

World Journal of *Orthopedics*

World J Orthop 2024 September 18; 15(9): 828-901



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WJO mainly publishes articles reporting research results and findings obtained in the field of orthopedics and covering a wide range of topics including arthroscopy, bone trauma, bone tumors, hand and foot surgery, joint surgery, orthopedic trauma, osteoarthropathy, osteoporosis, pediatric orthopedics, spinal diseases, spine surgery, and sports medicine.

INDEXING/ABSTRACTING

WJO is now abstracted and indexed in PubMed, PubMed Central, Emerging Sources Citation Index (Web of Science), Scopus, Reference Citation Analysis, China Science and Technology Journal Database, and Superstar Journals Database. The 2024 Edition of Journal Citation Reports® cites the 2023 journal impact factor (JIF) for WJO as 2.0; JIF Quartile: Q2. The WJO's CiteScore for 2023 is 3.1.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Yu-Qing Zhao*; Production Department Director: *Xiang Li*; Cover Editor: *Jin-Lei Wang*.

NAME OF JOURNAL

World Journal of Orthopedics

ISSN

ISSN 2218-5836 (online)

LAUNCH DATE

November 18, 2010

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Massimiliano Leigheb, Xiao-Jian Ye

EXECUTIVE ASSOCIATE EDITORS-IN-CHIEF

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EDITORIAL BOARD MEMBERS

<http://www.wjgnet.com/2218-5836/editorialboard.htm>

PUBLICATION DATE

September 18, 2024

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PUBLISHING PARTNER

The Minimally Invasive Spine Surgery Research Center Of Shanghai Jiaotong University

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

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ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

PUBLISHING PARTNER's OFFICIAL WEBSITE

https://www.shtrhospital.com/zkjs/info_29.aspx?itemid=647



Platelet-rich plasma for de Quervain's tenosynovitis: A systematic review and meta-analysis

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Specialty type: Orthopedics

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's classification

Scientific Quality: Grade C

Novelty: Grade C

Creativity or Innovation: Grade B

Scientific Significance: Grade C

P-Reviewer: Li XM

Received: March 18, 2024

Revised: August 1, 2024

Accepted: August 28, 2024

Published online: September 18, 2024

Processing time: 178 Days and 0.3 Hours



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Abstract

BACKGROUND

Platelet-rich plasma (PRP) injection is used as an alternative non-operative management for de Quervain's tenosynovitis (DQT) to regenerate tendon healing.

AIM

To assess and conclude the research-based study systematically to analyse the efficacy of PRP on DQT.

METHODS

This systematic review used the Cochrane Handbook for Systematic Reviews and the guideline of preferred reporting items for systematic review and meta-analysis. A systematic literature search was applied to 11 databases. The authors assessed the study quality and risk of bias of each included study. Results of the meta-analysis were presented using mean difference (MD)/standardized mean difference (SMD) and 95% confidence interval (CI).

RESULTS

The authors evaluated 275 studies found in the literature search; 12 studies met the criteria for this review, and then the study quality and risk of bias were assessed. Pooled analysis of data from two studies involving 194 subjects with DQT showed that, compared with conservative treatment, PRP injection was associated with a greater reduction in visual analog scale pain in one month and six months after treatment (MD: -0.67, P value < 0.00001; MD: -1.16, P value < 0.00001) and the increase of Mayo's wrist score in one month and six months after treatment (SMD: 3.72, P value < 0.00001; SMD: 4.44, P value < 0.00001).

CONCLUSION

PRP can be used as an alternative non-operative treatment for DQT due to the tissue regenerative effect of PRP.

Key Words: De Quervain's disease; De Quervain's tenosynovitis; Platelet-rich plasma; Stenosing tenosynovitis

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Core Tip: De Quervain's tenosynovitis (DQT) is a common tendon disorder characterized by wrist pain and tenderness at the first dorsal compartment of the wrist. Platelet-rich plasma (PRP) injection is currently used as an alternative non-operative management for DQT to regenerate tendon healing due to its tissue regenerative effect, which provides better pain management and stable improvement in functional outcomes in the long term. Ultrasonography-guided PRP with percutaneous needle tenotomy gives a better outcome. There are minimal side effects associated with PPR injection.

Citation: Hidajat NN, Magetsari RMSN, Steven G, Budiman J, Prasetyo GT. Platelet-rich plasma for de Quervain's tenosynovitis: A systematic review and meta-analysis. *World J Orthop* 2024; 15(9): 858-869

URL: <https://www.wjgnet.com/2218-5836/full/v15/i9/858.htm>

DOI: <https://dx.doi.org/10.5312/wjo.v15.i9.858>

INTRODUCTION

Tendon disorders are frequent conditions that limit daily activities and influence the quality of life[1-4]. De Quervain's tenosynovitis (DQT) is a common tendon disorder characterized by wrist pain and tenderness at the first dorsal compartment of the wrist; correlated with overworked, routine, and sustained activities that involve the tendons of abductor pollicis longus (APL) and extensor pollicis brevis (EPB)[5-14]. The incidence of DQT is 0.5% in males and 1.32% in females, and female between 30 to 50 years is the highest risk[6-9,11,12]. The diagnosis of DQT is confirmed with Finkelstein's test or Eichhoff's test and radiological examination if required[7,8,11].

Most patients respond well to non-surgical management, including activity modification, splinting, physical therapy, non-steroidal anti-inflammatory drugs (NSAIDs) medication, and corticosteroid injection[10-12]. In some cases where non-surgical management fails, primarily because of a false injection site and anatomical variation in the first dorsal compartment, a surgical release of the first dorsal compartment and decompression of the stenosed APL and EPB tendons is preferred[8,9,12,13,15]. Platelet-rich plasma (PRP) injection is currently used as an alternative non-operative management for DQT to regenerate tendon healing[9,10,12]. Gulati *et al*[6] concluded that PRP injection reduced pain and improved range of motion in DQT. PRP injection is a novel therapy used in various health disorders, including in orthopedic cases[4,16,17]. Platelet have hundreds of bioactive protein and cytokine which control cells differentiation and maturation, angiogenesis, and also synthesis of connective tissue. It supports the healing of degenerated tissue by stimulating revascularization, epithelialization, cell generation, and formation of extracellular matrix[4,18-21].

Many studies have explained PRP injection in DQT, but a systematic review focusing on PRP used for DQT is unavailable. This systematic review and meta-analysis aimed to systematically evaluate and conclude the research-based studies to report PRP's efficacy for DQT.

MATERIALS AND METHODS

This study's protocol was registered on the International Prospective Register of Systematic Reviews with register number CRD42023466818. The Cochrane Handbook for systematic reviews and the preferred reporting items for systematic review and meta-analysis (PRISMA) were used as guidelines in this systematic review-meta-analysis[22-24].

Inclusion and exclusion criteria

Inclusion criteria: Publication type: Full-text manuscripts reported the efficacy of PRP for DQT primary research study; Articles published in English; Articles published in January 2000 - December 2023; The study used humans as the subject; The objective, methodology, and outcome of the study must discuss the efficacy of PRP for DQT.

Exclusion criteria: Review; Variables that were associated with the efficacy of PRP for DQT.

Literature search

A systematic literature search was performed in these online scientific databases: ClinicalKey, Cochrane Library, EBSCOhost, Emerald Insight, Europe PMC, Google Scholar, JSTOR, ProQuest, PubMed, ScienceDirect, and Springer Link. The search used the following keywords for the title and abstract: (platelet-rich plasma OR PRP) AND (stenosing tenosynovitis OR de quervain tenosynovitis OR de quervain disease). The references of included studies were analysed to

ensure that all published studies were included.

Data collection and analysis

Articles were selected for evaluation after two authors (NNH and RSNM) had evaluated keywords from the online medical bibliographic databases. The results of the literature search were discussed with other authors (GS, JB and GTP), and any inconsistencies in results were deliberated. Three authors independently assessed selected full papers. Two authors independently evaluated selected studies for this systematic review to confirm the results (NNH and GS). The data from the included studies were presented in a summary table containing the key points of each study. The key points of each study were: First author, country, year, study design, sample, sample characteristic, outcome measure, and result.

Quality assessment

The first author evaluated the study quality and risk of bias of each included article and deliberated them with other authors. Version 2 of the Cochrane risk-of-bias tool for randomized trials (ROB 2) was performed to evaluate randomized control trial studies in which the interpretation was high risk or some concerns or low risk[25]. Newcastle-Ottawa scale for the prospective study was applied to assess the quality and risk of bias of the prospective study; the explanation of the result was: ≥ 7 points were included in the good study, 5-6 points were included in the fair study, < 5 points were included in the poor study. The Joanna Briggs Institute (JBI) critical appraisal checklist was used to evaluate the descriptive study's quality and risk of bias[25-27].

Statistical analysis

Review manager 5.4 was used to assess the overall effect size of PRP efficacy for DQT. A P value < 0.05 was considered statistically significant. Results were summarized using the mean difference (MD)/standardized mean difference (SMD) and 95% confidence interval (CI). Heterogeneity was evaluated using the I^2 (inconsistency) value; $< 25\%$, 26% - 50% , and $> 50\%$ were considered low, moderate, and high heterogeneity. Funnel plots were performed to assess the risk of publication bias[24,28].

RESULTS

Selection of articles for review

PRISMA flow diagram is presented in Figure 1. Initially, 275 peer-reviewed studies were identified from online medical research databases. After duplicates were removed, 152 studies were proceeded with the title and abstract screening. Seventeen articles were assessed for eligibility, of which 12 studies were included in the systematic review and two studies were included in the quantitative synthesis (meta-analysis).

Assessment of study validity (quality assessment and risk of bias)

All included studies were associated with the efficacy of PRP for DQT. Figure 2 provides the quality scores for randomized control trial studies, and the study had low risk. Table 1 shows quality scores for prospective studies, and the studies had 6-9 points (fair and good study). The JBI critical appraisal checklist for case reports and case series is presented in Table 2 and Table 3, and all of the studies had an overall appraisal in "included studies" for systematic review.

Study characteristic

Table 4 shows the study characteristics for the included studies. Most studies were prospective studies that discussed the efficacy of PRP in reducing pain in DQT subjects.

Meta-analysis of the included studies

The forest plots of included studies for meta-analysis of the PRP efficacy for DQT are shown in Figure 3. Pooled analysis of data from two studies involving 194 subjects with DQT showed that, compared with conservative treatment, PRP injection was associated with a greater reduction in visual analogue scale (VAS) pain in one month and six months after treatment [MD: -0.67 (95%CI: -0.96 to -0.38), P value < 0.00001 and the heterogeneity (I^2) was 9%; MD: -1.16 (95%CI: -1.41 to -0.91), P value < 0.00001 and the heterogeneity (I^2) was 0%] and the increase of Mayo's wrist score in one month and six months after treatment [SMD: 3.72 (95%CI: 3.22 to 4.22), P value < 0.00001 and the heterogeneity (I^2) was 98% (high heterogeneity); SMD: 4.44 (95%CI: 3.91 to 4.98), P value < 0.00001 and the heterogeneity (I^2) was 44% (moderate heterogeneity)]. The differences in demographic variance and occupational status influenced the heterogeneity of the included studies. Figure 4 shows the funnel plots, with the symmetry of the scatter plot in the triangle (low risk of bias).

DISCUSSION

Twelve studies had reported the efficacy of PRP as a treatment for DQT: Ten studies reported the reduction of VAS (scoring for assessing pain), four studies reported the improvement of Mayo's wrist score (scoring for assessing wrist as

Table 1 Newcastle-Ottawa scale (prospective study)

No.	Ref.	Selection				Comparability	Outcome			Total
		1	2	3	4		1	2	3	
1	Asaad <i>et al</i> [9], 2023	×		×	×		×	×	×	6
2	Deb <i>et al</i> [5], 2020	×	×	×	×	×	×	×	×	8
3	Giroti <i>et al</i> [12], 2021	×	×	×	×	×	×	×	×	9
4	Gulati and Ramesh [6], 2022	×	×	×	×	×	×	×	×	9
5	Johurul <i>et al</i> [29], 2019	×	×	×	×	×	×	×	×	9
6	Kumar <i>et al</i> [14], 2023	×	×	×	×	×	×	×	×	9
7	Ramesh <i>et al</i> [30], 2018	×		×	×		×	×	×	6
8	Sheikh <i>et al</i> [10], 2020	×	×	×	×	×	×	×	×	9

The maximum point for comparability was 2; Selection: (1) Representativeness; (2) Selection of non-exposed; (3) Ascertainment of exposure; and (4) Demonstration that outcome was not present at the beginning; Outcome: (1) Assessment of the outcome; (2) Follow-up long enough; and (3) Adequacy of follow-up.

Table 2 The Joanna Briggs Institute critical appraisal checklist for case report

No.	Major components	1	2
1	Were patient's demographic characteristics clearly described?	Y	Y
2	Was the patient's history clearly described and presented as a timeline?	Y	Y
3	Was the current clinical condition of the patient on presentation clearly described?	Y	Y
4	Were diagnostic tests or assessment methods and the results clearly described?	Y	Y
5	Was the intervention(s) or treatment procedure(s) clearly described?	Y	Y
6	Was the post-intervention clinical condition clearly described?	Y	Y
7	Were adverse events (harms) or unanticipated events identified and described?	Y	Y
8	Does the case report provide takeaway lessons?	Y	Y
	Overall appraisal	I	I

1: Chen *et al*[7], 2021, United States; 2: Peck and Ely[13], United States, 2013; I: Included, Y: Yes.

functional outcome), four studies reported the reduction of disabilities of the arm, shoulder, and hand (DASH) score (scoring for assessing disability), one study reported the improvement of Jebsen-Taylor hand function test (scoring for assessing hand as functional outcome), and two studies reported the improvement of ultrasound findings (tendon thickness, combined tendon and sheath thickness, and extensor retinaculum thickness). Pooled analysis of included studies also supported these results, in which PRP was associated with a reduction in VAS and increasing Mayo's wrist score ($P < 0.00001$). All these studies reported that PRP is an alternative treatment for DQT due to the initiation and production of growth factors like vascular endothelial growth factor, platelet-derived growth factor, transforming growth factor (TGF)- α , and TGF- β which supported the tissue regeneration through angiogenesis, chemotaxis, and cell proliferation that are activating intracellular signal transduction pathways[6-9,12,13,29-31].

Seven researches discussed about the comparison of PRP and corticosteroid (CS) as a treatment for DQT. All these studies concluded that PRP provided better outcomes than CS because PRP efficacy as an osteointegration and histopromotive agent had a long-term sustained effect with no adverse effect. In contrast, CS had a short-term effect[5,6,10-12,14, 29]. According to Giroti *et al*[12], VAS reduction and DASH improvement were better after CS injection in comparison to PRP injection in the first month; however, after six months, PRP injection showed greater VAS reduction and DASH improvement in comparison to CS injection. PRP has four stages of treatment as a regenerative agent, making PRP has a late onset and long-term effect compared to CS injection. The first stage is an inflammatory stage, consisting of increased vascular permeability, initiation of angiogenesis, stimulation of tenocyte proliferation, and initiation of type III collagen synthesis in the injection site within two to three days. This inflammatory stage begins with a temporary improvement of the inflammatory response due to cyclooxygenase-2 induction, nuclear factor kappa B activation, and the secretion of pro-inflammatory cytokines. This step is continued by the production of an anti-inflammatory microenvironment through the secretion of prostaglandin E2. The second stage is the proliferative stage, where fibroblast proliferation and neo-

Table 3 The Joanna Briggs Institute critical appraisal checklist for case series		
No.	Major components	1
1	Were there clear criteria for inclusion in the case series?	Y
2	Was the condition measured in a standard, reliable way for all participants included in the case series?	Y
3	Were valid methods used for identification of the condition for all participants included in the case series?	Y
4	Did the case series have consecutive inclusion of participants?	Y
5	Did the case series have complete inclusion of participants?	Y
6	Was there clear reporting of the demographics of the participants in the study?	Y
7	Was there clear reporting of clinical information of the participants?	Y
8	Were the outcomes or follow-up results of cases clearly reported?	Y
9	Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	Y
10	Was statistical analysis appropriate?	NA
	Overall appraisal	I

1: Mahdi Al-ardi[8], Iraq, 2017; I: Included, NA: Not available; Y: Yes.

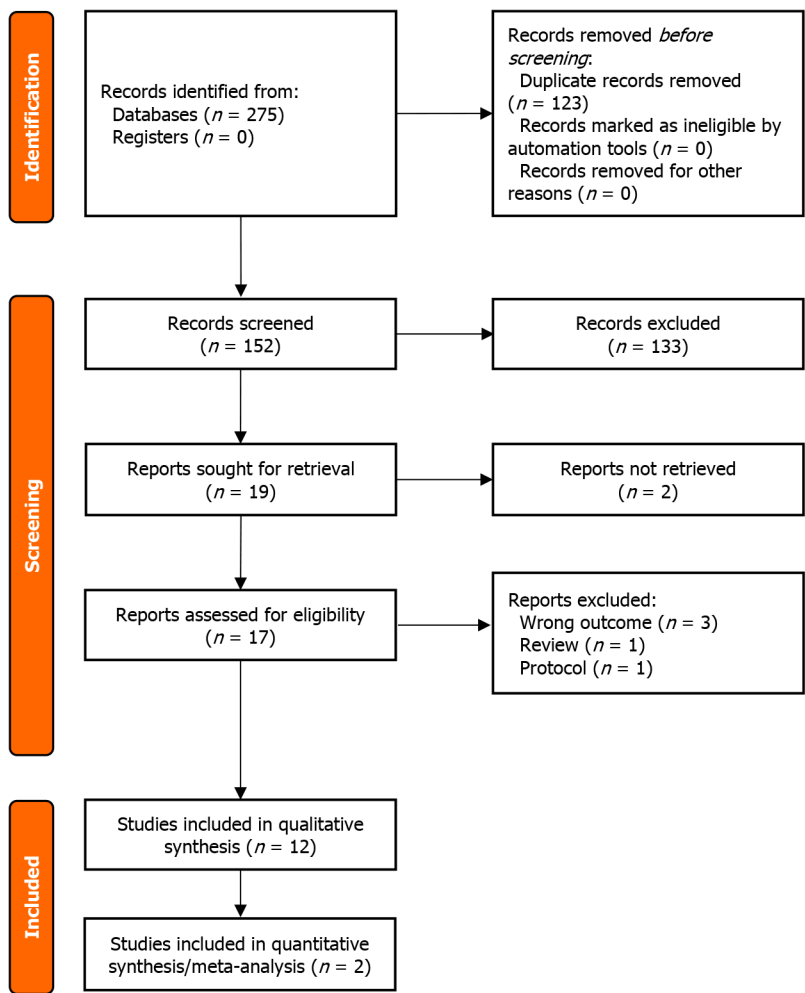


Figure 1 PRISMA flow diagram.

Table 4 Study characteristic

No.	Ref.	Study design	Sample (n)	Sample characteristic: age (year), gender (male, female)	Outcome measure	Result
1	Mahdi Al-ardi[8], 2017, Iraq	Case series	PRP: 30	Age: > 25	Pain reduction (VAS)	PRP injection reduced pain in 1, 3, and 6 months after treatment (VAS in baseline: 5.92; 1 months: 2.11; 3 months: 2.01; 6 months: 2.01; $P < 0.001$)
2	Asaad <i>et al</i> [9], 2023, Iraq	Prospective study	PRP: 12	Age: 43 (26-68); Gender: F	Pain reduction (VAS) and USG evaluation of tendon	PRP injection reduced pain significantly in 1 and 3 months after treatment (VAS in baseline: 8.66 ± 0.65 ; 1 months: 4.5 ± 1.97 ; 3 months: 1.91 ± 2.71 ; $P < 0.001$); decreased tendon sheath effusion significantly in 1 and 3 months after treatment (baseline: 2.07 ± 0.52 ; 1 months: 1.6 ± 0.75 ; 3 months: 0.73 ± 0.76 ; $P < 0.001$); decreased retinaculum thickness significantly in 1 and 3 months (baseline: 1.89 ± 0.5 ; 1 months: 1.3 ± 0.6 ; 3 months: 0.96 ± 0.56 ; $P < 0.001$); decreased peritendinous hyperemia significantly in 1 and 3 months (baseline: 58.3%; 1 months: 16.7%; 3 months: 0%; $P < 0.001$)
3	Chen <i>et al</i> [7], 2021, United States	Case report	PRP: 1	Age: 38; Gender: F	Pain reduction	The PRP injection reduced pain after 2 weeks, completely resolved it after 4 weeks, and there were no recurrent pain or weakness symptoms after 6 months
4	Deb <i>et al</i> [5], 2020, India	Prospective study	PRP: 67; Conservative: 64; CS: 69	PRP; Age: 53.96 ± 09.47 ; Gender: 38, 29; Conservative; Age: 51.85 ± 10.14 ; Gender: 43, 21; CS; Age: 57.49 ± 10.00 ; Gender: 33, 36	Pain reduction (VAS) and functional outcome (Mayo's wrist score)	PRP injection reduced pain significantly in 1, 6, 12 months after treatment compared to conservative and CS therapy (VAS in 1 months: 4.91 ± 1.01 vs 6.37 ± 2.45 vs 5.13 ± 2.07 ; 6 months: 3.96 ± 1.94 vs 5.01 ± 0.26 vs 6.09 ± 1.41 ; 12 months: 2.11 ± 0.28 vs 7.61 ± 0.72 vs 4.93 ± 1.95 ; $P < 0.001$) PRP injection improved functional outcome significantly in 1, 6, 12 months after treatment compared to conservative and CS therapy (Mayo's wrist score in 1 months: 73.61 ± 7.01 vs 39.71 ± 4.47 vs 63.45 ± 5.17 , p: 0.045; 6 months: 83.47 ± 6.83 vs 51.43 ± 6.64 vs 70.94 ± 6.29 , p: 0.003; 12 months: 87.24 ± 6.94 vs 64.78 ± 7.12 vs 72.01 ± 5.42 , p: 0.001).
5	Giroti <i>et al</i> [12], 2021, India	Prospective study	PRP: 22 hand; CS: 28 hand	PRP; Age: 44.44 (27-60); Gender: 2, 20; CS; Age: 43.16 (31-59); Gender: 3, 24	Pain reduction (VAS) and disability reduction (DASH score)	PRP injection reduced pain in 6 months after treatment compared to CS therapy (VAS: 1.4 vs 2.1) PRP injection reduced disability compared to CS therapy (DASH score: 23.5 vs 39.7)
6	Gulati and Ramesh[6], 2022, India	Prospective study	PRP: 22; CS: 22	PRP; Age: 46.3 ± 9.7 ; Gender: 6, 16; CS; Age: 42.3 ± 5.8 ; Gender: 7, 15	Pain reduction (VAS) and disability reduction (DASH score)	PRP injection reduced pain significantly in 4, 12, and 24 weeks after treatment compared to CS therapy (VAS in 4 weeks: 5 vs 7; 12 weeks: 3.5 vs 5; 24 weeks: 1 vs 5; $P < 0.001$) PRP injection reduced disability significantly in 4, 12, and 24 weeks compared to CS therapy (DASH score in 4 weeks: 61.3 vs 93.1; 12 weeks: 40.9 vs 87.2; 24 weeks: 13.6 vs 72.7; $P < 0.001$)
7	Johurul <i>et al</i> [29], 2019, Bangladesh	Prospective study	PRP: 25; CS: 35	PRP; Age: 35 ± 2.1 ; Gender: 10, 15; CS; Age: 42 ± 7.3 ; Gender: 15, 20	Pain reduction (wrist pain)	PRP injection reduced pain significantly in 60 days after treatment compared to CS therapy (wrist pain: 1.1 ± 1.0 vs 2.7 ± 1.0 , p: 0.0001)
8	Kumar <i>et al</i> [14], 2023, India	Prospective study	PRP: 30; CS: 30	PRP; Age: 35.83 ± 8.48 ; Gender: 8, 22; CS; Age: 37.80 ± 6.44 ; Gender: 10, 20	Pain reduction (VAS), disability reduction (DASH score), and functional outcome (Mayo's wrist score)	PRP injection reduced pain insignificantly in 3, 6, 12 months after treatment compared to CS therapy (VAS in 3 months: 1.87 ± 1.78 vs 2.30 ± 2.32 , p: 0.420; 6 months: 0.83 ± 0.99 vs 1.23 ± 1.61 , p: 0.251; 12 months: 0.40 ± 0.62 vs 0.47 ± 0.78 ; p: 0.715) PRP injection reduced disability insignificantly in 3, 6, 12 months after treatment compared to CS therapy (DASH score in 3 months: 5.66 ± 6.56 vs 6.82 ± 8.70 , p: 0.633; 6 months: 2.38 ± 3.87 vs 3.02 ± 5.13 , p: 0.587; 12 months: 0.49 ± 0.85 vs 1.21 ± 2.83 , p: 0.183) PRP injection improved functional outcome insignificantly in 3, 6, 12 months after treatment compared to CS therapy (Mayo's wrist score in 3 months: 82.83 ± 8.68 vs 82.00 ± 9.34 , p: 0.722; 6 months: 88.83 ± 6.91 vs 86.83 ± 7.13 , p: 0.274; 12 months: 92.50 ± 4.10 vs 90.83 ± 5.88 , p: 0.208)

9	Peck and Ely [13], 2013, United States	Case report	PRP: 1	Age: 74; Gender: F	Pain reduction (VAS)	PRP injection reduced pain in 3 and 6 months after treatment (VAS baseline: 38 of 100; 3 months: 10 of 100; 6 months: 14 of 100)
10	Ramesh <i>et al</i> [30], 2018, India	Prospective study	PRP: 141	Age: 41.24 (21-59); Gender: 77, 64	Pain reduction (VAS) and functional outcome (Mayo's wrist score)	PRP injection reduced pain significantly in 6 months after treatment (VAS: 9.42 <i>vs</i> 3.92, <i>P</i> < 0.001) PRP injection improved functional outcome significantly in 6 months after treatment (Mayo's wrist score: 22.71 <i>vs</i> 71.46, <i>P</i> < 0.001)
11	Sheikh <i>et al</i> [10], 2020, Egypt	Prospective study	PRP: 20 hand; CS: 20 hand	PRP; Age: 41.45 ± 11.54; Gender: 15, 2; CS; Age: 41.30 ± 8.06; Gender: 16, 2	Pain reduction (VAS), disability reduction (qDASH score), functional outcome (JHFT), and USG evaluation of tendon	PRP injection reduced pain significantly in 6 months after treatment compared to CS therapy (VAS: 2.13 ± 2.75 <i>vs</i> 1.94 ± 3.04, <i>p</i> : 0.034) PRP injection reduced disability significantly in 6 months after treatment compared to CS therapy (qDASH score: 10.90 ± 10.86 <i>vs</i> 9.38 ± 13.52, <i>p</i> : 0.729) PRP injection improved functional outcome significantly in 6 months after treatment compared to CS therapy (JHFT: 49.56 ± 5.98 <i>vs</i> 50.39 ± 7.63, <i>p</i> : 0.735) PRP injection decreased tendon thickness insignificantly in 6 months after treatment compared to CS therapy (LS: 2.35 ± 0.77 <i>vs</i> 1.99 ± 0.53, <i>p</i> : 0.133; TS: 2.54 ± 0.67 <i>vs</i> 2.42 ± 0.57, <i>p</i> : 0.571); decreased tendon and sheath thickness insignificantly in 6 months after treatment compared to CS therapy (LS: 3.23 ± 0.92 <i>vs</i> 2.91 ± 0.96, <i>p</i> : 0.335; TS: 3.53 ± 0.87 <i>vs</i> 3.18 ± 0.63, <i>p</i> : 0.183); decreased extensor retinaculum thickness significantly in 6 months after treatment compared to CS therapy (0.98 ± 0.35 <i>vs</i> 0.59 ± 0.25, <i>P</i> < 0.001)
12	Shoma <i>et al</i> [11], 2023, Bangladesh	RCT	PRP: 33; Conservative: 30; CS: 31	PRP; Age: 45.6 ± 10.4; Gender: 12, 21; Conservative; Age: 42.4 ± 6.3; Gender: 7, 23; CS; Age: 46.9 ± 11.3; Gender: 9, 22	Pain reduction (VAS) and functional outcome (Mayo's wrist score)	PRP injection reduced pain significantly in 3 and 6 months after therapy compared to conservative and CS therapy (VAS: 3.5 ± 0.7 <i>vs</i> 4.4 ± 0.7 <i>vs</i> 3.9 ± 0.5, <i>P</i> < 0.001) PRP injection improved functional outcome significantly in 3 and 6 months after therapy compared to conservative and CS therapy (Mayo's wrist score: 87.9 ± 3.7 <i>vs</i> 65.2 ± 7.2 <i>vs</i> 73.7 ± 4.8, <i>P</i> < 0.001)

CS: Corticosteroid; DASH: Disabilities of the arm, shoulder, and hand; DQT: De quervain's tenosynovitis; F: Female; JHFT: Jebsen hand function test; LS: Longitudinal section; n: Number; p: Probability; PRP: Platelet-rich plasma; ROM: Range of motion; TS: Transversal section; qDASH: Quick disabilities of the arm, shoulder, and hand; USG: Ultrasonography; VAS: Visual analogue scale.

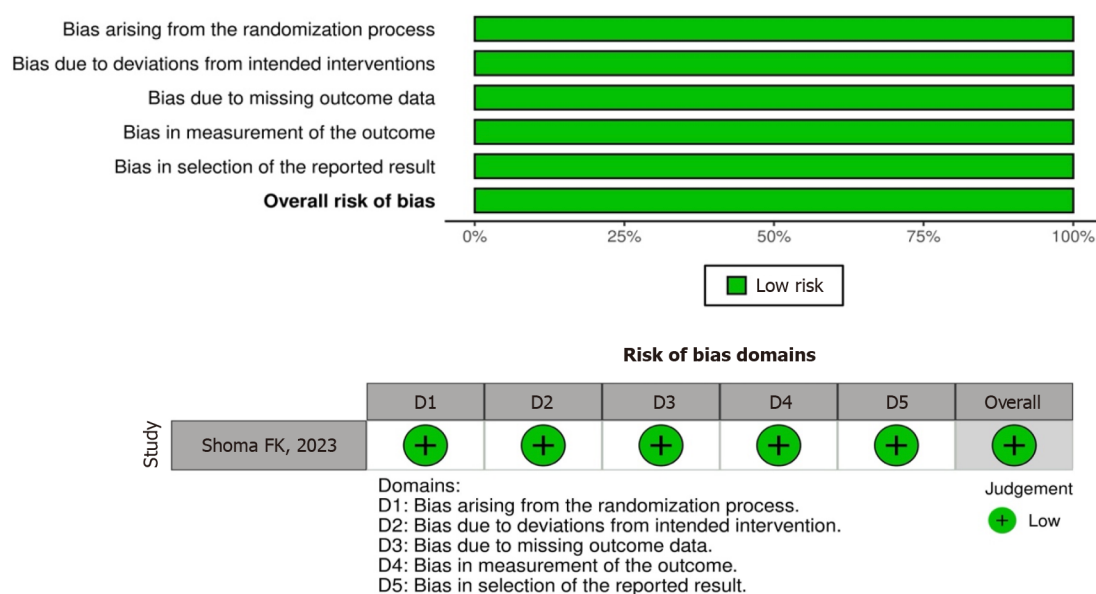


Figure 2 ROB 2: Shoma FK, 2023[11].

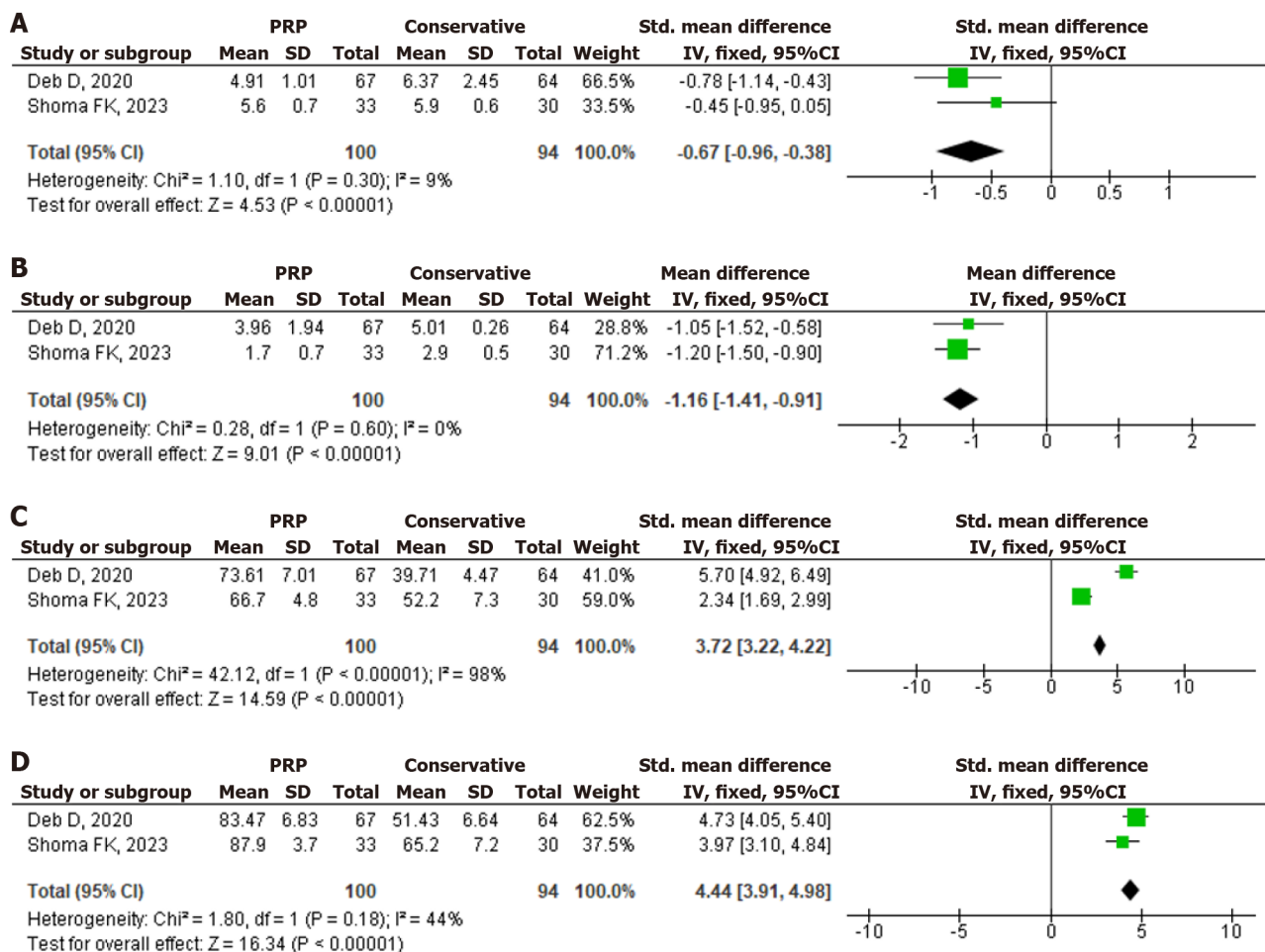


Figure 3 Forest plots of the comparison between platelet-rich plasma injection and conservative treatment. A: Visual analogue scale (VAS) pain at first month after treatment; B: VAS pain at six months after treatment; C: Mayo's wrist score at first month after treatment; D: Mayo's wrist score at six months after treatment. PRP: Platelet-rich plasma.

angiogenesis accumulate. During this stage, water content and glycosaminoglycan levels are high, which lasts from one to six weeks. The remodelling stage is the third stage (six to ten weeks), with cellularity, collagen, and glycosaminoglycan production reduced, followed by the last stage, namely the maturation stage, where production of type I collagen is occurred which lasts from ten weeks to six months (in this stage, the metabolism of tenocyte remains high)[6,32-34]. According to this finding, PRP injection provides better pain management and stable improvements in functional results in the long term. In contrast, CS injection results in rapid recovery but temporary improvement (short-term effect)[29,33,35,36].

For PRP preparation, most studies used 10-30 cc of blood from the patient's vein with an aseptic procedure and combined with an anticoagulant (citrate phosphate dextrose adenine-1). After that, the blood was placed into a PRP kit and centrifuge twice: The first time was four minutes at 3200 rpm, and the second time was three minutes at 3300 rpm to separate erythrocyte, platelet-poor plasma, and PRP. Then, 1.5-4 cc of PRP was collected. Prior to injection, 10% of calcium chloride solution was combined with autologous PRP in a ratio of 1: 10. First, the PRP injection was administered under local anaesthesia and injected along the inflamed tendon sheath of APL and EPB tendons; then, an antiseptic dressing was applied at the injection site after the procedure. The patient was observed for 10-15 minutes to monitor any adverse effects from the procedure and the patient was discharged with a recommendation to take a rest the next day, refrained from weight bearing and repetitive movements on the treated wrist for at least one week and the usage of wrist splint for 48-72 hours, the usage of cold compress or paracetamol for analgesia if necessary, and avoided the usage of NSAID[5-9,13,14,29,30].

Six studies discussed the usage of ultrasonography (USG) to guide the PRP injection to increase the accuracy of injection due to the anatomical variation of the first dorsal compartment of the wrist[5,7,9,10,13,30]. USG-guided PRP injection accurately directs the injection into the disorder area in cases of sub-compartmentalization, reduces the risk of subsequent tear, and prevents injection-associated complications, including superficial radial nerve injury[9,10]. Four studies used percutaneous needle tenotomy before the injection to create intra-tendinous micro tears and induce faster healing[9,37]. The fundamental theory of needle tenotomy is associated with the neovascularization and inflammatory response induced by perforation, which promotes tendon healing[38-41].

The dosage of PRP ranged from 1.5-4 cc from the included studies, with no differences in results in this dosage range[5-13,29,30]. However, with USG guided, the smaller volume of PRP injection (1.5 cc) can be effective in achieving good

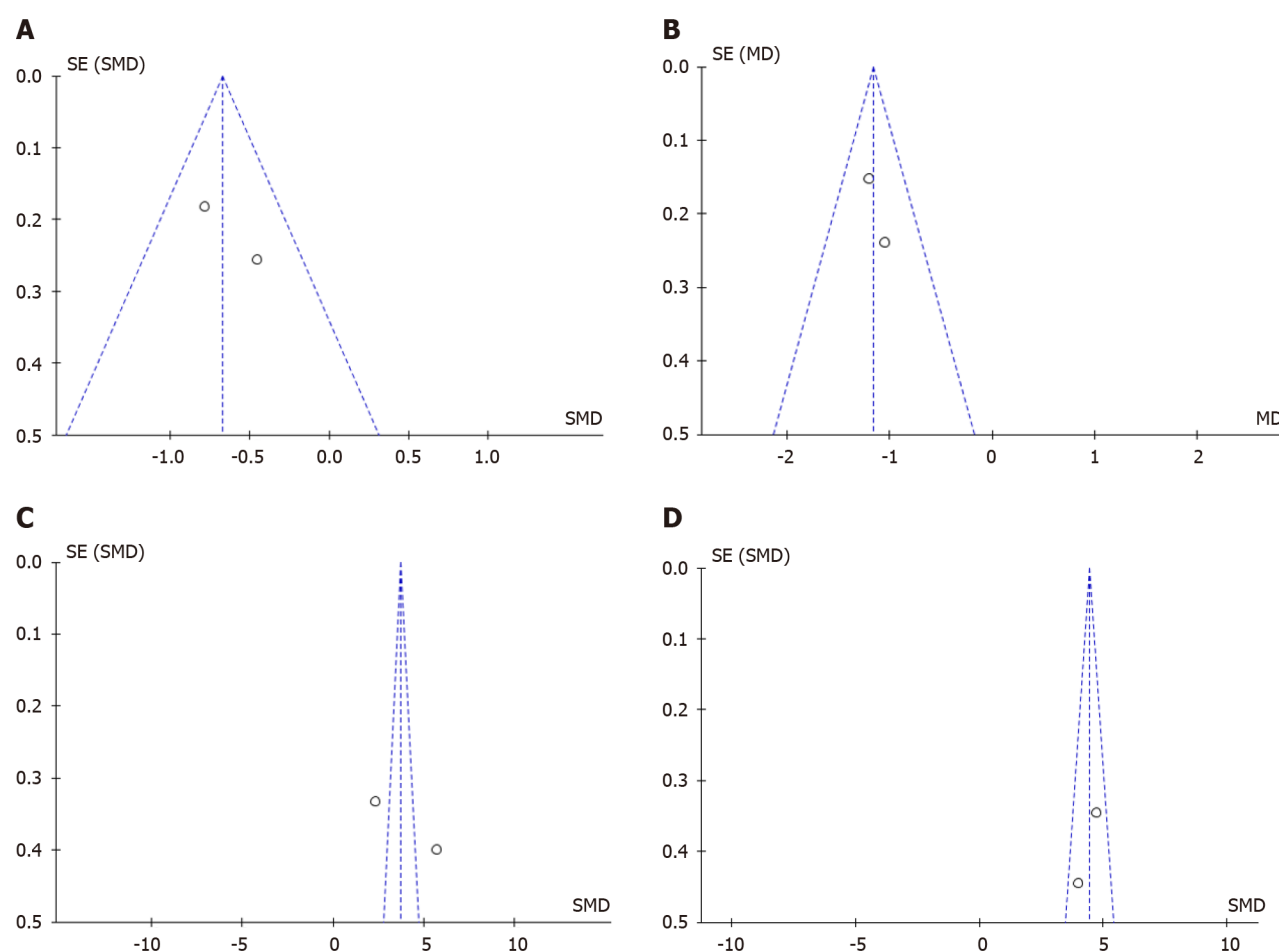


Figure 4 Funnel plots of the comparison between platelet-rich plasma injection and conservative treatment. A: Visual analogue scale (VAS) pain at first month after treatment; B: VAS pain at six months after treatment; C: Mayo's wrist score at first month after treatment; D: Mayo's wrist score at six months after treatment.

outcomes compared to PRP injection without USG guided due to the accuracy of injection location[8,29]. Most studies used single dose of PRP injection, but three studies used multiple doses of PRP injection, with the treatment interval being four weeks[5,6]. The interval between doses was required because of the initiation of fibroblast proliferation and neo-angiogenesis[30,42].

There was no complication associated with PRP injection in DQT treatment, however Asaad *et al*[9] reported two patients that experienced with mild vasovagal sign following the procedure due to the adverse event of lidocaine or pain at the time of procedure. According to Chen *et al*[7], the skin discoloration or atrophy caused by CS injection that has persisted for more than one year had utterly resolved after six weeks of PRP injection; this was probably due to the effect of PRP in tissue regeneration.

Despite PRP is a safe treatment with minimal side effects, some disadvantages and contraindications need to be considered. Adverse effects at the injection site (formation of scar tissue and calcification, infection, allergic reaction), no established and consistent method for preparing and administering PRP (ideal duration, method, frequency, volume and concentration of these components for maximizing beneficial effects are still unclear) are disadvantages for PRP treatment. While, critical thrombocytopenia, platelet dysfunction, hemodynamic instability, systemic infection, local inflammation at the injection site, and patients who are unwilling to accept risk are absolute contraindications for PRP treatment[43,44]. The relative contraindications of PRP treatments are the usage of NSAID within two days, glucocorticoid injection at the treatment site within a month, systemic glucocorticoid consumption within two weeks, recent fever or illness, malignancy especially bone or haematolymphoid malignancy, anaemia (haemoglobin less than 10 g/dL), thrombocytopenia (less than 150000 platelets per microliter), and smokers[45-47].

Strengths and limitations of the study

This systematic review consisted of 12 studies that discussed PPR efficacy for DQT. The majority of the studies were prospective studies that discussed the efficacy of PRP in reducing pain in DQT.

The limitations of this systematic review were that the majority of studies were observational studies, the baseline characteristics were varied, the demography variance and confounding variables in the human study were unknown, the sample size in some studies were small, the difference of PRP preparation and technique between included studies, there was limited follow-up time, and this systematic review only reviewed English-language articles.

Future implication

The current systematic review can be a scientific publication for physicians, researchers, and all readers associated with the efficacy of PRP for DQT. Further research is needed with a larger sample size, diverse demographic variances, longer follow-up time, and standardization of PRP preparation and injection technique.

CONCLUSION

PRP can be used as an alternative non-operative treatment for DQT who did not respond to traditional therapy due to its tissue regenerative effect. USG-guided PRP with percutaneous needle tenotomy gives better outcome in DQT. Further research is needed related to standardization of PRP preparation and PRP injection technique.

FOOTNOTES

Author contributions: Hidajat NN and Magetsari RMSN A contributed to the design and implementation of the study and the writing of the manuscript; Steven G and Budiman J contributed to the statistical analyses and the writing of the manuscript; Prasetyo GT contributed to the design of the study and the revision of the manuscript; Steven G and Budiman J contributed to the performance of the research; Magetsari RMSN and Prasetyo GT contributed to the quality and professional revision; Hidajat NN contributed to the quality and professional revision and the writing of the manuscript.

Conflict-of-interest statement: All authors have no conflicts of interest to disclose.

PRISMA 2009 Checklist statement: The authors have read the PRISMA 2009 Checklist, and the manuscript was prepared and revised according to the PRISMA 2009 Checklist.

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S-Editor: Liu JH

L-Editor: A

P-Editor: Yuan YY

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