

Optimising Surgical Management of Distal Radius Malunion: A Comparative Network Meta Analysis of Surgical Approaches

INTRODUCTION

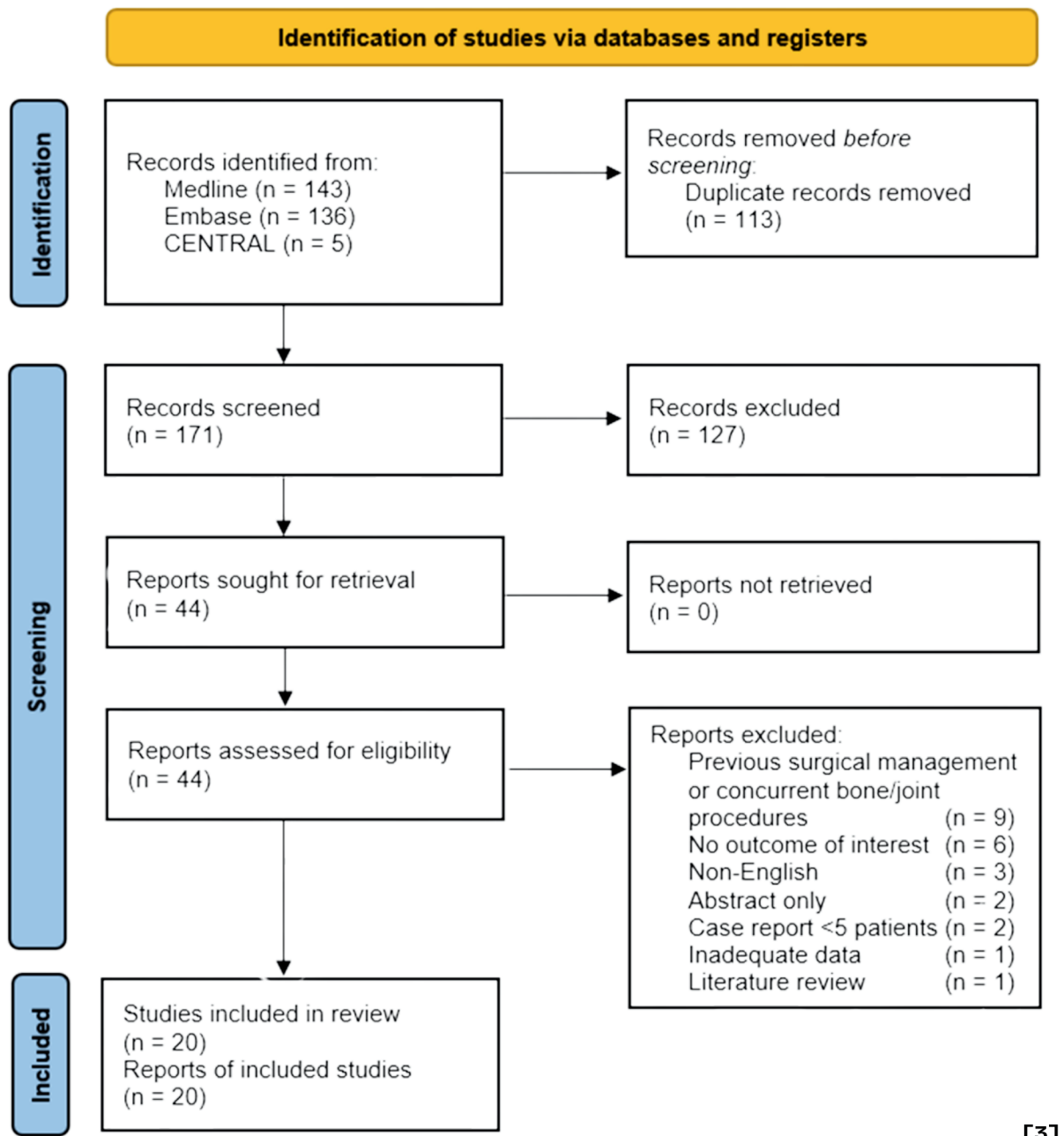
- Distal radius fracture malunion causes pain, reduced range of motion, reduced grip strength and impaired function.
- Corrective osteotomy aims to restore anatomical alignment and improve symptoms and function.^[1]
- 3 main surgical approaches:
 - Volar: most commonly used, greater soft tissue coverage.
 - Dorsal: improved access for correction of dorsal angulation.
 - Dual: more complex cases (e.g. intraarticular, multiplanar deformity).^[2]
- Little evidence to compare the outcomes of the three approaches.

AIMS

- To review the available evidence that considers the clinical outcomes of corrective osteotomy of distal radius malunions.
- Compare the outcomes of utilising volar, dorsal, or dual surgical approaches.

METHODS

- Systematic review & network meta-analysis in accordance with PRISMA.^[3]
- Search from inception to January 2024 (MEDLINE, EMBASE, Cochrane CENTRAL).
- 2x authors independently screened paper titles and abstracts for inclusion, followed by full text review.
- Senior authors adjudicated disagreements.



INCLUSION CRITERIA

Study types: RCTs, non-randomised controlled trials, prospective cohort studies, retrospective cohort studies, retrospective case series (≥5 patients).

Indications: Symptomatic DRF malunion, Clear osteotomy approach.

Population: Adult patients (age ≥16 years).

Exclusions: Adjunct procedures, No outcomes or complications reported.



RESULTS

- Significant improvement compared to pre-op values.
- No significant difference between approaches.
- Higher rate of metalwork removal in dorsal group.

Metalwork removal	11 / 241	Number of Implants	Total Implants Removed, %
		Volar	142
Dorsal		84	17 (12%)
Dual		17	40 (48%)
			2 (12%)

Complications	Volar, n (%)	Dorsal, n (%)	Dual, n (%)
Nerve injury/irritation	9 (2.9%)	2 (1.1%)	0 (0%)
Tendon injury/irritation	3 (1%)	8 (4.3%)	2 (9.1%)
Delayed union	9 (2.9%)	1 (0.5%)	0 (0%)
Re-operation (excluding metalwork removal)	4 (1.3%)	3 (1.6%)	0 (0%)
CRPS	3 (1%)	3 (1.6%)	0 (0%)
Post-traumatic arthritis	3 (1%)	0 (0%)	2 (9.1%)
Wound healing (deep/superficial infections)	0 (0%)	1 (0.5%)	0 (0%)
Other soft tissue injury	2 (0.7%)	3 (1.6%)	0 (0%)
TOTAL	33 (11%)	21 (11%)	4 (18%)

CRPS = Complex Regional Pain Syndrome.

DISCUSSION

- Limitations:
 - Limited comparisons of certain outcome measures due to data gaps.
 - Inconsistent outcome reporting between studies.
 - Moderate risk of bias overall.
 - Predominantly volar approach.
- All approaches resulted in improved outcomes.
- No conclusive evidence to recommend one approach over another.
- Surgical approach should therefore be tailored to individual cases.

REFERENCES

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Clinical Outcomes	No. of Studies / Total Wrists	Direct Comparison		Indirect Comparison	
		MD	95% CI	MD	95% CI
DASH ^a	7 / 135				
Volar vs Pre-op		-32.27	-41.94; -22.60		
Dual vs Pre-op		-34.31	-52.28; -16.34		
Volar vs Dual				-1.92	-19.93; 16.09
Pain VAS Scale ^b	5 / 95				
Volar vs Pre-op		-2.77	-4.93; -0.61		
Dorsal vs Pre-op		-5.20	-10.04; -0.36		
Volar vs Dorsal				-2.43	-7.73; 2.87
Flexion-Extension Arc, °	4 / 109				
Volar vs Pre-op		41.61	16.18; 67.05		
Dorsal vs Pre-op		42.75	9.32; 76.17		
Dual vs Pre-op		58.50	16.47; 100.53		
Volar vs Dorsal				1.13	-40.87; 43.13
Volar vs Dual				16.89	-32.24; 66.01
Dorsal vs Dual				15.75	-37.95; 69.45
Flexion ^b , °	11 / 229				
Volar vs Pre-op		27.07	17.19; 36.95		
Dorsal vs Pre-op		16.86	3.58; 30.13		
Volar vs Dorsal				10.21	-6.33; 26.76
Extension ^b , °	11 / 229				
Volar vs Pre-op		17.20	8.39; 26.01		
Dorsal vs Pre-op		15.25	3.34; 27.15		
Volar vs Dorsal				1.96	-12.85; 16.77
Pronation-Supination Arc, °	4 / 109				
Volar vs Pre-op		51.08	33.52; 68.64		
Dorsal vs Pre-op		49.65	26.92; 72.37		
Dual vs Pre-op		42.20	14.29; 70.11		
Volar vs Dorsal				1.44	-27.28; 30.15
Volar vs Dual				8.88	-24.09; 41.86
Dorsal vs Dual				7.45	-28.54; 43.44
Pronation ^b , °	11 / 229				
Volar vs Pre-op		26.11	16.06; 36.16		
Dorsal vs Pre-op		18.99	4.86; 33.12		
Volar vs Dorsal				7.12	-10.22; 24.46
Supination ^b , °	11 / 229				
Volar vs Pre-op		36.41	28.41; 44.41		
Dorsal vs Pre-op		25.71	13.75; 37.67		
Volar vs Dorsal				10.70	-3.69; 25.09
Radial Inclination, °	17 / 358				
Volar vs Pre-op		5.58	3.01; 8.15		
Dorsal vs Pre-op		5.28	1.45; 9.11		
Dual vs Pre-op		12.58	3.32; 21.84		
Volar vs Dorsal				0.30	-4.31; 4.92
Volar vs Dual				7.00	-2.61; 16.61
Dorsal vs Dual				7.30	-2.72; 17.32
Ulnar Variance, °	14 / 237				
Volar vs Pre-op		-3.65	-4.97; -2.34		
Dorsal vs Pre-op		-5.92	-8.02; -3.83		
Dual vs Pre-op		-3.17	-6.61; 0.28		
Volar vs Dorsal				-2.27	-4.74; 0.20
Volar vs Dual				-0.49	-4.18; 3.20
Dorsal vs Dual				-2.76	-6.79; 1.28
Volar Tilt in Dorsal	16 / 320				
Mal-union ^b , °					
Volar vs Pre-op		30.66	26.88; 34.44		
Dorsal vs Pre-op		27.84	22.60; 33.08		
Volar vs Dorsal				2.83	-3.64; 9.29
Graft and Union	10 / 161				
Graft vs No Graft				-1.31	-3.15; 0.54
Volar Graft vs No Graft				-1.28	-3.16; 0.60
Dorsal Graft vs No Graft				-2.09	-11.83; 7.65