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Bridge Plate Distraction for Complex Distal Radius Fractures: A Cohort Study and Systematic Review of the Literature

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Abstract

Background Dorsal bridge plating (DP) of the distal radius is used as a definitive method of stabilization in complex fracture configurations and polytrauma patients.
Questions/Purposes This review aims to summarize the current understanding of DP and evaluate surgical outcomes.
Methods Four databases were searched following the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines and registered with PROSPERO. Papers presenting outcome or complication data for DP were included. These were reviewed using the National Institutes of Health Quality Assessment and Methodological Index for Non-Randomised Studies tools. Results were collated and compared to a local cohort of DP patients.
Results Literature review identified 416 patients with a pooled complication rate of 17% requiring additional intervention. The most prevalent complications were infection/wound healing issues, arthrosis, and hardware failure. Average range of motion was flexion 46.5 degrees, extension 50.7 degrees, ulnar deviation 21.4 degrees, radial deviation 17.3 degrees, pronation 75.8 degrees, and supination 72.9 degrees. On average, DP removal occurred at 3.8 months. Quality assessment showed varied results.
There were 19 cases in our local cohort. Ten displayed similar results to the systematic review in terms of range of motion and radiographic parameters. Higher QuickDASH scores and complication rates were noted. Local DP showed earlier plate removal at 2.9 months compared to previous studies.
Conclusion DP is a valid and useful technique for treating complex distal radius fractures. It displays a lower risk of infection and pain compared to external fixation which is commonly used to treat similar injuries. Patients can recover well following treatment both in function and range of motion. Further high-quality studies are required to fully evaluate the technique.

Keywords
- distal radius
- bridge plate
- spanning plate
- distraction plate
- systematic review

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Dorsal bridge plating, also known as spanning or distraction plating (DP), is a technique that can be used to treat complex comminuted distal radius fractures (DRFs) associated with high-energy trauma or fragility fractures with articular or metaphyseal comminution and associated with ligamentous injuries. They can also be used as part of damage limitation in the setting of complex polytrauma, including open fractures, and physiologically unstable trauma patients. The plate is fixed to the second or third metacarpal distally and proximally to the radial shaft. The fracture is aligned with moderate distraction at the radiocarpal joint to offload comminuted joint fragments. In additional to an open approach, the plate may be inserted using a minimally invasive technique without exposure of the distal radius comminuted fragments to preserve soft tissue integrity.[1–9]

For complex injuries that can be challenging to reduce or stabilize with Kirschner wires or nonbridging internal fixation,[10] external fixation (ET) may be deployed to stabilize complex fractures, either as a prelude to definitive internal fixation, as an adjunct to internal fixation,[11] or as a definitive technique. However, ET is associated with high complication rates and stiffness.[12,13] DP offers an alternative method of fracture reduction and stabilization,[14] albeit with a different complication profile.[15] Complications to consider surrounding DP are hardware failure, tendon or soft tissue injuries, and the requirement of a second operative procedure of plate removal associated with its inherent risk. DP holds key benefits over ET, including better Gartland and Werley scores (hand and wrist outcome measure),[16] improved reduction and fixation,[14] and increased strength following surgery.[17,18] Additionally, Vakhshori et al suggest that DP is better tolerated by patients,[19] due to ET pin loosening, associated nerve injury, stiffness, and cosmetic appearance.[20]

Currently, the British Society of Surgery of the Hand (BSSH) DRF guidance[21] does not include DP recommendations, which may be due to lack of research around this topic. This systematic review aims to provide an up-to-date reflection of the current understanding surrounding the incidence, complications, and outcomes of complex DRF treated with DP. We also include the results of a single-center feasibility cohort study. Our hypothesis is that this technique may hold particular benefit for those with osteoporosis, given the nature of the fixation and the quality of the bone fracture site. Furthermore, we aimed to identify whether the metacarpal used for fixation would effect the final radiological position. Our results will be compared with those presented in the systematic review and used to inform the design of a future randomized controlled study of this technique, and hopefully have clear guidelines for which patient and what kind of comminuted DRF the DP are indicated.

Method

This review follows the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines.[22] The review was registered on an open access international register for systematic reviews (PROSPERO).

Search Strategy

A systematic review was performed in March 2022 by searching four databases: PubMed, EMBASE, CINAHL, and Medline. The search strategy included broad terms for DRF combined with the operation of interest and an outcome measure; the full search strategy is provided under ►**Supplementary Material**. Citations were screened for any additional relevant studies the search may have missed.

These were then reviewed by title and abstract independently by two authors with the senior author adjudicating discrepancies. Full texts of all selected papers were obtained and screened using the criteria below.

Inclusion and Exclusion Criteria

Inclusion criteria were: (1) peer-reviewed publication, (2) English language, (3) reviewed/presented treatment with DP for DRF, and (4) reported outcomes or complications.

Exclusion criteria were: (1) retracted postpublication, (2) population size less than 10, (3) non-English language publication, (4) did not use the DP technique, (5) reported a surgical technique only, and (6) reviewed duplicated cases included in a previous publication.

Data Extraction and Quality Assessment

Data was collected using a predefined pro forma, including demographic, outcomes, and complications. The primary outcomes were Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire or QuickDASH, range of motion (ROM), and grip strength and any reported complications.

Paper quality was assessed independently by two authors using the National Institutes of Health (NIH) Quality Assessment Tool for Case Series Studies[23] and the Methodological Index for Non-Randomised Studies (MINORS).[24] The results were combined and presented. The NIH scores were interpreted as poor quality if 9 or below, intermediate if 10 to 13, and good if 14 or more.

Data Analysis

Collected data was collated and presented in tables, where appropriate weighted means and percentages were calculated. A weighted mean was calculated for the paper where two separate populations are shown.[25]

The data from the systematic review and the new cohort of patients were then compared.

Local Scoping Search

The project was registered with the Clinical Audit and Research Management System and following institutional board review, a search of local operative record databases was implemented.

Patients were identified from the past 10 years including the terms "bridg*," "spanning," and "distraction" associated with surgical management of DRFs at a major trauma center.

The clinical notes and available radiographic images pre- and postfixation were assessed, and data surrounding indication, operation, recovery, and complications were collected. Orthogonal radiographs were evaluated using a standardized approach and measurement technique.[26] For volar tilt and ulnar variance, a minus value denotes dorsal angulation and the ulnar displaced proximally compared to the proximal surface of the lunate facet of the distal radius, respectively. The mean pre- and postreduction values are compared to evaluate anatomical restoration. Patients who had removed their bridge plate were contacted and completed a QuickDASH-9 questionnaire[27] remotely. This was compared to the findings of the systematic review.

Additionally, the compartment used for fixation was assessed for association with volar tilt and radial inclination. Data normality was assessed using the Shapiro–Wilk test. Comparison was made using the two-sample (*t*-test) test for parametric data and the Mann–Whitney *U* test for nonparametric data. Significance was defined as $p < 0.05$.

Results

Systematic Review

The search identified 471 papers after removal of duplicates, with 9 further papers reviewed from their references. Three additional papers were known to the research group and were included in the search.[25,28,29] Following initial screening, 33 full texts were reviewed and 13 met the inclusion criteria.[15,25,28–38] Of the papers excluded, one paper had been retracted due to an error identified postpublication.[39,40] Two were in a foreign language,[41,42] six did not include DP patients,[43–48] four were previous reviews,[16,49–51] and three had a small population.[14,19,52] Two papers had potential overlap with a subsequent paper[53,54] and were excluded to prevent duplication of patients, and two papers discussed a surgical treatment/technique summary[55,56] (►**Fig. 1**).

Note that 416 patients were identified in the 13 included papers,[15,25,28–38] with a further 19 patients identified from the local database search.

All identified papers were retrospective studies,[15,25,28,30,31,34–38] excluding the studies from Liechti et al[32] and Ruch et al,[33] which were prospective,[32] with the remaining paper not specifying the study design.[29] ►**Table 1** shows a summary of the results. ►**Table 2** shows a

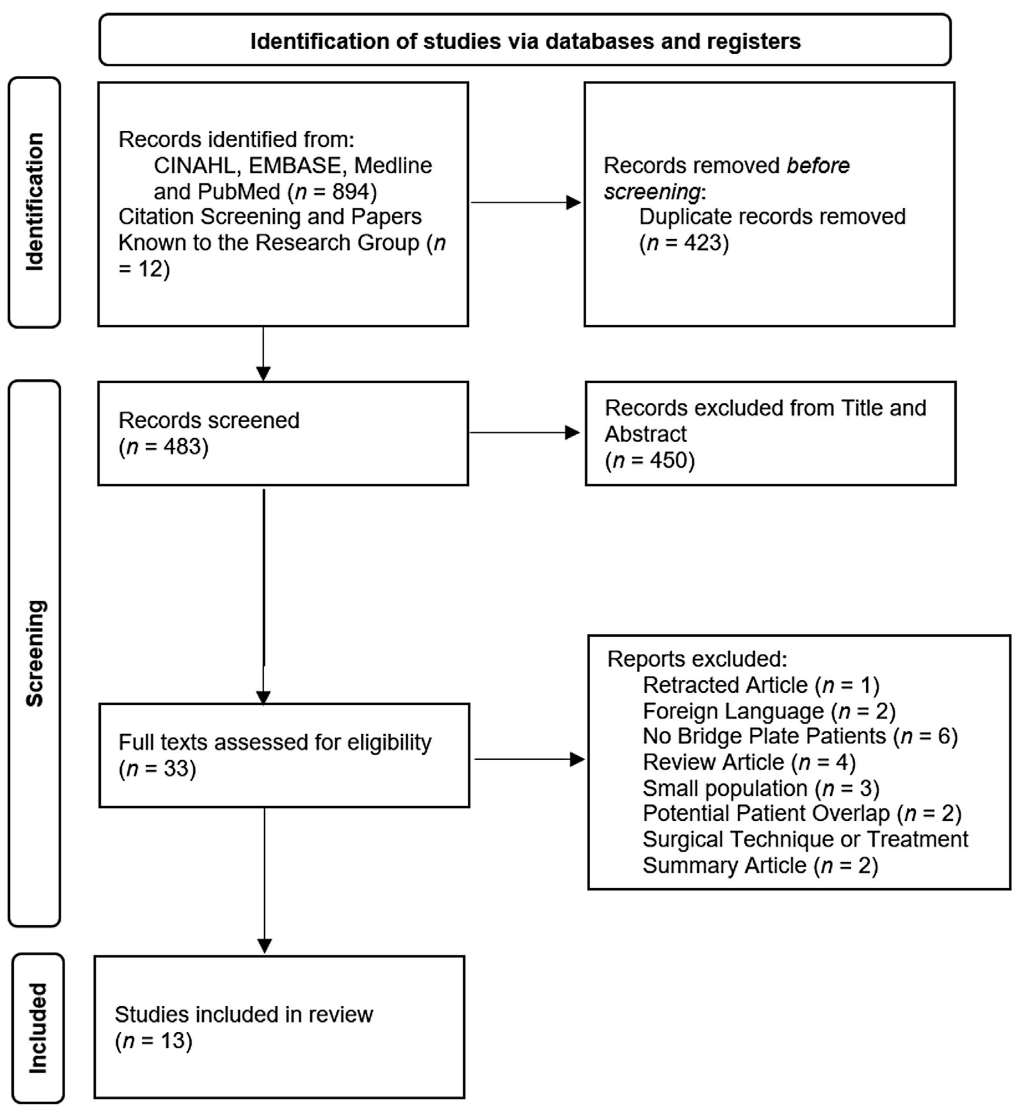

Fig. 1 Flowchart of included papers (Preferred Reporting Items for Systematic Review and Meta-Analyses [PRISMA], n.d.).

Table 1 Systematic review papers' demographic data

Paper	Year	Patients	Females (%)	Mean age	Time to DBP removal (d)	Mean follow-up (d)	Dominant hand (%)	AO type C fracture classification %
Ruch et al[33]	2005	22	10 (45)	54.6	124	754	16 (73)	20 (91)
Hanel et al[15]	2010	130	44 (34)	48.5	136	–	–	–
Richard et al[35]	2012	33	23 (70)	70	119	329	–	33 (100)
Dodds et al[37]	2013	25	11 (44)	54.6	185.5	201	–	18 (72)
Lauder et al[31]	2015	18	5 (28)	61	–	986	8 (44)	18 (100)
Bouvet et al[38]	2017	21	12 (57)	52	106.5	228	–	21 (100)
Huish et al[36]	2018	19	8 (42)	47.8	80.5	–	7 (37)	–
Tinsley and Ilyas[34]	2018	11	–	72	77	–	–	7 (64)
Wahl et al[30]	2021	13	2 (15)	42	109	462	4 (31)	–
Sharareh and Mitchell[28]	2020	24	7 (29)	41.2	87	137	–	24 (100)
Henry et al[25]	2021	60	45 (75)	65.5	82	287	–	60 (100)
Liechti et al[32]	2022	25	16 (64)	58.1	112.5	441	–	23 (82)
Mohamed et al[29]	2021	15	5 (33)	50	–	–	–	–
Weighted mean		416	188 (46)	54.7	117	367	35 (49)	224 (94)

Abbreviation: DBP, dorsal bridge plating.
Note: "-" indicates not reported.

Table 2 Complications presented in the systematic review papers

Paper	*N*	Complications (%)	Wound healing/ infection	Arthrosis	Hardware failure	Malunion/ nonunion/> 2 mm step	Tendon rupture	Pain	Tenolysis	Other
Ruch et al, 2005	22	3 (14)	3	–	–	1	0	–	–	3
Hanel et al, 2010	130	15 (12)	5	–	5	4	1	–	2	–
Richard et al, 2012	33	4 (12)	1	–	–	–	0	1	1	1
Dodds et al, 2013	25	22 (88)	0	–	3	–	–	–	19	–
Lauder et al, 2015	18	2 (11)	0	–	–	–	0	2	–	–
Bouvet et al, 2017	21	4 (19)	1	3	–	–	–	–	–	–
Huish et al, 2018	19	3 (16)	–	–	–	1	–	–	2	–
Tinsley and Ilyas, 2018	11	2 (18)	–	–	2	0	0	–	–	–
Wahl et al, 2021	13	11 (85)	0	11	–	0	0	0	–	–
Sharareh and Mitchell, 2019	24	12 (50)	–	–	1	9	–	–	1	1
Henry et al, 2021	60	16 (27)	4	–	3	3	2	1	2	1
Liechti et al, 2022	25	5 (20)	0	–	0	2	2	–	1	–
Mohamed et al, 2021	15	12 (80)	1	–	–	3	2	0	–	6
Total	416	111 (27)	15	14	14	23	7	4	28	12

Note: "-" indicates not reported.

breakdown of the complication rates. ►**Tables 3** and **4** show results of the quality assessments.

The demographics showed of the 416 patients treated with DPs, 188 (46%) were female. Osteoporosis status was only reported in three studies with 28.5 patients affected.[25,28,38] Mean weighted age, time to plate removal, and follow-up were 1.8, 3.8, and 12.1 months, respectively.

One hundred and eleven complications were noted. Tendon tether requiring tenolysis was the most reported complication. Joint arthrosis, wound healing, infection, and hardware failure were the next most prevalent. Nonunion[15,32] and malunion[15,25,32] were reported three and six times, respectively, with three papers reporting 11 cases of > 2 mm step.[28,33,36] Additional infrequent complications, classed as "other" in the table, were a case of transient

Table 3 Quality assessment of systematic review papers using the NIH tool

	Ruch et al, 2005	Hanel et al, 2010	Richard et al, 2012	Dodds et al, 2013	Lauder et al, 2015	Bouvet et al, 2017	Huish et al, 2018	Tinsley and Ilyas, 2018	Wahl et al, 2021	Sharareh and Mitchell, 2019	Henry et al, 2021	Liechti et al, 2022	Mohamed et al, 2021
Aim defined	2	1	2	0	2	2	2	0	2	2	2	1	0
Population description	1	1	2	1	1	1	2	0	2	2	2	2	0
Consecutive cases	CD	1	CD	CD	0	CD	2	CD	CD	2	0	2	CD
Comparable subjects	2	CD	2	1	2	CD	1	1	2	2	2	1	CD
Intervention description	2	2	2	2	1	2	2	2	1	2	1	2	1
Outcome measures	2	1	2	0	2	2	2	0	2	2	2	2	0
Follow-up time	2	CD	1	1	2	1	CD	2	2	1	2	2	CD
Statistical method description	2	0	2	0	2	0	0	0	2	2	2	2	2
Result description	2	1	2	0	2	2	2	0	2	2	2	2	1
Total	15	7	15	5	14	10	13	5	15	17	15	16	4

Abbreviations: CD, cannot determine; NIH, National Institutes of Health.

Table 4 Quality assessment of systematic review papers using MINORS tool

	Ruch et al, 2005	Hanel et al, 2010	Richard et al, 2012	Dodds et al, 2013	Lauder et al, 2015	Bouvet et al, 2017	Huish et al, 2018	Tinsley and Ilyas, 2018	Wahl et al, 2021	Sharareh and Mitchell, 2019	Henry et al, 2021	Liechti et al, 2022	Mohamed et al, 2021
Aim	4	2	4	0	4	4	4	0	4	4	4	2	0
Consecutive patients	0	2	0	0	0	0	4	0	0	4	0	4	0
Prospective	4	0	0	0	0	0	0	0	0	0	0	4	0
Appropriate endpoints	3	0	3	0	3	3	2	1	3	4	4	3	1
Unbiased assessment of endpoint	0	0	0	0	0	0	0	0	0	1	0	0	0
Follow-up time	4	0	2	2	4	2	0	4	4	2	4	4	0
Loss to follow-up < 5%	0	0	0	0	0	0	0	0	0	0	0	0	0
Prospective calculation of study size	0	0	0	0	0	0	0	0	0	0	4	0	0
Comparative studies only													
Adequate control group											4		
Contemporary groups											4		
Baseline equivalence of groups											2		
Adequate statistical analysis											3		
Total	15	4	9	2	11	9	10	5	11	15	29	17	1

Abbreviation: MINORS, Methodological Index for Non-Randomised Studies.

superficial radial neuritis,[35] two cases of carpal tunnel syndrome,[25,28] and three cases of extensor tendon lag.[33] However, at final follow-up these patients had no functional impairment. Remaining complications were three cases of pseudoatrophy, one metacarpal fracture, and one radial nerve injury; these were not further expanded upon.[29]

Classifying the tenolysis and intra-articular step as issues not requiring additional invention beyond standardized treatment reduces the overall complication rate to 17% ($n = 72$).

The quality assessment showed four poor quality studies,[15,29,34,37] two intermediate quality studies,[36,38] and seven high quality studies[25,28,30–33,35] using the NIH tool.

Weighted average outcome data are shown in ►**Table 5**, compared to our new cohort of cases. The complications included are only the issues requiring additional intervention.

Local Cohort

The local feasibility cohort search identified 19 cases over 10 years. The average age was 64.9 (60.2–92.7) years, with 68.4% female ($n = 13$), all having sustained a complex fracture with comminution. The method of injury was a low-energy fall for 9 patients and high-energy trauma for 10. All patients had an AO classification of distal radius 23C: 15 were a 3 subclassification, 2 were 2.2, and 2 were 1.2. Six patients had a preexisting diagnosis of osteoporosis and a further six were postmenopausal. Of the 11 patients whose hand dominance were recorded, 7 (64%) had injured the dominant hand.

All plates used were 3.5-mm locking compression plates sized according to the patient, ranging from 9 to 16 holes. Thirteen (68%) used the second compartment and index metacarpal, while the remaining six used the fourth compartment. Five of these used the middle metacarpal, and one used the ring due to associated injuries in the hand. Mean time from bridge plate insertion to removal was 2.9 month (1.4–6.4), three plates were not removed. One following an industrial accident was left to maintain wrist position, one was not removed for malunion, and one remained due to patient preference. Average follow-up time from plate insertion to discharge was 9 months (1.6–31). Outcome data is shown in ►**Table 5**. One postoperative radiograph was not available for review and one was not measurable in millimeter. ROM data was sporadically reported in the clinical notes. Additionally three patients had died, two bridge plates were still in situ, and four patients were not contactable so QuickDASH-9 data could not be collected. This data was collected on an average of 45 months following bridge plate insertion.

When comparing pre- and post-DP radiographs, the average improvement in distal radius alignment parameters was +5.1 mm for radial height, +10.6 degrees for radial inclination, –3.6 mm for ulnar variance, –2.2 for intra-articular step, and +14.6 degrees for volar tilt.

Six complications were seen in the local series and are described in ►**Table 6**. The metacarpal fracture occurred at a distal screw site and united without need for further intervention. The second periprosthetic fracture occurred following a low-energy fall after bone healing for the initial fracture was complete. This patient chose to retain the plate due to the support and reasonable level of function it offered. The nonunion plate was placed due to a failure of conservative treatment to maintain stability. This patient had many comorbidities and was a poor surgical candidate, the bone never fully healed and the bridge plate was never removed. A subsequent humeral fracture was also complicated by nonunion.

There were seven patients with an intra-articular step > 2 mm, but these were not classified as complications in our series as no additional intervention was required and an acceptable final ROM and function were achieved. Additionally, the tenolysis was removed from the overall complication figure in ►**Table 5** as it did not require additional operative time.

Fixation with routing of the DP through the second compartment (index metacarpal) showed mean radial inclination of 20.8 degrees and volar tilt of 5.3 degrees, compared to fourth compartment's (middle and ring metacarpal) 17.5 degrees and –1.4 degrees, respectively. Despite the apparent better anatomical restoration with the second compartment, statistical analysis showed no significance for radial inclination ($p = 0.34$) or volar tilt ($p = 0.08$).

Discussion

This review presents an up-to-date summation of the current knowledge surrounding DP treatment of DRFs outcomes and complications. It was required due to the retraction of a

Table 5 Comparison of our outcomes compared to those reported in the systematic review

	Our findings	Our patients	Systematic review findings	Systematic review patients	Normal range (Kim et al, 2014; Lad, n.d.)[66,67]
Flexion (degrees)	40.6	9	46.5	207	73
Extension (degrees)	43.8	8	50.7	207	71
Ulnar deviation (degrees)	23.3	3	21.4	118	33
Radial deviation (degrees)	20	3	17.3	118	19
Pronation (degrees)	60	10	75.8	207	60
Supination (degrees)	85	7	72.9	207	140
Grip strength (% contralateral side)	100%	3	66.8%	68	
Radial height (mm)	10.0	17	10.5	174	11–13
Radial inclination (degrees)	19.7	18	20.0	207	20–23
Ulnar variance (mm)	2.3	17	0.3	229	1–2
Volar tilt (degrees)	4.85	18	4.3	208	11
Intra-articular step (mm)	2.9	17	1.7	24	0
DASH			21.5	93	
QuickDASH			22.8	81	
QuickDASH-9	41.8	10			
Complications requiring intervention	5 (26%)	19	72 (17%)	416	

Abbreviation: DASH, Disabilities of the Arm, Shoulder, and Hand.

Table 6 Local series complications

Complications	Additional intervention	Recovery
Tendon rupture	Tendon transfer – EIP to EPL	Returned to concert pianist
Periprosthetic metacarpal fracture	None required	Normal
Periprosthetic fracture	Treated conservatively	–
Deep wound infection	Many subsequent surgeries – ALT free flap, debulking, release of joint contracture and wrist fusion	–
Tendon adhesion – 3rd compartment	Tenolysis at plate removal	–
Nonunion	None	Persistent nonunion

Abbreviations: ALT, anterolateral thigh; EIP, extensor indicis proprius; EPL, extensor pollicis longus.

study[39,40] included in previous reviews,[16,49–51] potential duplication of patients,[15,50,53] and new cases presented in four further studies,[25,28,29,32] as these changes would undoubtedly influence the quality of the existing reviews.

Overall, this review shows a loss in flexion, extension, and supination following DP removal. However, the DASH scores presented suggest that patients can still function well following plate removal.[25,30,32,33,35,38] At final review, DP and ET demonstrated similar radiographic outcomes. Although a meta-analysis has shown lower rates of infection and pain for DP, there is a higher risk of hardware failure, but no differences between DASH scores or additional operative interventions were noted. The authors did conclude, however, that this review was limited by the poor existing quality of evidence surrounding DP use.[16]

This current systematic review has a pooled complication rate of 27%. Tendon complications are frequent, and tenolysis during plate removal is a common adjunctive intervention.[37] Tendon rupture was reported in 8/435 DP procedures (1.8%). It may be associated with tendon injury at the time of the fracture, entrapment in the DRF, attrition over fracture fragments, and entrapment or irritation by the bridging plate.[15,25,29,32]

Persistent steps in the articular surface are a hazard of the DP technique, which focuses on the restoration of length and alignment without direct reduction and stabilization of all joint fragments not amenable for fixation using traditional nonbridging techniques. The risk of symptomatic secondary arthrosis is low despite radiographic changes with similar DASH scores to a comparative population and loss of function below 10%.[57]

When assessing the complications by only considering the events requiring additional intervention, the review's pooled complication rate is reduced to 17%. While it is important to consider the persistent articular step and potential for secondary tenolysis, they could overestimate the health care burden, suggesting that a change and unification in classification is required, as this technique could require less additional invention than appears at first glance.

We saw mixed results when reviewing the NIH quality scores of the reviewed papers. While many studies had sufficient follow-up to address their respective aims, no study measured outcomes beyond 5 years. Additionally, when comparing the papers using the MINORS criteria, there is an apparent lack of comparative, prospective research limiting the conclusions that can be drawn. There is no standardized core outcome data set and considerable variation in assessments. The publication with the largest patient cohort ($n = 130$) presented only complication data,[15] therefore limiting the conclusions that can be drawn when considering the entire reported population. Furthermore, a high level of heterogeneity has been reported in this cohort, suggesting that publication or outcome reporting bias may be present.[49,50]

Comparing the systematic review results to our local findings, we noted a shorter time from bridge plate insertion to removal in our study (2.9 months compared to 3.8 months). Similar outcome data were reported for both ROM and radiographic parameters, although we observed a higher ulnar variance than reported in the review. The DASH scores presented in the literature[25,30,32,33,35,38] are lower than our scores, although this may be explained by the shorter time between bridge plate removal and QuickDASH-9 score collection compared to our cohort. The poorer physical health, hand dominance of patients, subsequent operations, and injuries may also be confounding factors in our cohort.[58–60] As a major trauma center, we typically treat patients with injuries toward the severe end of the spectrum, which may have also influenced our poorer eventual outcomes.

When assessing osteoporosis status, only three papers by Bouvet et al, Sharareh and Mitchell, and Henry et al reported on this variable.[25,28,38] Their numbers showed 9 (43%), 1 (4%), and 18.5 (46%), respectively, with osteoporosis compared to our 6 (32%) confirmed cases. This is a potentially underinvestigated population, especially given their tendency toward more complicated fractures, which could benefit further from this technique.

Our local cohort showed no significant difference between the compartment used for radial inclination or volar tilt. Our recommendations include using precontoured plates to avoid weakening the implant and increasing the risk of hardware failure, although other solutions have been suggested, such as removing central screw holes in DP.[61] It is also important to ensure placement of screws through the center of the metacarpal to reduce the risk of periprosthetic fractures, which can be aided by using smaller diameter distal screws. Tendon entrapment should be assessed after DP application by passive finger and thumb flexion and checking for normal tenodesis. The risk of tendon adhesions and rupture can be reduced with low-profile plates.

Our results and those of the literature have shown that this procedure is commonly performed for complex type C fractures, often with an intra-articular component. Our experience has also noted that this procedure holds particular benefit in a polytrauma setting where speed combined with anatomical restoration are required. Furthermore, this technique is currently not included within the BSSH guidance. Given the reexamination of the complication rates, especially when compared to ET, this technique should be included within treatment guidelines.

This systematic review is limited by the type of studies included and the nonstandardized methodology used. Most papers were retrospective studies facing known internal and external validity questions.[62] Additionally, given the similar patient populations and similar outcomes reported, the level of heterogeneity will be extremely high, as previously reported.[49,50] This may limit their generalizability and shows a clear need for higher quality evidence when assessing the impact of this technique. The local cohort analysis faced several limitations, including the design as a retrospective study, inadequate coding, variations in techniques, and varied reporting on outcomes and complications. Due to the traumatic nature of these injuries, it was not possible to obtain a QuickDASH-9 before injury. As the data collection was retrospective, the scores obtained may be confounded by additional factors, such as subsequent operations and deteriorating physical health.[58–60] This is a constant challenge faced in evaluating trauma populations due to the difficulty in standardizing and comparing outcomes between patients pre- and postinjury. It did, however, provide a useful basis to guide future trial design for a prospective study.

Our review shows an area for improvement with a minimum core data set for standardizing publications. This will enable better interpretation of results and subsequent high-quality meta-analysis to inform clinical decisions further. These data sets have already been proposed and discussed in the form of the International Consortium for Health Outcomes Measurement for the wrist.[63] The nomenclature for this technique should be standardized to the internal distraction plate, first proposed by Burke and Singer in 1998,[14] rather than differing names of bridge, spanning, distraction, or combinations of these terms. As well as avoiding confusion, this will also improve the coding and identification of the method.

Longer follow-up and comparison to other interventions are required to fully evaluate the appropriateness of the technique, including the implications for posttraumatic osteoarthritis. This is more important considering the lack of correlation between radiographic appearance and functional outcome.[57,64,65]

Our results demonstrate earlier plate removal to have similar radiographic outcomes and ROM. This is supported by Henry et al showing improved ROM postoperatively, with no worsening of healing or further fracture displacement.[25] Given our findings, we would recommend 2 to 4 months for plate removal dependent upon the fracture healing. This improves access to earlier hand therapy to enable enhanced recovery.

In conclusion, this review has demonstrated that the use of DP is effective in treating complex type C DRFs and fractures in those with osteoporosis, where patients can remain with reasonable movement and function. Patients remain with good function despite objective postoperative limitations in ROM. Further high-quality comparative trials with longer term follow-up is required to evaluate this technique fully, particularly with regards to posttraumatic osteoarthritis, its complication profile, and comparative functional outcome.

Authors' Contributions

G.P.E. – Protocol, literature search, quality assessment, data collection, and dissemination.

V.S. – Literature search, quality assessment, and dissemination.

L.D. – Protocol, quality assessment, and dissemination.

F.W. – Protocol, quality assessment, and dissemination.

D.M.P. – Protocol and dissemination.

Informed Consent

None.

Ethical Approval

Local Clinical Audit and Research Management System and institutional board review.

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Conflict of Interest

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None.

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