

Original Article

## IMPROVING FUNCTION IN KNEE OSTEOARTHRITIS WITH PLATELET-RICH PLASMA THERAPY: A FUNCTIONAL OUTCOME EVALUATION

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### ABSTRACT

**Objective:** Osteoarthritis is a chronic and degenerative disease that commonly affects the knee joint. The effectiveness of using PRP injections in the knee joint for managing osteoarthritis symptoms, which include pain, disability, deformity, and reduced quality of life, is being studied.

**Methods:** This is a two-year prospective study conducted between January 2019 and December 2020 at the Government General Hospital in Kurnool. The study focused on the management of osteoarthritis knee in 60 patients who received 3 ml autologous intra-articular platelet-rich plasma injections, with their pain, joint stiffness, and joint mobility being evaluated using the WOMAC score. The majority of participants were middle-aged women with grade KL 2 and 3 osteoarthritis knee.

**Results:** The study included 60 cases with KL grade II (28 cases) and grade III (32 cases) of knee osteoarthritis. The pretreatment WOMAC score for KL grade II was 56.11±6.36, which showed significant improvement to 50.76±7.6 (p=0.000) at 2 w, 50.76±7.6 (p=0.001) at one month, 26.97±3.47 (p=0.001) at 3 mo, and 22.11±2.99 (p=0.001) at 6-month follow-up. Similarly, for KL grade III, the pretreatment WOMAC score was 59.21±5.63, which improved significantly to 55.76±7.6 (p=0.000) at 2 w, 48.79±5.42 (p=0.001) at one month, 36.46±4.36 (p=0.001) at 3 mo, and 32.12±2.66 (p=0.001) at 6-month follow-up.

**Conclusion:** PRP injection is a safe and cost-effective alternative for treating knee osteoarthritis, leading to pain relief and an enhanced quality of life, especially in the initial stages. Not only does PRP provide immediate relief, but it also results in gradual improvements over time. Overall, PRP is a viable option for individuals seeking alternative treatments for knee osteoarthritis.

**Keywords:** Platelet-rich plasma, Osteoarthritis, WOMAC score

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### INTRODUCTION

Osteoarthritis (OA) is a prevalent type of arthritis that can result in chronic disability, particularly when it affects the knee joint, and is more common among people aged 60 and above. The condition is characterized by changes in cells and tissues, leading to damage to the articular cartilage and subchondral bone and the formation of osteophytes and subchondral cysts. Common symptoms of OA include limited range of motion, joint pain, tenderness, crepitus, and occasional joint swelling without systemic effects. X-ray is a commonly used diagnostic method to detect OA, with findings such as tibiofemoral osteophytes and joint space greater than 3 mm. Some OA patterns may involve bilateral participation, mainly on the right side of the tibiofemoral joint and the medial side of the knee. OA results from an imbalance between the body's degradative and reparative processes, leading to secondary inflammatory changes in the synovium and articular cartilage [1, 2].

The primary goals of treating osteoarthritis are to relieve pain, improve joint mobility, prevent or correct deformity, and slow down disease progression. While NSAIDs and COX2 inhibitors can provide symptomatic relief, they don't have proven disease-modifying potential, and the relief is only temporary. Oral steroids can reduce inflammation and pain but are not recommended for long-term use due to side effects. Intra-articular injections of corticosteroids and visco-elastic supplementations have been tried, but the American Academy of Orthopedic Surgeons guidelines suggest that the evidence is inconclusive, and hyaluronic acid viscosupplementation is not recommended for patients with osteoarthritis of the knee [3-5].

Growth factors like PDGF and TGF- $\beta$  can activate tissue healing and have the potential to regenerate bone and cartilage, which can change the joint environment and promote healing. However, using genetically engineered growth factors is expensive and limits their

clinical use. Autologous PRP, which contains a high concentration of these growth factors, can effectively suppress inflammatory mediators and promote healing and regeneration in synovium and cartilage tissue. Several clinical studies have shown promising results with PRP therapy [6], including improvement in pain scores and functional outcomes. Therefore, this study aimed to evaluate the efficacy and functional outcome of intra-articular injection of autologous platelet-rich plasma therapy in managing knee osteoarthritis.

### MATERIALS AND METHODS

In this study, 60 patients with symptomatic knee osteoarthritis were treated with intra-articular autologous PRP injections from January 2019 to December 2020. Patients over 45 y of age with knee pain and joint tenderness having knee osteoarthritis of Kellgren-Lawrence classification [7] grade II and III on weight-bearing x-rays were included in the study. Patients with severe joint deformity, inflammatory or rheumatoid arthritis, hematological diseases, infections, or immunosuppressive or anticoagulant therapy were excluded. PRP was prepared in the outpatient department by centrifuging the patient's venous blood. The lower third PRP was isolated and injected into the involved knee joint using an 18 gauge needle. Patients were prescribed ice fomentation, paracetamol, and range of motion exercises. The patients were evaluated using the WOMAC score [8], and statistical analysis was performed using the ANOVA test, paired t-test, chi-square test, and simple regression analysis. The study was approved by the institutional ethical review committee (IEC-KMC-GGH/9/1/2019), and written informed consent was obtained from all participants.

### RESULTS

The study included 60 patients with knee osteoarthritis who were treated with autologous platelet-rich plasma (PRP) injections. Out of the 60 patients, 44 (74%) were females and 16 (26%) were males.

The average age of the patients was 55, with a range of 45 to 65 y. There were 15 patients (25.0%) in the age group of 45 to 50 y, 25 patients (42%) in the age group of 51 to 60 y, and 20 patients (33%) who were more than 60 y old.

Out of the 60 patients, 48 (80.0%) had a body mass index (BMI) greater than 25 kg/m<sup>2</sup>. 28 (46.66%) patients had K-L Grade III osteoarthritis, and 32 (53.33%) had K-L Grade II osteoarthritis.

For patients with K-L grade II osteoarthritis, the mean WOMAC score [8] before treatment was 56.11±6.36, which improved to

50.76±7.6 (p=0.000) at 2 w, to 31.97±4.51 (p=0.001) at 1 mo, to 26.97±3.47 (p=0.001) at 3 mo, and to 22.11±2.99 (p=0.001) at the final follow-up of 6 mo. For patients with K-L grade III osteoarthritis, the mean WOMAC score before treatment was 59.21±5.63, which improved to 55.76±7.6 (p=0.000) at 2 w, to 48.79±5.42 (p=0.001) at 1 mo, to 36.46±4.36 (p=0.001) at 3 mo, and to 32.12±2.66 (p=0.001) at the final follow-up of 6 mo. All patients reported being extremely satisfied with the treatment. There were no adverse reactions or serious complications observed after the PRP injections in any patient.

**Table 1: Mean WOMAC score [8] at different time interval**

Time interval	Pre-treatment	15 d	1month	3months	6 mo
K-L grade II	56.11±6.36	50.76±7.6	31.97±4.51	26.97±3.47	22.11±2.99
K-L grade III	59.21±5.63	55.76±7.6	48.79±5.42	36.46±4.36	32.12±2.66
P value		0.000	0.001	0.001	0.001

## DISCUSSION

To explain the development of osteoarthritis, a mix of mechanical, cellular, and biochemical processes occur, which disturb the balance between pro-inflammatory and anti-inflammatory cytokines. These disturbances cause alterations in the articular cartilage's composition and mechanical characteristics, eventually leading to proteolytic enzyme activation and cartilage destruction [9-11]. Various treatment options, such as non-surgical and surgical methods, are available for knee osteoarthritis. However, recent therapies aim to address these cytokine imbalances through the use of biologics [12-14].

Platelet-rich plasma (PRP) derived from the patient's blood contains a rich concentration of growth factors that can promote the healing process and increase cell proliferation. These growth factors, such as TGF- $\beta$ , PDGF, VEGF, IGF, FGF, and HGF can regulate the chondrocyte phenotype, which is essential in the development of osteoarthritis. Moreover, PRP has been found to inhibit the breakdown of articular cartilage, as evidenced by Goldring's study [15].

Autologous platelet-rich plasma (PRP) is rich in growth factors, including transforming growth factor- $\beta$  (TGF- $\beta$ ), platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), insulin-like growth factor (IGF), fibroblast growth factor (FGF), and hepatocyte growth factor (HGF). These growth factors play a crucial role in accelerating the healing process and cell proliferation by regulating the expression of the chondrocyte phenotype. TGF- $\beta$  specifically increases the expression of chondrocyte phenotype and stimulates the differentiation of mesenchymal stem cells while suppressing the synthesis of cartilage glycoprotein and inflammatory mediator IL-1 [16, 17]. PDGF helps in maintaining the cartilage phenotype by increasing the synthesis of glycoprotein, and VEGF induces cartilage, while IGF stimulates the synthesis of glycoprotein and degrades its catabolism [18, 19]. Additionally, FGF and HGF are growth factors that function independently or in cooperation for the regeneration of articular cartilage metabolism [20]. Overall, the growth factors present in PRP aid in the regeneration of cartilage and prevent the degenerative process.

We conducted a study on 60 patients with knee osteoarthritis, ages around 55, with KL grade II and III, to assess the effectiveness of autologous PRP injections. The patients' healing of cartilage and inflammation reduction was evaluated indirectly by measuring improvements in pain, function, and quality of life using the WOMAC score. We found a significant improvement in WOMAC scores at the 6-month follow-up for both grade II and grade III OA knee. Our patient profile and demographics were similar to other reported studies, and we did not observe any adverse reactions or serious complications in our patients.

The overall mean WOMAC score at the final follow-up was 30, with no significant difference between grade II and grade III. Several other studies, such as Rahimzadeh *et al.* [21], Vamshi *et al.* [22], and Güvendi *et al.* [23], have reported similar or slightly different mean scores. However, the results consistently demonstrate the efficacy and safety of PRP injections.

In our study, we only included patients with grade II and III knee osteoarthritis who received intra-articular autologous PRP injection therapy, which is consistent with most other studies except for those by Filardo *et al.* [24] and Meheux *et al.* [25], who included all grades of knee osteoarthritis for PRP injection. This is because PRP injections are more effective in the early stages of osteoarthritis and do not provide significant benefits in advanced stages. We observed better improvement in WOMAC score in patients with grade II osteoarthritis compared to those with grade III, which confirms that PRP is more effective in early-stage osteoarthritis.

A study focusing on platelet-rich plasma (PRP) is a novel and reasonable research avenue as it presents an innovative and potentially beneficial treatment method in sports medicine and orthopedics. While there is some supporting evidence of its efficacy, the exact mechanisms and optimal protocols of PRP are not yet fully comprehended. Thus, additional research is required to further investigate and determine its safety and effectiveness, particularly in different patient populations and clinical contexts.

## LIMITATIONS

The scope of our study is constrained due to a limited duration of observation, a small number of participants, and the absence of a comparative group.

## CONCLUSION

Autologous intra-articular PRP injection therapy is a suitable option for the treatment of early osteoarthritis, particularly in relatively younger patients. This therapy is a safe, cost-effective, and minimally invasive alternative to manage osteoarthritis of the knee. It not only provides significant pain relief but also enhances the patient's quality of life, resulting in a high rate of satisfaction. The benefits of PRP therapy are immediate and continue to increase over time.

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## AUTHORS CONTRIBUTIONS

All authors participated in every aspect of the study, including conceptualization, design, data collection, data analysis, interpretation, manuscript preparation, critical review, and approval of the final version to be published.

## CONFLICTS OF INTERESTS

The authors confirm that they have no conflicts of interest related to this research, authorship, and publication of this article

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