

## Does Dominant or Nondominant Extremity Involvement Matter in Lateral Elbow Tendinopathy for Functionality?

### Lateral Dirsek Tendinopatisinde Dominant veya Nondominant Ekstremit Etkilenimi Fonksiyonellik Açısından Önemli midir?

Gökhan Bayrak<sup>1\*</sup>, Mustafa Ali Kahreman<sup>2</sup>, Raziye Şavkın<sup>3</sup>, Taha Furkan Yağcı<sup>2</sup>, Hüseyin Emre Karaca<sup>2</sup>

1.Department of the Physiotherapy and Rehabilitation of the Faculty of Health Sciences, Muş Alparslan University, Muş, Türkiye

2.Department of the Orthopedics and Traumatology, Muş State Hospital, Muş, Türkiye

3.Faculty of Physiotherapy and Rehabilitation, Pamukkale University, Denizli, Türkiye

#### ABSTRACT

**Aim:** Lateral elbow tendinopathy (LET) is a problem affecting basic daily living activities, characterized by increased pain and decreased function. This study aimed to compare pain, function, and sleep quality according to extremity involvement in patients with LET.

**Methods:** Eighty-eight patients diagnosed with LET were divided into two groups: dominant extremity involvement (DEI, n=44) and those with nondominant extremity involvement (NDEI, n=44). Patient demographic and clinical data were recorded. Pain was evaluated using the Visual Analogue Scale (VAS), function using the Liverpool Elbow Score, and sleep quality using the Pittsburgh Sleep Quality Index (PSQI).

**Results:** The mean age of the DEI group was 45.64 years, and 44.82 years for the NDEI group (p=0.680). The mean symptom duration was 4.36 months for the DEI group and 5.23 months for the NDEI group (p=0.438). The mean resting, hand physical activity, and night VAS for pain were 2.47, 7.82, 5.79 for the DEI, 2.57, 7.45, and 5.28 for the NDEI group (p>0.05). There were no significant differences between the DEI and NDEI groups for the Liverpool Elbow Score clinical, patient-reported, elbow range of motion, elbow-related symptoms, and total score sub-dimensions (p>0.05) and PSQI scores (DEI: 6.18; NDEI: 6.07, p=0.876).

**Conclusion:** This novel observational study found no differences in pain, function, and sleep quality between dominant and nondominant extremities involved in patients with LET. Dominant or nondominant extremity involvement does not influence the clinical expression of LET, and treatment strategies should focus on the overall symptom severity rather than hand dominance.

**Key Words:** Upper Extremity, Lateral Epicondylitis, Function, Sleep Quality

#### ÖZ

**Amaç:** Lateral dirsek tendinopatisi (LDT) temel günlük yaşam aktivitelerini etkileyen, artan ağrı ve azalan fonksiyon ile karakterize bir problemdir. Bu çalışma LDT hastalarında ekstremit etkilenimine göre ağrı, fonksiyon ve uyku kalitesini karşılaştırmayı amaçlamıştır.

**Yöntem:** LDT tanısı konan seksen sekiz hasta: dominant ekstremitesi etkilenen (DEE, n=44) ve nondominant ekstremitesi etkilenen (NDEE, n=44) olmak üzere iki gruba ayrıldı. Hastaların demografik ve klinik verileri kaydedildi. Ağrı, Görsel Analog Skalası (GAS) kullanılarak, fonksiyon Liverpool Dirsek Skoru kullanılarak ve uyku kalitesi Pittsburgh Uyku Kalitesi İndeksi (PUKİ) kullanılarak değerlendirildi.

**Bulgular:** DEE grubunun yaş ortalaması 45,64, NDEE grubunun ise 44,82 idi (p=0,680). DEE grubunda ortalama semptom süresi 4,36 ay, NDEE grubunda ise 5,23 aydı (p=0,438). Ortalama istirahat, el fiziksel aktivitesi ve gece GAS ağrıları DEE grubu için 2,47, 7,82 ve 5,79, NDEE grubu için ise 2,57, 7,45 ve 5,28 idi (p>0,05). DEE ve NDEE grupları arasında Liverpool Dirsek Skoru'nun klinik, hasta tarafından bildirilen, dirsek hareket açıklığı, dirsekle ilişkili semptomlar ve toplam skor alt boyutlarında (p>0,05) ve PUKİ skorunda anlamlı fark yoktu (DEE: 6,18; NDEE: 6,07, p=0,876).

**Sonuç:** Bu yeni gözlemsel çalışmada LDT hastalarında dominant ve nondominant ekstremiteler arasında ağrı, fonksiyon ve uyku kalitesi açısından herhangi bir fark saptanmadı. Dominant veya nondominant ekstremit etkilenimi LDT'nin klinik ifadesini etkilememektedir ve tedavi stratejileri el baskınlığından ziyade genel semptom şiddetine odaklanmalıdır.

**Anahtar Sözcükler:** Üst Ekstremit, Lateral Epikondilit, Fonksiyon, Uyku Kalitesi

Received Date: 11/04/2025 / Accepted Date: 05/06/2025 / Published (Online) Date: 03/08/2025

\*Corresponding Author: Gökhan Bayrak Ph.D., Muş Alparslan University, Department of the Physiotherapy and Rehabilitation of the Faculty of Health Sciences, Muş, Türkiye. Phone: +90 535 629 1670 / mail: gokhan2803@gmail.com

ORCID: 0000-0001-9224-996X

**To cited:** Bayrak G, Kahreman MA, Şavkın R, Yağcı TF, Karaca HE. Does Dominant or Nondominant Extremity Involvement Matter in Lateral Elbow Tendinopathy for Functionality? Acta Med. Alanya 2025;9(2):142-147 doi: 10.30565/medalanya.1674197

## Introduction

**L**ateral elbow tendinopathy (LET) is a clinical condition that typically presents as pain in the lateral outer part of the elbow, worsening with repetitive wrist movements, which leads to disability, and is common in about 1–3% of adults [1,2]. LET is thought to occur due to overuse during eccentric contraction of the tendons that provide extension of the wrist and fingers [1,3]. Although LET generally appears in the dominant extremity [4,5], it can emerge in the nondominant extremity [6]. In patients with LET, dominant or nondominant extremity involvement is an important factor regarding the adverse effects on an individual's daily living activities and during functional movements [7]. Conservative methods, such as physiotherapy and rehabilitation, splinting, and electrotherapy, are frequently utilized to treat LET, regardless of the affected extremity [3,8,9].

Most studies in the field of LET have only focused on pain and functional outcomes rather than hand dominance and exploring its potential consequences [1,7,9]. More recently, a publication that offers findings about the affected side extremity, which is mostly the dominant side, has emerged as a significant risk factor for LET [10]. Furthermore, the presence of LET in the dominant elbow has been reported to have a worse prognosis compared with the nondominant extremity [5]. However, another study reported that affected hands with or without dominance do not pose a substantial risk for chronic LET [11]. When earlier reports in the literature are reviewed, there is no clear conclusion about how extremity involvement affects elbow pain and function in patients with LET [5,9].

Bateman et al. proposed that the core outcomes for patients with LET should include pain in activity, function, and psychological factors [3]. Research by Coombes et al. suggested that individuals suffering from LET experience considerable adverse effects on sleep quality [12]. Furthermore, the consequences of dominant or nondominant extremity involvement on sleep quality in patients with LET have yet to be fully elucidated [13]. The existing literature presents conflicting results regarding these consequences and their potentially undefined effects on hand

dominance, leading to a lack of definitive evidence concerning the impact of the affected extremity in LET patients. Accordingly, the primary objective of this study was to evaluate whether the involvement of the dominant or nondominant extremity influences elbow pain, functional outcomes, and sleep quality in patients with LET. By evaluating pain, functional status, and sleep quality in patients with LET with dominant or nondominant extremity involvement, this study aims to provide a comprehensive understanding of the clinical implications of extremity dominance and to guide treatment strategies.

## Methods

This prospective observational study included patients who applied to Muş State Hospital's orthopedics and traumatology polyclinic and were diagnosed with LET. Ethical approval for the study was obtained from the Muş Alparslan University Scientific Research and Publication Ethics Committee (09.10.2023-110929/8/37). The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. All patients were informed about the study, and a written informed consent form was obtained from each patient.

According to the power analysis based on the elbow function value of the reference study [2], the baseline sample size was calculated as 82 patients (at least 41 patients per group) with a 95% confidence interval and 80% power, assuming a medium effect size of 0.628. Patients with LET living in the Muş who were admitted to the orthopedics and traumatology polyclinic of the Muş State Hospital, comprised the study population. The dominant extremities of the patients were questioned, and the hand they used for writing was questioned. For patients who did not know how to write, the hand they used to open the door with the key was questioned. The inclusion criteria were: elbow pain of at least four intensity during hand activity according to the Visual Analogue Scale (VAS), being between 18 and 65 years of age, having an ultrasonographic lesion of the extensor carpi radialis brevis tendon specified by a radiologist, not using painkillers with a doctor's prescription previously for LET, and to be able to understand the verbal and written information.

The exclusion criteria were the presence of a concomitant pathology that could partially explain the symptoms, having undergone surgery around the elbow, having received injection treatments to the painful area in the last three months, bilateral extremity involvement, sleep disorders, or major systemic diseases. The patients were divided into two groups: the dominant extremity involvement (DEI, n=44) group and the nondominant extremity involvement (NDEI, n=44) group according to their affected extremity.

**Evaluations:** Demographic and clinical data of the participants were recorded. VAS was used to assess elbow pain, the Liverpool Elbow Score was used to assess elbow function, and the Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality. A specialized physiotherapist with ten years of experience evaluated the outcomes.

**Visual Analogue Scale:** Pain intensity was rated on a 10-cm VAS scale where 0 indicates no pain, and 10 represents the worst level of pain imaginable. Pain intensity was classified as follows: less than 5 to 44mm denotes mild pain, 45 to 74mm indicates moderate pain, and greater than 75mm signifies severe pain [14]. Patients recorded their levels of rest, hand physical activity, and night pain on the VAS form according to their average pain level during the last week.

**Liverpool Elbow Score:** The Liverpool Elbow Score is a functional assessment scale that has international validity. The Liverpool Elbow Score consists of a six-item clinical assessment section evaluated by a specialized physiotherapist and a nine-item patient-reported section. The items answered by the patient were rated using a five-point Likert scale from 0 (worst or least function) to 4 (best or most function). All responses are converted to a 0-10 scale to calculate a total score. The subdomains of the scale were clinical, patient-reported, elbow motion capacity, elbow-related symptoms, and total score. The reliability of the Liverpool Elbow Score in Turkish was previously validated [15].

**Pittsburgh Sleep Quality Index:** The PSQI is designed to assess sleep quality during the previous month and consists of 19 items. There are seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep

efficiency, sleep disturbance, sleep medication use, and daytime sleep dysfunction. Each component is evaluated on a 0–3-point scale, with a total score between 0 and 21. A high total score indicates poor sleep quality and a total PSQI score greater than 5 indicates a significant level of sleep disturbance [16].

**Statistical Analysis:** Data were analyzed using SPSS 27.0 (IBM SPSS Statistics 27, Armonk, NY, USA.) software. Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables as numbers and percentages. Differences between categorical variables were analyzed using Pearson's Chi-square test. When parametric test assumptions were met, the Student *t*-test of the difference between two means was used to compare independent group differences; when parametric test assumptions were not met, the Mann-Whitney U test was used to compare independent group differences. Effect size estimates were calculated as Cohen's *d* value ( $t/\sqrt{N}$ :  $(M2-M1) / SD$  pooled: Student samples *t*-test). The statistical significance was set at  $p < 0.05$ .

## Results

The study analyzed functional outcomes of the 44 dominant and 44 nondominant extremities in patients with LET.

The mean symptom duration did not differ, at 4.36 months in the DEI group and 5.23 months in the NDEI group ( $p=0.438$ ). The DEI group comprised 25 female (56.8%) and 19 male (43.2%) patients, while the NDEI group comprised 20 female (45.5%) and 24 male (54.5%) patients ( $p=0.286$ ). The age and body mass index (BMI) did not differ between groups: 45.64 years and 27.92 kg/m<sup>2</sup> in the DEI group and 44.82 years and 27.99 kg/m<sup>2</sup> in the NDEI group ( $p=0.680$  and  $p=0.932$ , respectively). The group's educational attainment level was 6.02 years in the DEI group and 6.12 years in the NDEI group ( $p=0.936$ ) (Table 1).

Table 2 compares elbow pain, function, and sleep quality scores between the groups. Both groups had low-level VAS resting pain with a mean of 2.47 in the DEI group and 2.57 in the NDEI group ( $p=0.858$ ). The groups had high-level VAS hand physical activity pain scores at 7.82 in DEI and

Table 1. Comparison of demographic and clinical characteristics of the groups

|                          |        | Dominant Extremity Involvement (n=44) |             | Nondominant Extremity Involvement (n=44) |             | P        | Cohen's d |
|--------------------------|--------|---------------------------------------|-------------|------------------------------------------|-------------|----------|-----------|
|                          |        | Mean $\pm$ SD                         | 95% CI      | Mean $\pm$ SD                            | 95% CI      |          |           |
| Age (year)               |        | 45.64 $\pm$ 9.34                      | 42.80–48.47 | 44.82 $\pm$ 9.19                         | 42.02–47.61 | 0.680    | 0.088     |
| BMI (kg/m <sup>2</sup> ) |        | 27.92 $\pm$ 4.19                      | 26.64–29.19 | 27.99 $\pm$ 4.07                         | 26.76–29.23 | 0.932    | -0.016    |
| Mean years of education  |        | 6.02 $\pm$ 4.34                       | 4.70–7.34   | 6.12 $\pm$ 6.11                          | 4.26–7.97   | 0.936    | 0.015     |
| Symptom duration (month) |        | 4.36 $\pm$ 4.29                       | 3.06–5.67   | 5.23 $\pm$ 5.96                          | 3.42–7.04   | 0.438    | -0.167    |
|                          |        | n                                     | %           | n                                        | %           | $\chi^2$ |           |
| Gender                   | Female | 25                                    | 56.8        | 20                                       | 45.5        | 0.286    | -         |
|                          | Male   | 19                                    | 43.2        | 24                                       | 54.5        |          |           |

SD: Standard deviation; 95% CI: 95% confidence intervals for means; n: number; %: percent; BMI: Body mass index

$\chi^2$ : Pearson Chi-square test p value

P: Student *t*-test significance p value

Cohen's d: Effect size value

Table 2. Comparison of elbow pain, function, and sleep quality scores of the groups

|                                |  | Dominant Extremity Involvement (n=44) |           | Nondominant Extremity Involvement (n=44) |           | P     | Cohen's d |
|--------------------------------|--|---------------------------------------|-----------|------------------------------------------|-----------|-------|-----------|
|                                |  | Mean $\pm$ SD                         | 95% CI    | Mean $\pm$ SD                            | 95% CI    |       |           |
| VAS (rest)                     |  | 2.47 $\pm$ 2.70                       | 1.65–3.29 | 2.57 $\pm$ 2.78                          | 1.73–3.42 | 0.858 | -0.036    |
| VAS (hand physical activity)   |  | 7.82 $\pm$ 1.98                       | 7.21–8.42 | 7.45 $\pm$ 2.52                          | 6.68–8.22 | 0.449 | 0.163     |
| VAS (night)                    |  | 5.79 $\pm$ 3.34                       | 4.77–6.80 | 5.28 $\pm$ 3.71                          | 4.15–6.40 | 0.499 | 0.144     |
| Liverpool Elbow Score          |  |                                       |           |                                          |           |       |           |
| Clinical                       |  | 3.16 $\pm$ 0.20                       | 3.09–3.22 | 3.16 $\pm$ 0.13                          | 3.12–3.20 | 0.889 | 0.000     |
| Patient-reported               |  | 3.95 $\pm$ 1.12                       | 3.61–4.29 | 3.86 $\pm$ 1.09                          | 3.52–4.19 | 0.688 | 0.081     |
| Elbow motion capacity          |  | 5.64 $\pm$ 1.10                       | 5.31–5.98 | 5.55 $\pm$ 1.03                          | 5.24–5.8  | 0.694 | 0.084     |
| Elbow-related symptoms         |  | 1.46 $\pm$ 0.22                       | 1.40–1.53 | 1.46 $\pm$ 0.19                          | 1.40–1.52 | 1.000 | 0.000     |
| Total score                    |  | 7.11 $\pm$ 1.23                       | 6.73–7.48 | 7.02 $\pm$ 1.17                          | 6.66–7.37 | 0.727 | 0.074     |
| Pittsburgh Sleep Quality Index |  | 6.18 $\pm$ 3.36                       | 5.16–7.21 | 6.07 $\pm$ 3.43                          | 5.02–7.11 | 0.876 | 0.032     |

SD: Standard deviation; 95% CI: 95% confidence intervals for means; VAS: Visual Analogue Scale

P: Student *t*-test significance p value

Cohen's d: Effect size value

7.45 in the NDEI group ( $p=0.449$ ). The groups had medium-level VAS night pain at 5.79 in DEI and 5.28 in the NDEI group ( $p=0.499$ ).

The clinical and elbow-related symptom subdomain scores of the Liverpool Elbow Score were the same for both groups at 3.16 and 1.46, respectively ( $p=0.889$  and  $p=1.000$ ). The patient-reported subdomain score was 3.95 in the DEI group and 3.86 in the NDEI group ( $p=0.688$ ). The elbow motion capacity subdomain score was 5.64 in the DEI group and 5.55 in the NDEI group ( $p=0.694$ ). Liverpool Elbow Scale total score subdomain was 7.11 in the DEI group and 7.02 in the NDEI group ( $p=0.727$ ).

The PSQI sleep quality scores showed that both groups had comparable sleep disturbances, with scores of 6.18 in the DEI group and 6.07 in the NDEI group ( $p=0.876$ ).

## Discussion

The findings of this study suggest that the involvement of the dominant or nondominant extremity in patients with LET does not significantly influence pain intensity, elbow function, or sleep quality. Despite the potential biomechanical and neuromuscular differences between the dominant and nondominant upper extremities, the findings demonstrated comparable outcomes across both DEI and NDEI groups in terms of VAS scores for resting pain, physical activity pain, and night pain, and the Liverpool Elbow Score subdomains and total score. Furthermore, as assessed by PSQI, sleep disturbances deteriorated similarly between both groups.

LET arises from a complex interplay of factors, including tendon pathology, motor dysfunction, nociceptive system alterations, and possible

psychological influences [12]. Repetitive tensile stresses that surpass the mechanical strength of tendons are one of the key contributors to the onset of LET pain, highlighting the crucial relationship between strain and injury [17]. Park et al. highlight that the dominant side involvement is a significant factor for LET [10]. This study's findings revealed no significant difference in resting pain, hand physical activity, and night pain between patients with dominant extremity involvement and those with nondominant extremity involvement. This is a novel observation, as most cases of LET typically affect the dominant extremity. However, patients with pain in their nondominant extremities also report similar symptoms, including elbow pain. It is important to consider that compensatory or psychological factors can obscure any potential differences between the two patient groups.

The biomechanical risk factors associated with LET include repetitive wrist and elbow movements, damaging efforts without adequate rest, uncomfortable body positions, or a combination of these factors [18]. Due to repetitive use, LET limits elbow and hand functions and can restrict gripping or lifting activities, eventually affecting patients' daily tasks [1]. While previous studies have primarily investigated the effects of injections and therapeutic treatments on patients with LET in both dominant and nondominant extremities [2,7,19,20], a thorough analysis of functional scores related to LET remains lacking [9]. Additionally, the effect of extremity dominance has been explored only to a limited extent [21]. Our Liverpool Elbow Score findings provide valuable insights into clinical, patient-reported, elbow motion capacity, elbow-related symptoms, and total score subdomains. These results indicate that involvement of the dominant or nondominant extremity does not significantly affect functional outcomes, offering clarity and guidance for those managing LET. Due to innate adaptation mechanisms or psychological states, the patients might have unconsciously altered their daily activities to compensate for pain in the affected elbow, which could have contributed to similar overall functional scores. Furthermore, the unmeasured biomechanical differences regarding extremity dominance might influence Liverpool Elbow Scores and could play a crucial role in functional outcomes.

Sleep disturbance is increasingly recognized as a common symptom in chronic pain experienced by patients with LET [12]. Sağlam et al. indicated that patients with LET frequently displayed sleep disturbances during painful times [13]. Their study mainly included dominant extremity involved LET patients, and the results showed that their PSQI scores were 7.18, indicating poor sleep quality. Bateman et al. conducted a study showing that patients with LET frequently experience significant sleep disturbances. These disruptions in sleep patterns have a notable effect on daily activities and overall quality of life. As a result, patients can struggle with diminished performance in both personal and professional tasks, highlighting the wider implications of sleep quality on day-to-day functioning [22]. The current study showed that dominant or nondominant extremity involvement did not significantly affect sleep quality; however, both groups displayed worsened sleep disturbance on PSQI. LET pain status, mental stress, pain medication, and physical activity status could have a potential hindering effect on the sleep quality of the patients.

This study provides a comprehensive and novel analysis of symptom severity in patients diagnosed with LET, specifically focusing on pain levels, functional limitations, and sleep quality. Additionally, the current study includes patients involving dominant and nondominant extremities, allowing for a clear understanding of how LET affects patients differently based on their primary hand dominance. By examining these factors, the research aims to shed light on the implications of LET for daily activities, thereby addressing a gap in existing literature regarding the condition's multiple effects.

**Limitations:** This study has several limitations. First, hand dominance was established by self-report rather than a validated inventory, which could limit the standardization of dominance classification. The patient's grip strength was not assessed, which, due to equipment limitations, can provide an objective outcome for this study. The biomechanical factors and physical activity level of the hand that might play a crucial role in the functional outcomes regarding extremity involvement were not investigated. Lastly, the patient's psychological status was not questioned,

which could have affected pain answers and sleep quality.

## Conclusion

This study found no significant differences in pain intensity, elbow function, or sleep quality between patients with LET affecting the dominant versus the nondominant upper extremity. Despite biomechanical and neuromuscular differences generally associated with extremity dominance, both groups experienced similar levels of symptom severity and sleep disturbance. These findings suggest that dominant or nondominant extremity involvement does not substantially influence the clinical course of LET and that treatment strategies should focus on the overall symptom severity rather than hand dominance. Future longitudinal studies incorporating objective assessments such as maximal grip strength in different joint angles, pain catastrophizing, and psychological state evaluation might offer deeper insights into the mechanisms underlying patient-reported outcomes in patients with LET.

**Conflict of Interest:** The authors declare no conflict of interest related to this article.

**Funding sources:** The authors declare that this study has received no financial support.

**Ethics Committee Approval:** Muş Alparslan University Scientific Research and Publication Ethics Committee approved the study (Date: 09.10.2023, Number:110929-8/37).

**ORCID and Author contribution:** **G.B. (0000-0001-9224-996X):** Conceptualization, Methodology, Data collection, Software, Statistical analysis, Interpretation of results, Writing—review and editing, Final approval. **M.A.K. (0000-0003-4052-5277):** Conceptualization, Methodology, Data collection, Writing—review and editing, Final approval. **R.Ş. (0000-0002-1636-4082):** Conceptualization, Methodology, Software, Statistical analysis, Interpretation of results, Writing—review and editing, Final approval. **T.F.Y. (0000-0002-5097-2241):** Conceptualization, Methodology, Data collection, Writing—review and editing, Final approval. **H.E.K (0000-0001-9851-1623):** Conceptualization, Methodology, Data collection, Writing—review and editing, Final

approval.

**Peer-review:** Externally peer reviewed.

**Acknowledgement:** We wish to express our gratitude to the participants; without their contribution, this study would not have been possible.

## REFERENCES

- Duncan J, Duncan R, Bansal S, Davenport D, Hacker A. Lateral epicondylitis: the condition and current management strategies. *Br J Hosp Med (Lond)*. 2019;80(11):647-51. doi: 10.12968/hmed.2019.80.11.647.
- Güngör E, Karakuzu Güngör Z. Comparison of the efficacy of corticosteroid, dry needling, and PRP application in lateral epicondylitis. *Eur J Orthop Surg Traumatol*. 2022;32(8):1569-75. doi: 10.1007/s00590-021-03138-2.
- Bateman M, Evans JP, Vuvan V, Jones V, Watts AC, Phadnis J, et al. Protocol for the development of a core outcome set for lateral elbow tendinopathy (COS-LET). *Trials*. 2021;22(1):339. doi: 10.1186/s13063-021-05291-9.
- Kotnis NA, Chiavaras MM, Harish S. Lateral epicondylitis and beyond: imaging of lateral elbow pain with clinical-radiologic correlation. *Skeletal Radiol*. 2012;41(4):369-86. doi: 10.1007/s00256-011-1343-8.
- Shiri R, Viikari-Juntura E. Lateral and medial epicondylitis: role of occupational factors. *Best Pract Res Clin Rheumatol*. 2011;25(1):43-57. doi: 10.1016/j.berh.2011.01.013.
- Cho YT, Hsu WY, Lin LF, Lin YN. Kinesio taping reduces elbow pain during resisted wrist extension in patients with chronic lateral epicondylitis: a randomized, double-blinded, cross-over study. *BMC Musculoskelet Disord*. 2018;19(1):193. doi: 10.1186/s12891-018-2118-3.
- Tran T, Harris C, Ciccarelli M. The impact of a hand therapy workplace-based educational approach on the management of lateral elbow tendinopathy: A randomized controlled study. *J Hand Ther*. 2023;36(1):45-59. doi: 10.1016/j.jht.2021.09.004.
- Lenoir H, Mares O, Carlier Y. Management of lateral epicondylitis. *Orthop Traumatol Surg Res*. 2019;105(8S):S241-6. doi: 10.1016/j.otsr.2019.09.004.
- Weber C, Thai V, Neuheuser K, Groover K, Christ O. Efficacy of physical therapy for the treatment of lateral epicondylitis: a meta-analysis. *BMC Musculoskelet Disord*. 2015;16:223. doi: 10.1186/s12891-015-0665-4.
- Park HB, Gwark JY, Im JH, Na JB. Factors Associated With Lateral Epicondylitis of the Elbow. *Orthop J Sports Med*. 2021;9(5):23259671211007734. doi: 10.1177/23259671211007734.
- Tajika T, Kobayashi T, Yamamoto A, Kaneko T, Takagishi K. Prevalence and risk factors of lateral epicondylitis in a mountain village in Japan. *J Orthop Surg (Hong Kong)*. 2014;22(2):240-3. doi: 10.1177/230949901402200227.
- Coombes BK, Bisset L, Vicenzino B. Thermal hyperalgesia distinguishes those with severe pain and disability in unilateral lateral epicondylalgia. *Clin J Pain*. 2012;28(7):595-601. doi: 10.1097/AJP.0b013e31823dd333.
- Sağlam G, Aküzüm F, Çetinkaya A, Şişir D. Assessment of psychiatric disorders and sleep quality in chronic lateral epicondylitis. *Agri*. 2022;34(3):193-9. doi: 10.14744/agri.2021.24119.
- Bayrak G, Alkan H. Factors influencing pain intensity in knee osteoarthritis: a cross-sectional biopsychosocial perspective. *BMC Musculoskelet Disord*. 2025;26(1):196. doi: 10.1186/s12891-025-08450-0.
- Şavkın R, Bükler N, Şimşek Ş. The Liverpool Elbow Score, patient-answered section: Cultural adaptation, validity and reliability of Turkish version. *Musculoskelet Sci Pract*. 2020;50:102256. doi: 10.1016/j.msksp.2020.102256.
- Ağargün MY, Kara H, Anlar Ö. The Validity and Reliability of the Pittsburgh Sleep Quality Index. *Türk Psikiyatri Dergisi*. 1996;7(2):107-15.
- Yoon SY, Kim YW, Shin IS, Kang S, Moon HI, Lee SC. The Beneficial Effects of Eccentric Exercise in the Management of Lateral Elbow Tendinopathy: A Systematic Review and Meta-Analysis. *J Clin Med*. 2021;10(17):3968. doi: 10.3390/jcm10173968.
- Curti S, Mattioli S, Bonfiglioli R, Farioli A, Violante FS. Elbow tendinopathy and occupational biomechanical overload: A systematic review with best-evidence synthesis. *J Occup Health*. 2021;63(1):e12186. doi: 10.1002/1348-9585.12186.
- Peterson M, Butler S, Eriksson M, Svärdsudd K. A randomized controlled trial of eccentric vs. concentric graded exercise in chronic tennis elbow (lateral elbow tendinopathy). *Clin Rehabil*. 2014;28(9):862-72. doi: 10.1177/0269215514527595.
- Sun Z, Chen S, Liu W, Sun G, Liu J, Wang J, et al. Efficacy of ultrasound therapy for the treatment of lateral elbow tendinopathy (the UCILET Trial): study protocol for a three-arm, prospective, multicentre, randomised controlled trial. *BMJ Open*. 2022;12(1):e057266. doi: 10.1136/bmjopen-2021-057266.
- Shiri R, Varonen H, Heliövaara M, Viikari-Juntura E. Hand dominance in upper extremity musculoskeletal disorders. *J Rheumatol*. 2007;34(5):1076-82. PMID: 17343320
- Bateman M, Hill JC, Cooper K, Littlewood C, Saunders B. Lived experience of people with lateral elbow tendinopathy: a qualitative study from the OPTimisE pilot and feasibility trial. *BMJ Open*. 2023;13(8):e072070. doi: 10.1136/bmjopen-2023-072070.