# Meta-Analysis of Treatment Outcomes for Distal Radius Fractures

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**Disclosures:** None

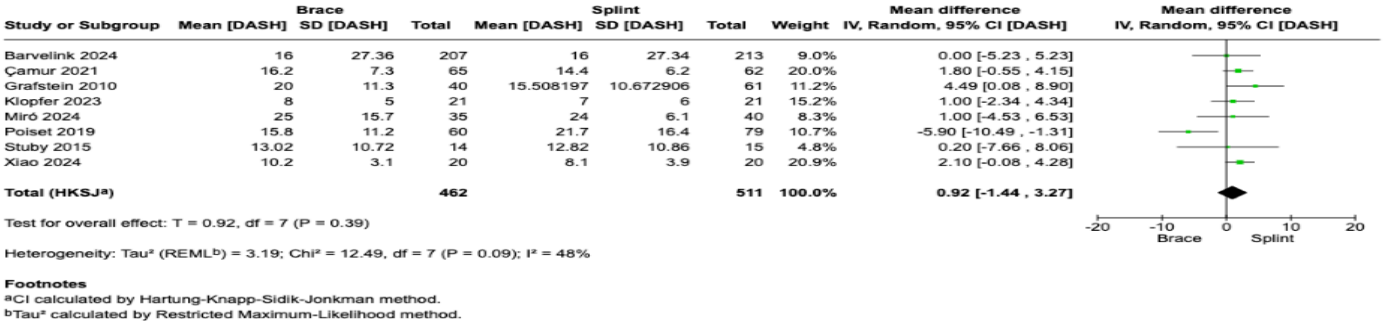
**INTRODUCTION:** Distal radius fractures (DRFs) are among the most common upper-extremity injuries, particularly in older and osteoporotic populations. Treatment options include volar locking plate (VLP) fixation, percutaneous pinning, splinting, and bracing, yet their comparative effectiveness remains unclear. This study aims to evaluate functional outcomes and complication rates across these modalities.

**METHODS:** A systematic search of PubMed, Google Scholar, and the Cochrane Library (September 2001–February 2025) identified randomized and cohort studies comparing DRF treatments. Outcomes included DASH, PRWE, grip strength, and complication rates (infection, malunion, nonunion, delayed union). Data were analyzed using Review Manager Web (RevMan) with significance set at $p \leq 0.05$.

**RESULTS:** Twenty-seven studies (n = 3,200) met inclusion criteria: VLP (n = 896), percutaneous pinning (n = 666), splinting (n = 718), and bracing (n = 903). No significant differences were found between splinting and either VLP or bracing. Percutaneous pinning demonstrated superior PRWE and DASH scores compared to bracing and VLP but had higher infection rates, while VLP showed better functional outcomes and fewer malunions than bracing.

**DISCUSSION:** All modalities produced acceptable functional recovery, though each carried distinct trade-offs. Conservative treatments (splinting, bracing) achieved outcomes comparable to surgical options in select measures, while VLP and pinning offered improved function at the cost of higher complication risks. These findings underscore the need for individualized treatment based on patient factors and goals.

**SIGNIFICANCE/CLINICAL RELEVANCE:** Both surgical and conservative approaches can yield satisfactory recovery following DRFs. Conservative management may suffice for low-demand or osteoporotic patients, while operative options may better optimize alignment and strength. Clinicians should balance functional benefits, complication risks, and patient preferences to guide optimal, evidence-based care.



| Study or Subgroup | Brace Mean [DASH] | Brace SD [DASH] | Brace Total | Splint Mean [DASH] | Splint SD [DASH] | Splint Total | Weight | Mean difference IV, Random, 95% CI [DASH] |
|---|---|---|---|---|---|---|---|---|
| Barvelink 2024 | 16 | 27.36 | 207 | 16 | 27.34 | 213 | 9.0% | 0.00 [-5.23 , 5.23] |
| Çamur 2021 | 16.2 | 7.3 | 65 | 14.4 | 6.2 | 62 | 20.0% | 1.80 [-0.55 , 4.15] |
| Grafstein 2010 | 20 | 11.3 | 40 | 15.508197 | 10.672906 | 61 | 11.2% | 4.49 [0.08 , 8.90] |
| Klopfer 2023 | 8 | 5 | 21 | 7 | 6 | 21 | 15.2% | 1.00 [-2.34 , 4.34] |
| Miró 2024 | 25 | 15.7 | 35 | 24 | 6.1 | 40 | 8.3% | 1.00 [-4.53 , 6.53] |
| Poiset 2019 | 15.8 | 11.2 | 60 | 21.7 | 16.4 | 79 | 10.7% | -5.90 [-10.49 , -1.31] |
| Stuby 2015 | 13.02 | 10.72 | 14 | 12.82 | 10.86 | 15 | 4.8% | 0.20 [-7.66 , 8.06] |
| Xiao 2024 | 10.2 | 3.1 | 20 | 8.1 | 3.9 | 20 | 20.9% | 2.10 [-0.08 , 4.28] |
| **Total (HKSJ[a])** | | | **462** | | | **511** | **100.0%** | **0.92 [-1.44 , 3.27]** |

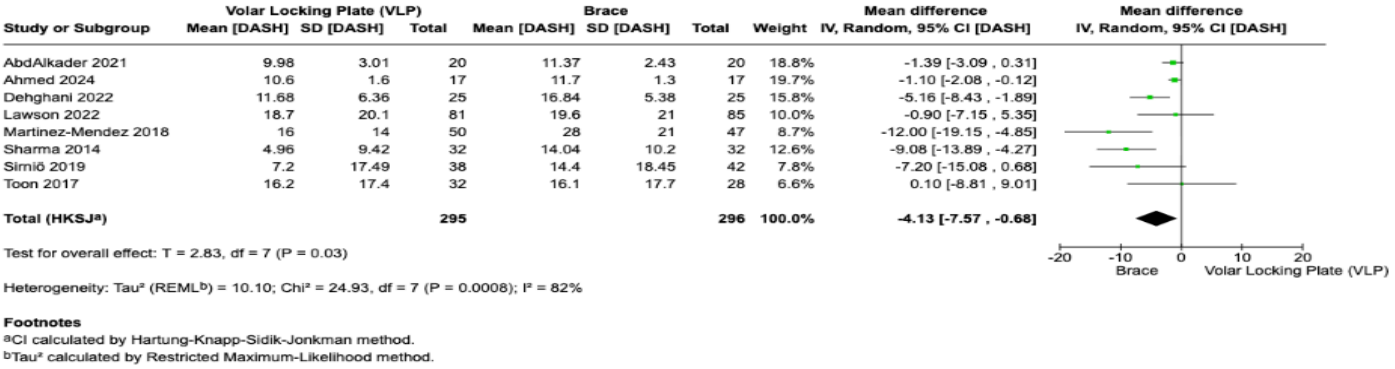
Test for overall effect: T = 0.92, df = 7 (P = 0.39)

Heterogeneity: Tau² (REML[b]) = 3.19; Chi² = 12.49, df = 7 (P = 0.09); I² = 48%



**Footnotes**
[a]CI calculated by Hartung-Knapp-Sidik-Jonkman method.
[b]Tau² calculated by Restricted Maximum-Likelihood method.

**Figure 1.** Forest Plot of DASH scores between Brace vs. Splint



| Study or Subgroup | Volar Locking Plate (VLP) Mean [DASH] | VLP SD [DASH] | VLP Total | Brace Mean [DASH] | Brace SD [DASH] | Brace Total | Weight | Mean difference IV, Random, 95% CI [DASH] |
|---|---|---|---|---|---|---|---|---|
| AbdAlkader 2021 | 9.98 | 3.01 | 20 | 11.37 | 2.43 | 20 | 18.8% | -1.39 [-3.09 , 0.31] |
| Ahmed 2024 | 10.6 | 1.6 | 17 | 11.7 | 1.3 | 17 | 19.7% | -1.10 [-2.08 , -0.12] |
| Dehghani 2022 | 11.68 | 6.36 | 25 | 16.84 | 5.38 | 25 | 15.8% | -5.16 [-8.43 , -1.89] |
| Lawson 2022 | 18.7 | 20.1 | 81 | 19.6 | 21 | 85 | 10.0% | -0.90 [-7.15 , 5.35] |
| Martinez-Mendez 2018 | 16 | 14 | 50 | 28 | 21 | 47 | 8.7% | -12.00 [-19.15 , -4.85] |
| Sharma 2014 | 4.96 | 9.42 | 32 | 14.04 | 10.2 | 32 | 12.6% | -9.08 [-13.89 , -4.27] |
| Simić 2019 | 7.2 | 17.49 | 38 | 14.4 | 18.45 | 42 | 7.8% | -7.20 [-15.08 , 0.68] |
| Toon 2017 | 16.2 | 17.4 | 32 | 16.1 | 17.7 | 28 | 6.6% | 0.10 [-8.81 , 9.01] |
| **Total (HKSJ[a])** | | | **295** | | | **296** | **100.0%** | **-4.13 [-7.57 , -0.68]** |

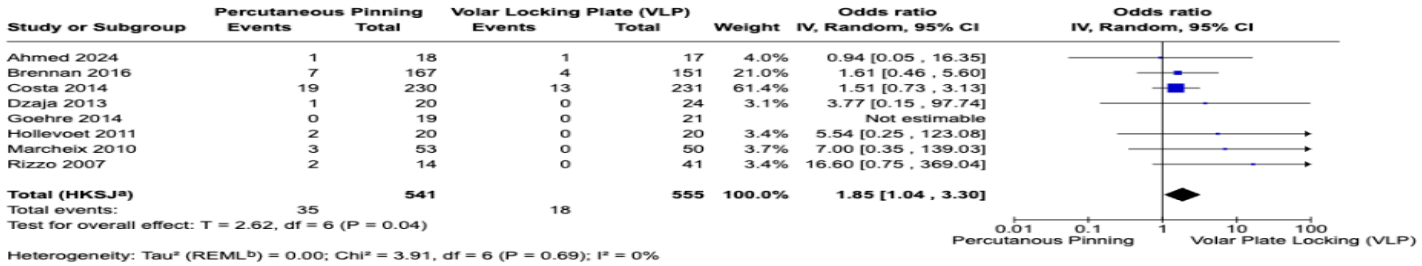
Test for overall effect: T = 2.83, df = 7 (P = 0.03)

Heterogeneity: Tau² (REML[b]) = 10.10; Chi² = 24.93, df = 7 (P = 0.0008); I² = 82%



**Footnotes**
[a]CI calculated by Hartung-Knapp-Sidik-Jonkman method.
[b]Tau² calculated by Restricted Maximum-Likelihood method.

**Figure 2.** Forest Plot of DASH scores between Brace vs. Volar Locking Plate (VLP)



| Study or Subgroup | Percutaneous Pinning Events | Percutaneous Pinning Total | VLP Events | VLP Total | Weight | Odds ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ahmed 2024 | 1 | 18 | 1 | 17 | 4.0% | 0.94 [0.05 , 16.35] |
| Brennan 2016 | 7 | 167 | 4 | 151 | 21.0% | 1.61 [0.46 , 5.60] |
| Costa 2014 | 19 | 230 | 13 | 231 | 61.4% | 1.51 [0.73 , 3.13] |
| Dzaja 2013 | 1 | 20 | 0 | 24 | 3.1% | 3.77 [0.15 , 97.74] |
| Goehre 2014 | 0 | 19 | 0 | 21 | | Not estimable |
| Hollevoet 2011 | 2 | 20 | 0 | 20 | 3.4% | 5.54 [0.25 , 123.08] |
| Marcheix 2010 | 3 | 53 | 0 | 50 | 3.7% | 7.00 [0.35 , 139.03] |
| Rizzo 2007 | 2 | 14 | 0 | 41 | 3.4% | 16.60 [0.75 , 369.04] |
| **Total (HKSJ[a])** | | **541** | | **555** | **100.0%** | **1.85 [1.04 , 3.30]** |
| Total events: | 35 | | 18 | | | |

Test for overall effect: T = 2.62, df = 6 (P = 0.04)

Heterogeneity: Tau² (REML[b]) = 0.00; Chi² = 3.91, df = 6 (P = 0.69); I² = 0%



**Footnotes**
[a]CI calculated by Hartung-Knapp-Sidik-Jonkman method.
[b]Tau² calculated by Restricted Maximum-Likelihood method.

**Figure 3.** Forest Plot of Infection rates between Volar Locking Plate (VLP) vs. Percutaneous Pinning