



Outcomes of Osteoarthritis Knee: A Comparative Study of PRP and Hyaluronic Acid at a Tertiary Level Hospital in Bangladesh

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Abstract: *Background:* Osteoarthritis (OA) of the knee is common and can affect a patient's ability to move and perform daily tasks. There is hope for managing knee OA with minimally invasive treatments such as hyaluronic acid (HA) injections and platelet-rich plasma (PRP). Patients with mild to moderate knee OA were enrolled in this study at a tertiary-level hospital in Bangladesh to compare the effects of intra-articular PRP and HA injections. *Methods:* Forty patients participated in this clinical research; twenty got HA injections, and twenty got PRP injections. The Rajshahi Medical College Hospital's Department of Physical Medicine & Rehabilitation accepted patients from January 2022 to December 2022. A visual analog scale (VAS) and the Knee Injury and Osteoarthritis Outcome Score were utilized in clinical examinations before injection and three to six months and twelve months following injection (KOOS). The knee's range of motion and crepitation were assessed at every checkup. Post-test results were compared to pre-test results. *Results:* After comparing platelet-rich plasma (PRP) injections with hyaluronic acid (HA) injections for knee osteoarthritis, PRP was the safer and more practical choice. Over a 12-month follow-up period with indicated PRP injections, PRP showed sustained benefits in patient-reported outcomes, such as pain reduction and increased daily function. The PRP group showed considerable improvements in pain levels and quality of life, as evidenced by raised ratings across KOOS subscales and reduced Visual Analog Scale (VAS) scores. Additionally, the PRP group outperformed the HA group in terms of crepitation improvement; at the first follow-up, 80% of PRP patients had gone from coarse to fine crepitation, while only 40% of HA recipients had done so. *Conclusion:* Patients with knee OA benefit from intra-articular PRP and HA injections. Compared to HA, PRP therapy improved most outcome indicators better and longer. PRP injections may be a better knee OA treatment in this patient cohort.

Keywords: Hyaluronic acid, Intra-articular injections, Knee osteoarthritis, Platelet-rich plasma.

Article at a glance:

Study Purpose: To compare PRP and HA injections for knee OA in a Bangladeshi hospital.

Key findings: PRP showed sustained pain reduction and improved function over 12 months. PRP also reduced crepitation better than HA.

Newer findings: PRP may be a superior and longer-lasting treatment option for knee OA compared to HA injections.

Abbreviations: PRP - Platelet-Rich Plasma; HA - Hyaluronic Acid; OA - Osteoarthritis; VAS - Visual Analog Scale.

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INTRODUCTION

Inflammation, changes in subchondral bone structure, deterioration of articular cartilage,

and injury to soft tissues characterize osteoarthritis (OA), a degenerative joint disease that persists over time.¹ When it affects joints that bear weight, it can

be very painful and even crippling. Estimates put the prevalence of knee OA in Iran at 15.5%, which is higher than any other condition in the Bangladeshi population.² Current OA treatments focus on relieving pain, reducing symptoms, and slowing joint degeneration since there is no definitive cure. Platelet-rich plasma (PRP) therapy is an emerging approach promising in halting OA progression.³ PRP is a concentrated plasma extracted from the patient's blood, which stands for platelet-derived growth factor, transforming growth factor-beta (TGF- β), insulin-like growth factor-1 (IGF-1), and other regeneration factors. Regenerative medicine using platelet-rich plasma (PRP) has shown promise in treating various orthopedic and soft-tissue injuries and wounds.⁴

In contrast to surgical procedures like arthroplasty and lavage, PRP injections are minimally invasive, akin to hyaluronic acid (HA) injections. However, their efficacy is still under investigation. HA is a vital extracellular matrix component, serving as a lubricant in synovial joints and supporting tissue regeneration and anti-inflammatory processes.⁵ Intra-articular HA injections received FDA approval for knee OA, initially showing promise in clinical trials by improving knee pain and function.⁶ However, HA-based products are now primarily recognized as symptom-modifying rather than structure-modifying, providing temporary viscosupplementation without significant long-term benefits for damaged cartilage.⁷ A trial was conducted on patients with mild to moderate knee OA to compare PRP's effectiveness with HA. Enriched with regenerative factors, PRP has demonstrated potential in halting OA progression.⁸ The research aimed to determine whether PRP is more effective than HA in alleviating knee OA symptoms and improving patients' quality of life.

MATERIALS AND METHODS

Patients were identified as having primary knee osteoarthritis (OA) according to the ACR criteria in this clinical trial study at the Department of Physical Medicine & Rehabilitation, Rajshahi Medical College Hospital, Bangladesh. Participants had to be between 45 and 75 and have mild (grade 2) or moderate (grade 3) knee OA per the Kellgren and Lawrence grading system to be considered for trial.⁹ Some of the conditions that were not allowed

to participate in the study were inflammatory arthritis, major psychological disorders, connective tissue disorders, concurrent endocrine disorders, secondary OA, major psychological disorders, and any chronic debilitating disease that needed constant treatment (such as cancer), a history of allergy to biologic products, intra-articular injections or any treatment in the six months prior to the intervention, and the need for anti-thrombotic medication treatment. The patients were randomly assigned to get either hyaluronic acid (HA) injections or intra-articular platelet-rich plasma (PRP). Importantly, unlike other studies, this one did not use blinding to conceal the therapy type from the patients.

Treatments and follow-ups

Two milliliters of either hyaluronic acid (HA) or autologous platelet-rich plasma (PRP) were injected intra-articularly into the trial participants (Hyalgan). Local skin asepsis and antisepsis were ensured before the injections were delivered. It was necessary to passively move the joint after injection to disperse the fluid uniformly. Sixty milliliters of peripheral venous blood were drawn into a blood bag that already included nine milliliters of clinical-grade citrate phosphate dextrose buffer in order to make the PRP. Afterward, a sterile room was used to move the blood bag. After that, the blood was centrifuged twice: once at 2000 g for 2 minutes and again at 4000 g for 8 minutes. After each centrifugation step, two milliliters of PRP were obtained by removing the supernatant plasma. With a platelet concentration four to five times greater than the initial blood count, the resultant PRP concentrate had at least one million platelets per microliter.

Patients underwent many evaluations at the baseline visit before injection and at 1, 3, 6, and 12 months post-injection. Patients were free to continue taking their rheumatologist-prescribed non-steroidal anti-inflammatory medication (NSAIDs) dosages as usual throughout the 12-month follow-up period. Still, they weren't to inject themselves with dexamethasone, HA, or PRP or take any corticosteroids. Intense physical loading, severe sports, kneeling, and lifting were also off-limits to them. The final analysis did not include patients who did not follow these post-intervention care guidelines.

Outcomes measures

As part of each appointment, participants filled out a standardized questionnaire focused on knee-related issues; this particular version of the KOOS was translated into Persian. A visual analog scale was also utilized to assess their subjective pain levels. Symptoms, Pain, ADL Function, Sport and Recreation Function, and Quality of Life comprise the KOOS questionnaire (QOL). There is a scale from 0 (no problems) to 100 (severe problems) for each subscale.¹⁰

At each appointment, the rheumatologist checked the patients' knees for swelling, crepitation, and damage to the major ligaments that support the knee, including the ACL, PCL, and MLS. They also measured the patients' ROM in both flexion and extension. Throughout the trial, we documented any adverse events or problems connected to the treatment. Both the baseline and follow-up responses were compared across the two therapy groups.

Statistical analyses

The data collected in this study were analyzed using SPSS software, version 23.0 (IBM). The normality of quantitative data was assessed using the Shapiro-Wilk test, which indicated that all quantitative variables had a normal distribution. These variables were reported using the mean and standard error of the mean (SEM). Qualitative variables were presented as frequency and percentage. A paired samples t-test was used to analyze the change in quantitative parameters between the two visits. A chi-squared test was employed to assess the frequency distribution between two visits for qualitative parameters. For between-group comparisons of quantitative parameters at each visit, the student t-test was used. On the other hand, the chi-squared test was utilized to evaluate the between-group difference of qualitative parameters at each visit. Statistical significance was set at p-values less than 0.05. Any results with p-values below this threshold were considered to be statistically significant.

Ethical Consideration

The study adhered to the norms and principles stated in the Declaration of Helsinki, which provides ethical standards for medical

research that involves human beings. Appropriate ethics committee permission was obtained for the study. All individuals took part in the study voluntarily after receiving thorough information about its goals, methods, risks, benefits, and how to give their informed consent. The participants' privacy, anonymity, and confidentiality were guaranteed, and all personal information was handled securely. Concern for the participants' safety and comfort was paramount, and measures were taken to ensure their comfort and safety.

RESULTS

This clinical trial encompassed 40 patients, with 20 individuals receiving PRP injections and the other 20 receiving HA injections as part of the investigation. Out of these participants, 26 patients met the inclusion criteria and were analyzed further. The PRP group comprised 12 patients, while the HA group comprised 14 patients. However, two patients from the PRP group were excluded from the analysis due to non-compliance with post-intervention care, and four patients from the HA group were excluded from receiving intra-articular injections elsewhere after their inclusion in the study. After these exclusions, the final analyses involved 24 patients, with each group having 12 patients for comparison. The included patients' baseline characteristics were similar between the PRP and HA cohorts, as shown in Table.

Treatment outcomes

According to the research, neither the PRP nor the HA treatments were associated with any serious side effects or problems. Using the subscales of the Knee Injury and Osteoarthritis Outcome Score (KOOS), PRP therapy demonstrated statistically significant and sustained improvements in pain, symptoms, and ADLs at the 12-month follow-up compared to the baseline, indicating positive subjective results. Sport/Rec increases, on the other hand, were only statistically significant for the first three months, whereas QOL improvements became statistically significant beginning with the sixth-month visit. The third month following PRP therapy was when symptoms, discomfort, ADL, and sport/rec scores peaked, but quality of life (QOL) improved the most in the sixth month.

However, limited improvement in symptoms, discomfort, and Sport/Rec after HA injections was observed for just one month, whereas improvements in ADL were shown for three months. After receiving HA, there was no discernible improvement in quality of life. At every follow-up appointment following PRP therapy, the patient reported much less pain on the Visual Analog Scale (VAS), with the lowest discomfort observed at the 6-month visit. The opposite was true for HA therapy, which reduced discomfort for one month before gradually increasing it on future visits.

At the 6- and 12-month follow-ups, patients receiving PRP had considerably better KOOS scores in pain, ADL, and QOL than those

receiving HA. In addition, at the same intervals, patients who received PRP reported substantially less pain intensity (VAS). The "extent of change" of each KOOS parameter at each visit is shown in Table 2, along with the between-group differences. The amount to which the KOOS subscale scores improved in the PRP group was substantially more than in the HA group at most visits, particularly at the most recent two follow-up visits. On top of that, the PRP group had a far bigger improvement in pain reduction (VAS) than the HA group. The study suggests that PRP treatment produced more significant and sustained improvements in subjective outcomes than HA injections, making it a favorable option for knee injuries and osteoarthritis patients.

Table 1: Demographics and baseline clinical features of patients included in the study

Variable	PRP Group	Hyaluronate Group	P-value
Number of patients	20	20	-
Age, yr, mean \pm SEM	52.2 \pm 1.9	55.1 \pm 2.5	0.355
Female gender, n (%)	9 (45%)	10 (50%)	0.305
Osteoarthritis severity*, n (%)			
Grade 2	4 (20%)	5 (25%)	0.653
Grade 3	6 (30%)	5 (25%)	
On-admission knee pain severity,	6.4 \pm 0.5	5.4 \pm 0.5	0.255

Table 2: Comparison of outcome parameters based on the treatment groups

Variable	PRP Treatment	Hyaluronate Treatment	P-value
KOOS subscales			
1st mo.* - baseline	12.6 \pm 3.5	4 \pm 1.4	0.035
3rd mo. - baseline	13.7 \pm 5.2	2.8 \pm 3.7	0.016
6th mo. - baseline	10.7 \pm 3.3	1.2 \pm 3.2	0.046
12th mo. - baseline	7.9 \pm 3.3	(-) $4.5^* \pm 3.3$	0.015
1st mo. - baseline	16.4 \pm 3.6	11.8 \pm 5	0.465
Between-visit change in pain			
3rd mo. - baseline	19 \pm 4.2	6.2 \pm 3.2	0.026
6th mo. - baseline	15.6 \pm 4.6	(-) 3.3 ± 3.7	0.005
12th mo. - baseline	15.2 \pm 4.8	(-) 5.7 ± 4.9	0.007
1st mo. - baseline	19.4 \pm 2.2	13.1 \pm 4	0.182
Between-visit change in function			
3rd mo. - baseline	27.3 \pm 4	12.9 \pm 1.7	0.004
6th mo. - baseline	18.8 \pm 4.2	(-) 1.4 ± 4.5	0.004
12th mo. - baseline	17.8 \pm 4.4	(-) 4.8 ± 6.3	0.009
1st mo. - baseline	16.5 \pm 7.4	21 \pm 7.5	0.674
Between-visit change in sports/ recreation			
3rd mo. - baseline	18 \pm 7.4	11.8 \pm 6.7	0.542
6th mo. - baseline	14.5 \pm 6.8	(-) 1.5 ± 4.8	0.036
12th mo. - baseline	8 \pm 8	(-) 9.5 ± 4.9	0.049
1st mo. - baseline	8.8 \pm 4.7	5 \pm 6.5	0.641

Between-visit change in quality of life			
3rd mo. - baseline	12.6 ± 5.9	4.9 ± 3.2	0.266
6th mo. - baseline	16.5 ± 6	(-)4.4 ± 4.2	0.010
12th mo. - baseline	15.1 ± 6.3	(-)5 ± 4.2	0.017
Between-visit change in VAS			
3rd mo. - baseline	(-)2.4 ± 0.3	(-)0.4 ± 0.7	0.011
6th mo. - baseline	(-)2.5 ± 0.4	1.1 ± 0.8	0.001
12th mo. - baseline	(-)1.8 ± 0.7	1.5 ± 0.7	0.003

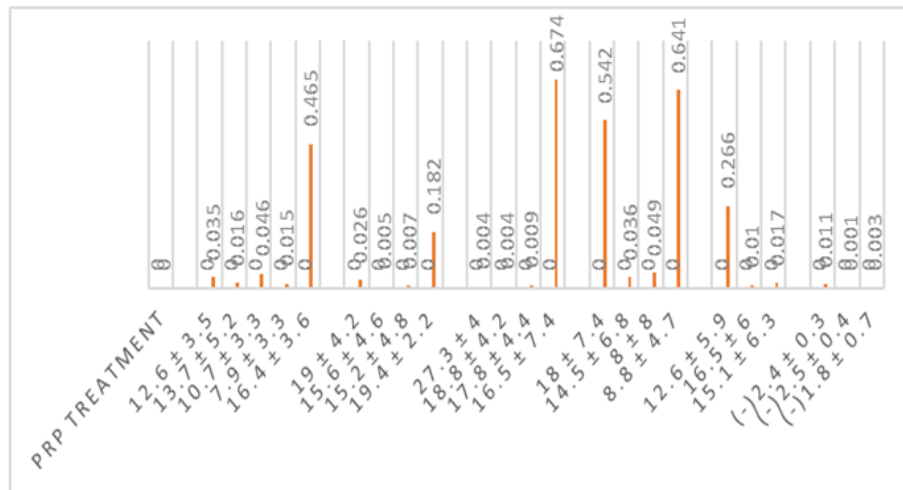


Figure 1: Difference between the two treatments for each specific parameter

Outcomes

Twenty participants were given PRP injections, and twenty were given HA injections as part of this study's 40 total participants. In order to determine which treatment was more effective in controlling osteoarthritis and knee injuries, the researchers looked at a number of subjective and objective outcomes. During the 12-month follow-up period, subjective outcomes showed that PRP therapy significantly and sustainably improved symptoms, pain, ADL, and QOL as judged by the Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales and the Visual Analog Scale (VAS) for pain intensity. Conversely, there was no discernible change in the quality of life (QOL), and only temporary relief from symptoms, pain, and limitations in sports and leisure activities was observed with HA injections. The PRP and HA groups' range of motion (ROM) was somewhat higher during physical assessments. However, this difference did not reach statistical significance. Crepitation, on the other hand, showed improvement; following the intervention, the majority of patients went from coarse to fine crepitation. Importantly, none of the patients in the research had a total disappearance of crepitation.

The absence of significant differences in effusion reduction between the two groups might be due to the small number of cases with mild effusion in the trial. However, both PRP and HA interventions effectively eliminated effusion. It is important to note that neither age nor OA severity significantly impacted the clinical response to either treatment, indicating that PRP and HA can be effective regardless of these factors. The study suggests that PRP treatment yields superior and sustained subjective outcomes compared to HA injections. Additionally, both interventions improve crepitation and effusion, highlighting their potential in managing knee injuries and osteoarthritis. The results provide valuable insights for clinicians and patients seeking effective treatment options for these conditions.

DISCUSSION

This study conducted a comprehensive evaluation to determine the safety and efficacy of platelet-rich plasma (PRP) therapy for knee osteoarthritis (OA) compared to hyaluronic acid (HA) injections. According to the research, results from both patient reports and physical evaluations of the knee showed that intra-articular PRP injections were more effective than HA injections.

Furthermore, the benefits of platelet-rich plasma (PRP) treatment lasted for a longer period; in fact, for the majority of study parameters, the differences between baseline and follow-up visits were statistically significant for as long as twelve months in the PRP group. In contrast, for HA recipients, significant differences were observed for only one month in most parameters and three months in two parameters. These findings highlight the potential of PRP therapy as a more durable treatment option for knee OA compared to HA injections, making minimally invasive and cost-effective treatments like PRP and HA more appealing alternatives to surgical interventions.

Notably, PRP therapy shows promise in potentially reversing cartilage degeneration based on previous studies.¹¹ However, questions remain regarding its efficacy and the duration of the clinical response. PRP products contain a high concentration of growth factors and bioactive proteins, which play crucial roles in activating and promoting the proliferation of local cells, particularly chondrocytes, in the affected joint. This leads to increased angiogenesis, enhanced extracellular matrix expression, and reduced osteoarthritic joint inflammation.¹² Recent research by Mousaei Ghasroldasht *et al.* showed that platelet-rich plasma (PRP) therapy enhances production of cartilage matrix by increasing the expression of genes such as insulin-like growth factor 1 (IGF-1) and bone morphogenetic protein 2 (BMP-2).¹³ In addition, synovial stem cells—which are more numerous in an osteoarthritic joint than in a healthy one—may be able to increase their regenerative capacity and chondrogenic differentiation with the help of growth factors derived from platelet-rich plasma. This may be useful in fixing cartilage damage.

On the other hand, while HA injections can effectively decrease friction and reduce articular inflammation, they have shown limitations in halting the progression of underlying degenerative processes in knee OA.¹⁴ Overall, this trial provides valuable insights into the safety and effectiveness of PRP therapy for knee OA, indicating its potential as a more durable and promising treatment option compared to HA injections. The findings also shed light on how PRP therapy may positively influence cartilage repair and regeneration, offering hope for

improved management of knee osteoarthritis. Thus, platelet-rich plasma (PRP) injection has demonstrated encouraging outcomes in promoting cartilage regeneration and postponing surgical procedures in patients with mild to moderate osteoarthritis (OA) of the knee. Further work is needed to determine its long-term efficacy, though. Several studies have shown that the effects of HA injections are at their strongest one to two months after the injection and that they can be felt for up to six months after that.¹⁵ According to the present study, the majority of the study parameters showed a decline in the therapeutic response to HA injections at three months post-injection. Conversely, PRP therapy peaked at its efficacy three months after injection, and improvements in subjective and objective results lasted for as long as twelve months following injection, in line with previous research.¹⁶ Additionally, clinical parameters improved more significantly after PRP injection than after HA injections. Based on these findings, PRP injections seem more effective than HA injections in treating knee OA, and the effects stay longer.

These results are in line with two recent meta-analyses that found platelet-rich plasma (PRP) injections to be more effective than HA injections in treating osteoarthritis (OA) of the knee.¹⁷ Patients with mild to moderate knee OA have reported significant improvement in physical function and pain relief after receiving intra-articular injections of PRP and HA. Despite HA's approval as a treatment for knee OA, PRP therapy has been demonstrated to be more effective in alleviating symptoms, improving quality of life, and restoring daily function while maintaining a favorable safety profile. Regardless of these promising results, more large-scale, randomized trials with double-anonymization are needed to establish definitive proof of PRP's possible advantage over HA.

CONCLUSION

PRP therapy has demonstrated promising potential in managing knee OA by stimulating cartilage regeneration and offering longer-lasting clinical benefits than HA injections. Nonetheless, further research is needed to fully understand its long-term efficacy and establish it as a superior treatment option for knee OA.

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Author Contributions

In this study, Dr. Md. Tamjid Ali led a research team at Rajshahi Medical College Hospital in Bangladesh to compare the effectiveness of platelet-rich plasma (PRP) therapy and hyaluronic acid (HA) injections for knee osteoarthritis (OA). Quazi Tamanna Haque assisted with data collection and literature review, while Abdus Sabur and Mohammad Fattah Ul Islam contributed to data analysis and manuscript preparation. The study found that PRP therapy yielded better and longer-lasting results than HA injections, offering potential benefits for knee OA patients.

Declarations

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Conflict of interest: None declared

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