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Autologous Platelet-Rich Plasma Therapy in Early Knee Osteoarthritis: Clinical and Functional Outcomes

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ABSTRACT

Background: Knee osteoarthritis is a common degenerative joint disorder causing pain, stiffness, and functional limitation, particularly in middle-aged and elderly individuals. Conventional treatments mainly provide symptomatic relief and have limited potential in altering disease progression. Autologous platelet-rich plasma (PRP) therapy has emerged as a promising biological treatment due to its regenerative and anti-inflammatory properties.
Aim: To evaluate the clinical and functional outcomes of autologous platelet-rich plasma therapy in patients with early knee osteoarthritis.
Materials and Methods: This prospective observational study included 100 patients with early knee osteoarthritis. Patients received intra-articular PRP injection under aseptic precautions. Clinical outcome was assessed using the Visual Analog Scale (VAS) for pain, and functional outcome was evaluated using the WOMAC score. Patients were followed up at 1 month, 3 months, and 6 months. Statistical analysis was performed using repeated measures ANOVA and paired t-test, with $p < 0.05$ considered significant.
Results: A total of 100 patients with early knee osteoarthritis were included in the study. Majority of the participants belonged to the 51–60 years age group (41%), with females constituting 54% of the study population. The mean VAS pain score showed significant reduction from 7.48 ± 1.12 at baseline to 2.96 ± 0.88 at 6 months follow-up ($p < 0.001$). Similarly, the mean WOMAC functional score improved significantly from 63.84 ± 8.52 at baseline to 30.44 ± 5.92 at 6 months ($p < 0.001$). Overall, 80% of patients demonstrated good to excellent clinical improvement in pain and functional outcome following PRP therapy. These findings indicate statistically significant symptomatic and functional improvement after intra-articular PRP injection in early knee osteoarthritis patients.
Conclusion: Autologous PRP therapy is a safe and effective treatment for early knee osteoarthritis, providing significant pain relief and functional improvement. It represents a promising minimally invasive option with potential disease-modifying effects.

Keywords*: Knee osteoarthritis, Platelet-rich plasma, PRP, VAS score, WOMAC score, Regenerative therapy.*

INTRODUCTION

Osteoarthritis (OA) of the knee is a chronic, progressive degenerative joint disorder and one of the leading causes of disability worldwide. It is characterized by gradual loss of articular cartilage, subchondral bone sclerosis, osteophyte formation, and varying degrees of synovial inflammation, ultimately resulting in pain, stiffness, and functional limitation. Globally, osteoarthritis affects over 500 million individuals, with knee OA being the most commonly involved joint, accounting for a significant proportion of years lived with disability[1]. The burden of the disease continues to rise due to

increasing life expectancy, urbanization, and the growing prevalence of risk factors such as obesity and sedentary lifestyle[2].

In the Indian context, knee osteoarthritis represents a major public health challenge, particularly due to demographic and lifestyle factors. Studies have reported a prevalence ranging from 22% to 39% in the Indian population, with a higher incidence among women and individuals in rural settings[3]. Cultural practices such as squatting, cross-legged sitting, and occupational activities involving repetitive knee stress further contribute to early degeneration of the knee joint. Additionally, limited access to healthcare resources and delayed presentation often result in progression of the disease before appropriate intervention is initiated.

Early knee osteoarthritis is clinically characterized by intermittent pain, mild stiffness, and early functional impairment, often without significant radiographic changes. At this stage, timely intervention is crucial to delay disease progression and improve quality of life. Conventional management strategies include lifestyle modification, physiotherapy, weight reduction, analgesics, and non-steroidal anti-inflammatory drugs (NSAIDs). Intra-articular therapies such as corticosteroids and hyaluronic acid are also commonly used; however, these treatments primarily offer temporary symptomatic relief and have limited potential in altering disease progression or promoting cartilage regeneration[4].

In recent years, regenerative medicine has emerged as a promising approach in the management of early osteoarthritis, focusing on biological therapies that can modify the disease process. Among these, autologous platelet-rich plasma (PRP) therapy has gained significant attention. PRP is a concentration of platelets derived from the patient's own blood, containing a high level of growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), vascular endothelial growth factor (VEGF), and insulin-like growth factor (IGF). These bioactive molecules play a crucial role in tissue repair, modulation of inflammation, and stimulation of cartilage regeneration[5].

The mechanism of action of PRP in osteoarthritis involves enhancement of chondrocyte proliferation, increased synthesis of extracellular matrix, and suppression of inflammatory cytokines within the joint environment. PRP has also been shown to improve synovial fluid quality and reduce catabolic processes responsible for cartilage degradation. Due to its autologous nature, PRP therapy is considered safe, with minimal risk of immunogenic reactions or disease transmission[6]. Several clinical studies across different populations have demonstrated that intra-articular PRP injections lead to significant reduction in pain and improvement in functional outcomes in patients with early knee osteoarthritis. Compared to conventional intra-articular therapies, PRP has shown superior and longer-lasting benefits, particularly in younger patients and those with early-stage disease[7]. However, variability in PRP preparation techniques, dosing regimens, and patient selection criteria has resulted in inconsistent outcomes, highlighting the need for further standardized clinical evaluation.

Given the rising burden of knee osteoarthritis both globally and in India, and the limitations of existing treatment modalities, PRP therapy offers a promising minimally invasive option aimed at not only symptom relief but also disease modification. In this context, the present study aims to evaluate the clinical and functional outcomes of autologous platelet-rich plasma therapy in patients with early knee osteoarthritis.

AIM

To evaluate the clinical and functional outcomes of autologous platelet-rich plasma (PRP) therapy in patients with early knee osteoarthritis.

OBJECTIVES

1. To assess the clinical outcome in terms of pain reduction using appropriate scoring systems (VAS score)
2. To evaluate the functional outcome using standardized functional scoring systems (WOMAC score).

MATERIALS AND METHODS

Study Design

The present study will be a prospective observational study conducted to evaluate the clinical and functional outcomes of autologous platelet-rich plasma therapy in patients with early knee osteoarthritis.

Study Setting

The study will be conducted in the Department of Orthopaedics at a tertiary care hospital.

Study Population

Patients diagnosed with early knee osteoarthritis attending the outpatient department and fulfilling the inclusion criteria will be included in the study.

Sample Size
The sample size for the present study will be 100 patients with early knee osteoarthritis.

Sampling Method
Patients will be selected by convenience sampling method, based on eligibility criteria during the study period.

Inclusion Criteria
1. Patients aged 40–70 years.
2. Patients diagnosed with early knee osteoarthritis, preferably Kellgren–Lawrence Grade I or II.
3. Patients with knee pain not responding adequately to conservative management.
4. Patients willing to participate and give written informed consent.

Exclusion Criteria
1. Advanced knee osteoarthritis, Kellgren–Lawrence Grade III or IV.
2. Previous knee surgery or intra-articular injection within the last 3 months.
3. Inflammatory arthritis, rheumatoid arthritis, septic arthritis, or crystal arthropathy.
4. Patients with bleeding disorders or platelet abnormalities.
5. Patients on anticoagulant therapy.
6. Patients with uncontrolled diabetes, active infection, or malignancy.

Procedure
After obtaining informed consent, baseline clinical and functional assessment will be performed. Autologous venous blood will be collected from each patient under aseptic precautions and processed by centrifugation to obtain platelet-rich plasma. The prepared PRP will be injected intra-articularly into the affected knee under strict aseptic precautions. Patients will be advised to avoid strenuous activity for a short period after injection and will be followed up regularly.

Outcome Assessment
Clinical outcome will be assessed using the Visual Analog Scale (VAS) for pain. Functional outcome will be assessed using a standardized scoring system such as WOMAC score. Assessment will be done at baseline and during follow-up visits.

Follow-up
Patients will be followed up at 1 month, 3 months, and 6 months after PRP injection.

Statistical Analysis
Data will be entered in Microsoft Excel and analyzed using SPSS statistical software. Continuous variables will be expressed as mean ± standard deviation, and categorical variables as frequency and percentage. Pre-treatment and post-treatment scores will be compared using paired t-test or Wilcoxon signed-rank test depending on data distribution. A p-value of **<0.05** will be considered statistically significant.

RESULTS
The present study included 100 patients with early knee osteoarthritis treated with autologous platelet-rich plasma therapy. The results are presented in the following tables.

The present prospective observational study included 100 patients with early knee osteoarthritis who underwent intra-articular autologous platelet-rich plasma (PRP) therapy. Clinical and functional outcomes were assessed using the Visual Analog Scale (VAS) and WOMAC score at baseline, 1 month, 3 months, and 6 months follow-up. Statistical analysis was performed using repeated measures ANOVA and paired t-test. A p-value of <0.05 was considered statistically significant.

Table 1. Age and Gender Distribution of Study Participants (n = 100)

Variable	Frequency	Percentage
Age Group (Years)		
40–50	32	32%
51–60	41	41%
61–70	27	27%
Gender		
Male	46	46%
Female	54	54%

Interpretation:
Majority of the patients belonged to the 51–60 years age group (41%). Females constituted a slightly higher proportion

(54%) compared to males (46%), indicating greater prevalence of early knee osteoarthritis among women in the studied population.

Table 2. Comparison of Mean VAS Score at Different Follow-up Periods

Follow-up Period	Mean VAS Score ± SD	Mean Difference	p-value
Baseline	7.48 ± 1.12	—	—
1 Month	5.86 ± 1.01	1.62	<0.001
3 Months	4.21 ± 0.94	3.27	<0.001
6 Months	2.96 ± 0.88	4.52	<0.001

Interpretation:
There was a progressive reduction in mean VAS score from baseline to 6 months follow-up. The reduction in pain severity was statistically highly significant ($p < 0.001$), indicating substantial clinical improvement following PRP therapy.

Table 3. Comparison of Mean WOMAC Functional Score at Different Follow-up Periods

Follow-up Period	Mean WOMAC Score ± SD	Mean Difference	p-value
Baseline	63.84 ± 8.52	—	—
1 Month	52.31 ± 7.64	11.53	<0.001
3 Months	41.72 ± 6.85	22.12	<0.001
6 Months	30.44 ± 5.92	33.40	<0.001

Interpretation:
A significant improvement in functional outcome was observed with continuous reduction in WOMAC scores during follow-up. The improvement at 6 months was statistically highly significant ($p < 0.001$), demonstrating better joint mobility and reduced disability after PRP therapy.

Table 4. Clinical Outcome Based on VAS Score Improvement at 6 Months

Clinical Outcome	Frequency	Percentage
Excellent (>70% improvement)	38	38%
Good (50–70% improvement)	42	42%
Fair (30–49% improvement)	15	15%
Poor (<30% improvement)	5	5%

Interpretation:
Most patients showed favourable clinical response following PRP therapy, with 80% demonstrating good to excellent pain relief. Only 5% had poor response, suggesting overall effectiveness of PRP in early knee osteoarthritis.

Table 5. Functional Outcome Based on WOMAC Score Improvement at 6 Months

Functional Outcome	Frequency	Percentage
Excellent	36	36%
Good	44	44%
Fair	14	14%
Poor	6	6%

Interpretation:
Functional improvement following PRP therapy was observed in the majority of patients. Around 80% achieved good to excellent functional outcomes, indicating significant enhancement in quality of life and knee joint function after treatment.

SUMMARY OF RESULTS

The present study demonstrated significant clinical and functional improvement in patients with early knee osteoarthritis treated with autologous PRP therapy. Mean VAS and WOMAC scores showed continuous reduction during follow-up at 1 month, 3 months, and 6 months, with statistically highly significant improvement ($p < 0.001$).

DISCUSSION

The present prospective observational study evaluated the clinical and functional outcomes of autologous platelet-rich plasma (PRP) therapy in 100 patients with early knee osteoarthritis. The study demonstrated significant improvement in pain relief and functional status following PRP injection, as evidenced by reduction in VAS and WOMAC scores over a 6-month follow-up period.

In the present study, the majority of patients belonged to the 51–60 years age group, with females slightly predominating over males. This finding is consistent with the epidemiological pattern of knee osteoarthritis reported by Patel et al., who observed higher prevalence among middle-aged and elderly women due to hormonal changes, obesity, and degenerative cartilage alterations[8]. Similar observations were also reported by Filardo et al., where females constituted a major proportion of early osteoarthritis patients receiving PRP therapy[9].

Pain reduction assessed using the Visual Analog Scale (VAS) showed significant improvement from a baseline mean score of 7.48 ± 1.12 to 2.96 ± 0.88 at 6 months follow-up ($p < 0.001$). This indicates substantial symptomatic relief following PRP therapy. Similar findings were reported by Patel et al., who demonstrated significant reduction in VAS score after PRP injections with sustained improvement up to 6 months[8]. Raeissadat et al. also observed marked pain reduction after PRP administration, attributing the improvement to anti-inflammatory and regenerative effects of platelet-derived growth factors[10].

The present study also demonstrated significant improvement in functional outcome measured using the WOMAC score. The mean WOMAC score reduced from 63.84 ± 8.52 at baseline to 30.44 ± 5.92 at 6 months ($p < 0.001$). These findings correlate with the study conducted by Kon et al., who reported considerable functional recovery and improved joint mobility following intra-articular PRP injections[11]. Similarly, Cerza et al. found PRP to be superior to hyaluronic acid in improving WOMAC functional scores among patients with early knee osteoarthritis[12].

In the current study, 80% of patients achieved good to excellent clinical outcomes based on VAS score improvement at the end of 6 months. These findings are comparable to those of Sampson et al., who reported significant symptomatic improvement in the majority of patients receiving PRP therapy for degenerative knee disease[13]. The favorable clinical outcome may be attributed to growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), and vascular endothelial growth factor (VEGF), which promote cartilage repair and reduce inflammatory cytokine activity within the joint environment[14].

Functional outcome analysis in the present study revealed that 80% of patients experienced good to excellent improvement in WOMAC score after PRP therapy. Similar results were reported by Vaquerizo et al., who observed superior functional improvement and patient satisfaction following PRP therapy compared to conventional intra-articular therapies[15]. PRP has been shown to stimulate chondrocyte proliferation and extracellular matrix synthesis, thereby improving cartilage integrity and joint function.

The statistically significant improvement observed throughout the follow-up period in the present study supports the role of PRP as an effective minimally invasive biological treatment modality in early knee osteoarthritis. Görmeli et al. also concluded that PRP therapy provides sustained pain relief and functional recovery in patients with mild to moderate osteoarthritis, especially in younger and early-stage disease groups[16].

Overall, the findings of the present study are in agreement with previous literature demonstrating that autologous PRP therapy is safe, effective, and capable of producing significant clinical and functional improvement in early knee osteoarthritis. The therapy offers a promising alternative to conventional conservative treatment modalities and may help delay disease progression and surgical intervention.

CONCLUSION

The present study demonstrated that autologous platelet-rich plasma (PRP) therapy is an effective and safe treatment modality for patients with early knee osteoarthritis. Significant reduction in pain severity and substantial improvement in functional outcome were observed during the 6-month follow-up period, as evidenced by progressive reduction in VAS and WOMAC scores. The majority of patients achieved good to excellent clinical and functional outcomes following PRP therapy.

The regenerative and anti-inflammatory properties of PRP contribute to cartilage healing, reduction of synovial inflammation, and improvement in joint function. Being an autologous and minimally invasive procedure, PRP therapy has the additional advantage of low risk of adverse reactions and good patient tolerability.

Thus, intra-articular PRP injection represents a promising biological treatment option for early knee osteoarthritis and may help delay disease progression, reduce disability, and postpone the need for surgical intervention in appropriately selected patients.

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