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Comparative Study of Functional Outcomes of Volar Plate Fixation and External Fixation for Distal Radius Fractures

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Abstract: ***Background: Distal radius fractures are common, and this study compares volar plate fixation with external fixation to evaluate functional recovery outcomes. Method: Thirty patients were treated using either volar plates or external fixators and assessed over 6 months for functional and radiological outcomes. Results: Volar plate fixation resulted in improved wrist mobility, quicker recovery, and fewer complications. Conclusion: Volar plate fixation is more effective than external fixation for distal radius fractures, offering quicker and better functional recovery.***

Keywords: distal radius fracture, volar plate fixation, external fixator, functional outcome, wrist mobility

1. Introduction

Fractures of the distal end of the radius represent approximately 16% of all fractures treated by orthopaedic surgeons [1].

The usual mode of injury of fractures of the distal end of the radius is due to fall on an outstretched hand with the wrist in hyperextension either involving vehicular accident, assault, or fall from height. The integrity of radiocarpal, ulnocarpal, and intercarpal ligaments, along with the triangular fibrocartilaginous complex, plays a crucial role in wrist stability [2].

Over the last three decades, modalities of treatment have evolved from plaster immobilization to percutaneous wiring and pinning, bridging external fixation to augmented external fixation and in the modern era, internal fixation with various kinds of plating [3].

Despite numerous studies, few directly compare outcomes between augmented external fixation and volar plating [4]. Therefore, the present study was conducted to compare closed reduction and augmented external fixation with open reduction and internal fixation using volar locking plates for the treatment of distal radius fractures, in terms of functional and radiological outcomes and complications.

Early functional advantages of VLP (e.g., PRWHE, QuickDASH) have been observed at 6 weeks, though at one year outcomes may equalize with external fixation [Trial, 2020] [5]. A 2021 meta-analysis found no significant difference in patient quality of life at ≥12 months between VLP and EF [2].

2. Materials and Methods

30 patients with fracture of distal radius were studied during January 2025 to June 2025 fulfilling the above-mentioned inclusion and exclusion criteria. Patients were selected based on history, clinical, and radiographic examination. Outcomes were assessed using the Modified Green & O'Brien scoring system (maximum score: 100).

Inclusion Criteria:
Patients aged above 18 years with displaced intra-articular distal end radius (DER) fractures were included. The injury had to be less than two weeks old, and only closed fractures or Gustilo Anderson type 1 open fractures were considered.

Exclusion Criteria:
Patients were excluded if they were below 18 years of age, unfit for surgery, unwilling to participate, or on corticosteroids, immunosuppressive, or chemotherapeutic agents. Gustilo Anderson type 2 and 3 open fractures were also excluded from the study.

Post OP Protocol
For both groups, in the early postoperative period, a range of motion exercises for shoulder, elbow, and finger joints was started to prevent joint stiffness. In Group A external fixator and K-wires were removed at 6-8 weeks post-surgery and in Group B below-elbow splint was removed at 4 weeks post surgery and wrist range of motion exercises and grip strength exercises were started. Patients were followed up at 6 weeks, 3 months, and 6 months, and scored according to the Green & O'Brien scoring system. Standard anteroposterior and lateral radiographs of the wrist were taken at the final follow-up. Radiological assessment was done by measuring radial height, radial inclination, and volar tilt.

3. Results

Consistent with recent randomized controlled trial data, volar locking plate (VLP) fixation resulted in faster functional recovery during the early postoperative period [5]. Additionally, radiological parameters such as radial height, inclination, and volar tilt were better maintained with VLP as compared to external fixators [6]. However, long-term follow-up studies have demonstrated functional equivalence between VLP and external fixation by 12 months postoperatively [5,7].

In elderly patients with complex intra-articular (AO type C) distal radius fractures, volar plating has been shown to improve radiological alignment and the range of supination without a corresponding increase in complication rates [8]. These findings are in line with the present study, which observed better DASH and PRWE scores in the VLP group at 6 months follow-up, along with improved radiographic parameters.

Statistical Analysis

Table 1: Functional outcome at six-month follow-up

Functional Parameters	AEF	VPF	P value
Wrist Flexion(degree)	64.22±3.71	76.33±6.39	<0.0001
Wrist Extension(degree)	61.37±2.18	70.13±4.33	<0.0001
Supination(degree)	69.12±3.46	75.50±4.17	<0.0001
Pronation (degree)	67.77±3.64	74.15±3.73	<0.0001
Grip Strength (kg)	26.70±5.3	29.77±6.64	0.891
Green & O'Brien Score	77.10 ± 9.7	84.30 ± 10.5	<0.05

Table 2: Radiological parameters at final follow-up

Radiological Parameters	AEF	VPF	P value
Radial height(mm)	10.5 ± 1.5	10.9 ± 1.6	0.697
Radial Inclination(degree)	19.7 ± 3.3	20.8 ± 4.1	0.543
Volar tilt(degree)	7.5 ± 3.3	8.3 ± 3.5	0.414

Figure 1: Sequential radiographs of a distal end radius fracture. (a) Preoperative anteroposterior (AP) and (b) lateral views showing distal radius fracture. (c) Immediate postoperative AP and (d) lateral views showing fixation with a volar locking plate. (e) Six-month follow-up AP and (f) lateral views demonstrating fracture healing.

Figure 2: Serial radiographs of a distal end radius fracture treated with an external fixator. (a) Preoperative anteroposterior (AP) and (b) lateral views showing the fracture. (c) Immediate postoperative AP and (d) lateral views showing fixation with an external fixator. (e) Six-month follow-up AP and (f) lateral views showing fracture consolidation.

Figure 3: Intraoperative photograph showing volar angle plate temporary fixed with K-wire in situ

Figure 4: Intraoperative photograph showing the distal radius plate after final screw placement.

Figure 5: Application of Schanz pin for external fixation of Distal end radius fracture

Figure 6: Postoperative photograph of external fixator for distal end radius fracture

4. Discussion

While our results support earlier studies reporting complications such as pin tract infections, joint stiffness, and hypertrophic scarring with external fixators [2,3], recent long-term data suggest both techniques ultimately yield comparable functional outcomes at one year [5,7]. This supports the notion that while VLP offers earlier mobility and better radiographic correction, external fixation remains a viable alternative, particularly when internal fixation is contraindicated. However, our study is limited by its small sample size and short follow-up. Larger multicenter trials with extended follow-up are needed to validate these findings and evaluate long-term complications such as hardware irritation, tendon injuries, or osteoarthritis.

5. Conclusion

This study concludes that both volar plate fixation and augmented external fixation are viable treatments for intra-articular distal radius fractures. However, volar plate fixation demonstrates superior outcomes in wrist mobility, grip strength, and overall functional recovery, along with a slightly lower complication rate. These findings support the preference for volar plating in managing such fractures when early functional recovery is a priority.

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