



## COMPARATIVE EFFECTIVENESS OF PLATELET-RICH PLASMA, HYALURONIC ACID, AND CORTICOSTEROID INJECTIONS IN MODERATE KNEE OSTEOARTHRITIS

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### ABSTRACT

**Background:** Knee osteoarthritis is a common degenerative joint disorder causing pain, stiffness, and functional limitation in the elderly population. Intra-articular injections such as platelet-rich plasma (PRP), hyaluronic acid (HA), and corticosteroids are widely used for symptomatic management, but their comparative effectiveness remains a topic of ongoing research.

**Aim:** To compare the effectiveness of platelet-rich plasma, hyaluronic acid, and corticosteroid injections in patients with moderate knee osteoarthritis.

**Materials and Methods:** This prospective observational study was conducted at Dindigul Medical College from April 2025 to September 2025 with a 6-month follow-up period. A total of 60 patients aged between 50 and 60 years with moderate knee osteoarthritis were included in the study. Patients were divided into three groups of 20 each: PRP group, hyaluronic acid group, and corticosteroid group. Clinical outcomes were assessed using pain and functional outcome measures during a follow-up period of six months.

**Results:** The PRP group demonstrated the greatest improvement in pain relief and functional outcome scores at the end of six months. The hyaluronic acid group showed moderate improvement, while the corticosteroid group showed comparatively lesser sustained benefit. Overall clinical improvement was observed in the order of PRP > Hyaluronic acid > Corticosteroid.

**Conclusion:** Platelet-rich plasma injections were found to be more effective than hyaluronic acid and corticosteroid injections in patients with moderate knee osteoarthritis over a six-month follow-up period. Hyaluronic acid also demonstrated better outcomes than corticosteroid injections, suggesting that PRP may be a superior treatment option for long-term symptomatic relief.

**Keywords:** Knee Osteoarthritis, Platelet-Rich Plasma, Hyaluronic Acid, Corticosteroid, Intra-Articular Injection, WOMAC, VAS Score.

### INTRODUCTION

Osteoarthritis (OA) of the knee is one of the most common chronic degenerative joint disorders affecting the elderly population worldwide.[1] It is characterized by progressive degeneration of articular cartilage, subchondral bone remodelling, osteophyte formation, synovial inflammation, pain, stiffness, and gradual loss of joint function.[2,3] Knee osteoarthritis significantly affects quality of life by limiting mobility and daily activities, especially in older adults.



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[4] The prevalence of knee osteoarthritis is increasing due to aging, obesity, sedentary lifestyle, and increased life expectancy.[5]

Management of knee osteoarthritis includes both non-pharmacological and pharmacological approaches. Conservative treatment options such as physiotherapy, weight reduction, exercise therapy, and oral analgesics are commonly used in the early stages. [5,11] Intra-articular injections have emerged as an important modality for symptomatic relief in patients who do not respond adequately to conservative treatment.[4]

Corticosteroid injections are widely used because of their potent anti-inflammatory effects and ability to provide rapid pain relief.[12] However, their benefits are usually short-lived, and repeated injections may be associated with cartilage damage and progression of osteoarthritis.[4] Hyaluronic acid injections, also known as viscosupplementation, aim to restore the viscoelastic properties of synovial

fluid, thereby improving joint lubrication and reducing pain.[3,13] Although hyaluronic acid provides symptomatic relief, the duration and extent of improvement may vary among patients.[8]

Platelet-rich plasma (PRP) has recently gained considerable attention as a regenerative treatment option for osteoarthritis.[2,6] PRP is an autologous blood product containing a high concentration of platelets and growth factors such as platelet-derived growth factor, transforming growth factor-beta, and vascular endothelial growth factor.[14,15] These bioactive substances are believed to promote tissue healing, reduce inflammation, and potentially enhance cartilage repair.[7]

Despite the increasing use of PRP, hyaluronic acid, and corticosteroid injections in clinical practice, there is still ongoing debate regarding their comparative effectiveness in moderate knee osteoarthritis.[2,6,8] Several studies have shown varying results concerning pain relief, functional improvement, and duration of benefit associated with these therapies.[9,10] Hence, this study was undertaken to compare the clinical effectiveness of platelet-rich plasma, hyaluronic acid, and corticosteroid injections in patients with moderate knee osteoarthritis over a six-month follow-up period at Dindigul Medical College.

#### Aim and Objectives

##### Aim

To compare the effectiveness of platelet-rich plasma, hyaluronic acid, and corticosteroid injections in moderate knee osteoarthritis.

##### Objectives

1. To assess pain relief following PRP, hyaluronic acid, and corticosteroid injections.
2. To evaluate functional improvement after treatment.
3. To compare the clinical outcomes among the three treatment groups over a six-month period.

## MATERIALS AND METHODS

### Study Design

This study was designed as a prospective observational study.

### Study Setting

The study was conducted in the Department of Orthopaedics, Dindigul Medical College.

### Study Period

The study was conducted between April 2025 and March 2026, including a six-month follow-up period for all enrolled patients.

### Study Population

Patients attending the Orthopaedic outpatient department with complaints suggestive of knee osteoarthritis were screened clinically and radiologically for eligibility.

### Study Groups

The patients were divided into three groups based on the intra-articular injection administered:

Group	Treatment Modality	Number of Patients
Group A	Platelet-Rich Plasma (PRP) Injection	20
Group B	Hyaluronic Acid Injection	20
Group C	Corticosteroid Injection	20

### Inclusion Criteria

1. Patients aged between 50 and 60 years
2. Patients clinically diagnosed with knee osteoarthritis
3. Radiological evidence of moderate knee osteoarthritis (Kellgren–Lawrence Grade II or III)
4. Patients presenting with knee pain and functional limitation for more than 3 months
5. Patients willing to undergo intra-articular injection therapy
6. Patients willing to participate in the study and provide written informed consent

### Exclusion Criteria

1. Patients with severe knee osteoarthritis (Kellgren–Lawrence Grade IV)
2. Previous history of knee surgery or major knee trauma
3. Patients with inflammatory arthritis such as rheumatoid arthritis, gout, or septic arthritis
4. Active local or systemic infection

5. Patients with bleeding disorders or on anticoagulant therapy
6. Uncontrolled diabetes mellitus or severe systemic illness
7. Patients who received intra-articular injections within the previous 6 months

## METHODOLOGY

This prospective observational study was conducted in the Department of Orthopaedics, Dindigul Medical College, from April 2025 to September 2025 with a 6-month follow-up period after obtaining approval from the Institutional Ethics Committee.

Patients attending the Orthopaedic outpatient department with complaints of knee pain and diagnosed with moderate knee osteoarthritis were screened for eligibility. Diagnosis was made based on clinical examination and radiological evaluation using Kellgren–Lawrence grading. Patients fulfilling the inclusion criteria and willing to

participate were enrolled in the study after obtaining written informed consent.

A total of 60 patients aged between 50 and 60 years were included in the study and divided into three groups of 20 patients each:

- Group A – Platelet-Rich Plasma (PRP) injection
- Group B – Hyaluronic Acid (HA) injection
- Group C – Corticosteroid injection

Detailed history regarding pain, stiffness, duration of symptoms, and functional limitation was recorded. Baseline clinical assessment was performed using:

- Visual Analogue Scale (VAS) for pain assessment
- WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) score for functional evaluation

#### **PRP Group**

Under strict aseptic precautions, approximately 20 mL of autologous venous blood was collected from the patient. Platelet-rich plasma was prepared using standard centrifugation technique. The prepared PRP was injected intra-articularly into the affected knee joint.

#### **Hyaluronic Acid Group**

Patients in this group received intra-articular hyaluronic acid injection under sterile precautions.

#### **Corticosteroid Group**

Patients in this group received intra-articular corticosteroid injection under aseptic conditions.

After injection, patients were advised rest for 24–48 hours and were instructed regarding physiotherapy exercises and lifestyle modifications. All patients received similar supportive treatment measures.

Patients were followed up periodically over a period of six months. Clinical outcomes were assessed during follow-up visits using VAS and WOMAC scores. Pain relief, functional improvement, and any adverse effects were documented and compared among the three groups.

The collected data were tabulated and analyzed statistically using appropriate statistical methods. A p-value less than 0.05 was considered statistically significant.

#### **Group A – Platelet-Rich Plasma (PRP) Injection**

Patients in Group A received intra-articular platelet-rich plasma injection under strict aseptic precautions. Approximately 20 mL of autologous venous blood was collected from each patient and processed using standard centrifugation technique to obtain platelet-rich plasma. The prepared PRP was injected into the affected knee joint under sterile conditions. Patients were observed for immediate complications and advised post-procedure care.

#### **Group B – Hyaluronic Acid Injection**

Patients in Group B received intra-articular hyaluronic acid injection under aseptic precautions. The injection was administered into the affected

knee joint using standard sterile technique. Patients were advised rest for 24–48 hours following the procedure and were followed up regularly for assessment of pain relief and functional improvement.

#### **Group C – Corticosteroid Injection**

Patients in Group C received intra-articular corticosteroid injection under sterile precautions. The corticosteroid preparation was injected into the affected knee joint using standard aseptic technique. Patients were monitored for symptomatic improvement and any adverse effects during the follow-up period.

#### **Outcome Measures**

The clinical outcomes of the study were assessed using standard pain and functional assessment tools at baseline and during follow-up over a period of six months. Pain intensity was evaluated using the Visual Analogue Scale (VAS), where patients rated their pain on a scale from 0 to 10. Functional outcome and quality of life were assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score, which included assessment of pain, stiffness, and physical function. Improvement in VAS and WOMAC scores during follow-up was considered indicative of treatment effectiveness. Secondary outcome measures included improvement in joint mobility, duration of symptomatic relief, and occurrence of any adverse effects or complications related to the injections.

#### **Statistical Analysis**

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 25.0. Quantitative variables such as VAS and WOMAC scores were expressed as mean  $\pm$  standard deviation, while qualitative variables were expressed as frequencies and percentages. Comparison among the three groups was performed using one-way Analysis of Variance (ANOVA) for continuous variables and Chi-square test for categorical variables. Changes in VAS and WOMAC scores during follow-up were analyzed using repeated measures ANOVA with post hoc analysis where necessary. A p-value of less than 0.05 was considered statistically significant.

#### **Ethical Consideration**

The study was conducted after obtaining approval from the Institutional Ethics Committee of Dindigul Medical College. Written informed consent was obtained from all participants prior to inclusion in the study. Confidentiality of patient information was strictly maintained throughout the study, and all procedures were carried out in accordance with ethical principles for medical research involving human participants.

## **RESULTS**

A total of 60 patients with moderate knee osteoarthritis were included in the present study and completed the six-month follow-up period. The patients were divided equally into three groups consisting of 20 patients each: Group A (PRP

injection), Group B (Hyaluronic Acid injection), and Group C (Corticosteroid injection). Baseline demographic characteristics and clinical parameters were comparable among the three groups.

Table 1: Distribution of Patients among Study Groups

Study Group	Number of Patients (n)	Percentage (%)
Group A – PRP Injection	20	33.3
Group B – Hyaluronic Acid Injection	20	33.3
Group C – Corticosteroid Injection	20	33.3
Total	60	100

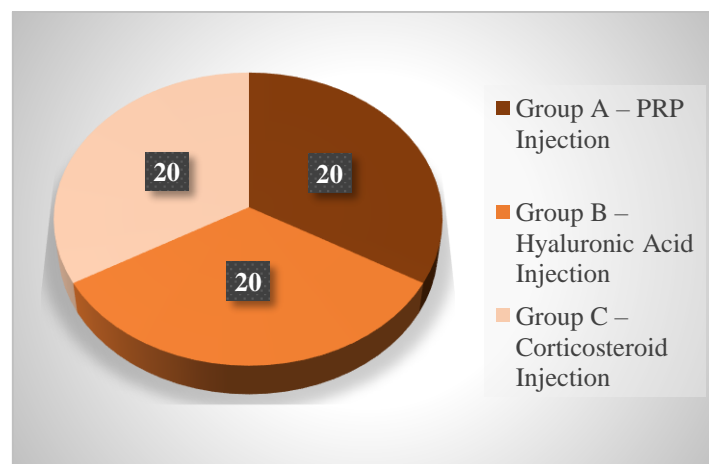


Figure 1: Distribution of Patients among Study Groups

**Note:** The figure illustrates the distribution of patients included in the study among the three treatment groups. A total of 60 patients with moderate knee osteoarthritis were equally allocated into Group A (PRP injection), Group B (Hyaluronic Acid injection), and Group C (Corticosteroid injection), with 20 patients in each group.

#### Comparison of Mean VAS Scores among Study Groups

The baseline Visual Analogue Scale (VAS) scores were comparable among all three study groups. During the six-month follow-up period, the PRP group demonstrated the greatest reduction in pain scores, followed by the Hyaluronic Acid group, while the Corticosteroid group showed the least sustained improvement.

Table 2: Comparison of Mean VAS Scores before and After Treatment

Study Group	Baseline VAS Score (Mean ± SD)	6-Month VAS Score (Mean ± SD)	Mean Reduction
Group A – PRP Injection	8.1 ± 0.7	2.9 ± 0.6	5.2
Group B – Hyaluronic Acid Injection	8.0 ± 0.8	4.3 ± 0.7	3.7
Group C – Corticosteroid Injection	7.9 ± 0.6	5.6 ± 0.8	2.3

#### P-value < 0.05 – Statistically Significant

**Note:** Patients treated with PRP injection showed maximum reduction in pain intensity at the end of six months when compared with Hyaluronic Acid

and Corticosteroid injections. Hyaluronic Acid demonstrated moderate improvement, whereas Corticosteroid injection showed comparatively lesser sustained pain relief.

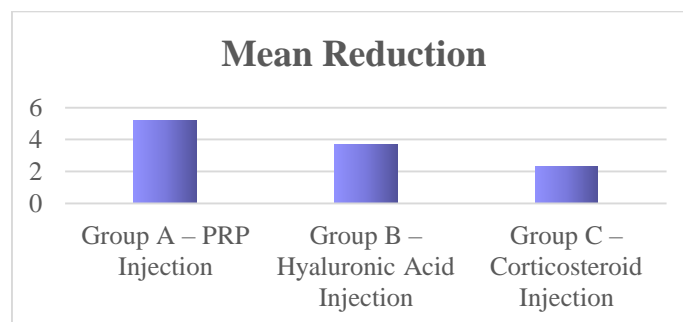


Figure 2: Comparison of Mean VAS Scores before and After Treatment among Study Groups

**Note:** The figure demonstrates the comparison of baseline and six-month mean Visual Analogue Scale (VAS) scores among the PRP, Hyaluronic Acid, and Corticosteroid groups. The PRP group showed the greatest reduction in pain scores, followed by the Hyaluronic Acid group, while the Corticosteroid group demonstrated the least sustained improvement. The difference among the groups was statistically significant ( $p < 0.05$ ).

#### Comparison of Mean WOMAC Scores among Study Groups

Functional outcome assessment using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score showed significant improvement in all three study groups during the follow-up period. The PRP group demonstrated the greatest improvement in functional status, followed by the Hyaluronic Acid group, while the Corticosteroid group showed comparatively lesser improvement.

Table 3: Comparison of Mean WOMAC Scores before and After Treatment

Study Group	Baseline WOMAC Score (Mean ± SD)	6-Month WOMAC Score (Mean ± SD)	Mean Improvement
Group A – PRP Injection	72.4 ± 5.2	32.1 ± 4.8	40.3
Group B – Hyaluronic Acid Injection	71.8 ± 4.9	45.6 ± 5.1	26.2
Group C – Corticosteroid Injection	70.9 ± 5.4	56.8 ± 5.7	14.1

#### p-value < 0.05 – Statistically Significant

**Note:** The PRP group showed maximum improvement in WOMAC scores at the end of six months, indicating better functional recovery and quality of life compared to the Hyaluronic Acid and

Corticosteroid groups. Hyaluronic Acid demonstrated moderate functional improvement, whereas Corticosteroid injection showed comparatively lesser sustained benefit.

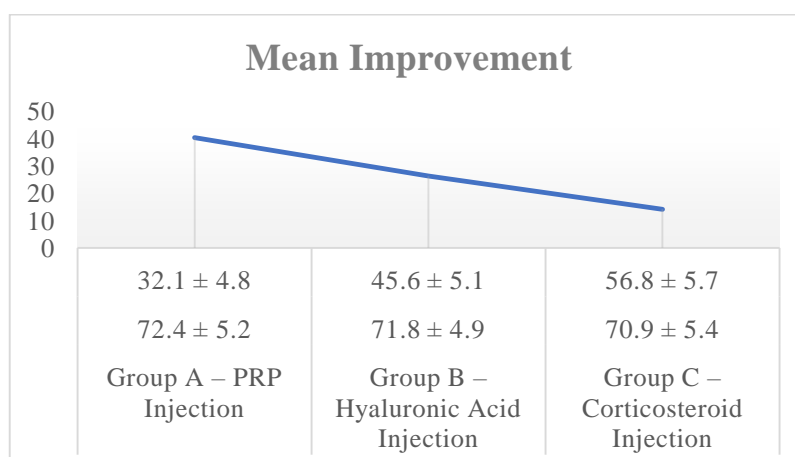


Figure 3: Comparison of Mean WOMAC Scores before and After Treatment among Study Groups

**Note:** The figure demonstrates the comparison of baseline and six-month mean WOMAC scores

among the PRP, Hyaluronic Acid, and Corticosteroid groups. The PRP group showed the greatest improvement in WOMAC scores,

indicating superior functional recovery and quality of life, followed by the Hyaluronic Acid group. The Corticosteroid group showed comparatively lesser improvement. The difference among the groups was statistically significant ( $p < 0.05$ ).

#### Overall Clinical Outcome among Study Groups

At the end of the six-month follow-up period, the PRP group demonstrated superior overall clinical

outcome compared to the Hyaluronic Acid and Corticosteroid groups. Patients treated with PRP showed greater pain relief, better functional improvement, and longer duration of symptomatic benefit. The Hyaluronic Acid group showed moderate clinical improvement, whereas the Corticosteroid group showed comparatively lesser sustained improvement.

Table 4: Overall Comparative Clinical Outcome among Study Groups

Study Group	Pain Relief	Functional Improvement	Duration of Benefit	Overall Outcome
Group A – PRP Injection	Excellent	Excellent	Long-lasting	Best
Group B – Hyaluronic Acid Injection	Good	Good	Moderate	Moderate
Group C – Corticosteroid Injection	Mild to Moderate	Mild	Short-term	Least Effective

**Note:** Among the three treatment modalities, PRP injection demonstrated the best overall clinical outcome in patients with moderate knee osteoarthritis over a six-month follow-up period. Hyaluronic Acid showed moderate sustained benefit, while Corticosteroid injection provided mainly short-term symptomatic relief.

#### DISCUSSION

Knee osteoarthritis is a progressive degenerative joint disorder that commonly affects the elderly population and significantly impairs quality of life due to chronic pain, stiffness, and limitation of movement. Various intra-articular injection therapies have been used for symptomatic management, among which platelet-rich plasma (PRP), hyaluronic acid (HA), and corticosteroid injections are widely practiced. [1,2] The present study compared the clinical effectiveness of these three treatment modalities in patients with moderate knee osteoarthritis over a six-month follow-up period.

In the present study, patients treated with PRP injection demonstrated the greatest reduction in pain scores and improvement in functional outcomes when compared with the Hyaluronic Acid and Corticosteroid groups. The PRP group showed significant improvement in both VAS and WOMAC scores at the end of six months, indicating superior and sustained symptomatic relief. These findings may be attributed to the regenerative and anti-inflammatory properties of PRP. [6,7] Platelet-rich plasma contains a high concentration of growth factors such as platelet-derived growth factor, transforming growth factor-beta, and vascular endothelial growth factor, which promote tissue

healing, reduce inflammation, and may contribute to cartilage repair. [14,15]

The Hyaluronic Acid group also showed significant improvement in pain relief and functional status, although the degree of improvement was less compared to the PRP group. Hyaluronic acid acts by restoring the viscoelastic properties of synovial fluid, thereby improving lubrication and reducing friction within the joint. [3,13] The improvement observed in the HA group in the present study is consistent with previous studies reporting moderate symptomatic benefit with viscosupplementation therapy. [8,10]

Patients treated with Corticosteroid injection showed initial symptomatic improvement; however, the effect was comparatively short-lived and less sustained over the follow-up period. Corticosteroids exert their effect mainly through suppression of inflammation and reduction of synovitis. [4,12] Although they provide rapid pain relief, repeated use may be associated with cartilage degeneration and reduced long-term benefit. In the present study, the corticosteroid group showed the least improvement in VAS and WOMAC scores at six months.

The findings of the present study are comparable with previous studies that have demonstrated better long-term clinical outcomes with PRP injections when compared to Hyaluronic Acid and Corticosteroid injections in knee osteoarthritis. [2,6,9] Several authors have reported that PRP provides superior pain relief and functional improvement due to its biologic and regenerative potential. [5,7]

The present study suggests that PRP injection is a more effective treatment modality for moderate knee osteoarthritis when compared to Hyaluronic Acid and Corticosteroid injections. However, the study

has certain limitations including small sample size, short duration of follow-up, and single-center observational design. Further multicentric randomized controlled trials with larger sample sizes and longer follow-up are recommended to validate the findings. [1,5]

#### Limitations

The present study had certain limitations. The sample size was relatively small, consisting of only 60 patients, which may limit the generalizability of the findings. The follow-up period was limited to six months and therefore long-term clinical outcomes could not be assessed. Since the study was conducted at a single center, the results may not represent the wider population. Randomization was not performed as this was a prospective observational study. In addition, radiological progression of osteoarthritis was not evaluated during follow-up, and factors such as patient lifestyle, physical activity, and compliance with physiotherapy may have influenced the treatment outcomes.

#### CONCLUSION

The present study demonstrated that intra-articular Platelet-Rich Plasma (PRP) injection provided superior pain relief and functional improvement compared to Hyaluronic Acid and Corticosteroid injections in patients with moderate knee osteoarthritis over a six-month follow-up period. Patients treated with PRP showed greater reduction in VAS scores and significant improvement in WOMAC scores, indicating better symptomatic relief and functional recovery. Hyaluronic Acid injections also produced favorable outcomes and were found to be more effective than Corticosteroid injections. Corticosteroid injections provided mainly short-term symptomatic relief with comparatively lesser sustained benefit. Based on the findings of the present study, PRP may be considered a more effective treatment option for moderate knee osteoarthritis. Further large-scale randomized controlled studies with longer follow-up are recommended to confirm these results.

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