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Comparative Clinical Response of Bilateral Knee Osteoarthritis Treated with Intra - Articular Platelet-Rich Plasma and Triamcinolone Acetonide - A 12-Month Within-Patient Case Report.

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Abstract

Background: Intra-articular corticosteroids provide rapid short-term anti-inflammatory and analgesic relief in knee osteoarthritis (OA), whereas autologous platelet-rich plasma (PRP) targets intra-articular biology to yield sustained symptomatic improvement. A within-patient comparative study design eliminates inter-individual confounders such as age, body mass index (BMI), systemic co morbidities, and baseline activity levels.

Case Presentation: A 62-year-old male presented with a 3-year history of bilateral primary knee OA, classified as Kellgren-Lawrence (K-L) Grade III bilaterally. Under ultrasound guidance, the right knee received a single dose of leuko-reduced autologous PRP (5 mL), while the left knee received 40 mg (1 mL) of triamcinolone acetonide mixed with 2 mL of 1% lidocaine. Clinical evaluations were performed at baseline, 1, 3, 6, and 12 months using the Visual Analog Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and range of motion (ROM). The corticosteroid-treated (left) knee demonstrated rapid pain relief and functional improvement at 1 month. However, symptom recrudescence was observed starting at 3–6 months, returning near baseline levels by 12 months. Conversely, the PRP-treated (right) knee demonstrated a delayed response initially, followed by progressive, sustained improvement in pain, joint function, and patient satisfaction maintained through the 12 - month mark.

Conclusion: This within-patient comparison highlights distinct temporal efficacy profiles: triamcinolone provides rapid short-term relief, whereas autologous

PRP offers superior, sustained long-term clinical outcomes over 12 months.

Keywords: Intra-Articular Injections, Knee Osteoarthritis, Platelet-Rich Plasma, Triamcinolone Acetonide, Within-Patient Comparison

Introduction

Knee osteoarthritis (OA) is a highly prevalent degenerative joint disorder characterized by progressive articular cartilage loss, subchondral bone remodeling, and low-grade synovial inflammation[1]. Intra-articular (IA) injections are an established conservative treatment modality when oral analgesics and physical therapy yield inadequate control[2].

Intra-articular corticosteroids, such as triamcinolone acetonide, act primarily via direct anti-inflammatory and immunosuppressive pathways within the synovium, delivering rapid symptom relief [3].

However, their duration of action is inherently transient, typically lasting 4 to 12 weeks, with concerns regarding potential chondrotoxicity upon repeated administrations[4].

Conversely, autologous platelet-rich plasma (PRP) delivers concentrated bioactive growth factors—including Transforming Growth Factor-beta (TGF-β), Platelet - Derived Growth Factor (PDGF), Vascular Endothelial Growth Factor (VEGF), and Insulin-like Growth Factor - 1 (IGF-1)—which modulate the intra-articular cytokine environment, inhibit NF-κB inflammatory pathways, and stimulate matrix synthesis[5,6].

While prospective randomized controlled trials (RCTs) compare these modalities across cohorts, inter-patient heterogeneity regarding body mass index (BMI), daily mechanical loading, pain tolerance, and systemic inflammation often confounds results[7]. Evaluating both interventions concurrently in opposite knees of the same individual offers a unique within-patient control model that eliminates inter-subject variance[8].

This case report documents the comparative 12-month prospective outcomes of a patient receiving IA PRP in one knee and IA triamcinolone acetonide in the contra lateral knee, conforming to the CARE (Case Report) guidelines[9].

Case Presentation

Patient Information

A 62-year-old male retired civil servant presented to the outpatient orthopaedic clinic with chronic, progressive bilateral knee pain spanning 3 years. Pain was exacerbated by weight - bearing activities, stair negotiation, and prolonged standing, severely restricting his daily activities. His medical history was negative for diabetes mellitus, hypertension, autoimmune conditions, or inflammatory Arthropathies. He had no history of previous knee trauma, knee surgery, or prior intra-articular interventions.

Clinical Findings

Physical examination revealed a BMI of 26.4 kg/m². Neutral lower limb alignment was present bilaterally with mild fixed mechanical varus alignment on weight bearing. Tenderness was localized along the medial joint line in both knees. Bilateral coarse crepitus was elicited during passive flexion. Active range of motion (ROM) was equal bilaterally (0° to 120°). Both knees were ligamentously stable in the antero posterior and varus-valgus stress planes, with no evidence of major articular effusion or localized warmth.

Diagnostic Assessment

Standard weight-bearing antero posterior and lateral radiographs demonstrated classic features of osteoarthritis, including asymmetrical medial joint space

narrowing, sub chondral sclerosis, and marginal osteophytosis. Both knees were classified as Kellgren-Lawrence (K-L) Grade III (Table 1).

Table 1: Baseline Radiological Parameters

Diagnostic Parameter	Right Knee	Left Knee
K-L Grade	Grade III	Grade III
Medial Joint Space	Severely reduced	Severely reduced
Osteophytes	Moderate marginal	Moderate marginal
Alignment	3° Varus	3° Varus

Baseline clinical and functional standard scores (VAS, WOMAC) were documented prior to the intervention (Table 2).

Therapeutic Intervention

Following a detailed discussion regarding non-operative management options, the patient provided written informed consent to undergo simultaneous ultrasound-guided IA injections: auto logous PRP in the right knee and triamcinolone acetonide in the left knee. Non-steroidal anti-inflammatory drugs (NSAIDs) were discontinued 2 weeks prior to the procedure.

PRP Preparation Protocol

Under aseptic conditions, 20 mL of autologous venous blood was drawn into tubes containing acid citrate dextrose (ACD-A). A double-centrifugation protocol was utilized:

- First spin (Soft spin): 1,500 rpm for 10 minutes to separate red blood cells.
- Second spin (Hard spin): 3,200 rpm for 10 minutes to isolate the platelet pellet.

This yielded approximately 5 mL of leuko-reduced PRP, achieving a baseline platelet concentration factor of 4.2 times over whole blood, with minimal leukocyte contamination to decrease post-injection inflammatory flare[5].

Injection Technique

Under ultrasound guidance using a high-frequency linear transducer (7.5–12 MHz) via a suprapatellar lateral approach:

- Right Knee: Received 5 mL of autologous PRP.
- Left Knee: Received 40 mg (1 mL) of triamcinolone acetonide reconstituted with 2 mL of 1% preservative-free lidocaine hydrochloride.

Post-Procedure Protocol

The patient was kept in a supine position with full extension for 20 minutes post-injection. Paracetamol (1 g PRN, maximum 3 g/day) was prescribed for acute analgesia.

Post-procedure rehabilitation was standardized for both lower extremities: non-weight-bearing activities for 24 hours, followed by isometric quadriceps strengthening, closed-chain kinetic exercises, and range-of-motion routines initiated on post-injection day 3. NSAIDs were restricted throughout the 12-month follow-up period.

Follow-Up and Outcomes

Serial clinical and functional assessments were documented at baseline, 1 month, 3 months, 6 months, and 12 months by an independent clinical assessor blinded to the specific drug allocated to each knee.

Table 2: Comparative Longitudinal Outcome Metrics Over 12 Months.

Outcome Metric	Baseline	1 Month	3 Months	6 Months	12 Months
VAS Score (0–10)					
Right Knee (PRP)	8	5	3	2	2
Left Knee (Steroid)	8	2	4	6	7
WOMAC Total (0–96)					
Right Knee (PRP)	68	42	26	18	16
Left Knee (Steroid)	66	20	34	52	62
Flexion Range (degrees)					
Right Knee (PRP)	0–120	0–125	0–130	0–130	0–130
Left Knee (Steroid)	0–120	0–130	0–125	0–120	0–120

Narrative Profile of Results

Short-term (1 Month)

The steroid-treated knee demonstrated rapid therapeutic gain, achieving significant pain reduction (ΔVAS = −6) and functional performance recovery (ΔWOMAC = −46). The PRP-treated knee demonstrated moderate short-term analgesia (ΔVAS = −3).

Mid-term (3 to 6 Months)

The benefit of the corticosteroid peaked, plateaued, and subsequently regressed rapidly, with VAS pain scores increasing from 2 at 1 month to 6 by month 6. Conversely, the PRP-treated knee exhibited continuous, progressive symptom mitigation, surpassing the corticosteroid-treated knee in all performance domains by month 3.

Long-term (12 Months)

At 12-month final follow-up, the PRP-treated knee maintained sustained functional outcomes (WOMAC = 16) and low pain severity (VAS = 2). The triamcinolone-treated knee deteriorated nearly to baseline metrics (WOMAC = 62; VAS = 7).

Adverse Events

No local complications such as infection, fat necrosis, skin depigmentation, or neurovascular deficits were recorded. Mild, self-limiting post-injection soreness lasting 48 hours was reported in the PRP-treated knee.

Discussion

This within-patient prospective comparative analysis illustrates the differing response kinetics between intra-articular triamcinolone acetonide and autologous PRP in grade III knee OA.

Corticosteroids mediate their anti-inflammatory effects by diffusing across cell membranes, binding glucocorticoid receptors, and down regulating pro-inflammatory cytokines such as IL-1β, TNF-α, and IL-6[3]. This yields rapid synovial decongestion and pain relief within days. However, because corticosteroids do not arrest underlying structural degeneration and undergo rapid joint clearance, their efficacy drops sharply after 8 to 12 weeks, as seen in the left knee's outcome trajectory[4, 10].

PRP works via a different mechanism: concentrated α-granules release growth factors (TGF-β1, PDGF, IGF-1) that inhibit nuclear factor-kappa B (NF-κB) signalling, stimulate hyaluronan synthesis by synovial fibroblasts, and promote matrix homeostasis[5,6]. This biological modulation takes longer to manifest clinically, explaining the moderate response at 1 month, but yields

sustained disease-modifying symptomatic stabilization extending to 12 months[11, 12].

The within-patient design employed here is particularly valuable. Thekkekkara et al.[8] previously demonstrated the feasibility of bilateral simultaneous comparisons in a double-blind RCT, though their follow-up was limited to 6 months. Our 12-month observation extends these findings and aligns with meta-analytic evidence that PRP provides superior long-term pain and function outcomes compared to corticosteroids at ≥6 months [13, 14].

Strengths and Limitations

Strengths: This report eliminates inter-subject confounding factors (age, genetic variations, baseline inflammatory status, loading mechanics, physical activity levels) by utilizing a within-patient contralateral control design; long-term 12-month follow-up using multiple validated clinical indices (WOMAC, VAS, ROM)[9].

Limitations: N-of-1 case study design precludes direct population-wide generalizations; lack of structural serial magnetic resonance imaging (MRI) or biomarker evaluation to assess objective cartilage volume changes; absence of blinding to intervention allocation; and potential for unilateral placebo or nocebo effects influencing contralateral perception [9].

Conclusion

In this within-patient comparative case report of bilateral grade III knee osteoarthritis, intra-articular triamcinolone acetonide yielded rapid, short-term analgesic and functional recovery that rapidly diminished after 3 months. In contrast, intra-articular autologous PRP provided sustained clinical benefit, superior functional recovery, and lasting symptomatic relief over 12 months.

Patient Perspective

The patient reported that while the left knee (steroid-treated) felt "dramatically better" within the first 2 weeks, the improvement "did not last." He described the right knee (PRP-treated) as having a "slower start" but "getting better and better each month," allowing him to resume daily walks and stair-climbing without significant discomfort by the 6-month mark. At 12 months, he expressed a strong preference for PRP if future intervention were required.

Informed Consent

Written informed consent was obtained from the patient for the administration of intra-articular treatments and the publication of this case report, including accompanying clinical data and radiological images. The patient was informed that all identifying information would be de-identified to protect confidentiality in accordance with the Declaration of Helsinki [15].

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