

Effectiveness of Platelet Rich Plasma (PRP) in Pain Management of Knee Osteoarthritis

Samreen Khan¹, Ayesha Junaid², Munazza Abbas³, Salman Ahmed⁴, Shafain Sheikh⁵, Maira Ijaz⁶
Shifa International Hospital Islamabad

ABSTRACT

Objectives: To determine mean change in pain score in patients with knee osteoarthritis after intra-articular injection of platelet rich plasma.

Methodology: A quasi experimental study was conducted at the departments of Hematology and Pain Management clinic at Shifa International Hospital Islamabad from 22nd December 2019 to 23 January 2022. A total of 52 patients diagnosed with Osteoarthritis Knee joints, 50 to 70 years of age were included. All patients received intra-articular injection of 5 ml PRP into the affected knee joint. Pain was calculated through Visual Analog Scale (VAS) using numerical scale from 0 to 10 and was measured prior to treatment at 3 and 6 months

Results In this study, at baseline, mean pain score was 6.90 ± 1.47 and at 6 months, mean pain score was 1.48 ± 0.89 with p-value of 0.0001. PRP injection in the intra-articular joint was effective in pain management in the early osteoarthritis with an average variation in the level of pain of 5.54 ± 1.55 , indicating a substantial improvement following PRP therapy.

Conclusion: Intra-articular injections of platelet-rich plasma are important in reducing pain in patients with mild to moderate knee osteoarthritis and represent an effective therapeutic option for early disease management.

Keywords: Intra-articular injection; Osteoarthritis; Platelet-rich plasma

Authors' Contribution:

^{1,2}Conception; Literature research; manuscript design and drafting; ^{3,4}Critical analysis and manuscript review; ^{5,6}Data analysis; Manuscript Editing.

Correspondence:

Samreen Khan
Email: samarif1115@gmail.com

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Introduction

Osteoarthritis (OA) is among the most common form of arthritis and is among the leading causes of disability. It affects knee more than any other joint. Osteoarthritis is increasing dramatically in the coming years and this is with aging and obesity.¹ The burden of osteoarthritis in Pakistan is increasing every year. Osteoarthritis mostly affects joints that bear weight like knee and hip joints.² Total knee replacement is the costliest treatment for

osteoarthritis, but other than knee replacement therapy, there are pharmacological and non-pharmacological approaches. Most pharmacological approaches like oral non-steroid anti-inflammatory drugs (NSAIDs), topical anti-inflammatory gel and oral supplements such as glucosamine and chondroitin sulfate are not considered safe for prolonged use.³ The non-pharmacological treatments are quite effective and safe for pain in knee osteoarthritis. It is less expensive and carries a lower risk of side effects. Its key advantage is its

ability to promote biological repair in the cartilage of patients with knee osteoarthritis, helping to counteract cartilage damage, surface cracks, joint-space narrowing, and the resulting pain.⁴

Platelet-rich plasma (PRP) refers to a concentration of human platelets in a small volume of insignificant plasma and may be as much as five-fold that of a healthy individual.⁵ Normal Platelet counts range from 150-450 x 10⁹/L with normal life span of 9-10 days.⁶ Injecting PRP in intra-articular area of knee is clinically beneficial for pain reduction in osteoarthritis with mean change in pain severity of about 6 ± 1.5.⁷ This therapy is invasive and enhances tissue regeneration. Platelet-rich plasma (PRP) is a natural growth factor autologous concentrate produced by centrifugation of autologous blood.⁸ Platelets are among the earliest to appear at the site and bring it's healing and anti-inflammatory process by releasing it's bioactive factors.⁹ Platelets have alpha and dense granules. Alpha granules secretes platelet-derived GF (PDGF), vascular endothelial GF (VEGF), transforming GF-β1 (TGF-β1), epidermal GF (EGF) and basic fibroblastic GF (bFGF).¹⁰



Figure 1. Blood 18cc was drawn from subject in 20 cc syringe which contained 2cc anticoagulant. PRP kit was placed to the centrifuge (with counterbalancing) for 5 minutes at 3500 RPM which separated the red blood cells and plasma.



Figure 2. To prevent the mixing of PRP and platelet poor plasma (PPP), the kit was kept in the upright position. Platelet rich plasma (PRP) was taken out from the kit

Dense granules releases ADP, ATP, dopamine, serotonin and calcium ions that cause tissue modulation and regeneration.¹²

Alpha granules on the other hand are involved in tissue remodeling and restoration.

The level of pain was measured using visual analog scale (VAS) in numerical scale of 0 to 10 which is 10cm horizontal line. The straight line establishes the outer limits like; no pain at all and pain as bad as it could be. The gap between no pain at all and the mark at the time determines the pain of the subject.^{11,12}

Platelet rich plasma is prepared in blood bank. Initially patient is physically examined and if there are no complications the procedure is started.

Methodology

This was a prospective Quasi Experimental Study where the data was collected from pain management consultant who administered the PRP injections. A total number of 52 patients were included who had mild or moderate knee osteoarthritis. Research was carried out after approval of IRB and ethical committee of Shifa International Hospital located in Islamabad, Pakistan. Written informed consent was attained from the research participants. Demographic data

included, name, age, gender, medical registration number, address & contact number. Confidentiality was maintained at every step; research & data collection was conducted by the trainee researcher. G-Power, was used to calculate the sample size by taking the following,¹³ Alpha error - 0.05, Power - 0.90, Mean VAS pre-treatment - 8.4 (S.D. = 6.88) [12], Mean VAS at 6-month follow-up - 4.5 (S.D. = 6.88) [12], Effect size - 0.566, Sample size – 50. Technique of sampling was non-probability, consecutive sampling.

Inclusion criteria was patients diagnosed with Osteoarthritis Knee joints (Mild and moderate) and both genders between age 50-70. Exclusion criteria was osteoarthritis, knee joints (Severe), rheumatoid arthritis, diabetes mellitus, cardiovascular diseases, Infections, coagulopathy (hematological diseases) and patients on therapy with anticoagulants/anti-platelets drugs, Immunosuppressive Therapy

All enrolled patients received 2 intra-articular injections of 5 mL PRP, administered into the affected knee joint at 3 months intervals. Total of 2 injections were given to each patient per knee.

The evaluation of pain was done before the treatment after three months of treatment, and six months of treatment. Pain was measured by Visual Analog Scale (VAS) in numerical scale of 0 to 10. One to three as mild, four to seven as moderate, and eight and above as severe pain.

For statistical analysis Data was analyzed by using SPSS Version 21.0. Mean ± standard deviation of quantitative variables like age, change in pain score were calculated. Frequencies and percentages of qualitative variables like severity were calculated. For comparison of pre & post-PRP pain score, paired sample t-test was applied. Age and severity were controlled through stratification. Post stratification paired samples; t-test was applied. P value <0.05 was considered significant.

Ethical approval was taken from the institutional review board and ethics committee of Shifa International Hospital, Islamabad (Ref. IRB No.007-49-2019) on 18-05-2019.

Results

The age of the study population was 50-70 years with the mean age of the study population of 61.46 ± 4.79 years. Most of the females i.e., 28 (56.0%) fell between the age of 61 to 70 years. Of these 50 patients, 16 (32.0%) were males and 34 (68.0%) were females with male to female ratio of 1:2.1. Baseline mean pain score was 6.90 ± 1.47 and 6 months mean pain score was 1.48 ± 0.89 as indicated in Table I. The PRP injection intra-articularly worked effectively in the pain relief of early osteoarthritis with mean change in the severity of pain of approximately 5.54 ± 1.55. Table II displays stratification of mean score of pain with respect to age groups gender and severity.

Table I: The mean change in the pain score in patients with knee osteoarthritis following intra-articular injection of platelet rich plasma.

	Pain Score		p-value
	Mean	SD	
Pre-injection	6.90	1.47	0.0001
Post-injection	0.89	0.89	
Change in pain score	5.54	1.55	

Table II: Stratification of Change in pain score with respect to gender & severity

Gender	Change in pain score		p-value
	Mean	SD	
Male	5.19	1.56	0.276
Female	5.71	1.56	
Severity			0.0001
Mild	4.21	1.02	
Moderate	6.71	0.71	

Discussion

Recently PRP has received considerable attention as a chondroprotective therapy in symptomatic knee

OA.¹¹ Our study showed that 10-ml volume containing millions of platelets were effective in terms of functional outcome and articular cartilage protection. Therapeutic efficacy of PRP in the management of mild to moderate knee osteoarthritis in the treatment of pain and physical functions came out as one of the major findings of this study. In our case, we observed significant improvement in patients over the follow up period based on the VAS (visual analog scale).

In a study carried out by Rasheed et al at the Dow University of health sciences among 225 patients, the impact of PRP injection in the management of chronic degenerative condition of the knees was observed. The mean WOMAC score has been reported to have significantly and statistically reduced ($p = 0.000$) with a lower value of 83.05 to 38.84.¹⁴

Role of PRP as proangiogenic in knee osteoarthritis has not been fully supported by controlled studies. In fact, several studies argue the role of PRP in pain reduction. Platelet rich plasma injections are characterized by delayed onset of action, but with prolonged and sustained symptomatic relief. Reduced pain during weight-bearing activities has been observed, in contrast to injectable corticosteroids.¹⁵

In another study, which was carried out by Bennell et al to evaluate PRP as a treatment of knee osteoarthritis, the population size of 288 randomized patients (mean age 61.9 6.5 years; 59% women) in the study were 269 (93%) participants who completed the study. There were three injections (97% of the participants in the PRP and placebo) in the PRP and placebo groups. The mean difference in knee pain scores at one year follow-up was found to be -2.1 in the PRP and -1.8 in the placebo (difference: -0.4 points; 95% CI: -0.9 to 0.2; $P = .17$). Among the 31 preset secondary outcomes, 29 did not have significant differences between the groups.¹⁶

The sample in another study by Raeissad comprised both knees of a total of 23 female patients with an

average age of 57.57 ± 5.9 years. The PRP group and the control group had 23 and 23 knees respectively. The baseline change of the total WOMAC and VAS score of the control group was 11.61 ± 8.5 and 1.3 ± 1.1 , respectively. The PRP group had more improvements, and the mean changes of WOMAC and VAS were 20 ± 12.3 for WOMAC and 3.2 ± 1.6 for VAS ($P < 0.05$). All the radiologic parameters such as patellofemoral cartilage volume, synovitis, and medial meniscus and lateral meniscus integrity were significantly improved ($P < 0.05$) in the PRP group.¹⁷ Most of the literature review illustrates that PRP is safe and effective as an alternative treatment to long-term pain reliever and functional improvement of patients with knee osteoarthritis. Moreover, PRP therapy was revealed to be effective in pain, functional limitation and stiffness reduction in knee OA patients up to 24 weeks.¹⁷ Platelet-rich plasma (PRP) is an easy, effective, and least invasive technique of extracting a natural concentration of autologous growth factors. The use of PRP represents a promising approach to treat hard to heal wounds. Indeed, besides its ability to support the hemostasis and the healing process via the secretion of growth factors in biologically determined ratio and in an orchestrated manner, it has been shown to have antimicrobial and pain-relieving properties.¹⁸

Ghai (2019) reported in 20 patients in the Post Graduate Institute of Medical education and Research Chandigarh India in 2019. At baseline, the VAS score in knee was 8.4 ± 0.88 but was reduced to 4.85 ± 2.48 after 6 months with PRP ($p < 0.001$), and the improvement was more pronounced than with normal saline ($p = 0.017$). Conversely, the normal saline group did not exhibit any significant change during the same period with a score changing slightly from 10.2 ± 1.2 to 10.05 ± 1.23 . Furthermore, reduction in stiffness and also enhanced physical function was observed in the PRP treated knee in contrast to the saline-treated knee.¹⁹ We have conducted our study to establish mean change in pain score of knee osteoarthritis patients,

after intra-articular injection of platelet rich plasma. The age of the study population was 50-70 years with the mean age of the study population of 61.46 ± 4.79 years. Stratification analysis showed no statistically significant difference in pain score reduction between males and females (p = 0.276). However, a significantly greater improvement was observed in patients with moderate knee osteoarthritis compared to those with mild disease (p = 0.0001), suggesting better symptomatic response to PRP in moderate cases. The mean pain score pre injection was 5.54 which reduced to 1.55 after PRP. There was improvement in movement and daily activities according to the subjects. The strength of our study was the use of autologous platelets where there was no chance of anaphylaxis. Visual analog scale (VAS) tool was used to improve reliability of results and it focused on mild to moderate osteoarthritis. The limitation was small sample size due to absent follow ups.

Conclusion

This study demonstrates that intra-articular platelet-rich plasma (PRP) injections are effective in managing pain and improving functional outcomes in patients with mild to moderate knee osteoarthritis. Autologous PRP, rich in growth factors and bioactive proteins, appears to promote tissue repair and modulate inflammatory processes within the joint. Evidence suggests that PRP significantly reduces pain severity and enhances functional capacity, with optimal outcomes observed after at least two injections. Therefore, PRP should be considered a valuable adjunctive treatment in the routine management of knee osteoarthritis to reduce pain and disease-related morbidity.

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