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Physiotherapy Management of Muscle Imbalance due to Lateral Epicondylitis: A Case Report

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Abstract

Background: Lateral epicondylitis (LE), commonly known as tennis elbow, is an overuse-related tendinopathy frequently associated with repetitive wrist extension activities. Although LE is widely reported, muscle imbalance as a contributing factor remains underrecognized and rarely discussed in clinical case reports.

Objective: This case report aimed to evaluate the effects of an integrated physiotherapy intervention on muscle imbalance secondary to lateral epicondylitis.

Methods: A case report was conducted involving a 27-year-old right-hand–dominant male presenting with pain and functional limitation of the right elbow. The patient underwent four physiotherapy sessions over a two-week period. The intervention program consisted of progressive strengthening exercises, muscle release techniques, stretching, and electrotherapy. Outcomes were assessed using the Visual Analog Scale (VAS) for pain, Manual Muscle Testing (MMT) for muscle strength, goniometric measurement for range of motion, and clinical provocation tests.

Results: Pain intensity decreased substantially from VAS 7 at baseline to VAS 1 after the final session, representing an 85.7% reduction. Wrist extensor muscle strength improved from MMT grade 4 to grade 5, while wrist range of motion increased. Mill's and Maudsley's tests changed from positive to negative. Functional performance improved, allowing the patient to resume daily activities and recreational sports without pain. No adverse effects were reported.

Conclusion: An integrated physiotherapy approach combining strengthening exercises, muscle release, stretching, and electrotherapy was effective in reducing pain, correcting muscle imbalance, and restoring functional performance in a patient with lateral epicondylitis. This case highlights the importance of comprehensive neuromuscular assessment and targeted physiotherapy management in LE.

Keywords
Physical Therapy Modalities; Lateral Epicondylitis; Muscle Imbalance; Electrotherapy; Case Reports

Introduction

Asymmetric mechanical loading during sports participation and daily activities frequently places uneven stress on the musculoskeletal system. When such asymmetry is sustained over time, it may lead to muscle imbalance, a condition characterized by disproportionate strength, flexibility, or neuromuscular control between agonist and antagonist muscle groups. Muscle imbalance has been widely recognized as an important contributing factor to musculoskeletal injuries, functional limitations, and altered joint biomechanics, as it increases localized tissue stress and compromises movement efficiency.[1] These biomechanical alterations may predispose individuals to various overuse disorders, including lateral epicondylitis.

Lateral epicondylitis (LE), commonly referred to as tennis elbow, is an overuse-related tendinopathy affecting the common extensor tendon origin at the lateral epicondyle of the humerus. The condition is typically associated with repetitive wrist extension, forearm supination, and forceful gripping activities. LE is frequently observed not only among athletes but also among manual laborers and individuals engaged in repetitive occupational tasks. Clinically, LE presents with localized pain and tenderness over the lateral elbow, reduced grip strength, and pain provoked by resisted wrist or finger extension.[2] Although traditionally considered a localized tendon pathology, contemporary perspectives suggest that LE is a multifactorial condition influenced by biomechanical, neuromuscular, and functional factors.

One important but often underemphasized factor in the development and persistence of LE is muscle imbalance within the forearm and upper extremity kinetic chain. Muscle imbalance occurs when certain muscle groups become excessively strong, stiff, or dominant relative to their antagonists, resulting in altered load distribution during functional tasks. In patients with LE, excessive activation or stiffness of the wrist extensors relative to the flexor musculature may increase tensile stress at the common extensor tendon insertion. Repeated exposure to this abnormal loading pattern can lead to microtrauma, tendon degeneration, and prolonged symptom duration.[3,4] Despite increasing recognition of these mechanisms, muscle imbalance is rarely highlighted as a central clinical feature in reports of LE management.

Conservative management remains the primary treatment approach for LE, with physiotherapy playing a central role in pain reduction, functional recovery, and prevention of recurrence. Common physiotherapy interventions include therapeutic exercise, manual therapy, and electrotherapy modalities. Exercise therapy aims to improve muscle strength, endurance, and load tolerance, while manual therapy techniques are applied to reduce soft tissue tension, improve joint mobility, and restore normal movement patterns. Electrotherapy modalities are frequently used as adjuncts to modulate pain and facilitate tissue healing.[5] However, treatment

outcomes may be suboptimal if interventions focus solely on symptom relief without addressing underlying neuromuscular imbalances.

Although a substantial body of literature has examined the effectiveness of physiotherapy interventions for LE, most studies emphasize pain reduction and functional improvement without explicitly addressing muscle imbalance as a contributing or modifiable factor. Furthermore, existing evidence is largely derived from randomized controlled trials or systematic reviews that may not capture the complexity of individual clinical presentations. Case reports offer valuable insights into clinical reasoning, individualized intervention strategies, and real-world outcomes, particularly in conditions where multifactorial contributors such as muscle imbalance are present.

To date, there remains a paucity of case-based literature specifically documenting the assessment and management of muscle imbalance in patients with LE using an integrated physiotherapy approach. This gap is clinically relevant, as failure to identify and correct muscle imbalance may contribute to symptom persistence, delayed recovery, or recurrence following treatment. Highlighting muscle imbalance within the context of LE may therefore enhance clinical decision-making and support a more comprehensive rehabilitation strategy.

This case report is important because it presents muscle imbalance as a clinically meaningful factor accompanying lateral epicondylitis and demonstrates the effectiveness of a targeted, integrated physiotherapy program. The report describes a patient with LE who exhibited functional limitations related to muscle imbalance and was treated using a combination of strengthening exercises, muscle release techniques, stretching, and electrotherapy. By documenting changes in pain intensity, muscle strength, range of motion, and functional performance, this case contributes practical clinical evidence supporting a comprehensive neuromuscular approach to LE management.

Therefore, the aim of this case report was to evaluate the effects of an integrated physiotherapy intervention on muscle imbalance secondary to lateral epicondylitis, with specific emphasis on pain reduction, functional recovery, and prevention of symptom recurrence.

Methods

This study was designed as a single-patient case report describing the clinical presentation, physiotherapy management, and treatment outcomes of muscle imbalance secondary to lateral epicondylitis. The report was prepared in accordance with the CARE (CAse REport) guidelines to ensure methodological transparency, clinical relevance, and completeness of reporting. The patient was a 27-year-old right-hand–dominant male who presented to a private physiotherapy clinic in Makassar, Indonesia, with complaints of pain and functional limitation in the right lateral elbow. He was physically active and routinely participated in recreational sports involving repetitive upper-extremity movements. The primary symptoms included pain during gripping activities, prolonged smartphone use, and sports participation. The symptoms had been present for approximately two months prior to consultation, with pain typically occurring shortly after activity and persisting until the following day, leading the patient to temporarily discontinue the provoking activities. The patient reported no history of elbow trauma, surgery, or prior physiotherapy treatment. He denied any systemic disease, neurological disorder, or relevant family history. Before attending physiotherapy, he had intermittently used nonsteroidal anti-inflammatory drugs, which provided only temporary symptom relief.

Clinical data were obtained through autoanamnesis and alloanamnesis, followed by a comprehensive physical examination. The examination included inspection, palpation, assessment of active and passive range of motion, muscle strength testing, and special provocation tests. Palpation revealed localized tenderness over the lateral epicondyle of the right elbow. Active wrist extension and gripping movements reproduced the patient's symptoms. Pain intensity was assessed using the Visual Analog Scale (VAS), with scores ranging from 0 (no pain) to 10 (worst imaginable pain). Muscle strength of the wrist extensors was evaluated using Manual Muscle Testing (MMT) based on a standardized five-grade scale. Wrist joint range of motion was measured using a universal goniometer. Functional limitations related to daily activities were documented through patient-reported descriptions.

To support diagnostic decision-making, specific provocation tests were performed. Mill's test and Maudsley's test elicited pain at the lateral epicondyle and were interpreted as positive. Differential diagnoses considered included radial tunnel syndrome, cervical radiculopathy, elbow osteoarthritis, and referred pain from the cervical spine. These conditions were excluded based on the absence of neurological symptoms, lack of radiating pain, preserved cervical range of motion, and the presence of localized tenderness specific to the lateral epicondyle. Imaging examinations were not conducted, as the clinical findings were considered sufficiently specific to establish the diagnosis. Based on the patient's history, physical examination findings, positive provocation tests, and exposure to repetitive activities, a diagnosis of muscle imbalance secondary to lateral epicondylitis was established. The prognosis was considered favorable with conservative physiotherapy management, although the risk of recurrence was discussed in relation to continued repetitive activity and adherence to the exercise program.

The patient underwent a total of four physiotherapy sessions over a two-week period, with each session lasting approximately 45 minutes. The intervention program was individualized and progressively adjusted according to the patient's symptom response and functional improvement. During the initial sessions, treatment primarily focused on pain reduction and soft tissue relaxation, followed by progressive strengthening and functional restoration in subsequent sessions.

The intervention consisted of a combination of electrotherapy, manual therapy, and therapeutic exercise. Electrotherapy modalities were applied to modulate pain and facilitate tissue recovery. Transcutaneous Electrical Nerve Stimulation using interferential current parameters was administered with electrodes placed around the lateral elbow and forearm. Therapeutic ultrasound was applied locally to the lateral epicondyle region using continuous mode at a frequency of 1 MHz and an intensity of 1 W/cm². Infrared therapy was used to promote local circulation and muscle relaxation. The dosage and intensity of these modalities were adjusted across sessions according to patient tolerance.

Manual therapy techniques included deep friction massage and muscle release applied to the forearm extensor musculature to reduce soft tissue tension and improve flexibility. Mobilization with movement techniques were applied to the elbow joint to improve joint mechanics and reduce pain during functional movements. Gentle joint traction was incorporated during later sessions to facilitate mobility.

Therapeutic exercise was progressively introduced throughout the intervention period. Early sessions emphasized active range-of-motion exercises and low-load isometric contractions to minimize pain provocation. As symptoms improved, isotonic and eccentric strengthening exercises targeting the wrist extensor muscles were introduced using dumbbells. Exercise intensity and volume were gradually increased across sessions. During the final session, functional exercises involving the elbow, wrist, and shoulder were incorporated to support return to daily and recreational activities. Cryotherapy was applied at the end of selected

sessions to reduce post-exercise discomfort, and kinesio taping was used intermittently to provide proprioceptive support and reduce mechanical strain on the lateral elbow during daily activities.

Outcome measures included pain intensity assessed using the Visual Analog Scale, muscle strength evaluated with Manual Muscle Testing, wrist joint range of motion measured with a goniometer, and the results of Mill's and Maudsley's tests. Functional improvement was assessed descriptively based on the patient's reported ability to perform daily activities and resume sports participation. Outcome assessments were conducted at baseline and during each treatment session to monitor progress and guide intervention adjustments. Given the single-subject design, data analysis was descriptive, with pre- and post-intervention outcomes compared to evaluate changes in pain, muscle strength, range of motion, and functional performance. No inferential statistical analysis was performed.

The patient provided written informed consent to participate in the study and to allow publication of clinical data for scientific purposes. The case report was conducted in accordance with the ethical principles of the Declaration of Helsinki, and patient anonymity was maintained throughout the manuscript.

Results

At baseline, the patient presented with moderate-to-severe pain localized to the lateral aspect of the right elbow, accompanied by reduced muscle strength and functional limitations during gripping activities and recreational sports. Initial clinical examination revealed localized tenderness over the lateral epicondyle, pain provocation during resisted wrist extension, and positive results on Mill's and Maudsley's tests. Pain intensity, muscle strength, range of motion, and functional performance were monitored across four physiotherapy sessions. To illustrate the chronological progression of the clinical management and assessment process, a timeline of the case is presented in Table 1.

Table 1. Clinical Timeline of the Case

Session	Clinical Phase	Description
Session 1	Initial assessment	Comprehensive anamnesis and physical examination, including VAS, MMT, ROM assessment, and provocation tests
Session 2	Early intervention	Pain modulation using electrotherapy and muscle release techniques
Session 3	Progressive strengthening	Introduction of eccentric and isotonic strengthening exercises for wrist extensors
Session 4	Final evaluation	Reassessment of pain, strength, ROM, and functional performance

At the initial assessment, pain intensity measured using the Visual Analog Scale was 7/10, indicating moderate pain. Muscle strength of the wrist extensors was graded as 4 on the Manual Muscle Testing scale, reflecting the ability to move against gravity with minimal resistance. Wrist joint range of motion was limited, and gripping activities reproduced lateral elbow pain. Provocation tests, including Mill's and Maudsley's tests, were positive. The progression of pain intensity across treatment sessions is summarized in Table 2**.**

Table 2. Pain Intensity Across Physiotherapy Sessions

Outcome Measure	Session 1	Session 2	Session 3	Session 4
VAS (0–10)	7	5	2	1

A consistent reduction in pain intensity was observed throughout the intervention period. Pain decreased from a VAS score of 7 at baseline to a score of 1 at the final session, representing an overall reduction of 85.7% over four sessions.
Changes in muscle strength and range of motion are presented in Table 3.

Table 3. Muscle Strength and Range of Motion Outcomes

Parameter	Baseline	Final Session
Wrist extensor strength (MMT)	Grade 4	Grade 5
Wrist ROM (extension)	Limited	Near full range

Muscle strength of the wrist extensors improved from MMT grade 4 at baseline to grade 5 by the final session. Wrist joint range of motion increased progressively, with near-full range achieved at the end of the intervention period.
The results of clinical provocation tests are summarized in Table 4.

Table 4. Provocation Test Results

Test	Baseline	Final Session
Mill's test	Positive	Negative
Maudsley's test	Positive	Negative

Both Mill's and Maudsley's tests, which initially elicited sharp pain at the lateral epicondyle, were negative at the final evaluation, indicating resolution of pain provocation during resisted movements. In terms of functional outcomes, the patient reported progressive improvement in activities of daily living across sessions. At baseline, the patient experienced difficulty maintaining a firm grip on a smartphone for prolonged periods and was unable to participate in recreational sports without pain. By the final session, the patient reported the ability to grip objects firmly, use a smartphone without discomfort, and return to recreational sports activities without pain-related limitations.

No adverse events or complications were observed during or after the physiotherapy intervention. The patient demonstrated high adherence to the supervised treatment sessions and reported compliance with the prescribed home exercise program. At a two-week follow-up after completion of the intervention, the patient reported sustained symptom improvement with no recurrence of significant pain.

Discussion

This case report demonstrates that an integrated physiotherapy intervention combining therapeutic exercise, muscle release techniques, stretching, and electrotherapy was effective in reducing pain, correcting muscle imbalance, and restoring functional performance in a patient with lateral epicondylitis. Over a relatively short intervention period of four sessions, the patient experienced

a marked reduction in pain intensity, improvement in muscle strength, normalization of range of motion, and resolution of pain provocation during clinical tests. These findings emphasize the importance of addressing muscle imbalance as part of a comprehensive conservative management strategy for lateral epicondylitis.

Lateral epicondylitis has traditionally been described as a localized tendinopathy involving degeneration of the common extensor tendon, particularly the extensor carpi radialis brevis, caused by repetitive mechanical overload.[6,7] However, contemporary evidence increasingly supports the view that lateral epicondylitis is a multifactorial condition influenced by repetitive loading patterns, neuromuscular control deficits, and muscle imbalance within the upper-extremity kinetic chain.[8,9] In the present case, the identification of muscle imbalance was supported by reduced wrist extensor strength, pain during resisted movements, and functional limitations during gripping activities. These findings align with previous literature suggesting that persistent muscle imbalance may exacerbate tendon overload and contribute to prolonged symptom duration.[1,3]

The substantial reduction in pain intensity observed in this case, with a decrease from VAS 7 to VAS 1 (85.7% reduction), is consistent with findings from prior studies investigating exercise-based rehabilitation for lateral epicondylitis. Progressive strengthening, particularly eccentric loading of the wrist extensors, has been shown to enhance tendon load tolerance and stimulate favorable tendon adaptation.[10,11] In addition, combining eccentric exercises with concentric and isometric components may further improve neuromuscular control and functional outcomes.[11] The rapid pain reduction observed in this case supports the effectiveness of a structured and progressive strengthening program when tailored to the patient's clinical presentation.

Electrotherapy modalities were incorporated as adjunctive interventions to facilitate pain modulation and support tissue recovery. Previous systematic reviews have reported that electrotherapy, including transcutaneous electrical nerve stimulation and therapeutic ultrasound, may provide short-term pain relief in patients with lateral elbow pain when combined with active rehabilitation.[12] Although electrotherapy alone is not recommended as a standalone treatment, its integration with exercise and manual therapy may enhance patient tolerance to loading during early rehabilitation phases. In the present case, electrotherapy appeared to support pain reduction during the initial sessions, allowing for earlier progression to strengthening exercises.

Manual therapy techniques, including muscle release and mobilization with movement, were used to address soft tissue restrictions and joint mechanics. Prior evidence suggests that manual therapy may reduce pain and improve function by modulating nociceptive input and restoring normal movement patterns.[13,10] Mobilization with movement techniques, in particular, have demonstrated immediate and short-term benefits in reducing pain and improving grip strength in patients with lateral epicondylitis.[10] The resolution of pain provocation during Mill's and Maudsley's tests in this case may reflect improved tendon loading capacity and reduced mechanical stress following combined manual and exercise-based interventions.

Functional improvement was an important outcome in this case. The patient reported the ability to resume daily activities and recreational sports without pain by the end of the intervention period. Although functional outcomes were assessed descriptively rather than using standardized instruments such as the DASH or PRTEE, the reported improvements are clinically meaningful and consistent with prior studies demonstrating functional recovery following comprehensive physiotherapy programs.[10,14] Nevertheless, the absence of standardized functional outcome measures represents a limitation that should be addressed in future studies.

A key strength of this case report lies in its emphasis on muscle imbalance as a clinically relevant factor in lateral epicondylitis management. While many studies focus primarily on pain reduction, this report highlights the role of neuromuscular imbalance in symptom development and recovery. By integrating strengthening, manual therapy, and electrotherapy within a single treatment program, this case provides practical insight into individualized physiotherapy decision-making. Furthermore, the rapid improvement observed within four sessions suggests that targeted intervention addressing underlying biomechanical contributors may accelerate recovery.

Despite these strengths, several limitations must be acknowledged. First, the single-subject design limits the generalizability of the findings. Individual characteristics, including activity level, adherence to exercise, and baseline functional status, may have influenced treatment response. Second, the short intervention duration and limited follow-up period restrict conclusions regarding long-term effectiveness and recurrence prevention. Third, outcome measures were primarily clinical and descriptive, with pain assessed using VAS and muscle strength evaluated using MMT, which may introduce measurement bias. The absence of standardized functional scales and objective biomechanical assessments further limits interpretability. Finally, the multimodal nature of the intervention precludes determination of the specific contribution of each treatment component.

Future research should aim to investigate the role of muscle imbalance in lateral epicondylitis using larger sample sizes, standardized outcome measures, and longer follow-up periods. Comparative studies evaluating isolated versus combined physiotherapy interventions may help clarify the relative effectiveness of specific treatment components. Additionally, incorporating objective assessments of muscle activation patterns and movement biomechanics may further elucidate the mechanisms underlying clinical improvement.

Overall, this case report supports the concept that lateral epicondylitis should be managed as a multifactorial condition rather than a purely localized tendon disorder. Comprehensive physiotherapy management that includes assessment and correction of muscle imbalance, combined with progressive exercise and adjunctive modalities, may lead to meaningful pain reduction and functional recovery in patients with lateral epicondylitis.

Conclusion

This case report demonstrates that an integrated physiotherapy approach combining progressive strengthening exercises, muscle release techniques, stretching, and electrotherapy was effective in reducing pain, correcting muscle imbalance, and restoring functional performance in a patient with lateral epicondylitis. A substantial reduction in pain intensity, improvement in muscle strength and range of motion, and resolution of clinical provocation signs were achieved within a short intervention period of four sessions.

The findings of this case highlight the clinical importance of identifying and addressing muscle imbalance as a contributing factor in lateral epicondylitis, rather than focusing solely on local tendon pathology. Comprehensive neuromuscular assessment and targeted physiotherapy intervention may accelerate recovery and facilitate a safe return to daily and recreational activities.

Although the clinical outcomes were favorable, the results should be interpreted with caution due to the single-case design, limited intervention duration, and absence of long-term follow-up. Further studies involving larger sample sizes, standardized functional outcome measures, and extended follow-up periods are warranted to confirm the effectiveness and sustainability of integrated physiotherapy management for lateral epicondylitis associated with muscle imbalance.

Author Contribution

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

Written informed consent was obtained from the patient for participation in this study and for the publication of clinical information. This case report was conducted in accordance with the ethical principles of the Declaration of Helsinki. No identifying patient information is disclosed in this manuscript.

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