

Clinical and Radiographic Outcomes following Volar Locked Plating versus Dorsal Bridge Plating for Distal Radius Fractures: A Propensity Score-Matched Analysis

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INTRODUCTION: Distal radius fractures indicated for operative intervention are most commonly treated with volar locked plating (VLP) and dorsal bridge plating (DBP). The purpose of this study was to utilize a propensity score to match and compare the radiographic and clinical outcomes of patients undergoing VLP or DBP for distal radius fractures.

METHODS: We performed a retrospective, propensity score-matched analysis of patients undergoing VLP or DBP treatment for isolated distal radius fractures from 2015 to 2022. Patients were propensity score matched by a total of 8 demographic and comorbidity factors, AO Foundation/Orthopaedic Trauma Association (AO/OTA) classification, and preoperative Patient-Reported Outcomes Measurement Information System (PROMIS) scores. Our primary outcomes included postoperative complications, wrist and forearm range of motion, grip strength, and radiographic measurements, including radial height, radial inclination, volar tilt, and articular step-off.

RESULTS:

Overall, 415 DBP and 2,075 VLP were successfully propensity score matched and included in this study. Grip strength and range of motion measurements at 6-month follow up, including wrist flexion, wrist extension, forearm pronation, forearm supination, radial deviation, and ulnar deviation, were increased in the VLP compared to DBP (p<0.05). Complication rates among both groups were relatively low, however, the rate of malunion and nonunion was significantly higher among the DBP group (p<0.05). Radial height, radial inclination, and articular step-off were improved in the VLP group compared to the DBP group (p<0.05), however, volar tilt was similar between groups. PROMIS Upper Extremity (UE) and Physical Function (PF) were significantly higher among the VLP group (p<0.05). There was no significant difference in PROMIS PI between groups.

DISCUSSION AND CONCLUSION: When compared to DBP, patients undergoing VLP are more likely to have improved clinical and radiographic outcomes. While improvement in wrist and forearm range of motion and radiographic parameters is statistically significant, it may not be clinically relevant.

Table 1. Unmatched Cohort Characteristics

Characteristic	Volar Locked Plating (n=2075)	Dorsal Bridge Plating (n=415)	P-value
Demographics			
Age (years)	53.7 (12.5)	52.1 (13.1)	p<0.001
Sex (Male/Female)	1068/1007	485/430	p<0.001
Race (%)			
Black or African American	133 (6.4)	49 (11.8)	p<0.001
White	1942 (93.6)	386 (93.2)	
Hispanic	10 (0.5)	1 (0.2)	
Asian	1 (0.05)	0	
Other	1 (0.05)	0	
Missing	1 (0.05)	0	
Other	1 (0.05)	0	
Missing	1 (0.05)	0	
Other	1 (0.05)	0	
Missing	1 (0.05)	0	
Other	1 (0.05)	0	
Missing	1 (0.05)	0	

Table 2. Propensity Score-Matched Cohort Characteristics

Characteristic	Volar Locked Plating (n=2075)	Dorsal Bridge Plating (n=415)	Standardized Difference
Demographics			
Age (years)	53.7	52.1	0.04
Sex (Male/Female)	1068	485	0.00
Race (%)			
Black or African American	133	49	0.00
White	1942	386	0.00
Hispanic	10	1	0.00
Asian	1	0	0.00
Other	1	0	0.00
Missing	1	0	0.00
Other	1	0	0.00
Missing	1	0	0.00
Other	1	0	0.00
Missing	1	0	0.00
Other	1	0	0.00
Missing	1	0	0.00

Table 3. Propensity Score-Matched Differences in Postoperative Clinical Outcomes at 6-Month Follow-Up

Outcome	Volar Locked Plating (n=2075)	Dorsal Bridge Plating (n=415)	P-value
Wrist Flexion (degrees)	146.2 (7.1)	137.4 (8.0)	<0.001
Wrist Extension (degrees)	141.1 (7.5)	134.4 (8.3)	<0.001
Forearm Pronation (degrees)	141.1 (7.5)	134.4 (8.3)	<0.001
Forearm Supination (degrees)	141.1 (7.5)	134.4 (8.3)	<0.001
Radial Deviation (degrees)	141.1 (7.5)	134.4 (8.3)	<0.001
Ulnar Deviation (degrees)	141.1 (7.5)	134.4 (8.3)	<0.001
Radial Height (mm)	141.1 (7.5)	134.4 (8.3)	<0.001
Radial Inclination (degrees)	141.1 (7.5)	134.4 (8.3)	<0.001
Articular Step-Off (mm)	141.1 (7.5)	134.4 (8.3)	<0.001
Malunion (%)	141.1 (7.5)	134.4 (8.3)	<0.001
Nonunion (%)	141.1 (7.5)	134.4 (8.3)	<0.001
Complications (%)	141.1 (7.5)	134.4 (8.3)	<0.001
Pain	141.1 (7.5)	134.4 (8.3)	<0.001
Numbness	141.1 (7.5)	134.4 (8.3)	<0.001
Swelling	141.1 (7.5)	134.4 (8.3)	<0.001
Wound Healing	141.1 (7.5)	134.4 (8.3)	<0.001
Infection	141.1 (7.5)	134.4 (8.3)	<0.001
Implant Failure	141.1 (7.5)	134.4 (8.3)	<0.001
Other	141.1 (7.5)	134.4 (8.3)	<0.001

Table 4. Propensity Score-Matched Differences in Postoperative Radiographic Outcomes at 6-Month Follow-Up

Outcome	Volar Locked Plating (n=2075)	Dorsal Bridge Plating (n=415)	P-value
Radial Height (mm)	141.1 (7.5)	134.4 (8.3)	<0.001
Radial Inclination (degrees)	141.1 (7.5)	134.4 (8.3)	<0.001
Articular Step-Off (mm)	141.1 (7.5)	134.4 (8.3)	<0.001
Malunion (%)	141.1 (7.5)	134.4 (8.3)	<0.001
Nonunion (%)	141.1 (7.5)	134.4 (8.3)	<0.001
Complications (%)	141.1 (7.5)	134.4 (8.3)	<0.001
Pain	141.1 (7.5)	134.4 (8.3)	<0.001
Numbness	141.1 (7.5)	134.4 (8.3)	<0.001
Swelling	141.1 (7.5)	134.4 (8.3)	<0.001
Wound Healing	141.1 (7.5)	134.4 (8.3)	<0.001
Infection	141.1 (7.5)	134.4 (8.3)	<0.001
Implant Failure	141.1 (7.5)	134.4 (8.3)	<0.001
Other	141.1 (7.5)	134.4 (8.3)	<0.001

Table 5. Subgroup Analysis of Matched Cohort for Age and Fracture Classification

Subgroup	Age Group	Fracture Classification	VLP (n)	DBP (n)	Wrist Flexion (6mo)	Wrist Extension (6mo)	Forearm Pronation (6mo)	Forearm Supination (6mo)	Radial Deviation (6mo)	Ulnar Deviation (6mo)	Radial Height (6mo)	Radial Inclination (6mo)	Articular Step-Off (6mo)	Malunion (6mo)	Nonunion (6mo)	Complications (6mo)	P-value
Overall	≤ 60	AO/OTA 23	1035	205	146.8	137.1	141.2	141.2	141.2	141.2	141.2	141.2	141.2	141.2	141.2	141.2	<0.001
	> 60	AO/OTA 23	1040	210	145.5	135.7	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	<0.001
AO/OTA 23	≤ 60	AO/OTA 23	518	103	147.1	137.4	141.5	141.5	141.5	141.5	141.5	141.5	141.5	141.5	141.5	141.5	<0.001
	> 60	AO/OTA 23	522	107	144.9	134.9	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	<0.001
AO/OTA 24	≤ 60	AO/OTA 24	517	102	146.5	136.7	140.7	140.7	140.7	140.7	140.7	140.7	140.7	140.7	140.7	140.7	<0.001
	> 60	AO/OTA 24	523	108	144.6	134.9	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	<0.001

Values are mean and standard deviation (SD). P-values are two-tailed. *Statistically significant (p < 0.05). DBP: Dorsal Bridge Plating; VLP: Volar Locked Plating; AO/OTA: AO Foundation/Orthopaedic Trauma Association; UE: Upper Extremity; PF: Physical Function; PI: Patient-Reported Outcomes Measurement Information System Physical Function; PROMIS: Patient-Reported Outcomes Measurement Information System; PROMIS UE: PROMIS Upper Extremity; PROMIS PF: PROMIS Physical Function; PROMIS PI: PROMIS Patient-Reported Outcomes Measurement Information System Physical Function. †Values are percentages of total patients with range of motion.