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**Is platelet rich plasma (PRP) injection an effective therapy in improving patient functional outcomes and decreasing pain postoperatively in adults with meniscal repairs?**

Paige A. Foschi, PA-S

A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies  
Philadelphia College of Osteopathic Medicine  
Philadelphia, Pennsylvania

December 17, 2021

## ABSTRACT

**Objective:** The objective of this selective EBM review is to determine: “Is platelet rich plasma (PRP) injection an effective therapy in improving patient functional outcomes and decreasing pain postoperatively in adults with meniscal repairs.”

**Study Design:** A systematic review of three randomized controlled trials (RCTs) published between 2018 and 2019.

**Data Sources:** All three RCTs were discovered using PubMed, AMED, CINAHL Plus, and Rehabilitation & Sports Medicine Source. The articles were published in English in peer-reviewed journals and selected based on applicability to the clinical question.

**Outcome Measured:** Patients’ pain was assessed using the Visual Analog Scale (VAS) and the Knee Injury and Osteoarthritis Outcome Score (KOOS) was used to measure patient quality of life. Outcomes were assessed pre- and post-intervention, the mean change from baseline was calculated once intervention was received.

**Results:** In the RCT by Kaminski et al. (2018), meniscal repair with PRP injection administered at repair site provided significant improvement in quality of life postoperatively compared with the control group with  $P < 0.01$ , but patient pain measured by the VAS assessment was found to be non-significant between in the groups. In the RCT by Kaminski et al. (2019), there was no difference in patient quality of life outcomes between trephination repair alone and trephination with PRP, p-value was all non-significant, but the p-value was  $<0.05$  and statistically significant for pain between groups on the VAS score. Lastly, Elnemr et al. demonstrated improvement in patient pain and quality of life with PRP injections administer at the meniscal repair site post-operatively compared to the control group with statistical significance of  $P < 0.05$  for both measures.

**Conclusion:** Two studies in this review demonstrated that PRP injection used in meniscal repairs significantly improves patient pain and quality of life, and one study found that PRP injections had no significant impact on these measures. Based on this review, the evidence for the effectiveness of PRP injections in meniscal repairs is promising, but ultimately inconclusive and further studies to explore this therapy are warranted.

**Key Words:** platelet rich plasma, tibial meniscus injuries, meniscal repair, surgery

## INTRODUCTION

The menisci are two c-shaped wedges of cartilaginous tissue located bilaterally between the tibial plateau and femoral condyle that make up the knee joint. The menisci provide stability to the knee by bearing the load of the knee while in flexion, they can tear acutely due to traumatic injury or chronically from degenerative changes.<sup>1</sup> Arthroscopy, a minimally invasive “all inside” surgical approach, is used predominantly and partial or total meniscectomy, removal of the injured meniscus, is the most common intervention performed<sup>1</sup>. Recently, complete surgical repair of the meniscus is favored instead, if possible, with or without biological or medical adjuvants to promote healing and preserve functionality of the knee long-term.<sup>1</sup>

In the United States, an estimated 850,000 arthroscopic meniscus surgeries will be performed each year, making it a very common orthopedic surgery.<sup>1</sup> Approximately 52–93% of all meniscal repairs will heal and the overall failure rate is about 23.1%.<sup>2</sup> In the United States the cost of arthroscopic knee surgeries overall, which includes meniscus surgeries, estimates to \$4 billion a year and the cost of surgery per individual patient can range anywhere from \$5,000 - \$10,000.<sup>3</sup> The incidence of meniscal tears is about 66 tears per 100,000 persons.<sup>1</sup> The type and location of tear impacts the functional status and pain levels of each individual patient, so not all patients with a meniscus tear will seek healthcare.

The menisci are important supportive structure of the knee joint and it's very common for them to tear. In terms of repair, surgical repair with suturing is typically reserved for younger, more active patients, while meniscectomy vs. repair is weighed in older or less active patients.<sup>2</sup> While PRP injections have been known and used in medicine since about the 1970s, there is little evidence about the effect PRP injections can have for meniscus tear healing.<sup>2</sup> Typical treatment of meniscal tears includes conservative treatment such as physical therapy and assistive devices

and over the counter pain medication such as NSAIDs. Pain refractory to NSAIDs can be managed with intraarticular corticosteroid or hyaluronic acid. Definitive treatment of a meniscal tear is completed via surgical repair, which can include surgical techniques such as trephination of the tear site and/or suturing with adjuvant therapies at the surgical site like fibrin glue or growth factor administration, and in cases where repair is not possible or failed, a partial or total meniscectomy may be performed.<sup>4</sup> It is possible to inject PRP preparation at the site of meniscal repair either during the time of repair or post-repair as an adjuvant to promote further healing of the repair site. PRP injections involve taking a patient's own blood to collect plasma with a highly concentrated collection of platelets inject it into a variety of tissues. The platelets contain growth factors, interleukins and cytokines that can promote the body's natural healing process and tissue regeneration at the injection site.<sup>5</sup> In regard to meniscal repairs, the menisci are relatively avascular, particularly in the inner two thirds, and the lack of blood flow poses risk of surgical repair failure so the use of biological adjuvants like PRP injections at the site are being investigated.<sup>5</sup> Interleukins and cytokines help to initiate immune responses in the body and can cause an inflammatory response when an injury occurs. They also play an important role in cell proliferation, like creating new cells to help repair areas of damage, so the simple theory behind PRP injections is to take concentrations of these inflammatory and essentially "rebuilding" proteins and inject them into any area that is definitely in need of repair and rebuilding, but is lacking in blood supply and these helpful proteins.

## **OBJECTIVE**

The objective of this systematic review is to determine: "Is platelet rich plasma (PRP) injection an effective therapy in improving patient functional outcomes and decreasing pain postoperatively in adults with meniscal repairs."

## **METHODS**

Studies were chosen based on validity, applicability to the clinical question, and incorporation of patient-oriented outcomes. Further, they were selected if they fulfilled criteria based on population, intervention, comparison, and outcome measured. All studies included in this review were chosen independently by the writer and found by using key words “platelet rich plasma”, “tibial meniscus injuries”, “meniscal repair”, and “surgery” in PubMed, AMED, CINAHL Plus, Rehabilitation & Sports Medicine Source databases. All included studies were required to be published between 2010 and 2020, published in peer reviewed journals, published in English language, be randomized controlled trials, and all study participants had to be adults aged 18+. Additionally, any studies that evaluated concomitant ligament or other knee injuries with meniscal tears and any studies published prior to 2011 were excluded. Statistical analyses used in the included studies included mean change from baseline in the VAS pain scale and KOOS functional outcome assessments, and statistical significance using p-values and number needed to treat (NNT).

The population criteria of the included studies examined adults ages 18-70 with meniscal tears. Specific demographic information and characteristics are included in Table 1. The intervention used in each study was PRP injection received at the site of repair. Kaminski et al. (2018) used patients undergoing surgical meniscal repair with placebo injection as comparison, Kaminski et al. (2019) used patients undergoing trephination repair without PRP injection as comparison, and Elnemr et al. used patients who received surgical meniscus repair with no PRP injections postoperatively as comparison. The outcomes measured that this selective EBM focuses on are patient pain and quality of life.

## OUTCOMES MEASURED

All studies in this review utilized the VAS assessment to measure patient pain and the KOOS assessment to measure quality of life. All patients were asked to complete both assessments prior to undergoing surgical intervention to repair the meniscus. Patients then completed the same two assessments post intervention, comparison and intervention groups were assessed at the same times, though the studies did vary in how often and specifically when patients were assessed post-intervention. Kaminski et al. (2018) specified that post-intervention evaluation of pain and quality of life were taken at 42 months, while Elmner et al. had patient complete post-intervention evaluations at 3 and 6 months. All studies had patients complete VAS and KOOS assessments prior to intervention and after intervention, but there is some variability in the length of time post intervention in which evaluation was completed.

**Table 1. Demographics & Characteristics of Included Studies**

Study	Type	# Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Kaminski 2018 (1)	RCT	37	Adults 18-55 years old	Patients aged 18–55 years, with complete vertical longitudinal tear >10 mm in length on MRI, or unstable peripheral tear, meniscus lesion in Cooper zone 2; more than 4 mm from the rim, and meniscus injury 1–18 months prior to surgery	Arthritic changes, degeneration, in the meniscus, meniscus lesion in the Cooper zone 0-1, injury >18 months prior to surgery, concomitant surgical procedures, inflammatory diseases	2	Meniscus surgical repair with platelet rich plasma (PRP) injection received at the repair site VS. surgical repair with placebo injection at repair site.
Kaminski 2019 (2)	RCT	72	Adults ages 18-70 years old	Skeletally mature patients aged 18–70 years, chronic horizontal tears on MRI, tear located in the	Arthritic changes, discoid meniscus axial leg deformity,	1	Percutaneous trephination of meniscal tear(s) with platelet rich plasma (PRP)

				vascular/avascular portion of the meniscus, and single tear of the medial and/or lateral meniscus	concomitant chondral defects Inflammatory diseases, chondral defects		injection received at the repair site VS. trephination without PRP
Elnemr 2019 (3)	RCT	30	Adults ages 18-55	Patients aged 18 - 55 years, having had complete meniscal tear in red-white zone, surgical repair by single surgeon, and complain of pain within 4 months after repair.	Patients with diabetes, autoimmune, hematologic, or cardiac diseases, infections, other knee injuries, and anticoagulant/ NSAID use within 5 days	0	PRP injected post-operatively and intra-articularly at 1-month intervals for 6 injections total VS. no PRP injections postoperatively

## RESULTS

The first study discussed in Kaminski et al. (2018). The authors enrolled 37 adult patients to undergo surgical meniscal repair. 2 were lost to follow-up, so ultimately 17 control group members and 15 test group members were analyzed. All patients underwent surgical meniscal repair by the same surgeon, the 17 control members were given a placebo injection at the time of repair at the repair site and the 18 treatment group members were given a PRP injection at the site of repair at the time of the repair. This study was double blinded so both patients and clinicians were unaware of which type of injection was given. Post-operatively, patients underwent the same rehabilitation guidelines and protocols. At 42 months, patients' pain levels and quality of life were assessed with the same VAS and KOOS assessments they completed prior to operation. The VAS score for pain showed some improvement in the PRP-treated group compared to the control group with a mean score of 0.84 compared to .89 respectively, but it wasn't found to be statistically significant. However, the KOOS score rating for Quality of Life improved greatly in the PRP treated group compared to the control group with a mean score of



80.90 and 66.18 respectively. The P-value was found to be statistically significant at .035, which indicates that patients who received PRP injection at the meniscal repair site had significantly improved quality of life compared to the control group post-operatively.

**Table 2. Secondary Outcome Assessment at 42 months<sup>2</sup>**

	Control Group	PRP-Treated Group	P-value
VAS Score	0.89 ± 0.08 (0.33–1.44)	0.84 ± 0.10 (0.04–1.65)	P = 0.15
KOOS Score – Quality of Life	66.18 ± 1.17 (57.94–74.42)	80.90 ± 1.09 (72.34–89.47)	P = 0.035

Data are presented as mean ± standard error (95% confidence interval)

Led by the same author, Kaminski et al. (2019) published a similar study a year later that focused on the specific surgical meniscal repair technique known as trephination. 72 adults with meniscus tears were included, 1 control member was lost to follow up, so in total 29 patients were analyzed in the control group and 42 were analyzed in the treatment group. The control group consisted of patients undergoing trephination surgical procedure for a meniscus repair with placebo injection administered at the time of repair and the treatment group consisted of patients undergoing trephination repair with PRP injection at the time of repair at the site of repair. This study achieved partial blinding, the patients and raters were blinded, but clinicians were not. The surgeries in both groups were performed by the same surgeon and postoperatively patients again underwent the same rehabilitation and post-operative protocols. Patients' pain levels and quality of life were assessed with the same VAS and KOOS assessments they completed prior to operation. The VAS score for pain showed improvement in the PRP group compared to the control group with a mean score of 3.62 compared to 2.36 respectively and was found to be statistically significant with  $p = 0.046$ . However, the KOOS score rating for Quality of Life was found to not be statically significant between the control and treatment groups. Upon further calculations, MCID scores provided in the study dichotomously allowed for the calculation of

NNT, which was 17 for quality of life and 13 for pain. While it is not a precise measure, it indicates that for every 17 people treated with trephination and PRP augmentation, one more will have a clinically significant improvement. This study indicates that patients who received PRP injection at the meniscal repair site with trephination had significantly improved pain, but not significant quality of life improvement compared to the control group post-operatively.

**Table 3. Patient-reported Outcome Measures<sup>4</sup>**

	Control Group	Control Improved by at least MCID [%]	PRP Group	PRP Group Improved by at least MCID [%]	P-value
VAS Score	2.36 ± 0.09 (3.86–5.20)	39	3.62 ± 0.07 (2.82–4.43)	65	P = 0.046
KOOS Score – Quality of Life	32.67 ± 1.06 (22.93–42.41)	70	28.43 ± 0.52 (22.23–34.64)	76	P = 0.41

Data are presented as mean ± standard error (CI 95%) unless otherwise indicated.

The third study conducted by Elnemr et al. looked at the effects of PRP injections injected at the site of meniscal repair post-operatively at 1-month intervals for a total of 6 injections over 6 months. The authors had participants complete the VAS assessment and KOOS assessment pre-operatively and then at 3-months and 6-months post-operatively, for the purposes of this review the 6-month post-operative scores are what will be considered. 30 participants were recruited to this study, no patients were lost to follow-up, and 15 were randomized to the control group and 15 were randomized to the treatment group. The authors of this study reported it was double-blinded, though there is room for doubt here regarding complete blinding as the participants were their own raters, no external raters were used to ensure full blindness of patients. The same surgeon was used for all participants, but it was not disclosed by the authors whether patients underwent the same rehabilitation protocol post-operatively. The control group underwent meniscal tear surgical repair without any sort of injection post-operatively, and the treatment group underwent surgical repair with 6 PRP injections post-operatively at 1-month

intervals. As noted in the chart below, the control group showed scores of 38.4 for the VAS assessment and 24.3 for the KOOS assessment, and the treatment group showed scores of 84.9 for VAS assessment and 42.2 for the KOOS assessment, which were both higher than the treatment group indicating better resolution of pain and improved quality of life in life post-operatively with PRP injections. The p-values for both measures were less than .05 indicating statistic significance in both measures within the treatment group.

**Table 4. Comparison Between Both Groups Regarding Clinical Evaluation Parameters<sup>5</sup>**

	PRP Group	Non-PRP Group	P-value
VAS Score % Change	↓84.9 ± 6.9	↓38.4 ± 37.4	P = < 0.001
KOOS Score % Change	↑42.2 ± 22.5	↑24.3 ± 18.8	P = 0.035

Statistically significant at  $P \leq 0.05$ .

## DISCUSSION

PRP injections are by no means a new technology, but the way the injections are utilized in orthopedic treatment, particularly in meniscus repair is a relatively new pursuit of therapy. Because of it's relatively new use in the treatment specifically of surgical meniscus repair augmentation, there is a limited number of recent studies to show the effects of this therapy. Also, cost may be a barrier to patients in accessing PRP injection augmentation with meniscal repair. Due to its relative newness and the lack of large scale studies demonstrating the efficacy of PRP injections for meniscal repair augmentation, most insurances do not cover PRP injections for this purpose so it is less likely for patients to pursue it as a treatment considering they would have to pay out of pocket for it.

The studies included in this review have demonstrated that there is some efficacy to the use of PRP injection augmentation of meniscal surgical repairs. Kaminski et al. (2018) showed statistically significant improvement in patient pain post-operatively with the use of PRP

injection during surgical repair, and Kaminski et al. (2019) showed statistically significant improvement in quality of life post-operatively. Elmner et al. showed statistical significance in improvement of both pain and quality of life post-op with PRP use. The results of this review show that there is some good efficacy for the use of PRP augmentation in meniscus repair, though some of the evidence was conflicting.

All three studies carry limitations of their own that impact the interpretation of the information they provide. In a positive aspect, all the studies included both male and female participants, making the results of the studies generalizable to the population in terms of gender. All studies were comprised of a relatively small sample size, larger study samples are warranted to make the results more generalizable to the population.

Both studies by Kaminski et al. disclosed that patients were given the same rehabilitation protocols post-operatively. This strengthens the validity of the results as we can be assured the post-operative rehabilitation of patients was not different and did not put any patients at advantage or disadvantage over others in terms of rehab and healing that could have impacted the levels of pain and quality of life patients experienced. Elnemr et al. did not disclose if patients were given a specific standardized rehabilitation protocol, leaving room for the possibility that patients could have had varying levels or experiences of post-op rehab that could have impacted their experiences of pain and quality of life post-operatively.

All three studies reported that they used the same method of preparation for their PRP injections used in surgery. It is worth noting though that the preparation methods were not identical between all the studies. Given how new the technology of PRP injections for meniscal repairs is, there is not yet a standardized protocol for PRP preparation, so it is possible that the

PRP preparations that were injected in participants were not the same between the 3 studies, which decreases validity and could pose a challenge with replicating future studies.

## **CONCLUSIONS**

Overall this review found that there was some conflicting evidence about the results of PRP injections used in meniscal surgical repairs for the improvement in patient pain and quality of life post-operatively, so it is not possible to determine if PRP injections for meniscal repairs are completely effective based on this review alone. Only one trial showed significant improvement in patient pain and quality of life post-operatively, while one showed only improvement in pain and one showed only improvement in quality of life. While this is encouraging, larger sample sizes and additional trials could benefit determining the complete efficacy of PRP injection use in meniscal repairs.

Another possibility to be explored in further studies would be to look exclusively at using PRP injections in meniscal tears that do not undergo surgical repair. For patients that are either not surgical candidates due to underlying comorbidities, or patients that do not want to pursue surgical repair immediately, PRP injections at the site of a tear may offer some relief in symptoms and promote some healing based on their mechanisms of healing. Additionally, if patients do decide to pursue surgical repair, it would be interesting to see if the administration of PRP injection to the site of a tear impacts the resulting patient outcomes after a surgical repair of the site.

PRP injections have proven to be beneficial in other areas of orthopedic soft tissue injuries, and they are considered to be safe to use in patients since the PRP preparation is made from the patient's own blood which is a reassuring fact when considering the use of PRP injection in experimental settings. The data available on PRP injection use in meniscal repair is

so far reassuring, and it will be exciting to see as more data comes out in larger studies to determine to overall efficacy of this treatment.

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