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LITERATURE REVIEW

Is Extracorporeal Shockwave Therapy More Effective than Conventional Physiotherapy Techniques in the Management of Chronic Lateral Epicondylitis?

Chinweuba C. Nwosu*

University of Chester, Liverpool, United Kingdom

***Corresponding author:** Chinweuba C. Nwosu, 40 Wellington Avenue, Liverpool, United Kingdom, Tel: +447450477303

Abstract

Background: Lateral epicondylitis is a self-limiting condition linked to biomechanical overuse, often from work or sports activities. It presents as lateral elbow pain during wrist extension or gripping, reduced grip strength. While 70% to 90% of LE cases gradually improve on their own, ESWT and conventional physiotherapy are commonly employed as supplementary therapies in conservative management of the condition.

Aim: This study aims to assess the effectiveness of ESWT and other conventional methods of physiotherapy for the conservative management of LE. By critically reviewing recent randomized controlled trials (RCTs), it seeks to identify which therapy demonstrates superior outcomes in managing LE.

Methods: Randomized controlled trials relevant to the study were retrieved from several databases, including CINAHL, Cochrane, PubMed, EMBASE, ScienceDirect, and MEDLINE.

Results: ESWT is very effective in managing pain in patients with LE, and greatly improves functionality in these patients. It is more effective in short-term (immediately after treatment) and long-term pain management than most conventional physiotherapy except kinesiotaping.

Conclusion: ESWT is highly effective than other conventional physiotherapy techniques except kinesiotaping

Keywords

Extracorporeal shockwave therapy, Lateral epicondylitis, Pain intensity

Introduction

Lateral epicondylitis commonly called tennis elbow, is a long-term deterioration of the tissues of the common extensor tendon of the forearm extensors at the origin of the extensor carpi radialis brevis (ECRB) tendon due to overuse (Ma, 2020) [1]. Lateral Epicondylitis (LE), has an estimated incidence rate of 40%, is prevalent in about 1% to 3% of the general population, is mostly common in individuals between 35 and 54 years of age and individuals whose occupation or hobbies involve repetitive wrist movements are at risk of LE (Bisset, 2015; Sandhu, et al. 2020) [2,3]. LE usually affects the dominant hand, with significant tendon deterioration like the presence of fibroblasts, vascular hyperalgesia, disrupted collagen mostly present, and localized pain at the epicondyle, although in more serious cases, it can radiate to the shoulder and wrist (Landesa-Piñeiro, et al. 2022) [4]. Exerting pressure or mechanical stress at the insertion point of the ECRB muscle is the primary pathology in LE, the tendons at this site are hypovascular, leading to hypoxic tendon degeneration as a result of muscular activity, therefore, ischemia is considered a crucial etiological factor in lateral epicondylitis (Aydin, et al. 2017; Yalvaç, et al. 2018) [5,6].

Treatment Approaches in the Management of Lateral epicondylitis

There are over 40 invasive and non-invasive treatment options available for the treatment of

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patients with LE outlined in literature (Hong, et al. 2004; Newcomer, et al. 2001; Smidt, et al. 2003) [7-9]. Various treatment methods have been recommended for lateral epicondylitis, including rest, medication, surgery, and other interventions but the first line of treatment is usually by using conservative means like orthotic devices, ice therapy, extracorporeal shock wave therapy (ESWT), ultrasound (US), massage and mobilization techniques, manipulative therapy, therapeutic exercises laser therapy (Yalvaç, et al. 2018; Landesa-Piñeiro & Leirós-Rodríguez, 2022) [6,4]. An effective conservative treatment plan for lateral epicondylitis should prioritize promoting soft tissue healing, managing inflammation, reducing pain, and optimizing the loading of the extensor tendon (Eraslan, et al. 2017) [10]. Utilizing drugs may provide temporary pain relief in cases of lateral epicondylitis but they may not address the root cause of the problem or prevent future occurrences over the long term. With more invasive procedures like a surgical intervention for LE, approximately 80-97% of cases experience immediate pain relief, however, around 1.5% of patients who undergo surgery usually require a second surgical procedure within the following 2 years (Landesa-Piñeiro & Leirós-Rodríguez, 2022) [4].

Mechanism of Action of Extracorporeal Shockwave Therapy

Extracorporeal shockwaves represent a form of energy that can produce maximal pressure a thousand 1000 times more than that produced by the ultrasound and they involve the application of intense energy, and imperceptible sound waves produced outside the body, which are then transported through tissue (Wang, 2012; Wheeler, et al. 2022) [11,12]. In clinical practice, two primary types of ESWT exist and are utilized for treatment: focused shockwave and radial shockwave (radial pressure). Shockwaves are considered to exert mechanical effects at cell levels which enhance tissue healing and modify pain sensations sent to the brain, the biological effects of ESWT are believed to result from mechanotransduction, where vibrations produced in tissue induce regeneration and healing (d'Agostino, et al. 2015; Wang, 2012) [13,11]. They exert this effect at cellular levels by facilitating the discharge of adenosine triphosphate to initiate biochemical signaling cascades to modify how ion channels operate in the cell membrane and this can induce microbubble formation and trigger the release of nitrogen monoxide, resulting in subsequent pain relief, angiogenesis, and anti-inflammation (Frairia & Berta, 2011; Wang, et al. 2009; Wang, et al. 2011; Weihs, et al. 2014) [14-17]. Shockwaves generate a positive pressure that initiates the uptake, deflection, and transference of energy within tissues and cells, potentially leading to the breakdown of calcifications within the tissue and stimulating collagen formation through various mechanisms, including elevating levels of transforming growth factor-beta 1 (TGF-B1) and insulin-like growth factor 1 (IGF-1), etc (Chen, et al. 2004; Perlick, et al. 2003; Peters, et al. 2004; Simplicio, et al. 2020) [18-21].

Conventional Physiotherapy Interventions in Lateral Epicondylitis

Physiotherapy plays an important role in the treatment of LE and should be prioritized as the primary treatment for patients with LE as it offers substantial and lasting benefits for their health. This is particularly significant given that cortisone injection treatment, was found to be ineffective in the early stages of tennis elbow (Newcomer, et al. 2001) [8]. Conventional Physiotherapy interventions include but are not limited to Ultrasound therapy, TENS, Kinesiotaping, cryotherapy, eccentric-concentric and isometric strengthening exercises, stretching, frictional massages, manipulative therapy, etc (Landesa-Piñeiro & Leirós-Rodríguez, 2022) [4]. Conventional Physiotherapy interventions are effective treatment approaches for lateral epicondylitis typically involving manual therapy techniques aimed at reducing pain and improving joint range of motion (ROM). It's crucial to perform these manual therapy interventions within the patient's pain tolerance to ensure safety and effectiveness (Coombes, et al. 2015; Lenoir, et al. 2019; Zhong, et al. 2020) [22-24]. In lateral epicondylitis as well as other tendon-related conditions, positive outcomes can be achieved through strengthening exercises targeting the affected area resulting from temporary disruption of blood flow in the vessels of the tendon during neoangiogenesis; A continuous production of mechanical stimulus, which could lead to tendon remodeling; and augmentation in collagen synthesis within the damaged tendon (Finestone & Rabinovitch, 2008; Peterson, et al. 2011) [25,26]. Goraj-Szczypiorowska, et al. noted that the effectiveness of these modalities relies on the parameters of the procedure utilized; eg using the pulsed mode of the Ultrasound was more advantageous, as the breaks between stimuli supplied helped to prevent overheating of the tissue and minimize the thermal effect on them while a reduction of the therapeutic dose by Spacca in his study was ineffective and brought no improvements to the patients (Gurney, et al. 2011; Spacca, et al. 2005) [27,28].

Efficacy of Extracorporeal Shockwave Therapy Interventions in Lateral Epicondylitis

Extracorporeal Shockwave Therapy (ESWT) has been identified as an effective treatment for lateral epicondylitis (LE), demonstrating superiority to other approaches in terms of pain reduction, grip strength improvement, and increased functional levels with its effectiveness of being evident immediately after treatment and at 3 months and 12 months of follow-up of patients (Kocjan, 2016; Król, et al. 2015; Yalvaç, et al. 2018) [31,32,6]. Treatment of LE with ESWT had relatively better outcomes than conventional Physiotherapy in domains of pain, grip strength, and levels of functionality after the third month and a year post-treatment (Rompe, et al. 2004) [33].

Efficacy of Extracorporeal Shockwave Therapy Interventions on Pain

The studies under review (Table 1) had pain as their primary outcome with some measuring pain intensity using the VAS and others using other validated instruments of pain measurement. Kubot, et al. (2017) [29] in their study compared the difference in outcome between ultrasound (treatment session carried out each day for 10 days) and ESWT (treatment sessions carried out weekly for 3 weeks) and reported a significantly lower score for pain in terms of intensity and frequency and also reduced dependency on pain medications. Similarly, Aydin, et al. (2017) [5], noted that the VAS scores of pain significantly reduced when compared with conventional physiotherapy (conservative) treatment with a statistically significant drop after 1-year post-treatment (p = 0.0004). Yalvaç, et al. (2018) [6] also reported that painevaluation using an algometer revealed a high between-group difference with a superior significance for the ESWT group (p = 0.029) even though VAS scores at rest and with resistance to wrist extensors showed no difference between US and ESWT. In the study by Eraslan, et al. (2017) [10], even though both the ESWT and kinesiotaping groups recorded very good pain outcomes post-treatment, the group treated with kinesiotaping had much lower pain scores compared to the ESWT group. In another study, the VAS score for both the ESWT group and the conventional PT group significantly improved for two follow-up visits up to six weeks post-treatment but no significant difference was observed in these two groups (Altun, et al. 2018) [30]. The observations from these studies are quite similar in the effectiveness of ESWT in reducing patient pain yielding better results compared to the use of conventional physiotherapy techniques like the US especially in the long term.

Efficacy of Extracorporeal Shockwave Therapy Interventions on Grip Strength

In the reviewed studies (Table 1), there was a significant improvement in grip strength for both the ESWT and CP groups but the difference between groups was not statistically significant, hence no group had superior improvement over the other in terms of grip strength in some of these studies (Altun, et al. 2018; Aydin, et al. 2017; Yalvaç, et al. 2018) [30,5,6]. However, the study by (Eraslan, et al. 2017) [10] revealed that the group that received both physiotherapy and kinesiotaping showed a superior improvement over the ESWT group, this could be as a result of the "fascia correction techniques" that were utilized for thekinesiotaping group which has been reported to reduce pain and improve grip strength that is pain-free in patients with LE (Chang, et al. 2013) [34].

Efficacy of Extracorporeal Shockwave Therapy Interventions on Functional Level

The studies reviewed (Table 1) assessed the functional levels of the participants as part of the outcomes utilized in determining the efficacy of the treatments using ESWT and CP. In their study, Kubot, et al. (2017) [29] observed that only the ESWT group proved very effective in improving the functional motor level of the affected upper limb as the group treated with US only showed a near significance in improving the motor function of the affected limb after treatment (p = 0.055). However, it is worthy of note that, the two groups were statistically significantly different in mobility limitations before treatment commenced. Aydin, et al. (2017) [5] also recorded similar improvements in the functional levels of the ESWT group, as 59.2% of them resumed their duties immediately after treatment was completed and returned fully to their occupation without any pain and reaching peak functional levels after one year post-treatment. Altun, et al. (2018) [30] and Yalvaç, et al. (2018) [6] similarly noted that there exists no significant difference in increased functionality between the ESWT groups and the CP groups although there was great improvement in functionality within groups. However, a contrary result was obtained in the study by Eraslan, et al. (2017) [10], as the ESWT group was bettered by the kinesiotaping group in improved functionality level scores.

Conclusion

In summary, a review of the studies in table 1 revealed that ESWT is very effective in managing pain in patients with LE, and greatly improves functionality in these patients. It is more effective in short-term (immediately after treatment) and long-term pain management than most conventional physiotherapy except kinesiotaping. This review also showed that a reduction in pain intensity and frequency in LE yields better outcomes in functionality and may have no effect on grip strength, as pain reduction improves functional levels, especially in the use of the affected upper limb for activities, and fosters a quicker return to patients' occupations. Kinesiotaping greatly overshadowed the positive effects of ESWT in managing LE providing superior outcomes in terms of pain reduction, and improvement of grip strength and functionality. However, the study did not cover a review of studies that directly compared the efficacy of ESWT and kinesiotaping and this limitation makes it difficult to conclude that kinesiotaping is more effective than ESWT which this study concludes is highly effective than other conventional physiotherapy techniques.

Table 1: Data characteristics of studies reviewed.

Study Reference	Study design	Number of Participants		Mean age (SD)		Dose of ESWT	Type of CP	Time of Intervention		Number of Sessions		The change in Efficacy outcomes of ESWT compared to CP		
		ESWT	CP	ESWT	CP			ESWT	CP	ESWT	CP	Pain	Grip Strength	Functional Level
Kubot, et al. (2017) [29]	RCT	30	30	47.6 (7.66) years	43.9 (9.44)	a) Pulse- 2000 b) Wavelength- 8 Hz c) Pressure -1.5-2.5 bar	Ultrasound a) Pulsed mode of 0.5 W/cm b) Frequency- 1MHz.	3 Weeks	10 days	3 (weekly)	10 (Daily)	Reduction in Pain ESWT showed superiority	NA	Improved functional levels Only ESWT was effective
Aydin, et al. (2017) [5]	RCT	27	19	42.9 (10.2) years	47.5 (9.1) years	a) Pulse- 1200 b) Wavelength- 3.5 Hz c) Pressure -1.5-2.5 bar	at least one of the following; a) NSAIDs, b) splints, c) physical treatment	1 month	1 month	4 (weekly)	4 (weekly)	Reduction in Pain ESWT showed superiority	Improved grip strength No significant difference between groups	Improved functional Levels ESWT showed superiority
Yalvaç, et al. (2018) [6]	RCT	20	24	46.04 (9.24) years	43.75 (4.52) years	a) Pulse- 2000 b) Wavelength- 10-15 Hz c)Pressure -1.5-2.5 bar	Ultrasound a) Continuous mode of 1.5 W/cm b) Frequency- 1MHz	3 weeks	2 weeks	3 (weekly)	10 (5 each week)	Reduction in Pain ESWT showed superiority	Improved grip strength No significant difference between groups	Improved functional levels No significant difference between groups
(Altun, et al. 2018) [30]	QES	37	36	50.4 (7.3) years	51.6 (7.6) years	a) Pulse- 1500 b) Wavelength-15 Hz c) Pressure -1.4 -1.6 bar	PT session (hot pack, US, and TENS)	3 weeks	10 days	3(every 7 to 10 days)	10 (daily)	Reduction in Pain No significant difference between groups	Improved grip strength No significant difference between groups	Improved functional levels No significant difference between groups
Eraslan, et al. (2017) [10]	RCT	15	15	48 (5.7)	48.5 (5.6)	a) Pulse- 2000 b) low-energy fux density	physiotherapy + kinesiotaping	3 weeks	3 weeks	3 (weekly)	15 (5 days/ week)	Reduction in Pain CP (Kinesiotaping) group showed superiority	Improved grip strength CP (Kinesiotaping) group showed superiority	Improved functional Levels CP (Kinesiotaping) group showed superiority

RCT: Randomized Control Trial; QES: Quasi Experimental Study; SD: Standard Deviation; PT: Physiotherapy; CP: Conventional Physiotherapy; ESWT: Extracorporeal Shockwave Therapy

Recommendations

The scope of this review did not include papers directly comparing the efficacy of kinesiotaping and ESWT in the management of patients with LE, the findings of this review have shown the need for a review of papers that directly compared the two treatment methods to determine the superiority of kinesiotaping in yielding better outcomes in LE. Moreover, in the search for papers to use for this review, the author did not come across many papers that made a direct comparison between the efficacy of kinesiotaping and ESWT in the managementof LE, hence there may be a need to conduct more studies in this regard.

Conflict of Interest

The author has no conflict of interest to declare

Ethical Approval

This study did not require ethical approval or informed consent as it is based on previously published literature and did not involve direct studies with human participants.

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Authors Contributions

The sole Author, Chinweuba Chukwuebuka Nwosu testifies that all persons designated as authors qualify for authorship and have checked the article for plagiarism. If plagiarism is detected, the sole author will be held equally responsible and will bear the resulting sanctions imposed by the journal thereafter.

The sole author have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted

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