%) AO Type B fractures, 15 of which were dorsal shear type of fractures. They also had 10 Type C intra articular displaced fractures and seven Type A extra articular comminuted fractures. Seven patients had concomitant fractures of the carpus and eleven had concomitant fractures of the ulna. Four patients had carpal tunnel releases at the time of surgery. Fifteen fractures were treated with supplemental bone grafting at the time of dorsal plating; 13 had synthetic calcium phosphate, and 2 only had auto graft using local callous. The remaining 13 patients did not have any form of bone grafting. All fractures united. Radiographic measurements were taken after union had been achieved. Only three patients had intra articular step off of ≥ 1 mm; all others healed with 0 mm of intra articular step off. At longest follow up, twenty three patients (68%) had an OA grading of zero, seven (21%) had an OA grading of 1, and four patients (12%) had an OA grading of 2. The average pain

at final follow up rated on a visual analog pain scale from 0-10, with 0 being no pain, was 2.1 ± 1.7 (range 0-5). Patient-reported complications include pain, tendon irritation, and decreased range of motion. Seven patients reported pain as a complication, four reported wrist stiffness, and one reported decreased ability to supinate the forearm. Range of motion was taken at longest follow up. The average Quick DASH score at longest follow up was 34.6 ± 25 . Eight patients (23.5%) required removal of a plate, five for tendon irritation, one after a tendon rupture and two for limited ROM.

In our study out of 44 patients, 27 male and 17 female patients enrolled in study with mean age of 44 years (range 19-70). All patients had union at the final follow up at 3 months. Our study has a male preponderance with 61.36%. In our study dominant side is involved 65.90%. In our study based on AO classification we had 14(31.81%) of type A fracture, 10(22.72%) of type B and 20(45.45%) of type C fractures.

Conclusion

- The aim of study was to understand the characteristics, treatment, outcome and complications of distal end radius fracture treated by Dorsal Radius Plating.
- 44 patients with distal end radius fracture treated by Dorsal Radius Plating were included in study.
- Average age of patients in this study was 44 years.
- Of all patients enrolled in study, we had 10 office workers, 19 labourers, and 15 housewives.
- High velocity trauma remains the most common cause of distal end radius fractures.
- Average duration of surgery in the study was 1-1:30 hrs.
- Average duration of hospital stay was 4 days.
- Functional outcome was assessed radiologically and return to function activity.
- At final follow up radial angulation was between 13-30 degrees in all patients.
- Ulnar variance was negative in 39 patients while remaining 5 patients had neutral ulnar variance.
- Palmar tilt was between 8-18 degrees.
- At final follow up 3 patients had less than 60 degree palmar flexion and 5 patients had less than 60 degree dorsiflexion.
- No patients had difficulty in radial and ulnar deviation.
- 1 patient had movement restriction as an late complication.
- In our study average duration of fracture union was 7 weeks.

Dorsal radius plating remains the standard treatment in dorsally displaced distal end radius fractures. Dorsal plates are used in all age groups, including osteoporotic fractures. Dorsal plating does not significantly increase operative time. Dorsal plating has a significantly low hospital stay. Functional range of motion are achieved for the patients even to continue activities involving labor work. Complications of dorsal plating are minimal and are comparable to any other orthopaedic surgical procedure. Proper reduction of fracture and surgical exposure is required for better outcomes of such fixations. Use of dorsal plates in distal radius fractures provides good to excellent results with correction and maintenance of distal radial anatomy.

Acknowledgments

The acknowledgements of the funding body, institutional head, coworkers, field assistants, local people etc. should be

briefed and declaration of any conflict of of interested related to work.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. *Injury*. 2006;37(8):691-697.
2. Nellans KW, Kowalski E, Chung KC. The epidemiology of distal radius fractures. *Hand clinics*. 2012 May 1;28(2):113-25.
3. Shauver MJ, Yin H, Banerjee M, Chung KC. Current and future national costs to medicare for the treatment of distal radius fracture in the elderly. *The Journal of hand surgery*. 2011 Aug 1;36(8):1282-7.
4. Lutsky K, Boyer M, Goldfarb C. Dorsal Locked Plate Fixation of Distal Radius Fractures. *The Journal of Hand Surgery*. 2013;38(7):1414-1422.
5. Matzon Jonas L, Kenniston Julia, Beredjikian Pedro K. Hardware-Related Complications after Dorsal Plating for Displaced Distal Radius Fractures. *Orthopedics*. 2014;37(11):e978-e982.
6. Jakob M, Rikli DA, Regazzoni P. From the Kantonsspital, Aarau, Switzerland- Fractures of the distal radius treated by internal fixation and early function.

How to Cite This Article

Damor YN, Chavali VH, Leuva TD, Damor AA, Negi M. A study of functional outcome of distal end radius fractures treated by dorsal radius plating. *International Journal of Orthopaedics Sciences*. 2023;9(1):371-379.

Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.