Chapter 10
Orthotic Use in the Management of Epicondylitis: What is the Evidence?

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Introduction

Management of lateral epicondylitis remains a controversial topic. Use of immobilization for treatment and symptom control is not a new concept. Morris described the primary etiology and symptoms of "tennis elbow" in 1882. He also recognized the importance of immobilizing the arm [1]. Splinting remains a key component of most treatment protocols [2–4]. Literature on the efficacy of orthotic use alone is difficult to analyze because studies rarely investigate an isolated treatment modality but rather the efficacy of a comprehensive treatment program [5–12]. With multiple treatment variables to consider, a precise determination of a particular modality is difficult. Therefore, current recommendations for splint use are predominantly based on traditional beliefs and anecdotal experience.

Much of the literature on epicondylitis treatment fails scientific scrutiny. Many of the articles are based on opinions and lack clear scientific methodology. Labelle et al. performed a systematic review to assess the scientific evidence for methods of treatment for lateral epicondylitis [8]. The authors concluded that there was insufficient evidence to support any of the current conservative treatment options, secondary to lack of scientific validity. Randomized controlled studies are rare and multiple variables between studies make comparisons difficult. There are a wide variety of treatment options to alleviate symptoms associated with lateral epicondylitis.

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The aim of this chapter is to review the evidence of bracing options and to provide clinical recommendations based on the available literature.

Objectives of Orthotic Wear

Patients will primarily complain of pain at the lateral elbow that radiates down the forearm as well as weakened grip and difficulty in lifting objects. Strength may be limited because of pain, although some believe that muscle dysfunction may be an independent symptom and not necessarily secondary to pain [2, 3, 13–16]. On examination, patients will have tenderness at the lateral epicondyle and distally in the dorsal forearm and wrist. They will have pain with resisted wrist extension as well as passive wrist flexion. Pain relief and restoration of muscle conditioning are the primary objectives of treatment. Some form of immobilization or splinting is used as an adjunct to various muscle conditioning protocols recommended for treatment.

Several objectives regarding orthotics exist for the treatment of lateral epicondylitis. Theoretically, splinting allows the involved muscles to rest, and counterforce bracing decreases stress on the pathologic tendon. Another favorable feature not readily investigated is the use of the orthotic device as a reminder to both the patient and others (i.e., the employer) to avoid activities that aggravate the condition.

Protective orthotics theoretically provide rest for the wrist extensors, particularly the extensor carpi radialis brevis (ECRB), extensor digitorum communis (EDC), and extensor carpi ulnaris (ECU) during use of the extremity. It is thought that immobilization of the wrist in extension will decrease muscle activity and thereby limit the excursion of the muscles and decrease tension on a diseased tendon [2, 3]. Splinting can be achieved by wrist immobilization, elbow immobilization, or a combination of both (Figs. 10.1 and 10.2). This may also aid in the healing of microscopic tears in the extensor origin since a splint places the muscle in a shortened position.

Fig. 10.1 *Wrist Brace*. The theoretical basis for the protective wrist orthotic is to provide rest for the wrist extensors, particularly the extensor carpi radialis brevis (ECRB), extensor digitorum communis (EDC), and extensor carpi ulnaris (ECU) during use of the extremity. The wrist should be held in an extended position (neutral extension or 15° extension)

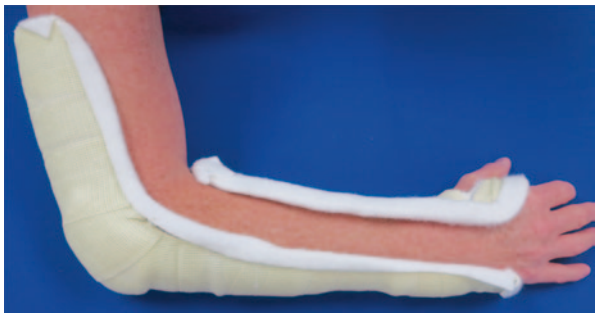

Fig. 10.2 *Long arm splint*. Immobilization of both the elbow and wrist decreases muscle activity across both joints acted on by the wrist extensors, thereby limiting excursion of the muscles and decrease tension on the diseased tendon origin

Evidence to Support Orthotic Use

Counterforce strap bracing refers to a nonelastic strap placed around the proximal forearm (Fig. 10.3), with the intended therapeutic effect of reducing stress on the lateral epicondyle by decreasing force transmission across the extensor muscle tendon unit. Meyer et al. performed a combined cadaveric and clinical study showing a 13–15% force reduction of the ECRB origin. Snyder-Mackler and Epler demonstrated a statistically significant decrease in ECRB and EDC muscle force recruitment with the counterforce strap, when compared to no strap, as measured by electromyography [17]. By inhibiting muscle expansion, the strap decreases the magnitude of muscle contraction, thereby reducing the tension at the musculotendinous junction proximal to the band [18]. Furthermore, the direct compression provided by the strap creates a secondary origin of the extensor tendons, which increases surface area and decreases stress and microtrauma experience by the true origin at the lateral epicondyle.

Struijs et al. performed a clinical trial randomizing 180 patients to a forearm band-type splint, physical therapy, or a combination of these and showed no significant differences at 26 and 52 weeks with regard to pain, disability, and satisfaction

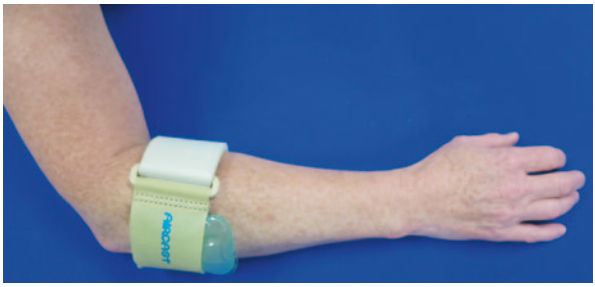

Fig. 10.3 Counter-force strap brace. Counterforce strap bracing refers to a nonelastic strap placed around the proximal forearm, with the intended therapeutic effect of reducing stress on the lateral epicondyle by decreasing force transmission across the extensor muscle tendon unit. Several varieties of this brace are available from different companies, with similar effects (pictured is one from Aircast, DJO Global, Vista, California)

[19]. Success rates at 52 weeks ranged from 85 to 89% within the three treatment groups. The same authors performed a meta-analysis that included all randomized clinical trials describing individuals with diagnosed lateral epicondylitis and comparing the use of an orthotic device as a treatment strategy [15, 20]. Only five studies met their inclusion criteria; overall, there were few outcome measures, large heterogeneity, and limited long-term results. None of the included studies investigated an orthotic as an isolated treatment modality. They stated no definitive conclusions could be drawn concerning the effectiveness of orthotic devices and that more well-designed randomized clinical trials of sufficient power are warranted [3, 15, 16, 20].

Altan and Kanat performed a short-term study of counterforce bracing versus a resting wrist splint and showed significant improvement in all parameters including pain at rest, pain with movement, and hand grip strength in the sixth week for both groups [21]. Comparison of the two groups showed significantly better improvement in resting pain with the wrist splint; otherwise other parameters were the same.

Van De Streek et al. from the Netherlands conducted a study comparing the effect of a forearm-based hand splint compared with an elbow band (counterforce brace) as a treatment for lateral epicondylitis. In this study they explored a new fabricated hand splint (thought to give more rest to the extensors of the wrist versus a cock-up splint) to an elbow band [22]. This was a randomized clinical trial with 43 patients. They were instructed to wear the braces for as much as possible for 6 weeks, with no other interventions. The outcome measures included maximal grip strength and patient-rated forearm evaluation questionnaire (PRFE). This study shows that the hand splint is no more effective than the elbow band as a treatment for lateral epicondylitis.

Garg et al. performed a randomized controlled trial (level of evidence II) investigating the clinical outcomes of a wrist extension splint with that of a counterforce forearm strap [6]. Among the 42 patients (44 elbows) investigated, they found that both modalities improved the Mayo elbow performance (MEP) and American Shoulder and Elbow Society (ASES) elbow assessment scores in the sixth week. The overall function was similar between the two groups. There was no significant difference measured between the braces with the ASES ($p=0.60$) nor MEP ($p=0.63$) scores. However, within the ASES derived score, pain relief was significantly better with the extension splint group ($p=0.027$). No other variables were statistically significantly different. They concluded that the greater degree of pain relief with the wrist extension splint may be due to improved immobilization of the wrist extensor muscles in a resting position.

Derebery et al. reviewed the potential disadvantages of bracing in lateral epicondylitis, particularly in cases involving workers' compensation [5]. They found that patients treated with splints had higher rates of limited duty ($p<0.001$), more medical visits and charges ($p<0.001$), higher total charges (medical and PT, $p<0.001$), and longer treatment durations ($p<.01$) than patients without splints. They concluded that splinting patients with epicondylitis may not optimize outcomes, including rates of limited duty, treatment duration, and medical costs. This article was unique in that it illustrates the variable of worker's compensation and potential negative impact on clinical outcomes.

Luginbuhl et al. performed a randomized study comparing the effect of the forearm-support band versus strengthening exercises for the treatment of lateral epicondylitis [9]. Twenty-nine patients with thirty tennis elbows were randomized into three groups of treatment: (I) forearm-support band, (II) strengthening exercises, and (III) both methods. Patients were evaluated at various time points over 1 year. At the latest follow up, there was a significant improvement of the symptoms compared to before treatment ($p < 0.0001$), considering all patients independently of the methods of treatment. However, no differences in the scores were found between the three groups of treatment ($p = 0.27$), indicating that no beneficial influence was found either for the strengthening exercises or for the forearm-support band. Improvement seems to occur with time, independent of the method of treatment used.

Discussion

A variety of splint types have been proposed to treat lateral epicondylitis. The significance of orthotic use is debatable, with no proven benefit of one orthotic treatment over another. There is evidence to suggest that immobilization with orthotics may be symptomatically beneficial in the short term. The choice of orthotic may be left to personal preference. The evidence that force reduction at the extensor origin occurs as demonstrated by biomechanical and electrodiagnostic findings may support the functional benefit of the counterforce brace. However, in the long-term, the use of orthotics may be no better than the natural course of the disease, left untreated. Despite the evidence presented here, a multimodal approach for lateral epicondylitis management remains the preferred treatment. This approach often includes orthotic wear, counter force brace, non-steroidal medication, activity modification, and therapy. Patients often expect some type of intervention to help with the management of their pain, and the use of orthotics provides a reasonable first line treatment option, with little downside and few side effects.

References

1. Morris H. The rider's sprain. Lancet. 1882;2:133–4.
2. Calfee RP, Patel A, DaSilva MF, Akelman E. Management of lateral epicondylitis: current concepts. J Am Acad Orthop Surg. 2008;16(1):19–29.
3. Struijs PA, Smidt N, Arola H, Dijk vC, Buchbinder R, Assendelft WJ. Orthotic devices for the treatment of tennis elbow. Cochrane Database Syst Rev. 2002;1:CD001821.
4. Tosti R, Jennings J, Sewards JM. Lateral epicondylitis of the elbow. Am J Med. 2013;126(4):357, e351–6.
5. Derebery VJ, Devenport JN, Giang GM, Fogarty WT. The effects of splinting on outcomes for epicondylitis. Arch Phys Med Rehabil. 2005;86(6):1081–8.
6. Garg R, Adamson GJ, Dawson PA, Shankwiler JA, Pink MM. A prospective randomized study comparing a forearm strap brace versus a wrist splint for the treatment of lateral epicondylitis. J Shoulder Elbow Surg. 2010;19(4):508–12.

7. Labelle H, Guibert R. Efficacy of diclofenac in lateral epicondylitis of the elbow also treated with immobilization. The University of Montreal Orthopaedic Research Group. Arch Fam Med. 1997;6(3):257–62.
8. 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;74(5):646–51.
9. Luginbuhl R, Brunner F, Schneeberger AG. No effect of forearm band and extensor strengthening exercises for the treatment of tennis elbow: a prospective randomised study. Chir Organi Mov. 2008;91(1):35–40.
10. Mahaffey P. Tennis elbow. There is no proved treatment. BMJ. 2009;339:b5325.
11. Mahaffey PJ. Tennis elbow myths. BMJ. 2011;342:d3837.
12. Wolf JM. Do we need to treat tennis elbow? Orthopedics. 2012;35(11):921–2.
13. 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;39(7):411–422 (discussion 411–422).
14. Faro F, Wolf JM. Lateral epicondylitis: review and current concepts. J Hand Surg Am. 2007;32(8):1271–9.
15. Smidt N, Assendelft WJ, Arola H, Malmivaara A, Greens S, Buchbinder R, van der Windt DA, Bouter LM. Effectiveness of physiotherapy for lateral epicondylitis: a systematic review. Ann Med. 2003;35(1):51–62.
16. Struijs PA, Smidt N, Arola H, van Dijk CN, Buchbinder R, Assendelft WJ. Orthotic devices for tennis elbow. Cochrane Database Syst Rev. 2001;2:CD001821.
17. Snyder-Mackler L, Epler M. Effect of standard and Aircast tennis elbow bands on integrated electromyography of forearm extensor musculature proximal to the bands. Am J Sports Med. 1989;17(2):278–81.
18. 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;28(2):279–87.
19. Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN. Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both-a randomized clinical trial. Am J Sports Med. 2004;32(2):462–9.
20. Struijs PA, Smidt N, Arola H, van Dijk CN, Buchbinder R, Assendelft WJ. Orthotic devices for tennis elbow: a systematic review. Br J Gen Pract. 2001;51(472):924–9.
21. Altan L, Kanat E. Conservative treatment of lateral epicondylitis: comparison of two different orthotic devices. Clin Rheumatol. 2008;27(8):1015–9.
22. Van De Streek MD Van Der Schans CP De Greef MH Postema K. The effect of a forearm/hand splint compared with an elbow band as a treatment for lateral epicondylitis. Prosthet Orthot Int. 2004;28(2):183–9.