

**Low intensity laser therapy versus ultrasound diathermy on hand grip strength, pain sensation and psychological well-being in patients with Lateral epicondylitis****<sup>1</sup>Ashraf A. Darwesh, <sup>1</sup>Ashraf A. El-Marakby, <sup>2</sup>Doaa A. Khalifa, <sup>1</sup>Ahmed M. Aboeleneen and <sup>1</sup>Ahmed A. Gad**<sup>1</sup>*Department of Physical Therapy, Faculty of Applied Medical Sciences, King Abdulaziz University, Saudi Arabia.*<sup>2</sup>*Department of Psychiatry and Internal Medicine, Faculty of Medicine, King Abdulaziz University, Saudi Arabia.*

Ashraf A. Darwesh, Ashraf A. El-Marakby, Doaa A. Khalifa, Ahmed M. Aboeleneen and Ahmed A. Gad: Low intensity laser therapy versus ultrasound diathermy on hand grip strength, pain sensation and psychological well-being in patients with Lateral epicondylitis

**ABSTRACT**

**Background:** Lateral epicondylitis is the most commonly diagnosed elbow condition and affects about 1–3% of the population at large. It produces a heavy burden of workdays lost and residual impairments. **Objective:** The aim of this study was to compare the effects of low intensity laser therapy and ultrasound diathermy on hand grip strength, pain sensation and psychological well-being in patients with lateral epicondylitis. **Material and Methods:** Thirty male patients with lateral epicondylitis were included in two equal groups. The first group (A) received ultrasound therapy in addition to their regular medical treatment. The second group (B) received low intensity laser therapy and their regular medical treatment. The program consisted of three sessions per week for one month. **Results:** There was a significant improvement in hand grip strength, pain severity and psychological well-being in both groups. Also, there were no significant differences between mean levels of the investigated parameters in both groups at the end of the study. **Conclusion:** Ultrasound diathermy and low intensity laser therapy improves grip strength, pain sensation and psychological well-being in patients with lateral epicondylitis with no significant differences between both treatment modalities.

**Key words:** Lateral Epicondylitis; Low Intensity Laser Therapy; Ultrasound Diathermy; Hand Grip Strength; Pain Sensation; Psychological Well-Being.**Introduction**

The incidence of lateral epicondylitis is approximately 1% to 3%, with less than half of patients seeking medical care; the prevalence has been reported to be between 1% and 10%, depending on the age group investigated. Women are more often affected than men with 9% and 3%, respectively. These differences may be due to factors related to employment, psychological-physiological, cultural, and biological factors. The dominant arm is involved twice as often as the nondominant arm. Most (80%) of the injuries represent chronic, repetitive ones that tend to be related to a particular profession or a particular hobby, whereas the remaining (20%) are related to direct or indirect acute injuries [1].

Lateral epicondylitis, is an injury related to overuse, which can cause serious long-term disability in both working and nonworking adults. Pain at the lateral aspect of the elbow is the main symptom of

lateral epicondylitis. The pain is exacerbated by passive extension of the elbow with the wrist flexed and by resisted extension of the wrist or third metacarpal with the elbow extended [2]. Gripping is impaired, most notably when strength is required, so that holding a cup of coffee or giving a handshake may be painful and difficult to accomplish. Thus, the patient is at a disadvantage in many situations and may experience difficulty with numerous activities of daily living. Statistical data indicate that lateral epicondylitis is associated with many lost days of work and with residual impairments associated with prolonged limitations in work capabilities [3].

Although the burden caused by lateral epicondylitis is considerable, the scientific evidence to support management strategies is meager. More than 40 treatment modalities have been described, and none has been proven superior over the others. This lack of evidence may be related to a number of factors, including the possibility that lateral epicondylitis may be a self-limited condition, the

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paucity of data on pathophysiological mechanisms, the methodological shortcomings of available studies, and the existence of numerous factors influencing the outcome of lateral epicondylitis [4].

Ultrasound is a deep heating modality that is most effective in heating tissues of deep joints [5]. It causes increases in tissue relaxation, local blood flow, scar tissue breakdown, protein synthesis, fibroblast activation, and possible effect on tendon healing. The effect of the increase in local blood flow can be used to help reduce local swelling and chronic inflammation [6].

Low intensity Laser therapy may cause many reactions and biological effects within the human body. Therefore it is recommended as a therapeutic modality in management of chronic inflammatory conditions due to its anti-inflammatory and immunocorrecting action [7].

The aim of this study was to compare the effects of low intensity laser therapy and ultrasound diathermy on hand grip strength, pain sensation and psychological well-being in patients with lateral epicondylitis.

#### *Patients and methods:*

##### *Subjects:*

Thirty male patients who were diagnosed based on the Southampton examination criteria for lateral epicondylitis; these are 1) pain lasting one day or longer in the last seven days in the lateral elbow region, 2) tenderness over the lateral elbow region, and 3) pain occurring over the lateral elbow region during resisted active extension of the wrist [8]. In patients who fulfilled the above criteria, X-rays were made of the elbow joint and cervical vertebra to rule out other pathologies of the elbow region or cervical disc pathologies; subsequently, they underwent diagnostic US to make a definite diagnosis of epicondylitis.

Inclusion criteria include history of epicondylalgia of the radial humerus, lateral epicondyle pain at rest and during resisted dorsiflexion of the wrist with elbow in full extension, pain for at least 6 months and age between 21 and 45 years.

Exclusion criteria for this study were bilateral lateral epicondylitis, an implanted pacemaker, systemic metabolic disease (diabetes mellitus, thyroid disease, etc.), chronic inflammatory and neoplastic disease, cervical and shoulder lesions, and treatment with corticosteroid or local anesthetic injection in the previous six months. The trial procedure was explained and written informed consent was obtained from all patients.

Participants were divided randomly into two equal groups ultrasound therapy group and low intensity laser therapy group however; all participants received the traditional medical treatment and exercises training. Hand grip strength

and pain severity were used as outcome measures. Outcome measures were tested before treatment (baseline) and after one month at the end of the treatment. All participants were free to withdraw from the study at any time. If any adverse effects had occurred, the experiment would have been stopped, with this being announced to the Human Subjects Review Board.

##### *Grip Strength assessment:*

Grip strength of the dominant hand was measured using three successive repetitions with a Jamar hand dynamometer (Sammons Preston Rolyan, Cedarburg, WI, USA). The elbow was flexed at a 90° angle and not allowed to contact any body part. Resting time between subsequent measurements was 30 s. The mean value of the two best performances was used in the analyses [9].

##### *Pain Severity assessment:*

Elbow pain lasting at least 24 hours was evaluated using a 10-cm visual analog scale (VAS) (0 = no pain, 10 = the most severe pain) [10].

##### *Psychological well-being assessment:*

Data were collected at baseline and at the end of treatment. Participants were required to attend two laboratory sessions in order to complete all psychological assessments, in each evaluation period. Self-esteem was assessed with the Rosenberg Self-Esteem Scale (RSES), composed by 10 items answered on a 4-point Likert scale. Higher scores of the RSES represent greater self-esteem ( $\alpha = .84$ ). Mood disturbance was assessed with the Profile of Mood States (POMS), which measures the transient emotional state through 65 items on a 5-point Likert scale. The questionnaire assesses 6 dimensions of mood that can be used to calculate a Total Mood Disturbance score (sum of the negative emotions subtracted by the positive Vigor dimension,  $\alpha = .92$ ), which was used in the present study (higher scores represent greater total mood disturbance). Questions pertain to emotional states of the previous month. Depression was evaluated with the Beck Depression Inventory (BDI), a 21-item inventory measuring several symptoms of depression. It uses a 4-point ordered scale and results in a total score ( $\alpha = .80$ ), where higher scores represent greater level of depressive symptoms [11].

##### *Low intensity laser therapy:*

Laser LTU 904 retroflected shield (class I laser product manufactured by laserex technologies PTYLTD, Australia) was used to apply laser therapy, while the patient was in the sitting position bare skin of the site of laser application, back was supported hips and knees were 90° flexion and feet rest on the

floor. Each point of the affected lateral epicondyle received laser for 90 seconds, three sessions per week for four successive weeks.

#### Ultrasound diathermy:

The ultrasonic therapy (Sonosan 100) was applied to the intact skin surrounding the wound using coupling gel for contact for 5 minutes 3 times per week, for a total period of one month, treatment was delivered at a frequency of 3 MHZ, at spatial average intensity of 0.5 w/ cm<sup>2</sup> and the pulse ratio was set at 1:5. The ultrasound head was cleaned with alcohol to avoid any infection transmitted to the patient

#### Exercise training:

Exercises consisted of (1) forearm supinator and pronator muscles performed with an imbalanced adjustable dumbbell weight, (2) forearm extensor and flexor muscle exercises using a free standing dumbbell and (3) forearm supinator and pronator muscle exercises using an imbalanced adjustable dumbbell weigh (a hammer), all were performed with isometric contraction at the end range of motion. The goal was to maintain contractions for 10 seconds, with 10 repetitions maximum, twice a day. The goal for all the exercise protocols 1, 2, and 3

were to have the participants maintain the duration of 10 seconds, with 10 repetitions maximum. In case the participants could not perform that many repetitions, the clinician instructed the participants to start with the 5 repetitions and to increase by one repetition each day up to 10 repetitions maximum. The progressions in load imposed on the muscle could be achieved by increasing the number of repetitions starting from 5 to 10, according to the participants' tolerance [12].

#### Statistical analysis:

The mean values of hand grip strength, pain sensation, RSES, BDI and POMS obtained before and after three months in both groups were compared using paired "t" test. Independent "t" test was used for the comparison between the two groups (P<0.05).

#### Results:

There was a significant improvement in hand grip strength, pain severity, self-esteem (RSES), depression (BDI) and total mood disturbance (POMS) in both groups (table 1 and 2). Also, there were no significant differences between mean levels of the investigated parameters in both groups at the end of the study (table 3).

**Table 1:** Mean value and significance of hand grip strength, pain severity, RSES, BDI and POMS in group (A) before and after treatment.

	Mean $\pm$ SD		T-value	Significance
	Before	After		
Hand grip strength	135.86 $\pm$ 10.74	182.20 $\pm$ 11.30	8.73	P <0.05
Pain severity	8.32 $\pm$ 1.82	5.84 $\pm$ 1.61	6.36	P <0.05
Self-esteem (RSES)	22.86 $\pm$ 3.87	26.43 $\pm$ 3.35	6.87	P < 0.05
Depression (BDI)	7.84 $\pm$ 3.45	5.29 $\pm$ 3.22	4.65	P < 0.05
Total mood disturbance (POMS)	23.57 $\pm$ 5.32	18.71 $\pm$ 4.53	6.21	P < 0.05

RSES: Rosenberg Self-Esteem Scale

BDI: Beck Depression Inventory

POMS: Profile of Mood States.

**Table 2:** Mean value and significance of hand grip strength, pain severity, RSES, BDI and POMS in group (B) before and after treatment.

	Mean $\pm$ SD		T-value	Significance
	Before	After		
Hand grip strength	132.91 $\pm$ 11.42	179.56 $\pm$ 10.33	7.21	P <0.05
Pain severity	8.87 $\pm$ 1.91	6.14 $\pm$ 1.65	5.89	P <0.05
Self-esteem (RSES)	23.48 $\pm$ 3.68	25.27 $\pm$ 3.56	5.26	P < 0.05
Depression (BDI)	7.53 $\pm$ 3.72	5.93 $\pm$ 3.52	3.97	P < 0.05
Total mood disturbance (POMS)	23.72 $\pm$ 5.41	19.16 $\pm$ 4.18	5.10	P < 0.05

RSES: Rosenberg Self-Esteem Scale

BDI: Beck Depression Inventory

POMS: Profile of Mood States.

**Table 3:** Mean value and significance of hand grip strength, pain severity, RSES, BDI and POMS in group (A) and group (B) after treatment.

	Mean $\pm$ SD		T-value	Significance
	Group (A)	Group (B)		
Hand grip strength	182.20 $\pm$ 11.30	179.56 $\pm$ 10.33	1.97	P >0.05
Pain severity	5.84 $\pm$ 1.61	6.14 $\pm$ 1.65	1.02	P >0.05
Self-esteem (RSES)	26.43 $\pm$ 3.35	25.27 $\pm$ 3.56	1.15	P >0.05
Depression (BDI)	5.29 $\pm$ 3.22	5.93 $\pm$ 3.52	0.98	P >0.05
Total mood disturbance (POMS)	18.71 $\pm$ 4.53	19.16 $\pm$ 4.18	1.12	P >0.05

RSES: Rosenberg Self-Esteem Scale

BDI: Beck Depression Inventory

POMS: Profile of Mood States.

*Discussion:*

Although there are a few reviews and meta-analyses regarding conservative treatment of lateral epicondylitis, there is still insufficient evidence regarding the management of lateral epicondylitis. It is difficult to compare our results with earlier studies, because no trials have compared LLLT, and US therapy in a similar setup to ours. US or LLLT in combination with other treatments has been found effective in reducing pain and improving hand grip strength.

Struijs et al. 2004 compared the same type of brace we used with physical therapy consisting of US, friction massage and exercise, or combination therapy (brace plus physical therapy). They found that only physical therapy was superior for pain, disability, and satisfaction on the short term, whereas only brace treatment was superior for problems during activities of daily living. However, combination therapy had no superior effect compared to physical therapy alone, but was superior to the brace on the short term. At the end of their study, Struijs et al. concluded that a brace can be considered as initial and supportive treatment. The main difference between the trial of Struijs et al. and the present study is that we used continuous US [13].

Holdworth and Anderson reported that hydrocortisone phonophoresis and brace treatment significantly decreased resting pain compared to conventional US in patients with lateral epicondylitis [14]. A review by Trudel et al. inspected the short-term effects of US in reducing pain on lateral epicondyle [15]. In another trial, continuous US therapy resulted in greater pain reduction compared with the placebo US and rest at three months, but offered no advantages over placebo US on pain, grip strength, and global improvement [16, 17].

Progressive strengthening and stretching programs have been shown to significantly reduce pain. However, the effect on grip strength does remain controversial, with some studies reporting improvement and others documenting no change. Svernlöv and Adolfsson reported progressive strengthening and stretching programs resulted in a significant reduction in pain and an increase in grip strength in their lateral epicondylitis patients [18].

On the other hand, a trial comparing a six- to eight-week stretching exercise program with isometric and isotonic exercises combined with US showed that the exercises may improve pain in lateral epicondylitis but do not improve maximum grip strength [19]. Although exercise was not an independent variable in our study, the inclusion of a stretching and strengthening program may have contributed to the lack of significant differences between our interventions.

Although, there is general agreement that LLLT is not effective in improving pain, grip strength, and global improvement on the short term in lateral

epicondylitis [20-24]. We found that laser and US significantly decreased pain from baseline to a period eight weeks later. In addition, laser significantly increased grip strength, from baseline to reevaluation eight weeks later. When the interventions were compared, however, there was no statistical difference in outcome measures for any of the treatment interventions.

*Conclusion:*

Ultrasound diathermy and low intensity laser therapy improves grip strength, pain sensation and psychological well-being in patients with lateral epicondylitis with no significant differences between both treatment modalities.

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