

Efficacy of Intraarticular Knee Injection of PRP (Platelet Rich Plasma) vs Steroid (Triamcinolone Acetate) for the Treatment of Primary Knee Osteoarthritis Grade I & II

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Abstract

Objective: To assess the effectiveness of PRP (Platelet Rich Plasma), and to compare with Triamcinolone 40mg (Steroid) on functional activity, stiffness and pain in Grade I & II Knee OA.

Method: A comparative cross sectional study was conducted at outdoor departments of Advanced Pain Relief Center, Lifeline Hospital Lahore (Pakistan) from January 2022 to December 2022. The present study included a total of 235 participants, out of whom 190 individuals were deemed eligible for inclusion based on predetermined criteria. The remaining 45 participants were excluded from the study due to non-adherence to eligibility criteria and lack of approval from institutional ethical committee. Out of a total of 190 subjects enrolled in the study, 64 (33%) were characterized as male while 126 (67%) were classified as female. The participants' mean age was 53.5 ± 6.4 years. Alternative patients were treated with intra-articular injection of either triamcinolone 40mg or PRP. Patients randomized in Steroid group (n=95) were gives intraarticular 40mg Triamcinolone acetate (1ml) along with 2ml of Local anaesthetic Lignocaine 1%, whereas patients randomized in PRP group (n=95) were injected 5ml PRP. "The Western Ontario and McMaster Universities Arthritis Index" (WOMAC) Scale was used for functional disability and pain before and after the therapy for the targeted knee joint at the baseline 1 week, 5 weeks, 8 weeks and 20 weeks follow-ups. Visual Analogue Scale (VAS) scores were also recorded for pain. Data analysis was done by using SPSS version 20.

Results: There wasn't any serious adverse effect observed during the study and follow-ups. 25 WOMAC functional activity scale showed statistically significant improvement with Intraarticular knee injection of PRP compared to steroids (40.64 ± 1.87 vs. 27.17 ± 6.01) ($p=0.000$). WOMAC pain scale results also demonstrated that intraarticular knee injection of PRP was more effective in reducing knee pain than steroids ($p=0.000$) at 20 weeks follow-up.

Conclusion: On the basis of the results of our study, we concluded that platelet rich plasma is more effective than intra-articular steroids in terms of improvement in functional activity and reduction of pain in patients with Grade I & II knee osteoarthritis. Both PRP and steroid intraarticular injections are safe.

Keywords: Platelet rich plasma; Osteoarthritis, Chronic; Pain; Visual Analogue Scale; WOMAC; Western Ontario and McMaster Universities Osteoarthritis Index

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Introduction

Knee osteoarthritis is a degenerative condition that involves the gradual deterioration of bone tissue and articular cartilages. The assessment of the progression of knee osteoarthritis degeneration is commonly accomplished through the implementation of the Kellgren-Lawrence Scale, which was originally devised by Sir Kellgren and Sir Lawrence in the latter part of 1957. In KL Scale radiographs of knee joint in AP standing view

are obtained and interpreted to not only diagnose Knee OA but also staging of degeneration. Knee OA is common disorder, which is also known as aging degenerative joint disorder, mostly observed in more than 60 years of age, and approximately 10% adult people > 65 years of age suffer from this it.¹

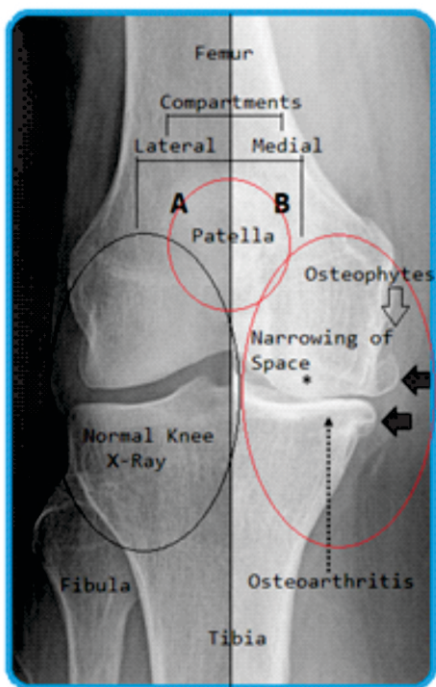


Fig. 1.1 X-Ray Knee AP View (Standing) Normal vs Osteoarthritis

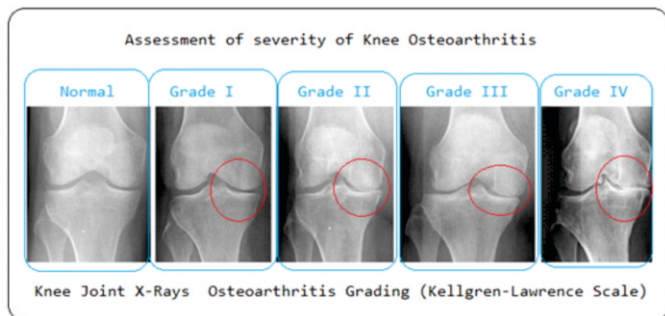


Fig. 1.2 Osteoarthritis grading by Kellgren-Lawrence Scale

The disease is more common in elderly women than in elderly males. World Health Organization estimates that more than 150 million of people globally are suffering from knee OA.² More than 30% of the population may have moderate to severe scores on WOMAC.³ The statistics from Netherlands show that cost of this degenerative disease annually is more than 540 billion euros. In the earlier days, OA disease was considered solely due to deterioration of the synovium and the cartilage

of the synovial joints.⁴ but new research has shown that OA is not only limited to the synovium and cartilage of the joints, but is also responsible for the destruction of the surrounding ligaments and even the subchondral bones.

Steroids have been the mainstay of treatment of knee OA. Their effects have been thought to be due to their anti-inflammatory and analgesic effects. Traditionally, long acting steroids, e.g. triamcinolone or methyl prednisolone are injected in the synovial cavity of the joint. The use of PRP for this purpose has been suggested by many authors and is an emerging alternative regenerative therapy that outweighs steroids in efficacy and safety. Many prospective, randomized, controlled trials have substantiated the use of PRP as a therapeutic agent in Rheumatology, Pain Management, Sports Medicine, Orthopedics and Regenerative Medicine. It has been suggested that Platelet rich Plasma Therapy should be considered as therapeutic agent in the primary knee osteoarthritis of Grade I & II only, not just because of its promising therapeutic outcomes, but better safety profile as well⁴, yet Total Knee Replacement (TKR) is still the mainstay treatment for knee OA of advanced stages. We conducted this randomized experimental trial to compare the effectiveness of PRP vs steroid (triamcinolone) on functional activity and the pain in patients with chronic primary OA of knee joints, as measured by using WOMAC Scale for functional disability and pain and (VAS) Visual Analogue Scale for pain assessment.

Material and Methods

Total number of patients selected for this prospective study was 235, of which 45 dropped and 190 meeting inclusion criteria finally enrolled, randomized trial, reporting to the OPD of Advanced Pain Relief Center, Lifeline Hospital, Lahore, from January 2022 to December 2022. Demographic variables like Gender, Age, Ethnicity, BMI and radiologically diagnosed cases of knee OA were collected. The patients suffering from non-traumatic chronic pain in one or both knee for at least one year, radiologically diagnosed to have grade I & II knee OA (1-4 Kellgren–Lawrence scale) were enrolled under convenient sampling, whereas Grade III & IV were excluded from the study. Patient not responding to conservative and pharmacological management were enrolled in the study. Even number patients reporting for the treatment of primary knee OA were injected with PRP into intraarticular knee joint, isolated and extracted by the PRP method using FDA Registered

Dr's PRP USA Kits and Compatible Dr's USA Centrifuge. Mean thrombocyte count used was 2,209,000/ μ l, \pm 901,000/ μ l. On the other hand, odd number patients were injected with the steroid (triamcinolone 40 mg). Patients were evaluated for pain clinically using VAS, and by WOMAC for functional activity, before intra-articular injections of the PRP or steroids, and at 1 week, 5 weeks, 8 weeks and 20 weeks follow-ups and changes in scoring were recorded. The results were statistically analyzed and compared.

Differential Centrifugation is the process through which PRP is prepared. In the present method, the acceleration force is calibrated to segregate distinct cellular elements on the foundation of their corresponding specific gravities. There are various methods of platelet rich plasma preparation of which "PRP Method" and "Buffy-coat Method" are commonly used. However, we used PRP method. In this RBCs are separated by an initial centrifugation, then Platelets concentrate, suspended in final plasma volume are obtained followed by a second centrifugation. A double centrifugation PRP method is described as flowchart in Fig. 1.5. 20 ml of autologous whole blood (WB) is initially collected in anticoagulant containing sterile tubes through venipuncture. The first step is to spin Whole Blood (3,400 RPM \times 4min) containing sterile tube at constant acceleration which separates Red Blood Cells (RBCs) from the remaining Whole Blood volume. Subsequent to the initial phase, the entirety of the Blood is divided into three distinct strata: Layer I, also known as the upper layer, predominantly comprises platelets and White Blood Cells (WBCs). The layer II, which is intermediate in thickness, is commonly referred to as the "Buffy Coat" and is abundant in white blood cells. Layer III, the lowest layer, predominantly comprises red blood cells (RBCs). After this step Layer I (Upper Layer) and Layer II (Buffy Coat) are transferred into an empty sterile tube for Second spin (3,500 RPM \times 2 min) to produce pure Platelet Rich Plasma (P-PRP). The entire second layer (Buffy Coat) and few RBCs can be transferred for the production of Leucocyte Rich PRP (L-PRP). Next, a second centrifugation step is conducted to facilitate the creation of malleable aggregates of erythrocytes and platelets that are amenable to settling at the base of the tube. After this procedure, the upper segment within the tube is drawn out via a sterile syringe containing an 18G needle and subsequently discarded, as this portion primarily consists of Platelet Poor Plasma (PPP). The final step remaining lower 1/3rd (5 ml of plasma) is homogenized with Pallet to create the pure

PRP (Platelet-Rich Plasma). Before intraarticular knee injection this pure PRP is activated through Photo-Bio-Modulation process. The statistical analysis was conducted utilizing SPSS Version 20.0. Categorical variables, such as gender, medical history, and adverse events, are typically reported in frequency and percentage form. The Chi-Square Test was utilized to discern the presence of a relationship between categorical variables within two distinct groups. In accordance with conventional statistical practices, a significance level of $p \leq 0.05$ was adopted as the threshold for determining statistical significance. The WOMAC pain scale assessment outcomes were recorded both prior to and subsequent to the administration of platelet-rich plasma (PRP) and steroid injection. Follow-up evaluations were carried out at 1, 5, 8, and 20 weeks post-treatment. The present study has revealed that the outcome measures of Platelet-Rich Plasma (PRP) treatment demonstrated nominal differences that did not surpass the levels of statistical significance ($p < 0.05$). The statistical comparison revealed a p value of 0.00, indicating that PRP therapy is significantly more efficacious in mitigating knee pain than the administration of steroid treatment. Steroid intra-articular injections provided pain relief and functional improvement up to 8 weeks whereas PRP up to 20 weeks. It is also noted that PRP not only improved function but also joint space at 20 weeks.



Table 1: Comparison of different parameters before and after PRP and steroid injections

Parameters	Differences noted in PRP Group		Differences noted in Steroid Group	
	Mean± S.D	P-value	Mean ± S.D	P-value
WOMAC Functional Activity Scale	40.64 ± 1.87	0.000	27.17 ± 6.01	0.071
VAS Score	6.38 ± 0.99	0.000	3.21 ± 0.87	0.086
WOMAC Pain Scale	8.29 ± 1.69	0.000	4.39 ± 1.63	0.061



Fig.1.3 Before & after Knee X-rays showing improvement at 20 weeks after PRP

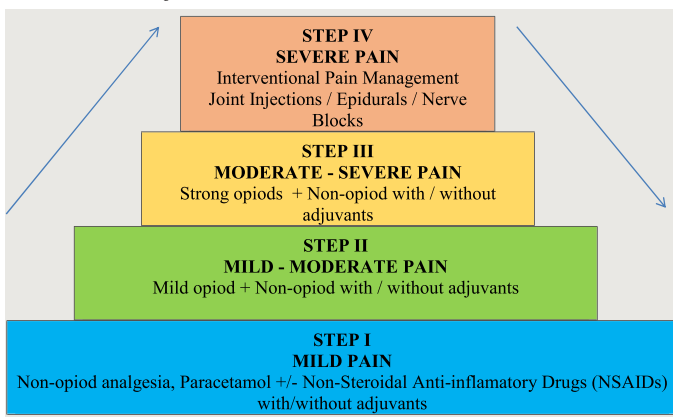


Fig. 1.4 Modified WHO Analgesic Ladder (WHO 1986)

Discussion

Knee osteoarthritis (OA) is characterized by a pervasive degenerative process affecting the joint bone and cartilage, ultimately leading to the progressive decline of the joint and the adjacent structures. In primary osteoarthritis (OA), the joint that is most significantly impacted is the knee joint, as it is responsible for supporting the weight of the body. Female population is affected more than Males especially postmenopausal females. Risk factors includes but not limited to Age, Gender, Overuse of joint, obesity, calcium & Vitamin D deficiency, trauma and familial history. The primary objective of knee osteoarthritis treatment is to mitigate pain

and stiffness, while simultaneously improving functional capabilities for day-to-day activities. There are many pharmacological (NSAIDS, Calcium & Vitamin D supplements, Glucosamine, Chondroitin) and nonpharmacological adjuvants (Acupuncture, Physiotherapy, Therapeutic Exercises) prescribed to manage primary knee OA however mainstay is to advised lifestyle modifications and strengthening of quadriceps and hamstring muscles to prevent further damage to joint. As per WHO analgesic ladder treatment should always start with conservative non-surgical approach (Step I and Step II) as described in the fig. 1.4. However, if conservative treatment fails then intervention should be considered. In the grade I & II primary knee OA, the utilization of plasma rich in growth factors, which contains a protein component, has been observed to yield favorable outcomes in augmenting functional capacities while mitigating painful sensations and musculoskeletal rigidity.⁶ Platelet-rich plasma (PRP) has been employed for over two decades in various orthopedic ailments, with a primary focus on knee osteoarthritis (OA).⁸ The present investigation noted that platelet-rich plasma (PRP) displays greater significance than steroids, not only in alleviating pain and stiffness, but also in functional restoration of the knee joint by initiating regeneration process of cartilage, hence improving knee joint space and enhancement was quantified utilizing the WOMAC scale across three domains, namely, Pain, Stiffness, and Functional activity. The results of the study indicate that a considerable percentage of patients, exceeding 80%, exhibited notable improvements in pain, stiffness and functional activities. Pain was also measured by the visual analogue scale and it was observed during the study that there was great improvement after intra-articular knee joint PRP injection. In literature review we came to find that there are researches which supported the same results as our study of which some are described below; In 2008, Sánchez et al. conducted a comparative study involving 50 patients who received platelet-rich plasma (PRP) therapy and an equal number of patients treated with hyaluronic acid injection. In the conclusive findings, it was observed that the outcomes of PRP injections were deemed more substantial in comparison to the application of hyaluronic acid within the context of pain management and promoting functional activities.⁸

Wang-Saegusa et al. conducted an additional study in 2011, which also showed improvement in WOMAC, VAS and SF-36 in after intraarticular knee PRP injections in 260 patients suffering from grade I primary knee osteoarthritis.⁹ Likewise, Kon et al., 2010 worked in 92 patients¹⁰, Chang et al. (2014) resulted in improvement in primary knee osteoarthritis after administration of intraarticular knee PRP to the hyaluronic acid¹¹. Sampson and colleagues conducted a study on the utilization of platelet-rich plasma (PRP) injections for the treatment of grade one knee osteoarthritis (OA) in a cohort of fourteen patients. Measurements were obtained prior to administering the platelet-rich plasma (PRP) injection, and subsequently, a three-month interval was observed. It was duly noted that the patient experienced significant relief from pain and stiffness following the treatment. The thickness of the cartilage at various levels was assessed by ultrasound, and it was observed that thirteen out of fourteen patients exhibited a significant increase in cartilage thickness. The findings of the study suggest that the administration of PRP injections can provide relief from both pain and stiffness, while also facilitating the regeneration and augmentation of cartilage thickness within the relevant joint.¹² The current investigation provides evidence for the effectiveness of Platelet-Rich Plasma (PRP) in individuals aged 40-60 years diagnosed with grade I & II primary knee Osteoarthritis (OA). It has been observed that this intervention not only facilitates pain and stiffness reduction but also effectively restores functional performance.

Conclusion

The observed findings indicate that platelet rich plasma (PRP) is highly efficacious and convenient for administration in individuals diagnosed with grade I and II knee osteoarthritis. The application of this intervention serves to alleviate pain, reduce stiffness, and improve functional activities among patients.

Conflict of Interest

None

Source of Funding

None

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Authors Contribution

SRD: Conceptualization of Project

NT: Data Collection

AS: Literature Search

SN: Statistical Analysis

WY: Drafting, Revision

WAC: Writing of Manuscript