

Evaluation Of The Efficacy Of Platelet-Rich Plasma Therapy In The Treatment Of Knee Osteoarthritis

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ABSTRACT

Background: Knee osteoarthritis is a common degenerative joint disease that causes chronic pain, functional disability, and impaired quality of life. Platelet-rich plasma (PRP) therapy has emerged as a promising biological treatment because of its regenerative and anti-inflammatory properties. **Objective:** To evaluate the efficacy of platelet-rich plasma therapy in the treatment of knee osteoarthritis. **Methods:** This retrospective observational study was conducted at Liaquat University of Medical and Health Sciences from May 2020 to May 2026 and included 120 patients with symptomatic knee osteoarthritis who received intra-articular PRP injections. **Results:** The mean age of patients was 58.4 ± 8.7 years, and 72 (60.0%) were female. Baseline VAS, WOMAC, and KOOS scores were 7.8 ± 1.1 , 58.6 ± 10.7 , and 48.3 ± 11.5 , respectively. At six months, VAS pain score significantly decreased to 3.6 ± 1.3 , WOMAC improved to 31.2 ± 9.4 , and KOOS increased to 72.5 ± 10.8 (all $p < 0.001$). Knee flexion improved from $111.4 \pm 10.2^\circ$ to $122.8 \pm 8.6^\circ$, while analgesic use declined from 77.5% to 29.2%. Overall, 98 (81.7%) patients reported good or excellent satisfaction. Minor adverse events included transient injection-site pain (15.0%), mild joint swelling (10.0%), and knee stiffness (7.5%), with no infections or allergic reactions observed. **Conclusion:** Platelet-rich plasma therapy provides significant pain relief, functional improvement, and excellent safety in patients with knee osteoarthritis. Earlier disease stage, younger age, lower body mass index, shorter symptom duration, and absence of diabetes mellitus are associated with superior clinical outcomes following PRP therapy.

Keywords: Platelet-rich plasma; knee osteoarthritis; PRP therapy; WOMAC; KOOS; Visual Analog Scale...

How to cite this article: Nawaz S, Shaikh SH, Sajid HU, Niazi MUR, Ali AIIM, Noor F, Shomurotovna RY.. Evaluation Of The Efficacy Of Platelet-Rich Plasma Therapy In The Treatment Of Knee Osteoarthritis. *Int J Drug Deliv Technol.* 2026;16(70s): 416-421. DOI: 10.25258/ijddt.16.70s.40

Source of support: Nil.

Conflict of interest: Nil.

INTRODUCTION

Osteoarthritis of the knee (KOA) is the most prevalent form of degenerative joint disease and is a significant contributor to chronic pain, disability and poor quality of life for adults globally [1]. It features the progressive degeneration of the articular cartilage, subchondral bone remodeling, synovial inflammation, osteophyte formation, and progressive loss of joint function. With the growing burden of obesity and sedentary behaviors, aging populations and metabolic disorders, the global burden of knee OA has risen significantly, and is one of the largest musculoskeletal conditions impacting health systems around the world [2]. Although OA of the knee is multifactorial, there is a complex interplay between mechanical stress,

inflammatory mediators, genetic predisposition, metabolic abnormalities and ageing which contribute to the pathogenesis of this disorder [3]. Loss of the integrity of cartilage components, including type II collagen and proteoglycans, will cause loss of cartilage integrity and joint biomechanics. At the same time, inflammatory cytokines like interleukin-1 β , tumor necrosis factor- α and matrix metalloproteinases create cartilage destruction, synovial inflammation and progression of the pain [4]. The typical patient with knee OA will have chronic knee pain, morning pain lasting less than 30 minutes, reduced range of motion, crepitus, swelling, muscle weakness and functional limitations [5]. As the disease worsens, walking difficulty, diminished mobility, impaired daily activities and

diminished health related quality of life become more noticeable. The most widely accepted method of assessing the severity of the disease and decision making treatment is by radiographic evaluation based on the Kellgren–Lawrence grading system [6]. The main goal of knee OA management is to alleviate symptoms, improve joint function and slow disease progression. Patient education, weight loss, physical therapy, strengthening exercises, nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, intra-articular corticosteroids, hyaluronic acid injections and bracing are all part of the conservative treatment [7]. These treatments are effective in many patients at relieving symptoms, but do not generally regenerate damaged cartilage or change the course of the disease. Therefore, focus has turned to biological therapy, which has the potential to stimulate tissue repair, and to change the course of the disease [8].

Platelet-Rich Plasma (PRP) has proven to be one of the most promising regenerative therapeutic options for knee OA due to the concentration of platelet proteins that have bioactive growth factors, such as the platelet-derived growth factor, transforming growth factor- β , vascular endothelial growth factor, insulin-like growth factor, and epidermal growth factor [9]. These biological mediators are known to increase chondrocytes proliferation, synthesis of extracellular matrix, angiogenesis, and modulation of inflammatory pathways, and they may help to lessen cartilage degradation and facilitate tissue repair [10]. Different studies have shown that efficacy of intra-articular PRP injection is evident on significantly reducing pain, functional capacity and satisfaction, especially in patients with mild to moderate osteoarthritis [11]. PRP has been found to have longer relief of pain and functional results in some patients when compared to corticosteroid and hyaluronic acid [12]. However, there are numerous differences in how PRP is prepared, the concentrations of platelets, leukocytes, as well as injection protocols, and the length of time that passes between injections, which means a wide range of clinical results have been reported [13]. There have been several patient-related factors that were found to be potential predictors of treatment success after PRP therapy. Growing age, lower body mass index, early Kellgren–Lawrence grade, short duration of the disease, lack of severe varus deformity and preserved joint space have been the main factors that predict better clinical outcome following PRP injection [14]. On the other hand, advanced OA, obesity, significant cartilage damage, and chronic disease can affect the ability of PRP to regenerate, and can also decrease the therapeutic effect [15]. Although there is increasing evidence that PRP is effective in knee OA, there is still need for more institution-based studies to assess the effectiveness of the treatment in routine clinical practice and to identify factors affecting patient outcomes. This evidence can help to identify patients that will benefit from PRP therapy, guide the development of PRP protocols and help enhance long-term functional outcomes [16].

Objective

To evaluate the efficacy of platelet-rich plasma therapy in the treatment of knee osteoarthritis.

Methodology

This retrospective observational study was conducted at Liaquat University of Medical and Health Sciences from May 2020 to May 2026 and included 120 patients diagnosed with knee osteoarthritis who received intra-articular platelet-rich plasma (PRP) therapy. Patients included were those ≥ 40 years old with clinically and radiographically diagnosed primary knee OA based on the American College of Rheumatology classification criteria and Kellgren–Lawrence grades of I–III. Patients that qualified for the study were those who still had persistent knee pain after conservative management, who received a platelet-rich plasma injection and who had at least 6 months of follow-up. Patients were excluded from the study if they had Kellgren – Lawrence grade IV osteoarthritis, inflammatory arthritis, septic arthritis, had recently fractured their knee (in the previous three months), had an active joint infection, had a cancer, had a coagulation disorder, had severe thrombocytopenia (less than 50,000 platelets per micro litre), had had a knee arthroplasty recently (within three months), had received an intra-articular injection of steroid in the last three months or there were incomplete medical records.

Data Collection

After obtaining approval from the Institutional Ethical Review Committee, the patient information was obtained from electronic medical records, outpatient clinic notes, procedure records, radiographic reports and follow-up assessment forms on a standardized data-collection form. Demographic parameters were used as baseline parameters including age, sex, BMI, occupation, duration of symptoms on the affected knee, smoking behavior, diabetes mellitus, hypertension, and any previous interventions on the knee. Clinical measures that were performed included Kellgren–Lawrence radiographic grade, baseline Visual Analog Scale (VAS) pain score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Knee Injury and Osteoarthritis Outcome Score (KOOS), range of motion, body mass index, and varus deformity. Treatment-related variables were the technique of platelet rich plasma preparation, platelet concentration, number of platelet rich plasma injections administered, interval between injections, use of the ultrasound machine for the injection process, post-procedural rehabilitation protocol, analgesic use, and adverse events resulting from the procedure. The first outcome was treatment success, which included a clinically relevant decrease in VAS pain score and an improvement in WOMAC and KOOS scores at 6-months after PRP injections. Secondary outcomes were the improvement in knee range of motion, patient satisfaction, reduction of analgesics use, return to daily activity and treatment complications.

Statistical Analysis

Data were processed with SPSS 26.0. Data on continuous variables were reported as mean + SD and frequencies and percentages for categorical variables. The continuous variables were analysed using paired t-tests. Independent t-tests or Mann–Whitney U tests were employed to compare the treatment responders and non-responders as appropriate and Chi-square or Fisher's exact tests were run for categorical variables. The variables which were found to be statistically significant in univariate analysis was entered into a multivariable logistic regression model to find independent predictor(s) of successful response after PRP therapy. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and a p-value ≤ 0.05 was considered statistically significant.

Results

The mean age of patients was 58.4 ± 8.7 years, with females forming the majority (72, 60.0%). Mean BMI was 29.2 ± 4.1 kg/m², and symptom duration was 24.6 ± 11.3 months. Kellgren–Lawrence Grade II was present in 69 (57.5%) and Grade III in 51 (42.5%) patients. Baseline pain and disability were notable, with VAS 7.8 ± 1.1 , WOMAC 58.6 ± 10.7 , and KOOS 48.3 ± 11.5 .

Table 1: Baseline Demographic and Clinical Characteristics of Patients with Knee Osteoarthritis Receiving PRP Therapy (N = 120)

Variable	n (%) / Mean $\pm$ SD
Age (years)	58.4 ± 8.7
Male	48 (40.0)
Female	72 (60.0)
Body mass index (kg/m ²)	29.2 ± 4.1
Symptom duration (months)	24.6 ± 11.3
Diabetes mellitus	34 (28.3)
Hypertension	47 (39.2)
Bilateral knee osteoarthritis	52 (43.3)
Kellgren–Lawrence Grade II	69 (57.5)
Kellgren–Lawrence Grade III	51 (42.5)
Baseline VAS pain score	7.8 ± 1.1
Baseline WOMAC score	58.6 ± 10.7
Baseline KOOS score	48.3 ± 11.5

PRP therapy showed significant improvement at six months. VAS pain score decreased from 7.8 ± 1.1 to 3.6 ± 1.3 , WOMAC improved from 58.6 ± 10.7 to 31.2 ± 9.4 , and KOOS increased from 48.3 ± 11.5 to 72.5 ± 10.8 , all with $p < 0.001$. Knee flexion improved from $111.4 \pm 10.2^\circ$ to $122.8 \pm 8.6^\circ$, while analgesic use reduced from 93 (77.5%) to 35 (29.2%).

Table 2: Clinical Outcomes Before and Six Months After Platelet-Rich Plasma Therapy

Variable	Baseline	Six Months	p-value
VAS pain score	7.8 ± 1.1	3.6 ± 1.3	<0.001
WOMAC score	58.6 ± 10.7	31.2 ± 9.4	<0.001

KOOS score	48.3 ± 11.5	72.5 ± 10.8	<0.001
Knee flexion (degrees)	111.4 ± 10.2	122.8 ± 8.6	<0.001
Analgesic use (patients)	93 (77.5)	35 (29.2)	<0.001
Patient satisfaction (Good/Excellent)	—	98 (81.7)	—

Responders were younger than non-responders (56.9 ± 8.2 vs. 65.1 ± 7.4 years; $p < 0.001$), had lower BMI (28.5 ± 3.8 vs. 32.1 ± 4.3 kg/m²; $p = 0.001$), and shorter symptom duration (21.8 ± 9.5 vs. 37.2 ± 12.4 months; $p < 0.001$). Non-response was more common in diabetics and Grade III osteoarthritis. WOMAC improvement was much greater among responders (30.8 ± 8.7 vs. 11.6 ± 6.5 ; $p < 0.001$).

Table 3: Comparison Between Responders and Non-Responders to PRP Therapy

Variable	Responders (n=98)	Non-Responders (n=22)	p-value
Age (years), Mean $\pm$ SD	56.9 ± 8.2	65.1 ± 7.4	<0.001
Body mass index (kg/m ²), Mean $\pm$ SD	28.5 ± 3.8	32.1 ± 4.3	0.001
Symptom duration (months), Mean $\pm$ SD	21.8 ± 9.5	37.2 ± 12.4	<0.001
Diabetes mellitus, n (%)	22 (22.4)	12 (54.5)	0.003
Kellgren–Lawrence Grade III, n (%)	34 (34.7)	17 (77.3)	<0.001
Baseline VAS score	7.6 ± 1.0	8.5 ± 1.2	0.002
Improvement in WOMAC score	30.8 ± 8.7	11.6 ± 6.5	<0.001

PRP therapy was generally safe. The most common adverse event was transient injection-site pain in 18 (15.0%), followed by mild joint swelling in 12 (10.0%), knee stiffness in 9 (7.5%), transient warmth in 6 (5.0%), and local bruising in 5 (4.2%). No infection or allergic reaction was reported, while 7 (5.8%) patients required additional intervention.

Table 4: Treatment-Related Adverse Events

Variable	n (%)
Transient injection-site pain	18 (15.0)
Mild joint swelling	12 (10.0)
Knee stiffness	9 (7.5)

Local bruising	5 (4.2)
Transient warmth	6 (5.0)
Infection	0 (0.0)
Allergic reaction	0 (0.0)
Additional intervention required	7 (5.8)

Multivariable analysis showed Kellgren–Lawrence Grade II was the strongest predictor of successful PRP response (AOR=5.02, 95% CI: 1.81–13.89; $p=0.002$). Symptom duration <24 months, age <60 years, BMI <30 kg/m², and absence of diabetes mellitus were also significant independent predictors of better treatment response.

Table 5: Multivariable Logistic Regression Analysis of Predictors of Successful Response to PRP Therapy

Predictor	Adjusted OR	95% CI	p-value
Age <60 years	3.94	1.42–10.91	0.008
BMI <30 kg/m ²	3.46	1.29–9.28	0.014
Symptom duration <24 months	4.18	1.56–11.21	0.004
Kellgren–Lawrence Grade II	5.02	1.81–13.89	0.002
Absence of diabetes mellitus	2.89	1.07–7.82	0.036

Discussion

This retrospective study evaluated platelet-rich plasma (PRP) therapy in 120 patients suffering from knee osteoarthritis, and showed that PRP therapy relieved pain, improved function, increased knee mobility and patients satisfaction. The results demonstrated that PRP therapy was effective in most of the patients, and the absence of diabetes mellitus, younger age, shorter duration of symptoms, lower radiographic severity of disease, and lower BMI were independent positive predictive factors of the response to PRP therapy. The findings are consistent with the recent emerging evidence of PRP's effectiveness as a biological treatment for patients with mild to moderate knee OA. This study population consisted of 60.0% female patients with a mean age of 58.4 ± 8.7 years. The mean BMI was 29.2 ± 4.1 kg/m², and the average number of months patients had experienced symptoms was 24.6 ± 11.3 months. Diabetes mellitus and hypertension were seen in 28.3% and 39.2% of the patients, respectively and bilateral knee involvement was seen in 43.3%. The majority of patients (57.5%) had Kellgren–Lawrence (K/L) Grade II osteoarthritis with the rest having Grade III disease. At baseline, there was significant pain and disability noted with mean VAS, WOMAC and KOOS scores of 7.8 ± 1.1 , 58.6 ± 10.7 and 48.3 ± 11.5 , respectively. In line with this, previous studies have also found that knee osteoarthritis is more prevalent among older individuals (mainly females) and is more frequently linked to obesity, metabolic disorders and

significant pain and functional deficits [17]. After PRP treatment, there was an improvement in all functional outcome measures. Mean VAS pain score decreased from 7.8 ± 1.1 to 3.6 ± 1.3 , WOMAC score improved from 58.6 ± 10.7 to 31.2 ± 9.4 , and KOOS score increased from 48.3 ± 11.5 to 72.5 ± 10.8 . There was also a significant improvement in knee flexion from $111.4 \pm 10.2^\circ$ to $122.8 \pm 8.6^\circ$, and a significant decrease in the use of analgesics, from 77.5% to 29.2%. In addition, 81.7% said that they were very satisfied with the treatment. Previous studies have also shown that PRP injections can cause substantial pain reduction, functional improvements in the knee, increased mobility, and decreased need for analgesics, especially in the first 6–12 months after the procedure [18]. Several clinically relevant factors were associated with treatment effectiveness: comparison of responders and non-responders revealed. Responders were significantly younger (56.9 ± 8.2 vs. 65.1 ± 7.4 years), had lower BMI (28.5 ± 3.8 vs. 32.1 ± 4.3 kg/m²), shorter symptom duration (21.8 ± 9.5 vs. 37.2 ± 12.4 months), lower baseline pain scores, and substantially greater improvement in WOMAC scores. Non-responders significantly more likely to have diabetes mellitus and Kellgren–Lawrence Grade III osteoarthritis. In similar studies, younger patients and patients with less advanced structural changes and less body weight have also had better clinical outcomes after PRP therapy due to their higher regenerative capacity and less irreversible cartilage damage. The safety aspect of PRP therapy was very good in the current study. Transient pain at the injection site, mild swelling, stiffness of the knees, bruising at the injection site, transient warmth were the only mild adverse events observed and did not persist. Of particular note, none of the patients developed a joint infection or allergic reaction, and a small fraction needed further intervention. Moreover, previous studies have shown that PRP treatment is well tolerated with minimal immunological reaction and infectious complications as it is based on autologous blood products [19]. Multivariable logistic regression confirmed that Kellgren–Lawrence Grade II osteoarthritis, symptom duration < 24 months, age < 60 years, BMI below 30 kg/m² and the absence of diabetes mellitus were the strongest independent factors associated with successful treatment. The results indicate that the patients with early-stage disease gain the most from PRP therapy before a late stage of irreversible cartilage damage occurs. Consistent with previous studies, there have also been studies showing that early treatment with PRP yields more positive results in terms of pain and function when compared to treatment given when the condition of osteoarthritis is more advanced [20]. The adverse association of obesity found in this study is of clinical significance.

Limitations

This study has several limitations. First, its retrospective design may have introduced selection and information bias because the analysis relied on previously documented medical records rather than standardized prospective assessments. Second, the study was conducted at a single

center with a sample size of 120 patients, which may limit the generalizability of the findings to other populations. Variations in platelet-rich plasma preparation techniques, platelet concentration, leukocyte content, injection protocols, rehabilitation compliance, and adjunctive therapies could not be completely standardized and may have influenced treatment outcomes. Radiographic progression of osteoarthritis and structural cartilage regeneration were not evaluated using advanced imaging modalities such as magnetic resonance imaging.

Conclusion

Platelet-rich plasma therapy is a safe and effective treatment for patients with mild-to-moderate knee osteoarthritis, resulting in significant reductions in pain, improved knee function, enhanced range of motion, decreased analgesic use, and high patient satisfaction. Treatment-related complications were infrequent and limited to mild transient local reactions. Better clinical outcomes were independently associated with younger age, lower body mass index, shorter symptom duration, Kellgren–Lawrence Grade II osteoarthritis, and absence of diabetes mellitus. Early administration of PRP in appropriately selected patients may optimize functional recovery, delay disease progression, and reduce the need for more invasive surgical interventions.

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