Research Article

Clinical and Radiological Outcomes of Arthroscopic Meniscal Repair With and Without Platelet Rich Plasma: A Prospective Comparative Observational Study

Dr. Bhuva Yagnik Rameshbhai[1] , Dr. Saradhara Gopiben Thakarashibhai[2] , Dr. Nishant Pravinbhai Suvagiya[3] , Dr. Bhavin N. Kadavala[4] , Dr. Kalpesh A. Tank[5] , Dr Nisha Dayabhai Vaghasiya[6]

[1]Assistant Professor, Department of Orthopaedics, Shantabaa Medical College & General Hospital, Amreli, Gujarat. Email ID: bhuvayagnik9@gmail.com, Address: J-304, Faculty Quarter, Shantaba Medical College Campus, Lathi Road, Amreli, Gujarat 365601
[2]Assistant Professor, Department of Radiology, Shantabaa Medical College & General Hospital, Amreli, Gujarat. Email ID: dr.gopisaradhara0294@gmail.com, Address: J-304, Faculty Quarter, Shantaba Medical College Campus, Lathi Road, Amreli, Gujarat 365601
[3]Assistant Professor, Department of Orthopaedics, Shantabaa Medical College & General Hospital, Amreli, Gujarat. Email ID: nishantsuvagiya66@gmail.com, Address: J-301, Faculty Quarter, Shantaba Medical College Campus, Lathi Road, Amreli, Gujarat 365601
[4]Associate Professor, Department of Psychiatry, Shantabaa Medical College & General Hospital, Amreli, Gujarat. Email ID: kadavalabhavin@gmail.com
Address: J-402, Faculty Quarter, Shantaba Medical College Campus, Lathi Road, Amreli, Gujarat 365601
[5]Associate Professor, Department of Orthopaedics, Shantabaa Medical College & General Hospital, Amreli, Gujarat. Email ID: drkalpeshtank@yahoo.com, Address: J-301, Faculty Quarter, Shantaba Medical College Campus, Lathi Road, Amreli, Gujarat 365601
[6]Assistant Professor, Department of Biochemistry, Shantabaa Medical College & General Hospital, Amreli, Gujarat. Email ID: nishavaghasiya880@gmail.com
Address: Alpa Society, Rajput Wadi, Gariyadhar, Bhavnagar, Gujarat 364605

CORRESPONDING AUTHOR: Dr. Bhavin N. Kadavala

ABSTRACT

Objective: To compare clinical and magnetic resonance imaging outcomes after arthroscopic meniscal repair with and without intraoperative platelet rich plasma augmentation.

Methods: This prospective comparative observational study included 30 patients younger than 50 years with repairable meniscal tears treated at Manipal Hospital, Jaipur, from January 2020 to June 2021. All patients underwent arthroscopic all inside meniscal repair. Thirteen patients received intraoperative platelet rich plasma and 17 underwent repair without platelet rich plasma. Clinical outcomes were assessed using the Lysholm knee score and Western Ontario Meniscal Evaluation Tool at 6 and 12 months. Magnetic resonance imaging hypersignal intensity was graded as low, intermediate, or high.

Results: The mean age was 29.67 ± 6.70 years and 20 of 30 patients were male. At 6 months, the platelet rich plasma group had a higher Lysholm score than the group without platelet rich plasma (98.15 ± 2.30 versus 91.71 ± 8.59, P = 0.014) and a lower WOMET score (369.23 ± 84.60 versus 576.47 ± 263.49, P = 0.011). At 12 months, the corresponding Lysholm scores were 96.00 ± 3.11 and 89.18 ± 8.75 (P = 0.012), while WOMET scores were 405.00 ± 101.41 and 608.53 ± 279.53 (P = 0.019). Magnetic resonance imaging grades did not differ significantly at 6 months (P = 0.374) or 12 months (P = 0.464).

Conclusion: Platelet rich plasma augmentation was associated with better patient reported clinical scores at 6 and 12 months after meniscal repair, while no statistically significant radiological difference was demonstrated. The small nonrandomized sample limits causal interpretation, and larger controlled studies are required.

Keywords: Meniscal repair, platelet rich plasma, arthroscopy, Lysholm knee score, WOMET, magnetic resonance imaging.

INTRODUCTION

The meniscus contributes to tibiofemoral congruence, load transmission, shock absorption, joint stability and proprioception. Loss of meniscal tissue alters knee contact mechanics and is associated with later degenerative change, which has driven a shift from meniscectomy toward meniscal preservation whenever repair is feasible.[1,2]

Meniscal healing remains challenging because vascularity is largely restricted to the peripheral portion of the adult meniscus. Biological augmentation has therefore been investigated as a strategy to improve healing. Platelet rich plasma is an autologous blood derivative containing a concentrated platelet fraction and several growth factors that may support angiogenesis, extracellular matrix synthesis and soft tissue repair.[3,4] Experimental work has also demonstrated regenerative effects of platelet rich plasma on meniscal cells and tissue.[5]

Clinical evidence on platelet rich plasma augmented meniscal repair has been inconsistent. Some studies have reported improved healing or lower failure rates, while others have shown little or no functional advantage.[6,7,8,9,10] A systematic review also highlighted substantial heterogeneity in platelet rich plasma preparation and limited certainty regarding its clinical benefit.[11] The present study therefore compared clinical and radiological outcomes of arthroscopic meniscal repair with and without intraoperative platelet rich plasma in a tertiary care hospital in Jaipur.

Study design and setting

A hospital based prospective comparative observational study was conducted in the Department of Orthopaedics, Manipal Hospital, Jaipur, from January 2020 to June 2021. Thirty one patients were initially enrolled; one patient was lost to follow up after 4 months and 30 patients were included in the final analysis. The final sample size of 30 was pragmatic because recruitment was constrained by the study duration and the COVID 19 pandemic.

Ethical approval and informed consent

Approval from the Institutional Ethics Committee of Manipal Hospital, Jaipur, was obtained before initiation of the study. Written informed consent was obtained from every participant before inclusion. Participants were informed about the study purpose, confidentiality of their information, and their right to withdraw at any time without affecting treatment.

Eligibility criteria

Patients were eligible if they were younger than 50 years and had a complete vertical or longitudinal meniscal tear in the vascular red red or red white zone, a single medial or lateral meniscal tear, and a stable knee or a knee stabilized with concurrent anterior cruciate ligament reconstruction. Major ligament instability, discoid meniscus, Outerbridge grade III or IV cartilage changes, Kellgren Lawrence grade III or higher radiographic degeneration, osteochondral defects requiring treatment, inflammatory arthropathy, nonrepairable or degenerative meniscal tears, calcium pyrophosphate crystal deposition, bleeding disorders, coagulopathy, and an anterior cruciate ligament deficient knee were excluded.

Group allocation

Allocation was not randomized. The first eligible patient underwent meniscal repair without platelet rich plasma. Thereafter, alternate eligible patients were offered platelet rich plasma augmentation, and final treatment allocation also depended on willingness to receive platelet rich plasma. This resulted in 13 patients in the platelet rich plasma group and 17 patients in the comparison group.

Operative technique and platelet rich plasma administration

All patients underwent arthroscopic meniscal repair through standard anteromedial and anterolateral portals under spinal anesthesia in the supine position with tourniquet control. The meniscus was repaired using an all inside technique with the JuggerStitch meniscal repair device (Biomet Sports Medicine, Warsaw, Indiana, USA). Platelet rich plasma was administered intraoperatively into the knee after meniscal repair in the platelet rich plasma group. The comparison group underwent the same repair without platelet rich plasma. Detailed study specific platelet rich plasma preparation parameters, including final platelet concentration and leukocyte content, were not recorded and could not be included in the analysis. The arthroscopic appearance of the repaired meniscus is shown in Figure 1.

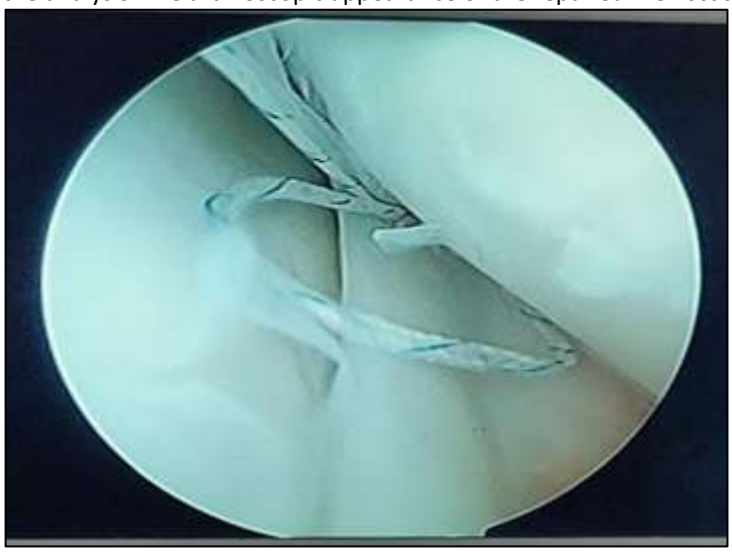


Fig. 1: Intraoperative arthroscopic image showing meniscal repair using the all inside technique.

Outcome assessment

Patients were assessed at 6 and 12 months. Clinical outcomes were measured with the Lysholm knee score and the Western Ontario Meniscal Evaluation Tool. The Lysholm score ranges from 0 to 100, with higher values indicating better knee function. WOMET ranges from 0 to 1600, with lower scores indicating better meniscus related health status. Radiological assessment was performed by magnetic resonance imaging and hypersignal intensity was categorized as low, intermediate, or high.

Postoperative rehabilitation

The same rehabilitation protocol was used for all participants. Patients remained non weight bearing for the first 3 weeks with knee range of motion limited to 0 to 60 degrees. Full range of motion and gradual full weight bearing were allowed from 3 to 6 weeks. A knee brace was used for up to 6 weeks, squatting was allowed after 3 months, and sports activity after approximately 20 weeks.

Statistical analysis

Data were analyzed using SPSS version 24.0. Continuous variables are presented as mean ± standard deviation and categorical variables as number and percentage. Between group continuous outcomes were compared using the Student t test. Categorical comparisons were assessed using chi square tests. A P value below 0.05 was considered statistically significant. Mean differences with 95% confidence intervals were calculated for the principal clinical outcomes.

RESULTS

Thirty patients were included in the final analysis. The mean age of the overall cohort was 29.67 ± 6.70 years, with an age range of 18 to 46 years. Twenty patients were male and 10 were female. Thirteen patients received platelet rich plasma augmentation and 17 underwent meniscal repair without platelet rich plasma. Sixteen patients had medial meniscal tears and 14 had lateral meniscal tears.

Table 1: Baseline characteristics of the study groups

Characteristic	PRP, n = 13	No PRP, n = 17	P value
Age, years, mean ± SD	28.46 ± 5.65	30.59 ± 7.43	0.398
Male sex, n (%)	10 (76.9)	10 (58.8)	0.297
Medial meniscal tear, n (%)	9 (69.2)	7 (41.2)	0.127
Lateral meniscal tear, n (%)	4 (30.8)	10 (58.8)	

Baseline age and sex distributions did not differ significantly between the groups. The distribution of medial and lateral meniscal tears was also not statistically different.

Clinical outcomes

At 6 months, patients who received platelet rich plasma had a higher mean total Lysholm score and a lower mean WOMET score than patients who did not receive platelet rich plasma. The same pattern remained at 12 months. Because higher Lysholm scores and lower WOMET scores indicate better outcomes, both instruments favored the platelet rich plasma group at each follow up point. Group mean Lysholm and WOMET scores are shown in Figures 2 and 3.

Table 2: Comparison of clinical outcomes between PRP and no PRP groups

Outcome	PRP, n = 13	No PRP, n = 17	Mean difference (95% CI)	P value
Lysholm score at 6 months	98.15 ± 2.30	91.71 ± 8.59	6.45 (1.42 to 11.48)	0.014*
WOMET score at 6 months	369.23 ± 84.60	576.47 ± 263.49	−207.24 (−363.27 to −51.21)	0.011*
Lysholm score at 12 months	96.00 ± 3.11	89.18 ± 8.75	6.82 (1.60 to 12.05)	0.012*
WOMET score at 12 months	405.00 ± 101.41	608.53 ± 279.53	−203.53 (−370.69 to −36.37)	0.019*

*P < 0.05. CI: confidence interval; PRP: platelet rich plasma; WOMET: Western Ontario Meniscal Evaluation Tool.

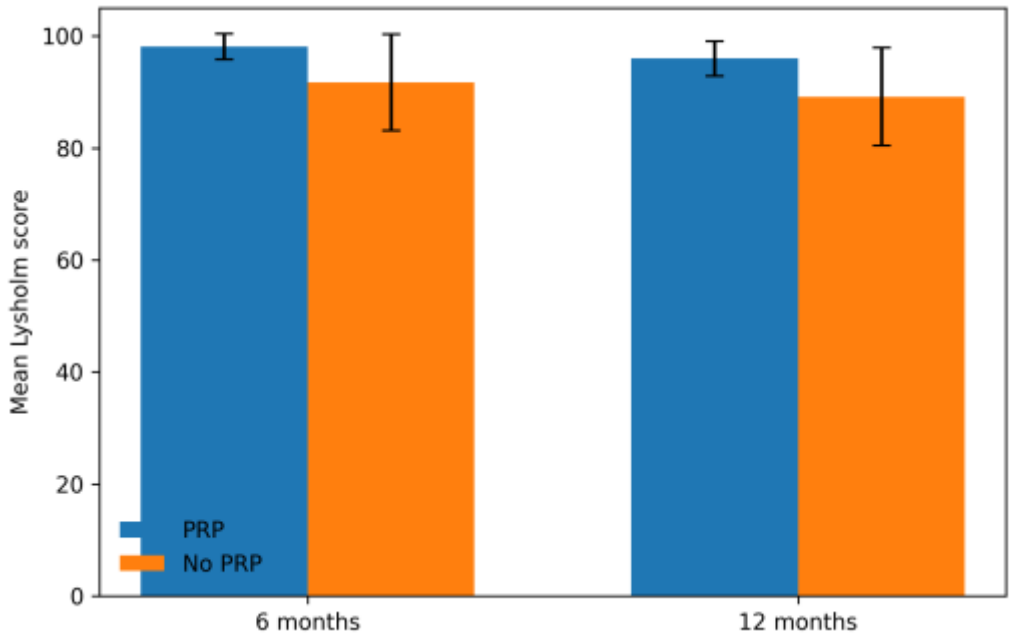


Fig. 2: Mean Lysholm knee scores at 6 and 12 months. Error bars represent standard deviation.

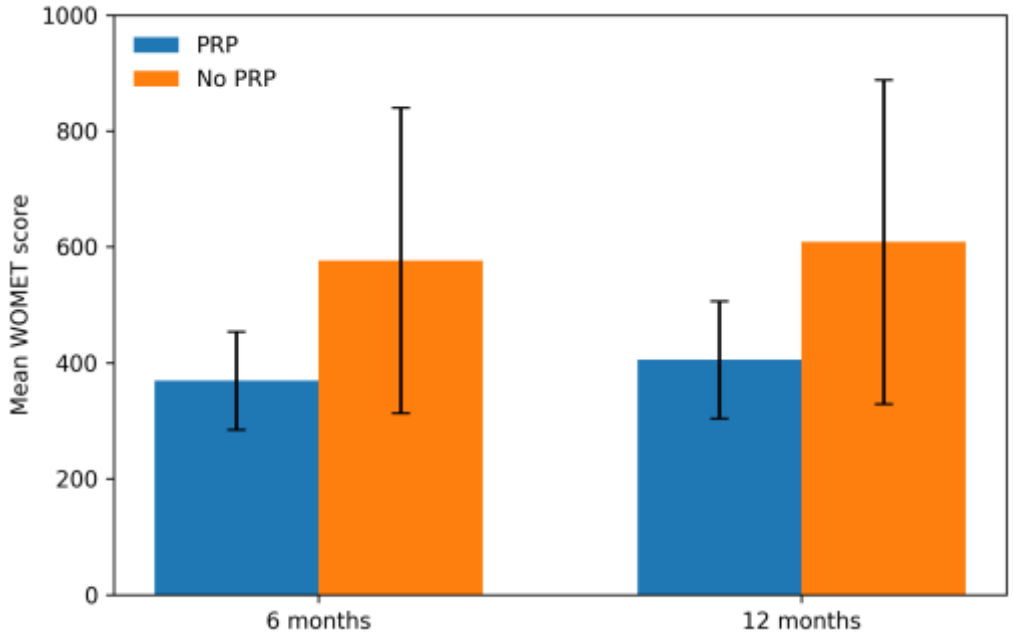


Fig. 3: Mean WOMET scores at 6 and 12 months. Lower WOMET scores indicate better outcomes. Error bars represent standard deviation.

Radiological outcomes

At 6 months, low grade magnetic resonance imaging hypersignal was observed in all 13 patients in the platelet rich plasma group and in 16 of 17 patients in the comparison group. At 12 months, low grade hypersignal was present in 12 of 13 patients in the platelet rich plasma group and 13 of 17 patients in the comparison group. The between group radiological differences were not statistically significant. Illustrative MRI images from the original thesis are shown in Figures 4 and 5.

Table 3: Magnetic resonance imaging evaluation at 6 and 12 months

Follow up	MRI grade	PRP n (%)	No PRP n (%)	Total n (%)	P value
6 months	Low	13 (100.0)	16 (94.1)	29 (96.7)	0.374
	Intermediate	0 (0.0)	1 (5.9)	1 (3.3)	

Follow up	MRI grade	PRP n (%)	No PRP n (%)	Total n (%)	P value
	High	0 (0.0)	0 (0.0)	0 (0.0)	
12 months	Low	12 (92.3)	13 (76.5)	25 (83.3)	0.464
	Intermediate	1 (7.7)	3 (17.6)	4 (13.3)	
	High	0 (0.0)	1 (5.9)	1 (3.3)	



Fig. 4: Preoperative MRI demonstrating a meniscal tear



Fig. 5: Postoperative MRI at 12 months after meniscal repair with PRP

DISCUSSION

This prospective comparative study found that patients receiving intraoperative platelet rich plasma augmentation had better clinical scores after meniscal repair at both 6 and 12 months. The between group differences were statistically significant for the total Lysholm score and WOMET score. In contrast, magnetic resonance imaging grading did not demonstrate a statistically significant difference at either follow-up point. These findings suggest that a clinical benefit may occur without a clearly demonstrable difference in the broad magnetic resonance imaging hypersignal grading used in this study.

The observed clinical pattern is biologically plausible because platelet-rich plasma contains growth factors that may support cell proliferation, matrix synthesis and vascular responses during soft tissue healing.[3,5] However, the clinical literature remains mixed. Kaminski et al. reported a higher meniscal healing rate after platelet-rich plasma-augmented repair and better long-term functional outcomes in a randomized, placebo-controlled study.[7] Pujol et al. also reported

modest clinical benefit and more favorable magnetic resonance imaging findings after platelet-rich plasma augmentation of open repair for horizontal tears.[9]

Other studies have been less supportive. Griffin et al. found no significant reduction in reoperation and no clear functional advantage with platelet-rich plasma in isolated arthroscopic repairs.[6] Dai et al. reported similar pain and functional improvement between platelet-rich plasma and non-platelet-rich plasma groups after repair of discoid lateral meniscal tears.[10] Kemmochi et al. observed postoperative improvement in both treatment and comparison groups without a significant between-group difference in Lysholm or International Knee Documentation Committee scores.[8]

Everhart et al. found that the association between platelet rich plasma and repair failure depended on the clinical setting. Platelet rich plasma was associated with a lower failure risk in isolated meniscal repair but not when meniscal repair was performed with concomitant anterior cruciate ligament reconstruction.[12] This finding is relevant because meniscal healing depends on tear characteristics, vascular zone, knee stability, associated reconstruction and rehabilitation, and the platelet product itself.

A systematic review by Haunschild et al. concluded that the available evidence was limited and heterogeneous, with variation in platelet-rich plasma preparation, application, and outcome assessment.[11] The present study adds prospective data from an Indian tertiary care setting, but the findings should be interpreted cautiously. The treatment groups were small and unequal in size, and allocation was not randomized. The decision to receive platelet rich plasma partly depended on patient willingness, creating potential selection bias and residual confounding.

Another limitation is the absence of preoperative Lysholm and WOMET values in the final dataset, which prevents direct estimation of within patient improvement from baseline. The study also did not provide detailed quantitative characterization of the platelet rich plasma product. Radiological grading used only low, intermediate and high hypersignal categories and may not have been sensitive enough to detect smaller differences in structural healing. The 12-month follow-up also limits conclusions about longer-term healing and reoperation.

The main strength of the study is the use of two patient-reported clinical instruments together with serial magnetic resonance imaging at 6 and 12 months, with a common surgical and rehabilitation protocol. The consistent direction of the Lysholm and WOMET results at both time points supports further evaluation of platelet-rich plasma augmentation in adequately powered randomized controlled trials.

CONCLUSION

In this cohort, intraoperative platelet-rich plasma augmentation of arthroscopic meniscal repair was associated with better Lysholm and WOMET clinical scores at 6 and 12 months than repair without platelet-rich plasma. No statistically significant difference was shown in MRI grading. These findings are preliminary because of the small sample size and nonrandomized allocation and should be confirmed in larger controlled studies.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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