



## Intra-Articular Platelet Rich Plasma Vs Hyaluronic Acid in Treatment of Osteoarthritis of Knee a Comparative Study.

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(Received: 16 March 2025

Revised: 20 April 2025

Accepted: 15 June 2025)

<p><b>KEYWORDS</b></p> <p>Osteoarthritis; Knee; Platelet-rich plasma; Hyaluronic acid; Intra-articular injection; Visual Analog Scale; WOMAC; Regenerative medicine; Viscosupplementation; Biologic therapy</p>	<p><b>ABSTRACT:</b></p> <p><b>Introduction:</b> Osteoarthritis (OA) of the knee is a prevalent degenerative joint disease characterized by progressive cartilage deterioration, pain, and functional limitation. Intra-articular injections of biologic agents have emerged as potential disease-modifying interventions for knee OA. This study aimed to compare the efficacy and safety of intra-articular platelet-rich plasma (PRP) versus hyaluronic acid (HA) in the treatment of mild to moderate knee OA.</p> <p><b>Methods:</b> In this prospective comparative study, 70 patients with Kellgren-Lawrence grade 1-2 knee OA were randomly allocated to receive either PRP (n=35) or HA (n=35) intra-articular injections. Patients were evaluated at baseline, 3 months, and 6 months post-injection using the Visual Analog Scale (VAS) for pain and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for functional assessment. Complications and adverse events were recorded throughout the follow-up period.</p> <p><b>Results:</b> Demographic characteristics were comparable between groups. At 3 months, the HA group showed significantly better pain reduction (VAS: 3.12±0.48 vs 4.65±0.68; p&lt;0.001) and functional improvement (WOMAC: 31.7±4.3 vs 47.2±5.4; p&lt;0.001) compared to the PRP group. However, at 6 months, the pattern reversed, with the PRP group demonstrating superior pain relief (VAS: 2.08±0.45 vs 3.14±0.51; p&lt;0.001) and functional outcomes (WOMAC: 22.11±3.2 vs 32.4±4.6; p&lt;0.001). The PRP group exhibited a better safety profile with no cases of infection or synovitis, compared to the HA group which reported infection (5.7%) and synovitis (11.4%).</p> <p><b>Conclusion:</b> Intra-articular PRP and HA demonstrate a distinct temporal efficacy pattern in knee OA management, with HA providing superior short-term benefits at 3 months and PRP showing significantly better long-term outcomes at 6 months. PRP also exhibited a more favorable safety profile. These findings suggest that PRP may be the preferred option for long-term management of mild to moderate knee OA, particularly in patients seeking sustained symptom relief and functional improvement.</p>
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### INTRODUCTION

Osteoarthritis (OA) of the knee is a prevalent degenerative joint disease characterized by progressive cartilage deterioration, pain, and functional limitation. Intra-articular injections of biologic agents have emerged as potential disease-modifying interventions for knee OA. This study aimed to compare the efficacy and safety of intra-articular platelet-rich plasma (PRP) versus hyaluronic acid (HA) in the treatment of mild to moderate knee OA<sup>1</sup>

### 1AIMS AND OBJECTIVES

#### Objectives:

- To research the use of platelet-rich plasma and intra-articular hyaluronic acid in the treatment of osteoarthritis in the knee.
- To assess PRP's effectiveness and safety in treating mild to moderately symptomatic knee osteoarthritis compared to hyaluronic acid.
- Research side effects of intra-articular injections used to treat osteoarthritis



## MATERIALS AND METHOD

In this prospective comparative study, 70 patients with Kellgren-Lawrence grade 1-2 knee OA were randomly allocated to receive either PRP (n=35) or HA (n=35) intra-articular injections. Patients were evaluated at baseline, 3 months, and 6 months post-injection using the Visual Analog Scale (VAS) for pain and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for functional assessment. Complications and adverse events were recorded throughout the follow-up period.

## METHODOLOGY:

The study was conducted at the Department of Orthopedics OPD in BLDE (Deemed to be University) Shri B.M.Patil Medical College, Hospital and Research Centre, Vijayapura. Patients with knee osteoarthritis were diagnosed through comprehensive clinical examination, detailed history taking, and radiological examination using X-rays. Prior to the interventions, all patients underwent standard pre-procedure investigations including complete blood count, random blood sugar testing, screening for HIV, HBsAg, and HCV, and knee X-rays. Additional specific investigations were conducted as needed based on individual patient requirements. For the PRP preparation, approximately 50 ml of patient blood was drawn into a 60-ml syringe pre-filled with 5 ml of sodium citrate. The collected blood was centrifuged using a desk-top centrifuge at 3,000 rotations per minute for 15 minutes. Following centrifugation, the platelet-poor plasma and platelet-rich plasma were isolated. The platelet-poor plasma was discarded, and the platelet-rich plasma underwent an additional agitation step. The final PRP concentrate achieved a platelet concentration approximately 6-8 times higher than baseline whole blood. The entire process from blood collection to injection took approximately 30-35 minutes.

For the hyaluronic acid group, a prefilled 2ml syringe containing 20mg of hyaluronic acid with a weight-average molecular weight of 0.6-1.5 Million Daltons was used. The injection procedure was performed in a sterile outpatient setting. With the knee flexed at 30 degrees, injections were administered using a 22-gauge needle via the lateral suprapatellar approach. The PRP group received 5cc of platelet concentrate, while the hyaluronic acid group received 2cc of prefilled hyaluronic acid. The intraosseous puncture site was positioned 1 cm above the lateral tibial plateau and 1 cm lateral to the patellar tendon, with the needle directed toward the medial joint line of the knee. Both groups received injections at baseline, 1 month, and 2 months post-procedure. Post-procedure management included analgesics and anti-inflammatory medications as needed, along with cold compression therapy applied to the knee for approximately 3 minutes. Patients were followed up clinically at 3 months and 6 months intervals. Treatment outcomes were assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score and Visual Analogue Scale (VAS).

## STATISTICAL ANALYSIS:

Data entered in Microsoft excel sheet and analysed by using paired T-test and chi square test.

## RESULT:

The present study was conducted in the department of Orthopedics at Shri B.M.Patil's Medical College, Hospital and Research Centre, Vijayapura from March 2023 to March 2025 to intra-articular platelet rich plasma vs hyaluronic acid in treatment of osteoarthritis of knee.

Total of 70 patients with 35 in each group.

- **Hyaluronic acid** :35 patients
- **Platelet rich plasma** :35 patients

**Table 1: Comparison of age among groups**

Age (in years)	Groups		p-value
	HA	PRP	
41-50	12 (34.3%)	12 (34.3%)	0.68
51-60	9 (25.7%)	9 (25.7%)	
61-70	8 (22.9%)	11 (31.4%)	
71-80	6 (17.1%)	3 (8.6%)	
<b>Total</b>	<b>35 (100%)</b>	<b>35 (100%)</b>	

Table 1 and graph1 shows the age distribution between the HA and PRP treatment groups. Both groups had

identical percentages of patients in the 41-50 age range (34.3%) and 51-60 age range (25.7%). The PRP group



had a slightly higher percentage of patients in the 61-70 age range (31.4% vs 22.9%), while the HA group had more patients in the 71-80 age range (17.1% vs 8.6%). With a p-value of 0.68, there was no statistically significant difference in age distribution between the two treatment groups, indicating they were well-matched by age.

Graph 1: Comparison of age among groups

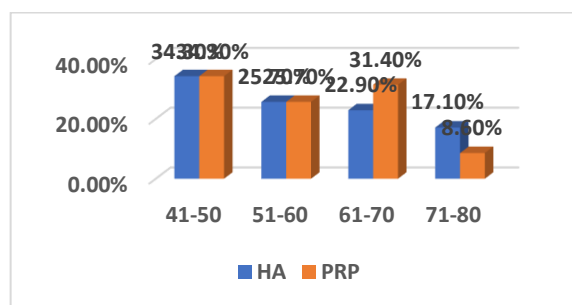


Table 2: Comparison of gender among groups

Gender	Groups		p-value
	HA	PRP	
Female	16 (45.7%)	9 (25.7%)	0.08
Male	19 (54.3%)	26 (74.3%)	
Total	35 (100%)	35 (100%)	

Table 2 and graph 2 presents the gender distribution among the treatment groups. The HA group had a more balanced gender distribution with 45.7% female and 54.3% male patients, while the PRP group had a higher proportion of male patients (74.3%) compared to female patients (25.7%). However, with a p-value of 0.08, this difference was not statistically significant, though it approached the significance threshold of 0.05.

Graph 2: Comparison of gender among groups

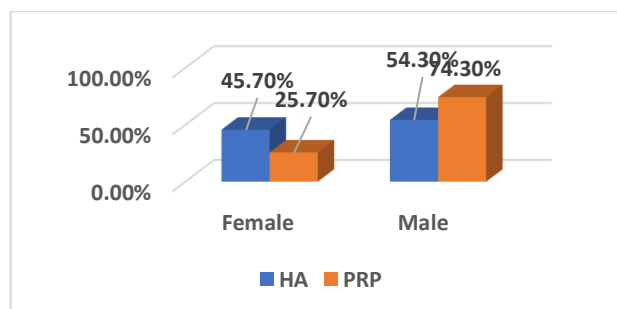


Table 3: Comparison of BMI among groups

BMI	Groups		p-value
	HA	PRP	
18.5-24.9	5 (14.3%)	6 (17.1%)	0.94
25-29.9	18 (51.4%)	17 (48.6%)	
>30	12 (34.3%)	12 (34.3%)	
Total	35 (100%)	35 (100%)	

Table 3 and graph 3 compares the Body Mass Index (BMI) distribution between the two groups. Both groups showed similar BMI distributions, with the majority of patients falling in the overweight category (25-29.9 BMI): 51.4% in the HA group and 48.6% in the PRP group. Both groups had identical percentages (34.3%) of obese patients (BMI >30). The p-value of 0.94 indicates that the BMI distribution was very similar between the two groups with no statistically significant difference.

Graph 3: Comparison of BMI among groups

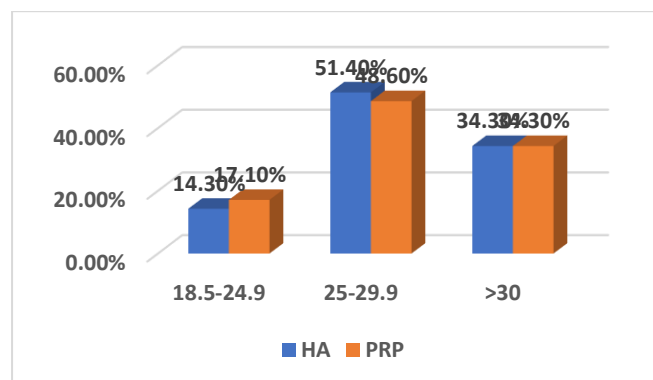


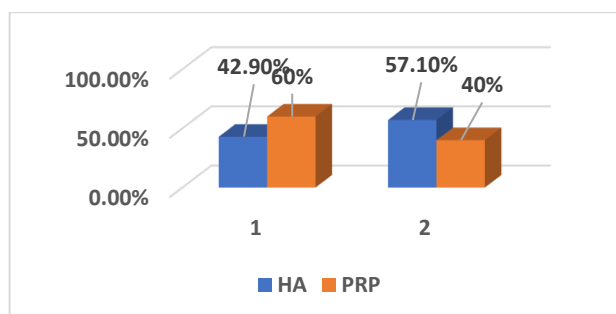
Table 4: Comparison of Kellgren Lawrence grade among groups

Kellgren Lawrence grade	Groups		p-value
	HA	PRP	
1	15 (42.9%)	21 (60%)	0.15
2	20 (57.1%)	14 (40%)	
Total	35 (100%)	35 (100%)	

Table 4 and graph 4 illustrates the distribution of Kellgren Lawrence grades, which measure the severity of knee osteoarthritis. The PRP group had more patients with grade 1 (milder) osteoarthritis (60%) compared to the HA group (42.9%), while the HA group had more patients with grade 2 osteoarthritis (57.1%) compared to the PRP group (40%). However, with a p-value of 0.15, this difference was not statistically significant.



**Graph 4: Comparison of Kellgren Lawrence grade among groups**

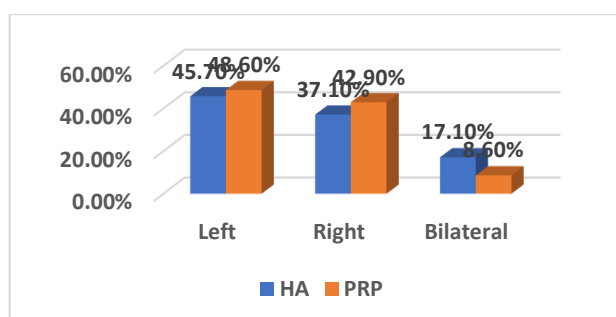


**Table 5: Comparison of affected knee among groups**

Affected knee	Groups		p-value
	HA	PRP	
Left	16 (45.7%)	17 (48.6%)	0.55
Right	13 (37.1%)	15 (42.9%)	
Bilateral	6 (17.1%)	3 (8.6%)	
Total	35 (100%)	35 (100%)	

Table 5 and graph 5 shows the distribution of affected knees between the treatment groups. Both groups had similar distributions of left knee involvement (45.7% in HA vs 48.6% in PRP) and right knee involvement (37.1% in HA vs 42.9% in PRP). The HA group had a higher percentage of bilateral knee involvement (17.1%) compared to the PRP group (8.6%). With a p-value of 0.55, there was no statistically significant difference in the distribution of affected knees between the two groups.

**Graph 5: Comparison of affected knee among groups**



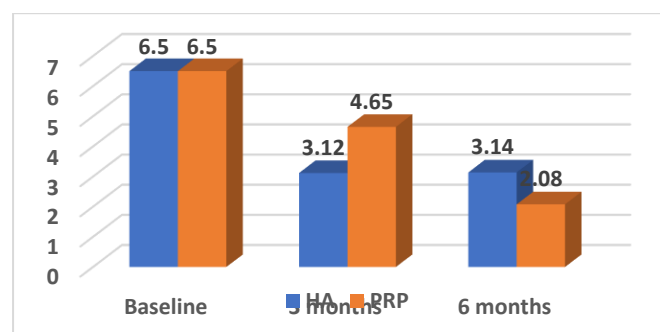
**Table 6: Comparison of VAS at different intervals among groups**

VAS (mean±SD)	Groups		p-value
	HA	PRP	
Baseline	6.5±0.81	6.5±0.8	0.84

3 months	3.12±0.48	4.65±0.68	<0.001
6 months	3.14±0.51	2.08±0.45	<0.001

Table 6 and graph 6 compares the Visual Analog Scale (VAS) pain scores between the groups at different time points. Both groups started with identical baseline pain scores (6.5±0.81 for HA and 6.5±0.8 for PRP). At 3 months, the HA group showed significantly better pain relief with a lower VAS score (3.12±0.48) compared to the PRP group (4.65±0.68). However, at 6 months, the PRP group demonstrated significantly better pain control (2.08±0.45) compared to the HA group (3.14±0.51). Both the 3-month and 6-month differences were statistically significant (p<0.001).

**Graph 6: Comparison of VAS at different intervals among groups**



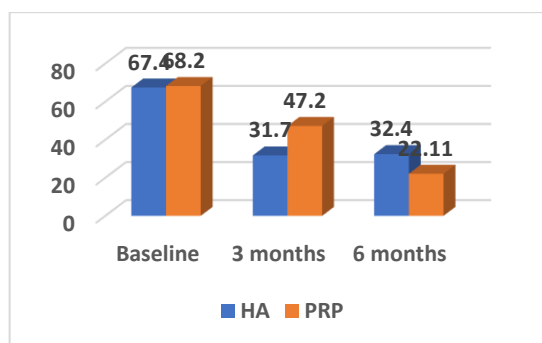
**Table 7: Comparison of WOMAC scores at different intervals among groups**

WOMAC scores (mean±SD)	Groups		p-value
	HA	PRP	
Baseline	67.4±6.4	68.2±6.4	0.55
3 months	31.7±4.3	47.2±5.4	<0.001
6 months	32.4±4.6	22.11±3.2	<0.001

Table 7 and graph 7 compares the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores between the groups. Both groups had similar baseline WOMAC scores (67.4±6.4 for HA and 68.2±6.4 for PRP). At 3 months, the HA group showed significantly better improvement with a lower WOMAC score (31.7±4.3) compared to the PRP group (47.2±5.4). However, at 6 months, the PRP group demonstrated significantly better results (22.11±3.2) compared to the HA group (32.4±4.6). Both the 3-month and 6-month differences were statistically significant (p<0.001).



**Graph 7: Comparison of WOMAC scores at different intervals among groups**

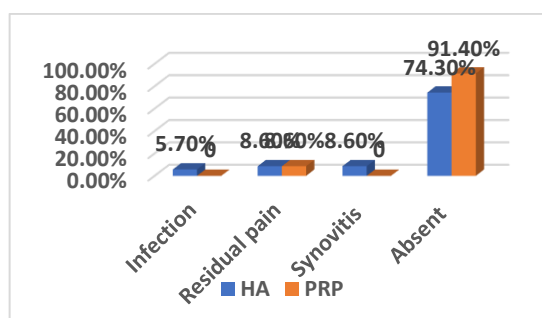


**Table 8: Comparison of complications among groups**

Complications	Groups		p-value
	HA	PRP	
Infection	2 (5.7%)	0	0.13
Residual pain	3 (8.6%)	3 (8.6%)	
Synovitis	3 (8.6%)	0	
Absent	26 (74.3%)	32 (91.4%)	
<b>Total</b>	<b>35 (100%)</b>	<b>35 (100%)</b>	

Table 8 and graph 8 compares complications between the treatment groups. The HA group experienced more complications overall with infection in 5.7% of patients, residual pain in 8.6%, and synovitis in 8.6%, while the PRP group only reported residual pain in 8.6% of patients with no cases of infection or synovitis. Overall, 91.4% of patients in the PRP group had no complications compared to 74.3% in the HA group. However, with a p-value of 0.13, this difference did not reach statistical significance.

**Graph 8: Comparison of complications among groups**



**DISCUSSION:**

**Demographic and Baseline Characteristics**

Our study included 70 patients with knee OA, equally distributed between the HA and PRP groups (35 patients each). The demographic characteristics of both groups were comparable in terms of age distribution, with the majority of patients (34.3% in both groups) in the 41-50 years age bracket. There was a slightly higher proportion of male patients in the PRP group (74.3%) compared to the HA group (54.3%), though this difference did not reach statistical significance (p=0.08). The BMI distribution was remarkably similar between groups, with approximately half of the patients in both groups being overweight (BMI 25-29.9) and about one-third being obese (BMI >30), reflecting the recognized association between elevated BMI and knee OA.<sup>3</sup>

These demographic findings are comparable to those reported by Raeissadat et al<sup>2</sup>, who conducted a similar comparative study between PRP and HA, with a mean participant age of 56.85 ± 9.13 years in the PRP group and 61.10 ± 7.57 years in the HA group. Similarly, Montañez-Heredia et al.<sup>4</sup> reported a mean age of 66.3 ± 8.2 years for their study population comparing PRP and HA, with a slightly higher proportion of female participants (67% overall), contrasting with our predominance of male patients, particularly in the PRP group.

The Kellgren-Lawrence (KL) radiographic grading revealed that 60% of patients in the PRP group had grade 1 OA, compared to 42.9% in the HA group, while 40% in the PRP group had grade 2 OA versus 57.1% in the HA group. Although this suggests a slightly higher proportion of grade 2 OA in the HA group, the difference was not statistically significant (p=0.15). This distribution is important when interpreting clinical outcomes, as previous studies have suggested that response to intra-articular injections may vary based on OA severity.<sup>5,6</sup>

The distribution of affected knees (left, right, or bilateral) was also comparable between groups (p=0.55), with unilateral involvement being predominant in both groups. Notably, the HA group had a slightly higher proportion of bilateral knee involvement (17.1%) compared to the PRP group (8.6%), which could potentially influence patient-reported outcomes.

**Clinical Outcomes**

**Pain Assessment (VAS)**

Pain reduction, as measured by the Visual Analog Scale (VAS), demonstrated an interesting



temporal pattern in our study. At baseline, both groups had comparable mean VAS scores ( $6.5 \pm 0.81$  for HA and  $6.5 \pm 0.8$  for PRP;  $p=0.84$ ), indicating moderate to severe pain levels. At the 3-month follow-up, the HA group showed significantly better pain reduction ( $3.12 \pm 0.48$ ) compared to the PRP group ( $4.65 \pm 0.68$ ;  $p < 0.001$ ). However, this pattern reversed dramatically at the 6-month follow-up, with the PRP group demonstrating superior pain relief ( $2.08 \pm 0.45$ ) compared to the HA group ( $3.14 \pm 0.51$ ;  $p < 0.001$ ).

This temporal evolution of comparative efficacy between PRP and HA aligns with findings from several previous studies. Görmeli et al.<sup>7</sup> conducted a randomized controlled trial comparing single and triple PRP injections with HA in 162 patients with knee OA and found that while both interventions provided significant pain relief, PRP showed superior and more sustained improvements, particularly for early-stage OA. Similarly, Cole et al.<sup>8</sup> in their randomized trial of 111 patients with knee OA reported that while both PRP and HA treatments resulted in significant clinical improvements, the PRP group maintained significantly better outcomes at 24 and 52 weeks.

The initial superiority of HA at 3 months followed by better outcomes with PRP at 6 months in our study suggests different mechanisms of action and durability for these two interventions. HA primarily provides viscosupplementation and acts as a lubricant, potentially offering more immediate symptomatic relief. In contrast, PRP contains numerous growth factors and bioactive proteins that may stimulate cartilage matrix synthesis, modulate inflammation, and promote tissue regeneration, potentially explaining its superior long-term efficacy.<sup>9</sup> This mechanism aligns with the systematic review and meta-analysis by Tang JZ et al.<sup>10</sup>, which concluded that PRP injections provided better pain relief than HA at 6 and 12 months post-injection.

### Functional Assessment (WOMAC)

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores in our study followed a pattern similar to the VAS scores. Baseline WOMAC scores were comparable between groups ( $67.4 \pm 6.4$  for HA and  $68.2 \pm 6.4$  for PRP;  $p=0.55$ ). At 3 months, the HA group demonstrated significantly better functional improvement ( $31.7 \pm 4.3$ ) compared to the PRP group ( $47.2 \pm 5.4$ ;  $p < 0.001$ ). However, by 6 months, the PRP group showed markedly superior functional outcomes ( $22.11 \pm 3.2$ ) compared to the HA group ( $32.4 \pm 4.6$ ;  $p < 0.001$ ).

This temporal evolution of functional outcomes mirrors the findings of several previous investigations.

Lana et al.<sup>11</sup> conducted a randomized clinical trial comparing HA, PRP, and combined therapy in 105 patients with knee OA and reported that while all interventions improved WOMAC scores, PRP and combined therapy resulted in better maintenance of functional improvements at 1-year follow-up. Di Martino et al.<sup>12</sup> in their randomized controlled trial with 192 patients reported that both PRP and HA significantly improved WOMAC scores, with PRP showing a trend toward better results, particularly in patients with early OA.

The reversal pattern observed in our study, with HA showing better early outcomes and PRP demonstrating superior longer-term results, may reflect the different biological mechanisms of these interventions. HA potentially provides immediate improvement through enhanced joint lubrication and anti-inflammatory effects, while PRP's regenerative and anti-inflammatory properties may take longer to manifest but provide more sustainable benefits.<sup>13</sup> This temporal pattern is particularly important in clinical decision-making, as the choice between PRP and HA might depend on whether the primary goal is short-term or longer-term symptom management.

### Complications and Safety Profile

The safety profiles of PRP and HA in our study revealed some notable differences. The PRP group demonstrated a superior safety profile with 91.4% of patients experiencing no complications, compared to 74.3% in the HA group. Specifically, the HA group reported complications including infection (5.7%), residual pain (8.6%), and synovitis (11.4%), while the PRP group only reported residual pain (8.6%). Although the overall difference in complication rates did not reach statistical significance ( $p=0.09$ ), the absence of infection and synovitis in the PRP group is clinically relevant.

The higher incidence of synovitis in the HA group (11.4%) compared to none in the PRP group is particularly noteworthy and consistent with previous literature. Patel et al.<sup>15</sup> reported transient pain and swelling after HA injections, attributing this to a possible inflammatory response to exogenous hyaluronic acid. Similarly, Sundman et al.<sup>14</sup> demonstrated in an in vitro study that PRP had anti-inflammatory effects through suppression of inflammatory mediators, potentially explaining the lower incidence of post-injection synovitis.

The absence of infections in the PRP group despite its more complex preparation process is reassuring and consistent with previous safety assessments. Riboh et al.<sup>16</sup> in their meta-analysis of



randomized controlled trials found no significant increase in adverse events with PRP compared to placebo or HA, while Filardo et al.<sup>17</sup> reported only minor and transient adverse events associated with PRP injections, primarily post-injection pain.

The safety advantage of PRP may be attributed to its autologous nature, reducing the risk of immune-mediated reactions, and to the presence of antimicrobial peptides like platelet factor 4, RANTES, and connective tissue-activating peptide 3, which have been shown to have bactericidal and bacteriostatic properties.<sup>14</sup> This safety profile, combined with its superior long-term efficacy, supports the use of PRP as a favourable option for knee OA management.

### Interpretation in Context of Disease Severity

The distribution of OA severity in our study population, as measured by the Kellgren-Lawrence (KL) grading system, showed a slightly higher proportion of grade 1 (mild) OA in the PRP group (60% vs 42.9% in HA group) and grade 2 (moderate) OA in the HA group (57.1% vs 40% in PRP group). This difference, although not statistically significant ( $p=0.15$ ), could potentially influence treatment outcomes, as previous research has suggested differential responses to biologics based on OA severity.

Campbell et al.<sup>18</sup> in their systematic review found that patients with early to moderate OA (KL grade 1-2) typically respond better to PRP than those with advanced disease. Similarly, Kon et al.<sup>87</sup> reported that the efficacy of PRP decreased with increasing severity of degenerative changes. Our finding of superior long-term outcomes with PRP despite the balanced distribution of OA severity suggests that PRP's benefits may be applicable across the spectrum of mild to moderate knee OA.

The efficacy of HA has also been shown to vary with OA severity. Bowman et al.<sup>19</sup> reported that HA provided significant pain relief in mild to moderate OA but showed limited efficacy in severe cases. The initial superiority of HA at 3 months in our study, particularly for functional outcomes, may suggest that HA provides valuable short-term benefits irrespective of OA severity within the mild to moderate range.

### Pathophysiological Considerations

The differential temporal efficacy pattern observed in our study may be explained by the distinct mechanisms of action of PRP and HA in the context of OA pathophysiology. Knee OA involves cartilage degradation, subchondral bone alterations, synovial inflammation, and impaired joint homeostasis. HA, as a

principal component of synovial fluid, primarily functions through mechanical effects (shock absorption, lubrication) and biological effects (anti-inflammatory, chondroprotective) that may provide immediate symptomatic relief.<sup>11</sup>

In contrast, PRP contains a concentrated cocktail of growth factors including platelet-derived growth factor (PDGF), transforming growth factor- $\beta$  (TGF- $\beta$ ), insulin-like growth factor-1 (IGF-1), vascular endothelial growth factor (VEGF), and fibroblast growth factor (FGF). These factors have been shown to stimulate chondrocyte proliferation, enhance cartilage matrix synthesis, reduce matrix degradation, and modulate inflammation through multiple signaling pathways.<sup>12</sup> The activation of these regenerative pathways may take longer to manifest clinically, potentially explaining the superior long-term outcomes observed with PRP in our study.

Importantly, PRP's anti-inflammatory effects may extend beyond symptomatic relief to potentially address underlying pathophysiological processes. Osterman et al.<sup>20</sup> demonstrated that PRP reduces expression of inflammatory cytokines like TNF- $\alpha$ , IL-1 $\beta$ , and catabolic enzymes such as matrix metalloproteinases (MMPs) in synovial fibroblasts. This anti-inflammatory action may explain the lower incidence of synovitis in our PRP group compared to the HA group.

### Clinical Implications and Future Directions

The findings of our study have several important clinical implications. First, the temporal evolution of efficacy suggests that the choice between PRP and HA should consider the desired duration of effect and patient-specific factors. For patients requiring immediate symptom relief, HA may be preferable, while PRP may be more appropriate for those seeking longer-term benefits.

Second, the superior safety profile of PRP, particularly the absence of synovitis and infection, supports its use in clinical practice, especially for patients with a history of adverse reactions to previous intra-articular therapies or those at higher risk of infection.

Third, although our study demonstrated superior long-term outcomes with PRP, the optimal preparation protocol, injection frequency, and patient selection criteria remain to be standardized. The heterogeneity in PRP preparation methods, including variations in platelet concentration, activation status, and leukocyte content, may influence clinical outcomes and should be considered in future investigations.<sup>14</sup>



Looking ahead, several aspects warrant further exploration. Larger multicenter trials with longer follow-up periods are needed to confirm the durability of PRP benefits beyond 6 months. Studies investigating the combination of PRP with other therapeutic modalities, such as HA, corticosteroids, or physical therapy, could potentially optimize treatment outcomes. Additionally, advanced imaging and biochemical marker studies may help elucidate the structural and molecular effects of PRP on cartilage and synovium, providing insights into its disease-modifying potential.

### Strengths and Limitations

Our study has several strengths, including the prospective design, equal distribution of patients between groups, comprehensive assessment of pain and function using validated tools (VAS and WOMAC), and detailed documentation of complications. The inclusion of patients with mild to moderate OA (KL grade 1-2) allows our findings to be applicable to the population most likely to benefit from intra-articular therapies.

However, certain limitations should be acknowledged. The follow-up period of 6 months may not be sufficient to assess the long-term durability of treatment effects. The absence of a placebo control group limits our ability to account for the natural history of the disease and placebo effect. Additionally, the lack of advanced imaging or biochemical marker assessments prevents direct evaluation of structural or molecular changes in cartilage and synovium. The single-center nature of our study and the relatively small sample size may limit generalizability, although our findings are consistent with larger multicenter investigations.

### CONCLUSION:

In conclusion, our comparative study of intra-articular PRP versus HA in patients with mild to moderate knee OA demonstrates a distinct temporal efficacy pattern, with HA providing superior short-term improvements in pain and function at 3 months, while PRP shows significantly better outcomes at 6 months. PRP also demonstrated a more favorable safety profile, with no cases of infection or synovitis compared to HA. These findings suggest that PRP may be the preferred option for long-term management of knee OA, particularly in patients seeking sustained symptom relief and functional improvement. Further research with larger sample sizes, longer follow-up periods, and assessment of structural changes is warranted to fully elucidate the disease-modifying potential of these biological interventions.

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