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Original Research Article

To Compare Functional Outcome between Jess and Plating in Distal End Radius Fracture

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Conflict of interest: Nil

Abstract

Background: Distal radius fractures are common orthopaedic injuries with significant functional implications. The optimal treatment for unstable fractures remains debated. This study compares functional and radiological outcomes between Joshi's External Stabilization System (JESS) and volar locking plate fixation.

Methods: A prospective observational study was conducted from May 2024 to February 2026 at a tertiary care centre. Thirty patients with intra-articular distal radius fractures (AO type B and C) were divided into JESS (n=15) and plating (n=15) groups. Functional outcomes were assessed using the Green and O'Brien scoring system. Radiological union, time to union, intra-operative blood loss, and complications were evaluated. Statistical analysis was performed using appropriate tests with $p<0.05$ considered significant.

Results: Demographic variables were comparable between groups ($p>0.05$). The plating group showed significantly better functional outcomes, with higher total Green and O'Brien scores (43.67 ± 2.29 vs 32.67 ± 2.58; $p<0.000001$), improved pain, and greater range of motion ($p<0.001$). Time to union was significantly shorter in the plating group (6.80 ± 0.77 weeks) compared to JESS (8.13 ± 1.13 weeks; $p=0.0022$). In contrast, intra-operative blood loss was significantly lower in the JESS group ($p<0.00001$). Union rates were comparable in both groups ($p=1.000$).

Conclusion: Both modalities achieve satisfactory union, however, volar locking plate fixation provides superior functional outcomes and faster recovery, whereas JESS offers advantages of minimal invasiveness and reduced blood loss.

Keywords: Distal Radius Fracture, JESS, Volar Locking Plate, Functional Outcome, Fracture Union.

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Introduction

Distal radius fractures are among the most common injuries encountered in orthopaedic practice, accounting for a significant proportion of upper extremity fractures [1,2]. Beyond their high incidence, these injuries have important functional implications, as they directly affect wrist biomechanics, hand function, and activities of daily living (3). Restoration of key anatomical parameters—radial length, radial inclination, and volar tilt—is essential for optimal outcomes, as even minor deviations can disrupt load transmission and lead to reduced range of motion, pain, and decreased grip strength [4,5].

These fractures demonstrate a bimodal age distribution, occurring in younger individuals following high-energy trauma and in elderly patients after low-energy falls, often associated with osteoporosis [2,6]. In older patients, distal radius fractures may represent an early indicator of skeletal fragility, highlighting the need for comprehensive management beyond fracture fixation [7]. Radiological assessment forms the cornerstone of evaluation and management. Standard posteroanterior and true lateral radiographs are essential for assessing alignment, including radial height, inclination, volar tilt, and articular congruity [4]. In complex intra-articular fractures, computed tomography provides better delineation of fracture patterns and aids in surgical planning [8]. Serial imaging is crucial to detect early loss of reduction, which may adversely affect functional outcomes [9].

Management options range from conservative treatment with casting to surgical interventions

such as external fixation and volar locking plate fixation [10]. External fixation, including Joshi's External Stabilization System (JESS), utilizes ligamentotaxis to maintain alignment and is particularly useful in comminuted fractures with minimal soft tissue disruption [11]. Volar locking plate fixation allows stable internal fixation, facilitates anatomical reduction, and enables early mobilization, especially in unstable and intra-articular fractures [12].

Despite advances in surgical techniques, high-quality prospective comparative data evaluating functional outcomes between these modalities remain limited, particularly in the Indian population [13]. This study aims to address this gap and provide evidence to guide optimal treatment selection and improve patient outcomes.

This study aims to compare functional outcomes between Joshi's External Stabilization System (JESS) and volar locking plate fixation in distal radius fractures, using the Green and O'Brien scoring system, while also evaluating radiological union in both cases.

Materials and Methods

Study design - This prospective observational study was conducted in the Department of Orthopaedics at a tertiary care hospital from November 2023 to February 2026. Patients aged 18–80 years with intra-articular distal radius fractures (AO type B and C) were enrolled and divided into two groups: Group A (JESS fixation) and Group B (volar locking plate fixation), based on treatment received.

Sample size - Calculated using comparison of two independent means, assuming α=0.05, power=80%, standard deviation of 12, and clinically significant difference of 15. A total of 30 patients were included considering feasibility.

Inclusion Criteria

- Intra-articular distal radius fractures classified as AO type B and type C
- Unilateral distal radius fractures
- Polytrauma patients with distal radius fracture and without associated head or spinal injury

Exclusion Criteria

- Open fractures
- Bilateral distal radius fractures
- Associated head injury or spinal injury
- Previous fracture in the same limb
- Pathological fractures

Pre-Treatment Assessment - All patients underwent clinical and radiological evaluation with standard wrist radiographs and CT scan for fracture classification and surgical planning. Preoperative assessment and informed consent were obtained. Surgical management was performed using standard techniques for JESS (ligamentotaxis with/without K-wires) or plating (open reduction and internal fixation).

Postoperative care - Included immobilization followed by physiotherapy. Patients were followed up regularly for clinical and radiological assessment. Functional outcomes were evaluated using the Green and O'Brien scoring system, and radiological parameters included radial height, inclination, volar tilt and fracture union.

Statistical analysis - Data were analyzed using Student's t-test and Chi-square/Fisher's exact test, with $p<0.05$ considered significant.

Results:

Table 1: Demographic characteristics of study population

Parameter	JESS (n=15)	PLATE (n=15)	P value
AGE (years)			
Mean ± SD	56.8 ± 11.4	60.5 ± 9.6	0.340
SEX			
Females	9 (60.0%)	6 (40.0%)	0.466
Males	6 (40.0%)	9 (60.0%)	

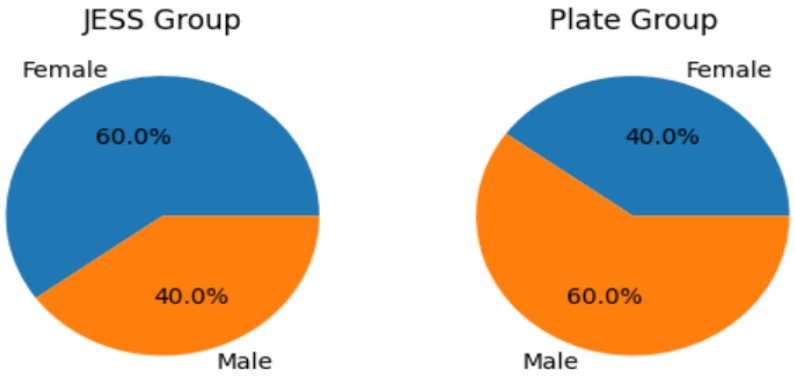

Figure 1: Demographic characteristics of the population

The demographic characteristics of the study population are summarized in Table 1 and illustrated in the accompanying figure. The mean age of patients in the JESS group was 56.8 ± 11.4 years, while in the plating group it was 60.5 ± 9.6 years. The difference in mean age between the two groups was not statistically significant (p = 0.340), indicating that both groups were comparable with respect to age distribution.

With regard to sex distribution, females constituted 60% of the JESS group and 40% of the plating group, whereas males accounted for 40% and 60% in the respective groups. The difference in sex distribution between the two groups was not statistically significant (p = 0.466), suggesting an even representation of genders across both treatment modalities. The pie charts further demonstrate the proportional distribution of males and females within each group, showing a female predominance in the JESS group and a male predominance in the plating group. However, these differences are not statistically meaningful.

Overall, the absence of significant differences in age and sex distribution confirms that the two groups are demographically comparable. This comparability reduces the likelihood of confounding bias and ensures that differences in functional and radiological outcomes can be more reliably attributed to the treatment modalities rather than baseline demographic variations.

Table 2: Intra-operative blood loss (mL)

Parameter	JESS (n=15)	PLATE (n=15)	p-value
Mean ± SD	22.7 ± 3.72 mL	158.3 ±9.94 mL	0.000002

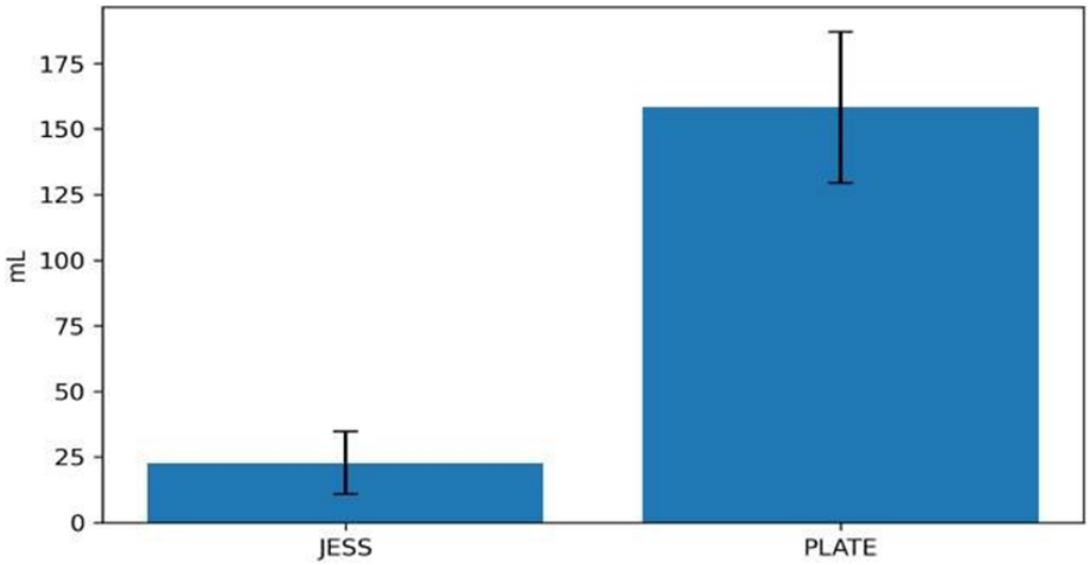

Figure 2: Comparison of intra operative blood loss between 2 groups

Table 2 compares intra-operative blood loss between the JESS and plating groups. The mean blood loss in the JESS group was 22.7 ± 3.72 mL, whereas in the plating group it was significantly higher at 158.3 ± 9.94 mL. This difference was found to be highly statistically significant (p = 0.000002), indicating a clear distinction between the two surgical modalities.

The markedly lower blood loss in the JESS group can be attributed to its minimally invasive nature. JESS relies on percutaneous pin placement and ligamentotaxis, avoiding extensive soft tissue dissection and exposure of the fracture site. As a result, vascular disruption is minimal, leading to reduced intra-operative bleeding. In contrast, volar plating requires open reduction and internal fixation, which involves surgical exposure, soft tissue handling, and periosteal stripping, all contributing to increased blood loss. Clinically, reduced intra-operative blood loss is advantageous, particularly in elderly patients or those with comorbidities, as it decreases the risk of perioperative complications and may reduce the need for transfusion.

Although both procedures are generally safe, this finding highlights an important benefit of JESS in terms of surgical morbidity. Overall, the results demonstrate that JESS is associated with significantly lower intra-operative blood loss compared to plating, reinforcing its role as a less invasive treatment option in appropriately selected cases.

Table 3: Green & O'Brien component scores

Component	JESS (n=15)	PLATE (n=15)	p-value
Pain	5.0 ± 0.0	10.0 ± 0.0	0.000000083
ROM	5.0 ± 0.0	10.0 ± 0.0	0.000000083
Functional activity	7.67 ± 2.58	8.67 ± 2.29	0.271
Residual deformity	5.0 ± 0.0	5.0 ± 0.0	-
Bone healing	10.0 ± 0.0	10.0 ± 0.0	-

Table 3 presents a comparison of individual components of the Green and O'Brien scoring system between the JESS and plating groups. Significant differences were observed in pain and range of motion (ROM), while other parameters showed no statistically meaningful variation.

The mean pain score in the JESS group was 5.0 ± 0.0 compared to 10.0 ± 0.0 in the plating group, with a highly significant p-value (p = 0.000000083). This indicates that patients treated with plating experienced markedly less pain at follow-up. Similarly, ROM scores were significantly better in the plating group (10.0 ± 0.0) compared to the JESS group (5.0 ± 0.0), again showing strong statistical significance (p = 0.000000083). These findings suggest that volar plating facilitates superior functional recovery, likely due to stable fixation allowing early mobilization and reduced stiffness.

Functional activity scores were slightly higher in the plating group (8.67 ± 2.29) compared to the JESS group (7.67 ± 2.58); however, this difference was not statistically significant (p = 0.271). This implies that, despite differences in pain and ROM, overall ability to perform daily activities was comparable between the two groups.

Residual deformity scores were identical in both groups (5.0 ± 0.0), indicating similar cosmetic and anatomical outcomes. Likewise, bone healing scores were equal (10.0 ± 0.0), reflecting satisfactory fracture union in both treatment modalities. Since there was no variation in these parameters, statistical comparison was not applicable.

Overall, the results demonstrate that while both JESS and plating achieve comparable fracture healing and alignment, volar plating provides significantly better outcomes in terms of pain relief and range of motion. These differences highlight the functional advantage of plating, particularly in facilitating early rehabilitation and improved wrist mobility.

Table 4: Green & O'Brien total score

Parameter	JESS (n=15)	PLATE (n=15)	p-value
Mean ± SD	32.67 ± 2.58	43.67 ± 2.29	<0.000001

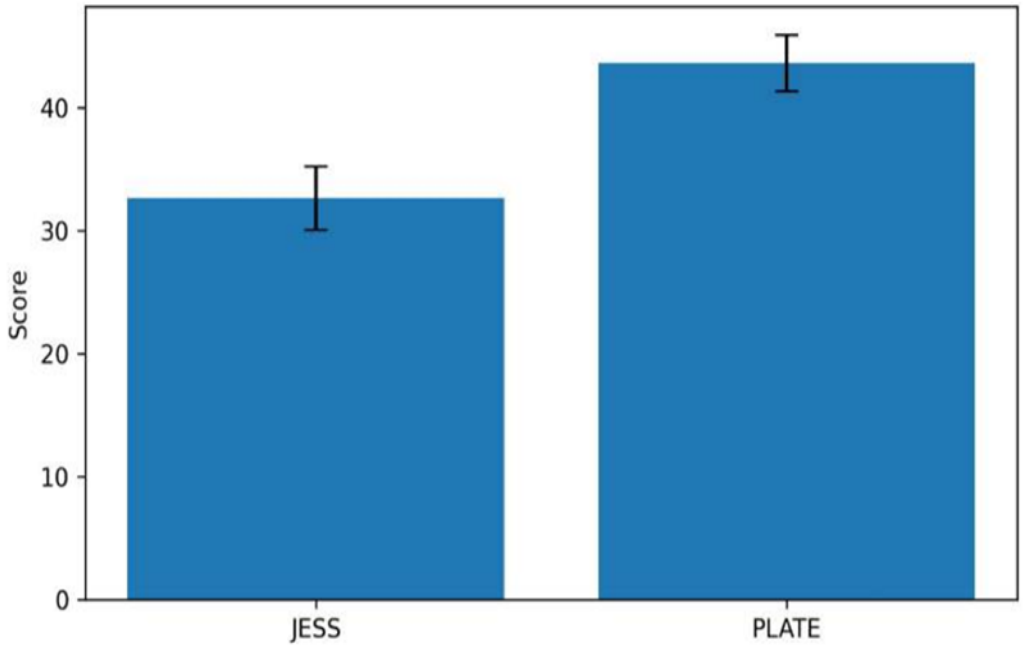

Figure 3: Comparison of total Green & O'Brien score

In our study, plating produced clearly better functional recovery than JESS as measured by Green & O'Brien scoring. The major drivers of this difference were better pain control and better ROM scores in the plating group, which clinically aligns with the concept that stable internal fixation permits earlier mobilisation and more confident rehabilitation, ultimately translating into superior functional grading. At the same time, both groups showed similarly good bone healing scores and similar residual deformity scores, suggesting that the functional advantage with plating was mainly related to early comfort and mobility, rather than a difference in radiographic healing potential.

Table 5: Comparison of union status between 2 groups

Union status	JESS (n=15)	PLATE (n=15)	p-value
United	14 (93.3%)	15 (100%)	1.000
Delayed union	1 (6.7%)	0 (0.0%)	

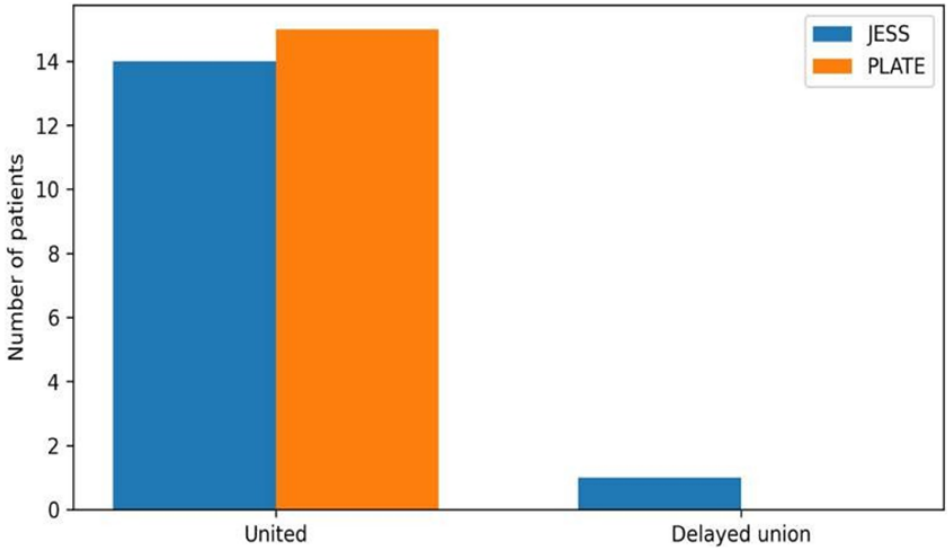

Figure 4: Comparison of union status

Table 5, figure 4 presents the comparison of union status between the JESS and plating groups. In the JESS group, 14 out of 15 patients (93.3%) achieved complete fracture union, while 1 patient (6.7%) showed delayed union. In contrast, all patients in the plating group (100%) achieved union, with no cases of delayed union observed. The difference between the two groups was not statistically significant (p = 1.000), indicating comparable outcomes with respect to fracture healing.

The high union rates in both groups demonstrate that both JESS and volar plating are effective modalities for achieving fracture union in distal radius fractures. The slightly lower union rate in the JESS group may be attributed to factors such as fracture comminution, stability of fixation, or patient-related variables, although the difference is not clinically or statistically meaningful. The absence of delayed union in the plating group may be related to the rigid internal fixation provided by volar locking plates, which ensures stable fracture alignment and promotes early bone healing.

On the other hand, JESS relies on ligamentotaxis and external stabilization, which, while effective, may offer relatively less rigid fixation in certain fracture patterns. Overall, the findings suggest that both treatment modalities are reliable in achieving union, with no significant difference between them. This indicates that choice of treatment can be guided by other factors such as functional outcomes, complications, and surgeon preference rather than concerns regarding fracture healing.

Table 6: Time to union (weeks)

Parameter	JESS (n=15)	PLATE (n=15)	p-value
Mean ± SD	8.13 ± 1.13	6.80 ± 0.77	0.0022

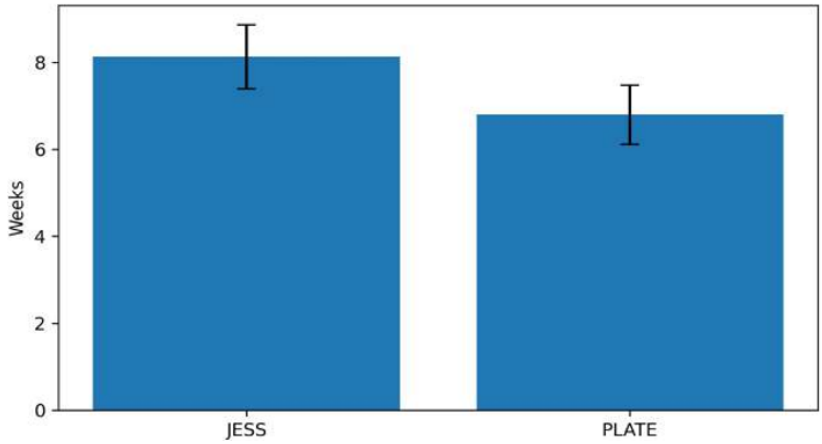

Figure 5: Time to union in both groups

Table 6, Figure 5 compares the mean time to union between the JESS and plating groups. The mean time to union in the JESS group was 8.13 ± 1.13 weeks, whereas in the plating group it was significantly shorter at 6.80 ± 0.77 weeks. This difference was statistically significant (p = 0.0022), indicating faster fracture healing with plating. The earlier union observed in the plating group may be attributed to stable internal fixation and better maintenance of anatomical alignment, which promotes optimal healing conditions. In contrast, JESS relies on external stabilization, which may result in relatively delayed union in some cases.

Discussion

The present study aimed to compare the functional and radiological outcomes of distal radius fractures managed with Joshi's External Stabilization System (JESS) and volar locking plate fixation. The findings demonstrate that while both modalities are effective in achieving fracture union, plating offers superior functional outcomes, particularly in terms of pain relief, range of motion, and overall functional score.

The demographic profile of patients in both groups was comparable, with no statistically significant difference in age or sex distribution. This baseline similarity minimizes confounding bias and strengthens the validity of outcome comparisons. Distal radius fractures were more common in the older age group, consistent with the known association with osteoporosis and low-energy trauma [6,7].

A key intraoperative finding in this study was the significantly lower blood loss associated with JESS compared to plating. This is attributable to the minimally invasive nature of JESS, which avoids extensive soft tissue dissection. In contrast, volar plating involves open reduction, leading to greater

intraoperative bleeding. Similar findings have been reported in previous studies comparing minimally invasive and open fixation techniques [16].

Functional outcomes, as assessed by the Green and O'Brien scoring system, were significantly better in the plating group. This difference was primarily driven by superior pain scores and improved range of motion. The rigid internal fixation provided by volar locking plates allows early mobilization, which likely contributes to reduced stiffness and faster functional recovery [12,14]. Comparable studies have also demonstrated improved functional outcomes with volar plating over external fixation methods [14,15].

Interestingly, no significant difference was observed in functional activity scores, residual deformity, or bone healing between the two groups. This suggests that both techniques are equally effective in achieving satisfactory anatomical alignment and fracture union. Similar observations have been reported in literature where union rates between external fixation and plating were found to be comparable [13,17].

However, the time to union was significantly shorter in the plating group. This may be due to stable fixation and better preservation of fracture biology, which promotes early healing [18]. JESS, relying on ligamentotaxis, may not provide the same degree of stability in all fracture patterns, potentially contributing to delayed union in some cases.

Overall, the findings of this study suggest that while JESS remains a valuable, less invasive, and cost-effective option—particularly in selected cases—volar locking plate fixation provides superior functional outcomes and faster recovery. Therefore, plating may be preferred in patients where early mobilization and optimal functional restoration are primary goals, consistent with findings from previous comparative studies [14,15]

Clinical Implications: The findings of this study have important clinical implications in the management of distal radius fractures. Volar locking plate fixation provides superior functional outcomes, earlier mobilization, and faster union, making it the preferred option in patients with high functional demands and intra-articular fractures. However, JESS remains a valuable alternative in selected cases, particularly in elderly patients, those with significant comorbidities, or in resource-limited settings due to its minimally invasive nature and lower intra-operative blood loss.

Thus, treatment should be individualized based on patient factors, fracture characteristics, and available resources to achieve optimal outcomes.

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