Section: Orthopaedics

Original Research Article

PLATELET-RICH PLASMA VERSUS CORTICOSTEROID INJECTION FOR LATERAL EPICONDYLITIS: A PROSPECTIVE COMPARATIVE STUDY

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ABSTRACT

Background: Lateral epicondylitis is a common degenerative tendinopathy of the elbow that causes pain and functional impairment. Although corticosteroid injections provide rapid symptomatic relief, their long-term efficacy remains questionable. Platelet-rich plasma (PRP) has emerged as a biological treatment aimed at promoting tendon healing and sustained functional recovery. This study compared the clinical outcomes of PRP and corticosteroid injections in the management of lateral epicondylitis.

Materials and Methods: A prospective comparative study was conducted in the Department of Orthopaedics, Narayana Medical College and Hospital, Nellore, between January 2024 and December 2025. Thirty adult patients with clinically diagnosed lateral epicondylitis refractory to conservative treatment were randomly allocated into two groups: PRP (n = 15) and triamcinolone injection (n = 15). Pain and functional outcomes were assessed using the Visual Analog Scale (VAS) and Disabilities of the Arm, Shoulder and Hand (DASH) score at baseline and at 4, 8, 12, and 24 weeks after injection. Complications were also recorded.

Results: Baseline demographic characteristics, symptom duration, VAS scores, and DASH scores were comparable between the two groups. At 4 weeks, the corticosteroid group demonstrated significantly greater pain relief and functional improvement than the PRP group ($p < 0.001$). However, from 8 weeks onward, patients treated with PRP showed significantly superior outcomes. At 24 weeks, the mean VAS score was 1.67 ± 0.49 in the PRP group compared with 4.67 ± 0.49 in the corticosteroid group ($p < 0.001$). Similarly, the mean DASH score at 24 weeks was 11.53 ± 0.83 in the PRP group versus 42.53 ± 1.36 in the corticosteroid group ($p < 0.001$). Minor complications included transient post-injection pain and swelling following PRP and skin depigmentation after corticosteroid injection, with no serious adverse events observed.

Conclusion: Both PRP and corticosteroid injections were effective in reducing pain and improving function in patients with lateral epicondylitis. Corticosteroid injection produced superior short-term symptomatic relief, whereas PRP demonstrated significantly better sustained pain relief and functional improvement over 24 weeks. PRP appears to be a safe and more effective treatment option for achieving long-term clinical outcomes in patients with lateral epicondylitis.

Keywords: Platelet-rich plasma; Corticosteroid; Triamcinolone; Lateral epicondylitis; Tennis elbow; Visual Analog Scale; DASH score.

INTRODUCTION

Lateral epicondylitis (LE), commonly known as tennis elbow, is one of the most frequent causes of lateral elbow pain in adults. Despite its name, the condition predominantly affects non-athletes and is commonly encountered in individuals engaged in repetitive occupational activities involving forceful

gripping, wrist extension, and forearm rotation. Histopathological studies have demonstrated that chronic lateral epicondylitis is characterized by angiofibroblastic degeneration, collagen disorganization, fibroblast proliferation, and neovascularization rather than active inflammation, supporting its current classification as a degenerative tendinopathy rather than an inflammatory disorder.[1-3]

The prevalence of lateral epicondylitis is estimated to range from 1% to 3% in the general population, with the highest incidence occurring between the fourth and sixth decades of life. Occupational exposure to repetitive upper limb movements, manual labor, and the use of vibrating tools significantly increases the risk of developing the condition.[4-6] Persistent pain and reduced grip strength adversely affect activities of daily living, work productivity, and quality of life, making lateral epicondylitis an important clinical and socioeconomic problem.[7]

Conservative treatment remains the cornerstone of management and includes activity modification, physiotherapy, non-steroidal anti-inflammatory drugs (NSAIDs), bracing, and various injection therapies. Although many patients improve with non-operative treatment, a considerable proportion continue to experience persistent pain and functional disability despite prolonged conservative management.[8-10]

Local corticosteroid injection has long been considered one of the most commonly used interventions for lateral epicondylitis because of its rapid analgesic effect. Corticosteroids suppress inflammatory mediators and provide significant short-term pain relief, often facilitating an early return to daily activities. However, several randomized controlled trials and systematic reviews have demonstrated that these benefits are usually transient, with higher recurrence rates and inferior long-term outcomes compared with placebo, physiotherapy, or biological therapies.[11-13 Furthermore, repeated corticosteroid injections have been associated with impaired collagen synthesis, tendon degeneration, and an increased risk of tendon rupture.[14]

Platelet-rich plasma (PRP) has emerged as a promising orthobiologic treatment aimed at promoting tendon healing rather than merely providing symptomatic relief. PRP is an autologous concentration of platelets containing numerous growth factors, including platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), vascular endothelial growth factor (VEGF), and insulin-like growth factor-1 (IGF-1), which stimulate angiogenesis, collagen synthesis, extracellular matrix remodeling, and tendon regeneration.[15] Unlike corticosteroids, whose primary mechanism is suppression of pain and inflammation, PRP is intended to enhance the intrinsic healing response of the degenerated tendon.[16]

Recent systematic reviews and meta-analyses have consistently reported a temporal difference in treatment response between these two modalities. Corticosteroid injections generally provide superior pain relief during the early post-treatment period, whereas PRP demonstrates significantly better long-term improvements in pain, functional outcomes, and patient satisfaction.[17-20] Nevertheless, considerable heterogeneity exists among published studies because of differences in PRP preparation techniques, platelet concentration, injection protocols, rehabilitation regimens, duration of symptoms, and follow-up periods. Consequently, the relative effectiveness of PRP and corticosteroid injections remains a subject of ongoing debate, particularly in routine clinical practice.

Comparative studies conducted in different populations have generally favored PRP for sustained clinical improvement, although many have been limited by small sample sizes, variable methodology, or short-term follow-up. Moreover, evidence from the Indian population remains relatively limited. A prospective comparison using standardized pain and functional outcome measures may therefore provide clinically relevant evidence to guide treatment selection in patients with lateral epicondylitis.

The present study was undertaken to compare the clinical effectiveness of platelet-rich plasma and corticosteroid injections in patients with lateral epicondylitis by evaluating pain relief, functional recovery, and treatment-related complications over a 24-week follow-up period. The findings are expected to contribute to the growing body of evidence regarding the optimal injectable treatment for chronic lateral epicondylitis.

MATERIALS AND METHODS

Study Design: This prospective, randomized, double-blind comparative study was conducted in the Department of Orthopaedics, Narayana Medical College and Hospital, Nellore, India, over a period of 24 months from January 2024 to December 2025. The study protocol was approved by the Institutional Ethics Committee before commencement. Written informed consent was obtained from all participants prior to enrolment.

Both the participants and the outcome assessor were blinded to the treatment allocation throughout the study period.

Study Population: Thirty consecutive patients presenting with clinically diagnosed lateral epicondylitis and fulfilling the eligibility criteria were included in the study.

Patients were randomly allocated into two equal groups (n = 15 each) using computer-generated random numbers.

- Group A: Platelet-rich plasma (PRP) injection
- Group B: Corticosteroid (Triamcinolone acetonide) injection

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

- Age ≥18 years.
- Clinical diagnosis of lateral epicondylitis based on history and physical examination.
- Persistent symptoms for more than six weeks despite conservative treatment including rest and NSAIDs.
- Localized tenderness over the lateral epicondyle with pain reproduced by resisted wrist extension and/or resisted middle-finger extension (Cozen's and/or Maudsley's test).
- Willingness to participate and comply with the follow-up schedule.

Exclusion Criteria

Patients were excluded if they had:

- Previous elbow surgery.
- Previous injection around the affected elbow within six months.
- Elbow fractures, dislocations or recent trauma.
- Rheumatoid arthritis, inflammatory arthropathy or advanced osteoarthritis.
- Active local or systemic infection.
- Coagulopathy or anticoagulant therapy.
- Pregnancy.
- Known hypersensitivity to corticosteroids.
- Inability or unwillingness to provide informed consent.

Baseline assessment

A detailed history and clinical examination were performed before intervention.

The following baseline variables were recorded:

- Age
- Sex
- Occupation
- Dominant hand
- Side involved
- Duration of symptoms

Pain severity was evaluated using the Visual Analog Scale (VAS), while functional disability was assessed using the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire.

Preparation of Platelet-Rich Plasma

Autologous platelet-rich plasma was prepared immediately before injection using a standardized manual double-spin technique in accordance with contemporary recommendations for musculoskeletal orthobiologics and the Minimum Information for Studies Evaluating Biologics in Orthopaedics (MIBO) reporting principles. A leukocyte-rich PRP (LR-PRP) preparation was used in all patients.

Approximately 20 mL of peripheral venous blood was collected under aseptic precautions into anticoagulant-containing tubes.

PRP was prepared using differential centrifugation:

- First (soft) spin: 100–300 × g for 5–10 minutes, allowing separation of erythrocytes from plasma and the buffy coat.
- The plasma layer together with the entire buffy coat was transferred into a sterile tube.
- Second (hard) spin: 400–700 × g for 10–17 minutes, resulting in concentration of platelets and leukocytes into a platelet pellet.

Following the second centrifugation, the upper platelet-poor plasma was discarded while the lower plasma fraction containing the platelet pellet was gently resuspended to obtain approximately 3–4 mL of leukocyte-rich platelet-rich plasma for injection. No exogenous platelet activator was used before administration, as activation occurs following contact with collagen within the tendon tissue.

Injection Technique: All injections were administered under strict aseptic precautions in the outpatient procedure room.

The patient was positioned comfortably with the elbow flexed to approximately 90° and the forearm pronated. The point of maximal tenderness over the common extensor tendon origin was identified clinically.

PRP Group: Approximately 3–4 mL of leukocyte-rich PRP was injected into the common extensor tendon origin using a single skin entry with a peppering technique to ensure uniform intratendinous distribution.

Corticosteroid group: Patients received 1 mL Triamcinolone acetonide (40 mg/mL) mixed with 2 mL of 1% lignocaine, injected into the common extensor tendon origin using the identical peppering technique.

All injections were performed by the same orthopaedic surgeon to eliminate operator-related variability.

Post-injection rehabilitation: Patients in both groups were advised relative rest for 48 hours following the procedure.

Ice application and oral paracetamol were permitted for post-procedural discomfort. NSAIDs were avoided, particularly in the PRP group, to prevent interference with platelet activation and growth factor release.

Beginning after the initial rest period, all patients followed an identical rehabilitation programme consisting of:

- Gentle stretching exercises of the wrist extensors,
- Progressive eccentric strengthening exercises,
- Gradual return to occupational activities according to symptom tolerance.

Compliance with rehabilitation was reinforced during every follow-up visit.

Outcome measures

Patients were evaluated at:

- Baseline
- 4 weeks
- 8 weeks
- 12 weeks
- 24 weeks

The primary outcome measures were:

- Visual Analog Scale (VAS)
- Disabilities of the Arm, Shoulder and Hand (DASH) score

Secondary outcome measures included treatment-related complications and adverse events.

Statistical analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS

Statistics for Windows, Version 30.0 (IBM Corp., Armonk, NY, USA).

Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were expressed as frequencies and percentages.

Baseline demographic characteristics between the two groups were compared using the independent-samples Student's t-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as appropriate.

Differences in VAS and DASH scores between the two treatment groups at each follow-up interval were analysed using the independent-samples Student's t-test. All statistical tests were two-tailed, and a p value of <0.05 was considered statistically significant

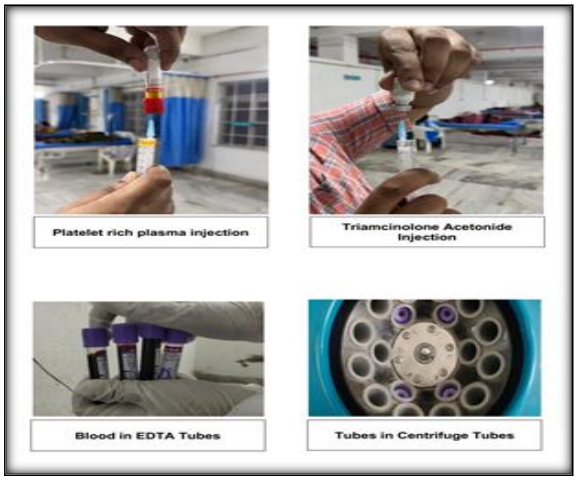

Figure 1: preparation of PRP and Steroid injections

RESULTS

A total of 30 patients with clinically diagnosed lateral epicondylitis were included in the study and completed the 24-week follow-up. Fifteen patients received platelet-rich plasma (PRP) injections (Group A), while fifteen received triamcinolone acetonide injections (Group B). There were no losses to follow-up, protocol deviations, or treatment crossovers.

The baseline demographic and clinical characteristics were comparable between the two treatment groups. The majority of patients belonged to the 41–50-year age group, and there was no statistically significant difference in age distribution between the PRP and corticosteroid groups (p = 0.482). Similarly, sex distribution was comparable between the groups, with males constituting the majority of the study population (p = 0.699).

Most patients were right-hand dominant (86.7%), and the dominant hand distribution was similar between both groups (p = 0.591). The right elbow was the predominantly affected side (76.7%), with no statistically significant difference in laterality between treatment groups (p = 0.667).

The majority of patients were engaged in occupations involving repetitive upper limb activity, including agricultural work, construction work, homemaking, teaching, mechanical work, painting, plumbing, and electrical work. Occupational distribution did not differ significantly between the two groups (p = 0.899).

The duration of symptoms before intervention ranged from 6 to 16 weeks. Most patients presented between 6 and 10 weeks after symptom onset. No statistically significant difference was observed in symptom duration between the two groups (p = 0.768), indicating comparable chronicity at baseline.

Baseline pain severity assessed using the Visual Analog Scale (VAS) was similar between the PRP and corticosteroid groups (7.47 ± 0.64 vs. 7.27 ± 0.70, p = 0.422).

At the 4-week follow-up, patients treated with triamcinolone demonstrated significantly lower VAS scores than those treated with PRP (3.73 ± 0.46 vs. 5.27 ± 0.46, p < 0.001). However, this trend changed during subsequent follow-up. At 8 weeks, mean VAS scores became significantly lower in the PRP group (3.67 ± 0.49 vs. 4.27 ± 0.46, p = 0.002). Progressive improvement continued in the PRP group throughout the study, with significantly lower pain scores observed at 12 weeks (2.53 ± 0.52 vs. 4.53 ± 0.52, p < 0.001) and 24 weeks (1.67 ± 0.49 vs. 4.67 ± 0.49, p < 0.001).

Functional outcome assessed using the DASH score followed a similar pattern. Baseline DASH scores were identical in both groups (53.07 ± 1.53 vs. 53.07 ± 1.22, p = 1.000). At 4 weeks, the corticosteroid group demonstrated significantly better functional improvement than the PRP group (32.73 ± 2.12 vs. 42.20 ± 2.14, p < 0.001). However, patients receiving PRP demonstrated progressive functional improvement during later follow-up. Mean DASH scores at 8 weeks (28.87 ± 0.92 vs. 35.33 ± 1.23, p < 0.001), 12 weeks (19.80 ± 1.42 vs. 38.93 ± 1.22, p < 0.001), and 24 weeks (11.53 ± 0.83 vs. 42.53 ± 1.36, p < 0.001) were significantly lower in the PRP group.

Treatment-related complications were infrequent and self-limiting. In the PRP group, two patients experienced transient post-injection pain flare and one patient developed mild local swelling, all of which resolved with conservative management. In the corticosteroid group, two patients developed localized skin depigmentation. No cases of infection, tendon rupture, neurovascular injury, or other serious adverse events were observed in either group.

Table 1: Baseline demographic and clinical characteristics

Variable	PRP (n=15)	Triamcinolone (n=15)	P value
Age 20–30	1 (6.7%)	3 (20.0%)	0.482
Age 31–40	4 (26.7%)	3 (20.0%)	
Age 41–50	7 (46.7%)	4 (26.7%)	
Age >50	3 (20.0%)	5 (33.3%)	

Male	11 (73.3%)	9 (60.0%)	0.699
Female	4 (26.7%)	6 (40.0%)	
Right-hand dominant	14 (93.3%)	12 (80.0%)	0.591
Left-hand dominant	1 (6.7%)	3 (20.0%)	
Right elbow	12 (80.0%)	11 (73.3%)	0.667
Left elbow	3 (20.0%)	4 (26.7%)	
Duration of symptoms (weeks), mean ± SD	8.7 ± 2.5	8.9 ± 2.8	0.77

Table 2: Comparison of VAS scores

Follow-up	PRP (Mean±SD)	Triamcinolone (Mean±SD)	P value
Baseline	7.47 ± 0.64	7.27 ± 0.70	0.422
4 weeks	5.27 ± 0.46	3.73 ± 0.46	<0.001
8 weeks	3.67 ± 0.49	4.27 ± 0.46	0.002
12 weeks	2.53 ± 0.52	4.53 ± 0.52	<0.001
24 weeks	1.67 ± 0.49	4.67 ± 0.49	<0.001

Table 3: Comparison of DASH scores

Follow-up	PRP (Mean±SD)	Triamcinolone (Mean±SD)	P value
Baseline	53.07 ± 1.53	53.07 ± 1.22	1.000
4 weeks	42.20 ± 2.14	32.73 ± 2.12	<0.001
8 weeks	28.87 ± 0.92	35.33 ± 1.23	<0.001
12 weeks	19.80 ± 1.42	38.93 ± 1.22	<0.001
24 weeks	11.53 ± 0.83	42.53 ± 1.36	<0.001

Table 4: Treatment-related complications

Complication	PRP	Triamcinolone
Transient post-injection pain flare	2	0
Local swelling	1	0
Skin depigmentation	0	2
Infection	0	0
Neurovascular injury	0	0
Tendon rupture	0	0

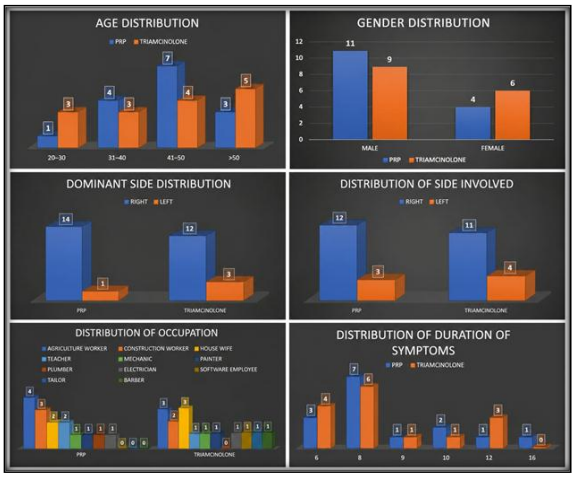

Figure 2: Comparison of baseline demographic characteristics of both groups

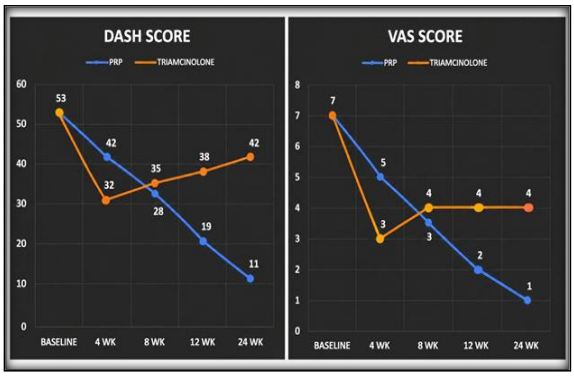

Figure 3: Comparison of DASH score and the VAS scores over the course of treatment in both the groups

DISCUSSION

Lateral epicondylitis is a common degenerative tendinopathy affecting the origin of the extensor carpi radialis brevis tendon and remains one of the most frequent causes of chronic elbow pain in adults. Although numerous conservative treatment options have been described, the optimal injectable therapy continues to be debated. The present prospective randomized double-blind study compared the clinical efficacy of leukocyte-rich platelet-rich plasma (LR-PRP) with corticosteroid injection over a 24-week follow-up period. The principal findings of this study were that corticosteroid injection produced superior short-term pain relief and functional improvement at four weeks, whereas PRP demonstrated significantly greater and sustained improvements in both pain and functional outcome from eight weeks onwards. These findings support the concept that corticosteroids primarily provide symptomatic relief, while PRP facilitates biological tendon healing and long-term functional recovery.

The demographic characteristics of our study population were comparable between the two treatment groups. Most patients were between 40 and 50 years of age, with a predominance of males and involvement of the dominant upper limb. These observations are consistent with previous epidemiological studies reporting the highest incidence of lateral epicondylitis among middle-aged individuals engaged in occupations requiring repetitive wrist extension and forearm rotation.

Sanders et al. reported that lateral epicondylitis most commonly affects individuals between the fourth and sixth decades of life, while Shiri and Viikari-Juntura emphasized the strong association between repetitive occupational activities and the development of tendinopathy.[21,22]

Baseline VAS and DASH scores were comparable between the two groups, confirming that randomization achieved similar disease severity before intervention. Such baseline equivalence minimizes selection bias and strengthens the internal validity of comparative outcome analysis.

At four weeks, patients treated with corticosteroid injection demonstrated significantly greater reduction in pain and better functional improvement than those receiving PRP. This observation agrees with several randomized controlled trials demonstrating the rapid analgesic effect of corticosteroids. Corticosteroids inhibit phospholipase A2 activity and suppress inflammatory mediators, thereby providing early symptomatic relief despite the predominantly degenerative pathology of chronic tendinopathy. Coombes et al., in a landmark systematic review, concluded that corticosteroid injections provide superior short-term outcomes but are associated with poorer intermediate and long-term results compared with other conservative treatments.[23] Similarly, Fitzpatrick et al., in their meta-analysis of PRP studies, reported that corticosteroids consistently outperform PRP during the early post-treatment period but lose their clinical advantage with longer follow-up.[24]

In contrast, the PRP group demonstrated progressive improvement after the initial four weeks and achieved significantly lower VAS scores at 8, 12, and 24 weeks. The sustained reduction in pain observed in the present study is consistent with the biological mechanism of PRP, which delivers concentrated autologous platelets containing multiple growth factors including PDGF, TGF-β, VEGF, IGF-1, and epidermal growth factor that stimulate angiogenesis, collagen synthesis, extracellular matrix remodeling, and tendon regeneration. Rather than suppressing symptoms alone, PRP is believed to enhance intrinsic tendon healing through modulation of the reparative process.[25,26]

Functional recovery, assessed using the DASH score, paralleled the improvement in pain. Although corticosteroid-treated patients demonstrated superior function at four weeks, PRP recipients showed significantly greater functional improvement during subsequent follow-up, with markedly lower DASH scores at 8, 12, and 24 weeks. These findings are in agreement with the randomized controlled trial by Gosens et al., who demonstrated sustained superiority of PRP over corticosteroid injections even after two years of follow-up.[27] Similar long-term benefits have also been reported in recent systematic reviews and network meta-analyses, which concluded that PRP provides greater improvements in pain, grip strength, and patient-reported functional outcomes beyond six months.[28,29]

Several contemporary meta-analyses have further strengthened the evidence supporting PRP. Chen et al. analyzed randomized controlled trials involving various tendinopathies and concluded that PRP significantly improves long-term pain and functional outcomes while reducing recurrence rates compared with corticosteroids.[30] Likewise, Xu et al. reported that although corticosteroids remain effective for rapid symptom control, PRP consistently demonstrates superior long-term efficacy, making it a more suitable biological treatment for chronic tendinopathy.[31] These observations closely mirror the temporal response pattern observed in the present study.

The favourable long-term results observed with PRP may also be attributable to the use of leukocyte-rich PRP prepared using a standardized double-spin protocol. Current orthobiologic consensus statements recommend standardized reporting of PRP composition because platelet concentration, leukocyte content, preparation technique, and activation methods substantially influence clinical outcomes.[32] Although controversy persists regarding the relative advantages of leukocyte-rich and leukocyte-poor preparations, leukocyte-rich PRP has demonstrated encouraging clinical outcomes in chronic tendinopathies owing to its higher concentration of anabolic growth factors and cytokines involved in tissue repair.[33]

Treatment-related complications were minimal in both groups. Patients receiving PRP experienced transient post-injection pain and mild local swelling, both of which resolved without intervention. In contrast, two patients in the corticosteroid group developed localized skin depigmentation. No patient experienced infection, tendon rupture, neurovascular injury, or other major adverse events. These findings are consistent with previous reports demonstrating the overall safety of PRP while recognizing the well-established local adverse effects associated with corticosteroid injections, including skin atrophy, depigmentation, and potential tendon weakening following repeated administration.[23,34]

The present study has several strengths. It employed a prospective randomized double-blind design with complete follow-up of all enrolled patients, standardized rehabilitation protocols, validated outcome measures (VAS and DASH), and a uniform injection technique performed by a single surgeon, thereby minimizing performance bias and inter-operator variability.

However, certain limitations should be acknowledged. The sample size was relatively small, and the follow-up period was limited to 24 weeks. Platelet concentration was not quantified, and advanced imaging modalities such as ultrasonography or magnetic resonance imaging were not used to objectively evaluate tendon healing following treatment. Furthermore, grip strength measurements and patient satisfaction scores were not assessed, which may have provided additional information regarding functional recovery. Future

multicentre randomized controlled trials with larger sample sizes, standardized biologic characterization according to current orthobiologic reporting guidelines, and longer follow-up are warranted to further establish the long-term efficacy of PRP.

Overall, the findings of the present study support the growing body of evidence favouring platelet-rich plasma as a biologically based treatment capable of producing sustained pain relief and superior functional recovery in patients with chronic lateral epicondylitis. While corticosteroid injections remain useful for rapid short-term symptom relief, PRP appears to offer greater long-term clinical benefit and may therefore represent the preferred injectable treatment for appropriately selected patients.

CONCLUSION

Platelet-rich plasma and corticosteroid injections were both effective in reducing pain and improving function in patients with lateral epicondylitis. Corticosteroid injection provided superior short-term pain relief and functional improvement during the early follow-up period. However, platelet-rich plasma demonstrated significantly greater and sustained improvement in both pain and functional outcomes from 8 weeks onwards, with superior results at 24 weeks. Both treatment modalities were safe, with only minor self-limiting complications and no serious adverse events observed. These findings suggest that while corticosteroid injection remains a useful option for rapid symptomatic relief, leukocyte-rich platelet-rich plasma offers better long-term clinical outcomes and may be considered the preferred injectable treatment for patients with chronic lateral epicondylitis.

CASE ILLUSTRATIONS:

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