

Original Research Article

Comparison of Functional Outcome of Volar Plate vs K Wires Fixation for Distal Radius Extra Articular Fractures

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Abstract:

Background: Distal radius fractures (DRFs) are common fractures which occur in the upper limb, particularly in young adults and senior osteoporotic patients. The best surgical treatment for intra-articular DRFs is still up for debate, while K-wire fixation and volar locking plates are common methods. Hypothesis: For adults with distal radius fractures participated in joint repair surgery, volar locking plate fixation and K-wire fixation would yield equivalent short-term functional outcomes. Research Question: Does the functional outcome of volar locking plate fixation compare favorably with the K-wire fixation at short-term in adult patients with intra-articular distal radius fractures?

Study Design: Randomized controlled trial.

Place and Duration of Study: The Department of Orthopaedics at Gujranwala Medical College from 13 August 2025 to 13 November 2025.

Methodology: A total of 174 people who had an injury to the distal radius from 30 to 65 years old were recruited and were equally divided by random allocation into two treatment groups. There were 87 patients in each group, A (volar locking plate fixation) and B (percutaneous K-wire fixation). Functional results were assessed using the Quick Disabilities of the Arm, Shoulder, and Hand (Quick DASH) score and on six weeks' follow-up. The collected data were analyzed using SPSS v26 at 0.05 significance level.

Results: DASH scores were good in 47.1% of Group A; and in 31.0% of Group B, which was a considerable improvement in functional results. Of the 17 patients in the K-wire group, poor outcomes occurred in 17.2% while none of the 20 patients in the volar plate group had poor outcomes. The mean DASH score was lower for the volar plate group (8.9 ± 4.7) than for the K-wire group (14.6 ± 6.2) indicating greater function and recovery for the volar plate group. **Concl.** Volar locking plate fixation has yielded better early functional outcome results when compared to K-wire fixation. The two methods are both clinically viable practices however, it may be the preferred method in cases where shorter rehabilitation time and better early recovery is required.

Conclusion: Volar plate fixation showed superior early functional recovery compared to K-wire fixation, though both methods were effective treatment options.

Keywords: Distal Radius Extra-Articular Fractures, Volar Plate Fixation, K-Wire Fixation, Functional Outcome Comparison.

INTRODUCTION

Distal radius fractures (DRF) comprise almost a quarter (25%) of all upper limb fractures presenting to the emergency room (ER) (1). They are the third common fracture after hip fracture and spinal fracture and most common fracture of the upper limb (2). Strangely enough, the pattern of fracture occurrence is bifocated,

in that postmenopausal women are liable to those resulting from low energy trauma (osteoporosis) and young men to high energy trauma (1). In addition, the global burden of DRFs is expected to grow due to an ageing population and improved life expectancy, necessitating the need to optimise the management of DRFs. Conservative treatment for fractures of the distal

radius is achieved using closed reduction and immobilisation in a cast (less sophisticated) and called surgical alternative are percutaneous pinning or open reduction and internal fixation (ORIF). While it is sometimes useful to recommend conservative management for stable and minimally displaced fractures, more complicated or unstable gaps often require surgical intervention for anatomic alignment and function (3,4). The two common surgical procedures are open reduction and internal fixation (ORIF), using volar locking plates and percutaneous fixation (Perc) using Kirschner wires (K-wires). If the instability of the metaphyseal area or simple intra-articular involvement occurs, fixation with k-wire is preferred because it is minimally-invasive, easy to use, relatively inexpensive and practical (5). However, it is associated with problems such as pin drift and infection and offers little fragment control.

In unstable and intra-articular fractures, however, faster mobilisation and potentially improved functional outcomes with volar locking plate fixation, with fracture reduction and alignment greater than side-to-side compression with screws, resulted in this method being the preferred fixation technique (6). There are however drawbacks to this technique including greater surgical manipulation and an increased risk of tendon damage, hardware complications and wound problems (7,8). There are tools such as the Quick Disabilities of the Arm, Shoulder, and Hand (Quick DASH) score that enable patient-reported outcomes to be accurately measured, but outcomes of these interventions for functional recovery can vary significantly. Although both techniques have been used extensively, there is limited local information on the functional outcome of the two techniques, especially in the immediate postoperative period. In a randomised experiment (9,10), though issues were found in both groups, the patient who received volar plating had better results at 6 weeks compared to patient who was also K-wire fixed. This highlights that context-specific evidence-based recommendations are essential to provide for surgical decision making and promote the greatest possible recovery from surgery. In this study, the authors compared functional outcomes of volar plate fixation with distal radius articular fractures to K-wire fixation and the clinical relevance and ongoing debate regarding the optimal method for fixation. The results are anticipated to enhance fracture management and treatment guidelines for such common injuries.

Objective

To evaluate the functional outcomes of volar plate fixation and K-wire fixation in patients with extra-articular distal radius fractures.

METHODOLOGY

The research summary was then formally approved by Institutional Research and Ethics Committee and a randomized controlled trial was conducted in the Department of Orthopaedics in Gujranwala Medical College from 13 13 August 2025 till 13 13 November

2025. Ethical approval was obtained before data collection and informed written consent was obtained from all participants after they were thoroughly informed about the aims, risk and benefits of the study. All participants were assured of confidentiality, voluntary participation and freedom to refuse at any time without interrupting their usual medical care. Based on the operational definition, the study population consisted of adult patients (30-65 years old, without age limits), with distal radius fractures confirmed on conventional radiographs. Patients with open fractures, patients with a body mass index (BMI) over 30 kg/m², patients with a history of smoking, polytraumatization or Glasgow coma score (GCS) below 15 that would have affected compliance or follow-up were also excluded. In order to minimise confounding factors that could affect fracture healing or post-operative functional recovery, these exclusion criteria were chosen (11,12). The sample size was calculated to be 19 participants based on a 95% confidence level with a power of 80% due to the assumption of an expected mean Quick DASH score of 63.08% for the volar plate group and 41.54% for the K-wire group using OpenEpi software. This gave a total number of 174 patients/people in the sample (87 patients allocated to each group). In order to reduce allocation bias, patients were randomly assigned to treatment arms using blocked randomisation with age-matching using a non-probability sequential sampling technique. In group A, some patients underwent open reduction and internal fixation with volar locking plates while in group B, some patients underwent closed reduction and percutaneous fixation with K-wires. Surgery was performed by qualified orthopaedic surgeons following standard practice. All patients were followed up after 6 weeks from surgical intervention and the functional outcomes were evaluated. Functional assessment was carried out using a validated index called the Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH) score that measures physical function and symptoms of upper limb musculoskeletal diseases. The baseline demographic and clinical parameters, such as age, gender, BMI, side of injury, duration of Fracture presentation in hours, Educational status, Profession, Socioeconomic background and AO fracture classification (13-15) were all recorded on a pre-designed data collection proforma by the principal investigator. Objectively recorded at 6 weeks' follow-up end. An IBM SPSS Statistics version 26 software package was used to perform statistical analysis, and the Shapiro-Wilk test was used to determine whether continuous variables—such as age, BMI, duration of fracture, or DASH scores—were tested for normality. While frequencies and percentages were calculated for categorical variables like gender, fracture laterality, AO type, and functional outcome categories, means and standard deviations (or medians and interquartile ranges when appropriate) were provided for continuous data. The Chi-square test or Fisher's exact test, if applicable, were used to compare the functional results between the

two therapy groups. To control for any possible confounding, functional outcomes were divided among demographic groups including gender, age, BMI, laterality, AO fracture type and fracture duration. The post-stratification tests included a Chi-square test and Fisher's exact test. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Altogether 174 patients with distal radius articular fractures were recruited, and divided in two groups, Group A being treated with volar locking plates and Group B, with closed reduction and percutaneous fixation by K-wires, both groups being of equal size. Group A's mean age was 48.6 ± 9.3 years, whereas Group B's was 49.1 ± 8.7 years. The distribution of genders was comparable in both groups, with a little higher percentage of men. The volar plate group's average BMI was 24.1 ± 3.2 , while the K-wire groups was 24.5 ± 3.5 . Most of those in both groups were in the middle income spectrum. Urban residents made up slightly more than 50% of those who completed both rows; also, within each arm, there were slightly more urban than rural residents. The average injury time before presentation was 9.2 ± 2.1 hours in the volar plate group, and 9.5 ± 2.3 hours in the K-wire group. Similar fractural distribution was found in both groups (Type B the most common, Type C and Type A). Functional results were assessed by the Quick DASH score, six weeks after the surgery. In Group A, 41 of 86 (47.1%) patients had excellent results, 26 of 86 (29.9%) patients had a good result and 20 of 86 (23.0%) had a tolerable result, whilst there were no bad results. For group B the converse was true with favorable results of 25.3% of patients, adequate results 26.4%, poor 17.2%, and exceptional 31.0%. The functional limitation (Quick DASH) was worse in the K-wire than in the volar plate group (mean score 14.6 ± 6.2 versus 8.9 ± 4.7). These findings demonstrate that although both types of treatment (surgical and non-surgical) resulted in favorable clinical outcomes in a significant number of patients, volar locking plate fixation was associated with a higher number of excellent outcomes and a lower number of poor outcomes at six weeks' post-surgery. Comparable baseline characteristics and differences in AO fracture distribution between groups enhanced internal validity of outcome comparisons. The two groups were comparable at baseline with no significant differences in age, gender distribution, BMI, socioeconomic status, occupation, or residence. Both Group A (Volar Locking Plate) and Group B (K-wire) had similar demographic and socioeconomic profiles, with only minor variations in employment and urban-rural distribution. Overall, the groups were well matched, minimizing potential confounding factors (Table 1).

Table 1. Demographic Characteristics of Study Participants

Variable	Group A: Volar Locking Plate (n=87)	Group B: K-wire (n=87)
Age (years, mean \pm SD)	48.6 ± 9.3	49.1 ± 8.7
Gender		
Male	52	49
Female	35	38
BMI (kg/m ² , mean \pm SD)	24.1 ± 3.2	24.5 ± 3.5
Socioeconomic Status		
Lower	26	30
Middle	48	45
Upper	13	12
Occupation Status		
Employed	63	58
Unemployed	24	29
Residence		
Rural	33	35
Urban	54	52

Results for functional outcomes with DASH scores were superior in the Volar Locking Plate group. In group A, excellent, functional results were obtained in nearly half (47.1%), while in group B 17.2% of K-wire patients obtained poor functional results. The results suggest that volar locking plate fixation results in improved functional recovery than K-wire fixation. (Table 2).

Table 2. Functional Outcomes by DASH Score

DASH Outcome Category	Group A: Volar Locking Plate (n=87)	Group B: K-wire (n=87)
Excellent (0–5)	41 (47.1%)	27 (31.0%)
Good (6–15)	26 (29.9%)	22 (25.3%)
Satisfactory (16–35)	20 (23.0%)	23 (26.4%)
Poor (>35)	0 (0.0%)	15 (17.2%)

A lower mean DASH score (8.9 ± 4.7) was observed in the Volar Locking Plate group, which considered good functional outcomes than the K-wire group (14.6 ± 6.2) ($p < 0.001$). The result further substantiated that volar locking plate fixation is superior because lower scores indicate better upper limb functions (Table 3).

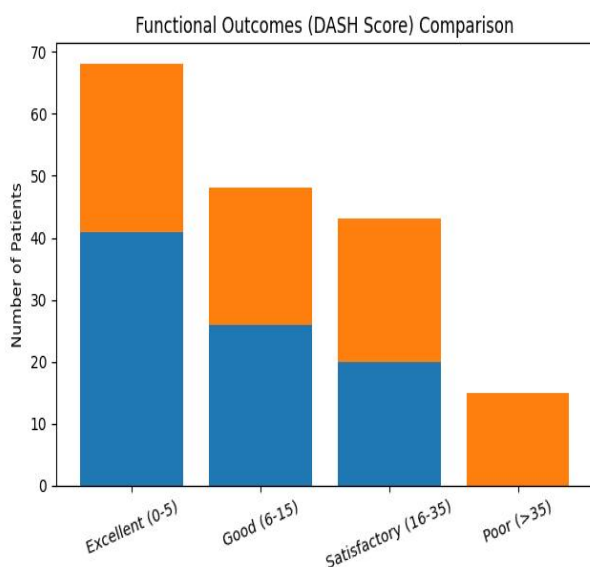
Table 3. DASH Score Summary

Group	Mean DASH Score \pm SD
Volar Locking Plate	8.9 \pm 4.7
K-wire	14.6 \pm 6.2

The distribution of AO fracture types was comparable between the two groups. Type C fractures were the most common in both groups, followed by Type B and Type A fractures. This similarity indicates that fracture severity was evenly distributed, ensuring a fair comparison of treatment outcomes between the two groups (Table 4).

Table 4. AO Fracture Type Distribution

AO Fracture Type	Group A: Volar Locking Plate (n=87)	Group B: K-wire (n=87)
Type A	25	27
Type B	30	29
Type C	32	31



DISCUSSION

The findings of this study are included in the growing body of evidence that has been gathered to compare percutaneous K-wire fixation with volar locking plate fixation of distal radius articular fractures. This trial's

early good functional outcomes statistically associated with volar plate fixation are in agreement with numerous recent studies. There was a higher rate of excellent functional outcomes and significantly better DASH scores in the volar plate group compared to the K-wire group at 6 weeks, favouring the early recovery trajectory. Conclusions for the 2 treatments were similar, though results in the volar plate group at 3 and 6 months were found to have better scores on the DASH and PREW, respectively (16). Similarly, a study showed that the volar plate group had significantly higher scores at three and six months but 12 months later the functional rating was comparable for both (17). A recent meta-analysis which combined data from 14 RCTs with over 1,400 patients confirmed these findings. It was found that volar locking plate fixation gave higher ROM and better DASH score especially in early post-operative period and the differences lost significance after 1 year (18). The study acknowledges that both approaches worked well and have been widely used, but are still attuned to their limitations. Enhanced by K-wire fixation, the study concluded that it remains a good choice especially when minimally invasive treatment is indicated, despite the superior ROM and lower complication rates of volar plate fixation (19). But having a fine understanding of challenges is essential. The 17.2% poor outcomes in the K-wire group contrasted with the lack of poor outcomes in the present investigation in the volar plate group. This is similar to the literature reporting more instances of hardware-related pain and superficial hardware infection in the K-wire group, however, final functional outcome was the same between the two groups (20). Most importantly, the benefits of volar plating, including early advantages, could have an economic impact that extends beyond socioeconomic issues generally and working populations in particular, in which speed with which patients regain function becomes a paramount consideration. Studies (21, 22) indicate that volar plates are beneficial in early recovery of grip strength and ROM, which allows for earlier rehabilitation and return to day-to-day activities. Strengths of the study are the inclusion of established and valid outcome measures, age matching of subjects within groups and a randomised design. Real-life factors such as occupation, level of socioeconomic status, and urban-rural distribution have been included which enhances the external validity of the results. Future research will include studies comparing the cost effectiveness of both approaches, long-term outcomes and complete patient satisfaction. Moreover, more specific recommendations for individualised care could be developed using data from multi-centre trials, which have larger numbers of patients and also fracture type (e.g. AO fracture classification) and age subgroups (e.g. 23). Finally, in distal radius articular fractures, volar locking plate fixation was shown to be associated with better early functional outcomes and to reduce the incidence of bad outcomes, compared to K-wire fixation. Although both are applicable, in situations

with a positive impact in early functional recovery, they may have an impact on clinical decision.

Limitations

There are some minor limitations of this study, however. First, the time up to 6 weeks is a very short time to evaluate long-term functional results and any late complications, like hardware irritation or post-traumatic arthritis. Long-term studies have shown similar results after the first year for both techniques, although it seems as though much better initial scores are being obtained with volar plating. Second, the absence of blinding may cause an evaluation of results to be less than impartial. Third, there may be limited applications in larger populations because of use of a single center and the non-probability sampling technique.

CONCLUSION

For distal radius articular fractures, the results of this study indicate that good early functional outcomes occur more, and poor outcomes less, often in excellent outcome is more frequently seen with volar locking plate fixation than is seen with K-wire fixation at 6 weeks. Both procedures are effective, but the volar plate procedure may be preferable when swift rehabilitation coupled with good functional results is the immediate goal. These findings emphasise the importance of individualized surgical decision making by fracture type and patient's needs and the increasing clinical application of this approach.

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