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TO COMPARE THE FUNCTIONAL OUTCOME OF DISTAL END OF RADIUS FRACTURE MANAGED BY KAPANDJI TECHNIQUE VS VOLAR PLATING

Orthopaedics

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ABSTRACT

Background: Distal radius fractures are among the most common orthopedic injuries, with increasing preference for operative management to restore anatomy and expedite function. Kapandji intrafocal pinning and volar locking plate fixation are widely used techniques, yet their comparative functional effectiveness remains debated. **Aim:** To compare functional and radiological outcomes of distal end radius fractures treated using Kapandji intrafocal pinning versus volar locking plate fixation. **Methods:** A prospective randomized comparative study was conducted at a tertiary-care center over 18 months, involving 60 adults with acute distal radius fractures. Patients were randomized equally into Kapandji (n=30) and volar plating groups (n=30). Functional outcomes were assessed using VAS, grip strength, range of motion, DASH, and PRWE scores at 1 week, 1 month, 3 months, and 6 months. Radiological parameters (radial height, inclination, volar tilt, union) were evaluated at each follow-up. **Results:** Both groups achieved 100% fracture union. Volar plating showed significantly better early VAS scores ($p<0.05$), faster recovery of wrist ROM, and superior grip strength at all follow-ups. DASH scores were significantly lower in the volar plating group at 1 month (36.4 vs 42.6), 3 months (20.3 vs 26.8), and 6 months (14.2 vs 18.6). PRWE scores at 6 months favored volar plating (17.8 vs 23.2, $p<0.05$). Radiological parameters were better restored and maintained with volar plating across all intervals ($p<0.05$). Minor complications were more common in the Kapandji group (pin-tract infection 10%, loss of reduction 6.7%). **Conclusion:** Both procedures provide satisfactory outcomes, but volar plating offers superior early functional recovery, better radiological maintenance, and improved patient-reported outcomes. Kapandji remains a valuable, cost-effective option for selected extra-articular fractures.

KEYWORDS

distal radius fracture, Kapandji technique, volar locking plate, DASH, PRWE, randomized study.

INTRODUCTION

Distal end radius (DER) fractures are among the most frequent skeletal injuries encountered in orthopedic practice, accounting for nearly one-sixth of all fractures in adults. They occur across all age groups but show a bimodal distribution-high-energy trauma in younger individuals and low-energy fragility injuries in older adults, particularly postmenopausal women. As the wrist plays a crucial role in daily activities, disturbance of distal radial anatomy can significantly affect wrist biomechanics, grip strength, and overall upper-limb function.

Historically, non-operative casting was the mainstay of treatment; however, its limited ability to maintain anatomical reduction in unstable patterns often resulted in malunion, stiffness, and long-term functional impairment. Consequently, surgical management has gained widespread acceptance, with volar locking plate fixation and percutaneous pinning emerging as two commonly employed options.

Volar plate fixation offers rigid internal stabilization, reliable restoration of volar tilt and radial height, and permits early mobilization. Conversely, the Kapandji intrafocal pinning technique is a minimally invasive, cost-effective alternative that utilizes K-wires inserted within the fracture line to achieve reduction and stabilization with minimal soft-tissue disruption. While both techniques are widely used, the literature remains inconclusive regarding their comparative effectiveness, particularly concerning early functional recovery, grip strength, and maintenance of radiological parameters.

Given these considerations, the present prospective randomized study aims to compare functional and radiological outcomes of DER fractures managed with the Kapandji technique versus volar locking plate fixation. The findings seek to guide clinicians in selecting the most appropriate treatment modality based on fracture characteristics, functional demands, and resource availability.

MATERIALS AND METHODS

Study Design And Setting

A prospective randomized comparative study conducted over 18 months at Rajshree Medical Research Institute. Bareilly, UP.

Sample Size And Randomization

Sixty adults meeting inclusion criteria were randomized equally into:

Group 1 – Kapandji intrafocal pinning (n=30)
Group 2 – Volar locking plate fixation (n=30)

Inclusion Criteria

Age ≥ 18 years
Acute distal radius fractures confirmed radiologically
Fit for surgery and able to provide consent

Exclusion Criteria

Previous wrist fracture/surgery
Pathological fractures
Polytrauma
Complex intra-articular volar Barton fractures unsuitable for both techniques

Surgical Techniques

Standardized operative protocols were followed for both groups. Kapandji involved intrafocal K-wire lever reduction and three-point fixation, followed by casting. Volar plating used modified Henry approach and fixed-angle LCP application, allowing early mobilization.

Outcome Measures

Functional outcomes:
VAS pain scale
Wrist ROM using goniometer
Grip strength as % of normal side
DASH score (1, 3, 6 months)
PRWE score (6 months)

Radiological Parameters

Radial height
Radial inclination
Volar tilt
Union status

Statistical Analysis

Data analysis was performed using Statistical Package for the Social Sciences version 25.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages.

Independent t-test → Comparison Of Continuous Variables Between Groups

Repeated Measures ANOVA → DASH, VAS, ROM, grip strength over time

Chi-square/Fisher's exact tests → categorical variables

Pearson correlation → relationship between radiological and functional outcomes

A p-value < 0.05 was considered statistically significant.

RESULTS

Demographics

Both groups were comparable in age, gender, limb dominance, fracture pattern, and mechanism of injury (p>0.05).

Age Group (years)	Kapandji (n=30)	Volar Plating (n=30)	Total (n=60)
18–30	4 (13.3%)	5 (16.7%)	9 (15.0%)
31–40	6 (20.0%)	7 (23.3%)	13 (21.7%)
41–50	9 (30.0%)	8 (26.7%)	17 (28.3%)
51–60	7 (23.3%)	6 (20.0%)	13 (21.7%)
>60	4 (13.3%)	4 (13.3%)	8 (13.3%)
Mean ± SD (years)	46.8 ± 12.4	45.3 ± 11.9	—

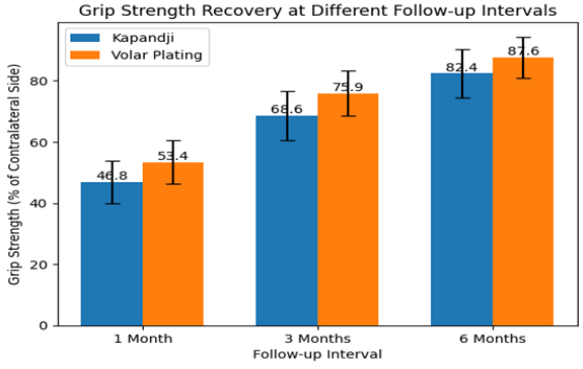
Pain (VAS)

Volar plating resulted in significantly lower pain at 1 week and 1 month (p<0.05). Pain differences equalized by 6 months.

Follow-up Interval	Kapandji Group (Mean ± SD)	Volar Plating Group (Mean ± SD)	p-value
1 week	5.6 ± 1.1	4.8 ± 1.0	0.01
1 month	3.4 ± 0.9	2.8 ± 0.8	0.02
3 months	1.6 ± 0.6	1.3 ± 0.5	0.07
6 months	0.8 ± 0.4	0.6 ± 0.3	0.09

Grip Strength

Volar plating demonstrated superior recovery at all time points (p<0.05).



Range Of Motion

Earlier improvement in flexion, extension, pronation, and supination was observed with volar plating (p<0.05).

Follow-up	Group	Flexion (°) Mean ± SD	Extension (°) Mean ± SD
1 month	Kapandji	32.6 ± 6.4	30.1 ± 5.9
	Volar plating	38.9 ± 6.1	36.7 ± 5.4
3 months	Kapandji	51.8 ± 7.3	48.4 ± 6.9
	Volar plating	58.6 ± 6.8	55.2 ± 6.3
6 months	Kapandji	64.2 ± 8.6	60.7 ± 7.8
	Volar plating	68.5 ± 7.9	65.1 ± 6.9

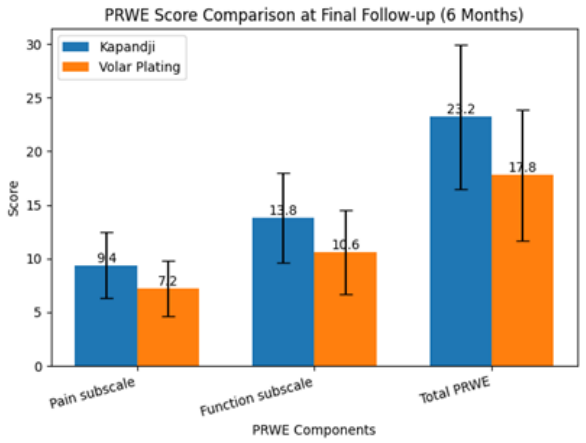
Functional Scores

At 6 months:

DASH: Kapandji 18.6 ± 6.2 vs Volar plating 14.2 ± 5.4 (p=0.01)

Follow-up Interval	Kapandji Group (Mean ± SD)	Volar Plating Group (Mean ± SD)	p-value
1 month	42.6 ± 8.1	36.4 ± 7.5	0.01
3 months	26.8 ± 6.9	20.3 ± 6.1	0.01
6 months	18.6 ± 6.2	14.2 ± 5.4	0.01

PRWE: Kapandji 23.2 ± 6.7 vs Volar plating 17.8 ± 6.1 (p=0.01)



Radiological Parameters

Volar plating significantly better maintained:
Radial height
Radial inclination
Volar tilt
throughout follow-up (p<0.05).

Radiological Parameter	Follow-up	Kapandji (Mean ± SD)	Volar Plating (Mean ± SD)	p-value
Radial Height (mm)	Immediate Post-op	11.6 ± 1.3	12.8 ± 1.2	0.01
	1 month	11.2 ± 1.4	12.5 ± 1.3	0.01
	3 months	10.9 ± 1.4	12.3 ± 1.2	0.01
	6 months	10.8 ± 1.4	12.1 ± 1.2	0.01
Radial Inclination (°)	Immediate Post-op	21.8 ± 3.2	23.9 ± 2.7	0.02
	1 month	21.3 ± 3.2	23.4 ± 2.6	0.02
	3 months	20.9 ± 3.1	23.1 ± 2.6	0.01
	6 months	20.6 ± 3.1	22.8 ± 2.6	0.01
Volar Tilt (°)	Immediate Post-op	8.6 ± 2.4	11.4 ± 2.2	0.01
	1 month	8.1 ± 2.4	11.0 ± 2.2	0.01
	3 months	7.7 ± 2.3	10.6 ± 2.1	0.01
	6 months	7.4 ± 2.3	10.2 ± 2.1	0.01
Fracture Union (%)	1 month	60%	70%	0.39
	3 months	93.3%	96.7%	0.55
	6 months	100%	100%	–

Complications

1- Kapandji: pin-tract infections (10%), loss of reduction (6.7%).
2- Volar plating: tendon irritation (6.7%), superficial infection (3.3%).
No major complications in either group.

DISCUSSION

The present study compared Kapandji intrafocal pinning and volar locking plate fixation in the management of distal end radius fractures, with particular emphasis on functional outcomes. The findings demonstrate that while both techniques achieve reliable fracture union and acceptable long-term function, volar plating consistently offers superior early functional recovery, better radiological maintenance, and greater patient-reported satisfaction.

Our results revealed significantly lower DASH and PRWE scores, faster improvement in wrist motion, and stronger grip strength in the volar plating group throughout the early postoperative period. These outcomes align closely with previous studies. Rozental et al. reported substantially better early mobility, grip strength, and DASH scores in patients treated with volar plates, although long-term differences diminished by one year. Similarly, Chaudhry et al., in a meta-analysis of seven randomized trials, found volar plating to offer statistically superior DASH scores at 3 and 12 months, though the improvements did not exceed the minimum clinically important difference. This pattern was also observed by Peng et al., who documented superior supination strength and better radiographic alignment with plating.

In contrast, the Kapandji method—though minimally invasive and cost-effective—demonstrated slower early functional recovery in the present study. Grip strength and range of motion lagged behind the volar plating group at each follow-up interval. This is consistent with

literature indicating that intrafocal pinning requires postoperative immobilization, delaying functional rehabilitation. Studies by McQueen, Kim, and Moon have also reported higher rates of reduction loss and slower return of motion with percutaneous techniques, particularly in osteoporotic or comminuted fractures.

However, the Kapandji technique still produced acceptable functional outcomes at six months, consistent with major comparative evidence. The landmark DRAFFT trial involving 461 patients found no clinically meaningful long-term differences between K-wires and volar plating based on PRWE scores at 3, 6, and 12 months. Costa et al.'s 5-year follow-up reinforced this equivalence, demonstrating convergence of functional outcomes over time regardless of fixation method. Our study mirrors this trend—while early functional parameters favored volar plating, both groups achieved satisfactory function by six months, indicating that long-term recovery may be similar when appropriate rehabilitation is maintained.

Radiological outcomes in our study favored volar plating across all parameters—including radial height, inclination, and volar tilt—findings consistent with **Brennan et al.** and **Kiernan et al**., who showed radiographic superiority of plating. These parameters have been correlated with improved early function, and the stronger correlation coefficients observed in our volar plating cohort support that anatomical restoration more reliably translates to better function when rigid fixation is used.

Complication patterns also reflected established trends. Pin-tract infections and reduction loss occurred only in the Kapandji group, echoing findings from **Parupalli et al.** and **Shyamalan et al**. Conversely, volar plating was associated with tendon irritation—a known hardware-related issue—though no major complications were observed. The overall complication rates remained low in both groups.
In summary, the present study supports the growing body of evidence indicating that volar plating provides superior early functional outcomes and more consistent radiological restoration, while the Kapandji technique remains a valid, cost-effective option for selected extra-articular fractures, particularly where early functional demands are lower or implant costs are limiting.

CONCLUSION

Both the Kapandji intrafocal pinning technique and volar locking plate fixation proved effective in achieving reliable fracture union and satisfactory functional recovery in distal end radius fractures. However, volar plating demonstrated clear advantages in the early postoperative period, including superior pain reduction, faster restoration of wrist motion, improved grip strength, and better patient-reported outcomes. It also provided more consistent maintenance of anatomical parameters such as radial height, inclination, and volar tilt.

Despite these benefits, the Kapandji technique remains a valuable, minimally invasive, and cost-effective option for selected extra-articular and less complex fractures, particularly in resource-limited settings. Overall, treatment should be individualized based on fracture pattern, functional demands, and clinical context, with volar plating favored when early functional recovery and anatomical precision are priorities.

REFERENCES

1. Parupalli S, et al. Comparative study of Kapandji technique versus volar plating in comminuted distal radius fractures. *J Orthop Surg*. 2019.
2. Bhatnagar P, et al. Volar locking plate versus K-wire fixation for intra-articular distal radius fractures in geriatric patients. *J Orthop Spine*. 2025.
3. Ahmed S, et al. Outcomes of distal radius fractures managed with casting versus percutaneous K-wire fixation. *Indian J Orthop*. 2024.
4. Rozental TD, et al. Prospective randomized comparison of volar plate fixation versus percutaneous pinning in distal radius fractures. *J Bone Joint Surg Am*. 2015.
5. Peng L, et al. Volar locking plate versus percutaneous pinning for distal radius fractures: A meta-analysis. *J Hand Surg*. 2018.
6. Kiernan C, et al. Radiographic and functional outcomes of volar plating compared with K-wire fixation. *Injury*. 2012.
7. Brennan SA, et al. Comparison of radiological and functional results between K-wire fixation and volar plating. *Acta Orthop Belg*. 2016.
8. Costa ML, et al. DRAFFT trial: K-wire fixation versus volar plating for dorsally displaced distal radius fractures. *Lancet*. 2014.
9. Costa ML, et al. Five-year outcomes of the DRAFFT trial. *Bone Joint J*. 2019.
10. Chaudhry H, et al. Meta-analysis of volar locking plates versus percutaneous K-wires in distal radius fractures. *Acta Orthop*. 2015.
11. Rizzo M, et al. External fixation and pinning versus volar plate fixation for intra-articular distal radius fractures. *J Hand Surg Am*. 2008.
12. Kim J, et al. Predictors of reduction loss after Kapandji pinning for distal radius fractures. *Clin Orthop Surg*. 2010.
13. Moon JG, et al. Stability analysis of Kapandji pinning in osteoporotic distal radius fractures. *J Orthop Trauma*. 2012.
14. Samal P, et al. Volar locking plate versus K-wire fixation in intra-articular distal radius fractures: Randomized study. *Orthop Traumatol Surg Res*. 2025.
15. Shyamalan G, et al. Cost analysis of K-wire fixation versus volar plating. *Ann R Coll Surg Engl*. 2009.
16. McQueen MM, Caspers J. Relationship between deformity and functional outcome in Colles' fractures. *J Bone Joint Surg Br*. 1988.
17. Trumble TE, et al. Intrafocal pinning outcomes in distal radius fractures. *J Hand Surg Am*. 2000.
18. Kapandji A. Intrafocal pinning technique for distal radius fractures. *Ann Chir Main*. 1987.
19. Yetkin H, et al. Comparison of volar plates and K-wires in AO type C1 distal radius fractures. *Acta Orthop Traumatol Turc*. 2017.
20. Khan M, et al. Randomized comparison of K-wire versus volar plating in AO type A/B distal radius fractures. *Cureus*. 2023.