Parallel vs. Orthogonal Dual Plating for Distal Humerus Fractures: A Systematic Review and Pooled Analysis of Functional Outcomes and Union Times

Ryan St. John[1], Hanna Brancaccio[1], Seth Spicer[1], Kunal P. Shah[1], Tia Alexander DO[2], Christopher Haydel MD[3], Sergio Pulido DO[3], Sean McMillan DO[3]

Presenting Author: Ryan St. John
Futures Forward Research Institute[1]
Jefferson Health New Jersey[2]
Virtua Health[3]

SAOAO
STUDENT AMERICAN OSTEOPATHIC ACADEMY OF ORTHOPEDICS

FUTURES FORWARD RESEARCH INSTITUTE

Virtua Health

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Disclosures

- None

Background:

- Distal humerus fractures account for 2% of all fractures and approximately 30% of fractures at the elbow[1-3].

- Biomechanical studies have demonstrated improved stability with parallel plating techniques compared to orthogonal techniques[3-4].

- Previous literature has not demonstrated how this translates clinically[5].

- Hypothesis: Due to the relatively more stable construct, parallel plating osteosynthesis will correlate with improved functional outcomes and a shorter time to radiographic union.

Objective

- Conduct a systematic review to determine the functional outcomes of parallel and orthogonal dual plating techniques.
  - Mayo Elbow Performance Score (MEPS)
  - Radiographic time to union

Function	Points	Definition (Points)
Pain	45	None (45) Mild (30) Moderate (15) Severe (0)
Motion	20	Arc >100 degrees (20) Arc 50–100 degrees (15) Arc <50 degrees (5)
Stability	10	Stable (10) Moderate instability (5) Gross instability (0)
Function	25	Comb hair (5) Feed (5) Perform hygiene (5) Don shirt (5) Don shoe (5)
Total	100	

Classification: excellent, >90; good, 75–89; fair, 60–74; poor, <60.

(Kushwanth 2021)

Methods

Inclusion Criteria

- Skeletal maturity reached (>18 years of age)
- Randomized controlled trials and prospective cohort studies
- Must include Mayo Elbow Performance Score or time to radiographic union

Exclusion Criteria

- Cadaveric studies
- Studies with incomplete data sets
- Unavailable full texts

Search Procedure

- Search was conducted on July 27, 2024 utilizing terms related to “distal humerus fracture” and “orthogonal” and “parallel” and “internal fixation.”
- 5 medical databases (PubMed, Embase, Scopus, Web of Science, Cochrane) were queried.
- 679 studies were identified.
- 8 studies were included in final analysis.

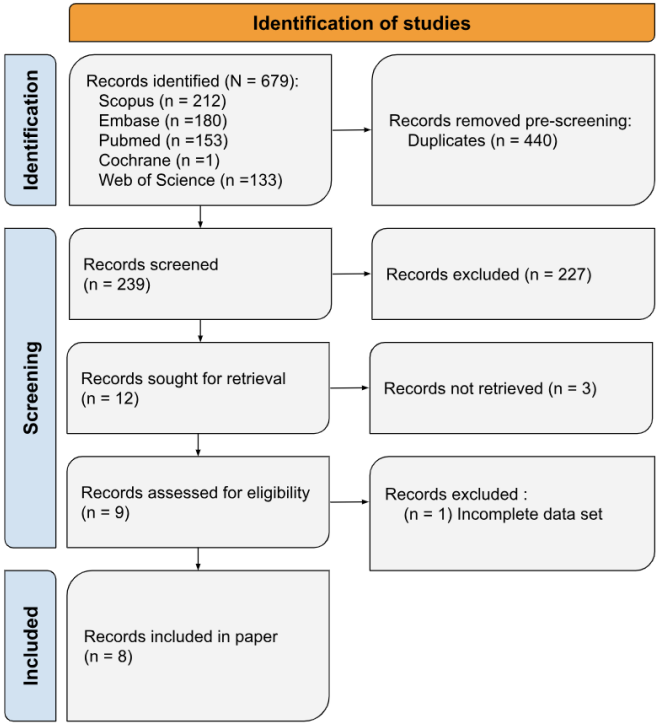

Fig. 1 PRISMA flowchart illustrating the systematic review process. The flowchart outlines the selection and screening of studies, including search strategies, eligibility criteria, and the final inclusion of relevant studies for data synthesis and analysis

Results

- Utilized pooled weighted averages and independent sample t-tests.
- Parallel plating was superior ($p < 0.05$) to orthogonal plating in union time and Mayo Elbow Performance score (MEPS) at every time point.

Table 1. *Overview of statistics for MEPS and union time*

Plating Type	***Union Time Mean ± SD (n= 189)***	***MEPS (6 months) Mean ± SD (n= 103)***	***MEPS (12 months) Mean ± SD (n= 65)***	***MEPS (24 months) Mean ± SD (n= 160)***
Parallel	19.52 ± 6.09	78.73 ± 0.00	93.61 ± 0.00	88.75 ± 0.92
Orthogonal	22.96 ± 5.05	75.35 ± 3.18	88.11 ± 0.18	85.10 ± 0.00

Conclusion

- Parallel plating osteosynthesis had statistically significant superior outcomes for MEPS at all time points.
- Parallel plating osteosynthesis had statistically significant shorter time to radiographic union.
- Correlates with improved stability found in biomechanical studies.

Limitations

- Few randomized controlled trials.
- Minimal clinically important difference has yet to be determined for open reduction and internal fixation for distal humerus fractures.

Applicability to the Field

- To our knowledge, this is the first systematic review and pooled analysis to demonstrate a significant difference in clinical outcomes between parallel and orthogonal plating techniques.

- Further research is needed which incorporates high powered, multicenter randomized controlled trials to determine the validity of these findings.

References: