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Functional Outcomes of Volar Barton Fractures Treated with Volar Buttress Plating: A Prospective Observational Study

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ABSTRACT

Background: Distal radius fractures account for approximately 14% of all extremity fractures. Volar Barton fractures, involving the anterior rim of the radiocarpal joint, pose a surgical challenge due to their intra-articular nature and inherent instability. Volar buttress plating is widely used to achieve anatomical reduction and stable fixation; however, prospective data evaluating functional outcomes using standardized scoring systems remain limited in the Indian context.

Objectives: To assess functional outcomes and postoperative complications of volar Barton fractures treated with open reduction and internal fixation (ORIF) using a volar buttress plate, measured by the Disabilities of the Arm, Shoulder and Hand (DASH) score.

Methods: This prospective observational study included 101 adult patients with volar Barton fractures treated at a tertiary orthopaedic center in Indore, India, between August 2022 and January 2024. All patients underwent ORIF via the Modified Henry approach using a volar buttress plate. DASH scores were recorded at 6 weeks, 3 months, and 6 months postoperatively. Radiological parameters were evaluated at final follow-up. Statistical analysis was performed using paired t-test and Wilcoxon signed-rank test, with $p < 0.05$ considered significant.

Results: The cohort included 62 males and 39 females, with a mean age of 41.18 ± 13.54 years. Road traffic accidents were the most common cause (69.3%). Mean DASH scores improved significantly from 16.87 ± 6.42 at 6 weeks to 13.11 ± 5.85 at 6 months ($p < 0.001$). Functional range of motion was achieved in all patients. Complications occurred in 17.8%, mainly stiffness and malunion. Palmar tilt showed a significant negative correlation with DASH score ($r = -0.635$, $p < 0.001$).

Conclusion: Volar buttress plating provides effective functional recovery with low complication rates. Restoration of palmar tilt is a key determinant of favorable outcomes.

Keywords: Barton fracture, Distal radius fracture, Volar buttress plate, DASH score, Open reduction internal fixation, Wrist fracture outcome

INTRODUCTION

Distal radius fractures are among the most prevalent skeletal injuries in clinical practice, accounting for approximately 14-18% of all fractures and representing a substantial proportion of emergency department presentations.[1,2] Their incidence follows a bimodal distribution: younger patients sustain these injuries primarily through high-energy mechanisms such as road traffic accidents, while older individuals are predisposed through low-energy falls on an outstretched hand, a pattern closely linked to osteoporosis and declining bone mineral density.[1] As global life expectancy continues to rise, the burden of these fractures is anticipated to increase substantially, making their optimal management a pressing public health concern.

Barton fractures represent a specific sub-type of distal radius fracture characterised by an oblique intra-articular fracture-dislocation of the radiocarpal joint involving either the dorsal or volar (anterior) rim. Volar Barton fractures, which involve the anterior margin of the joint, are the more clinically common variant.[3] These injuries are particularly challenging to manage owing to the intra-articular nature of the fracture, the inherent instability created by volar capsular disruption, and the risk of progressive subluxation of the carpus. Conservative management, while appropriate for undisplaced fractures, is associated with a high rate of malunion, stiffness, post-traumatic osteoarthritis, and persistent wrist dysfunction in displaced intra-articular patterns.[4]

Over the past two decades, surgical techniques for distal radius fractures have advanced considerably. Percutaneous Kirschner wire fixation, external fixation, and dorsal plating were among the earlier operative options; however, all carried inherent limitations including soft tissue irritation, extensor tendon injury, and restricted early rehabilitation.[5] Volar locking plate systems have subsequently gained widespread acceptance as a biomechanically superior alternative, offering fixed-angle construct stability, subchondral support for articular fragments, and the advantage of anatomical contouring that facilitates secure fixation even in osteoporotic bone.[6,7]

For volar Barton fractures specifically, the volar buttress plate acts as an antiglide device, preventing volar and proximal displacement of the carpus. Unlike conventional volar locking plates used for extra-articular distal radius fractures, buttress plating addresses the pathomechanics of marginal fracture-dislocations directly.[8] While early studies have reported promising results, there remains a paucity of prospective data from the Indian subcontinent, where the mechanism of injury (predominantly high-energy road traffic accidents in a younger population) differs significantly from Western cohorts dominated by low-energy osteoporotic falls.

The Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire is a validated, patient-reported outcome measure that captures upper limb function comprehensively and has been widely adopted in wrist fracture research. Its use enables standardised, reproducible assessment of functional recovery across time points and facilitates meaningful comparison with published literature.[9]

Given the relative scarcity of prospective outcome data on volar Barton fractures specifically treated with buttress plating in a high-volume Indian tertiary orthopaedic setting, the present study was designed to evaluate functional recovery, radiological parameters, and complication rates following ORIF with volar buttress plating. The primary objective was to quantify the change in DASH score from 6 weeks to 6 months postoperatively; secondary objectives included characterisation of range of motion at final follow-up, radiological outcome assessment, and identification of predictors of functional outcome.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective, observational study conducted in the Department of Orthopaedics, Bombay Hospital, Indore, Madhya Pradesh, India a tertiary care referral centre. The study was carried out over a period of 17 months, from August 2022 to January 2024.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee of Bombay Hospital, Indore (Ref: BHI: DDMS: 2023-

02:503). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed voluntary consent was obtained from all participants or their legally acceptable representatives prior to enrolment, in addition to the standard surgical consent. Patient confidentiality was maintained throughout; only anonymised, study-relevant data were utilised.

Study Population and Sample Size: All patients aged 18 years and above presenting to our institution during the study period with a confirmed diagnosis of distal radius volar Barton fracture constituted the study population. Based on a preliminary institutional audit, approximately 120 patients were identified during the study period. Of these, 101 patients met the inclusion criteria and were enrolled in the study, while 19 were excluded in accordance with the predefined exclusion criteria.

Inclusion and Exclusion Criteria: Patients were enrolled if they satisfied all of the following inclusion criteria: (1) age ≥ 18 years; (2) confirmed diagnosis of a volar Barton fracture of the distal radius on plain radiography, with computed tomography with three-dimensional reconstruction where required; and (3) willingness to provide written informed consent. Patients were excluded if they had: age <18 years; compound (open) injuries; previously operated or old (neglected) fractures; pathological fractures; dorsal Barton fractures; volar fractures associated with other ipsilateral upper limb fractures; or unwillingness to provide consent or undergo surgical treatment.

Surgical Procedure: All enrolled patients underwent preoperative assessment including complete blood count, viral markers (Hepatitis B, C, HIV), random blood sugar, serum creatinine, blood group and Rh typing, coagulation profile (bleeding time, clotting time, prothrombin time, INR), and RT-PCR for COVID-19. Surgery was performed under general or regional (axillary/supraclavicular block) anaesthesia with tourniquet control via the Modified Henry volar approach. An incision was made in the plane between the flexor carpi radialis tendon and the radial artery. The pronator quadratus was reflected via an L-shaped incision to expose the fracture site. Fracture reduction was achieved under direct visualisation and fluoroscopic guidance, with provisional Kirschner wire fixation where necessary. A volar buttress plate was applied, secured proximally with cortical screws and distally with locking screws, ensuring maintenance of reduction. The pronator quadratus was repositioned over the plate and, where feasible, reattached. A sterile dressing with a cock-up splint was applied postoperatively.

Outcome Measures and Follow-up: The primary outcome measure was the DASH score, recorded at 6 weeks, 3 months, and 6 months postoperatively. The DASH score ranges from 0 (no disability) to 100 (maximum disability), with lower scores reflecting better functional status. Secondary outcomes included wrist range of motion in six planes (dorsiflexion, palmar flexion, pronation, supination, radial deviation, and ulnar deviation), radiological parameters at final follow-up (radial length, palmar tilt, radial inclination, and articular step-off), and postoperative complications. Data were collected prospectively using a standardised, customised proforma.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS Version 22 (IBM Corp., Armonk, NY, USA) and Python 3.11 (SciPy 1.11 library). Continuous variables were expressed as mean ± standard deviation (SD) with 95% confidence intervals (CI); categorical variables were presented as frequencies and percentages. Normality was assessed using the Shapiro-Wilk test. Since DASH scores and most radiological variables demonstrated non-normal distribution ($p < 0.05$), non-parametric tests were applied where appropriate. Changes in DASH scores across time points were compared using the paired t-test (confirmed by Wilcoxon signed-rank test). Intergroup comparisons were performed using the Mann-Whitney U test (two groups) and Kruskal-Wallis test (≥ three groups). Correlations between continuous variables were evaluated using Spearman's rank-order correlation coefficient. Effect size was computed as Cohen's d for paired comparisons. A p-value < 0.05 was considered statistically significant for all analyses.

RESULTS

Baseline Demographics and Clinical Characteristics: A total of 101 patients with volar Barton fractures of the distal radius were enrolled and followed up for a mean

period of 9.72 ± 2.97 months (range: 6-18 months). Baseline characteristics are summarised in Table 1.

The cohort comprised 62 males (61.4%) and 39 females (38.6%), indicating a male preponderance. Mean age was 41.18 ± 13.54 years (range: 18-76 years), with the majority of patients (46.5%) aged between 41 and 60 years. Road traffic accidents constituted the dominant mechanism of injury (n = 70; 69.3%), followed by fall on an outstretched hand (FOOSH; n = 24; 23.8%) and fall from height (n = 7; 6.9%). Fractures predominantly affected the right (dominant) side (n = 56; 55.4%). Associated injuries were documented in 21 patients (20.8%), the most frequent being head injury (n = 14; 13.9%).

Regarding time to surgery, 61 patients (60.4%) underwent operative intervention on the day following presentation. The remaining patients were operated within 1-2 days (n = 11; 10.9%), 2-3 days (n = 16; 15.8%), or after more than 3 days (n = 13; 12.9%) for various clinical or logistical reasons.

Table 1: Baseline Demographic and Clinical Characteristics (N = 101)

Variable	N (%)
Age (years)	
Mean ± SD	41.18 ± 13.54
Range	18 - 76 years
≤ 20 years	7 (6.9)
21-40 years	41 (40.6)
41-60 years	47 (46.5)
> 60 years	6 (5.9)
Sex	
Male	62 (61.4)
Female	39 (38.6)
Mode of Injury	
Road Traffic Accident	70 (69.3)
Fall on Outstretched Hand	24 (23.8)
Fall from Height	7 (6.9)
Side Affected	
Right	56 (55.4)
Left	45 (44.6)
Associated Injuries	
None	80 (79.2)
Head Injury	14 (13.9)
Other fractures	6 (5.9)
Days to Surgery	
Next day	61 (60.4)
1-2 days	11 (10.9)
2-3 days	16 (15.8)
> 3 days	13 (12.9)
Follow-up Duration	
Mean ± SD	9.72 ± 2.97 months

RTA = Road Traffic Accident; FOOSH = Fall on Outstretched Hand; FFH = Fall from Height

Radiological and Functional Outcomes at Final Follow-up: Radiological and functional outcome data are presented in Table 2. At final follow-up, the mean radial length was 10.18 ± 1.09 mm (range: 8-17 mm), within the normal physiological range of 8-13 mm. The mean palmar tilt was 8.05 ± 4.89 degrees (range: -5 to 20 degrees), approximating the normal value of 11-12 degrees. Mean radial inclination was 19.43 ± 2.73 degrees (normal: 22-23 degrees), and mean articular step-off was 1.06 ± 0.54 mm, with all patients maintaining a step-off below the accepted threshold of 2 mm.

With respect to range of motion at final follow-up, all 101 patients (100%) achieved dorsiflexion exceeding 45°, palmar flexion exceeding 30°, pronation exceeding 50°, and supination exceeding 50°. Radial deviation ≥ 15° was accomplished by 89 patients (88.1%), and ulnar deviation ≥ 15° by 100 patients (99.0%). Mean values for all motion planes were: palmar flexion 68.22 ± 5.94°, dorsiflexion 66.44 ± 4.32°, supination 67.67 ± 5.13°, and pronation 67.48 ± 5.86°.

Table 2: Radiological and Functional Outcomes at Final Follow-up (N = 101)

Parameter	Value (Mean ± SD)	95% CI of Mean
Radiological Outcomes		
Radial Length (mm)	10.18 ± 1.09	9.97 - 10.40
Palmar Tilt (degrees)	8.05 ± 4.89	7.08 - 9.02
Radial Inclination (degrees)	19.43 ± 2.73	18.89 - 19.97
Articular Step-off (mm)	1.06 ± 0.54	0.96 - 1.17
Range of Motion		
Palmar Flexion (mean degrees)	68.22 ± 5.94	67.05 - 69.39
Dorsiflexion (mean degrees)	66.44 ± 4.32	65.58 - 67.30
Supination (mean degrees)	67.67 ± 5.13	66.65 - 68.69
Pronation (mean degrees)	67.48 ± 5.86	66.32 - 68.64
Radial Deviation ≥ 15°, n(%)	89 (88.1%)	
Ulnar Deviation ≥ 15°, n(%)	100 (99.0%)	
Functional (DASH) Scores		
DASH at 6 weeks	16.87 ± 6.42	15.60 - 18.14
DASH at 3 months	14.84 ± 6.07	13.64 - 16.04
DASH at 6 months	13.11 ± 5.85	11.96 - 14.27
Postoperative Complications, n(%)		
No complications	83 (82.2%)	
Stiffness	16 (15.8%)	
Malunion	2 (2.0%)	

DASH = Disabilities of the Arm, Shoulder and Hand; CI = Confidence Interval

DASH Score Trajectory: The primary outcome, the DASH score, demonstrated a consistent and statistically significant reduction across all time points (Table 3). The mean DASH score at 6 weeks was 16.87 ± 6.42 (95% CI: 15.60-18.14). By 3 months, this had decreased to 14.84 ± 6.07 (95% CI: 13.64-16.04), representing a mean reduction of 2.03 points ($t = 29.855$; $p < 0.001$; Cohen's $d = 0.33$). A further significant decrease was observed at 6 months, reaching 13.11 ± 5.85 (95% CI: 11.96-14.27), a reduction of 1.73 points from 3 months ($t = 27.303$; $p < 0.001$; Cohen's $d = 0.29$). The overall improvement from 6 weeks to 6 months represented a mean reduction of 3.76 DASH points ($t = 36.082$; $p < 0.001$; Cohen's $d = 0.62$), indicating a moderate-to-large effect size over the complete follow-up period.

Table 3: DASH Score Progression from 6 Weeks to 6 Months (Paired t-test; N = 101)

Comparison	Time Point	Mean ± SD	t-value / U	p-value
6 weeks → 3 months	6 weeks: 16.87 ± 6.42; 3 months: 14.84 ± 6.07	Δ = 2.03	t = 29.855	< 0.001*
3 months → 6 months	3 months: 14.84 ± 6.07; 6 months: 13.11 ± 5.85	Δ = 1.73	t = 27.303	< 0.001*
6 weeks → 6 months	6 weeks: 16.87 ± 6.42; 6 months: 13.11 ± 5.85	Δ = 3.76	t = 36.082	< 0.001*

*Statistically significant (p <0.05). DASH = Disabilities of the Arm, Shoulder and Hand; Δ = mean difference.

Advanced Statistical Analysis: Subgroup and Correlation Analysis: Advanced analyses examining predictors and modifiers of functional outcome are presented in Table 4. DASH scores at 6 months did not differ significantly between male and female patients (Mann-Whitney $U = 1148.0$; $p = 0.673$), nor across age groups (Kruskal-Wallis $H = 2.634$; $p = 0.452$) or mechanisms of injury ($H = 0.278$; $p = 0.870$). Similarly, the timing of surgical intervention (next day versus 2-3 days versus > 3 days) did not significantly influence the DASH score at 6 months ($H = 0.963$; $p = 0.618$).

Patients who developed postoperative complications demonstrated markedly higher DASH scores at 6 months compared to those without complications (23.42 ± 5.82 versus 10.88 ± 2.52; Mann-Whitney $U = 0.0$; $p < 0.001$), confirming the strong functional impact of complications on outcome.

Spearman correlation analysis identified a strong, statistically significant negative correlation between palmar tilt and DASH score at 6 months ($r = -0.635$; $p < 0.001$), indicating that better restoration of palmar tilt was strongly associated with lower disability. A moderate negative correlation was similarly observed between radial inclination and final DASH score ($r = -0.379$; $p < 0.001$). Radial length ($r = -0.044$; $p =$

0.663) and articular step-off (r = 0.063; p = 0.533) did not reach statistical significance. Notably, DASH score at 6 weeks was strongly predictive of DASH score at 6 months (r = 0.961; p < 0.001), suggesting that early functional status is a robust marker of longer-term recovery.

Table 4: Subgroup Analysis and Spearman Correlation Predictors of DASH Score at 6 Months

Analysis	DASH at 6 Months (Mean ± SD)	p-value
Sex (Mann-Whitney U)		
Male (n=62)	12.87 ± 5.66	0.673
Female (n=39)	13.49 ± 6.20	
Complication (Mann-Whitney U)		
No (n=83)	10.88 ± 2.52	< 0.001*
Yes (n=18)	23.42 ± 5.82	
Mode of Injury (Kruskal-Wallis)		
RTA (n=70)	13.00 ± 5.93	0.870
FOOSH (n=24)	13.65 ± 6.13	
FFH (n=7)	12.37 ± 4.51	
Age Group (Kruskal-Wallis)		
≤20 yrs (n=7)	13.90 ± 4.39	0.452
21-40 yrs (n=41)	12.80 ± 6.57	
41-60 yrs (n=47)	13.25 ± 5.23	
>60 yrs (n=6)	13.20 ± 7.94	
Palmar Tilt vs DASH 6m (Spearman)	r = -0.635	< 0.001*
Radial Inclination vs DASH 6m (Spearman)	r = -0.379	< 0.001*
DASH 6w vs DASH 6m (Spearman)	r = 0.961	< 0.001*

*Statistically significant (p <0.05). DASH = Disabilities of the Arm, Shoulder and Hand; RTA = Road Traffic Accident; FOOSH = Fall on Outstretched Hand; FFH = Fall from Height.

Postoperative Complications: The overall postoperative complication rate was 17.8%. The majority of patients (n = 83; 82.2%) experienced no complications. Stiffness was the most frequent complication, observed in 16 patients (15.8%), predominantly managed with supervised physiotherapy and wrist mobilisation exercises. Malunion was documented in 2 patients (2.0%). No cases of implant failure, superficial or deep infection, neurovascular injury, or tendon rupture were encountered during the study period.

DISCUSSION

The present prospective study evaluated 101 patients with volar Barton fractures of the distal radius managed by ORIF with volar buttress plating, and demonstrated consistent, statistically significant improvements in functional outcome as measured by the DASH score over a 6-month postoperative period. The overall complication rate was 17.8%, which is comparable to, or lower than, rates reported in the existing literature. Advanced statistical analyses further identified palmar tilt restoration as a novel and clinically significant predictor of functional recovery, a finding that has not been prominently reported in prior Indian studies on this specific fracture pattern.

The demographic profile of our cohort predominantly males (61.4%), mean age 41.18 years, and high-energy road traffic accidents as the primary mechanism (69.3%) is consistent with patterns reported from analogous Indian studies.[10,11] This contrasts markedly with Western cohorts, where volar distal radius fractures predominantly affect older females with osteoporosis injured by low-energy falls.[1] The difference in patient demographics underscores the importance of region-specific outcome data, as the biomechanics of fracture, bone quality, and patient rehabilitation capacity differ substantially between these populations.

The gender distribution in our study (61.4% male) aligns closely with findings by Khan S et al.[12] (60% male) and Keshkar S et al. [13] (72.7% male)18 and corroborates the well-established male preponderance in high-energy wrist fractures in the Indian context, primarily attributable to differential road traffic accident exposure. Saini et al. reported an even higher male proportion of 80%. The mean age of 41.18 years in our

cohort falls within the range reported by comparator studies (37.6-46 years). [10,12,13] Importantly, our subgroup analysis found no statistically significant difference in DASH scores at 6 months across age groups (Kruskal-Wallis H = 2.634; p = 0.452), suggesting that age per se did not independently influence functional recovery in this cohort, consistent with the results of other prospective studies on volar plating.

Road traffic accidents accounted for 69.3% of injuries in our series, a proportion consistent with findings by Keshkar S et al. [13] (68.2%) and Saini DR et al. [10] (84%). In contrast, Mandalia DM et al. [14] reported a predominance of falls (60%). These differences likely reflect local referral patterns and catchment demographics rather than fundamental differences in fracture biology. The mode of injury did not significantly influence final DASH scores in our analysis (H = 0.278; p = 0.870), consistent with the premise that fracture pattern and surgical quality are more critical determinants of outcome than mechanism of injury per se.

Radiological outcomes in our cohort reflected satisfactory anatomical restoration. The mean palmar tilt of 8.05 ± 4.89 degrees compares favourably with the 9 degrees reported by Mandalia DM et al. [14] and approximates the physiological norm, though a degree of residual deficit from the normal 11-12 degrees is not uncommon following this fracture type. The mean radial inclination of 19.43 degrees was consistent with near-normal alignment, and all patients maintained articular step-off below 2 mm, the accepted threshold above which post-traumatic arthritis risk increases substantially. [15] The novel finding in our study a strong inverse Spearman correlation between palmar tilt and DASH score at 6 months ($r = -0.635$; $p < 0.001$) suggests that each degree of palmar tilt restoration translates meaningfully into improved patient-reported function. This highlights the primacy of anatomical articular reduction as a surgical objective in this fracture type. A similar, though less pronounced, correlation was observed for radial inclination ($r = -0.379$; $p < 0.001$).

With respect to wrist mobility, all patients achieved clinically acceptable ranges of dorsiflexion, palmar flexion, pronation, and supination at final follow-up. The proportions achieving radial deviation ≥ 15° (88.1%) and ulnar deviation ≥ 15° (99.0%) were comparable to Saini DR et al. [10] (92% and 88%, respectively), although superior to Mandalia DM et al. [14], who reported substantially lower rates of 57.5% and 60% for these movements likely attributable to differences in patient demographics and rehabilitation protocols.

Our mean DASH score at 6 months of 13.11 ± 5.85 compares well with prior literature on volar plating for distal radius fractures, though direct comparison is complicated by variability in outcome tools employed across studies. Studies using the Gartland and Werley score reported excellent outcomes in 63-72.5% of patients, and those using the Mayo Wrist Score reported 64% excellent outcomes, [10,12,14] all suggesting broadly consistent functional recovery. The consistently low DASH scores in our cohort, with near-normal upper limb function by 6 months, validate volar buttress plating as an effective intervention for volar Barton fractures. The strong correlation between early (6-week) and final (6-month) DASH scores ($r = 0.961$; $p < 0.001$) is a novel finding, suggesting that early postoperative functional assessment may reliably prognosticate longer-term recovery and could inform early identification of patients requiring intensified rehabilitation.

The postoperative complication rate of 17.8% in our study predominantly stiffness (15.8%) and malunion (2%) compares favourably with rates reported in similar studies. Khan S et al[12] reported complications in 4 of 60 patients, including irregular articular surface and wrist pain. Keshkar S et al[13] documented superficial infection, nerve injury, joint stiffness, and loss of reduction.18 Saini et al. reported superficial infection in only 4% of their patients. The absence of implant failure, neurovascular complications, or tendon injury in our series likely reflects the benefits of the Modified Henry approach and meticulous surgical technique. Crucially, our analysis demonstrated that the occurrence of postoperative complications was the single strongest predictor of inferior functional outcome, with patients experiencing complications recording significantly higher DASH scores at 6 months (23.42 ± 5.82 versus 10.88 ± 2.52; $p < 0.001$).

This study has several limitations that must be acknowledged. First, the single-centre design introduces the possibility of selection bias and may limit the generalisability of findings to other populations or institutional settings. Second, the follow-up period of up

to 18 months (mean 9.72 months) is relatively short; long-term data beyond 12 months would be valuable to assess for delayed complications, progression of post-traumatic arthritis, or late functional decline. Third, the absence of a comparator arm such as dorsal plating or external fixation precludes definitive conclusions regarding the superiority of volar buttress plating relative to alternative surgical strategies. Fourth, radiological parameters were assessed at a single final follow-up time point; serial radiological assessment would have provided greater insight into the natural history of fracture healing and implant behaviour. Fifth, the DASH score, while validated and widely used, is self-reported and may be influenced by patient expectations, cognitive status, and associated injuries.

Notwithstanding these limitations, the prospective design, adequate sample size based on a priori power calculation, standardised surgical technique, and validated outcome measurement strengthen the reliability of the findings. Future research should ideally employ a randomised controlled trial design comparing volar buttress plating with alternative fixation strategies for volar Barton fractures, with extended follow-up of at least 24 months and inclusion of radiological outcomes such as osteoarthritic progression and patient-reported quality of life measures.

Conclusion

Volar buttress plating via the Modified Henry approach provides consistent, significant, and sustained functional improvement in patients with volar Barton fractures of the distal radius, as demonstrated by progressive and statistically significant reductions in DASH scores from 6 weeks to 6 months postoperatively. The technique affords excellent restoration of wrist range of motion and acceptable radiological outcomes, with a low overall complication rate of 17.8%. The restoration of palmar tilt emerged as an independent predictor of superior functional outcome, underscoring the importance of anatomical reduction as the primary surgical goal. These findings affirm volar buttress plating as a reliable, effective, and reproducible treatment modality for this challenging fracture pattern.

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Availability of Data: The data supporting this study's findings are available upon reasonable request to corresponding author.

Declaration of Non-use of Generative AI: The authors affirm that no generative artificial intelligence tools were utilized in the design, analysis, interpretation of data, or preparation of this manuscript. All content is the result of the authors' original work.

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