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Clinical Effectiveness of Platelet-Rich Plasma for Meniscal Injuries: A Systematic Review

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ABSTRACT

Background: Meniscal injuries are common among active individuals, and meniscal repair is increasingly favored over meniscectomy due to its joint-preserving benefits. Platelet-rich plasma (PRP) has emerged as a biological adjunct to enhance healing, though clinical evidence of its efficacy remains inconclusive.

Methods: A systematic search of PubMed, Embase, Google Scholar, and Cochrane Library (2010–2025) was conducted for English-language studies comparing meniscal repair with or without PRP. Inclusion required original research reporting functional outcomes or pain scores. Risk of bias was assessed.

Results: The initial search yielded a total of A total of 462 records were identified; after screening and full-text review, 4 studies met inclusion criteria for systematic review. This review highlights promising findings from four studies one RCT and three cohorts demonstrating the clinical potential of PRP in meniscal repair. PRP was associated with improved outcomes in IKDC, WOMAC, and VAS scores, as well as high return-to-activity rates, suggesting its beneficial role in enhancing meniscal healing.

Conclusion: While PRP appears beneficial as an adjunct in meniscal repair, standardized protocols and well-powered randomized trials are needed to clarify its efficacy and identify optimal indications.

Keywords: Platelet-Rich Plasma; Meniscal Repair; Functional Outcome; Good Health and Well-Being

INTRODUCTION

Meniscal injuries are among the most prevalent intra-articular knee injuries, particularly affecting athletes and active individuals. The meniscus plays a critical role in knee biomechanics, contributing to load transmission, shock absorption, joint stability, and lubrication. Traditionally, partial or total meniscectomy was the primary surgical approach for irreparable meniscal tears. However, accumulating evidence has emphasized the long-term degenerative consequences of meniscectomy, particularly osteoarthritis, leading to a paradigm shift towards meniscus-preserving strategies such as meniscal repair.

Despite the widespread adoption of repair techniques, the intrinsic avascular nature of the meniscus, especially in the inner zones, poses significant challenges to healing. Biological augmentation, notably with platelet-rich plasma (PRP), has emerged as a promising strategy to enhance the reparative potential of meniscal tissue. PRP is an autologous concentration of platelets in

plasma, rich in growth factors such as platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and transforming growth factor-beta (TGF-β), which are known to modulate inflammation, promote cell proliferation, and support tissue regeneration.

Recent basic science and translational studies have demonstrated the potential of PRP to stimulate meniscal cell migration, proliferation, and matrix synthesis. However, clinical evidence supporting its routine application in meniscal repair remains inconsistent. Kaminski et al. conducted a randomized, double-blind, placebo-controlled trial on patients with unstable vertical meniscal tears and found that PRP augmentation significantly improved healing rates and functional outcomes compared to saline injection, with an 85% healing rate in the PRP group versus 47% in the control group ($p = 0.048$) (1).

In contrast, Dai et al. evaluated PRP augmentation in the arthroscopic repair of discoid lateral meniscus (DLM) tears and found no significant differences in pain reduction or functional improvement compared to the control group over a 24-month follow-up period (2). Their findings suggest that while PRP may contribute to healing, its impact on clinical outcomes may be modest or context dependent.

Similarly, Griffin et al. observed no statistically significant improvement in functional scores or reoperation rates in patients undergoing meniscal repair with or without PRP. Although both groups showed postoperative improvement, the effect size was insufficient to demonstrate superiority of PRP, potentially due to limited sample size and variability in tear types (3).

Notably, Everhart et al. conducted a large-scale cohort study involving 550 patients and found that PRP significantly reduced the risk of failure in isolated meniscal repairs (adjusted hazard ratio: 0.18; $p = .002$), but had no significant benefit in cases with concomitant anterior cruciate ligament (ACL) reconstruction (4). This finding underscores the importance of surgical context and suggests that PRP's efficacy may be influenced by the biological environment and concurrent procedures.

Further innovation in biologic scaffolding has led to the combined use of PRP and platelet-rich fibrin (PRF), which offers a three-dimensional fibrin network for sustained growth factor release. Kemmochi et al. evaluated the use of PRF and PRP in meniscal repair and found improvements in clinical scores in both PRF and non-PRF groups, although the differences were not statistically significant. They highlighted the biocompatibility and potential of PRF as a novel adjunct in regenerative knee surgery (5).

Collectively, the clinical landscape presents a complex and somewhat conflicting view of PRP efficacy in meniscal repair. Differences in PRP preparation methods, tear characteristics, surgical techniques, and outcome measures may contribute to the variability in results. This systematic review aims to critically evaluate and synthesize current clinical evidence on the use of PRP in meniscal repair, focusing on healing rates, functional outcomes, and reoperation risk, to better inform clinical decision-making and identify areas for future research.

MATERIALS & METHODS

Search Strategy

Literature Search Strategy and Study Selection We systematically searched for relevant articles in PubMed, Embase, Google Scholar, and Cochrane Library on studies published 2010 to 2025. To include all the articles about the clinical efcacy of meniscus repair performed with PRP, a structured literature search was applied using the following string: ((“PRP” OR “platelet-rich plasma” OR “plasma-rich fbrin”) AND (“meniscus” OR “menisci” OR “meniscal”)). The inclusion criteria for this review were: (1) original research articles; (2) comparative studies evaluating meniscal repair with or without PRP augmentation; (3) studies reporting at least one of the following outcomes—visual analog scale (VAS) scores, WOMAC, or knee-specific

patient-reported outcomes; and (4) full-text availability in English. Studies were excluded if they: (1) involved patients receiving surgical procedures unrelated to meniscal repair; (2) did not isolate PRP as the only variable between study groups; (3) were animal studies, basic science research, review articles, or technical notes; or (4) were published in languages other than English. Full-text versions of all eligible studies were obtained. In cases of duplicate publications, only the most recent or the version containing the most comprehensive data was included.

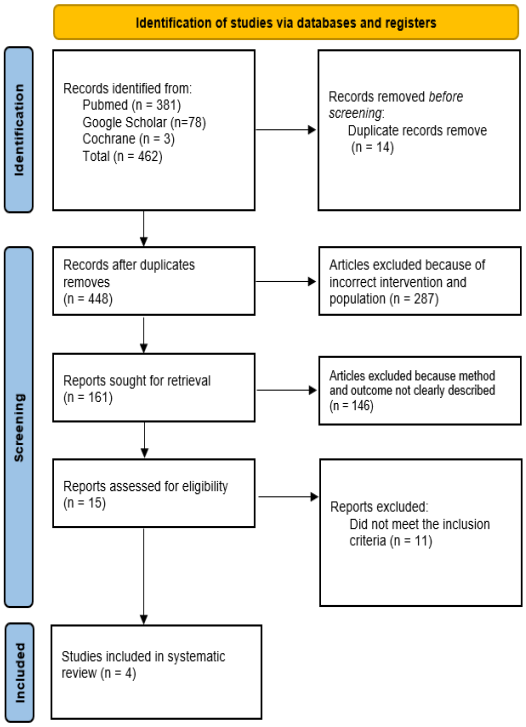

Figure 1. PRISMA Flow Chart

Methodological Quality Assessment

For the methodological quality assessment, the Review Manager Software Version 5.4 was used. Two authors independently performed the assessment. The Cochrane Risk of Bias (RoB) tool evaluates the selected studies based on five specific domains: selection bias (random sequence generation and allocation concealment), performance bias, detection bias, attrition bias, and reporting bias, shown in figure 2.

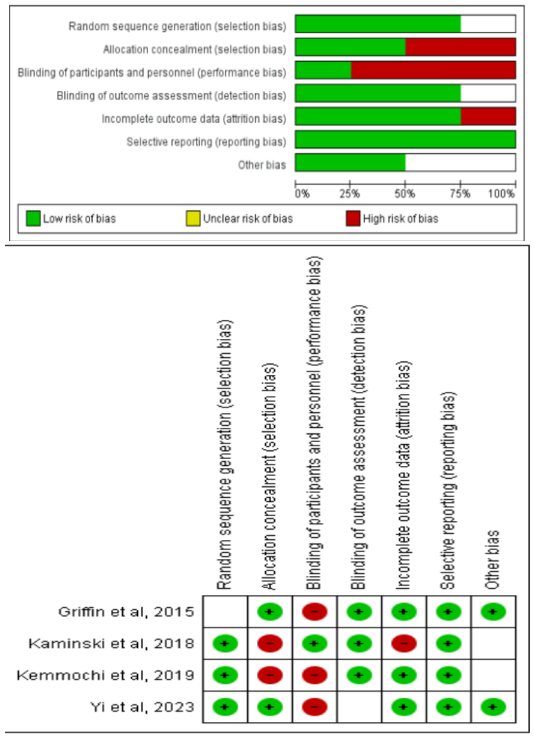

Figure 2. Risk of Bias Assessment

RESULT

Observations/A systematic search was conducted across three major databases: PubMed (n = 381), Google Scholar (n = 78), and Cochrane Library (n = 3), yielding a total of 462 records. After the removal of 14 duplicate entries, 448 records were retained for screening. During the initial screening phase, 287 articles were excluded due to incorrect intervention or study population. The remaining 161 articles were then retrieved for full-text assessment. Among these, 146 articles were excluded because the methodology or outcomes were not clearly described.

Fifteen studies were further assessed for eligibility, of which 11 were excluded for not meeting the predefined inclusion criteria. Ultimately, 4 studies were included in the final systematic review (shown in Figure 1). This selection process followed PRISMA guidelines and ensured a rigorous and transparent approach to identifying relevant studies for inclusion.

This systematic review summarizes four studies that evaluated the use of Platelet-Rich Plasma (PRP) in meniscal tear repair, including both prospective and retrospective cohorts, as well as one randomized

controlled trial (RCT). The studies varied in design, sample size, and outcome measures, providing a broad perspective on PRP's clinical utility.

Griffin et al. (2015) conducted a prospective cohort study with a total of 35 patients, including 20 receiving PRP and 15 as controls. The PRP group had a mean age of 26 years (±9), while the control group averaged 35 years (±14). Most participants were male (28 males, 7 females). The study assessed outcomes using the International Knee Documentation Committee (IKDC) score, Lysholm score, and return to activity rate.

Kaminski et al. (2018) conducted a randomized controlled trial (RCT) involving 37 participants (19 PRP, 18 control), with mean ages of 30 (range 18–43) in the PRP group and 26 (range 19–44) in the control group. The sex distribution was 30 males and 7 females. This study reported a wide range of functional outcomes, including the Visual Analog Scale (VAS) for pain, IKDC score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and the Knee injury and Osteoarthritis Outcome Score for Activities of Daily Living (KOOS–ADL).

Yi et al. (2023) presented a retrospective cohort study with a relatively older patient population, comprising 56 subjects (28 PRP and 28 controls). The PRP group had a mean age of 69.96 ± 4.02 years, while the control group had a mean age of 69.50 ± 4.94 years. The sex distribution was relatively balanced (27 males and 29 females). Outcomes were measured using WOMAC, VAS, and Lysholm scores, suggesting the application of PRP even in elderly patients undergoing meniscal repair.

Kemmochi et al. (2019) conducted a prospective cohort study on 22 patients (17 PRP, 5 controls), with a mean age of 32.4 ± 16.3 years in the PRP group and 20.8 ± 8.8 years in the control group. The sample was evenly distributed in terms of sex (12 males, 10 females). The functional outcomes assessed included the Tegner Activity Scale, IKDC, Lysholm score, and VAS.

Overall, the studies consistently used validated outcome measures (IKDC, Lysholm, VAS, WOMAC), showing a growing trend in evaluating PRP as an adjunctive therapy in meniscal healing. While age, sample size, and methodology varied, all studies included both subjective (pain, activity scales) and objective (functional scores) assessments. The evidence suggests that PRP may provide benefit in meniscal repair, although further large-scale, randomized studies are necessary to confirm efficacy and determine optimal patient selection (shown in table 1).

This synthesis evaluates the effectiveness of Platelet-Rich Plasma (PRP) in meniscal tear repair using five common clinical outcome measures: IKDC, Lysholm Score, WOMAC, Return to Activity, and VAS score, across four studies (shown in table 2).

IKDC (International Knee Documentation Committee) scores were reported in three studies. Griffin et al. (2015) found no statistically significant difference between PRP (69 ± 26) and control groups (76 ± 17) (P = 0.550). In contrast, Kaminski et al. (2018) and Kemmochi et al. (2019) demonstrated significantly higher IKDC scores in the PRP group compared to controls. Kaminski et al. reported a mean IKDC of 97.56 ± 0.63 in the PRP group versus 84.77 ± 0.92 in controls (P = 0.001), while Kemmochi et al. reported 91.5 ± 1.2 for PRP versus 87.4 ± 10.4 for controls (P = 0.0003).

Lysholm scores were reported in three studies. Griffin et al. found no significant difference (PRP: 66 ± 31.9 vs. Control: 89 ± 9.7; P = 0.059). However, Yi et al. (2023) and Kemmochi et al. (2019) showed lower scores in the PRP group. Yi et al. reported a significantly lower mean Lysholm score in the PRP group (82.31 ± 5.31) than in controls (79.10 ± 5.24) (P = 0.027), while Kemmochi et al. showed higher Lysholm scores in controls (97.2 ± 1.8) than in PRP patients (95.8 ± 7.1) (P = 0.0003).

Table 1. Demographic Data of Included Study

No	Authors	Types of Study	Sample Size	Mean Age		Sex		Outcomes Recorded
				PRP	Control	M	F	
1	Griffin et al, 2015	Cohort Prospective	35 PRP=20 Control=15	26(9)	35 (14)	28	7	- IKDC - Lysholm score - Return to Activity
2	Kaminski et al, 2018	RCT	37 PRP=19 Control=18	30 (18–43)	26 (19–44)	30	7	- VAS - IKDC - WOMAC - KOOS (ADL)
3	Yi et al, 2023	Cohort Retrospective	56 PRP=28 Control=28	69.96 ± 4.02	69.50 ± 4.94	27	29	- WOMAC - VAS -Lysholm score
4	Kemmochi et al, 2019	Cohort Prospective	22 PRP=17 Control=5	32.4 ± 16.3	20.8 ± 8.8	12	10	- Tegner Activity Scale - IKDC - Lysholm score - VAS

Table 2. Clinical Outcomes of Included Study

No	Reference	IKDC	Lysholm Score	WOMAC	Return to Activity	VAS score
1	Griffin et al, 2015	PRP: 69 (± 26) Control: 76 (± 17) 0.550	PRP: 66 (± 31.9) Control: 89 (± 9.7) 0.059	-	PRP: 100% Control: 91%	-
2	Kaminski et al, 2018	PRP: 97.56 ± 0.63 Control: 84.77 ± 0.92 *P* =0.001	-	PRP: 0.95 ± 0.13 Control: 3.95 ± 0.33 *P* =0.002	PRP: 98.18 ± 0.13 Control: 95.14 ± 0.38 *P* =0.004	PRP: 0.84 ± 0.10 Control: 0.89 ± 0.08 *P* =0.001
3	Yi et al, 2023	-	PRP: 82.31 (± 5.31) Control: 79.10 (± 5.24) 0.027	PRP: 52.46 (± 4.11) Control: 62.91 (± 3.14) 0.000	-	PRP: 1.05 ± 0.16 Control: 2.38 ± 0.28 *P* =0.000
4	Kemmochi et al, 2019	PRP: 91.5 ± 1.2 Control: 87.4 ± 10.4	PRP: 95.8 ± 7.1 Control: 97.2 ± 1.8 0.0003	-	PRP: 5.9 ± 2.3 Control: 7.8 ± 1.6 0.0003	PRP: 5.06 ± 0.13 Control: 6.21 ± 0.13 *P* =0.014

WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) outcomes varied. Kaminski et al. showed significantly better WOMAC scores in the PRP group (0.95 ± 0.13) compared to controls (3.95 ± 0.33) (P = 0.002). Yi et al. reported the opposite, with worse WOMAC scores in the PRP group (52.46 ± 4.11) versus controls (62.91 ± 3.14), also statistically significant (P = 0.000), indicating possible inconsistencies in scoring or interpretation across studies.

Return to activity was assessed by Griffin et al. and Kaminski et al. Griffin et al. reported a 100% return rate in the PRP group versus 91% in the control group. Kaminski et al. reported similarly high rates with no significant difference (PRP: 98.18 ± 0.13 vs. Control: 95.14 ± –, P = 0.38).

VAS (Visual Analog Scale) scores for pain were included in all but Griffin's study. Kaminski et al. showed a slight but statistically significant reduction in pain scores in the PRP group (0.84 ± 0.10) vs. control (0.89 ± –, P = 0.001). Yi et al. found a significantly lower VAS score in the PRP group (1.05 ± 0.16) compared to 2.38 ± – in controls (P = 0.000). Kemmochi et al. also reported a significantly better VAS score in PRP (5.06 ± 0.13) than in controls (6.21 ± –; P = 0.014).

DISCUSSION

The findings from four clinical studies comprise prospective and retrospective cohorts as well as one randomized controlled trial, evaluating the efficacy of Platelet-Rich Plasma (PRP) in meniscal tear repair (1,3,5,6). While the results indicate that PRP may improve clinical outcomes, variations in study design, patient populations, and outcome measures introduce heterogeneity, necessitating careful interpretation of the findings.

The Lysholm score, another indicator of knee function, yielded mixed outcomes. While Yi et al. (6) reported modest improvements in PRP-treated elderly patients, Kemmochi et al. (5) paradoxically noted better Lysholm scores in controls. This discrepancy could be attributed to differences in baseline characteristics, surgical techniques, or rehabilitation protocols, reflecting findings from other orthopedic PRP studies that have demonstrated outcome variability depending on patient age and tissue vascularity (8).

The WOMAC index, primarily used to assess pain and stiffness in osteoarthritic populations, also showed conflicting results: Kaminski et al. (1) reported superior outcomes in the PRP group, while Yi et al. (6) reported the reverse. This contrast may be due to differing interpretations of WOMAC subdomains or the influence of preexisting joint degeneration, as noted in previous PRP meta-analyses on osteoarthritis (2,12).

VAS scores consistently showed improved pain outcomes with PRP application across Kaminski, Yi, and Kemmochi's studies, reinforcing the anti-inflammatory and analgesic potential of PRP. This aligns with the underlying biological mechanism, where PRP releases growth factors such as TGF-β, VEGF, and PDGF, contributing to reduced inflammation and enhanced tissue regeneration (9).

Despite the generally positive trends, the data on return to activity remain inconclusive. While Griffin et al. (3) and Kaminski et al. (1) both reported high return rates postoperatively in PRP groups, the difference was not statistically significant. This may highlight a ceiling effect in young, active populations or underscore the importance of psychological and social factors in return-to-play decisions, as previously noted in sports medicine literature (10).

Notably, study heterogeneity in PRP preparation (e.g., leukocyte-rich vs. leukocyte-poor), delivery methods (intraoperative vs. postoperative injections), and rehabilitation regimens may have significantly influenced outcomes. The lack of standardized PRP protocols has long been a limitation in PRP research across musculoskeletal applications (11,12).

CONCLUSION

Current evidence indicates that PRP may enhance pain control and functional scores in meniscal repair, particularly as reflected by IKDC and VAS outcomes. However, variability in clinical benefit, especially regarding Lysholm and WOMAC scores, underscores the need for standardized protocols and larger, high-quality randomized trials. Stratified research based on age, tear morphology, and PRP composition is essential to determine the optimal indications for its use.

Declaration by Authors
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