Lateral epicondylitis: the condition and current management strategies

ABSTRACT

Lateral epicondylitis or tennis elbow is a common condition estimated to affect between 1 and 3% of adults. As a result of its high prevalence, both primary and secondary care physicians are frequently presented with this problem, so knowledge of its presentation and up-to-date management strategies is essential.

This review collates the most recent evidence on lateral epicondylitis to help the clinician perform assessments and make treatment decisions, based on the best current clinical practice.

Lateral epicondylitis or tennis elbow is a common condition estimated to affect between 1 and 3% of adults (Altchek et al, 2018). Thought to be an overuse injury, lateral epicondylitis is a disease of degeneration and impaired healing rather than an inflammatory process, as the name may suggest (Ellenbecker et al, 2013). In particular, lateral epicondylitis has an association with overloading of the tendons connecting to the lateral epicondyle and repetitive overhead movements. It is generally accepted that the diagnosis of lateral epicondylitis is a clinical one and the majority of patients should be managed in primary care, with specialist referral only in specific circumstances (Ahmad et al, 2013; National Institute of Health and Clinical Excellence, 2017).

This review collates the most recent evidence on lateral epicondylitis to help the clinician perform assessments and make treatment decisions, based on the best clinical practice.

Anatomy and pathology

The term 'epicondylitis' is somewhat of a misnomer as the pathology lies not in the epicondyle, but rather in the tendons attaching to the lateral epicondyle of the humerus. Specifically, the condition afflicts the tendinous attachment of four of the extensor muscles of the forearm: extensor carpi radialis brevis, extensor digitorum communis, extensor digiti minimi and extensor carpi ulnaris, with the extensor carpi radialis brevis being the most commonly affected (Krogh et al, 2017). These four muscles converge to attach via a singular tendon – the common extensor tendon. Its function is to extend the wrist and fingers, while also supinating the forearm.

The pathology in lateral epicondylitis stems from repetitive overuse of the posterior muscles of the forearm (Heliövaara et al, 2006). This causes multiple micro-tears and leads to a cascade of degenerative processes occurring within the tendon, known as a tendinosis. The histological defining feature of this tendinosis is angiofibroblastic dysplasia, an umbrella term which encompasses fibroblast hypertrophy, disorganized collagen and vascular hyperplasia (Kraushaar and Nirschl, 1999). Note that this is distinctly different to a tendinitis, in which there is an influx of inflammatory cells into the tendon (Kannus and Józsa, 1991). If left unattended, the tendinosis can progress to structural failure leading to complete rupture and calcification (rarely) (Kraushaar and Nirschl, 1999).

Clinical presentation

Although lateral-sided elbow pain is a reasonably non-specific symptom, the diagnosis of lateral epicondylitis can largely be made through history and clinical examination alone (Ahmad et al, 2013).

History

Lateral epicondylitis injuries are most commonly acquired in either occupational or sporting circumstances, with repetitive overuse being particularly evident in the history (Ellenbecker et al, 2013).

In the occupational setting, jobs involving repetitive elbow flexion and extension (>2 hours/day) (Herquelot et al, 2013), overloading of tendons connecting to the epicondyle (>5 kg for more than 2 hours/day) (Seidel et al, 2019) and overexposure to vibrating tools (>2 hours/day) (Heliövaara et al, 2006) have the highest risk of injury. With sports, lateral epicondylitis is most often associated with activities that involve repetitive wrist motion or a

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power grip (such as overhead throwing, tennis and golf) (Galloway et al, 1992; Finestone and Rabinovitch, 2008), and can develop with a sudden increase in the use of previously underused wrist extensor muscles.

Although it can occur at any age, lateral epicondylitis is more common between the ages of 30 and 50 years. Patients present complaining of a small area of persistent pain affecting the lateral aspect of the elbow, with symptoms arising insidiously over a period of weeks or months. The pain is usually sharp in nature, exacerbated by resisted wrist extension and gripping activities, and occasionally radiates down the forearm. After an initial episode, symptoms may recur frequently in the future following further overuse.

Examination

As with all basic orthopaedic examinations, a 'look, feel, move and special tests' structure can be used.

Look

Inspection is generally unremarkable in the presence of lateral epicondylitis, but it is essential to exclude differential diagnoses, particularly 'red flag' signs such as a swollen, red joint, which may indicate a more concerning pathology.

Figure 1. Mill's test in **(a)** starting and **(b)** finishing positions.

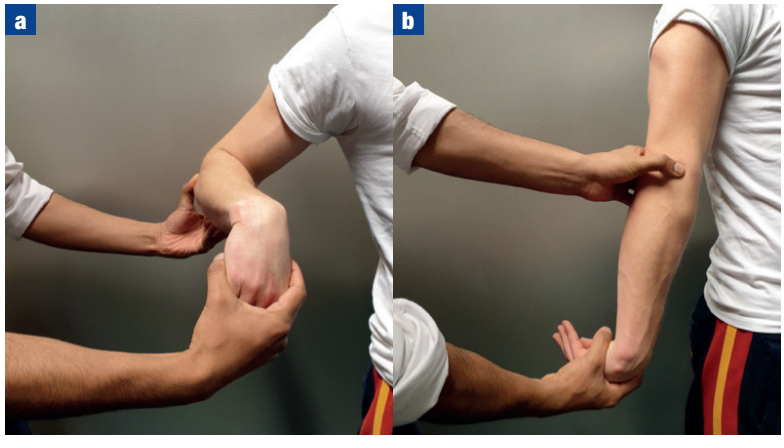
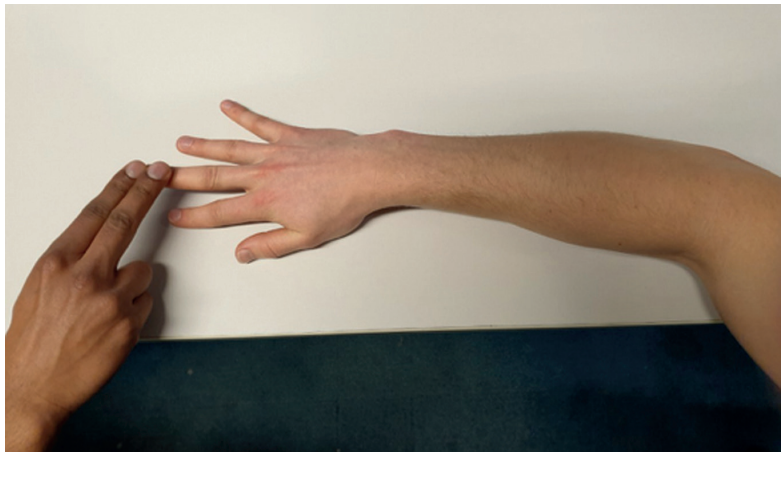


Figure 2. Maudsley's test.



Feel

Palpation of the lateral epicondyle and lateral supracondylar ridge will cause point tenderness. There should be no temperature change present.

Move

Active and passive movements of the elbow, wrist and fingers may be unremarkable. However, provocative tests including resisted wrist extension with the elbow fully extended and resisted extension of the fingers should reproduce the pain. Reduced grip strength on the affected side may be noted, but it is important to complete a full neurological examination of the limb to help differentiate this from entrapment syndromes.

Special tests

Saroja et al (2014) calculated the sensitivity and specificity of different provocative tests in lateral epicondylitis. The most sensitive and specific of these are outlined below:

Mill's test for lateral epicondylitis involves the examiner palpating the patient's lateral epicondyle with his/her thumb while passively pronating the forearm, flexing the wrist and extending the elbow (Magee, 2008) (*Figure 1*). A positive test will reproduce the pain near the lateral epicondyle. This test has a sensitivity of 53% and specificity of 100% (Saroja et al, 2014).

Maudsley's test for lateral epicondylitis involves the examiner resisting extension of the third digit of the hand, with the patient's elbow flexed at 90° and the forearm pronated (Magee, 2008) (*Figure 2*). A positive test will reproduce the pain near the lateral epicondyle. This test is said to have a sensitivity of 88% and specificity of 0% (Saroja et al, 2014). The high sensitivity of Maudsley's test allows it to correctly identify the vast majority of patients with lateral epicondylitis, but the low specificity implies that it will also identify healthy subjects as having a positive result.

Differential diagnoses

Other causes of elbow pain must also be carefully considered and excluded in the history and examination, including radial tunnel syndrome, osteoarthritis, osteochondritis dissecans of the capitellum, gout, septic arthritis, olecranon bursitis and pronator teres syndrome.

The joints above and below the elbow should also be considered as possible causes of referred pain, and cervical radiculopathy and carpal tunnel syndrome considered as possible differentials. *Table 1* summarizes the differential diagnoses of lateral epicondylitis and their clinical presentations.

Investigations

Lateral epicondylitis is generally managed in primary care, but the National Institute for Health and Care Excellence (2017) recommends referral to an orthopaedic surgeon where one or more of the following criteria are met:

1. Diagnostic uncertainty
2. Severe functional impairment
3. Persistence of symptoms despite 6–12 months of management in primary care.

Where there is diagnostic uncertainty, there are several investigations the surgeon can use, which are broadly divided into laboratory-based and imaging-based modalities.

Laboratory-based investigations

Haematological analysis may be considered for the identification of alternate pathologies causing lateral elbow pain. In particular, inflammatory or autoimmune markers can prove useful where infective or inflammatory arthropathies are suspected.

Imaging-based investigations

A plain elbow radiograph may be appropriate for the exclusion of bony pathologies, in particular fractures, osteoarthritis and osteochondritis dissecans.

Ultrasound is generally considered the first-line diagnostic tool in confirming lateral epicondylitis. Operators would expect to see structural changes characteristic of lateral epicondylitis in affected tendons including variations on normal thickness, calcification, tissue tears and areas of hypoechogenicity indicating degeneration (Ahmad et al, 2013). Miller et al (2002) report a sensitivity of 64–82% and a specificity of 67–100% when using ultrasound to investigate lateral epicondylitis.

Magnetic resonance imaging is a more reproducible mode of imaging which can better demonstrate the presence of degenerative changes within the tendon and associated tissue. This makes it second line as a diagnostic tool in confirming lateral epicondylitis, where it is usually reserved for patients who have normal findings on ultrasound but remain symptomatic. Findings on magnetic resonance imaging will show the same structural changes as a positive ultrasound (Ahmad et al, 2013).

Management

Lateral epicondylitis is a self-limiting condition with 70–80% of patients improving within 1 year without active treatment (Labelle et al, 1992; De Smedt et al, 2007). However, without proper management the condition may

Table 1. Differential diagnoses

	Characteristics	History	Physical examination
Radial tunnel syndrome	Compression neuropathy of posterior interosseous nerve. Co-exists in 5% of patients with lateral epicondylitis	Aching pain affecting the dorsoradial aspect of the proximal forearm	Tenderness over the mobile wad of the forearm. Pain can be provoked by resisted supination or finger extension
Osteoarthritis of the elbow	Classically older cohort. May present earlier alongside history of manual labour or trauma	Progressively worsening pain, typically at end of range of motion	Crepitus and loss of range of movement, possibly with a fixed flexion deformity
Osteochondritis dissecans of the capitellum	Classically male adolescents secondary to repetitive overhead throwing activities	Acute onset pain and effusion	Point or generalized tenderness with a reduced range of motion
Gout and septic arthritis	Gout – classically obese male with history of excessive meat and/or alcohol intake Septic arthritis – history of infection or trauma	Present similarly with the typical 'hot, swollen and tender' elbow	Very limited range of movement. Referral for joint aspiration (crystal analysis, microscopy and culture) is essential to rule out septic arthritis
Olecranon bursitis	Inflammation of the olecranon bursa. Classically young to middle aged men who have regular pressure on the elbow (e.g. gardeners) or play sports involving repetitive elbow movement	Pain, erythema and swelling which is confined to the extensor aspect of the elbow	Normal range of movement that is generally painless, except at extreme flexion when the bursa is compressed
Pronator teres syndrome	Compression neuropathy of the median nerve between the two heads of pronator teres at the elbow	Pain or numbness in the distribution of the median nerve	Tenderness to palpation of the proximal median nerve at the elbow, may also have weakness of the muscles supplied by the nerve
Cervical radiculopathy	Compression of the C6 nerve root. Consider in patients with history of neck trauma or degenerative spinal changes	Pain in the elbow and radial aspect of the forearm	Altered sensation and weakness in brachioradialis and in wrist extension
Carpal tunnel syndrome	Compression of the median nerve as it passes through the carpal tunnel	Pain and numbness affecting the radial three and a half digits of the hand, especially at night. Patients may complain of pain radiating to the elbow, which can confuse the diagnosis	Altered sensation in the distribution of the median nerve. May be accompanied by weakness or wasting of the thenar muscles

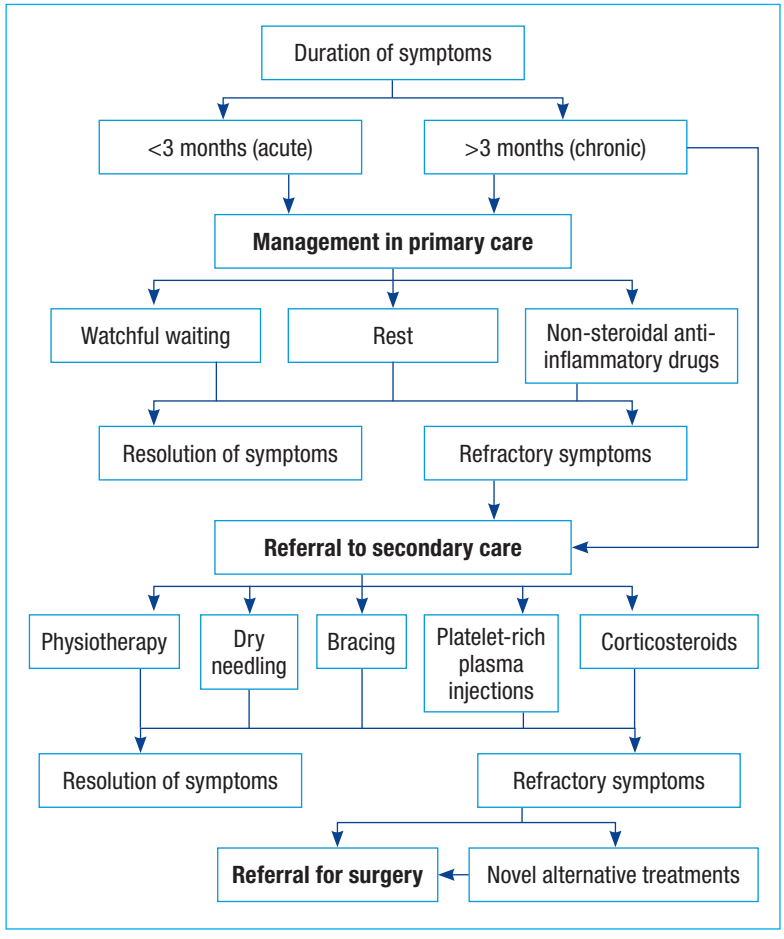


Figure 3. Flowchart for the management of patients with lateral epicondylitis. From Behrens et al (2012).

persist for many years and cause significant detriment to quality of life. Most cases of lateral epicondylitis can be sufficiently managed in primary care, with referral to secondary care only required in persistent and recurrent cases.

The primary modes of treatment for lateral epicondylitis are conservative, including rest, non-steroidal anti-inflammatory drugs, corticosteroid injections, physiotherapy and bracing (Boyd and McLeod, 1973). Of these, resting and avoidance of activities which exacerbate the symptoms are often first-line options, despite a paucity of clinical evidence of their effectiveness (Nimgade et al, 2005). In practice, non-steroidal anti-inflammatory drugs are commonly prescribed alongside rest and have a good evidence base for reducing pain in the short term (topical and oral) compared to placebo (Bisset et al, 2011).

The evidence for corticosteroid injections is limited. A randomized controlled trial by Bisset et al (2006) concluded that corticosteroid injections provide no significant benefit over rest alone over a 52-week period. They also discovered that patients treated with corticosteroid injections had a much higher incidence of recurrence than those treated with physical therapy (72% *vs* 8%). Although they may sometimes be beneficial in the short term, corticosteroid injections have also been shown to have no effect, or even delay recovery in some patients (Coombes et al, 2013). Therefore, the use of steroid injections is not advised as a first-line therapy in primary care.

Physiotherapy and rehabilitation are core features of recovery in chronic lateral epicondylitis, and are superior to conservative management alone at 6 weeks (Bisset et al, 2005). Although there is no standard regimen, a physiotherapy referral for the patient will most likely involve stretching and strengthening exercises, concentric and eccentric muscle training, ultrasound therapy and massage (National Institute of Health and Clinical Excellence, 2017). Good physiotherapy outcomes rely on patient compliance and a level of pain tolerance while completing the exercises. Smidt et al (2002) found physiotherapy to be superior to corticosteroid therapy and watchful waiting in areas of pain improvement, maximum grip strength and subjective satisfaction.

A further management option is bracing. The goal of epicondylar counterforce braces is to relieve tension in the extensor carpi radialis brevis, by effectively shifting the 'origin point' distal to the elbow. This can reduce the force at the origin of the extensor carpi radialis brevis by up to 15% (Meyer et al, 2003).

A newer treatment option for lateral epicondylitis is platelet-rich plasma injections. The patient's own blood is centrifuged to extract the plasma, which contains growth factors that promote healing and this extracted plasma is then re-injected into the patient's tendon (Lynch et al, 1989; Marx, 2004). Studies to date have provided promising results for platelet-rich plasma, but evidence is limited and more is needed before it becomes a mainstream form of treatment. This treatment, alongside other novel treatments such as dry needling and autologous blood injections, may be performed under ultrasound guidance during the investigative stage of management.

The vast majority of patients with lateral epicondylitis can be managed using the options discussed above (*Figure 3*). However, if symptoms persist despite optimal management, referral for surgical intervention (tendon release, repair or reattachment, epicondylar drilling or tendinosis debridement; Dunn et al, 2008) or alternative treatments such as extracorporeal shockwave therapy, laser therapy, acupuncture or botulinum toxin injection is justified.

Conclusions

Tennis elbow is a tendinosis most commonly affecting the extensor carpi radialis brevis tendon and consists of a degenerative process superimposed upon impaired healing. The presenting history of lateral epicondylitis is likely to be one of repetitive overuse of the elbow joint, frequently within an occupational or sporting setting. Examination of the elbow takes the format of a look, feel, move and special tests approach. Within this, Mill's test is useful in ruling in lateral epicondylitis, whereas Maudsley's test is better at ruling out lateral epicondylitis. There are several

differential diagnoses for a painful elbow and these must all be considered. Lateral epicondylitis is generally a clinical diagnosis, although haematological analysis and cross-sectional imaging may be considered in special cases. Up to 80% of cases may resolve without intervention, but optimal management increases recovery and decreases morbidity. Numerous treatment options are available in the community, but none warrant preference over another because of a lack of conclusive evidence. Therefore, choice of management should be based on patient preference and clinical experience. Recalcitrant cases may need referral for surgical intervention. **BJHM**

Conflict of interest: none.

KEY POINTS

- Lateral epicondylitis most commonly presents in the third and fourth decade of age, as persistent pain over the lateral elbow as a result of repetitive overuse.
- Examination of the elbow should follow the standard 'look, feel, move' approach, as well as incorporating Mill's and Maudsley's provocative tests to confirm any clinical suspicion.
- Specialist referral and investigations are indicated if there is diagnostic uncertainty and/or the patient is functionally impaired and/or the lateral epicondylitis symptoms have persisted despite at least 6 months of treatment.
- Lateral epicondylitis can be mostly managed in primary care with rest and non-steroidal anti-inflammatory drugs, or in secondary care with physiotherapy, steroid injections, bracing and some novel treatments, with a very small proportion of patients requiring surgery.

Ahmad Z, Siddiqui N, Malik SS, Abdus-Samee M, Tytherleigh-Strong G, Rushton N. Lateral epicondylitis. Bone Joint J. 2013 Sep;95-B(9):1158–1164. https://doi.org/10.1302/0301-620X.95B9.29285

Altchek DW, Camp CL, Conti MS, Degen RM, Dines JS, Werner BC. Epidemiology and disease burden of lateral epicondylitis in the USA: analysis of 85,318 patients. HSS Jrnl. 2018 Feb;14(1):9–14.

Behrens SB, Deren ME, Matson AP, Bruce B, Green A. A review of modern management of lateral epicondylitis. Phys Sportsmed. 2012 May;40(2):34–40. https://doi.org/10.3810/psm.2012.05.1963

Bisset L, Paungmali A, Vicenzino B, Beller E. A systematic review and meta-analysis of clinical trials on physical interventions for lateral epicondylalgia. Br J Sports Med. 2005 Jul 01;39(7):411–422, discussion 411–422. https://doi.org/10.1136/bjsm.2004.016170

Bisset L, Beller E, Jull G, Brooks P, Darnell R, Vicenzino B. Mobilisation with movement and exercise, corticosteroid injection, or wait and see for tennis elbow: randomised trial. BMJ. 2006 Nov 04;333(7575):939. https://doi.org/10.1136/bmj.38961.584653.AE

Bisset L, Coombes B, Vicenzino B. Tennis elbow. BMJ Clin Evid. 2011 Jun 27;2011:1117.

Boyd HB, McLeod AC Jr. Tennis Elbow. J Bone Joint Surg. 1973 Sep;55(6):1183–1187. https://doi.org/10.2106/00004623-197355060-00005

Coombes BK, Bisset L, Brooks P, Khan A, Vicenzino B. Effect of corticosteroid injection, physiotherapy, or both on clinical outcomes in patients with unilateral lateral epicondylalgia: a randomized controlled trial. JAMA. 2013 Feb 06;309(5):461–469. https://doi.org/10.1001/jama.2013.129

De Smedt T, de Jong A, Van Leemput W, Lieven D, Van Glabbeek F. Lateral epicondylitis in tennis: update on aetiology, biomechanics and treatment. Br J Sports Med. 2007 Nov 01;41(11):816–819. https://doi.org/10.1136/bjsm.2007.036723

Dunn JH, Kim JJ, Davis L, Nirschl RP. Ten- to 14-year follow-up of the Nirschl surgical technique for lateral epicondylitis. Am J Sports Med. 2008 Feb;36(2):261–266. https://doi.org/10.1177/0363546507308932

Ellenbecker TS, Nirschl R, Renstrom P. Current concepts in examination and treatment of elbow tendon injury. Sports Health. 2013 Mar;5(2):186–194. https://doi.org/10.1177/1941738112464761

Finestone HM, Rabinovitch DL. Tennis elbow no more: practical eccentric and concentric exercises to heal the pain. Can Fam Physician. 2008 Aug;54(8):1115–1116.

Galloway M, DeMaio M, Mangine R. Rehabilitative techniques in the treatment of medial and lateral epicondylitis. Orthopedics. 1992 Sep;15(9):1089–1096.

Heliövaara M, Shiri R, Varonen H, Viikari-Juntura E. Prevalence and determinants of lateral and medal epicondylitis: a population study. Am J Epidemiol. 2006 Dec 1;164(11):1065–1074. https://doi.org/10.1093/aje/kwj325

Herquelot E, Bodin J, Roquelaure Y et al. Work-related risk factors for lateral epicondylitis and other cause of elbow pain in the working population. Am J Ind Med. 2013 Apr;56(4):400–409. https://doi.org/10.1002/ajim.22140

Kannus P, Józsa L. Histopathological changes preceding spontaneous rupture of a tendon. A controlled study of 891 patients. J Bone Joint Surg Am. 1991 Dec;73(10):1507–1525. https://doi.org/10.2106/00004623-199173100-00009

Kraushaar BS, Nirschl RP. Tendinosis of the elbow (tennis elbow). Clinical features and findings of histological, immunohistochemical, and electron microscopy studies. J Bone Joint Surg. 1999 Feb;81(2):259–278. https://doi.org/10.2106/00004623-199902000-00014

Krogh TP, Fredberg U, Ammitzbøl C, Ellingsen T. Ultrasonographic characteristics of the common extensor tendon of the elbow in asymptomatic individuals: thickness, color Doppler activity, and bony spurs. Orthop J Sports Med. 2017 May;5(5). https://doi.org/10.1177/2325967117704186

Labelle H, Guibert R, Joncas J, Newman N, Fallaha M, Rivard CH. Lack of scientific evidence for the treatment of lateral epicondylitis of the elbow. An attempted meta-analysis. J Bone Joint Surg Br. 1992 Sep;74-B(5):646–651. https://doi.org/10.1302/0301-620X.74B5.1388172

Lynch SE, Colvin RB, Antoniades HN. Growth factors in wound healing. Single and synergistic effects on partial thickness porcine skin wounds. J Clin Invest. 1989 Aug 1;84(2):640–646. https://doi.org/10.1172/JCI114210

Magee DJ. 2008. Orthopedic Physical Assessment. 5th edn. St. Louis, MO: Saunders Elsevier. 379–380.

Marx RE. Platelet-rich plasma: evidence to support its use. J Oral Maxillofac Surg. 2004 Apr;62(4):489–496. https://doi.org/10.1016/j.joms.2003.12.003

Meyer NJ, Walter F, Haines B, Orton D, Daley RA. Modeled evidence of force reduction at the extensor carpi radialis brevis origin with the forearm support band. J Hand Surg Am. 2003 Mar;28(2):279–287. https://doi.org/10.1053/jhsu.2003.50045

Miller TT, Shapiro MA, Schultz E, Kalish PE. Comparison of sonography and MRI for diagnosing epicondylitis. J Clin Ultrasound. 2002 May;30(4):193–202. https://doi.org/10.1002/jcu.10063

National Institute for Health and Clinical Excellence. 2017. Clinical Knowledge Summaries: Tennis Elbow. (accessed 26 May 2019) https://cks.nice.org.uk/tennis-elbow

Nimgade A, Sullivan M, Goldman R. Physiotherapy, steroid injections, or rest for lateral epicondylosis? What the evidence suggests. Pain Pract. 2005 Sep;5(3):203–215. https://doi.org/10.1111/j.1533-2500.2005.05307.x

Saroja G, Aseer PAL, Venkata Sai PM. Diagnostic accuracy of provocative tests in lateral epicondylitis. Int J Physiother Res. 2014 Dec 11;2(6):815–823. https://doi.org/10.16965/ijpr.2014.699

Seidel DH, Ditchen DM, Hoehne-Hückstädt UM, Rieger MA, Steinhilber B. Quantitative measures of physical risk factors associated with work-related musculoskeletal disorders of the elbow: a systematic review. Int J Environ Res Public Health. 2019 Jan 05;16(1):130. https://doi.org/10.3390/ijerph16010130

Smidt N, van der Windt DAWM, Assendelft WJJ, Devillé WLJM, Korthals-de Bos IBC, Bouter LM. Corticosteroid injections, physiotherapy, or a wait-and-see policy for lateral epicondylitis: a randomised controlled trial. Lancet. 2002 Feb;359(9307):657–662. https://doi.org/10.1016/S0140-6736(02)07811-X