

REGENERATIVE OUTCOMES OF INTRA-ARTICULAR STEROID AND SEQUENTIAL PRP INJECTIONS FOR PAIN MANAGEMENT IN KNEE OSTEOARTHRITIS PATIENTS

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DOI: <https://doi.org/10.5281/zenodo.23181083>

Keywords

Knee osteoarthritis; intra-articular corticosteroid; platelet-rich plasma; pain relief; functional mobility; Western Ontario and McMaster Universities Osteoarthritis Index; Visual Analog Scale; regenerative medicine; Interventional pain management

Article History

Received: 28 June 2026

Accepted: 19 September 2026

Published: 06 October 2026

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ABSTRACT

Background: Knee osteoarthritis is a common chronic musculoskeletal disorder characterized by persistent pain, functional limitation, and reduced mobility. Intra-articular corticosteroid injections are widely used for short-term symptom relief, while platelet-rich plasma has emerged as a minimally invasive biological treatment intended to provide more sustained clinical improvement. However, evidence regarding the clinical outcomes of sequential platelet-rich plasma following corticosteroid treatment in routine clinical practice remains limited.

Objective: To compare the post-treatment pain relief, functional recovery, duration of pain relief, and local safety outcomes of corticosteroid monotherapy with corticosteroid followed by sequential platelet-rich plasma injections in patients with symptomatic knee osteoarthritis.

Methods: A retrospective comparative cohort study was conducted using clinical records from two pain-management settings in Lower Dir, Khyber Pakhtunkhwa, Pakistan, covering the study period from January 2025 to January 2026. A total of 56 eligible patients with symptomatic knee osteoarthritis were included, with 28 patients receiving intra-articular corticosteroid monotherapy and 28 receiving corticosteroid followed by three sequential platelet-rich plasma injections at approximately three-week intervals. Patients had symptomatic Kellgren–Lawrence Grade I–III knee osteoarthritis. Demographic and clinical characteristics, pain outcomes, functional limitations, duration of pain relief, and post-injection local adverse effects were evaluated. Pain was assessed using the Visual Analog Scale, while functional limitations were assessed using selected Western Ontario and McMaster Universities Osteoarthritis Index activities. Between-group categorical outcomes were assessed using the Chi-square or Fisher–Freeman–Halton test, while non-parametric continuous outcomes were compared using the Mann–Whitney U test, with statistical significance defined as $p < 0.05$.

Results: The study showed a slight female predominance (57.1%), with 50.0% of patients being overweight and 53.6% classified as overweight or obese. Most patients had Kellgren–Lawrence Grade II or III osteoarthritis,

with 42.9% in Grade III and 41.1% in Grade II. Symptoms were chronic in most patients, with 66.1% reporting symptoms for more than three years, and 80.4% had bilateral knee involvement. Baseline characteristics were comparable between the treatment groups, with no significant differences observed (all $p > 0.05$).

Both groups showed significant improvement in pain after treatment; however, corticosteroid followed by sequential PRP produced significantly better outcomes for pain at rest ($p = 0.0018$), walking pain ($p < 0.001$), night pain ($p = 0.032$), rising from a chair ($p < 0.001$), walking ($p = 0.0026$), and stair climbing/descending ($p < 0.001$). The sequential PRP group also reported longer-lasting pain relief, with 85.7% experiencing relief for at least three months and 46.4% beyond six months, whereas 92.9% of the corticosteroid-only group reported relief lasting less than one month (significant ($p = 1.000$)).

Both treatments demonstrated a favorable safety profile. No adverse effects were reported by 82.1% of the corticosteroid-only group and 85.7% of the sequential PRP group, while the remaining patients experienced only mild pain or swelling. The difference in adverse effects between groups was not statistically ($p = 1.000$).

Conclusion: In this retrospective cohort, corticosteroid followed by sequential platelet-rich plasma was associated with greater post-treatment improvement in pain and everyday functional mobility and a substantially longer duration of perceived pain relief than corticosteroid monotherapy, without an observed increase in local adverse effects. These findings support further prospective, adequately powered randomized studies to evaluate the effectiveness, durability, and standardized clinical application of sequential platelet-rich plasma therapy in knee osteoarthritis.

Introduction

Knee osteoarthritis (KOA) is a chronic musculoskeletal disorder characterized by pain, stiffness, restricted mobility, and difficulty performing everyday activities. Although historically described as a consequence of mechanical wear, it is now understood as a multifactorial disease involving interactions between biomechanical loading, inflammation, metabolic disturbance, and cellular ageing. Pathological changes extend beyond articular cartilage to involve subchondral bone, the synovium, menisci, ligaments, and surrounding muscles. This whole-joint perspective explains why structural degeneration and symptom severity vary between individuals and why treatment directed at a single pathological process may provide incomplete relief. Effective management therefore requires attention to both pain and functional disability. (1)

The burden of KOA is influenced by population ageing, excess body weight, previous joint injury, and differences in physical demands. Increasing

body mass can contribute to disease through mechanical loading and metabolic pathways, while impaired muscle strength may further compromise joint stability and movement. Studies examining obesity-related disease burden and dynapenic abdominal obesity emphasize the interaction between body composition and physical capacity. These factors are relevant when comparing treatment outcomes because patients with similar radiographic findings may differ substantially in mobility, symptom duration, and rehabilitation potential. Evaluating injection therapies consequently requires consideration of the clinical characteristics of the treated population. (2,3,4)

Beyond localized discomfort, KOA can interfere with walking, stair negotiation, rising from a chair, sleep, and independent participation in daily life. Patients frequently adopt compensatory movement patterns, including slower walking and shorter strides, to reduce discomfort during weight bearing. Such

adaptations may preserve immediate mobility while contributing to reduced activity and persistent functional limitations. Psychological factors also matter, as depression and altered pain processing can influence symptom experience and perceived treatment response. Consequently, pain intensity alone provides an incomplete assessment of therapeutic benefit; functional recovery and the duration of improvement are equally relevant to patient-centred evaluation of treatment effectiveness. (5,6,7,8)

Conservative management includes education, exercise, weight management, physical therapy, and appropriate analgesic or anti-inflammatory medication. These approaches seek to reduce symptoms and maintain independence, but some patients continue to experience substantial limitations despite treatment. Intra-articular injections offer an additional option for symptom management before, or alongside consideration of, surgical intervention. Their clinical appeal lies in delivering treatment to the symptomatic joint through a minimally invasive procedure. Nevertheless, injectable products differ in mechanism, expected duration of benefit, preparation requirements, and supporting evidence. Selecting an injection strategy therefore requires assessment of sustained clinical outcomes rather than assuming that all intra-articular treatments provide equivalent benefits. (9,10)

Intra-articular corticosteroids are commonly used because their anti-inflammatory action can provide rapid symptomatic relief. By reducing inflammatory activity within the joint, they may help patients experiencing painful exacerbations and facilitate participation in rehabilitation. However, symptom improvement is not necessarily sustained, and corticosteroid treatment should not be interpreted as restoration of damaged cartilage. Questions concerning repeated exposure, tissue effects, and variation in individual response have encouraged investigation of alternative injectable therapies. The clinical challenge is therefore not simply to achieve an early reduction in pain, but to determine whether another treatment strategy can extend relief while maintaining an acceptable safety profile. (10,11,12)

Platelet-rich plasma (PRP) has attracted attention as an autologous biological treatment for symptomatic KOA. Prepared from the patient's blood, PRP contains concentrated platelets and associated mediators that may influence inflammatory signalling and tissue homeostasis. Platelet-derived growth factor, transforming growth factor, and other bioactive molecules provide a biological rationale for its proposed therapeutic effects. However, biological plausibility must be distinguished from demonstrated clinical efficacy, and improvement in symptoms does not establish cartilage regeneration. PRP is therefore best evaluated through measurable patient outcomes and, when structural claims are made, appropriate imaging or biological assessments capable of demonstrating changes beyond symptomatic relief. (9,12,13)

Evidence syntheses provide support for PRP while also identifying important uncertainty. Bensa and colleagues examined randomized controlled trials and reported clinically meaningful improvements in pain and function, with outcomes influenced by platelet concentration. Their findings suggest that PRP can produce benefits extending beyond statistical significance, an important consideration when evaluating whether treatment changes patients' daily experience. However, pooled findings represent multiple preparation methods and treatment schedules, limiting their direct application to any single protocol. Such evidence supports further evaluation of PRP but does not establish the effectiveness of corticosteroid pretreatment or identify an optimal sequence for combining the two interventions. (14)

Comparative evidence has also examined PRP alongside other commonly administered intra-articular agents. Qiao and colleagues conducted a systematic review and network meta-analysis assessing corticosteroids, hyaluronic acid, PRP, and combination therapy. Their findings generally favoured PRP and PRP combined with hyaluronic acid for pain and functional outcomes across follow-up periods. Nevertheless, evidence concerning PRP combined with hyaluronic acid cannot be directly transferred to a corticosteroid-PRP sequence. The biological interactions,

administration schedules, and comparator treatments differ. This distinction is important because favourable results for one combination do not demonstrate that another combination provides additional benefit beyond its individual components or usual clinical care. (15)

Not all randomized evidence demonstrates superiority of PRP. Tschopp and colleagues compared glucocorticoid, hyaluronic acid, PRP, and placebo injections in patients with early to moderate KOA. The trial found no clear advantage of the active injections over placebo in a population with relatively low baseline pain. These findings contrast with favourable pooled estimates and illustrate the importance of baseline symptom burden, participant selection, and treatment protocols. They also show why improvement following an injection cannot automatically be attributed to the injected substance. Controlled comparisons remain necessary to distinguish treatment effects from symptom fluctuation, contextual effects, and other influences on recovery. (16)

Observational studies offer complementary information about outcomes in clinical practice. Sun and colleagues retrospectively evaluated 140 patients who completed six months of follow-up after PRP treatment. Median Visual Analog Scale scores decreased from 66.5 to 24, while Western Ontario and McMaster Universities Osteoarthritis Index scores decreased from 29 to 12. Five mild adverse events were reported. Injection number was associated with pain outcomes, whereas body mass index and disease duration influenced functional outcomes. Although these findings support investigation of repeated PRP administration, the retrospective design and absence of a randomized comparator limit causal interpretation and leave uncertainty about the contribution of treatment selection. (17)

Variation in PRP composition remains a major obstacle to consistent interpretation. Preparations differ in platelet concentration, leukocyte content, activation methods, injection volume, and treatment frequency. Anitua and colleagues evaluated these differences in a systematic review and network meta-analysis, identifying potential benefits associated with activation while finding no consistent additional advantage from greater platelet or leukocyte

enrichment. Considered alongside the findings of Bensa and colleagues, this evidence indicates that concentration alone cannot fully characterize treatment performance. Clear reporting of preparation and administration procedures is therefore essential when comparing studies, interpreting conflicting results, and determining whether a protocol can be reproduced in practice. (14,18)

A sequential strategy involving corticosteroid followed by PRP offers a plausible but incompletely established approach to symptom management. The proposed rationale is that corticosteroid may address an initial inflammatory component, while subsequent PRP administration may support a more sustained clinical response through different biological pathways. This remains a hypothesis requiring direct evaluation, rather than evidence of synergy or regeneration. Repeated PRP injections may also differ from a single administration in cumulative exposure and response duration. Consequently, the effectiveness of a staged regimen must be assessed against corticosteroid monotherapy using defined outcomes and an explicitly documented treatment schedule. (9,10,13)

Safety is another essential component of this comparison. Although PRP is autologous, its preparation and injection still require appropriate handling and aseptic technique. Local pain and swelling may occur, and microbial contamination remains a procedural concern. A regimen involving several injections also creates additional treatment encounters, making it important to consider tolerability alongside potential benefit. Existing comparative reviews and observational reports provide useful safety information, but small cohorts cannot reliably exclude uncommon complications. Evaluating recorded adverse effects together with pain relief and functional improvement therefore provides a more balanced assessment of the practical value of sequential injection therapy. (15,17,19)

The reviewed literature principally addresses individual injectable agents, comparisons between PRP and other treatments, or combinations that differ from corticosteroid followed by sequential PRP. It therefore leaves a clinically relevant question concerning whether

adding a defined PRP course after corticosteroid treatment is associated with better outcomes than corticosteroid alone. Routine clinical records can contribute preliminary evidence, particularly when they capture functional activities and the persistence of pain relief. However, differences in patient selection, baseline severity, concurrent care, and follow-up must remain central to interpretation. A comparative observational approach can inform subsequent trials without establishing definitive treatment superiority or structural regeneration. (14,15,16)

Accordingly, this retrospective comparative cohort study evaluated corticosteroid monotherapy and corticosteroid followed by three sequential PRP injections in patients with symptomatic Kellgren–Lawrence grade I–III KOA attending two pain-management settings in Lower Dir, Pakistan. The study compared pain, everyday functional limitations, duration of perceived pain relief, and recorded local adverse effects. Pain assessment used the Visual Analog Scale, while functional assessment considered selected activities from the Western Ontario and McMaster Universities Osteoarthritis Index. By examining these patient-relevant outcomes, the study sought to address the treatment-sequencing gap and provide preliminary clinical evidence to guide the design of prospective, standardized comparative investigations. (9,10,15)

Methodology

A retrospective comparative cohort study was conducted to compare the clinical outcomes of two treatment approaches for symptomatic knee osteoarthritis (KOA): single intra-articular corticosteroid injection alone and single intra-articular corticosteroid injection followed by three sequential platelet-rich plasma (PRP) injections. The study was conducted using clinical records obtained from two specialized clinical settings in Lower Timergara, District Dir, Khyber Pakhtunkhwa, Pakistan, namely Dr. Ijaz Ahmad's Pain Medicine Specialist clinical practice and Dr. Arshad Iqbal Neurosurgeon/Brain and Spine Clinic. Both clinical settings provide management for musculoskeletal and pain-related conditions, including persistent knee pain associated with

degenerative joint disease. The study period was reported as January 2025 to January 2026, while the study duration was described as four months in the original methodology. Relevant patient records were retrospectively reviewed according to predefined eligibility criteria and the treatment documented in the clinical records.

The study sample comprised 56 eligible patients, with 28 patients allocated to each treatment group based on their documented treatment exposure. The sample size was determined using a two-group comparison approach with a 95% confidence level, 80% statistical power, a pooled standard deviation of 2 for the Visual Analogue Scale (VAS), and a minimum clinically meaningful difference of 1.5. Based on these parameters, a minimum of 28 participants per group was considered necessary, resulting in a total sample size of 56 patients. Eligible records were identified from existing prescriptions and clinical records using uniform inclusion and exclusion criteria. A non-probability convenience sampling approach was used, with participants categorized according to the treatment documented in their clinical records. Group A comprised patients who received a single intra-articular corticosteroid injection only, whereas Group B comprised patients who received a single intra-articular corticosteroid injection followed by three sequential PRP injections.

Patients with symptomatic KOA classified as Kellgren–Lawrence (KL) grades I–III were eligible for inclusion. The eligibility criteria included the specified adult age range, knee pain persisting for at least three months, a VAS pain score of ≥ 4 , and functional limitations affecting daily activities. Records of patients who had received a knee injection within the preceding three months were excluded. Additional exclusion criteria included KL grade IV osteoarthritis or an indication for surgical management, previous knee surgery, severe knee deformity, hematological disorders or anticoagulant use, active infection or uncontrolled systemic disease, pregnancy, and known steroid hypersensitivity. Records that did not satisfy the predefined eligibility criteria or lacked sufficient information relevant to the study outcomes were excluded from the final analysis.

Patient information was retrospectively extracted from available clinical records using a standardized Case Report Form (CRF). Data extraction was performed according to predefined criteria and included demographic and clinical characteristics, KL radiographic grade, treatment exposure, pain severity, functional status, use of adjunctive therapies, treatment response, duration of symptom relief, and documented adverse events. Baseline clinical information included VAS pain scores, WOMAC-based functional measures, and the use of adjunct therapies such as physiotherapy and supplements. The same data-collection criteria and definitions were applied to records obtained from both clinical settings to maintain consistency. Following extraction, the records were reviewed for completeness, consistency, and accuracy before being entered into a password-protected database for statistical analysis. Data extraction was reported to have been performed by an independent research assistant blinded to clinical outcomes, with the purpose of minimizing data-collection bias.

All patients included in the study had received a single intra-articular corticosteroid injection as part of their clinical management. Patients in Group A received corticosteroid injection alone, whereas patients in Group B additionally received three sequential PRP injections at approximately three-week intervals, corresponding to weeks 3, 6, and 9 following corticosteroid administration. Follow-up information, where available in the clinical records, included pain outcomes assessed using VAS at rest and during activity, WOMAC pain and functional measures, duration of symptom relief or time to return of baseline pain, and treatment-related adverse events. Adverse-event information included post-injection flare or swelling, redness, infection, and systemic reactions. Other relevant clinical outcomes documented in the records were also considered in the analysis. The study aimed to compare the clinical outcomes between the corticosteroid-only and corticosteroid-plus-sequential-PRP treatment groups while accounting for relevant baseline characteristics, KL grade, and concomitant treatments.

The study was conducted in accordance with the ethical standards established by the Institutional

Review Board (IRB) and Ethics Committee. The methodology stated that informed consent was obtained from participants after providing information regarding the study purpose, procedures, and potential risks, and that participants were free to withdraw without consequences. Patient confidentiality was maintained throughout the data-collection and analysis processes. No personal identifiers were included in the study database or final thesis presentation, and the collected information was securely stored and used solely for research purposes. The study findings were intended to be reported honestly, with relevant conflicts of interest disclosed.

Statistical analysis was performed using IBM SPSS Statistics version 27. Continuous variables, including age, body mass index, VAS pain scores, functional scores, and duration of symptom relief, were summarized using means and standard deviations when normally distributed, whereas categorical variables, including sex, KL grade, treatment group, adverse events, and use of adjunctive therapies, were summarized using frequencies and percentages. The distribution of continuous variables was assessed before inferential analysis. Between-group comparisons of continuous variables were performed using the independent-samples *t*-test for normally distributed data and the Mann-Whitney *U* test for non-normally distributed data. Categorical variables were compared using the chi-square test, where appropriate. For within-group comparisons of pre- and post-treatment outcomes, paired-samples *t*-tests were planned for normally distributed continuous variables, whereas the Wilcoxon signed-rank test was used when parametric assumptions were not satisfied. Where multiple follow-up measurements were available, repeated-measures analyses, including repeated-measures analysis of variance or the Friedman test, were considered according to the distribution and characteristics of the data.

The primary analysis focused on comparing changes in pain and functional outcomes between the corticosteroid-only group and the corticosteroid-plus-sequential-PRP group. Secondary analyses included comparisons of functional outcomes, range of motion, duration of symptom relief, patient satisfaction, and

adverse events where the relevant information was available in the clinical records. Effect estimates with 95% confidence intervals were reported alongside *p*-values to describe the magnitude and precision of observed differences. All statistical tests were two-tailed, and a *p*-value of <0.05 was considered statistically significant. The statistical analysis comprised descriptive characterization of the study population, bivariate comparisons between treatment groups, within-group assessment of pre- and post-treatment changes where

applicable, and between-group comparison of clinical outcomes associated with the two treatment approaches.

RESULTS

4.1 Participant Demographic and Clinical Characteristics

A total of 56 patients with knee osteoarthritis were included. The treatment groups were balanced in size, with 28 patients receiving single corticosteroids and 28 receiving single corticosteroids and three-sequential PRP injections.

Frequency distribution of demographic and radiological characteristics of patients (n=56)

Table 1: Overall demographic and clinical characteristics of participants (N=56)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	30–39	6	10.7
	40–49	16	28.6
	50–59	20	35.7
	60–69	8	14.3
	≥70	6	10.7
Sex	Female	32	57.1
	Male	24	42.9
Body mass index (kg/m ²)	Underweight (<18.5)	2	3.6
	Normal weight (18.5–24.9)	24	42.9
	Overweight (25.0–29.9)	28	50
	Obese (≥30.0)	2	3.6
Radiological severity (Kellgren–Lawrence grade)	Grade I	9	16.1
	Grade II	23	41.1
	Grade III	24	42.9

The results demonstrate that the research cohort's (N = 56) demographic and radiological baseline characteristics exhibit a typical distribution for knee osteoarthritis. The bulk of patients are middle-aged or older, with the highest concentration found in the 50–59 age group at 35.7% (n = 20), closely followed by the 40–49 age group at 28.6% (n = 16), the 60–69 age group at 14.3% (n = 8), and the 30–39 age group and the 70 age group at 10.7% (n = 6). Additionally, our findings indicate that there is a little female majority, with men accounting for 42.9% (n = 24) and females for 57.1% (n = 32) of participants and the body mass index distribution shows that the majority of patients have an elevated mechanical burden, with 50.0% (n = 28) categorized as overweight, 42.9% (n = 24) having a normal BMI, 3.6% (n = 2) being obese, and 3.6% (n = 2) being underweight. Finally, radiological severity as measured by the Kellgren-Lawrence grade shows that virtually all individuals have moderate-to-advanced joint degeneration, with 42.9% (n = 24) in Grade III and 41.1% (n = 23) in Grade II, and 16.1% (n = 9) in Grade I. Simply said, these results tables reveal a well-matched, representative research population of middle-aged to older persons who are experiencing substantial joint damage and excess weight.

Age the patients?

56 responses

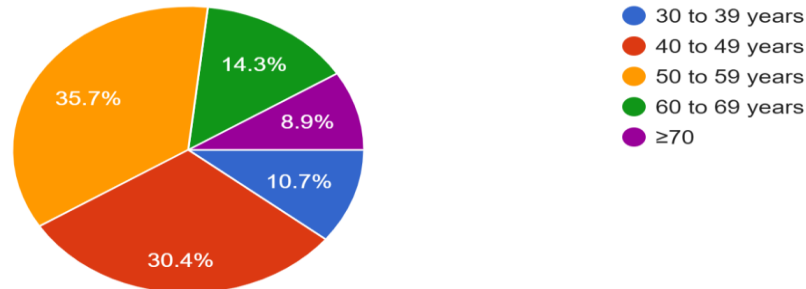


Figure 1:age of the patients

Sex of the patients?

56 responses

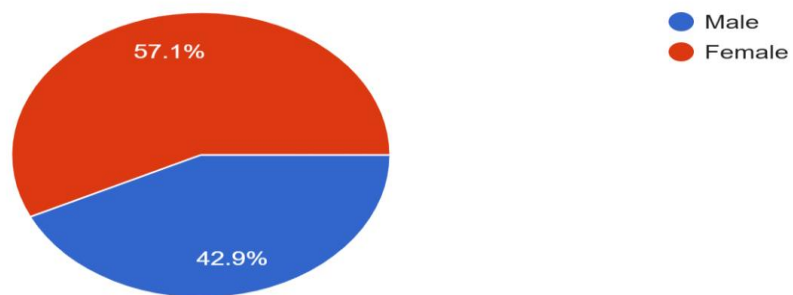


Figure 2:Sex of the patients

Body mass index category?

56 responses

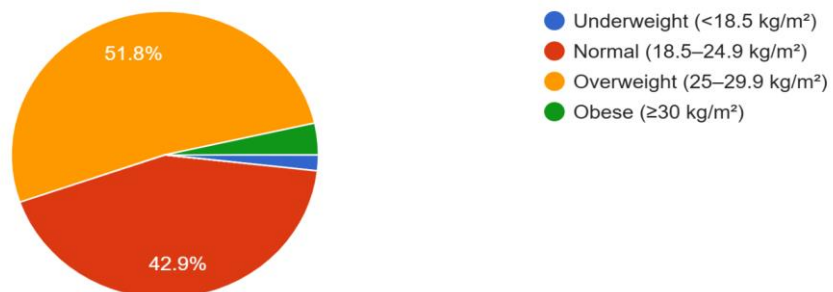


Figure 3; Body mass index category of the patients

Table 2: Duration of knee symptoms

Duration of knee symptoms?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>3 years	37	66.1	66.1	66.1
	1–3 years	15	26.8	26.8	92.9
	6–12 months	4	7.1	7.1	100.0
	Total	56	100.0	100.0	

Duration of knee symptoms?

56 responses

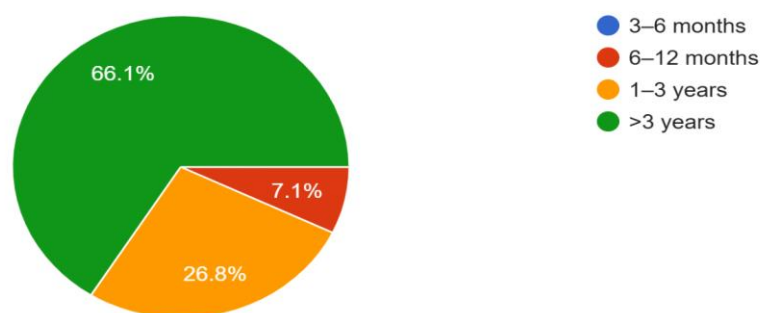


Figure 4: Duration of knee symptoms

These findings tables reveal that the duration of knee complaints within the study group (N = 56) is primarily chronic, indicating osteoarthritis. When looking at the timeline of a condition, the great majority of patients had been suffering for a long time, with the largest concentration reported in the >3 years' group at 66.1% (n = 37). Furthermore, our findings show that 26.8%

(n = 15) of individuals reported symptoms lasting between one and three years, whereas 7.1% (n = 4) reported symptoms lasting six to twelve months. Simply put, these results tables show that the research sample is predominantly made up of individuals with long-standing, chronic knee issues who have had persistent symptoms for more than a year.

Table 3: Sides involved in pain

Side involved?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bilateral	45	80.4	80.4	80.4
	Left knee	1	1.8	1.8	82.1
	Right knee	10	17.9	17.9	100.0
	Total	56	100.0	100.0	

Side involved?

56 responses

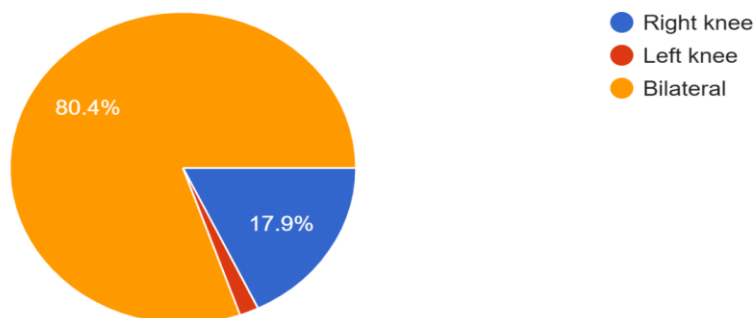


Figure 5: Sides involved in pain

These findings tables demonstrate that the anatomical side involvement in the research cohort (N = 56) implies a high frequency of bilateral joint illness. When examining the afflicted joints, the great majority of patients have bilateral knee involvement, accounting for 80.4% (n = 45) of the cohort. Furthermore, our findings show that unilateral instances are

largely centered in the right knee (17.9%, n = 10), with left knee involvement accounting for just 1.8% (n = 1). Simply put, the data tables show that the research group is strongly biased toward individuals with symmetrical, multi-joint knee osteoarthritis rather than isolated single-leg involvement.

Radiological severity (Kellgren–Lawrence grade)?

56 responses

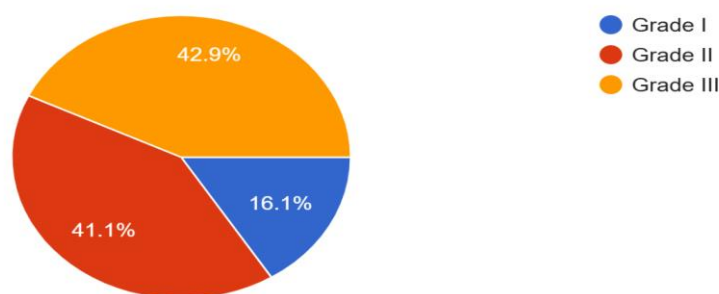


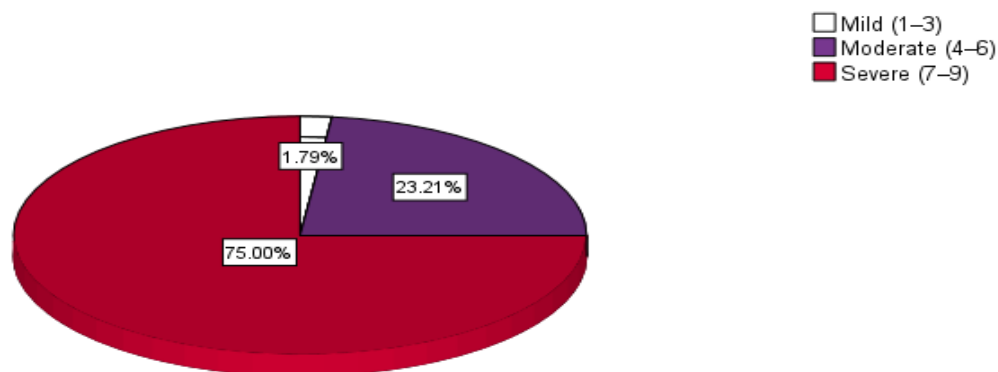
Figure 6: Radiological severity (Kellgren–Lawrence grade)

Table 4: Pre-operative knee pain during walking (VAS)

Pre-operative knee pain at rest (VAS)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild (1–3)	1	1.8	1.8	1.8
	Moderate (4–6)	13	23.2	23.2	25.0

Severe (7-9)	42	75.0	75.0	100.0
Total	56	100.0	100.0	

Pre-operative knee pain at rest (VAS)?*Figure 7: Pre-operative knee pain at rest (VAS)?*

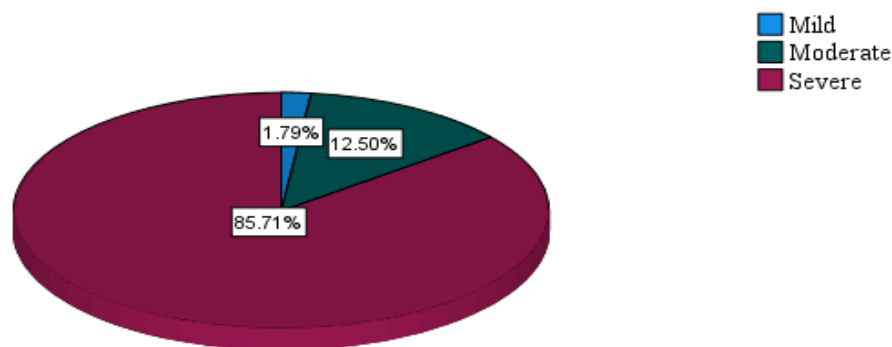
These findings tables reveal that the pre-operative resting pain levels evaluated using the Visual Analog Scale (VAS) within the study group (N = 56) suggest a significant baseline burden of severe discomfort. When considering the severity distribution, the great majority of patients had severe baseline symptoms, with 75.0% (n = 42) falling into the severe (7-9) group. Furthermore, our findings show that

23.2% (n = 13) of patients had moderate (4-6) pain, whereas 1.8% (n = 1) reported light (1-3) discomfort, and no patients claimed total pain relief during rest. Simply put, these findings tables show that the research group had substantially skewed, high-intensity resting discomfort before receiving their various treatment therapies.

Table 5: Pre-operative knee pain during walking (VAS)?

Pre-operative knee pain during walking (VAS)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	1	1.8	1.8	1.8
	Moderate	7	12.5	12.5	14.3
	Severe	48	85.7	85.7	100.0
	Total	56	100.0	100.0	

Pre-operative knee pain during walking (VAS)?*Figure 8: Pre-operative knee pain during walking (VAS)?*

These findings tables demonstrate that pre-operative knee pain when walking, as evaluated by the Visual Analog Scale (VAS) within the study group (N = 56), implies a more severe baseline load than resting pain. When examining the functional severity distribution, the vast majority of patients reported extreme distress when moving, with 85.7% (n = 48) falling into the severe group. Furthermore, our

findings show that 12.5% (n = 7) of patients experienced significant walking discomfort, whereas just 1.8% (n = 1) reported light pain. Simply put, these outcome tables demonstrate that virtually all patients started the investigation with serious functional pain during activity, establishing a high baseline severity before therapy.

Table 6: Pre-operative night pain

Pre-operative night pain?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Frequently	44	78.6	78.6	78.6
	Occasionally	12	21.4	21.4	100.0
	Total	56	100.0	100.0	

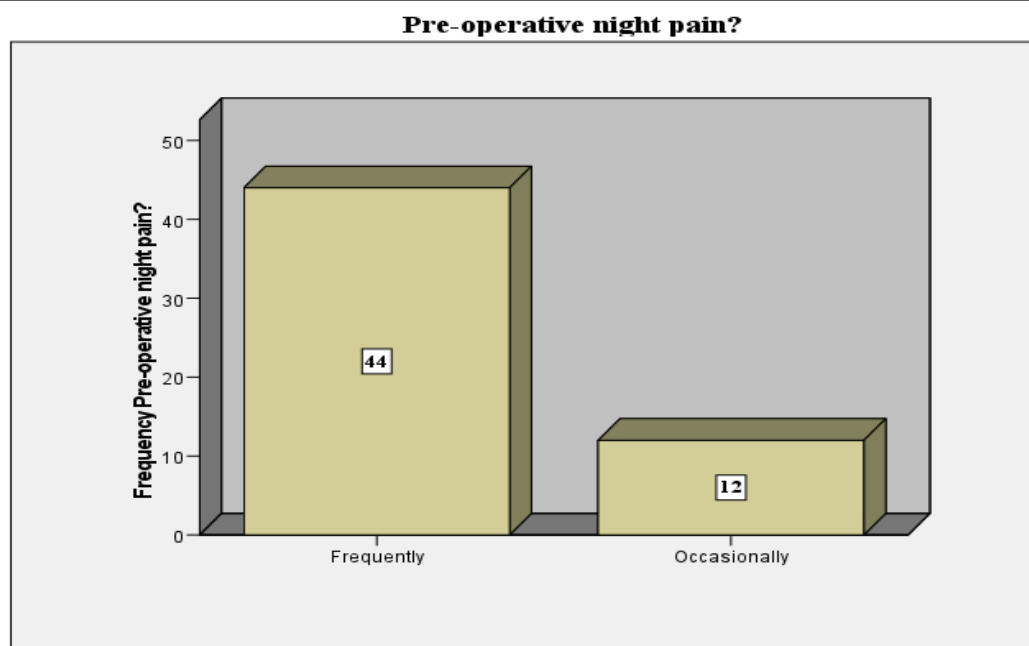


Figure 9: Pre-operative night pain

These findings tables reveal that pre-operative night pain in the study cohort (N = 56) is a common and disruptive nocturnal symptom burden. According to the frequency distribution, the great majority of patients suffered regular evening discomfort, with 78.6% (n = 44) reporting frequent night pain. Furthermore, our findings show that the remaining 21.4% (n = 12) of participants

reported intermittent night discomfort, with no patients claiming full absence of nocturnal symptoms. Simply put, these findings tables show that every single participant experienced sleep-disturbing night pain previous to therapy, emphasizing the widespread impact of osteoarthritis on their sleep and quality of life.

Table 7: Post-operative knee pain at rest (VAS)?

Post-operative knee pain at rest (VAS)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	8	14.3	14.3	14.3
	Moderate	7	12.5	12.5	26.8
	No pain	40	71.4	71.4	98.2
	Sever	1	1.8	1.8	100.0
	Total	56	100.0	100.0	

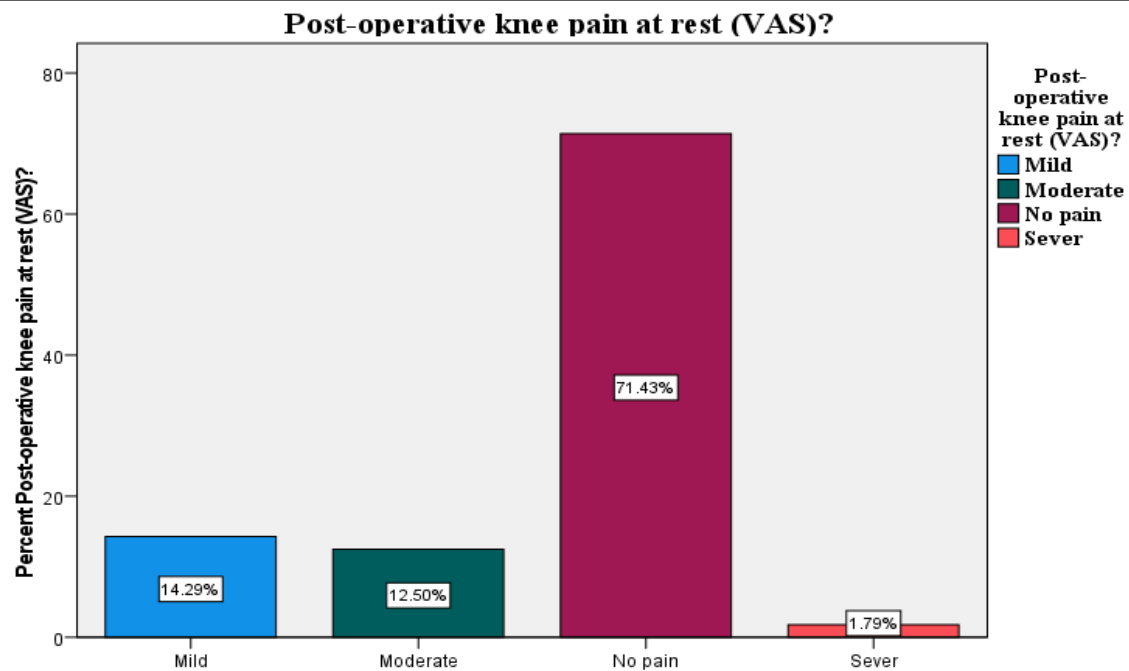


Figure 10: Post-operative knee pain at rest (VAS)?

These data tables reveal that the post-operative resting pain levels evaluated using the Visual Analog Scale (VAS) within the study cohort (N = 56) represent a significant overall reduction in resting discomfort following therapy. When examining the post-intervention distribution, the vast majority of patients were completely comfortable, with 71.4% (n = 40) reporting no

discomfort. Furthermore, our findings show that 14.3% (n = 8) suffered mild pain and 12.5% (n = 7) reported moderate pain, with just 1.8% (n = 1) remaining in the severe group. Simply put, the data tables show that the combined therapies effectively relieved resting discomfort for the vast majority of subjects.

Table 8: Post-operative knee pain during walking (VAS)?

Post-operative knee pain during walking (VAS)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	13	23.2	23.2	23.2
	Moderate	7	12.5	12.5	35.7
	No pain	29	51.8	51.8	87.5
	Severe	7	12.5	12.5	100.0
	Total	56	100.0	100.0	

Post-operative knee pain during walking (VAS)?

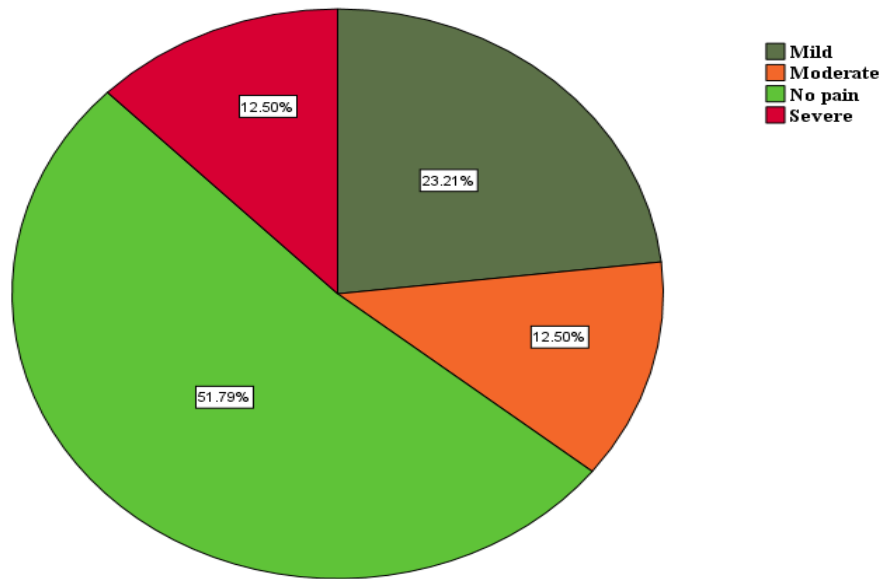


Figure 11: Post-operative knee pain during walking (VAS)?

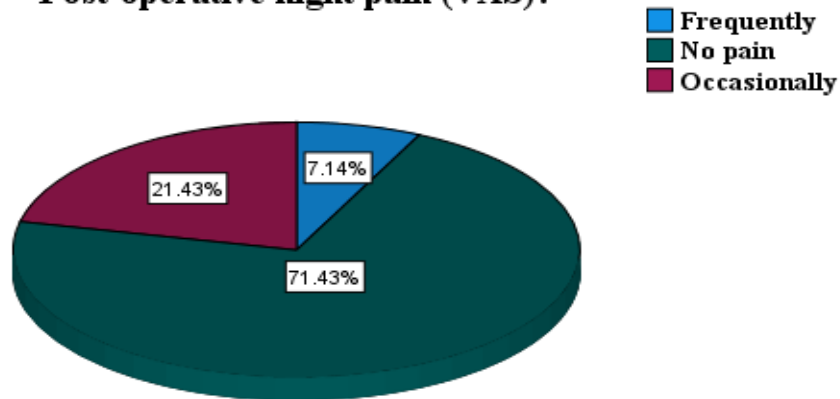
These findings tables reveal that post-operative knee discomfort during walking, as evaluated by the Visual Analog Scale (VAS) in the study cohort (N = 56), shows a significant functional improvement compared to baseline. Looking at the post-intervention distribution, more than half of the patients experienced no discomfort during ambulation, with 51.8% (n = 29) reporting no pain. Furthermore, our findings

show that 23.2% (n = 13) of participants had light walking discomfort, 12.5% (n = 7) reported moderate pain, and a small minority (n = 7) reported severe pain. Simply put, the results tables show that the therapies were helpful in restoring comfortable mobility for the majority of the cohort during regular activities.

Table 9: Post-operative night pain (VAS)?

Post-operative night pain (VAS)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Frequently	4	7.1	7.1	7.1
	No pain	40	71.4	71.4	78.6
	Occasionally	12	21.4	21.4	100.0
	Total	56	100.0	100.0	

Post-operative night pain (VAS)?*Figure 12: Post-operative night pain (VAS)?*

These data tables demonstrate that a significant improvement in night rest after therapy is reflected in the post-operative night pain among the study cohort (N = 56). According to the post-intervention distribution, a surprising 71.4% (n = 40) of patients reported no pain, and the great majority of patients completely removed discomfort at night. Additionally, our findings show that just 21.4% (n = 12) of individuals had

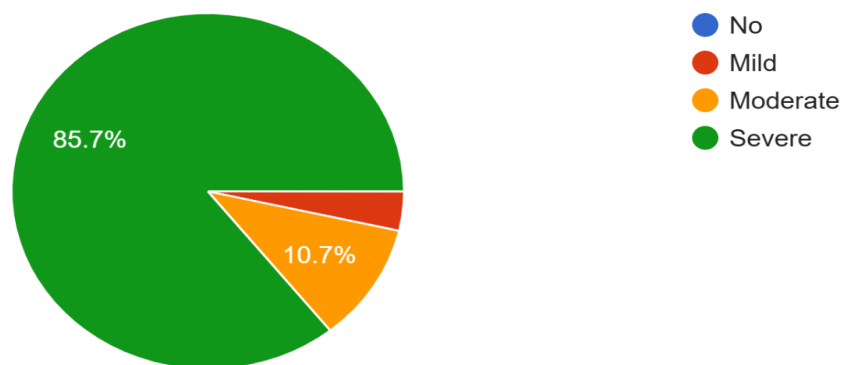
occasional overnight discomfort, but the percentage of participants who reported regular nocturnal symptoms fell precipitously to just 7.1% (n = 4). Simply put, these results tables show that the therapies helped the vast majority of patients who had previously had frequent nocturnal interruptions to regain peaceful, pain-free sleep.

*Table 10: Pre-Injection Difficulty rising from sitting (WOMAC)?***Pre-Injection Difficulty rising from sitting (WOMAC)?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	2	3.6	3.6	3.6
	Moderate	6	10.7	10.7	14.3
	Severe	48	85.7	85.7	100.0
	Total	56	100.0	100.0	

Pre-Injection Difficulty rising from sitting (WOMAC)?

56 responses

*Figure 13: Pre-Injection Difficulty rising from sitting (WOMAC)?*

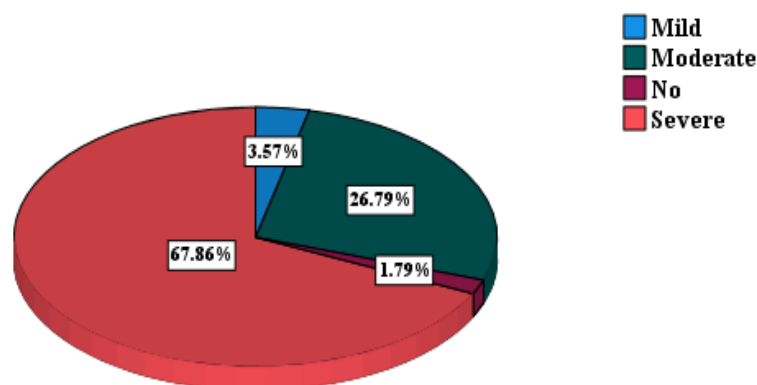
These findings tables reveal that the pre-operative difficulty in rising from a sitting position, as evaluated by the WOMAC index in the study group (N = 56), implies a significant functional constraint. When examining the distribution of stiffness and lower limb weakness during transitions, the vast majority of patients reported significant impairment, with 85.7% (n = 48) falling into this group. Furthermore, our

findings indicate that 10.7% (n = 6) of patients experienced significant difficulty, whereas 3.6% (n = 2) reported light difficulty. Simply put, these findings tables show that virtually all of the patients started the research with significant functional limitations while attempting to rise up from a seated posture.

Table 11: Pre-Injection Difficulty walking on flat surfaces (WOMAC)

Pre-Injection Difficulty walking on flat surfaces (WOMAC)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	2	3.6	3.6	3.6
	Moderate	15	26.8	26.8	30.4
	No	1	1.8	1.8	32.1
	Severe	38	67.9	67.9	100.0
	Total	56	100.0	100.0	

Pre-Injection Difficulty walking on flat surfaces (WOMAC)*Figure 14:Pre-Injection Difficulty walking on flat surfaces (WOMAC)*

These findings tables reveal that the pre-injection difficulties in walking on flat surfaces, as evaluated by the WOMAC index in the study group (N = 56), implies a significant baseline functional impairment during basic ambulation. When examining the distribution of walking difficulties before to therapy, the great majority of patients exhibited severe restriction, with 67.9% (n = 38) falling into this group.

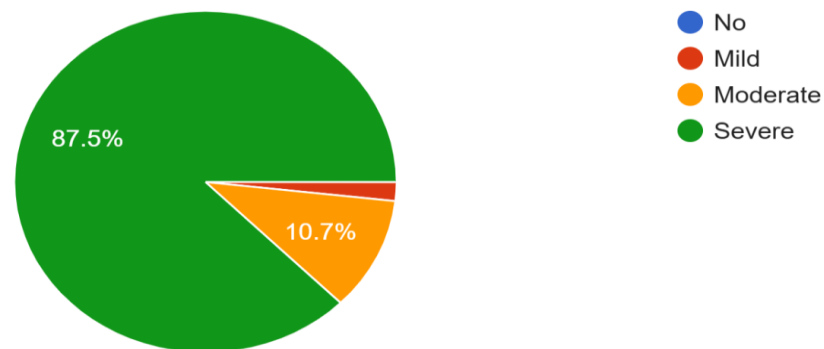
Furthermore, our findings show that 26.8% (n = 15) reported considerable difficulty, 3.6% (n = 2) encountered mild difficulty, and just 1.8% (n = 1) reported no difficulty at all. Simply put, these findings tables show that almost the whole group experienced significant walking constraints on flat surfaces prior to receiving their individual therapies.

*Table 12:Pre-Injection Difficulty climbing/descending stairs (WOMAC)***Pre-Injection Difficulty climbing/descending stairs (WOMAC)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	1	1.8	1.8	1.8
	Moderate	6	10.7	10.7	12.5
	Severe	49	87.5	87.5	100.0
	Total	56	100.0	100.0	

Pre-Injection Difficulty climbing/descending stairs (WOMAC)

56 responses

*Figure 15:Pre-Injection Difficulty climbing/descending stairs (WOMAC)*

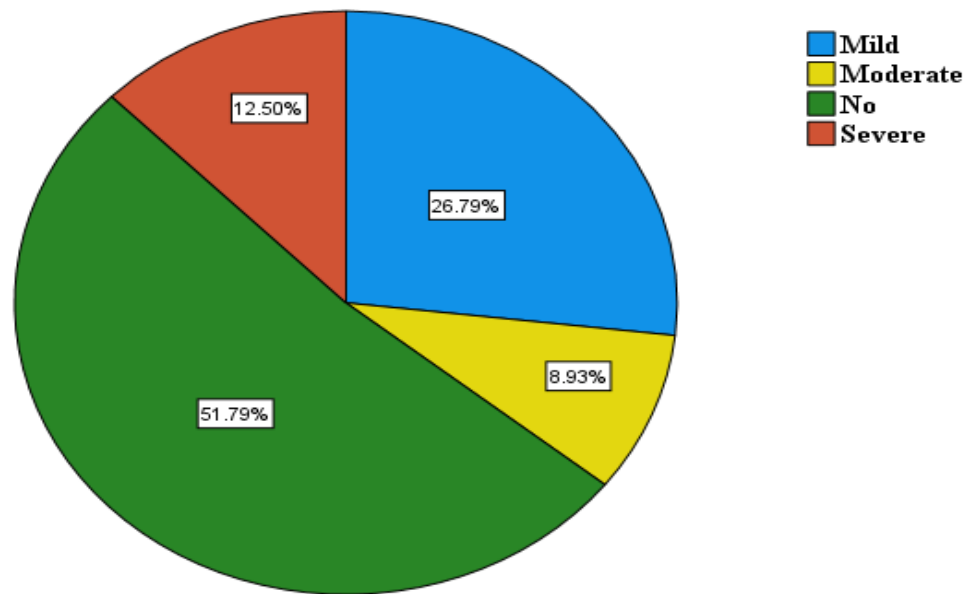
These findings tables reveal that the pre-injection difficulty in climbing or descending stairs, as measured by the WOMAC score in the study group (N = 56), shows a severe baseline impairment in complicated lower limb tasks. When examining the distribution of stair-climbing limits before to therapy, the vast majority of patients exhibited severe restriction, with 87.5% (n = 49) falling into this group.

Furthermore, our findings show that 10.7% (n = 6) of patients experienced considerable difficulty, while light difficulty was reported by just 1.8% (n = 1) of participants, and no patients reported no impairment. Simply put, these results tables demonstrate that navigating stairs was an almost universal, severely debilitating difficulty for the sample prior to intervention.

Table 13:Post-Injection Difficulty rising from sitting (WOMAC)?

Post-Injection Difficulty rising from sitting (WOMAC)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	15	26.8	26.8	26.8
	Moderate	5	8.9	8.9	35.7
	No	29	51.8	51.8	87.5
	Severe	7	12.5	12.5	100.0
	Total	56	100.0	100.0	

Post-Injection Difficulty rising from sitting (WOMAC)?*Figure 16:Post-Injection Difficulty rising from sitting (WOMAC)?*

The results demonstrate that the sample size (N = 56) post-injection difficulties rising from sitting, as assessed by the WOMAC score, indicates a significant functional recovery after treatment. Over half of the patients effectively overcome transition-related constraints, with 51.8% (n = 29) reporting no difficulty, according to the post-intervention distribution.

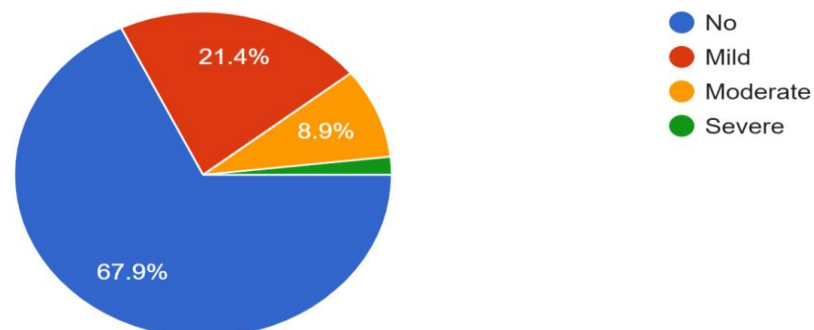
Additionally, our findings show that only 12.5% (n = 7) remained in the severe group, but 26.8% (n = 15) reported light difficulty and 8.9% (n = 5) reported moderate difficulty. In other words, these results tables verify that the majority of the cohort's independent sit-to-stand capacity was successfully restored by the treatments.

*Table 14:Post-Injection Difficulty walking on flat surfaces (WOMAC)?***Post-Injection Difficulty walking on flat surfaces (WOMAC)?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	12	21.4	21.4	21.4
	Moderate	5	8.9	8.9	30.4
	No	38	67.9	67.9	98.2
	Severe	1	1.8	1.8	100.0
	Total	56	100.0	100.0	

Post-Injection Difficulty walking on flat surfaces (WOMAC)?

56 responses

*Figure 17: Post-Injection Difficulty walking on flat surfaces (WOMAC)?*

Interpretation

These data tables demonstrate that the research cohort's (N = 56) post-injection difficulties in walking on flat surfaces, as determined by the WOMAC index, shows a notable improvement in basic ambulation after treatment. According to the post-intervention distribution, 67.9% (n = 38) of patients reported no difficulty at all, and the vast majority of patients successfully

eradicated flat-surface walking difficulties. Additionally, our findings show that just 1.8% (n = 1) remained in the severe group, but 21.4% (n = 12) reported light difficulty and 8.9% (n = 5) reported moderate difficulty. In other words, these results tables show that for the great majority of individuals, the therapies were successful in restoring smooth, effortless, flat-ground walking.

Table 15: Post-Injection Difficulty climbing/descending stairs (WOMAC)?

Post-Injection Difficulty climbing/descending stairs (WOMAC)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	18	32.1	32.1	32.1
	Moderate	9	16.1	16.1	48.2
	No	23	41.1	41.1	89.3
	Severe	6	10.7	10.7	100.0
	Total	56	100.0	100.0	

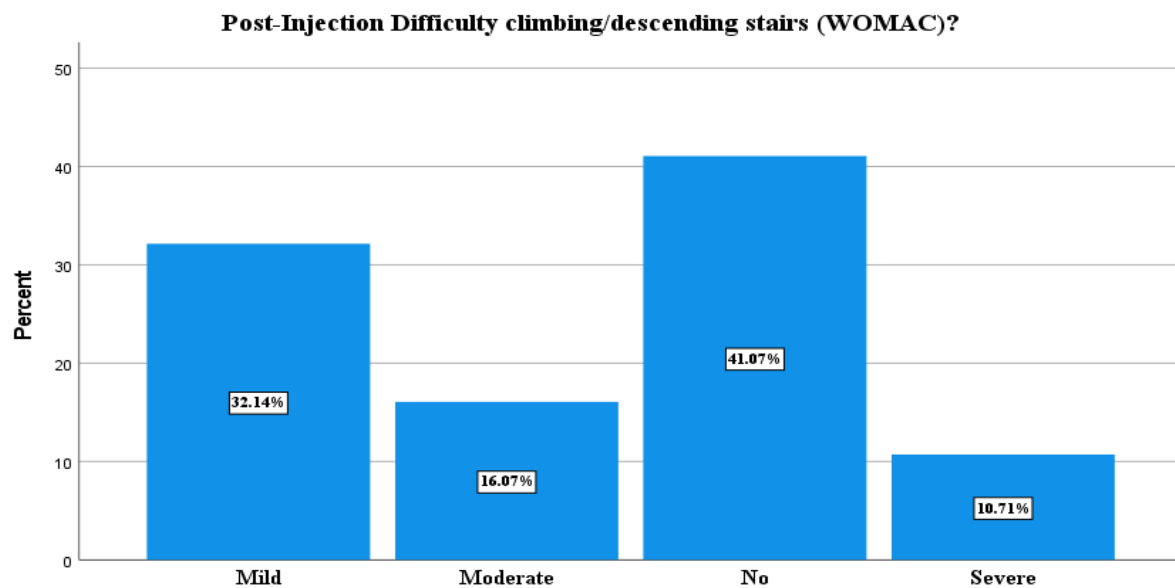


Figure 18: Post-Injection Difficulty climbing/descending stairs (WOMAC)?

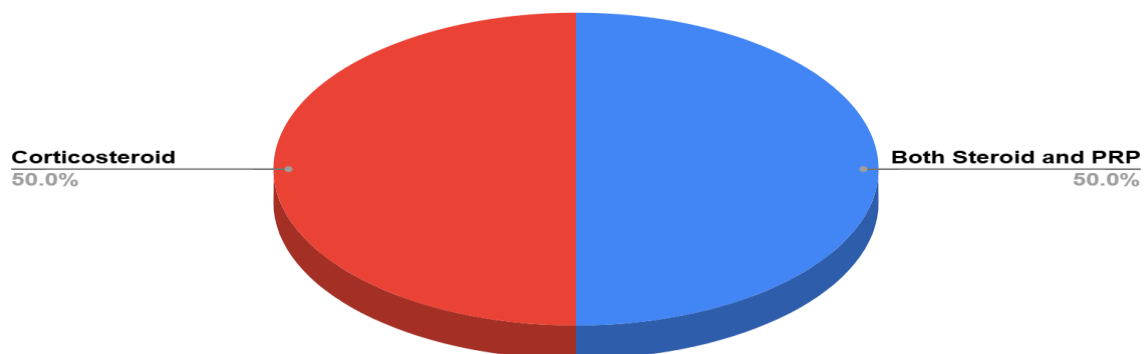
These data tables demonstrate a major reversal of baseline structural and lower limb constraints after treatment, as indicated by the study cohort's (N = 56) post-injection difficulties climbing or descending stairs as determined by the WOMAC score. A significant 41.1% (n = 23) of patients effectively removed stair-related limitation, claiming no difficulty, according to the post-intervention distribution. Additionally,

our findings show that just a small 10.7% (n = 6) fell into the severe category, with 32.1% (n = 18) reporting light difficulty and 16.1% (n = 9) reporting moderate difficulty. Simply put, these results tables show that for most patients who had previously had severe impairment, the combined therapy method significantly recovered effective stair mobility.

Table 16: Type of Intra Articular Injection

Type of Intra Articular Injection

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Both Steroid and PRP	28	50.0	50.0	50.0
	Corticosteroid	28	50.0	50.0	100.0
	Total	56	100.0	100.0	

Type of intra-articular injection received?*Figure 19: Type of Intra Articular Injection*

The intra-articular injection type used throughout the study cohort (N = 56) demonstrates an equally balanced comparative design, according to these findings tables. The cohort was split exactly in half when it came to treatment allocation; 50.0% (n = 28) of the participants received corticosteroid monotherapy, while the remaining 50.0% (n =

28) received sequential therapy that included both steroid and platelet-rich plasma (PRP). In short, these data tables provide a strong comparison basis for assessing the long-term therapeutic advantages of adding PRP by confirming that the trial maintained an equal distribution across the two intervention groups.

*Table 17: Volume of PRP injected?***Volume of PRP injected?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>5 mL	2	3.6	3.6	3.6
	4-5 mL	26	46.4	46.4	50.0
	No	28	50.0	50.0	100.0
	Total	56	100.0	100.0	

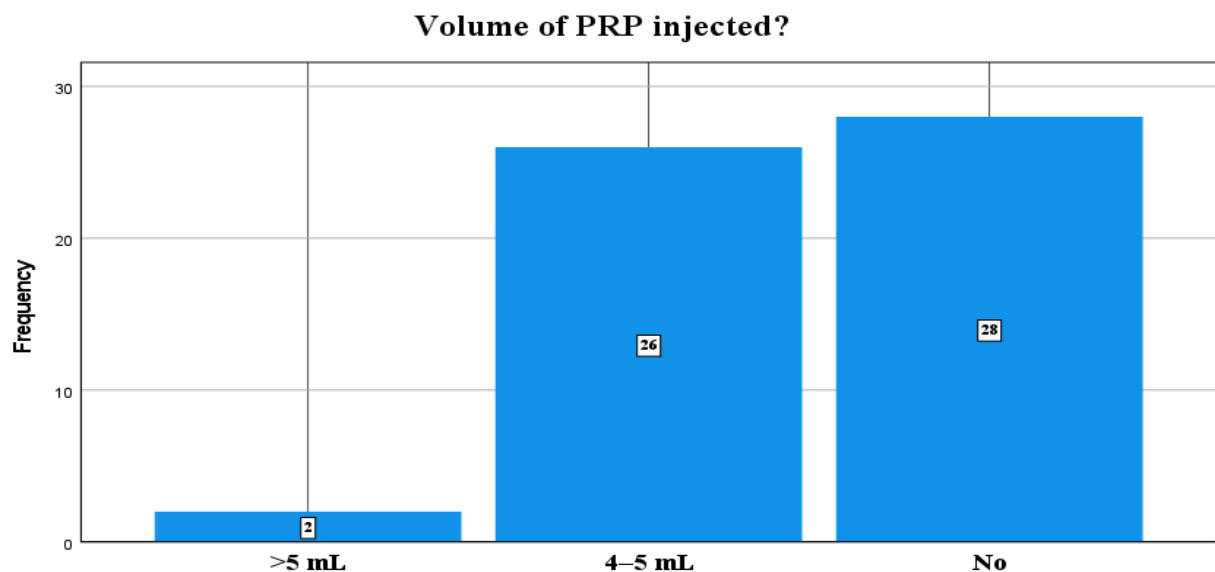


Figure 20: Volume of PRP injected?

These data tables demonstrate that the precise procedural division of the trial's interventional arms is reflected in the volume of platelet-rich plasma (PRP) injected across the research cohort (N=56). Examining the administration split, exactly 50.0% (n=28) of the subjects fall into the "No" group, which corresponds to the cohort members who did not receive PRP and instead received corticosteroid monotherapy. The

injected quantities were concentrated within therapeutic limits for patients in the sequential treatment arm, with 46.4% (n=26) getting between 4 and 5 mL and a tiny fraction of 3.6% (n=2) receiving more than 5 mL. In short, these data tables verify that the biological dose for the PRP arm was mostly standardized within the therapeutic window of 4 to 5 mL.

The steroid component of therapy demonstrated perfect procedural consistency. All corticosteroid-treated patients (100%, N = 56) were given dosages ranging from 40 to 80

mg, confirming a uniform baseline regimen prior to platelet-rich plasma treatment.

Steroid dose administered?

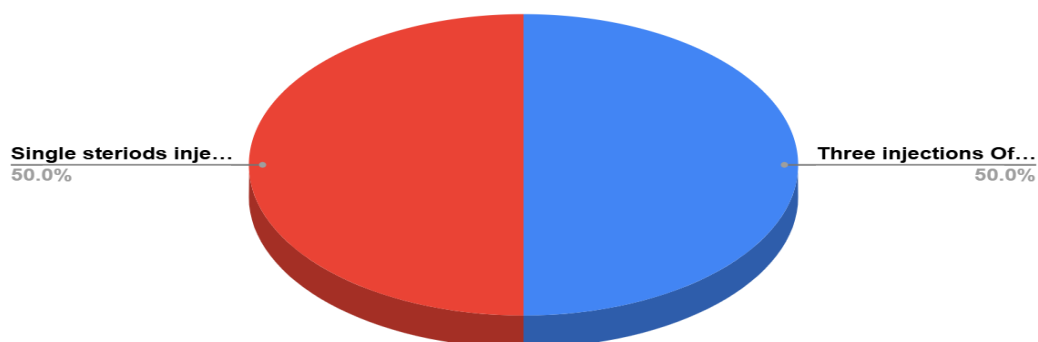
56 responses

*Table 18: Frequency of injections in past year?*

Frequency of Intra articular injections in past year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single steroids injection	28	50.0	50.0	50.0
	Three injections Of PRP single steroids	28	50.0	50.0	100.0
	Total	56	100.0	100.0	

Frequency of injections in past year?

*Figure 21: Frequency of injections in past year?*

These data tables demonstrate how the different procedural routes of the trial's two comparison arms are reflected in the frequency of injections given during the previous year across the study cohort (N = 56). The cohort's treatment history distribution shows that 50.0% (n = 28) received

a single steroid injection, while the other 50.0% (n = 28) received a sequential regimen consisting of a single steroid injection followed by three injections of platelet-rich plasma (PRP). In other words, these findings tables validate the precise treatment regimens used to evaluate the long-

term efficacy of a combination, multi-session biological strategy with corticosteroid solo.

Table 19: Post-injection local adverse effects?

Post-injection local adverse effects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild pain/swelling	7	12.5	12.5	12.5
	No adverse effect	49	87.5	87.5	100.0
	Total	56	100.0	100.0	

Post-injection local adverse effects?

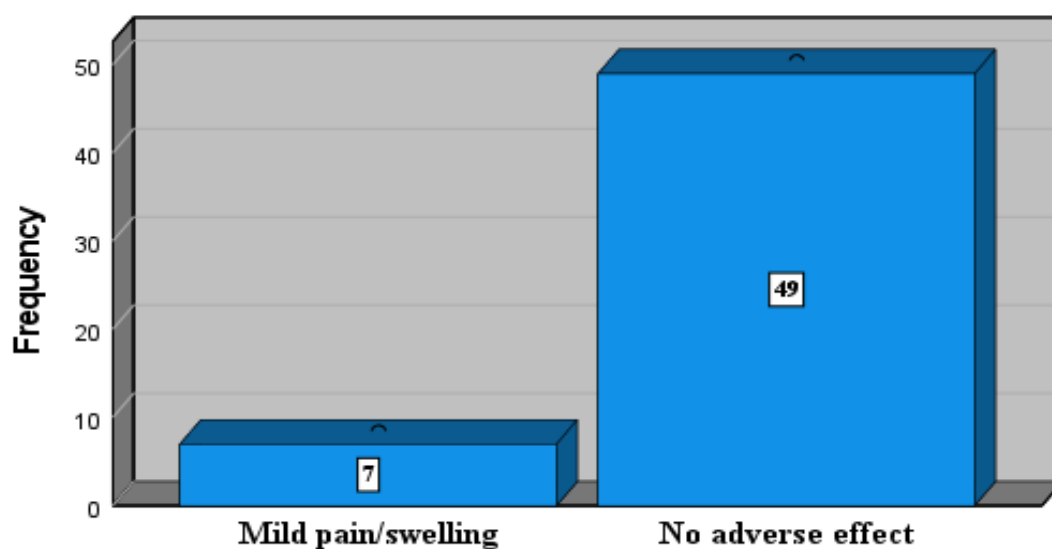


Figure 22: Post-injection local adverse effects?

These data tables reveal that the post-injection local adverse effects seen across the trial cohort (N = 56) indicate a good level of safety and tolerability for both intervention groups. When looking at the safety distribution, the great majority of patients had a smooth recovery without difficulties, with 87.5% (n = 49) reporting no side effects. Furthermore, our findings indicate that the remaining 12.5% (n =

7) had relatively minor, temporary discomfort or edema at the injection site. Simply put, these data tables show that the intra-articular operations, whether corticosteroid monotherapy or the sequential steroid-plus-PRP protocol, were extremely well tolerated, with only slight self-limiting local responses.

Table 20: Duration of post-injection discomfort?

Duration of post-injection discomfort?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A. None	49	87.5	87.5	87.5
	B. <24 hours	7	12.5	12.5	100.0

Total	56	100.0	100.0	
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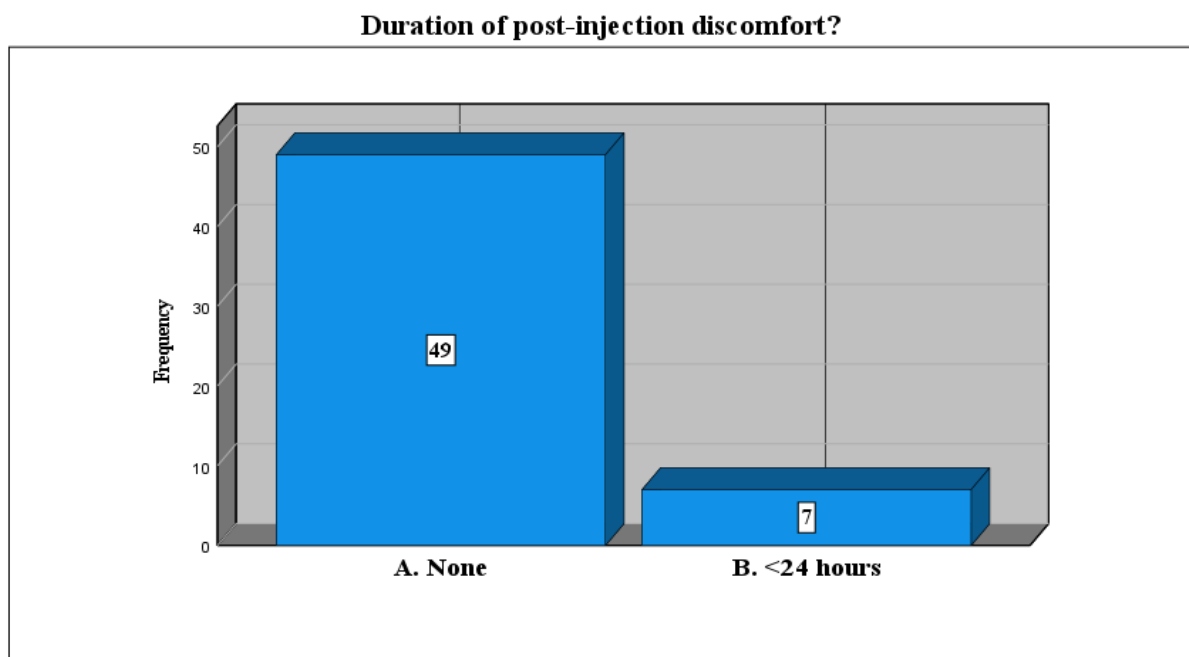


Figure 23:Duration of post-injection discomfort?

The time period of post-injection pain across the research cohort (N = 56) indicates a quick recovery of any mild procedural side effects, according to these findings tables. A staggering 87.5% (n = 49) of patients reported having no discomfort at all when examining the temporal distribution of symptoms. Additionally, our findings indicate that post-procedural pain

persisted shorter than 24 hours for the remaining 12.5% (n = 7). In short, these findings tables show that any localized discomfort brought on by the intra-articular treatments was temporary and quickly resolved away within the first day.

Table 21:Perceived duration of pain relief?

Perceived duration of pain relief?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A. <1 month	26	46.4	46.4	46.4
	B. 1-3 months	6	10.7	10.7	57.1
	C. 3-6 months	11	19.6	19.6	76.8
	D. >6 month	13	23.2	23.2	100.0
	Total	56	100.0	100.0	

Perceived duration of pain relief?

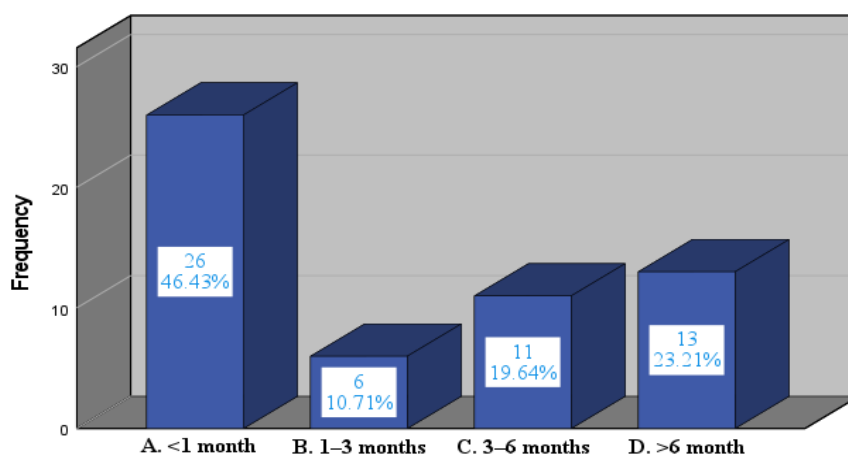


Figure 24: Perceived duration of pain relief?

The study's (N = 56) subjective duration of pain alleviation shows a broad range of therapeutic lifespan after the procedures. According to the length split, 10.7% (n = 6) of patients claimed a duration of one to three months, while 46.4% (n = 26) reported pain alleviation lasting less than one month. Additionally, our findings show that 23.2% (n = 13) saw long-term advantages that lasted longer than six months, and 19.6% (n = 11) experienced continuous

alleviation for three to six months. Simply put, these results tables show how the monotherapy and sequential arms had different response timelines. They show that although almost half of the patients had short-term relief, more than half maintained their pain reduction after a month, and almost a quarter had long-term relief lasting more than six months.

Table 22: Use of pain medicines for knee osteoarthritis during treatment?

Use of pain medicines for knee osteoarthritis during treatment?

			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	i.	Non-selective NSAIDs (Ibuprofen, Naproxen, Diclofenac, Aspirin)	7	12.5	12.5	12.5
	ii.	Selective COX-2 inhibitors (Celecoxib, Etoricoxib)	26	46.4	46.4	58.9
	iii.	Opioids	8	14.3	14.3	73.2
	iv.	Opioids and NSAIDs	15	26.8	26.8	100.0
	Total		56	100.0	100.0	

Use of pain medicines for knee osteoarthritis during treatment?

56 responses



Figure 25: Use of pain medicines for knee osteoarthritis during treatment?

The findings indicate that the use of a combination of pain medications for knee osteoarthritis during therapy across the sample size (N = 56) represents a variety of pharmacological management options to reduce breakthrough symptoms. When considering the distribution of analgesic usage, selective COX-2 inhibitors (such as celecoxib and etoricoxib) were the most often used standalone class, accounting for 46.4% (n = 26) of patients. Furthermore, our findings show that 26.8% (n =

15) required a mix of opioids and NSAIDs, 14.3% (n = 8) depended solely on opioids, and 12.5% (n = 7) used non-selective NSAIDs such as ibuprofen, naproxen, diclofenac, or aspirin to treat their symptoms. Simply put, these data tables demonstrate that participants' supplementary medicine requirements varied greatly, with targeted anti-inflammatory medications serving as the major pharmacological backup throughout treatment.

Table 23: Use of supplementary medicines and physiotherapy for knee osteoarthritis during treatment period

Use of supplementary medicines and physiotherapy for knee osteoarthritis during treatment period?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Only Nutraceuticals (e.g., glucosamine, chondroitin, collagen, MSM, turmeric)	1	1.8	1.8	1.8
	Both Nutraceuticals and Physiotherapy	19	33.9	33.9	35.7
	Physiotherapy + Nutraceuticals and Multivitamins	36	64.3	64.3	100.0
	Total	56	100.0	100.0	

Use of supplementary medicines and physiotherapy for knee osteoarthritis during treatment period?

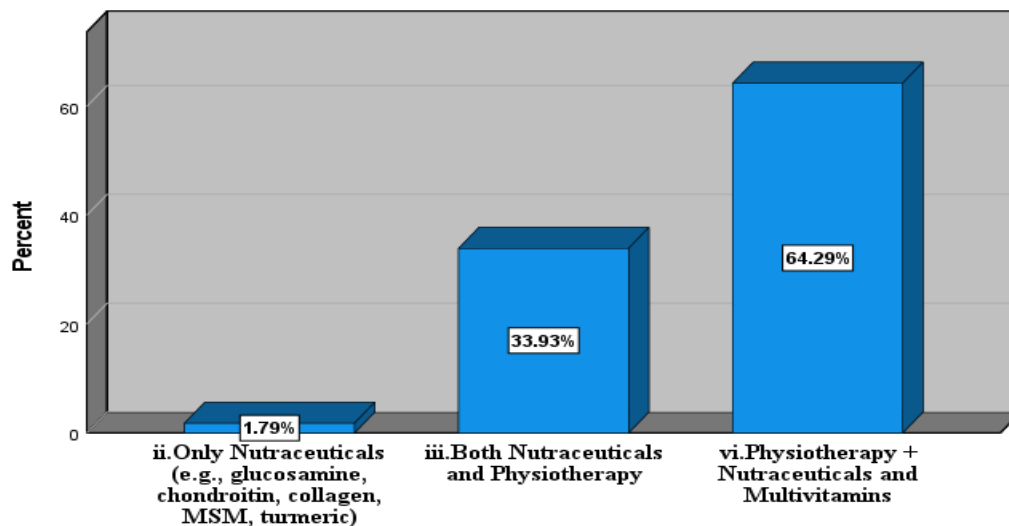


Figure 26: Use of supplementary medicines and physiotherapy for knee osteoarthritis during treatment period.

The findings indicate that the use of concurrent pain medications for knee osteoarthritis throughout therapy across the research cohort (N = 56) represents a variety of pharmacological management techniques for controlling breakthrough symptoms. When considering the distribution of analgesic usage, selective COX-2 inhibitors (such as celecoxib and etoricoxib) were the most often used standalone class, accounting for 46.4% (n = 26) of patients. Furthermore, our findings indicate that 26.8%

(n = 15) required a mix of opioids and NSAIDs, 14.3% (n = 8) depended solely on opioids, and 12.5% (n = 7) treated their symptoms with non-selective NSAIDs such as ibuprofen, naproxen, diclofenac, or aspirin. Simply put, these data tables demonstrate that participants' supplementary medicine requirements varied greatly, with targeted anti-inflammatory medications serving as the major pharmacological backup throughout treatment.

Table 24: Baseline characteristics according to treatment group of chi-square tests

Baseline characteristics according to treatment group					
Baseline variable	χ^2	df	p-value	Cramer's V	Interpretation
Age	2.083	4	0.72	0.193	Not significant
Sex	0.073	1	0.787	0.036	Not significant
BMI category	6.786	3	0.079	0.348	Not significant
Duration of symptoms	1.627	2	0.443	0.17	Not significant
Side involved	5.156	2	0.076	0.303	Not significant
Kellgren-Lawrence grade	1.391	2	0.499	0.158	Not significant

The clinical investigation comparing corticosteroid monotherapy to sequential steroid-plus-platelet-rich plasma (PRP) therapy in 56 patients with knee osteoarthritis found that both treatment regimens are safe, well-tolerated,

and effective at relieving pain and improving joint function. Baseline variables such as age, gender, BMI, symptom duration, side involvement, and Kellgren-Lawrence grades did not differ significantly between the groups,

suggesting a homogenous and impartial study design. Post-intervention results demonstrated significant clinical improvements, with the majority of patients experiencing pain alleviation when walking and at night, coupled with notable functional recoveries across WOMAC subscales such as rising from a sitting posture.

Walking on level areas and climbing stairs. Furthermore, the intra-articular therapies had an outstanding safety profile; 87.5% of participants reported no side effects, and any small local pain was self-limiting and resolved within 24 hours. While analgesic and adjunctive medication requirements varied—with selective

COX-2 inhibitors serving as the primary standalone backup—the duration of therapeutic relief was notable, with more than half of the cohort maintaining benefits for more than one month and nearly a quarter experiencing extended pain relief for more than six months which means baseline comparison found no statistically significant differences between the corticosteroid and steroid plus sequential PRP groups in terms of age, gender, BMI category, duration of knee symptoms, side involved, or Kellgren-Lawrence radiological grade (all $p > 0.05$), indicating broadly comparable baseline characteristics between the treatment groups.

Table 25: Wilcoxon signed-test for Pre and post treatment change in knee pain at rest

Within-group change in knee pain at rest				
Treatment group	Pre-treatment median (IQR)	Post-treatment median (IQR)	Wilcoxon W	p-value
Corticosteroid	3 (3-3)	0 (0-2)	0	<0.001
Steroid + sequential PRP	3 (2-3)	0 (0-0)	0	<0.001

Both corticosteroid monotherapy and sequential steroid-plus-PRP treatment resulted in a substantial decrease in resting knee discomfort from baseline to post-treatment ($p < 0.001$). Patients receiving corticosteroid monotherapy declined from a pre-treatment median score of 3 (IQR 3-3) to 0 (IQR 0-2), whereas those in the steroid-plus-PRP group

improved from a pre-treatment median of 3 (IQR 2-3) to a post-treatment median of 0 (IQR 0-0). Finally, these data demonstrate that both therapy procedures are effective in producing considerable clinical improvement in resting pain.

Table 26: Mann-Whitney U test for comparison of post-treatment of KOA rest between groups.

Comparison of post-treatment knee pain at rest between treatment groups					
Outcome	Corticosteroid	Steroid + sequential PRP	Mann-Whitney U	p-value	Rank-biserial effect
Post-treatment pain at rest, median (IQR)	0 (0-2)	0 (0-0)	544	0.0018	0.388

$p = 0.0018$ Statistically, this is significant. The distribution of post-treatment pain ratings was better for the steroid with sequential PRP group.

Table 27: Clinical and comparative distribution in post treatment pain et rest between single steroid and single steroid with PRP group

Post-treatment pain at rest	Corticosteroid n (%)	Steroid + PRP n (%)
No pain	15 (53.6%)	25 (89.3%)

Mild	5 (17.9%)	3 (10.7%)
Moderate	7 (25.0%)	0 (0.0%)
Severe	1 (3.6%)	0 (0.0%)
Total	28 (100%)	28 (100%)

The comparative distribution of post-treatment pain at rest between the corticosteroid monotherapy (n = 28) and sequential steroid-plus-PRP (n = 28) groups demonstrates a clear clinical advantage favoring the combined biological protocol. Specifically, an overwhelming 89.3% (n = 25) of patients receiving the sequential steroid-and-PRP regimen reported achieving complete freedom from resting pain (no pain), compared to only 53.6% (n = 15) of those treated with corticosteroid monotherapy. Furthermore, residual pain categories illustrate a marked reduction in symptom severity within the

sequential arm: mild resting pain was reported by 17.9% (n = 5) of the corticosteroid group versus 10.7% (n = 3) of the sequential group. Most notably, moderate and severe post-treatment pain at rest were entirely restricted to the monotherapy arm—accounting for 25.0% (n = 7) and 3.6% (n = 1) of patients respectively—while the sequential steroid-plus-PRP cohort recorded 0.0% in both categories. These findings highlight that sequential biological therapy significantly enhances resting pain relief and minimizes persistent discomfort compared to standalone steroid injections.

Table 28; Wilcoxon signed-test with in groups pain during walking

Within-group change in knee pain during walking				
Treatment group	Pre-treatment median (IQR)	Post-treatment median (IQR)	Wilcoxon W	p-value
Corticosteroid	3 (3–3)	1.5 (0–2.25)	0	<0.001
Steroid + sequential PRP	3 (3–3)	0 (0–0.25)	0	<0.0

Table 29: Between-Group Comparison of Primary Post-Treatment Pain and Functional Outcomes Using the Mann–Whitney U Test.

THE MOST IMPORTANT RESULTS and Summary of primary treatment outcomes					
Outcome	Corticosteroid post-treatment	Steroid + sequential PRP post-treatment	Between-group test	p-value	Effect
VAS pain at rest	0 (0–2)	0 (0–0)	MWU = 544	0.0018	0.388
VAS pain during walking	1.5 (0–2.25)	0 (0–0.25)	MWU = 623	<0.001	0.589
Night pain	0 (0–1)	0 (0–0)	MWU = 496	0.032	0.265
WOMAC rising from sitting	1 (1–2.25)	0 (0–0)	MWU = 660	<0.001	0.684
WOMAC walking	0.5 (0–1)	0 (0–0)	MWU = 544	0.0026	0.388
WOMAC stairs	2 (1–2)	0 (0–1)	MWU = 690	<0.001	0.76

A comparison of main post-treatment outcomes between corticosteroid monotherapy and sequential steroid-plus-PRP groups reveals a statistically significant advantage for the combined biological therapy across all parameters. Patients who received the sequential steroid-and-PRP therapy had substantially decreased post-treatment median ratings in VAS pain at rest (0 vs. 0, $p = 0.0018$), walking pain (0 vs. 1.5, $p < 0.001$), and night pain (0 vs. 0, $p = 0.032$). Functional tests using the WOMAC index showed significant benefits for the

sequential group in rising from a seat (0 vs. 1, $p < 0.001$), walking (0 vs. 0.5, $p = 0.0026$), and traversing stairs (0 vs. 2, $p < 0.001$), with moderate-to-large effect sizes. Finally, our data suggest that, while both therapies give relief, the consecutive inclusion of PRP results in much greater pain reduction and functional recovery than corticosteroid monotherapy alone. All six primary post-treatment outcome comparisons favor the steroid + sequential PRP group, and all are statistically significant at $p < 0.05$.

Table 30: Comparison of Perceived Duration of Pain Relief Between Treatment Groups.

Table 13. Perceived duration of pain relief by treatment		
Duration of pain relief	Corticosteroid n (%)	Steroid + sequential PRP n (%)
<1 month	26 (92.9%)	0 (0.0%)
1–3 months	2 (7.1%)	4 (14.3%)
3–6 months	0 (0.0%)	11 (39.3%)
>6 months	0 (0.0%)	13 (46.4%)
Total	28 (100%)	28 (100%)

A very significant difference between treatments ($p < 0.001$) is shown by the Fisher-Freeman-Halton analysis. 85.7% of the steroid-plus-PRP group experienced pain relief for at least three months, with 46.4% exceeding the threshold of 6 months, but 92.9% of the corticosteroid group reported pain reduction lasting less than one

month. These results demonstrate that sequential PRP treatment offers a statistically better and longer-lasting duration of pain alleviation for osteoarthritis in the knee.

Table 31: Wilcoxon Signed-Rank Test Within-Group Changes in Knee Pain During Walking Following Treatment

Within-group change in knee pain during walking				
Treatment group	Pre-treatment median (IQR)	Post-treatment median (IQR)	Wilcoxon W	p-value
Corticosteroid	3 (3–3)	1.5 (0–2.25)	0	<0.001
Steroid + sequential PRP	3 (3–3)	0 (0–0.25)	0	<0.0

Knee pain during walking decreased significantly in both treatment groups following intervention. The corticosteroid group showed a

reduction in median pain from 3 to 1.5, whereas the steroid plus sequential PRP group showed a greater reduction from 3 to 0. The Wilcoxon

signed-rank test demonstrated statistically significant within-group improvements in both groups ($p < 0.001$).

Table 32: Mann-Whitney U Test Between-Group Comparison of Post-Treatment Knee Pain During Walking

Between-group comparison of post-treatment pain during walking					
Outcome	Corticosteroid	Steroid + sequential PRP	Mann-Whitney U	p-value	Rank-biserial effect
Post-treatment pain during walking, median (IQR)	1.5 (0-2.25)	0 (0-0.25)	623	<0.001	

A statistically significant difference was observed between the two treatment groups in post-treatment walking pain (Mann-Whitney $U = 623$, $p < 0.001$). The median pain score was

lower in the steroid plus sequential PRP group [0 (0-0.25)] than in the corticosteroid group [1.5 (0-2.25)], indicating greater reduction in walking-related pain in the sequential PRP group.

Table 33: Chi-Square Test of Independence Distribution of Post-Treatment Knee Pain During Walking by Treatment Group

Post-treatment pain during walking	Corticosteroid	Steroid + PRP
No pain	8 (28.6%)	21 (75.0%)
Mild	6 (21.4%)	7 (25.0%)
Moderate	7 (25.0%)	0
Severe	7 (25.0%)	0

The distribution of post-treatment walking pain differed significantly between treatment groups ($p < 0.001$). No pain was reported by 75.0% of patients receiving steroid plus sequential PRP compared with 28.6% in the corticosteroid group. Moderate and severe pain remained

present in the corticosteroid group but were not observed in the steroid plus sequential PRP group. This distribution is consistent with the median-based analysis showing significantly lower post-treatment walking pain in the sequential PRP group.

Table 34: Wilcoxon Signed-Rank Test Within-Group Changes in Night Pain Following Treatment

Treatment group	Pre-treatment median	Post-treatment median	Wilcoxon p
Corticosteroid	2	0	<0.001
Steroid + sequential PRP	2	0	<0.001

Both treatment groups demonstrated statistically significant reductions in night pain, with median scores declining from 2 before treatment to 0 after treatment ($p < 0.001$ for both groups).

Table 35; Mann–Whitney U Test Between-Group Comparison of Post-Treatment Night Pain

Outcome	Corticosteroid	Steroid + sequential PRP	U	p-value
Post-treatment night pain, median (IQR)	0 (0–1)	0 (0–0)	496	0.032

Although both groups achieved a median post-treatment night-pain score of 0, the distribution differed significantly between groups ($U = 496$, $p = 0.032$). The narrower IQR in the steroid plus sequential PRP group [0 (0–0)] compared with

the corticosteroid group [0 (0–1)] suggests less residual night pain following sequential PRP treatment. However, the between-group separation was smaller than that observed for walking pain.

Table 36; Wilcoxon Signed-Rank Test Within-Group Changes in Difficulty Rising from a Sitting Position Following Treatment

Group	Pre median	Post median	Wilcoxon p
Corticosteroid	3	1	<0.001
Steroid + sequential PRP	3	0	<0.001

Difficulty rising from a sitting position improved significantly in both groups ($p < 0.001$). The corticosteroid group improved from a median score of 3 to 1, while the steroid plus sequential

PRP group improved from 3 to 0, demonstrating a greater reduction in functional difficulty in the sequential PRP group.

Table 37; Mann–Whitney U Test Between-Group Comparison of Post-Treatment Difficulty Rising from a Sitting Position

Outcome	Corticosteroid	Steroid + sequential PRP	U	p-value	Effect
Post-treatment difficulty	1 (1–2.25)	0 (0–0)	660	<0.001	0.684

A statistically significant between-group difference was observed in post-treatment difficulty rising from a sitting position ($U = 660$, $p < 0.001$). The steroid plus sequential PRP group had a median score of 0 compared with 1

in the corticosteroid group. The rank-biserial effect size of 0.684 indicates a substantial separation between the treatment-group distributions, supporting a clinically meaningful difference in this functional outcome.

Table 38; Master and important results and Summary

Summary of primary treatment outcomes					
Outcome	Corticosteroid post-treatment	Steroid + sequential PRP post-treatment	Between-group test	p-value	Effect
VAS pain at rest	0 (0–2)	0 (0–0)	MWU = 544	0.0018	0.388
VAS pain during walking	1.5 (0–2.25)	0 (0–0.25)	MWU = 623	<0.001	0.589
Night pain	0 (0–1)	0 (0–0)	MWU = 496	0.032	0.265
WOMAC rising from sitting	1 (1–2.25)	0 (0–0)	MWU = 660	<0.001	0.684

WOMAC walking	0.5 (0-1)	0 (0-0)	MWU = 544	0.0026	0.388
WOMAC stairs	2 (1-2)	0 (0-1)	MWU = 690	<0.001	0.76

A comparison of main post-treatment outcomes between corticosteroid monotherapy and sequential steroid-plus-PRP groups reveals a statistically significant advantage for the combined biological therapy across all parameters. Patients who received the sequential steroid-and-PRP therapy had substantially decreased post-treatment median ratings in VAS pain at rest (0 vs. 0, $p = 0.0018$), walking pain (0 vs. 1.5, $p < 0.001$), and night pain (0 vs. 0, $p = 0.032$) Functional tests using the WOMAC index showed significant benefits for the

sequential group in rising from a seat (0 vs. 1, $p < 0.001$), walking (0 vs. 0.5, $p = 0.0026$), and traversing stairs (0 vs. 2, $p < 0.001$), with moderate-to-large effect sizes. Finally, our data suggest that, while both therapies give relief, the consecutive inclusion of PRP results in much greater pain reduction and functional recovery than corticosteroid monotherapy alone all six primary post-treatment outcome comparisons favor the steroid + sequential PRP group, and all are statistically significant at $p < 0.05$.

Table 39; post injection local adverse effects

Adverse effect	Corticosteroid n (%)	Steroid + PRP n (%)
No adverse effect	23 (82.1%)	24 (85.7%)
Mild pain/swelling	5 (17.9%)	4 (14.3%)
Total	28 (100%)	28 (100%)

Chi-square $p = 1.000$ There was no statistically significant difference in reported local adverse effects between treatment groups. The comparative analysis of post-injection local adverse effects indicates an exceptional safety and tolerability profile across both treatment arms, with 82.1% ($n = 23$) of patients in the corticosteroid monotherapy group and 85.7% ($n = 24$) in the sequential steroid-plus-PRP group

experiencing no adverse events whatsoever. Furthermore, the remaining minor occurrences of transient mild pain or swelling were similarly distributed—affecting 17.9% ($n = 5$) and 14.3% ($n = 4$) of patients respectively—yielding a chi-square test result of $p = 1.000$ that confirms no statistically significant difference in local adverse effects between the two treatment groups.

Table 40; summary table

Outcome	Within-group improvement	Between-group difference in improvement	Direction	Effect
VAS pain at rest	Both $p < 0.001$	$p = 0.079$	PRP favored descriptively	Small-moderate
VAS pain during walking	Both $p < 0.001$	$p < 0.001$	PRP superior	Large
Night pain	Both $p < 0.001$	$p = 0.155$	PRP favored descriptively	Small
WOMAC rising from sitting	Both $p < 0.001$	$p < 0.001$	PRP superior	Large
WOMAC walking	Both $p < 0.001$	$p = 0.017$	PRP superior	Moderate
WOMAC stairs	Both $p < 0.001$	$p < 0.001$	PRP superior	Large

Duration of pain relief	—	Exact $p < 0.001$	PRP strongly favored	Strong distributional difference
Local adverse effects	—	Not significant	No demonstrated difference	—

Discussion:

This retrospective cohort study of 56 patients found that corticosteroid followed by three sequential platelet-rich plasma (PRP) injections was associated with better pain and functional outcomes than corticosteroid monotherapy. Complete relief of resting pain occurred in 89.3% of the sequential-treatment group compared with 53.6% of the corticosteroid-only group. Between-group comparisons also favoured sequential treatment for walking pain, night pain, and daily mobility. These findings are directionally consistent with comparative evidence favouring PRP-based interventions, although previous studies generally evaluated PRP alone or combinations other than corticosteroid followed by PRP. (15)

Treatment durability was a notable finding. Whereas 92.9% of corticosteroid-only patients reported relief lasting less than one month, 85.7% of sequential-treatment patients reported relief for at least three months, including 46.4% beyond six months ($p < 0.001$). This difference suggests a potentially meaningful advantage in sustained symptom control. Corticosteroid-mediated suppression of inflammation and subsequent PRP-associated biological activity provide a plausible explanation; however, this mechanism was not investigated. Clinical improvement therefore cannot establish synergistic effects, cartilage repair, or disease modification. (9,10)

Functional outcomes similarly favoured sequential treatment for rising from a chair, walking, and stair negotiation. These activities reflect practical aspects of independence and complement pain assessment. Sun and colleagues reported improvements in pain and WOMAC scores after PRP treatment, supporting the broader observation that symptomatic improvement may accompany better perceived function. Nevertheless, the present study assessed selected functional activities rather than demonstrating comprehensive recovery using objective

performance measures. Its findings should therefore be interpreted as improved patient-reported mobility, without assuming equivalent improvements in strength, gait mechanics, or joint structure. (17)

The findings should also be considered alongside conflicting randomized evidence. Tschopp and colleagues found no clear superiority of glucocorticoid, PRP, or hyaluronic acid over placebo in patients with relatively low baseline pain. Differences in symptom severity, injection schedules, outcome measurement, and study design may partly explain the contrasting results. However, these differences do not establish that sequential treatment overcomes limitations identified in controlled trials. The absence of randomization and blinding in the present study leaves treatment expectations, selection effects, and residual confounding as alternative explanations for the observed advantage. (16)

Local tolerability appeared comparable. No adverse effects were recorded in 82.1% of corticosteroid-only patients and 85.7% of sequential-treatment patients; reported reactions involved mild pain or swelling. The between-group difference was not statistically significant ($p = 1.000$), consistent with broader comparative evidence reporting favourable tolerability of intra-articular treatments. However, the small cohort cannot establish safety equivalence or exclude uncommon complications, and retrospective documentation may underestimate adverse events. (15)

Interpretation is further limited by incomplete clinical records, potential recall bias in reported relief duration, and nonstandardized follow-up. Without a PRP-only group, the independent contribution of corticosteroid pretreatment remains uncertain. Moreover, symptomatic outcomes cannot substantiate regeneration without structural assessment. Larger randomized studies should compare corticosteroid alone, PRP alone, and sequential treatment using standardized preparation,

validated functional instruments, objective performance testing, and longer follow-up. Such standardization is particularly important because PRP composition and administration protocols may influence outcomes. These limitations support interpreting the findings as preliminary associations requiring prospective confirmation. (14,18)

CONCLUSION

This retrospective comparative cohort study of 56 patients with symptomatic knee osteoarthritis found that both intra-articular corticosteroid alone and corticosteroid followed by sequential platelet-rich plasma improved pain and functional mobility. However, the sequential corticosteroid plus platelet-rich plasma approach showed significantly greater improvement in pain at rest, during walking, and at night, as well as in everyday activities such as rising from a chair, walking, and using stairs ($p = 0.032$ to <0.001). The duration of pain relief also differed markedly between groups. Most patients receiving corticosteroid alone experienced relief for less than one month, whereas the majority receiving sequential platelet-rich plasma reported relief lasting at least three months, with 46.4% reporting relief beyond six months ($p < 0.001$). Both treatments were well tolerated. Most patients experienced no local adverse effects, and the reported reactions were limited to mild pain or swelling, with no significant difference between groups ($p = 1.000$). Overall, sequential platelet-rich plasma following corticosteroid injection was associated with greater and longer-lasting improvement in pain and functional mobility without an observed increase in local adverse effects. As this study was retrospective and involved a relatively small cohort, these findings should be interpreted as an observed clinical association. Larger prospective randomized studies with standardized platelet-rich plasma protocols and longer follow-up are needed to confirm the durability and effectiveness of this treatment approach.

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