e-ISSN: 0975-1556, p-ISSN:2820-2643
Available online on www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2025; 17(1); 34-37
Original Research Article

Effect of Platelet-Rich Plasma Therapy in Knee Osteoarthritis

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Received: 26-10-2024 / Revised: 27-11-2024 / Accepted: 28-12-2024
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Conflict of interest: Nil

Abstract:

Aim: This study aimed to evaluate the effects of PRP on pain, joint function, and cartilage thickness in patients with knee OA over 12 months.

Methods: In a randomized controlled trial conducted from 2020 to 2023 at IGIMS and PMCH in Patna, 100 patients with knee OA were assigned to either a PRP group (n=50) or a control group (n=50). PRP patients received three intra-articular injections, while controls received saline. Pain (VAS), function (WOMAC), and cartilage thickness (MRI) were measured at baseline, 3, 6, and 12 months.

Results: PRP significantly reduced pain ($p<0.001$) and improved function ($p<0.001$) compared to control. MRI showed a modest increase in cartilage thickness in the PRP group, suggesting possible regenerative effects.

Conclusion: PRP therapy provides effective pain relief and functional improvement in knee OA patients, with the potential for cartilage regeneration, indicating its promise as a non-surgical treatment option.

Keywords: Knee Osteoarthritis, Platelet-Rich Plasma, Pain Management, Cartilage Regeneration.

Introduction

Platelet-rich plasma (PRP) therapy involves injecting a concentrated platelet solution, obtained from the patient's blood, directly into the affected joint [1]. The concept behind PRP therapy is that platelets release growth factors and other bioactive substances that can help reduce inflammation and may encourage cartilage repair [2]. Initial research indicates that PRP could provide clinical benefits, such as pain relief and improved joint function, by enhancing the body's natural healing mechanisms. However, outcomes have been inconsistent, and more research is required to establish optimal treatment protocols and assess the long-term effectiveness of PRP for managing knee osteoarthritis [3,4,5].

This study aims to assess the effectiveness of PRP therapy in alleviating pain, enhancing joint function, and promoting cartilage regeneration in patients with knee osteoarthritis. Specifically, it seeks to evaluate PRP's therapeutic potential in comparison to conventional treatments, determine optimal dosing protocols, and explore the long-term effects of PRP on disease progression and joint health in knee osteoarthritis patients.

Methodology

Study Design: This study is a randomized controlled trial (RCT) conducted over three years, from 2020 to 2023, to assess the efficacy of platelet-rich plasma (PRP) therapy in the treatment of knee osteoarthritis.

Study Setting: The study was carried out at two major medical institutions in Patna, India: Indira Gandhi Institute of Medical Sciences (IGIMS) and Patna Medical College and Hospital (PMCH).

Participants: A total of 100 patients diagnosed with knee osteoarthritis were enrolled in the study. Patients were selected based on inclusion and exclusion criteria, which included age (between 40 and 75 years), confirmed radiographic evidence of knee osteoarthritis, and no prior knee surgery or intra-articular injections within the past six months.

Intervention: Participants were randomly assigned to either the PRP therapy group (n=50) or the control group (n=50).

1. **PRP Group**: Patients received a series of three PRP injections, administered at three-week

intervals. PRP was prepared from the patient's own blood, with platelets concentrated and injected directly into the affected knee joint.
2. **Control Group**: Patients received a placebo saline injection, administered in the same manner as the PRP group.

Outcome Measures: The primary outcomes measured were:

1. **Pain Levels**: Assessed using the Visual Analog Scale (VAS) at baseline, 3 months, 6 months, and 12 months post-treatment.
2. **Functional Improvement**: Measured by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score at the same intervals.
3. **Cartilage Regeneration**: Assessed through magnetic resonance imaging (MRI) at baseline and 12 months to observe changes in cartilage thickness.

Data Analysis: Statistical analysis compared the mean VAS and WOMAC scores between the PRP and control groups over time. Paired t-tests and ANOVA were used to assess within-group and between-group differences. MRI results were analyzed to identify any statistically significant changes in cartilage thickness in the PRP group compared to the control group.

Results

The study results are presented based on pain levels, functional improvement, and cartilage regeneration as assessed through VAS, WOMAC, and MRI findings, respectively. All measurements were recorded at baseline, 3 months, 6 months, and 12 months post-treatment for both the PRP and control groups.

Table 1: Pain Levels (VAS Scores)

Timepoint	PRP Group (n=50)	Control Group (n=50)	p-value
Baseline	7.8 ± 1.2	7.7 ± 1.3	0.85
3 Months	4.6 ± 1.5	6.9 ± 1.4	<0.001
6 Months	3.9 ± 1.4	6.5 ± 1.3	<0.001
12 Months	3.4 ± 1.6	6.3 ± 1.5	<0.001

The PRP group showed significant pain reduction compared to the control group over time, with a mean VAS score of 4.6 at 3 months, notably lower than the control group's 6.9 ($p<0.001$). This improvement continued at 6 and 12 months, indicating lasting pain relief with PRP therapy.

Table 2: Functional Improvement (WOMAC Scores)

Timepoint	PRP Group (n=50)	Control Group (n=50)	p-value
Baseline	72.5 ± 5.6	71.8 ± 6.0	0.67
3 Months	54.3 ± 6.5	69.7 ± 6.3	<0.001
6 Months	48.6 ± 5.9	68.2 ± 6.4	<0.001
12 Months	43.2 ± 6.1	67.8 ± 6.5	<0.001

WOMAC scores indicated significant functional improvement in the PRP group at all follow-ups. At 3 months, the PRP group's mean score was 54.3, significantly reduced from baseline and much lower than the control group's 69.7 ($p<0.001$). This functional improvement in the PRP group persisted through 12 months, while the control group showed minimal changes.

Table 3: Cartilage Thickness (MRI Assessment)

Assessment	PRP Group (n=50)	Control Group (n=50)	p-value
Baseline	3.4 ± 0.6 mm	3.5 ± 0.5 mm	0.48
12 Months	3.9 ± 0.7 mm	3.4 ± 0.5 mm	<0.001

MRI analysis showed a slight increase in cartilage thickness in the PRP group at the 12-month follow-up, with an average increase of 3.9 mm, suggesting potential cartilage regeneration. The control group did not show any significant change in cartilage thickness from baseline ($p<0.001$ for between-group comparison).

Discussion

This study assessed the efficacy of platelet-rich plasma (PRP) therapy in managing knee osteoarthritis (OA) over 12 months, focusing on pain reduction, functional improvement, and cartilage regeneration [8]. Results revealed that PRP significantly decreased pain and enhanced functional outcomes compared to the control group, which received placebo saline injections. Specifically, the PRP group's mean VAS score dropped from 7.8 at baseline to 3.4 at 12 months, while the control group showed only minimal change. Similarly, WOMAC scores in the PRP group declined from 72.5 to 43.2, indicating substantial functional improvement. These findings

support PRP as a promising non-surgical treatment for knee OA, consistent with evidence from prior studies, such as Smith et al. (2021) [6,9], which demonstrated PRP's effectiveness in pain relief and joint function improvement over hyaluronic acid injections.

These findings are consistent with a systematic review by Dai et al. (2020), which demonstrated that PRP significantly improved pain and functional outcomes in knee OA patients compared to placebo and corticosteroid injections (Dai et al., 2020) [7,10]. PRP's therapeutic benefits may result from its anti-inflammatory effects, reducing synovial inflammation, and growth factors that promote joint healing and tissue regeneration. A unique aspect of this study was the MRI-based assessment of cartilage thickness, showing a modest increase in the PRP group, with cartilage thickness rising from 3.4 mm at baseline to 3.9 mm at 12 months. Although modest, this increase hints at PRP's regenerative potential, aligning with similar findings by Khoshbin et al. (2019), who reported cartilage regeneration trends with PRP treatment. Further research is warranted to clarify PRP's regenerative effects in OA, as effective cartilage repair may require more advanced PRP formulations or combination therapies [11].

This study's findings align with recent literature and contribute additional insights into PRP's long-term effects on knee osteoarthritis. A meta-analysis by Bennell et al. (2021) indicated short-term benefits of PRP for pain relief and function in knee OA, with limited evidence on long-term effects (Bennell et al., 2021) [12]. Our results demonstrate sustained improvements over 12 months, supporting PRP's potential as a long-term therapy. Future directions for PRP therapy include optimizing platelet concentration and dosing to enhance outcomes and exploring combination therapies with regenerative approaches like stem cells or hyaluronic acid for possible synergistic effects. Extended studies beyond 12 months are needed to evaluate PRP's durability and its potential to delay surgical interventions. Tailoring PRP to individual patient factors such as age, OA severity, and lifestyle may also improve outcomes, paving the way for PRP to become a personalized and effective treatment for knee OA [13,14,15].

Conclusion

This study reinforces the potential of PRP therapy as an effective treatment for knee osteoarthritis, particularly in reducing pain, improving function, and potentially supporting cartilage repair. However, while promising, PRP therapy requires further investigation to fully establish its role and optimize protocols for long-term benefits in knee OA management.

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