

COMPARATIVE CLINICAL OUTCOMES OF INTRA-ARTICULAR PLATELET-RICH PLASMA VERSUS HYALURONIC ACID IN KNEE OSTEOARTHRITIS

Orthopaedics

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ABSTRACT

Background: Knee osteoarthritis (KOA) is a common degenerative joint disorder associated with chronic pain, stiffness and functional limitation. Intra-articular platelet-rich plasma (PRP) and hyaluronic acid (HA) are widely used non-operative options with different biological and symptomatic mechanisms. **Methods:** This prospective comparative study included 92 patients with KOA, allocated equally to PRP (Group A, n=46) and HA (Group B, n=46). Patients were aged >40 years and had Kellgren–Lawrence grade I–III disease. Outcomes were assessed using the Visual Analogue Scale (VAS), Knee Society Score (KSS), and range of motion (ROM) at baseline and follow-up. Data were analyzed using SPSS and Microsoft Excel. **Results:** Baseline characteristics were comparable. VAS decreased from 7.8 ± 1.1 to 2.9 ± 0.8 in the PRP group and from 7.6 ± 1.2 to 4.2 ± 1.1 in the HA group at 12 weeks. Between-group differences were significant at 2 weeks ($p=0.03$) and highly significant at 6 and 12 weeks ($p<0.001$). KSS improved from 43 ± 6 to 78 ± 7 with PRP versus 44 ± 7 to 65 ± 8 with HA; ROM improved from $102 \pm 12^\circ$ to $124 \pm 8^\circ$ versus $104 \pm 11^\circ$ to $114 \pm 10^\circ$, respectively. Overall improvement and satisfaction were also higher with PRP (87% and 91%) than HA (69% and 74%). **Conclusion:** Both intra-articular PRP and HA were associated with clinical improvement. In this cohort, PRP produced greater and more sustained improvement in pain, function and ROM over 12 weeks, with favorable patient-reported outcomes and no serious complications.

KEYWORDS

Knee Osteoarthritis; Platelet-Rich Plasma; Hyaluronic Acid; VAS; Knee Society Score; Range of Motion; Intra-Articular Injection.

INTRODUCTION

Knee osteoarthritis is a whole-joint disorder involving articular cartilage, subchondral bone, menisci, synovium, ligaments and periarticular muscles. Mechanical loading, aging and inflammatory mediators contribute to matrix degradation, pain and progressive functional impairment. The increasing prevalence of obesity, sedentary behavior and population aging has made KOA a major cause of disability.

Intra-articular HA is traditionally used as a viscosupplement to improve the rheological properties of synovial fluid, reduce friction and provide symptomatic benefit. PRP is an autologous blood-derived preparation containing platelets and bioactive mediators that may modulate inflammation and support anabolic activity within the joint. The thesis underlying the present study describes PRP as a biological/regenerative approach and HA as primarily viscosupplementary, while acknowledging variability in preparation methods and patient response.

Direct clinical comparisons are relevant because the magnitude and duration of benefit may differ by treatment, disease severity and patient characteristics. The present study therefore compared PRP and HA using standardized clinical outcomes over a 12-week period.

Aim and Objectives

Aim: To compare the clinical outcome of intra-articular injections of platelet-rich plasma versus hyaluronic acid in the treatment of knee osteoarthritis.

- To compare pain relief using the Visual Analogue Scale (VAS).
- To compare functional improvement using the Knee Society Score (KSS).
- To compare improvement in knee range of motion (ROM).
- To compare overall improvement, patient satisfaction and complications between treatment groups.

MATERIALS AND METHODS

Study Design and Participants

A prospective comparative study was conducted after Institutional Ethics Committee approval at the National Institute of Medical Sciences and Research, Jaipur. Written informed consent was obtained. Ninety-two eligible patients were included and divided equally into Group A (PRP, n=46) and Group B (HA, n=46). The thesis reports assignment by serial number, with odd serial numbers receiving PRP and even serial numbers receiving HA.

Eligibility Criteria

Inclusion criteria were age above 40 years, radiographic KOA up to KL grade III, absence of focal chondral/osteochondral lesion, hemoglobin >11 g/dL, platelet count $>150,000/\text{mm}^3$, and willingness to participate. Exclusion criteria included previous knee surgery, systemic inflammatory disease and neurological conditions affecting the lower limb.

Outcome Assessment

VAS was used to quantify pain. KSS was used to assess functional outcome. Knee ROM was measured in degrees. Follow-up assessments were performed at baseline, 2 weeks, 6 weeks and 12 weeks for VAS; KSS and ROM were reported at baseline, 6 weeks and 12 weeks. Rescue analgesic requirement and adverse events were recorded.

Statistical Analysis

The thesis reports statistical analysis using SPSS software version 24.0 and Microsoft Excel. Continuous variables were summarized as mean $\pm$ SD and categorical variables as counts and percentages. Between-group p-values reported in the thesis are reproduced without re-analysis.

RESULTS

Ninety-two patients completed the comparative cohort described in the thesis, with 46 patients in each treatment group. The groups were broadly comparable at baseline, supporting interpretation of subsequent between-group differences.

Table 1. Baseline Demographic And Radiographic Characteristics.

Characteristic	PRP (n=46)	HA (n=46)	p-value
Age, years	58.4 ± 8.6	59.1 ± 7.9	0.68
Male, n (%)	20 (43.5)	18 (39.1)	—
Female, n (%)	26 (56.5)	28 (60.9)	—
KL grade 1, n	8	7	—
KL grade 2, n	22	24	—
KL grade 3, n	16	15	—

Table 2. Distribution Of Major Reported Comorbidities.

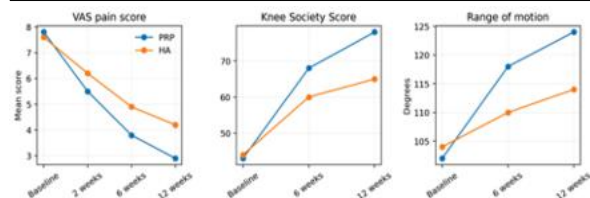
Comorbidity	PRP	HA	Total (%)
Diabetes mellitus	12	11	23 (25.0)
Hypertension	15	14	29 (31.5)

Table 3. Occupational Distribution.

Occupation	PRP	HA	Total (%)
Sedentary	12	14	26 (28.3)
Moderate	18	16	34 (36.9)
Heavy work	16	16	32 (34.8)

Table 4. Comparative Clinical Outcomes At Follow-up.

Outcome	PRP	HA	Between-group p-value
VAS baseline	7.8±1.1	7.6±1.2	0.52
VAS 2 weeks	5.5±1.0	6.2±1.1	0.03
VAS 6 weeks	3.8±0.9	4.9±1.0	<0.001
VAS 12 weeks	2.9±0.8	4.2±1.1	<0.001
KSS baseline	43±6	44±7	0.61
KSS 6 weeks	68±8	60±7	0.002
KSS 12 weeks	78±7	65±8	<0.001
ROM baseline	102±12°	104±11°	0.48
ROM 6 weeks	118±10°	110±9°	0.01
ROM 12 weeks	124±8°	114±10°	<0.001

**Figure 1. Longitudinal Comparison of VAS, KSS and Knee ROM using the Mean Values Reported in the Thesis.****Table 5. Patient-reported Outcomes And Serious Complications.**

Patient-reported outcome	PRP	HA
Overall pain improvement	87%	69%
Patient satisfaction	91%	74%
Serious infection/complication	0	0

DISCUSSION

The principal finding of this prospective comparative study was that both PRP and HA were associated with clinically meaningful improvement, but PRP demonstrated greater improvement across the major outcome domains. Pain reduction was progressive in both groups, with a statistically significant separation appearing by 2 weeks and becoming more pronounced at 6 and 12 weeks. The 12-week VAS difference favored PRP by 1.3 points.

Functional recovery followed a similar pattern. KSS increased by 35 points in the PRP group compared with 21 points in the HA group. ROM increased by 22° with PRP compared with 10° with HA. These findings suggest that the superior pain response with PRP was accompanied by clinically relevant functional improvement rather than an isolated change in pain reporting.

The thesis discussion relates the PRP findings to its autologous growth-factor content and potential anti-inflammatory and anabolic effects, while describing HA as a viscosupplement with mechanical and biochemical actions. However, treatment response should not be interpreted as proof of structural cartilage regeneration because the present study primarily assessed clinical outcomes and had only 12 weeks of follow-up.

Baseline comparability is important. Mean age was similar between groups (58.4 versus 59.1 years), and the distribution of sex, occupation, comorbidities and KL grades was broadly balanced. Half of the study population had KL grade II disease, while one-third had grade III disease. The concentration of patients in early-to-moderate radiographic stages may partly explain the favorable response to intra-articular therapy.

Safety outcomes were favorable. The thesis reports transient pain/swelling as the principal minor adverse effects and no infection or serious complication. The autologous nature of PRP may reduce immunogenic concerns, while HA has an established tolerability profile. Nevertheless, injection-related infection remains a clinically important potential complication of any intra-articular procedure and depends strongly on aseptic technique.

Limitations

- Prospective comparative design rather than a blinded randomized

controlled trial.

- Follow-up was limited to 12 weeks, so durability beyond the study period cannot be established.
- PRP preparation characteristics and HA formulation are not sufficiently standardized in the reported methodology to permit direct comparison with all commercially available protocols.
- The study focused on clinical outcomes and did not establish structural cartilage regeneration with MRI or other quantitative imaging.
- The thesis contains some methodological text that appears unrelated to the knee-injection study (for example, postoperative opioid monitoring); these elements were not incorporated into the present manuscript because they are not relevant to the stated PRP-versus-HA comparison.

CONCLUSION

In this 92-patient prospective comparative study, both intra-articular PRP and HA were associated with improvement in pain and knee function. PRP produced significantly greater improvement in VAS, KSS and ROM at later follow-up, with higher reported overall improvement and patient satisfaction. At 12 weeks, VAS was 2.9±0.8 with PRP versus 4.2±1.1 with HA; KSS was 78±7 versus 65±8; and ROM was 124±8° versus 114±10°. These findings support PRP as a promising option for symptomatic and functional management of selected patients with mild-to-moderate KOA, while recognizing the need for standardized preparation protocols and longer, adequately powered randomized trials.

DECLARATIONS

Ethics Approval and Consent: The thesis reports Institutional Ethics Committee approval and written informed consent from participants.

Data Availability: Data underlying this manuscript are contained in the institutional thesis/master dataset and were not independently reanalyzed for this manuscript.

Conflict of Interest: Not stated in the thesis; this should be completed by the authors before journal submission.

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REFERENCES

1. Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. *Lancet*. 2019;393:1745-1759.
2. Bannuru RR, Osani MC, Vaysbrot EE, et al. OARSI guidelines for the non-surgical management of knee, hip, and polyarticular osteoarthritis. *Osteoarthritis Cartilage*. 2019;27:1578-1589.
3. Filardo G, Kon E, Roffi A, et al. Platelet-rich plasma: why intra-articular injections are a promising treatment for knee osteoarthritis. *Br J Sports Med*. 2011;45:129-133.
4. Kon E, Filardo G, Di Martino A, Marcacci M. Platelet-rich plasma injections for the treatment of knee osteoarthritis. *J Knee Surg*. 2011;24:203-210.
5. Sampson S, Reed M, Silvers H, Meng M, Mandelbaum B. Injection of platelet-rich plasma in patients with primary and secondary knee osteoarthritis. *Am J Sports Med*. 2010;38:155-165.
6. Patel S, Dhillon MS, Aggarwal S, Marwaha N, Jain A. Treatment with platelet-rich plasma is more effective than placebo for knee osteoarthritis: a prospective, double-blind, randomized trial. *Am J Sports Med*. 2013;41:356-364.
7. Bannuru RR, Natov NS, Dasi UR, Schmid CH, McAlindon TE. Therapeutic trajectory of hyaluronic acid versus corticosteroids in the treatment of knee osteoarthritis. *Arthritis Rheum*. 2009;61:1704-1711.
8. Colen S, van den Bekerom MPJ, Mulier M, Haverkamp D. Hyaluronic acid in the treatment of knee osteoarthritis: a systematic review and meta-analysis with emphasis on the efficacy of different products. *BioDrugs*. 2012;26:257-268.
9. Rutjes AWS, Juni P, da Costa BR, Trelle S, Nuesch E, Reichenbach S. Viscosupplementation for osteoarthritis of the knee: a systematic review and meta-analysis. *Ann Intern Med*. 2012;157:180-191.
10. Marx RE. Platelet-rich plasma: evidence to support its use. *J Oral Maxillofac Surg*. 2004;62:489-496.