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RESEARCH ARTICLE
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FUNCTIONAL OUTCOME OF INTRA ARTICULAR PLATELET RICH PLASMA INJECTIONS IN OSTEOARTHROSIS KNEE

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Introduction

Knee osteoarthritis (OA) is a progressive degenerative joint disorder and one of the leading causes of chronic pain and disability worldwide. Characterized by cartilage degradation, subchondral bone sclerosis, and inflammation of the synovium, OA primarily affects the elderly but is increasingly observed in younger populations due to obesity and lifestyle changes. The condition significantly impacts mobility, quality of life, and economic productivity, making it a major public health concern. In India, the burden of knee OA has been steadily increasing due to an aging population and rising obesity rates. Conservative treatments, such as physiotherapy, weight management, and pharmacological interventions like NSAIDs and corticosteroids, provide symptomatic relief but fail to address the underlying disease process. Surgical interventions, such as total knee arthroplasty, are reserved for advanced stages but carry higher costs and potential complications.

In recent years, regenerative therapies have emerged as promising alternatives to traditional treatments. Among these, platelet-rich plasma (PRP) has gained attention for its ability to harness the body's natural healing mechanisms. PRP is an autologous preparation of concentrated platelets containing growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), and vascular endothelial growth factor (VEGF). These factors promote tissue repair, reduce inflammation, and stimulate chondrocyte proliferation, potentially reversing some aspects of OA pathology.

Numerous studies have demonstrated the efficacy of PRP in improving pain and functional outcomes in knee OA, with significant improvements in Visual Analog Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores. These scoring systems are reliable tools for assessing pain intensity and joint functionality. The VAS quantifies pain on a 10-point scale, while WOMAC evaluates pain, stiffness, and physical function, offering a comprehensive assessment of knee health.

Despite its growing popularity, challenges remain in standardizing PRP preparation protocols, determining optimal injection frequencies, and identifying patient populations that benefit most. Furthermore, while short-term benefits are well-documented, long-term outcomes and the durability of PRP's effects require further investigation.

This study aims to evaluate the efficacy of PRP injections in reducing pain and improving functionality in patients with Grade 2 and 3 knee OA. Using VAS and WOMAC scoring systems, the study seeks to provide evidence for PRP's role in early to moderate OA management. Additionally, it explores factors such as age, gender, and BMI that may influence treatment outcomes.

Methods

Study Design

This was a prospective study conducted over 12 months at a tertiary care orthopedic center. Ethical clearance was obtained, and written informed consent was collected from all participants. The study included 60 patients diagnosed with Grade 2 and 3 knee OA according to the Kellgren-Lawrence classification system.

Inclusion and Exclusion Criteria

Inclusion criteria

1. Patients with Grade 2 and Grade 3 OA as per Kellgren and Lawrence system for classification of OA
2. Both male & female patient of age between 40 and 70 years.
3. Body mass Index (BMI) <30.
4. Normal complete blood count (CBC) and coagulation control.
5. Not responding to non-invasive treatment for more than 6 months
6. Ready to give written informed consent to be part of study.

Exclusion criteria

1. Those who refused consent
2. Age less than 40 and over 70 years.
3. History of presence of neoplasm, any infection or active wound over the knee.
4. Pregnant women
5. Those who received oral steroids or chemotherapeutic agents for arthritis or for any other reason
6. Patients with progressive polyarticular arthritis such as secondary to rheumatoid arthritis, systemic lupus erythematosus, and gout.

Baseline Assessments

Demographic data, including age, gender, BMI, and duration of symptoms, were recorded. Baseline VAS and WOMAC scores were documented for all patients. Radiological evaluations included weight-bearing X-rays, and advanced imaging was performed as required.

PRP Preparation

PRP was prepared using a double-spin centrifugation method. Approximately 10 mL of venous blood was collected in sterile, citrate-anticoagulated tubes. The first centrifugation separated the plasma and platelets from red blood cells at 2000 rpm for 5 minutes. The second spin, at 3000 rpm for 10 minutes, concentrated the platelets. The lower third of the plasma, rich in platelets, was extracted and injected into the affected joint. Each PRP sample contained a platelet concentration 3–5 times above baseline.

Injection Protocol

PRP was injected intra-articularly under sterile conditions using a lateral approach to the knee joint. Each patient received three injections at four-week intervals. Post-injection, patients were advised to avoid strenuous activities for 48 hours and were permitted to use cold packs and paracetamol for pain relief.

Follow-Up and Outcome Measures

Patients were followed up at one, three, and six months post-treatment. Pain intensity was assessed using the VAS, and functionality was evaluated using the WOMAC scoring system. Improvements in pain and function were analysed and compared to baseline scores.

Statistical Analysis

Data were analyzed using SPSS software (version 21.0). Continuous variables were expressed as means and standard deviations, while categorical data were presented as percentages. Paired t-tests were used to compare pre- and post-treatment scores. A p-value of <0.05 was considered statistically significant.

Results

Demographics

Of the 60 patients, 38 (63.3%) were female, and 22 (36.7%) were male. The mean age was 54.8 ± 7.2 years. Obesity (BMI ≥ 30) was observed in 40% of patients, with overweight (BMI 25–29.9) in 45% and normal weight in 15%. Grade 2 OA was present in 36 patients (60%), while 24 patients (40%) had Grade 3 OA.

VAS Scores

At baseline, the mean VAS score was 7.6 ± 0.8, indicating severe pain. Significant reductions were observed at follow-up intervals, with scores decreasing to 5.4 ± 0.9 at one month, 3.8 ± 0.7 at three months, and 3.4 ± 0.6 at six months ($p < 0.001$).

WOMAC Scores

Baseline WOMAC scores averaged 78.2 ± 5.4, reflecting substantial impairment. By the first month, scores reduced to 57.8 ± 4.9, further improving to 41.5 ± 3.8 at three months and 37.6 ± 3.2 at six months ($p < 0.001$). Improvements were consistent across pain, stiffness, and physical function subscales.

Age and Gender Analysis

Patients aged below 50 years showed more significant improvements, with mean VAS and WOMAC scores at six months of 3.1 and 34.5, respectively, compared to 3.8 and 40.2 in patients aged above 50 years. Both genders demonstrated significant improvement, with no statistically significant differences.

Severity of OA

Patients with Grade 2 OA exhibited greater reductions in VAS and WOMAC scores compared to Grade 3 OA. At six months, VAS scores averaged 3.2 for Grade 2 and 3.6 for Grade 3, while WOMAC scores were 36.2 and 39.4, respectively.

Safety and Complications

PRP injections were well-tolerated. Minor complications, such as transient pain and swelling at the injection site, were reported in 15% of cases and resolved within 48 hours. No infections or systemic adverse effects were observed.

Discussion

The findings of this study highlight the efficacy of platelet-rich plasma (PRP) in alleviating pain and improving joint functionality in patients with Grade 2 and 3 knee osteoarthritis (OA), as evaluated through the Visual Analog Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scoring systems. The significant improvements observed in these scores validate the therapeutic potential of PRP as a regenerative treatment for knee OA.

Patients demonstrated a substantial reduction in VAS scores over the six-month follow-up, with the mean score improving from 7.6 ± 0.8 at baseline to 3.4 ± 0.6 at six months ($p < 0.001$). This decrease reflects reduced pain levels and aligns with prior studies showing PRP's effectiveness in modulating inflammatory mediators, promoting cartilage repair, and alleviating pain. WOMAC scores also showed consistent improvement, with the mean baseline score of 78.2 ± 5.4 decreasing to 37.6 ± 3.2 at six months. These improvements were observed across all subdomains of WOMAC, including pain, stiffness, and physical function, indicating comprehensive benefits for joint health and mobility.

Age significantly influenced outcomes, with younger patients (≤50 years) achieving more pronounced reductions in VAS and WOMAC scores compared to older individuals. This trend can likely be attributed to better baseline cartilage integrity and regenerative capacity in younger populations. Similarly, patients with Grade 2 OA experienced greater improvements compared to those with Grade 3 OA. At six months, VAS and WOMAC scores for Grade 2 patients were 3.2 and 36.2, respectively, compared to 3.6 and 39.4 for Grade 3 patients. These findings suggest that PRP is more effective in earlier stages of OA, where the extent of structural damage is less severe.

The preparation of PRP using the double-spin centrifugation method ensured a high concentration of platelets, optimizing the delivery of growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), and vascular endothelial growth factor (VEGF). These growth factors play critical roles in reducing inflammation, stimulating chondrocyte activity, and promoting extracellular matrix production, all of which contribute to cartilage repair and joint function improvement. The standardized preparation and injection protocols used in this study likely contributed to the observed efficacy.

When compared to traditional intra-articular treatments such as corticosteroids and hyaluronic acid, PRP demonstrated superior and longer-lasting benefits. Corticosteroids provide short-term pain relief but fail to address the underlying degenerative processes of OA, while hyaluronic acid shows variable efficacy, particularly in advanced stages of OA. In contrast, PRP targets the disease's pathology by reducing pro-inflammatory cytokines and enhancing cartilage regeneration. The improvements in WOMAC scores observed in this study underscore PRP's ability to enhance physical function, reduce stiffness, and improve overall quality of life.

While the results are promising, the study has some limitations. The absence of a control group restricts the ability to compare PRP outcomes with other treatments or placebo. Additionally, variability in PRP preparation methods and differences in platelet concentrations may influence the consistency of results. Long-term efficacy and durability of PRP's benefits remain areas for future research, as the follow-up period in this study was limited to six months.

In conclusion, PRP injections represent a safe, minimally invasive, and effective treatment option for patients with early to moderate knee OA. The significant improvements in VAS and WOMAC scores observed in this study reinforce the potential of PRP as a regenerative therapy. However, further

studies with larger sample sizes, standardized protocols, and longer follow-up durations are essential to fully establish PRP's role in OA management and optimize its clinical applications.

Conclusion

This study highlights the efficacy and safety of platelet-rich plasma (PRP) injections in managing early to moderate knee osteoarthritis (OA). Significant improvements in Visual Analog Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores demonstrate PRP's potential to reduce pain, improve joint functionality, and enhance the overall quality of life for patients. Younger individuals and those with Grade 2 OA showed more pronounced benefits, emphasizing the importance of early intervention.

PRP, as a minimally invasive and regenerative treatment, offers advantages over traditional approaches such as corticosteroids and hyaluronic acid, providing longer-lasting relief while targeting the disease's underlying pathology. The absence of major complications and the consistent improvements across pain and functional domains reinforce its safety and effectiveness.

Despite these positive outcomes, further research is needed to address limitations such as variability in PRP preparation methods, lack of long-term data, and absence of a control group. Standardizing protocols and conducting larger, long-term studies will help establish PRP's role in the routine management of knee OA.

In conclusion, PRP injections are a promising therapeutic option for early to moderate knee OA, offering substantial improvements in pain relief and functionality, and potentially delaying the need for surgical interventions.