



Original Research Article

Effectiveness of intra-articular injection of platelet-rich plasma versus triamcinolone in osteoarthritis of knee – A hospital-based randomized clinical trial

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ABSTRACT

Introduction: Osteoarthritis of the knee is one of the most common conditions which clinicians have to deal with in their day-to-day practice. There are various pharmacologic therapies recommended for OA knee. Intra-articular Platelet Rich Plasma (PRP) and Intra-articular Triamcinolone have been shown to relieve pain and improve quality of life in patients with OA knee. This study is conducted to compare the effectiveness of PRP and Triamcinolone intra-articular injections in Grade 1 & 2 OA knee.

Materials and Methods: We conducted a randomized control study including 70 patients with Grade 1 & 2 (Kellgren & Lawrence grading) OA knee. 35 patients each were divided into the PRP group and Triamcinolone group. Intra-articular PRP 5ml and Intra-articular Triamcinolone 80mg were injected twice 3 weeks apart. The effectiveness of the treatment was evaluated by using VAS, KOOS, and WOMAC scores at 3 weeks, 3 months, and 6 months of the follow-up period.

Results: At 3 weeks follow up both the groups showed similar results decreasing pain and improving quality of life. At 6 months follow-up, the PRP group showed better results, and the same effect was observed at 6 months of follow-up. Overall, the PRP group showed better VAS, KOOS, and WOMAC scores compared to the Triamcinolone group.

Conclusion: In the present study both the groups showed improvement in function and reduction in pain in patients with Osteoarthritis of the knee but Triamcinolone had a short-term effect compared to PRP. The study showed the effect of intra-articular injection of platelet-rich plasma was better than triamcinolone in early osteoarthritis of the knee.

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1. Introduction

Osteoarthritis is classically described as a non-inflammatory, degenerative joint disease most commonly occurring in the elderly population. According to the American College of Rheumatology (ACR), Osteoarthritis is defined as a “Heterogeneous group of conditions which may lead to joint symptoms and signs associated with defective integrity of underlying bones and joint margins”. It is an inherently noninflammatory disorder of movable

joints characterized by deterioration of articular cartilage and by the formation of new bone and joint surfaces and margins.¹ The causes of osteoarthritis are believed to be multifactorial including genetic, environmental, metabolic, and biomechanical. Risk factors that are associated with OA knee mostly are old age, obesity, gender, low bone mineral density, joint hyper-mobility, instability, joint trauma, immobilization, diabetes mellitus, occupation, sports activities, genetic factors, and proprioceptive deficit.²

An array of evidence shows that OA knee is treated with surgical, pharmacological, and non-pharmacological

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interventions. Treatment of OA knee is directed towards reducing joint pain and stiffness, maintaining and improving joint mobility, reducing physical disability and handicap, improving health-related quality of life, limiting the progression of joint damage, educating patients about the nature of the disorder and its management. The pharmacological line of treatment included drug therapy like Acetaminophen, Non-Steroidal Anti-Inflammatory drugs (NSAIDs), NSAIDs along with PPI, Misoprostol, COX-2 inhibitors, Topical NSAIDs, capsaicin, oral analgesic, anti-inflammatory agents, injections of IA hyaluronate glucosamine and/or chondroitin sulfate, opioids and narcotic analgesics.³

The intra-articular PRP and Triamcinolone have shown to be effective in treating the early OA knee. The rationale of this study was to evaluate the effectiveness of both and helping the treating clinicians to opt for a better mode of management among the two.

2. Objectives of Study

To assess clinically, the reduction in pain, stiffness, and improvement in functional outcomes in patients injected with intra-articular injections of Platelet Rich Plasma v/s Triamcinolone in Grade I and Grade II Osteoarthritis of knee. [Kellgren and Lawrence Grading].

3. Materials and Methods

This is a randomized clinical trial conducted over one year from January 2016 to December 2016 in the department of orthopedics, KLE'S Dr. Prabhakar Kore Hospital and Medical research center, Belagavi attached to KAHER's Jawaharlal Nehru Medical College, Belagavi. Seventy subjects of both genders of all age groups treated 35 subjects with triamcinolone and 35 subjects with PRP included in this study. Demographic data such as age, sex, and history is obtained through an interview and grade of osteoarthritis decided with the help of plain anteroposterior and lateral radiography of the knee. These patients were further subjected to clinical examination and finding such as grade and extent were noted on a predesigned and pretested proforma. Figure 1

3.1. Inclusion criteria

Grade I and Grade II Osteoarthritis of knee diagnosed by taking X-rays of the affected knee on standing position based on Kellgren and Lawrence grading of osteoarthritis of the knee. Aged between 40 and 70 years

3.2. Exclusion criteria

Patients excluded from this study are critical thrombocytopenia, hemodynamical instability or septicemia, septic arthritis, overlying cellulitis or

adjacent osteomyelitis, platelet dysfunction syndrome, patients on antiplatelet drugs, diabetes, rheumatoid arthritis, nonspecific arthritis, corticosteroid or hyaluronic acid injection of the knee within 1 month or systemic corticosteroid use within 2 weeks, recent fever or illness, cancer, particularly of bone or malignancy.

3.3. Outcome measurement

Patients were prospectively evaluated basally and at 3 weeks, 3 months, and 6 months of follow-up using VAS, KOOS, and WOMAC scores.

3.4. Procedure

After obtaining ethical clearance from the institutional ethical committee and informed written consent, the participants were screened based on the inclusion and exclusion criteria. Sample allocation in the two groups was done based on envelop method. Demographic data, Visual Analogue Scale, KOOS Scale, and WOMAC scale were documented. The subjects were randomly allocated into 2 groups namely the PRP group and TRIAMCINOLONE group.

PRP group patients were injected with intra-articular injection of PRP prepared from their blood inside the operating theater with all aseptic precautions using the superolateral approach to the knee joint. About 5ml of PRP was injected into the suprapatellar pouch twice at an interval of 3 weeks.⁴⁻⁷

3.5. PRP preparation

The PRP required for injection was prepared by drawing the patient's venous blood of about 40ml under aseptic precautions.

The blood was collected in a BD Vacutainer® Coagulation Tubes (Buffered Sodium Citrate) 67599 KFK022 4.5 CTAD (0.109M). The tubes were then centrifuged first at 1500 rpm for 6 minutes to separate erythrocytes, and a second at 3500 rpm for 15 minutes to concentrate platelets produced around 5ml of PRP.

Triamcinolone group was injected with 80mg of intra-articular injection through a superolateral approach to the knee. About 2ml (80mg) of Triamcinolone was injected twice at an interval of 3 weeks.⁸⁻¹⁰

3.6. Statistical methods

The primary outcome variables: VAS, KOOS components, and overall score by WOMAC score were consider as the outcome parameters.

Primary explanatory variable: Study group A=PRP and B=TRIAMCINOLONE.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and

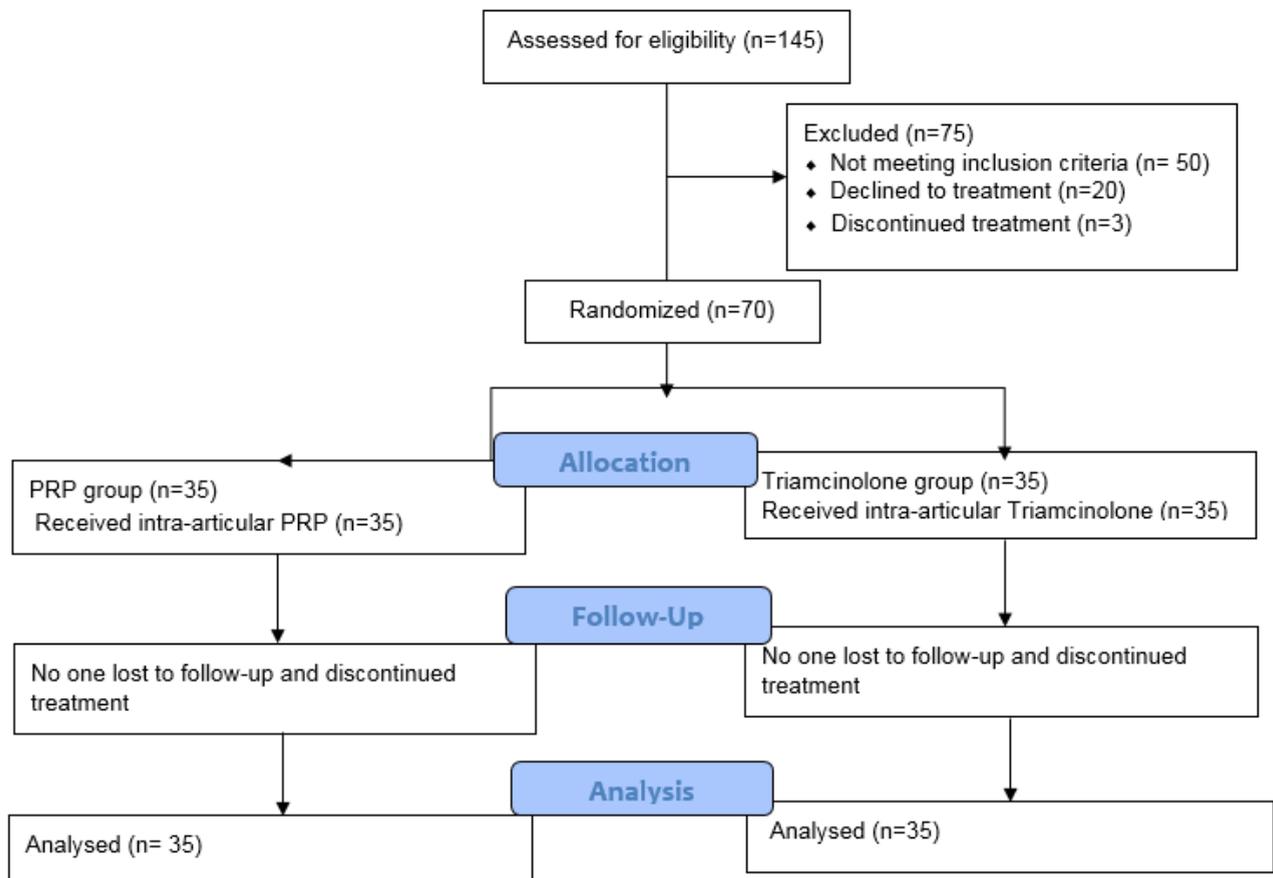


Fig. 1:

proportion for categorical variables.

Both the study group were compared concerning baseline characteristics like gender, side involved and grade of OA by cross-tabulation, and a comparison of percentages with 95% CI is presented. The Chi-square test was used to test statistical significance and represented using the graph in the trend line.

The association between the study group and VAS, KOOS pain, KOOS symptom, KOOS Activities Of Daily Living, KOOS sports/rec, KOOS Quality Of Life, WOMAC scores was assessed by comparing the mean values. The mean differences along with their 95% CI were presented.

P-value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

4. Results

The participants with right knee affected were 23 (65.71%) in the PRP group and 22 (62.86%) in the Triamcinolone group and left knee affected were 12 (34.29%) in the PRP group and 13 (37.14%) in the steroid group. The PRP group and the triamcinolone group, both received two doses of respective intraarticular injections at 3 weeks intervals. In

our study, the right knee is affected most commonly than the left one.

The percentage of Kellgren and Lawrence radiograph classification for grade I was 54.29% in the PRP group, 40% in the triamcinolone group, and that for grade II was 45.71% in the PRP group, 60% in the triamcinolone group.

Outcome measures in the present study were VAS for pain and two functional assessment questionnaires.

The VAS scores were comparable during the pre-intervention period. As shown in Table 1 - The scores decreased in both the groups at 3 weeks of follow up suggesting there was pain relief among both the groups, indicating both interventions were equally effective at 3 weeks to follow-up. At 3 months the PRP group VAS scores were less compared to the Triamcinolone group suggesting PRP gave more relief which was statistically significant. The same trend was observed in the 6th month showing the PRP group had better pain relief in long-term follow-up. shows the decreasing VAS scores in both the groups but the PRP group shows the better result at 6 months follow up.

As shown in Table 2 - The KOOS Pain subscale baseline values in both PRP and Triamcinolone groups were comparable as $P > 0.05$ ($P=0.060$). The pain in both the

Table 1: Comparison of mean of Visual Analogue Scale (VAS) scores between two study groups at different follow-up periods (N=70)

VAS	Mean \pm SD		P-value
	PRP (N=35)	Triamcinolone (N=35)	
Pre-treatment	5.0 \pm 0.99	5.41 \pm 0.74	0.055
3 rd week	3.97 \pm 0.7	4.25 \pm 0.74	0.113
3 rd month	3.24 \pm 0.7	3.67 \pm 0.66	0.011
6 th month	3.06 \pm 0.59	3.69 \pm 0.6	<0.001

groups improved at 3rd week, 3rd month follow up with a statistically significant improvement in the PRP group compared to the Triamcinolone group. At the 6th month follow-up, PRP group scores improved further significantly (P<0.001) compared to Triamcinolone suggesting the long-term effect of PRP. Shows the pain scale decreasing comparably between both groups at 3 weeks and 3 months but 6 months follow-up PRP group had better pain control.

The KOOS Symptom subscale values in both PRP and Triamcinolone groups were comparable as P >0.05 (P=0.089). The symptoms improved with good pain relief in both the groups from baseline values at 3rd week and 3rd month with the statistically significant difference in the improvement in the PRP group. At the 6th month follow-up, the PRP group showed further improvement in the scores whereas the Triamcinolone group scores almost plateaued with significant difference between both the groups signifying effectiveness of PRP even at the end of 6 months.

The KOOS Activities of daily living subscale baseline mean scores were 66.24 \pm 6.82 in the PRP group and 65.21 \pm 4.43 in the Triamcinolone group with a p-value of 0.457 suggesting both the groups were comparable on baseline values. Though the scores in both the groups improved from baseline values, there was no statically significant difference between results of both the groups at 3rd week and 3rd month suggesting both had equal efficacy in terms of improvement of function in activities of daily living at 3rd week and 3rd month. However, the PRP group showed a slightly significant difference in improvement over Triamcinolone at the 6th month follow up suggesting long-term action of PRP.

In KOOS Sports and recreational activities subscale, the baseline value in the PRP group was lower compared to the Triamcinolone group which was statistically significant which indicates that the level of function in sports and recreational activities was much lower in the PRP group. At 3rd-week follow-up scores in both groups increased but the PRP group scores were lower compared to Triamcinolone which was statistically significant signifying Triamcinolone had a better outcome at 3rd week in terms of function. In the 3rd month, the PRP group scores were higher than the Triamcinolone group which was statistically significant suggesting PRP's action was much better in the 3rd month. The scores further continued to increase a little at the 6th month in both the groups with the statistically significant

increase in the PRP group compared to Triamcinolone which started plateauing on graphs. The PRP group showed a better outcome in terms of function concerning Sports and recreational activities at the end of 6 months.

The mean KOOS Quality of Life Pre-treatment score in the PRP group was 58.42 and in the Triamcinolone group it was 62.86, the difference between the two groups was statistically significant (P-value <0.001), and hence they were not comparable on baseline values. The patients in the Triamcinolone group had better scores. Both the groups showed improvement in the scores at 3 weeks, 3 months, and 6 months with parallel increment on the graph when compared with significant difference between each group at every follow up proving Triamcinolone group had a better outcome in function related to the quality of life.

The WOMAC scores as shown in Table 3- followed a similar trend as VAS scores with pre-intervention scores being not significant in both groups which were comparable with mean scores of 49.23 \pm 8.24 in the PRP group and 51.89 \pm 7.6 in triamcinolone; p=0.165. The scores dropped in both the group from baseline at 3 weeks of follow up proving pain relief, decreased stiffness and improvement in physical function indicating the efficacy of both interventions were equal at 3 weeks follow up. At 3 months follow up both the groups showed a dip in scores from baseline and values suggesting further improvement in WOMAC scores but the difference in the mean of both the groups were significant statistically suggesting PRP had a better outcome compared to Triamcinolone at 3 months.

In the 6th month, the PRP group showed a further decrease in the WOMAC scores suggesting its efficacy was good in long-term outcomes whereas the WOMAC scores in the Triamcinolone group showed a plateau phase compared to 3-month scores signifying its short duration of action.

Shows that both the treatments were effective at 3 weeks and the end of 6 months PRP group shows improved scores and proving to be effective on long term follow-up.

5. Discussion

The present study was conducted to compare the effectiveness of intra-articular injection of Platelet Rich Plasma versus Triamcinolone, clinically in terms of reduction in pain and stiffness and improvement in function, quality of life in Grade I and Grade II Osteoarthritis of knee, but as per the available literature Raeissadat et al.,

Table 2: Comparison of KOOS Pain score between two study groups at different follow-up periods (N=70)

KOOS Pain	Mean \pm SD		P-value
	PRP (N=35)	Triamcinolone (N=35)	
Pre-treatment	71.14 \pm 3.56	69.21 \pm 4.44	0.060
3rd week	80.57 \pm 4.02	76.59 \pm 2.96	<0.001
3 months	84.54 \pm 4.85	80.08 \pm 2.28	<0.001
6 months	87.56 \pm 2.76	80.87 \pm 2.68	<0.001

Table 3: Comparison of mean of WOMAC between two study groups at different follow-up periods (N=70)

WOMAC	Mean \pm SD		P-value
	PRP (N=35)	Triamcinolone (N=35)	
Pre treatment	49.23 \pm 8.24	51.89 \pm 7.6	0.165
3rd week	44.91 \pm 7.61	44.45 \pm 9.23	0.817
3 months	37.00 \pm 5.23	40.43 \pm 6.21	0.015
6 months	35.77 \pm 6.32	39.8 \pm 6.24	0.009

in their randomized clinical trial comparing intra-articular injections of PRP with HA reported similar fall in WOMAC scores at 52 weeks of follow up with decrement more in PRP group ($p < 0.001$) which is comparable to our study.⁴ In a systematic review done by Campbell et al., functional assessment done with WOMAC total score suggested of significantly increased function at both 3rd and 6th month after the intervention while sustaining improvements up to 48 weeks post-PRP injections,¹¹ recommending PRP injections in OA knee.

Studies have shown that the right knee is most affected in men aged 60 and above. In the women population there is an even distribution among right knee (24.2%) and left knee (24.7%),^{12,13} Our study showed right knee affected more than left.

The VAS has been studied for reliability and validity in patients with chronic musculoskeletal pain. It is shown to have good reliability (0.60 to 0.77) and validity (0.16 to 0.51) for assessing chronic musculoskeletal pain.¹⁴ In 2013, Patel et al., in their randomized control trial reported similar trends in the fall of VAS scores like our results which were significant between the groups when comparing PRP injections with placebo injections.¹⁵ and the recommended PRP injection in the early OA knee.

The KOOS subscale results when compared with a study done by Joshi Jubert, Nayana et al, comparing PRP with corticosteroid followed similar trends on the graph in terms of pain relief, symptoms, activities of daily living, sports, and recreational activities without any significant difference between the outcome of two groups under the KOOS scales, whereas our results showed a significant difference in outcome between two groups. On the contrary, the quality of life scores improved in their study compared to ours wherein there was no significant difference between the two groups.¹⁶ and concluded that PRP injection is effective for relieving pain, improving quality of life and activities of daily living even in the late stage of OA knee.

The KOOS results in a study conducted by Abeer H Ismaiel showed improvement concerning pain, ADL, and quality of living in the PRP group compared to the steroid group. In our study, the findings concerning pain and ADL are similar to his study but the quality of life showed better in the steroid group at 6 months follow-up.

The PRP group showed statistically significant improvement in all outcome measures when pre and post-intervention values were compared. The possible mechanism for the effectiveness of PRP was the active participation of platelets by delivering a broad spectrum of growth factors like insulin-like growth factor, transforming growth factor b-I, platelet-derived growth factor, and many other active molecules like cytokine, chemokines, arachidonic acid metabolites, extracellular matrix proteins, nucleotides, and ascorbic acid, etc. in the healing process. The release of the above-mentioned growth factors results in crucial changes in cartilage-like cell proliferation, migration, chemotaxis, differentiation, modulating inflammatory process, and matrix synthesis.¹⁷

6. Conclusion

In the present study both the groups showed improvement in function and reduction in pain in patients with Osteoarthritis of the knee but Triamcinolone had a short-term effect compared to PRP. The study showed the effect of intra-articular injection of platelet-rich plasma was better than triamcinolone in early osteoarthritis of the knee.

7. Source of Funding

No financial support was received for the work within this manuscript.

8. Conflict of Interest

The authors declare they have no conflict of interest.

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