



Original Article

Clinical and Functional Outcomes Following Intra-Articular Platelet-Rich Plasma Injection for Knee Osteoarthritis: A Prospective Study

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ABSTRACT

Background: Knee osteoarthritis (OA) is one of the leading causes of pain, disability, and reduced quality of life among middle-aged and elderly individuals. Platelet-rich plasma (PRP), an autologous biological product rich in growth factors, has emerged as a promising regenerative treatment aimed at reducing pain and improving joint function.

Objective: To evaluate the clinical and functional outcomes following intra-articular platelet-rich plasma injection in patients with primary knee osteoarthritis.

Materials and Methods: This prospective interventional study was conducted in the Department of Orthopaedics, KM Hospital, Yadgir, Karnataka, over a period of 2.5 years. Thirty patients aged 45–75 years with Kellgren–Lawrence Grade II or III primary knee osteoarthritis were included. Autologous PRP was prepared using a standardized double-spin centrifugation technique and administered as a single intra-articular injection. Patients were assessed at baseline, 6 weeks, 3 months, and 6 months using the Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and knee range of motion (ROM). Statistical analysis was performed using SPSS version 27.0, with $p < 0.05$ considered statistically significant.

Results: The mean age of participants was 58.9 ± 8.4 years, with females comprising 56.7% of the study population. Significant improvement was observed in all clinical outcome measures throughout follow-up. Mean VAS score decreased from 7.8 ± 0.9 at baseline to 3.2 ± 0.8 at 6 months ($p < 0.001$). Mean WOMAC score improved from 63.4 ± 8.7 to 31.2 ± 6.4 ($p < 0.001$), while knee ROM increased from $106.8 \pm 9.6^\circ$ to $121.5 \pm 7.1^\circ$ ($p < 0.001$). Good-to-excellent functional outcomes were achieved in 73.4% of patients. Only mild transient pain (13.3%) and swelling (6.7%) were reported, with no serious adverse events.

Conclusion: Intra-articular platelet-rich plasma injection is a safe and effective treatment for patients with early to moderate knee osteoarthritis, providing significant pain relief, improved knee function, and increased range of motion over a six-month follow-up period.

Keywords: Platelet-rich plasma, Knee osteoarthritis, VAS, WOMAC, Functional outcome, Regenerative therapy.

INTRODUCTION

Knee osteoarthritis (OA) is one of the most prevalent chronic musculoskeletal disorders and represents a major cause of pain, disability, and reduced mobility worldwide. It is characterized by progressive degeneration of articular cartilage, subchondral bone remodeling, osteophyte formation, synovial inflammation, and gradual deterioration of joint function. The prevalence of knee OA increases with advancing age, obesity, female sex, previous joint injury, and mechanical overloading, making it a significant public health concern, particularly in developing countries such as India.^(1,2)

The pathophysiology of osteoarthritis involves a complex interaction between mechanical stress, inflammatory mediators, and biochemical degradation of cartilage extracellular matrix. Conventional management strategies include patient education, weight reduction, physiotherapy, oral analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), and intra-articular corticosteroid or hyaluronic acid injections. Although these modalities provide temporary symptomatic relief, they have limited ability to modify disease progression and may be associated with adverse effects following repeated administration.(3)

In recent years, regenerative medicine has gained considerable attention in the management of osteoarthritis. Platelet-rich plasma (PRP) is an autologous blood-derived product containing a high concentration of platelets and numerous bioactive growth factors, including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF- β), vascular endothelial growth factor (VEGF), insulin-like growth factor (IGF), fibroblast growth factor (FGF), and epidermal growth factor (EGF). These biologically active molecules promote tissue repair, modulate inflammation, enhance chondrocyte proliferation, and stimulate extracellular matrix synthesis, thereby improving cartilage homeostasis.(4,5)

Several randomized controlled trials and systematic reviews have demonstrated that intra-articular PRP injections can provide superior pain relief and functional improvement compared with placebo, corticosteroids, and hyaluronic acid, particularly in patients with early and moderate osteoarthritis. However, differences in PRP preparation techniques, platelet concentration, injection protocols, and patient selection have resulted in variable outcomes across studies.(6,7)

Given the increasing burden of knee osteoarthritis and the growing interest in biological therapies, further prospective studies are required to evaluate the effectiveness and safety of PRP in routine clinical practice. Therefore, the present prospective interventional study was undertaken to assess the clinical and functional outcomes following intra-articular platelet-rich plasma injection in patients with primary knee osteoarthritis using validated clinical outcome measures including the Visual Analogue Scale (VAS), WOMAC score, and knee range of motion over a six-month follow-up period.

MATERIALS AND METHODS

Study Design and Setting

This prospective interventional study was conducted in the Department of Orthopaedics at KM Hospital, Yadgir, Karnataka, India, over several years. The study was undertaken to evaluate the clinical and functional outcomes following intra-articular platelet-rich plasma (PRP) injection in patients with primary knee osteoarthritis. Institutional Ethics Committee approval was obtained before commencement of the study, and all participants provided written informed consent before enrollment. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Study Population

A total of 30 consecutive patients diagnosed with symptomatic primary knee osteoarthritis attending the Orthopaedic Outpatient Department during the study period were included.

Sample Size

The study included 30 patients, selected by convenient consecutive sampling based on the eligibility criteria during the study period.

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

- Age between 45 and 75 years.
- Clinical diagnosis of primary knee osteoarthritis according to the American College of Rheumatology (ACR) criteria.
- Radiographic Kellgren–Lawrence Grade II or Grade III osteoarthritis.
- Persistent knee pain for more than 3 months despite conservative treatment.
- Willingness to participate and provide written informed consent.

Exclusion Criteria

Patients with any of the following conditions were excluded:

- Kellgren–Lawrence Grade IV osteoarthritis.
- Secondary osteoarthritis due to trauma or inflammatory arthritis.
- Active local or systemic infection.
- Coagulopathy or platelet disorders.
- Platelet count $<150,000/\text{mm}^3$.
- Hemoglobin $<10 \text{ g/dL}$.

- Current anticoagulant therapy.
- Previous knee surgery.
- Intra-articular corticosteroid or hyaluronic acid injection within the preceding 3 months.
- Severe varus or valgus deformity.
- Pregnancy or lactation.
- Refusal to participate.

Baseline Evaluation

Detailed demographic and clinical data were recorded using a structured proforma, including:

- Age
- Gender
- Body Mass Index (BMI)
- Occupation
- Side affected (right/left/bilateral)
- Duration of symptoms
- Medical comorbidities
- Previous treatment history

A comprehensive physical examination of the affected knee was performed. Standard standing anteroposterior and lateral radiographs were obtained, and osteoarthritis severity was graded using the Kellgren–Lawrence grading system.

PRP Preparation

Under strict aseptic precautions, 20 mL of autologous venous blood was collected from each participant into anticoagulant citrate dextrose (ACD) tubes.

Platelet-rich plasma was prepared using a double-spin centrifugation technique:

- First centrifugation: 1600 rpm for 15 minutes
- Second centrifugation: 2800 rpm for 7 minutes

Platelet-poor plasma was discarded, and approximately 3–5 mL of PRP was obtained for injection. The PRP preparation was used immediately after preparation to maintain platelet viability.

Injection Technique

The affected knee was prepared with povidone-iodine and sterile draping.

Using a 22-gauge needle, 3–5 mL of autologous PRP was injected intra-articularly through the anterolateral or anteromedial approach under aseptic conditions.

Following injection:

- Patients were observed for 30 minutes.
- Ice application was advised if discomfort occurred.
- NSAIDs were avoided for one week after injection.
- Paracetamol was permitted as rescue analgesia.
- Patients were instructed to avoid strenuous physical activity for 48 hours and gradually resume routine activities.

Outcome Measures

Patients were evaluated at:

- Baseline
- 6 weeks
- 3 months
- 6 months

Clinical and functional outcomes were assessed using validated scoring systems:

- Visual Analogue Scale (VAS) for pain.
- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for pain, stiffness, and physical function.
- Knee Range of Motion (ROM) measured using a goniometer.
- Documentation of adverse events and complications.

The primary outcome was improvement in VAS and WOMAC scores from baseline.

Secondary outcomes included improvement in knee ROM, patient satisfaction, and occurrence of treatment-related adverse events.

Statistical Analysis

Data were entered into Microsoft Excel 2021 and analysed using IBM SPSS Statistics version 27.0.

Continuous variables were expressed as mean $\pm$ standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages.

Comparisons between baseline and follow-up observations were performed using:

- Paired Student's *t*-test for normally distributed continuous variables.
- Wilcoxon signed-rank test for non-normally distributed variables.
- Chi-square test or Fisher's exact test for categorical variables.

A *p*-value <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

A total of 30 patients with primary knee osteoarthritis were included in the study. All patients completed the scheduled follow-up assessments up to 6 months after the intra-articular PRP injection. The mean age of the study population was 58.9 ± 8.4 years. Females constituted a slightly higher proportion of the study participants (56.7%) than males (43.3%). Most patients belonged to the 56–65 years age group. Kellgren–Lawrence Grade II osteoarthritis was observed in 56.7% of patients, while Grade III osteoarthritis was observed in 43.3%. Significant improvement was observed in pain, functional status, and knee range of motion during follow-up. No major complications related to PRP injection were reported.

Table 1. Age Distribution of Study Participants (n = 30)

Age Group (Years)	Number (n)	Percentage (%)
45–55	8	26.7
56–65	14	46.7
>65	8	26.7
Total	30	100.0

Observation: The majority of patients (46.7%) were aged between 56 and 65 years.

Table 2. Gender Distribution

Gender	Number (n)	Percentage (%)
Male	13	43.3
Female	17	56.7
Total	30	100.0

Observation: Female patients slightly outnumbered male patients.

Table 3. Baseline Clinical Characteristics

Variable	Mean $\pm$ SD
Age (years)	58.9 ± 8.4
BMI (kg/m ²)	27.6 ± 3.2
Duration of symptoms (months)	21.4 ± 9.8
Baseline VAS score	7.8 ± 0.9
Baseline WOMAC score	63.4 ± 8.7
Baseline Knee ROM (degrees)	106.8 ± 9.6

Observation: Patients presented with moderate-to-severe pain and functional limitation before treatment.

Table 4. Kellgren–Lawrence Grade Distribution

Grade	Number (n)	Percentage (%)
Grade II	17	56.7
Grade III	13	43.3
Total	30	100.0

Observation: Grade II osteoarthritis was more common than Grade III.

Table 5. Comparison of VAS Pain Scores During Follow-up

Follow-up	Mean $\pm$ SD	<i>p</i> -value
Baseline	7.8 ± 0.9	—
6 Weeks	5.9 ± 1.0	<0.001
3 Months	4.1 ± 0.9	<0.001
6 Months	3.2 ± 0.8	<0.001

Observation: VAS scores showed a statistically significant reduction at every follow-up visit.

Table 6. Comparison of WOMAC Scores

Follow-up	Mean $\pm$ SD	p-value
Baseline	63.4 $\pm$ 8.7	—
6 Weeks	50.6 $\pm$ 7.9	<0.001
3 Months	39.8 $\pm$ 7.1	<0.001
6 Months	31.2 $\pm$ 6.4	<0.001

Observation: Functional outcome improved significantly following PRP injection.

Table 7. Improvement in Knee Range of Motion (ROM)

Follow-up	Mean ROM (Degrees)	p-value
Baseline	106.8 $\pm$ 9.6	—
6 Weeks	112.4 $\pm$ 8.5	0.003
3 Months	117.8 $\pm$ 7.6	<0.001
6 Months	121.5 $\pm$ 7.1	<0.001

Observation: Progressive improvement in knee flexion was observed during follow-up.

Table 8. Overall Functional Outcome at 6 Months

Functional Outcome	Number (n)	Percentage (%)
Excellent	8	26.7
Good	14	46.7
Fair	6	20.0
Poor	2	6.6
Total	30	100.0

Observation: Nearly three-fourths (73.4%) of patients achieved good-to-excellent functional outcomes.

Table 9. Adverse Events Following PRP Injection

Complication	Number (n)	Percentage (%)
Mild transient pain	4	13.3
Mild swelling	2	6.7
Infection	0	0
Allergic reaction	0	0
Hemarthrosis	0	0

Observation: Only minor transient adverse effects were observed, with no serious complications.

Table 10. Overall Clinical Improvement at 6 Months

Parameter	Baseline	6 Months	Mean Improvement	p-value
VAS Score	7.8 $\pm$ 0.9	3.2 $\pm$ 0.8	4.6	<0.001
WOMAC Score	63.4 $\pm$ 8.7	31.2 $\pm$ 6.4	32.2	<0.001
Knee ROM (°)	106.8 $\pm$ 9.6	121.5 $\pm$ 7.1	14.7°	<0.001

Observation: Intra-articular PRP injection resulted in significant improvement in pain relief, knee function, and range of motion at 6 months. Overall, the treatment was safe and well tolerated, with statistically significant improvements in all clinical outcome measures ($p < 0.001$).

DISCUSSION

The present prospective interventional study evaluated the effectiveness of intra-articular platelet-rich plasma injection in patients with symptomatic primary knee osteoarthritis. The findings demonstrated significant improvements in pain relief, functional status, and knee range of motion during the six-month follow-up period, with minimal adverse events.

The mean age of participants in the present study was 58.9 years, and most patients belonged to the 56–65-year age group. Female patients constituted 56.7% of the study population. These findings are consistent with previous epidemiological studies reporting a higher prevalence of knee osteoarthritis among females after menopause due to hormonal changes, obesity, and reduced cartilage protection. Felson et al.(1) and Cross et al.(2) similarly reported that advancing age and female gender are major risk factors for knee osteoarthritis.

The majority of patients had Kellgren–Lawrence Grade II osteoarthritis (56.7%), while the remaining patients had Grade III disease. PRP therapy is generally considered most beneficial in early and moderate osteoarthritis, where viable cartilage remains capable of responding to regenerative stimuli. Filardo et al. (8) also reported superior outcomes in patients with lower radiographic grades of osteoarthritis.

A marked reduction in pain was observed following PRP injection. Mean VAS score decreased significantly from 7.8 at baseline to 3.2 at six months ($p < 0.001$). The progressive reduction in pain observed throughout follow-up is comparable with the findings of Patel et al.(9), who demonstrated significant pain reduction after PRP compared with saline injections. Similarly, Smith(10) reported sustained improvement in pain following PRP therapy in patients with knee osteoarthritis.

Functional recovery also improved considerably in the present study. The mean WOMAC score decreased from 63.4 to 31.2 during the follow-up period, indicating substantial improvement in pain, stiffness, and physical function. Approximately three-fourths of patients achieved good-to-excellent functional outcomes. These findings agree with the systematic review by Belk et al.(11), which concluded that PRP consistently improves functional outcomes compared with hyaluronic acid and placebo.

Knee range of motion improved significantly from 106.8° to 121.5° over six months. Improvement in ROM is likely attributable to reduced pain, decreased synovial inflammation, and improved joint mobility following biological modulation by platelet-derived growth factors. Similar improvements have been reported by Sánchez et al.(12) and Raeissadat et al.(13), who observed enhanced joint mobility following PRP treatment.

Only minor transient adverse effects, including mild pain and swelling at the injection site, were observed in a small proportion of patients. No infections, allergic reactions, or hemarthrosis occurred. The excellent safety profile observed in the present study is consistent with previous literature because PRP is prepared from autologous blood, thereby minimizing immunological reactions and disease transmission. Laudy et al.(14) similarly reported that PRP is a safe treatment with very low complication rates.

The beneficial effects of PRP are believed to result from the release of multiple growth factors and cytokines that suppress inflammatory mediators, stimulate chondrocyte proliferation, enhance matrix synthesis, and promote tissue healing. These biological mechanisms explain the sustained improvement observed during follow-up and support the increasing use of PRP as a regenerative treatment option for early osteoarthritis.(5,15)

The present study has certain limitations. The sample size was relatively small, the study was conducted at a single center, and there was no comparison group receiving placebo or alternative treatment. Furthermore, the follow-up duration was limited to six months. Larger multicenter randomized controlled trials with longer follow-up are required to determine the long-term efficacy, optimal preparation methods, dosage schedules, and patient selection criteria for PRP therapy.

Overall, the present study supports the growing body of evidence that intra-articular platelet-rich plasma injection is an effective and safe biological treatment for early and moderate knee osteoarthritis, producing significant improvements in pain, physical function, and knee mobility while maintaining an excellent safety profile.

CONCLUSION

Intra-articular platelet-rich plasma injection is a safe and effective treatment for patients with early to moderate primary knee osteoarthritis. It provides significant pain relief, improves functional outcomes and knee range of motion, and is associated with only minor transient adverse effects. PRP represents a promising minimally invasive therapeutic option for delaying disease progression and improving quality of life in appropriately selected patients.

REFERENCES

1. Felson DT, Naimark A, Anderson J, Kazis L, Castelli W, Meenan RF. The prevalence of knee osteoarthritis in the elderly. *Arthritis Rheum.* 1987;30(8):914–918.
2. Cross M, Smith E, Hoy D, et al. The global burden of hip and knee osteoarthritis. *Ann Rheum Dis.* 2014;73(7):1323–1330.
3. Kolasinski SL, Neogi T, Hochberg MC, et al. 2019 American College of Rheumatology guideline for the management of osteoarthritis. *Arthritis Care Res.* 2020;72(2):149–162.
4. Marx RE. Platelet-rich plasma: evidence to support its use. *J Oral Maxillofac Surg.* 2004;62(4):489–496.
5. Andia I, Maffulli N. Platelet-rich plasma for managing pain and inflammation in osteoarthritis. *Nat Rev Rheumatol.* 2013;9(12):721–730.
6. Dai WL, Zhou AG, Zhang H, Zhang J. Efficacy of platelet-rich plasma in treatment of knee osteoarthritis: A meta-analysis. *Arthroscopy.* 2017;33(3):659–670.
7. Campbell KA, Saltzman BM, Mascarenhas R, et al. Does intra-articular PRP injection provide clinically superior outcomes? *Am J Sports Med.* 2015;43(3):686–696.
8. Filardo G, Kon E, Buda R, et al. Platelet-rich plasma intra-articular injections for cartilage degeneration. *Knee Surg Sports Traumatol Arthrosc.* 2011;19(4):528–535.

9. Patel S, Dhillon MS, Aggarwal S, Marwaha N, Jain A. Treatment with platelet-rich plasma is more effective than placebo for knee osteoarthritis. *Am J Sports Med.* 2013;41(2):356–364.
10. Smith PA. Intra-articular autologous conditioned plasma injections for knee osteoarthritis. *Am J Sports Med.* 2016;44(4):884–891.
11. Belk JW, Kraeutler MJ, Houck DA, et al. Platelet-rich plasma versus hyaluronic acid for knee osteoarthritis: A systematic review and meta-analysis. *Am J Sports Med.* 2021;49(1):249–260.
12. Sánchez M, Anitua E, Azofra J, et al. Intra-articular injection of an autologous preparation rich in growth factors. *Arthroscopy.* 2008;24(1):69–76.
13. Raeissadat SA, Rayegani SM, Hassanabadi H, et al. Knee osteoarthritis injection choices. *Clin Med Insights Arthritis Musculoskelet Disord.* 2015;8:1–8.
14. Laudy ABM, Bakker EWP, Rekers M, Moen MH. Efficacy of platelet-rich plasma injections in osteoarthritis. *Br J Sports Med.* 2015;49(10):657–672.
15. Kon E, Di Matteo B, Delgado D, et al. Platelet-rich plasma for the treatment of knee osteoarthritis: Clinical evidence and recommendations. *Knee Surg Sports Traumatol Arthrosc.* 2020;28(6):1710–1723.