

Impact of Fixation Strategy on Return-to-Work and Health-Related Quality of Life in Patients with Complex Distal Radius Fractures

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Abstract

Background: Complex intra-articular distal radius fractures involving a dorsal-ular fragment present significant surgical challenges because conventional volar plating may not adequately stabilise all articular components. Fragment-specific fixation has been proposed as an alternative strategy to achieve anatomical reconstruction and improved functional outcomes, but its comparative effectiveness remains debated. This study aimed to evaluate the impact of fixation strategy on functional recovery, return to work, health-related quality of life, and complication rates in patients with AO/OTA type 2R3C1.1 distal radius fractures.

Methods: A prospective comparative study was conducted at a tertiary care center between February 2024 and February 2026. Eighty adult patients (18–65 years) with closed intra-articular distal radius fractures containing a separate dorsal-ular fragment were enrolled and divided into two groups: fragment-specific plating (FSP, n = 40) and single volar plating (SVP, n = 40). Functional outcomes at 12 months were assessed using the Visual Analogue Scale (VAS), Disabilities of the Arm, Shoulder and Hand (DASH) score, range of motion, grip strength, Patient-Rated Wrist Evaluation (PRWE), and Mayo Wrist Score. Secondary outcomes included return to work and health-related quality of life using the EQ-5D instrument. Postoperative complications were recorded. Statistical analysis was performed using SPSS v25 with significance set at $p < 0.05$.

Results: Baseline characteristics were comparable between groups. EQ-5D domain scores were similar; however, the EQ-5D VAS was significantly higher in the FSP group (81.8 ± 8.65 vs 77.7 ± 7.65 ; $p = 0.028$). Patients treated with FSP returned to work earlier (13.0 ± 2.81 vs 14.7 ± 4.37 weeks), although this difference narrowly missed statistical significance ($p = 0.051$). Functional assessment at one year showed significantly better outcomes in the FSP group, including lower PRWE pain ($p = 0.028$) and total scores ($p = 0.022$), lower DASH scores ($p < 0.001$), and superior wrist range of motion in flexion, extension, pronation, and supination ($p \leq 0.002$ for all). Grip strength, Mayo Wrist Score, and VAS pain were better in the FSP group but did not reach statistical significance. Most patients in both groups returned to their pre-injury occupation, with a higher proportion in the FSP group returning early. Complication rates were low and comparable between groups, with no significant differences in fixation failure, infection, implant issues, or carpal instability.

Conclusion: Both fragment-specific plating and single volar plating provide safe and effective treatment for complex intra-articular distal radius fractures with a dorsal-ular fragment. However, fragment-specific plating offers superior functional outcomes, a greater range of motion, and improved patient-perceived health status without increasing the risk of complications. These findings support a morphology-based approach to fixation, with fragment-specific constructs preferred for fractures involving unstable dorsal-ular components.

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Introduction

Distal radius fractures are among the most common orthopaedic injuries and frequently involve the articular surface, particularly following high-energy trauma in the working-age population. Achieving anatomical reduction and stable fixation is essential to restore wrist biomechanics, allow early mobilisation, and prevent long-term complications such as stiffness, weakness, and post-traumatic arthritis [1]. Volar locking plate fixation has become the most widely used surgical technique due to its ability to provide angular stability through a single approach with relatively low soft-tissue morbidity [2]. However, in complex intra-articular fractures with a separate dorsal-ular fragment, volar plating alone may not adequately buttress all articular

components, potentially leading to loss of reduction, distal radioulnar joint dysfunction, and persistent disability [3].

Fragment-specific fixation has emerged as an alternative strategy designed to stabilise individual fracture fragments directly using low-profile implants applied through targeted approaches, thereby improving articular congruity and construct stability [4]. Although biomechanical and clinical studies suggest advantages of fragment-specific constructs in comminuted fracture patterns, concerns regarding operative complexity, implant irritation, and cost have limited their universal adoption [5]. Consequently, the optimal fixation strategy for distal radius fractures with dorsal-ular involvement remains controversial. The present study was conducted

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to compare functional outcomes, return to work, health-related quality of life, and complication rates between fragment-specific plating and single volar plating in patients with AO/OTA type 2R3C1.1 fractures.

Materials and Methods

This prospective observational study was conducted in the Department of Orthopaedics at Kalinga Institute of Medical Sciences and Pradyumna Bal Memorial Hospital, Bhubaneswar, over a 24-month period from February 2024 to February 2026. A total of 80 adult patients (aged 18–65 years) with closed intra-articular distal radius fractures containing a separate dorsal-ulnar fragment (AO/OTA type 2R3C1.1), confirmed by computed tomography, were included and divided into two equal groups: fragment-specific plating (FSP, n = 40) and single volar plating (SVP, n = 40) in a 1:1 ratio using an **alternate allocation sequence**. Patients with extra-articular fractures, pathological or fragility fractures, associated fractures of the ipsilateral upper limb, or those without a minimum follow-up of one year were excluded. All patients underwent internal fixation with angle-stable locking plate constructs based on fracture morphology. Epidemiological, clinical, and operative data were obtained from hospital records, and radiographic evaluation was performed using standardised posteroanterior and lateral wrist radiographs at immediate post-op and after 1-year intervals. All patients followed an identical postoperative rehabilitation protocol. Functional outcomes were evaluated at 12 months using the Visual Analogue Scale (VAS), Disabilities of the Arm, Shoulder and Hand (DASH) score, range of motion, and grip strength, while the Patient-Rated Wrist Evaluation (PRWE) and Mayo Wrist Score were assessed at 1 year. Secondary outcomes included return to work and health-related quality of life using the EQ-5D instrument. Postoperative complications such as loss of fixation, implant loosening, screw back-out or breakage, tendon or nerve injury, surgical site infection, complex regional pain syndrome, and carpal instability patterns (DISI and VISI) were recorded.

Ethical Consideration

Before beginning the study, approval was obtained from the research and ethical committees of KIMS Medical College. The ethical approval proposal number is KIIT/KIMS/IEC/1604/2024. Written informed consent was secured from each participant, and assurance was given that confidentiality would be maintained throughout all aspects of the study.

Statistical Analysis

Data was collected in an MS Excel worksheet, and analyses were performed using IBM SPSS Statistics software, version 25. Data were presented as mean ± standard deviation, median, and interquartile range. Normality was assessed using the Kolmogorov-Smirnov test (p>0.05). Group comparisons were performed using an unpaired t-test for normally distributed data and a Mann-Whitney test for non-normally distributed data. All statistical tests were 2-tailed. Categorical variables were analysed using the chi-square test or Fisher’s exact test. A p-value <0.05 was considered statistically significant.

Results

A total of 80 patients with complex distal radius fractures were included in the study, with 40 patients treated using Fragment-Specific Plating (FSP) and 40 patients treated using Single Volar Plating (SVP). The outcomes assessed included socio-demographic characteristics, health-related quality of life (EQ-5D), time to return to work, functional outcomes at 12 months, and postoperative complications.

As represented in Table 1, the baseline socio-demographic and clinical characteristics of participants were comparable between the two treatment groups. The majority of patients in both groups were middle-aged. In the FSP group, the highest proportion of patients was in the 41–50 years age category (18.8%), followed by 51–65 years (13.8%), 31–40 years (11.3%), and 18–30 years (6.3%). A similar distribution was observed in the SVP group, where most patients were also aged 41–50 years (20%), followed by 31–40 years (13.8%), 51–65 years (12.5%), and 18–30 years (3.8%). Male patients predominated in both groups. In the FSP group, 32.5% were male and 17.5% were female, while in the SVP group, 31.3% were male and 18.8% were female. Employment status showed that most participants were employed at the time of injury, accounting for 65% in the FSP group and 60% in the SVP group. Regarding the side of injury, right-sided fractures were slightly more common than left-sided fractures in both groups. Right wrist injuries occurred in 30% of the FSP group and 31.3% of the SVP group, while left wrist injuries accounted for 20% and 18.8%, respectively. The mechanism of injury was predominantly low-energy falls in both groups (32.5% in FSP vs 28.7% in SVP). Road traffic accidents were the second most common cause (15% vs 17.5%), followed by other causes such as sports injuries or assault (2.5% vs 3.8%). Overall, both groups were well matched at baseline, minimizing potential confounding.

Table 1: Socio-demographic and Clinical Characteristics of Study participants

		Fragment Specific Plating		Single volar Plating	
		Frequency (N=40)	Percentage (%)	Frequency (N=40)	Percentage (%)
Age group	18-30 years	5	12.5	3	7.5
	31-40 years	9	22.5	11	27.5
	41-50years	15	37.5	16	40
	51-65 years	11	27.5	10	25

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Gender	Male	26	65	25	62.5
	Female	14	35	15	37.5
Employment Status	Employed	26	65	24	60
	Unemployed	14	35	16	40
Side of Injury	Left	16	40	15	37.5
	Right	24	60	25	62.5
Mechanism of Injury	Low-energy fall	26	65	23	57.5
	RTA	12	30	14	35
	Other(sports/assault)	2	5	3	7.5

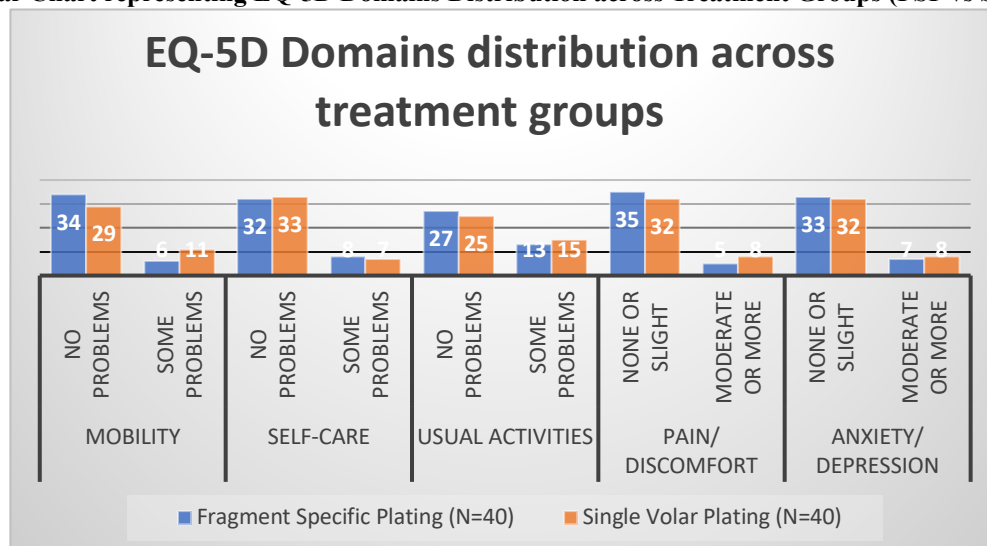
As represented by Table 2 and Figure 1, assessment of health-related quality of life using the EQ-5D instrument revealed broadly similar outcomes between treatment groups across all five domains. For mobility, most patients reported no problems (34 in FSP vs 29 in SVP), while a smaller proportion reported some problems (6 vs 11). The difference was not statistically significant ($\chi^2 = 1.87, p = 0.172$). In the self-care domain, 32 patients in the FSP group and 33 in the SVP group reported no problems, while 8 and 7 patients respectively reported some difficulties. This difference was also not significant ($p = 0.775$). Regarding usual activities, 27 patients in the FSP group and 25 in the SVP group had no limitations, whereas 13 and 15 patients respectively

experienced some restrictions ($p = 0.639$). Pain or discomfort was absent or mild in the majority of participants (35 in FSP vs 32 in SVP). Moderate or severe pain was reported by 5 patients in the FSP group and 8 in the SVP group ($p = 0.363$). Similarly, anxiety or depression was minimal in most patients, with 33 in the FSP group and 32 in the SVP group reporting none or slight symptoms. Moderate or severe psychological distress was reported by 7 and 8 patients respectively ($p = 0.775$). Overall, no statistically significant differences were observed in any EQ-5D domain, indicating comparable general health status between groups at follow-up.

Table 2: EQ-5D Domains Distribution by Treatment Groups (FSP vs SVP) (N = 80)

EQ-5D domain	Category	Fragment Specific Plating (N=40)	Single Plating (N=40)	Volar Total (N=80)	χ^2	p-value
Mobility	No problems	34	29	63	1.87	0.172
	Some problems	6	11	17		
Self-care	No problems	32	33	65	0.0821	0.775
	Some problems	8	7	15		
Usual activities	No problems	27	25	52	0.220	0.639
	Some problems	13	15	28		
Pain/Discomfort	None or slight	35	32	67	0.827	0.363
	Moderate or more	5	8	13		
Anxiety/Depression	None or slight	33	32	65	0.0821	0.775
	Moderate or more	7	8	15		

Figure 1: Bar Chart representing EQ-5D Domains Distribution across Treatment Groups (FSP vs SVP) (N = 80)



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As represented by Table 3, the EQ-5D Visual Analogue Scale (VAS) at 12 months demonstrated a statistically significant advantage for the FSP group. Patients treated with FSP reported a higher mean VAS score (81.8 ± 8.65) compared to the SVP group (77.7 ± 7.65), with a mean difference of 4.09 points ($p = 0.028$). Median scores also favoured FSP (83.4 vs 76.8). Time taken to

return to work was shorter in the FSP group (13.0 ± 2.81 weeks) compared with the SVP group (14.7 ± 4.37 weeks). Although the mean difference of -1.63 weeks suggested an earlier return in the FSP group, this difference narrowly missed statistical significance ($p = 0.051$).

Table 3: EQ-5D VAS at 12 Months and Time taken to return to work by Treatment Group (Mean \pm SD, Median with 95% CI) (N = 80)

Variable	Fragment-specific plating (N=40)		Single Volar Plating (N=40)		Mean difference (FSP-SVP)	t(df)	p-value
	Mean \pm SD	Median (95% CI)	Mean \pm SD	Median (95% CI)			
EQ-5D VAS (12 months)	81.8 ± 8.65	83.4 (79.0–84.5)	77.7 ± 7.65	76.8 (75.2–80.1)	4.09	2.24 (78)	0.028
Time taken to return to work (weeks)	13.0 ± 2.81	12.4 (12.1–13.9)	14.7 ± 4.37	13.9 (13.3–16.1)	-1.63	-1.98 (78)	0.051

Time Taken to Return to Work (Weeks) by Treatment Group (N = 80)

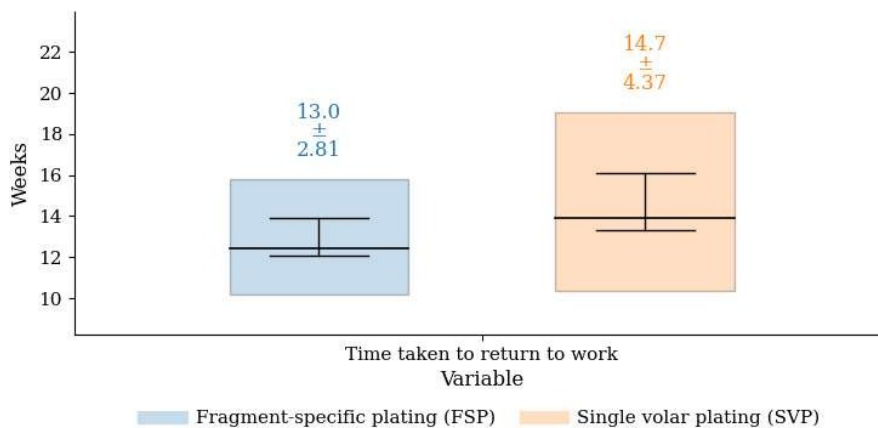


Figure 2: Box & Whisker plot representing time to return to work in weeks across different treatment groups. (N=80)

As shown in Table 4, most patients in both groups returned to their pre-injury occupation. In the FSP group, 38 patients (47.5%) resumed their original occupation compared with 35 patients (43.8%) in the SVP group. The difference was not statistically significant ($p = 0.235$). Early return to work within the first three months

occurred more frequently in the FSP group (19 patients; 23.8%) than in the SVP group (11 patients; 13.8%). Conversely, delayed return beyond three months was more common in the SVP group (36.3% vs 26.3%). However, this difference did not reach statistical significance ($p = 0.065$).

Table 4: Return to work in 1st 3 months and return to pre-injury occupation across different treatment groups. (N=80)

Variables		Fragment Specific Plating		Single volar Plating		Chi-Square	p-value
		Frequency (N=40)	Percentage (%)	Frequency (N=40)	Percentage (%)		
Returned to	No	2	5	5	12.5	1.41	0.235

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pre-injury occupation	Yes	38	95	35	87.5		
Return to work in 1 st 3 months	No	21	52.5	29	72.5	3.41	0.065
	Yes	19	47.5	11	27.5		

As shown in Table 5 and Figure 3, overall complication rates were low in both groups. Loss of fixation was absent in all FSP cases and occurred in only one SVP patient (1.2%). Implant loosening was rare and identical in both groups (1 case each). Screw back-out or breakage occurred in two FSP patients (2.5%) and one SVP patient (1.2%). Superficial surgical site infection was also slightly more frequent in the FSP group (2 cases) compared to the SVP group (1 case). No deep infections were reported in either group. Tendon irritation or tenosynovitis occurred in three patients in the FSP group

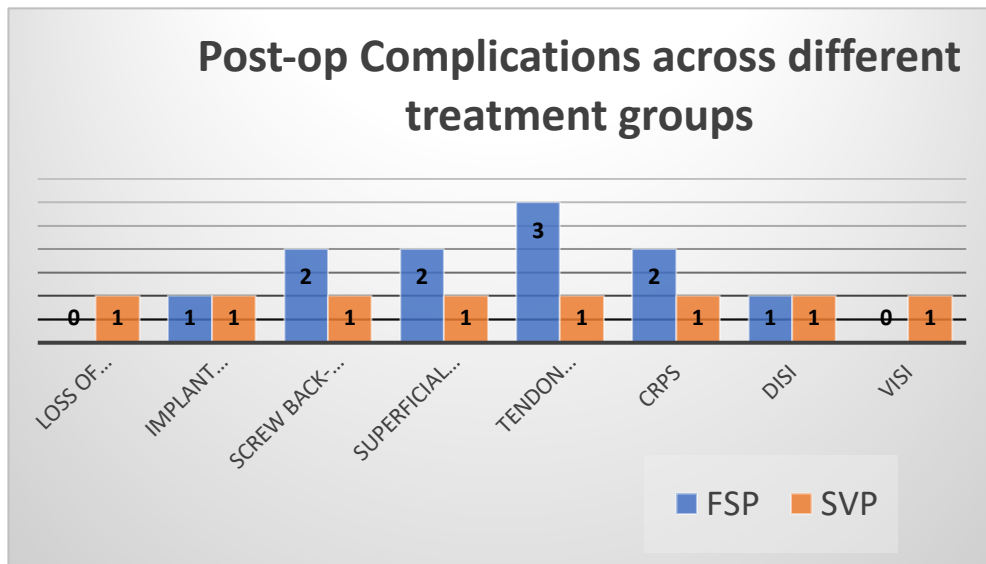
and one patient in the SVP group. Complex Regional Pain Syndrome (CRPS) was reported in two FSP patients and one SVP patient. Carpal instability patterns were rare. Dorsal intercalated segment instability (DISI) occurred in one patient in each group, while volar intercalated segment instability (VISI) was observed only in one SVP patient.

Statistical analysis revealed no significant differences in complication rates between groups for any individual complication, indicating that both fixation strategies had comparable safety profiles.

Table 5: Presence of post-op complications across different treatment groups(FSP vs SVP)

Complication	Category	Fragment Specific Plating		Single volar Plating		p- value
		Frequency (N=40)	Percentage (%)	Frequency (N=40)	Percentage (%)	
Loss of fixation	No	40	100	39	97.5	0.99
	Yes	0	0	1	2.5	
Implant loosening	No	39	97.5	39	97.5	0.99
	Yes	1	2.5	1	2.5	
Screw back-out or breakage	No	38	95	39	97.5	0.99
	Yes	2	5	1	2.5	
Superficial surgical site infection	No	38	95	39	97.5	0.99
	Yes	2	2	1	2.5	
Deep infection	No	40	100	40	100	-
	Yes	0	0	0	0	
Tendon irritation/tenosynovitis	No	37	92.5	39	97.5	0.615
	Yes	3	7.5	1	2.5	
CRPS	No	38	95	39	97.5	0.556
	Yes	2	5	1	2.5	
DISI	No	39	97.5	39	97.5	1.0
	Yes	1	2.5	1	2.5	
VISI	No	40	100	39	97.5	0.314
	Yes	0	0	1	2.5	

Figure 3: Bar chart representing post-operative complications across different treatment groups(FSP vs SVP)



As shown in Table 6, functional assessment using validated scoring systems demonstrated superior outcomes for the FSP group in several domains. The Patient-Rated Wrist Evaluation (PRWE) pain score was significantly lower (better) in the FSP group (6.87 ± 4.96) compared with the SVP group (9.37 ± 4.99), with a mean difference of -2.495 ($p = 0.028$). The PRWE total score also favoured FSP (12.34 ± 6.24 vs 15.59 ± 6.23 ; $p = 0.022$). However, the PRWE function subscale showed no significant difference ($p = 0.354$). The Mayo Wrist Score was higher in the FSP group (90.27 ± 5.83) than in the SVP group (87.06 ± 8.98), though this difference did not reach statistical significance ($p = 0.061$). Pain intensity measured by the Visual Analogue Scale was slightly lower in the FSP group (2.52 ± 1.109)

compared with the SVP group (2.95 ± 0.959), but this difference was not significant ($p = 0.071$). Grip strength was marginally better in the FSP group (89.2 ± 6.39) than in the SVP group (86.2 ± 8.34), without statistical significance ($p = 0.073$). The Disabilities of the Arm, Shoulder and Hand (DASH) score showed a significant advantage for FSP, with lower disability scores (7.95 ± 1.41 vs 10.13 ± 2.10 ; $p < 0.001$). Range of motion measurements demonstrated consistently better outcomes in the FSP group. Wrist flexion (77.3° vs 72.3°), wrist extension (72.1° vs 69.0°), forearm pronation (84.6° vs 82.5°), and supination (83.3° vs 80.2°) were all significantly greater in patients treated with fragment-specific plating ($p \leq 0.002$ for all comparisons).

Table 6: Functional Outcome at 12months across different treatment groups (Mean \pm SD, Median with 95% CI) (N = 80)

Functional Outcome at 12 months	Fragment-specific plating (N=40)		Single Volar Plating (N=40)		Mean difference (FSP-SVP)	t(df)	p-value
	Mean \pm SD	Median (95% CI)	Mean \pm SD	Median (95% CI)			
PRWE (Pain)	6.87 ± 4.96	6.35 (5.29–8.46)	9.37 ± 4.99	9.85 (7.77–10.96)	-2.495	-2.243 (78)	0.028
PRWE (Function)	5.46 ± 3.63	5.30 (4.30–6.63)	6.24 ± 3.82	6.40 (5.02–7.47)	-0.777	-0.933 (78)	0.354
PRWE (Total)	12.34 ± 6.24	12.80 (10.34–14.33)	15.59 ± 6.23	15.60 (13.59–17.58)	-3.248	-2.330 (78)	0.022
Mayo Wrist Score	90.27 ± 5.83	90.45 (88.40–92.14)	87.06 ± 8.98	88.20 (84.18–89.93)	3.215	1.898 (78)	0.061 ^a

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Visual Analogue Score	2.52 ± 1.109	±2.00 (2.17–2.88)	2.95 ± 0.959	3.00 (2.64–3.26)	–0.425	–1.83 (78)	0.071
Grip strength	89.2 ± 6.39	88.8 (87.1–91.2)	86.2 ± 8.34	87.8 (83.5–88.8)	3.02	1.82 (78)	0.073
DASH score	7.95 ± 1.41	8.00 (7.50–8.40)	10.13 ± 2.10	10.00 (9.45–10.80)	–2.17	–5.43 (78)	<0.001
Wrist Flexion (in degrees)	77.3 ± 2.90	77.5 (76.3–78.2)	72.3 ± 3.17	73.0 (71.3–73.3)	4.92	7.25 (78)	<0.001
Wrist Extension (in degrees)	72.1 ± 2.63	72.0 (71.2–72.9)	69.0 ± 3.09	70.0 (68.0–69.9)	3.13	4.88 (78)	<0.001
Forearm Pronation (In degrees)	84.6 ± 1.89	85.0 (84.0–85.2)	82.5 ± 3.42	82.0 (81.5–83.6)	2.03	3.28 (78)	0.002
Forearm Supination (In degrees)	83.3 ± 2.05	83.5 (82.6–83.9)	80.2 ± 3.77	80.5 (79.0–81.4)	3.03	4.46 (78)	<0.001

Discussion

The present study demonstrates that both fragment-specific plating (FSP) and single volar plating (SVP) are effective treatment options for complex intra-articular distal radius fractures with a dorsal-ulnar fragment, producing satisfactory functional recovery and low complication rates at one year. However, patients treated with FSP showed significantly better patient-reported outcomes, including lower PRWE pain and total scores and lower DASH disability scores, along with superior wrist range of motion. These findings suggest that direct stabilisation of individual articular fragments allows more precise anatomical reconstruction and improved restoration of wrist kinematics. Previous clinical and biomechanical studies have emphasized that fragment-specific fixation can provide enhanced stability in comminuted intra-articular fractures by buttressing key structural components that may not be adequately controlled by a single volar plate [4,6].

The age distribution in this study showed a predominance of middle-aged adults, with the largest group aged 41–50 years (38.8%), followed by the 51–65 year group (26.3%). There was no statistically significant difference between the fragment-specific plating and single volar plating groups ($\chi^2 = 0.780$, $p = 0.854$), indicating effective age matching. A similar middle-aged demographic has been reported by Bezirgan et al. (2024)[7] and Ferozkhan et al. (2024)[8], both of whom noted mean patient ages of around 40 years in cohorts treated for intra-articular distal radius fractures, suggesting these injuries commonly affect the economically active population.

The EQ-5D domain analysis showed that both fragment-specific plating and single volar plating groups

experienced generally positive health-related quality-of-life scores at follow-up. Most patients in both groups reported no issues in mobility, self-care, usual activities, pain/discomfort, and anxiety/depression domains. There were no statistically significant differences between the groups in any domain (all $p > 0.05$). This overall similarity in EQ-5D domains aligns with findings reported by Lundqvist et al. (2022)[9], Sagerfors et al. (2020)[10], and Bowers et al. (2023)[11], where both fixation strategies led to good general health status at mid- to long-term follow-up.

The overall complication rate in this study was low for both groups, with no significant differences between fragment-specific plating and single volar plating. Parameters such as fixation loss, implant loosening, screw back-out or breakage, superficial and deep infections, and tendon irritation or tenosynovitis showed similar results. This low complication rate and safety profile align with findings from Bowers et al. (2023)[11], Zhou et al. (2025)[12], and Lundqvist et al. (2022)[9], who reported comparable complication rates between volar and fragment-specific or combined constructs when using modern implants and techniques. The superior range of motion observed in the FSP group may be attributed to better control of the dorsal-ulnar corner, a biomechanically critical region for maintaining radiocarpal alignment and distal radioulnar joint stability. Inadequate fixation of this fragment has been associated with residual instability, pain, and impaired forearm rotation despite otherwise satisfactory fixation [3,13]. Nevertheless, the satisfactory outcomes achieved with single volar plating in many patients indicate that it remains an effective and less technically demanding

option when fracture morphology permits adequate stabilization through a volar approach alone. Overall, the findings of this study reinforce the importance of a morphology-based approach to implant selection. Fragment-specific plating appears particularly beneficial in highly comminuted intra-articular fractures involving key articular fragments, whereas single volar plating continues to provide reliable results in selected cases with less complex patterns.

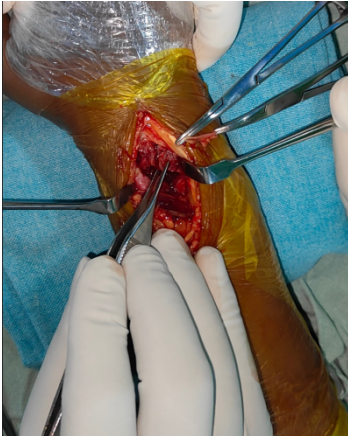


Fig 4: Dorsal Approach to distal radius



Fig 5: Volar Approach to distal radius

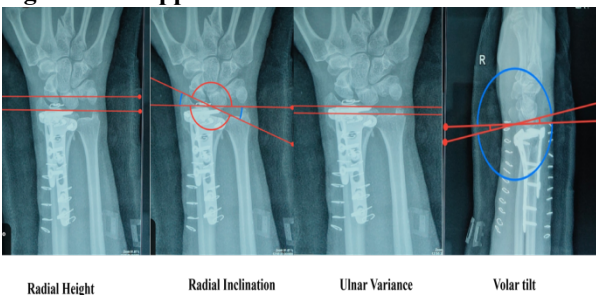


Fig 6: Radiological Parameters following FSP



Fig 7: Grip strength after FSP

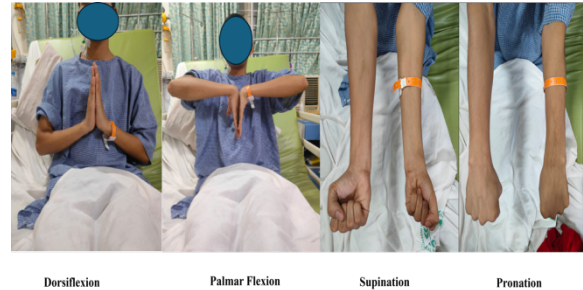


Fig 8: Post operative functional outcome

Conclusion

Fragment-specific plating and single volar plating both achieved satisfactory functional recovery and low complication rates in the treatment of complex intra-articular distal radius fractures with a dorsal-ulnar fragment; however, fragment-specific plating demonstrated superior patient-reported outcomes, lower disability scores, and significantly better wrist range of motion at one year without increasing surgical risk. Although overall health-related quality of life and return-to-work rates were broadly comparable, patients treated with fragment-specific constructs showed a trend toward improved perceived health status and earlier functional recovery. These findings suggest that while single volar plating remains an effective option in appropriately selected cases, fragment-specific plating offers meaningful advantages in restoring wrist function in fractures with unstable dorsal-ulnar components, supporting a morphology-based approach to implant selection.

Limitations

First, the sample size was relatively modest (80 patients), which may limit the statistical power to detect small but clinically relevant differences between treatment groups, particularly for secondary outcomes such as return to work and complication rates. Second, the study was conducted at a single tertiary-care centre, which may restrict the generalizability of the findings to other institutions, healthcare systems, or populations with different injury patterns and rehabilitation resources

Recommendations

Fragment-specific plating is preferred for complex intra-articular distal radius fractures with a dorsal-ulnar fragment, especially in high-demand patients, as it better restores wrist mechanics and outcomes without raising

complication risk. Single volar plating is acceptable when fracture morphology permits stable fixation or when surgery complexity, cost, or implant availability are limiting. Preoperative CT is recommended to identify key fragments and guide planning. Surgeons should be trained in fragment-specific techniques, and standardised rehab protocols should be used to optimise recovery and return to work. Larger studies are needed to validate these findings, assess long-term outcomes, and create guidelines for fixation strategy.

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Nil

Conflicts of Interest

There are no conflicts of interest

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