Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Comparative Clinical Outcomes of Monotherapy and Combined Conservative Treatment Strategies in Lateral Epicondylitis: A Retrospective Cohort Study of 420 Patients

Volkan Kizilkaya

dr_volkankizilkaya@hotmail.com

Private Metrolife Hospital

Sefa Erdem Karapinar

Suleyman Demirel University School of Medicine

Ali Levent

Private Metrolife Hospital

Ertan Gocer

Iskenderun State Hospital

Mehmet Melih Asoglu

Private Metrolife Hospital

Mustafa Cukurlu

Private Adiyaman Park Hospital

Research Article

Keywords: Lateral epicondylitis, Tennis elbow, Conservative treatment, Orthosis, Splinting, Corticosteroid injection, Platelet-rich plasma, Grip strength, PRTEE, Retrospective study

Posted Date: June 15th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9861274/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at European Journal of Orthopaedic Surgery & Traumatology on September 23rd, 2026. See the published version at https://doi.org/10.1007/s00590-026-04978-6.

Abstract

Introduction: Lateral epicondylitis is a common degenerative tendinopathy of the elbow that can significantly impair pain, functional capacity, and grip strength. Although various conservative treatment options are available, evidence comparing different conservative treatment combinations remains limited. This study aimed to compare the clinical outcomes of different conservative treatment strategies in patients with lateral epicondylitis.

Study Design: Retrospective cohort study; Level of Evidence: III.

Materials and Methods: A total of 420 patients diagnosed with lateral epicondylitis were retrospectively reviewed and categorized into four groups according to the conservative treatment strategy received during routine clinical practice: NSAID therapy alone, NSAID combined with orthotic support, NSAID combined with injection therapy, and NSAID combined with both orthotic support and injection therapy. Pain was assessed using the Visual Analog Scale (VAS), functional outcomes using the Patient-Rated Tennis Elbow Evaluation (PRTEE), and grip strength using a Jamar hydraulic hand dynamometer. Clinical assessments were performed at baseline and at the 6-month follow-up. Changes in VAS, PRTEE, and grip strength scores were compared among treatment groups.

Results: Significant improvements were observed in all groups for VAS, PRTEE, and grip strength scores at 6 months (all $p < 0.001$). However, the magnitude of improvement differed significantly among treatment groups (all $p < 0.001$). The greatest reductions in pain (ΔVAS 4.84 ± 2.02) and PRTEE scores (ΔPRTEE 26.31 ± 9.70), as well as the largest increase in grip strength (ΔGrip 14.88 ± 4.12 kgf), were observed in patients treated with combined NSAID, orthotic support, and injection therapy. In contrast, the NSAID-only group demonstrated the smallest improvements across all outcome measures.

Conclusion: Patients treated with combined conservative treatment modalities demonstrated greater improvements in pain, functional outcomes, and grip strength than those receiving less comprehensive treatment strategies. The combination of NSAID therapy, orthotic support, and injection therapy was associated with the most favorable short-term clinical outcomes.

INTRODUCTION

Lateral epicondylitis, also known as tennis elbow, is one of the most common causes of elbow pain and is characterized by tenderness over the lateral aspect of the elbow. In some patients, pain may radiate to the forearm and shoulder and occasionally extend to the third and fourth fingers [1]. Symptoms are typically aggravated by wrist and elbow movements, particularly repetitive activities. Repetitive upper extremity use, forceful gripping, and manual labor have been associated with an increased risk of developing lateral epicondylitis. Smoking has also been reported as a potential risk factor because of its negative effects on vascularity and tissue healing [2]. The extensor carpi radialis brevis (ECRB) tendon is the structure most commonly involved in lateral epicondylitis. Repetitive microtrauma to the tendon results in a chronic degenerative process rather than an acute inflammatory response [3].

Histopathological studies have demonstrated angiofibroblastic degeneration characterized by microtears, collagen disorganization, vascular hyperplasia, and granulation tissue formation [4]. Diagnosis is primarily based on clinical history and physical examination findings, while imaging studies are generally reserved for atypical or refractory cases [5].

Various treatment methods have been described for the management of lateral epicondylitis. Conservative treatment remains the first-line approach, whereas surgical intervention is generally reserved for chronic and treatment-resistant cases [6]. Commonly used conservative modalities include activity modification, nonsteroidal anti-inflammatory drugs (NSAIDs), physical therapy, orthotic devices, and injection therapies [7]. Corticosteroid injections have been shown to provide effective short-term pain relief; however, their long-term efficacy remains controversial because of relatively high recurrence rates and potential functional deterioration over time [8]. In contrast, platelet-rich plasma (PRP) injections have been reported to promote tendon healing through biological regeneration mechanisms and may provide more sustained clinical improvement in the medium and long term [9].

Orthotic devices, including counterforce braces, wrist splints, and immobilization orthoses, have emerged as useful adjunctive treatment options by reducing mechanical stress on the extensor tendon complex and facilitating symptom control [10]. In routine clinical practice, treatment is frequently based on combinations of pharmacological therapy, orthotic support, and injection modalities. Despite their widespread use, comparative data regarding the effectiveness of different conservative treatment combinations remain limited.

Recent meta-analyses have suggested that PRP and corticosteroid injections may provide comparable short-term outcomes, while combined treatment approaches may offer additional functional benefits in selected patients [11]. Nevertheless, evidence comparing multimodal conservative treatment strategies in large patient cohorts remains scarce.

The aim of this study was to compare the clinical outcomes of different conservative treatment combinations in patients with lateral epicondylitis. Patients were categorized according to the conservative treatment strategy received during routine clinical practice, including NSAID therapy alone, NSAID combined with orthotic support, NSAID combined with injection therapy, and combined NSAID, orthotic support, and injection therapy. Changes in pain severity measured by the Visual Analog Scale (VAS), functional outcomes assessed using the Patient-Rated Tennis Elbow Evaluation (PRTEE), and grip strength were evaluated at baseline and at 6-month follow-up. We hypothesized that combined conservative treatment strategies would be associated with greater improvements in pain, function, and grip strength. A better understanding of the relative effectiveness of these treatment combinations may help optimize nonoperative treatment algorithms for patients with lateral epicondylitis.

MATERIALS AND METHODS

Study Design and Patient Selection

This retrospective single-center cohort study included 420 consecutive patients diagnosed with lateral epicondylitis who were treated in the Department of Orthopedics and Traumatology between January 1, 2021, and January 1, 2025. The study protocol was approved by the Harran University Clinical Research Ethics Committee (Session No: 10, Decision No: 02, dated May 26, 2025). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Patient data were anonymized prior to analysis to ensure confidentiality. The diagnosis of lateral epicondylitis was established based on clinical history and physical examination findings, including localized tenderness over the lateral epicondyle and pain provoked by resisted wrist extension and gripping activities.

Inclusion criteria were as follows:

- • Adults aged 18–65 years
- • Clinically diagnosed lateral epicondylitis
- • Receipt of conservative treatment with complete baseline and 6-month follow-up evaluations

Exclusion criteria were:

- • Previous elbow surgery or trauma
- • Systemic diseases that could affect pain perception or upper extremity function (e.g., rheumatoid arthritis, diabetic neuropathy, cervical radiculopathy)
- • Bilateral elbow involvement
- • Concomitant upper extremity pathology during the study period
- • Incomplete follow-up data

According to these criteria, a total of 420 patients (276 females and 144 males; mean age 43.08 ± 8.06 years) were included in the final analysis.

All patients received standard NSAID therapy as part of routine clinical practice. Additional treatment modalities, including orthotic support and/or injection therapy, were prescribed according to symptom severity, duration of symptoms, functional impairment, previous treatment history, and physician preference. Treatment allocation was not randomized.

For comparative analysis, patients were categorized into four groups according to the conservative treatment strategy received:

Group 1

NSAID therapy alone

Group 2

NSAID therapy combined with orthotic support (brace, splint, or cast)

Group 3

NSAID therapy combined with injection therapy (corticosteroid or platelet-rich plasma)

Group 4

NSAID therapy combined with both orthotic support and injection therapy

Treatment Procedures

All injections were administered by the same orthopedic surgeon (VK) under sterile conditions at the point of maximal tenderness over the lateral epicondyle. For platelet-rich plasma (PRP) treatment, 20 mL of peripheral venous blood was collected and centrifuged at 3000 rpm for 10 minutes. Approximately 3 mL of PRP obtained from the plasma layer was injected into the affected region.

Corticosteroid injections consisted of 1 mL methylprednisolone acetate (40 mg/mL) mixed with 1 mL local anesthetic solution (Jetokain®) and administered into the affected region. Orthotic devices, including braces, splints, or casts, were prescribed according to the treatment protocol and were recommended to be worn for at least 6 hours daily for a minimum of 6 weeks [12].

Evaluation Parameters

Clinical evaluations were performed before treatment (baseline) and at the 6-month follow-up. Three outcome measures were assessed: pain intensity, functional outcomes, and grip strength.

Pain Assessment

Pain intensity was evaluated using the Visual Analog Scale (VAS), a validated 10-point scale ranging from 0 (no pain) to 10 (maximum pain intensity).

Functional Assessment

Functional outcomes were assessed using the Patient-Rated Tennis Elbow Evaluation (PRTEE) questionnaire. The PRTEE is a validated disease-specific instrument consisting of 15 items designed to evaluate pain and functional disability associated with lateral epicondylitis. Total scores range from 0 to 100, with higher scores indicating greater pain and functional impairment.

Grip Strength Assessment

Grip strength was measured using a Jamar hydraulic hand dynamometer. Measurements were performed with the patient seated or standing upright, with the shoulder in a neutral position, the elbow flexed to 90°, the forearm in neutral rotation, and the wrist maintained at 0°–30° of extension and 0°–15° of ulnar deviation. Three consecutive measurements were obtained with a 30-second rest interval between trials, and the mean value was used for statistical analysis. Grip strength was recorded in kilogram-force (kgf) [2].

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows (Version 30.0; IBM Corp., Armonk, NY, USA). The distribution of continuous variables was evaluated using histograms, Q–Q plots, and the Shapiro–Wilk test. Continuous variables are presented as mean ± standard deviation (SD), while categorical variables are presented as frequencies and percentages.

Baseline demographic and clinical characteristics were compared among the four treatment groups. Continuous variables were analyzed using the Kruskal–Wallis test, whereas categorical variables were compared using the chi-square test.

Within-group changes between baseline and 6-month follow-up measurements were assessed using the Wilcoxon signed-rank test. Between-group differences in change scores (ΔVAS, ΔPRTEE, and ΔGrip strength) were analyzed using the Kruskal–Wallis test. When significant differences were detected, post hoc pairwise comparisons were performed using Dunn–Bonferroni correction.

To evaluate the independent association between treatment strategy and clinical improvement, multivariable linear regression analyses were performed for ΔVAS, ΔPRTEE, and ΔGrip strength. Age, sex, baseline score, and treatment group were entered as independent variables. NSAID therapy alone was used as the reference category. Regression coefficients are presented with 95% confidence intervals.

Effect sizes for between-group comparisons were calculated using eta-squared (η^2). All tests were two-tailed, and a p-value < 0.05 was considered statistically significant.

RESULTS

The patient selection process and study cohort formation are illustrated in Fig. 1. A total of 420 patients with lateral epicondylitis were included in the study. Patients were categorized into four treatment groups according to the conservative treatment strategy received: NSAID therapy alone (n = 44), NSAID combined with orthotic support (n = 89), NSAID combined with injection therapy (n = 180), and NSAID combined with both orthotic support and injection therapy (n = 107). Baseline demographic and clinical characteristics are summarized in Table 1. Baseline age, VAS scores, and PRTEE scores were comparable among the treatment groups (all $p > 0.05$). However, significant differences were observed in

sex distribution and baseline grip strength values (Table 1). Female patients constituted the majority of the study population (65.7%).

Table 1
Baseline demographic and clinical characteristics

Variable	NSAID (n = 44)	NSAID + Orthosis (n = 89)	NSAID + Injection (n = 180)	NSAID + Orthosis + Injection (n = 107)	p value
Age (years)	44.0 ± 8.72	43.16 ± 8.39	43.62 ± 7.94	43.32 ± 9.08	0.751
Female, n (%)	28 (63.6)	60 (67.4)	96 (53.3)	72 (67.3)	0.048
Male, n (%)	16 (36.4)	29 (32.6)	84 (46.7)	35 (32.7)	
Baseline VAS	7.84 ± 1.38	7.80 ± 1.39	7.92 ± 1.48	7.69 ± 1.40	0.656
Baseline PRTEE	60.95 ± 10.09	60.44 ± 10.56	60.77 ± 10.58	60.48 ± 10.22	0.991
Baseline Grip Strength (kgf)	30.02 ± 1.98	38.64 ± 3.34	40.47 ± 4.84	35.26 ± 4.43	< 0.001

Values are presented as mean ± standard deviation (SD) or number (%). Continuous variables were compared using the Kruskal–Wallis test and categorical variables using the chi-square test.

Pain outcomes (VAS)

All treatment groups demonstrated significant reductions in VAS scores at 6-month follow-up compared with baseline values (all $p < 0.001$). However, the magnitude of pain reduction differed significantly among treatment groups ($p < 0.001$). The greatest improvement was observed in patients receiving combined NSAID, orthotic support, and injection therapy (ΔVAS = 4.84 ± 2.02), whereas the smallest improvement was observed in the NSAID-only group (ΔVAS = 1.02 ± 1.13). Patients treated with NSAID combined with orthotic support (ΔVAS = 2.46 ± 1.64) and NSAID combined with injection therapy (ΔVAS = 1.87 ± 1.57) demonstrated intermediate improvements. Detailed VAS outcomes are presented in Table 2.

Table 2
Visual Analog Scale (VAS) scores at baseline and 6-month follow-up according to treatment strategy

Treatment Group	n	Baseline VAS	6-Month VAS	ΔVAS	p†
NSAID	44	7.84 ± 1.38	6.82 ± 1.06	1.02 ± 1.13	< 0.001
NSAID + Orthosis	89	7.80 ± 1.39	5.34 ± 1.22	2.46 ± 1.64	< 0.001
NSAID + Injection	180	7.92 ± 1.48	6.05 ± 1.21	1.87 ± 1.57	< 0.001
NSAID + Orthosis + Injection	107	7.69 ± 1.40	2.85 ± 1.31	4.84 ± 2.02	< 0.001

Values are presented as mean ± standard deviation (SD). Within-group comparisons between baseline and 6-month follow-up were performed using the Wilcoxon signed-rank test.

† Within-group p values from the Wilcoxon signed-rank test.

Functional outcomes (PRTEE)

Significant improvements in PRTEE scores were observed in all treatment groups at the 6-month follow-up (all $p < 0.001$). Between-group analysis demonstrated significant differences in functional improvement ($p < 0.001$). The greatest improvement was observed in the combined NSAID, orthotic support, and injection therapy group (ΔPRTEE = 26.31 ± 9.70), whereas the NSAID-only group showed the smallest improvement (ΔPRTEE = 6.48 ± 4.63). Intermediate improvements were observed in the NSAID plus orthotic support group (ΔPRTEE = 15.03 ± 8.10) and the NSAID plus injection therapy group (ΔPRTEE = 15.93 ± 8.89). Detailed PRTEE outcomes are presented in Table 3.

Table 3
Patient-Rated Tennis Elbow Evaluation (PRTEE) scores at baseline and 6-month follow-up according to treatment strategy

Treatment Group	n	Baseline PRTEE	6-Month PRTEE	ΔPRTEE	P value
NSAID	44	60.95 ± 10.09	54.47 ± 10.21	6.48 ± 4.63	< 0.001
NSAID + Orthosis	89	60.44 ± 10.56	45.41 ± 8.76	15.03 ± 8.10	< 0.001
NSAID + Injection	180	60.77 ± 10.58	44.84 ± 9.21	15.93 ± 8.89	< 0.001
NSAID + Orthosis + Injection	107	60.48 ± 10.22	34.17 ± 8.54	26.31 ± 9.70	< 0.001

Values are presented as mean ± standard deviation (SD). Within-group comparisons between baseline and 6-month follow-up were performed using the Wilcoxon signed-rank test.

† Within-group p values from the Wilcoxon signed-rank test.

Grip strength outcomes

Grip strength increased significantly in all treatment groups at the 6-month follow-up compared with baseline measurements (all $p < 0.001$). However, the magnitude of improvement differed significantly among treatment groups ($p < 0.001$). The greatest increase in grip strength was observed in patients treated with combined NSAID, orthotic support, and injection therapy (ΔGrip strength = 14.88 ± 4.12 kgf), whereas the smallest improvement was observed in the NSAID-only group (ΔGrip strength = 2.50 ± 1.18 kgf). Patients receiving NSAID combined with orthotic support (ΔGrip strength = 2.63 ± 1.47 kgf) and NSAID combined with injection therapy (ΔGrip strength = 9.63 ± 3.26 kgf) demonstrated intermediate improvements. These findings indicate that the addition of both orthotic support and injection therapy was associated with the greatest enhancement in hand grip strength (Table 4).

Table 4
Grip Strength Measurements at Baseline and 6-Month Follow-up According to Treatment Strategy

Treatment Group	n	Baseline Grip Strength (kgf)	6-Month Grip Strength (kgf)	ΔGrip Strength (kgf)	P value
NSAID	44	30.02 ± 1.98	32.52 ± 1.86	2.50 ± 1.18	< 0.001
NSAID + Orthosis	89	38.64 ± 3.34	41.27 ± 3.01	2.63 ± 1.47	< 0.001
NSAID + Injection	180	40.47 ± 4.84	50.10 ± 5.12	9.63 ± 3.26	< 0.001
NSAID + Orthosis + Injection	107	35.26 ± 4.43	50.14 ± 4.67	14.88 ± 4.12	< 0.001
Values are presented as mean ± standard deviation (SD). Within-group comparisons between baseline and 6-month follow-up were performed using the Wilcoxon signed-rank test.					
† Within-group p values from the Wilcoxon signed-rank test.					

Overall comparison of treatment effectiveness

Between-group comparisons of change scores are presented in Table 5 and demonstrated significant differences among treatment strategies for pain (ΔVAS), functional outcomes (ΔPRTEE), and grip strength (ΔGrip strength) (all $p < 0.001$). Patients treated with combined NSAID therapy, orthotic support, and injection therapy consistently achieved the greatest improvements across all outcome measures. In contrast, the NSAID-only group demonstrated the least favorable outcomes. These findings suggest that multimodal conservative treatment approaches may provide greater clinical benefit than single-modality treatment strategies in patients with lateral epicondylitis.

Table 5
Overall Comparison of Change Scores Between Treatment Groups

Outcome Measure	Mean Change (Overall)	Between-Group p Value
ΔVAS	2.45 ± 1.90	< 0.001
ΔPRTEE	14.80 ± 10.58	< 0.001
ΔGrip Strength (kgf)	8.64 ± 5.22	< 0.001
Between-group comparisons were performed using the Kruskal–Wallis test.		

Multivariable Regression Analysis

Multivariable linear regression analyses were performed to identify independent predictors of clinical improvement. After adjustment for age, sex, and baseline scores, treatment strategy remained independently associated with improvements in VAS, PRTEE, and grip strength outcomes (Table 6). Compared with NSAID therapy alone, the combination of NSAID therapy, orthotic support, and injection therapy was associated with the greatest improvements in pain ($\beta = 3.94$, $p < 0.001$), functional outcomes ($\beta = 20.07$, $p < 0.001$), and grip strength ($\beta = 14.74$, $p < 0.001$).

DISCUSSION

In the present study, the 6-month clinical outcomes of four different conservative treatment strategies were compared in 420 patients diagnosed with lateral epicondylitis. All treatment strategies resulted in significant improvements in pain, functional outcomes, and grip strength compared with baseline values. However, patients treated with combined NSAID therapy, orthotic support, and injection therapy demonstrated significantly greater improvements than those receiving less comprehensive treatment approaches. The NSAID-only group consistently exhibited the smallest improvements across all outcome measures.

In a prospective randomized study, Garg et al. compared a wrist extension splint and a forearm brace in 42 patients and demonstrated that the wrist extension splint resulted in greater pain reduction ($p = 0.027$). This finding was explained by the splint reducing tension on the extensor tendon and regulating load transmission [13]. Similarly, Songur et al. evaluated two different orthotic devices in 159 patients with lateral epicondylitis and reported superior functional outcomes and grip strength in patients treated with a wrist extension splint compared with a counterforce brace [14]. In contrast, a systematic review by Lapner et al. concluded that orthotic devices were not superior to other conservative treatment modalities in long-term follow-up, although they provided meaningful symptomatic relief during the early stages of treatment [12].

The present study extends these findings by evaluating orthotic support as part of a multimodal treatment strategy rather than as a stand-alone intervention. Our results suggest that combining orthotic support with injection therapy may provide additional clinical benefits compared with isolated treatment approaches. Patients treated with combined NSAID therapy, orthotic support, and injection therapy

demonstrated the greatest reductions in pain, the largest improvements in functional outcomes, and the greatest increases in grip strength. These findings support the concept that reducing mechanical stress on the extensor tendon while simultaneously providing biological or anti-inflammatory treatment may improve overall clinical recovery.

Corticosteroid injections are known to provide effective short-term pain relief in patients with lateral epicondylitis. Previous meta-analyses have demonstrated that corticosteroid injections are associated with superior short-term outcomes, although their benefits may diminish over longer follow-up periods [15]. Our findings are consistent with these observations and further suggest that the addition of orthotic support may enhance the clinical effectiveness of injection-based treatment strategies. A similar pattern was observed for functional outcomes. Improvements in PRTEE scores were significantly greater in patients treated with combined conservative treatment strategies, whereas patients receiving NSAID therapy alone demonstrated the smallest functional gains. These findings suggest that addressing both mechanical loading and biological healing processes simultaneously may provide greater clinical benefit than isolated treatment approaches.

Grip strength outcomes followed a similar trend. The greatest increase in grip strength was observed in patients receiving combined NSAID therapy, orthotic support, and injection therapy, while the smallest gains were observed in the NSAID-only group. Improvement in grip strength is particularly relevant because it reflects both symptom relief and restoration of upper extremity function, which are important determinants of daily activities and occupational performance.

Previous meta-analyses have demonstrated that corticosteroid injections provide substantial short-term clinical improvement, whereas platelet-rich plasma (PRP) may offer more durable benefits during longer follow-up periods [16]. Although the present study was not designed to directly compare corticosteroid and PRP injections, our findings suggest that injection-based treatment strategies may be more effective when incorporated into a broader multimodal treatment approach that also includes orthotic support. The primary objective of the present study was to evaluate escalating conservative treatment strategies rather than to compare specific injection modalities. Baseline grip strength differed among treatment groups; however, multivariable analyses adjusted for baseline values, and treatment strategy remained independently associated with clinical improvement.

From a clinical perspective, our findings suggest that patients receiving combined conservative treatment strategies may achieve greater improvements in pain, function, and grip strength than those treated with a single modality. In particular, the addition of both orthotic support and injection therapy was associated with the most favorable clinical outcomes in this cohort. These findings may help clinicians when selecting conservative treatment options for patients with lateral epicondylitis.

A major strength of the present study is the inclusion of a relatively large cohort of patients treated in routine clinical practice. By evaluating four commonly used conservative treatment strategies in a cohort of 420 patients, the study provides clinically relevant information regarding the comparative effectiveness of multimodal treatment approaches in routine orthopedic practice.

This study has several limitations. First, because of its retrospective and non-randomized design, the possibility of selection bias and residual confounding cannot be completely excluded. Treatment allocation was based on routine clinical decision-making rather than randomization, which may have influenced clinical outcomes. Second, adherence to orthotic use, NSAID treatment, and rehabilitation recommendations could not be objectively verified because of the retrospective nature of the study. Third, potentially relevant clinical variables such as symptom duration, occupational demands, and activity levels were not available for all patients and therefore could not be included in the analysis.

Injection therapy included either corticosteroid or platelet-rich plasma according to routine clinical practice. Because corticosteroid and PRP injections were not analyzed as separate subgroups, the results should be interpreted as outcomes of injection-based treatment strategies rather than direct evidence favoring one injection modality over another. Finally, the study was conducted at a single center, which may limit the generalizability of the findings to other patient populations and healthcare settings.

CONCLUSION

The findings of this study suggest that combined conservative treatment strategies may provide greater improvements in pain, functional outcomes, and grip strength than less comprehensive treatment approaches in patients with lateral epicondylitis. Patients treated with a combination of NSAID therapy, orthotic support, and injection therapy achieved the most favorable clinical outcomes at 6-month follow-up. These results support the use of multimodal conservative treatment protocols in the nonoperative management of lateral epicondylitis. Further prospective randomized studies are required to confirm these findings and to determine the optimal combination of conservative treatment modalities.

Abbreviations

VAS
Visual Analog Scale
PRTEE
Patient-Rated Tennis Elbow Evaluation
NSAID
Nonsteroidal Anti-Inflammatory Drug
PRP
Platelet-Rich Plasma
ECRB
Extensor Carpi Radialis Brevis
SD
Standard Deviation
kgf
Kilogram-force

Declarations

Conflict of Interest

The authors declare no conflicts of interest.

Funding

No funding was received for this research.

Acknowledgement

The authors also acknowledge the contributions of the medical faculty students who assisted with data collection and follow-up.

Data Availability Statement

Data supporting the findings are available from the corresponding author upon reasonable request.

Ethics Approval and Declaration

The study protocol was approved by the Harran University Clinical Research Ethics Committee (Session No: 10, Decision No: 02, dated May 26, 2025). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Patient data were anonymized prior to analysis to ensure confidentiality.

Consent to Participate

The requirement for informed consent was waived by the Ethics Committee because of the retrospective nature of the study.

Consent for Publication

Not applicable.

Clinical Trial Number

Not applicable

Author Contributions

Conceptualization and study design: VK, SEK, AL
Data collection and curation: MMA, EG
Formal analysis and interpretation: MMA, SEK
Methodology and supervision: AL, SEK

Statistical analysis: VK, EG

Writing—original draft: VK, MC
Writing—review & editing: SEK,MC

All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

References

1. Kholinne E, Singjie LC, Anastasia M, et al (2024) Comparison of Clinical Outcomes After Different Surgical Approaches for Lateral Epicondylitis: A Systematic Review and Meta-analysis. Orthopaedic Journal of Sports Medicine 12:23259671241230291. https://doi.org/10.1177/23259671241230291
2. Karapinar SE, Dincer R, Atay T, et al (2024) The Clinical Results of Percutaneous Drilling in the Treatment of Chronic Lateral Epicondylitis. Cureus 16:e64345. https://doi.org/10.7759/cureus.64345
3. Chen Y, Hong C-K, Hsu K-L, et al (2025) Variations in Neuromuscular Functions After Platelet-Rich Plasma and Dextrose Injections in Chronic Lateral Epicondylitis: A Randomized Controlled Study. Sports Health 19417381251314056. https://doi.org/10.1177/19417381251314056
4. Dean BJF, Gettings P, Dakin SG, Carr AJ (2016) Are inflammatory cells increased in painful human tendinopathy? A systematic review. Br J Sports Med 50:216–220. https://doi.org/10.1136/bjsports-2015-094754
5. Ahmed AF, Rayyan R, Zikria BA, Salameh M (2023) Lateral epicondylitis of the elbow: an up-to-date review of management. Eur J Orthop Surg Traumatol 33:201–206. https://doi.org/10.1007/s00590-021-03181-z
6. Kim JH, Hoy JF, Smith SR, et al (2024) Recalcitrant Lateral Epicondylitis: A Systematic Review on Current Nonoperative and Operative Treatment Modalities. JBJS Rev 12:. https://doi.org/10.2106/JBJS.RVW.24.00059
7. Coombes BK, Bisset L, Vicenzino B (2015) Management of Lateral Elbow Tendinopathy: One Size Does Not Fit All. J Orthop Sports Phys Ther 45:938–949. https://doi.org/10.2519/jospt.2015.5841
8. Olaussen M, Holmedal Ø, Mdala I, et al (2015) Corticosteroid or placebo injection combined with deep transverse friction massage, Mills manipulation, stretching and eccentric exercise for acute lateral epicondylitis: a randomised, controlled trial. BMC Musculoskelet Disord 16:122. https://doi.org/10.1186/s12891-015-0582-6
9. Arirachakaran A, Sukthuayat A, Sisayanarane T, et al (2016) Platelet-rich plasma versus autologous blood versus steroid injection in lateral epicondylitis: systematic review and network meta-analysis. J Orthop Traumatol 17:101–112. https://doi.org/10.1007/s10195-015-0376-5
10. Bisset LM, Vicenzino B (2015) Physiotherapy management of lateral epicondylalgia. J Physiother 61:174–181. https://doi.org/10.1016/j.jphys.2015.07.015

11. Ahmad Z, Siddiqui N, Malik SS, et al (2013) Lateral epicondylitis: a review of pathology and management. Bone Joint J 95-B:1158–1164. https://doi.org/10.1302/0301-620X.95B9.29285
12. Lapner P, Alfonso A, Hebert-Davies J, et al (2021) Nonoperative treatment of lateral epicondylitis: a systematic review and meta-analysis. JSES Int 6:321–330. https://doi.org/10.1016/j.jseint.2021.11.010
13. Garg R, Adamson GJ, Dawson PA, et al (2010) A prospective randomized study comparing a forearm strap brace versus a wrist splint for the treatment of lateral epicondylitis. J Shoulder Elbow Surg 19:508–512. https://doi.org/10.1016/j.jse.2009.12.015
14. Songur K, Demir ZD, Baysan C, Dilek B (2024) Clinical and Ultrasonographic Effectiveness of Two Different Splints Used for the Treatment of Lateral Epicondylitis: A Prospective Randomized Controlled Study. Arch Phys Med Rehabil 105:655–663. https://doi.org/10.1016/j.apmr.2023.12.010
15. Li A, Wang H, Yu Z, et al (2019) Platelet-rich plasma vs corticosteroids for elbow epicondylitis: A systematic review and meta-analysis. Medicine 98:e18358. https://doi.org/10.1097/MD.0000000000018358
16. Tang S, Wang X, Wu P, et al (2020) Platelet-Rich Plasma Vs Autologous Blood Vs Corticosteroid Injections in the Treatment of Lateral Epicondylitis: A Systematic Review, Pairwise and Network Meta-Analysis of Randomized Controlled Trials. PM R 12:397–409. https://doi.org/10.1002/pmrj.12287

Table 6

Table 6 is available in the Supplementary Files section.

Figures

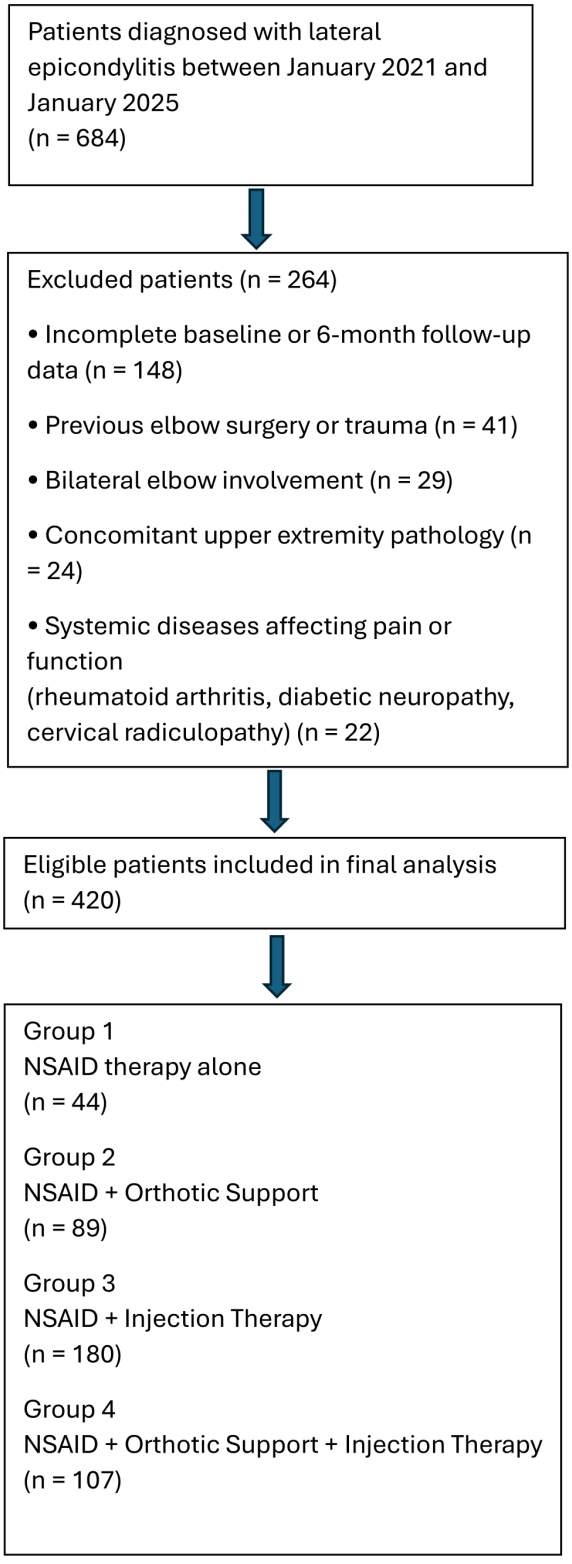


Figure 1

Flowchart of patient selection and study group allocation

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Table6.docx