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# ULTRASOUND EVALUATION OF TENNIS ELBOW AND THE ROLE OF VITAMIN- D DEFICIENCY IN TENDON HEALING: A SYSTEMATIC REVIEW

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## ABSTRACT

*Lateral epicondylalgia is the most common cause of lateral elbow pain. Musculoskeletal ultrasonography is being used more frequently by medical professionals to detect tendon diseases that may be linked to lateral epicondylalgia . Neovascularization, hypoechoic regions, and tendon thickness all significant markers of the severity of tendon disease can be seen in MSKUS. Bone health and muscle function depend on vitamin D. Epidemiological studies have connected vitamin D deficiency to tendon issues like tendinopathy and poor recovery.*

***Objective:*** *The purpose of this study was to review tennis elbow using ultrasound and examine how vitamin D deficiency affects tendon healing.*

***Method:*** *A systematic review was conducted to find studies evaluating USG findings in tennis elbow and the effect of vitamin D deficiency on tendon healing, a systematic review was carried out. Data were extracted according to PICO chart. Observational study was used in this review.*

***Result:*** *A total of 12 studies were included in this systematic review, consisting of observational studies, cross-sectional analyses, retrospective studies, and diagnostic studies. Tendon thickening, hypoechoic areas, calcific alterations, loss of normal fibrillar architecture, and cortical irregularities at the common extensor origin were frequently observed. Tendinopathies and other musculoskeletal conditions have often been linked to vitamin D deficiency.*

***Conclusion:*** *Ultrasound is effective for diagnosing and monitoring tennis elbow. Vitamin D deficiency may affect tendon healing.*

***Key words:*** *Tennis elbow, lateral epicondylitis, tendon healing, musculoskeletal ultrasound, and vitamin D deficiency.*

## Introduction

The most frequent cause of a lateral elbow pain is lateral epicondylalgia. The pathological alterations in the tendinous origins of the Extensor Carpi Radialis Brevis (ECRB) and Extensor Digitorum Communis (EDC) muscles are usually linked with osteotendinous irritation of the common extensor origin [1].

Other terms which are similar to tennis elbow include tendonitis of a common extensor origin, lateral elbow pain, lateral epicondylitis, lateral epicondylalgia and peritendinitis of the elbow. Tennis elbow is defined by pain and tenderness about the lateral epicondylus of the humerus and pain in case of resisting the wrist or the middle finger or both in the dorsiflexion of the wrist (1-3% of the population), with the

highest occurrence between 40-50 years of age. The rate increases to 10 percent among the women aged 42 46 years [2].

Tennis elbow occurs as a result of a torque injury or an abrupt overstretching of the tendons which are attached to the epicondyles on the humerus. An enthesopathy is the most common lesion, a pathological lesion at the junction of tendons and bones. The commonest location is the lateral epicondylar, which is three times as common as the medial epicondylar. Almost fifty percent of tennis players can experience tennis elbow at some point in their lives. This will be too harsh to some one-third of the players who will find it hard to carry out their daily tasks [9].

The condition was first described by Runge in 1873 when he called it the writer's cramp. The term has over time evolved to mean a shift in thinking where it is an inflammatory and not a degenerative process. Rather than describing the inflammation, modern terminology emphasizes the degenerative nature of lateral epicondylitis which is characterized by microtears and angiofibroblastic degeneration of the ECRB tendon [3].

Medical professionals are increasingly employing musculoskeletal ultrasonography in the diagnosis of tendon diseases that could be related to lateral epicondylalgia. The musculoskeletal ultrasound is cheap and is highly available, non-invasive and reliable as per reports [1].

Neovascularization, hypoechoic lesions, and tendon thickness can be demonstrated in MSKUS, being the significant signs of extent of tendon illness. It is possible to locate the pain generators with the assistance of dynamic scanning. Selection of Probe: A high-frequency linear transducer (1015MHz) is recommended to provide the best solution. Scanning Protocol: Extensor Tendon Examination: In order to examine the presence of hypoechoic areas, calcifications or tears in the common extensor tendon, the transducer must be placed longitudinally over the lateral epicondyle. Longitudinal and transverse images of the extensor digitorum and ECRB tendons should be present[4].

Six types of ultrasonographic were identified: Enthesiopathic Echogenicity changes and the development of the enlargement of the proximal part of the tendon was observed. Tendonitis The extensor carpi radialis brevis tendon was enlarged and the normal microscopic waveform structure of the tendon collagen was disrupted leaving regions of dyshomogeneous hypoechogenic areas. The peritendonitis status There was an augmentation in peritendonous lining. A bursa The inferior surface of the extensor carpi radialis brevis tender was occupied by a bursa. Hemorrhage within the muscle The muscle bulk of the extensor carpi radialis brevis had a number of ovoid or circular hypoechogenic areas. Combined lesions These were not linked to any relationship with the extent and length of the symptoms [5].

Bone (has to be reinforced with vitamin D to enhance the absorption of calcium and prevent stress fractures), muscle (has to be strengthened to avoid weakness and harm), and respiratory infections (need to be reduced by vitamin D) [7].

One of the regulators of musculoskeletal health, vitamin D can influence musculoskeletal tendon regeneration by inhibiting inflammatory response, extra-cellular matrix metabolism, and cell growth. The estimated number of people with vitamin D deficiency is more than 1 billion all over the world. These deficits have been associated with one Impaired musculoskeletal functioning, and the inability to repair injuries promptly [6].

Vitamin D in tendons combines with vitamin D receptor to control mineralization, inflammation and collagen production. Vitamin D deficiency has been linked to epidemiological studies in relation to tendon problems including tendinopathy and a lack of healing. Vitamin D supplements have a potential to improve tendon activity and strength especially in vulnerable groups like athletes and older age [8].

Some treatment therapies that can be used to treat tennis elbow include rest, brace, therapeutic exercises, medication, laser, acupuncture, extracorporeal shock wave therapy, ultrasonic and surgery [10].

Although there are numerous treatments, the healing in tendons is slow and tends to recur. Nutritional deficiency, particularly Vitamin D and magnesium, disturbs collagen production and tendon healing. Ultrasound imaging is a

non-invasive tool to determine the tendon structure and monitoring of healing. This review is a methodical study of literature regarding the assessment of ultrasound and the effect of Vitamin D deficiency on tendon recovery.

The term "lateral epicondylitis" (LE) is frequently used to refer to a variety of medical disorders affecting the extra-articular soft tissues of the lateral elbow compartment. A variety of USG procedures can be applied to sonographic findings in patients with LE. The use of US is essential for two reasons: first, it improves clinical decision-making regarding the interventional procedure by providing a better understanding of the pathology; second, it offers precise targeting and guidance during the subsequent procedure that is customized for each individual patient [20].

A useful diagnostic technique for the assessment and treatment of lateral elbow disorders is musculoskeletal ultrasonography (MSKUS). Because it may give real-time, high-resolution imaging of soft tissues, such as tendons, ligaments, and nerves, without the radiation exposure associated with other imaging modalities, musculoskeletal ultrasound (MSKUS) has become a popular diagnostic modality. Tendon thickness, hypoechoic areas, and neovascularization can all be seen with MSKUS, giving important information about the degree of tendon pathology [4].

For evaluating soft tissue involvement in lateral epicondylalgia, ultrasound is regarded as a dependable, accessible, non-invasive, and affordable imaging method. The optimum combination of diagnostic sensitivity and specificity is found in the hypoechogenicity of the common extensor origin. When identifying elbows with lateral epicondylalgia, it is highly specific [Specificity: 0.82 (0.72-0.90)] and moderately sensitive [Sensitivity: 0.64 (0.56-0.72)] [1].

Adults (≥18 years old) with LET had several degenerative tendon findings. The most common were hypoechogenicity (67.77%) and neovascularity (37.8%). For both sexes, the average tendon tear length was 4.44 (± 2.81) millimeters [11].

66 adult subjects with a clinical diagnosis of lateral epicondylalgia had both elbows examined. A professional assessor examined tendon thickness (longitudinal and transverse plane) and scored common extensor hypoechogenicity, heterogenicity, neovascularity, and bony anomalies at the enthesis using a standardized ultrasound image grading scale. The patient-rated tennis elbow (PRTEE), pain-free grip strength, and pain visual analog scale (PVAS) were used to measure pain and function. Neovascularity and transverse tendon thickness may be linked to changes in the sensory system in LE [12].

Power ultrasound examination Neovascularity and grey scale ultrasonography abnormalities (maximum anterior-posterior thickness, lateral epicondyle bony spurring or irregularity, and echo characteristics) of the common extensor tendon were detected by Doppler. Strength While a combined null finding in power Doppler and grey scale ultrasonography produced a high negative likelihood ratio of 0.05, Doppler had a strong positive likelihood ratio of 45.39. In general, the diagnostic accuracy of grey scale shifts was lower [13].

Color Doppler and four grayscale US findings a convex exterior contour, an erosive lateral epicondular cortex, interior calcifications, or a tear have compelling likelihood ratios and a specificity and PPV of 100% for neovascularity. For the purpose of diagnosing chronic lateral epicondylitis, the combination of grayscale and color Doppler alterations is preferable [22].

High-resolution evaluation of the elbow has been made possible by advancements in ultrasound (US) technology, which also, crucially, enables real-time, radiation-free intervention guidance. Tendon's repeated stretching can result in irreversible denaturing of matrix proteins and fibrous tissue proliferation; hence, US imaging is required to provide an accurate diagnosis, especially in unclear situations . The prevalence of tennis elbow was assessed to be 1-3% , and the annual incidence was found to be 2.4 per 1000 individuals [19].

The US's sensitivity and specificity for identifying symptomatic lateral epicondylitis varied from 72% to 88% and 36% to 48.5%, respectively. Common extensor tendon calcification, tendon thickening, irregularities in the surrounding bone, focal hypoechoic areas, and diffuse heterogeneity When it came to identifying symptomatic lateral epicondylitis,

US of the common extensor tendon had a high sensitivity but a low specificity [18].

The LE group's mean vitamin D level was 16.47±8.22 (range: 8.32 to 39.55) ng/mL, while the control group's was 23.64±8.4 (range: 11.6 to 49) ng/mL. Although vitamin D deficiency was present in 31 of the patients (77.5%) who were diagnosed with LE, this finding suggests that low vitamin D may play a role in the etiology of LE [14].

Thirty patients (33.33%) had an acceptable amount of vitamin D, ten patients (11.11%) had an insufficient level, and fifty patients (55.56%) had a deficiency. Patients with lateral epicondylitis in this study had low vitamin D levels, demonstrating the strong correlation between lateral epicondylitis and vitamin D insufficiency. Grip strength, visual analog scale score (VAS), and patient-rated tennis elbow assessment score (PTREE) were all lower in patients with vitamin D insufficiency [15].

Collagen synthesis, inflammation, and mineralization are all regulated by vitamin D's interaction with vitamin D receptors in tendons. Epidemiological research has connected vitamin D deficiency to tendon issues such tendinopathy and slow healing [16].

Vitamin D, a key regulator of musculoskeletal health, may affect tendon regeneration through inflammatory regulation, extracellular matrix remodeling, and cell proliferation. Vitamin D deficiency may make it more difficult for tendons to heal and regenerate. Mechanistic studies indicates that vitamin D enhances healing through changes to the extracellular matrix and inflammation [6].

The presence of the vitamin D receptor (VDR) in skeletal muscle fibers suggests that vitamin D directly influences muscle function.People of all ages and nationalities were identified as the target population. Athletes and physically active individuals were the main focus. Our analysis's findings emphasize the necessity of measuring and supplementing these people with vitamin D because low vitamin D levels are frequently linked to musculoskeletal issues or complaints. Regarding the impact of vitamin D supplementation on different musculoskeletal outcomes, including muscle function and exercise-induced muscle injury, the evidence is conflicting [17].

There were 205 patients with either medial or lateral epicondylitis. There were 62 male patients and 143 female patients. The average age was 46.1±10 years, and the average vitamin D level was 16.5±9.9 (2.92-69.70). Twenty patients had normal results. 185 patients had poor vitamin D levels. There may be a connection between low vitamin D levels and epicondylitis because patients with the condition had noticeably low vitamin D levels [21].

## Material and Methods

### Study design and Literature-Search Strategy

This systematic review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The PICO (Population, Intervention, Comparison, Outcome framework guided the identification of relevant studies published between 1990 and 2025.The primary objective of this review was ultrasound evaluation of tennis elbow and the role of vitamin D deficiency in tendon healing.

**Table 1. PICO Search Strategy**

| Elements | Inclusive criteria | Exclusive criteria |
|---|---|---|
| **Population (P)** | Adults aged >18<br>Clinical diagnosed with tennis elbow<br>Both genders | Animal studies<br>Pediatric patients (<18)<br>Patient with other tendon injuries |
| **Intervention (I)** | Studies reporting vitamin D supplementation effects on tendon recovery | Vitamin D studies without tendon healing outcomes |
| **Comparison (C)** | Comparison with patients having normal vitamin D levels or standard therapy | Studies without a comparison group |
| **Outcome (O)** | Ultrasound evalution of tendon | Outcomes unrelated to tendon |

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|---|---|---|
| | healing<br>Improvement in symptoms | healing or functionality |
| **Study Designs** | Observational studies: quantitative, mixed-methods | Qualitative study ,Reviews, viewpoints, single case reports |

A comprehensive literature search was carried out using major electronic databases, including PubMed, and Google Scholar. Other useful databases including springer link and science direct.

The search strategy incorporated relevant keywords combined with appropriate Boolean operators, such as:

- "lateral epicondylitis" AND "ultrasound" AND "diagnosis"
- "tennis elbow" AND "musculoskeletal ultrasound" AND "tendon abnormalities"
- "lateral epicondylitis" AND "vitamin D deficiency" AND "tendon healing"
- "lateral epicondylitis" AND "vitamin D" AND "clinical symptoms"
- "ultrasound" AND "tennis elbow" AND "tendon evaluation"

**Prisma Chart**

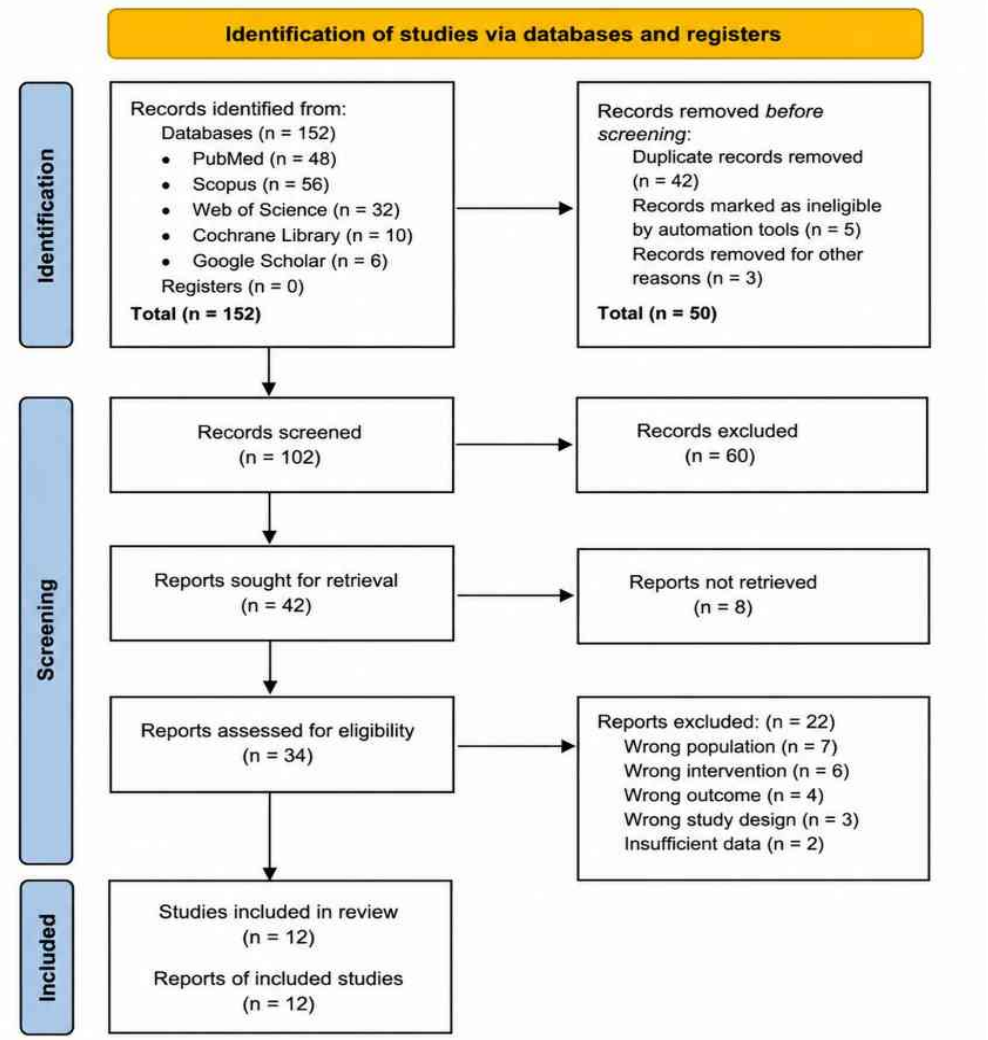


**Fig. 1:** *Prisma Chart of Studies*

## RESULTS

A total of 12 studies were included, consisting of observational, cross-sectional, retrospective, and diagnostic studies.The literature included publications related to early and modern studies published between 1990 and 2025. Most of the studies involved lateral epicondylitis in adult patients commonly referred to as tennis elbow and most predominantly musculoskeletal ultrasonography was employed to evaluate and make a diagnosis. A relationship between the level of vitamin D and tendon health had also been explored in several studies some of which were aimed at lateral epicondylitis.

A number of studies consistently displayed unique tendon anomalies in patients of tennis elbow through ultrasound. Thickening of tendons, hypoechoic foci, calcific changes, disappearance of normal fibrillar structure and cortical defects at the same extensor origin were common. Power Doppler imaging tended to show an elevated vascularity of persistent cases, which indicated that neovascularization is associated with tendon degeneration. Power Doppler ultrasound has been illustrated to increase the confidence of diagnosis in chronic and refractory cases by identifying active tendon disease.

Vitamin D deficiency has been mostly attributed to tendinopathies and other musculoskeletal conditions. The literature reviewed states that the low concentration of vitamin D can have an adverse impact on collagen production, suppression of inflammation, and the overall tendon capacity to repair. Studies have found that there is a strong relationship between the lack of vitamin D and more severe symptoms, in particular, in patients with lateral epicondylitis the level of vitamin D was considered. Individuals with decreased vitamin D levels were normally experiencing more discomfort and took a better time to heal. These findings give a legitimate support to the theory that poor tendon repair in tennis elbow could be due to lack of vitamin D.

**Table 2. Characteristics and Key Findings of Included Studies**

| Author (Year) | Country | Study Design | Sample Size | Population | Outcome(s) Measured | Major Findings |
|---|---|---|---|---|---|---|
| Droppelmann G et al., 2022 | Chile | Retrospective observational | 4,324 ultrasound examinations | Patients undergoing ultrasound evaluation for lateral elbow tendinopathy | Ultrasound tendon features | Hypoechoic areas, tendon thickening, correlation with chronicity |
| Mezian K et al., 2021 | Czech Republic | Observational | 30 | Common elbow tendinopathies | Ultrasound-guided procedures | US guides injections, improves accuracy |
| Seferoglu B et al., 2025 | Turkey | Cross-sectional | 60 | Adults with epicondylitis | Vitamin D levels | Vitamin D deficiency associated with increased risk & symptoms |
| Obradov M et al., 2012 | Serbia | Observational | 35 | Chronic lateral epicondylitis | Ultrasound findings | US detected tendon abnormalities and correlated with clinical severity |

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|---|---|---|---|---|---|---|
| Palaniswamy V et al., 2018 | Australia | Cross-sectional | 80 | Chronic lateral epicondylalgia | Ultrasound, sensory, clinical characteristics | Tendon abnormalities correlated with pain & functional deficits |
| Du Toit C et al., 2008 | South Africa | Diagnostic accuracy | 35 | Chronic tennis elbow | Power Doppler US | Increased vascularity improves diagnostic accuracy |
| Yaka H et al., 2022 | Turkey | Cross-sectional | 70 | Adults with lateral epicondylitis | Vitamin D levels, clinical outcomes | Lower Vitamin D associated with higher symptom severity |
| El-Leithy SA et al., 2023 | Egypt | Cross-sectional | 50 | Adults with lateral epicondylitis | Vitamin D levels | Vitamin D deficiency correlated with impaired tendon healing |
| Levin D et al., 2005 | USA | Diagnostic study | 64 elbows | Patients with lateral epicondylitis | Ultrasound findings | Hypoechogenicity, tendon thickening and cortical irregularity were significantly associated with lateral epicondylitis. |
| Maffulli N et al., 1990 | Italy | Observational | 35 | Tennis players evaluated for lateral elbow pain/tendinopathy | Ultrasonographic tendon morphology | Ultrasound detected tendon thickening, hypoechoic lesions and degenerative tendon changes, supporting its value in early diagnosis |
| Connell D et al., 2001 | Australia | Observational diagnostic study | 72 elbows | Patients with lateral epicondylitis | Sonographic examination | Ultrasound identified tendon thickening, hypoechogenicity and partial tears, demonstrating good diagnostic value in chronic lateral epicondylitis. |

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| Memon AG et al., 2023 | Pakistan | Cross-sectional observational | 80 | Adult male restaurant chefs | Serum vitamin D levels and lateral epicondylitis prevalence | Low vitamin D levels were observed among participants with lateral epicondylitis, suggesting a possible association between vitamin D status and tendon-related disorders. |

In table 2, the findings of ultrasound imaging identifying tendon thickening, hypoechogenicity and cortical irregularities are consistently present in all twelve individual studies included our review, while lower vitamin D levels are routinely associated with more severe suffering and delayed closure of lateral epicondylitis. Meantime, most of studies are observational or cross-sectional in design with relatively small sample sizes, while the global geographic spread of the studies (Chile, Turkey, Pakistan, Australia and others) allow to extrapolate these findings to other regions and populations as well.

**Table 3. Risk of Bias Assessment of Included Studies**

| Study | Study Design | Tool Used | Key Bias Domains | Overall Risk |
|---|---|---|---|---|
| Droppelmann G et al., 2022 | Retrospective observational | NOS | Retrospective data collection, selection bias | Moderate |
| Mezian K et al., 2021 | Observational | NOS | Small sample size, lack of control group, possible selection bias | Moderate |
| Seferoglu B et al., 2025 | Cross-sectional | NOS | Single-center recruitment, confounding factors, cross-sectional design | Moderate |
| Obradov M et al., 2012 | Observational | NOS | Small sample size, observer bias, limited generalizability | Moderate |
| Palaniswamy V et al., 2018 | Cross-sectional | NOS | Selection bias, inability to establish causality | Low–Moderate |
| Du Toit C et al., 2008 | Diagnostic accuracy | QUADAS-2 | Patient selection, reference standard, applicability concerns | Low–Moderate |
| Yaka H et al., 2022 | Cross-sectional | NOS | Confounding variables, cross-sectional limitations | Moderate |
| El-Leithy SA et al., 2023 | Cross-sectional | NOS | Sample size, selection bias, limited external validity | Moderate |
| Levin D et al., 2005 | Diagnostic study | QUADAS-2 | Patient selection, index test interpretation, applicability concerns | Low–Moderate |
| Maffulli N et | Observational | NOS | Small sample size, lack | Moderate |

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|---|---|---|---|---|
| al., 1990 | | | of control group | |
| Connell D et al., 2001 | Diagnostic observational | QUADAS-2 | Patient selection, imaging interpretation bias | Low–Moderate |

Table 3 shows that majority of the included studies had a considerable risk of bias, primarily because of selection bias, small sample sizes, and the lack of control groups. While the diagnostic accuracy studies assessed with QUADAS-2 show a slightly lower, low-to-moderate risk. Because none of the included studies had a low-risk grade, the review's conclusions should be regarded cautiously.

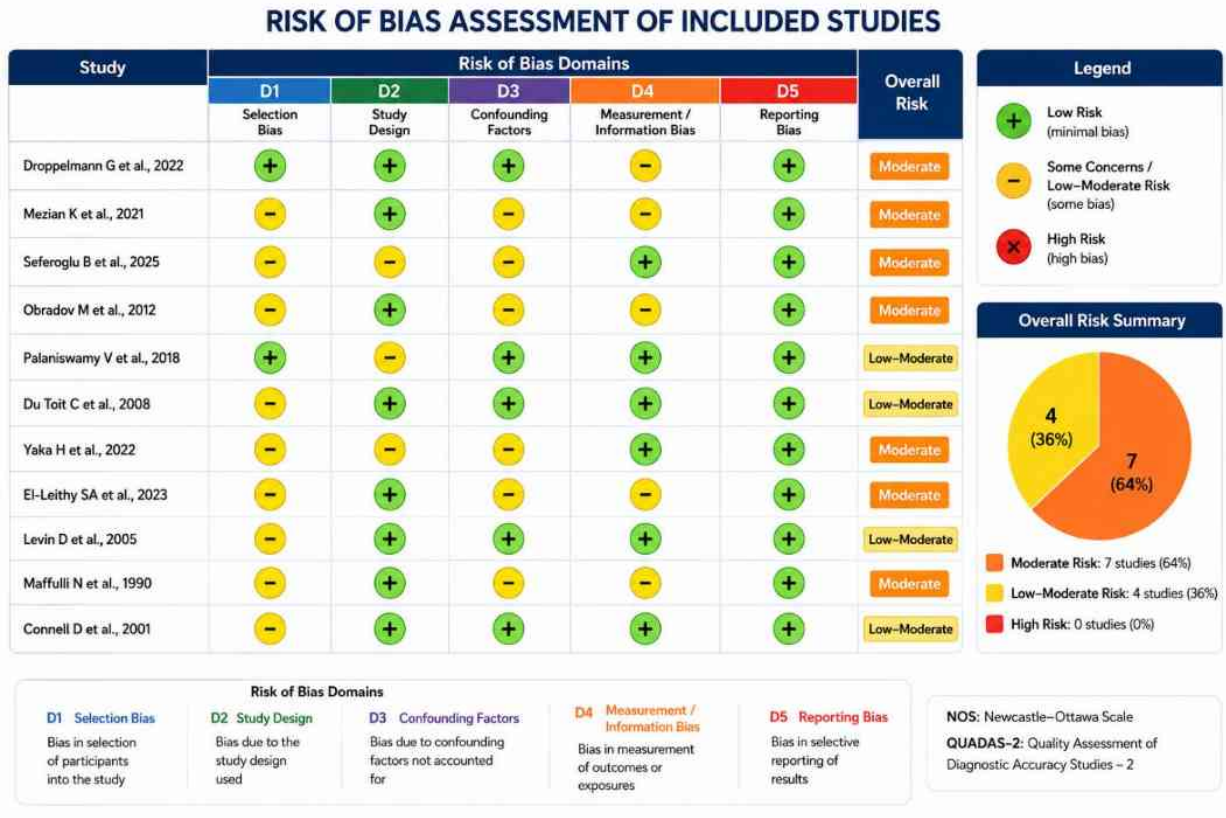


**Figure 2.** ***Risk of Bias Evaluation of the Included Articles***

Seven articles (63.6%) were found to have a moderate risk of bias while four articles (36.4%) had a low to moderate risk of bias. None of the articles were found to have a high risk of bias. Some of the key methodological issues were selection bias, small sample sizes, confounding, retrospective or cross-sectional design of the study, and applicability issues of the diagnostic accuracy studies.

**Table 4. Summary of Evidence and Strength of Conclusions**

| Outcome | No. of Studies | Direction & Consistency of Results | Strength / Certainty of Evidence |
|---|---|---|---|
| Ultrasound findings in lateral epicondylitis | 8 | Ultrasound consistently detected tendon thickening, hypoechogenicity, and structural changes related to disease severity. | Moderate |
| Power Doppler ultrasound findings | 2 | Increased blood flow/neovascularization was linked with chronic tendon changes. | Low–Moderate |

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|---|---|---|---|
| Vitamin D deficiency and lateral epicondylitis | 4 | Low vitamin D levels were associated with increased symptoms and severity of lateral epicondylitis. | Moderate |
| Vitamin D role in tendon healing | 3 | Vitamin D may support collagen formation, tendon repair, and regulation of inflammation. | Low–Moderate |
| Vitamin D supplementation and recovery | 2 | Correction of deficiency may improve recovery, but evidence is still limited. | Low |
| Ultrasound-guided management | 3 | Ultrasound improves diagnosis and accuracy of tendon-related procedures. | Moderate |

Table 4 shows that the strongest evidence, with moderate certainty, supports the use of ultrasound as a diagnostic tool for lateral epicondylitis and the correlation between the severity of symptoms and vitamin D deficiency. In contrast, the evidence that links vitamin D supplementation to recovery is remains weak, with low certainty, and is based on just two studies. All things considered, this emphasizes ultrasound as a reliable diagnostic technique, whereas additional randomized trials are still needed to demonstrate the therapeutic effect of vitamin D.

**Discussions**

The outcomes of this systematic review prove the increasing clinical importance of vitamin D in tendon health and healing and the well-known application of musculoskeletal ultrasonography in the management of lateral epicondylitis.

Ultrasound is an appropriate technique in visualizing the degenerative but not inflammatory tendon changes that characterize the lateral epicondylitis because prior studies have already revealed [1,5,18]. The systematic and observational studies in this review corroborate the prior results that indicated a relationship between the severity of the illness and ultrasound detected abnormalities such as tendon thickness, hypoechogenicity and loss of fibrillar structure [1,11,12]. Other studies in the past especially those that have concluded that neovascularization aids in persistent tendon disease are further supported by the enhanced application of power Doppler ultrasonography in chronic patients [13].

Over the past few years, the relationship between the musculoskeletal diseases and the lack of vitamin D has become more frequently reported [6,8,17]. The studies that were incorporated in this review extend this evidence to the lateral epicondylitis that demonstrates that decreased vitamin D concentrations are often observed in patients with the disease and can be associated with more severe symptoms [14,15,21]. This is consistent with larger studies that have found that vitamin D influences tendon remodelling, collagen synthesis and inflammatory regulation that are necessary in tendon repair [6, 8].

Clinically, the examined data can be used to justify regularity in using ultrasound as an imaging procedure as a first-line tool in the diagnosis and subsequent treatment of lateral epicondylitis, particularly in chronic or treatment-resistant patients [4,10,18].

Since there is an association between lateral epicondylitis and the lack of vitamin D, establishing the level of vitamin D in a patient might be helpful when it comes to treating patients with persistent symptoms. Combined with conventional rehabilitation approaches, the clinical outcomes and tendon healing could be enhanced by identifying and correcting the vitamin D deficiency [6,14,15].

**Conclusion**

Ultrasound is an effective imaging modality for the diagnosis and follow-up of tennis elbow (lateral epicondylitis), allowing clinicians to monitor tendon healing over time. Adequate vitamin D levels may also play an important role in tendon repair, as vitamin D deficiency has been associated with impaired tendon healing. Identifying and correcting vitamin D deficiency may support the healing process and improve clinical outcomes. Therefore, combining nutritional assessment with ultrasound evaluation provides a more

comprehensive approach to the diagnosis, monitoring, and management of patients with tennis elbow.

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