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# Effectiveness of Low Level Laser Therapy on Adult Patients with Lateral Epicondylitis – A Randomized Controlled Trial

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Lateral Epicondylitis (LE) is the most common syndrome in the elbow joint, described as an inflammation of the common extensor muscles. Many studies reported that low-level laser therapy may decrease pain and inflammation, but limited data have evaluated the effect of LLLT on hand grip strength in patients with LE. This study aimed to investigate the effects of low-level laser therapy on pain severity and handgrip strength in patients with LE.Thirty adult patients with LE aged 20-40 years. They were randomly classified into two groups, fifteen in each group; low-level laser therapy (LLLT) and traditional physiotherapy program (TPT) groups. The LLLT group received a program of low-level laser therapy with bracing application and traditional physiotherapy group received deep friction massage and ultrasonic therapy with bracing application. Pain severity using visual analogue scale (VAS) and hand grip strength were evaluated at the beginning of the intervention, at the fourth week, and at the end of the study after eight weeks of the intervention. Baseline characteristics showed non-significant differences in VAS and hand grip strength between the two groups at the beginning of the study. The findings of this study showed significant decreases in pain severity in the two groups while the hand grip strength has improved significantly only in the LLLT group at the end of the study with $p<0.05$ after the 8-week intervention. In accordance with study results, LLLT has beneficial effects on pain severity, hand grip strength, and global assessment of patient improvement in adult patients with LE after 8-week intervention.

**Keywords: : Lateral epicondylitis; Low-level laser therapy; Traditional physiotherapy; Bracing.**

## INTRODUCTION

**L**ateral epicondylitis (LE) or as tennis elbow and/or lateral elbow tendinopathy is a common condition, often described as inflammation of the common wrist extensor. Research shows that granulation tissue can be found at the origin of the extensor carpi radialisbrevis muscle (Goldie, 1964). Additionally, macroscopic tearing was associated with histological findings (Coonrad and Hooper, 1973). This pathology suggested a degenerative process, as no inflammatory cells were identified histologically (Nirschl and Pettrone, 1979).

The prevalence of LE ranges from 1% to 1.3% in men and from 1.1% to 4.0% in women in the general populations (Shiri et al., 2007). This syndrome appears to be of longer duration and severity in women (Vicenzino and Wright, 1996). It varies between 0.3% and 13.5% in working populations (Ono et al., 1998). It is most often encountered between the ages of 40 and 60 years, and the dominant arm is generally affected (Thurston, 1998).

The diagnosis of LE is clinical and based on

symptoms and findings of physical examination (Goguin and Rush, 2003).Pain in the lateral aspect of the elbow is the main symptom. Pain is typically related to activity. There is tenderness at the lateral humeral epicondyle on clinical examination. Clinical tests, consisting of active and resisted movements of the extensor muscles of the forearm, provoke epicondylar pain (Harrington et al., 1998). However, in patients with persistent pain and disability despite treatment, imaging methods including ultrasonography might be necessary. For this reason, ultrasonographic evaluation for injuries of the wrist extensor tendon, nearby soft tissues, and the cortex of the lateral epicondyle may be valuable (Struijs et al., 2005).

There are many treatments for LT including non-steroid anti-inflammatory drugs, splinting, exercises, physiotherapy, local injection therapy, and surgery; the condition has been known to resolve spontaneously within eight to twelve months (Hong et al., 2004).

Low-level laser therapy (LLLT) is a common electro-physical modality used in clinical practice; it seems to be effective in promoting tissue healing and pain control, which may involve various mechanisms (Basford, 1989).Limited data were observed on the clinical effects of LLLT in the management of LE. Therefore, the aim of this study was to evaluate the clinical effects of LLLT on adult patients with LE.

## MATERIALS AND METHODS

### Subjects

Between August 2016 and January 2017, thirty adult male patients with LE were recruited in this study. This study was conducted in the physical therapy outpatient clinic at Prince Sattam Bin Abdulaziz University. Inclusion criteria; all patients were previously diagnosed with LE, age was 20-40 years, and the duration of symptoms was more than 3 months. Exclusion criteria; if the patients were an implanted pacemaker, systemic metabolic disease such as diabetes mellitus or thyroid disease, chronic inflammatory and neoplastic disease, and treatment with corticosteroid or local anaesthetic injection in the previous six months. They were randomly classified into two groups, fifteen in each group; low-level laser therapy (LLLT) and traditional physiotherapy program (TPT) groups. The LLLT group received a program of low-level laser therapy with bracing application and traditional physiotherapy group received deep friction massage and ultrasonic therapy with bracing application.

### Procedures

#### I- Evaluation

a) Hand grip strength was assessed at 90° elbow flexion using a hand dynamometer at level 3 and used the mean of three measurements (Mathiowetz et al., 1984).

b) Pain severity of the elbow joint lasting at least 24 hours was evaluated using a 10 cm Visual Analogue Scale (VAS) which scored from 0 to 10, 0 means no pain and 10 means the most severe pain (Price et al., 1983).

c) A six-point scale was used to assess the global assessment of improvement scale. The patient was asked to rank the degree of improvement as completely recovered, much improved, slightly improved, not changed, slightly worse, and much worse (Struijs et al., 2004).

#### II- Intervention

Group A (LLLT group) received LLLT combined with brace application (lateral counterforce brace, Aurafix, Turkey). The class 3B Laser M 1000 (THOR Photomedicine Inc., Maryland, USA) was used in this study. The laser parameters were: Gallium-Aluminium-Arsenide (GaAlAs), the wavelength of 904 nm, continuous mode, frequency of 50 Hz, power density of 50 $mW/cm^2$, spot size of 0.5 $cm^2$, duty cycle of 0%, energy density of 1.5 $J/cm^2$, and the duration of irradiation was 30 sec for each point. The patient sat in a relaxed and comfortable position with the elbow resting on the bed. Before applying LLLT, the area was cleaned with alcohol. Six points over the facet of the lateral epicondyle were irradiated (Bjordal et al., 2003).All patients were checked to not feel anything like warmth or any other sensation such as rubbing, tingling, or discomfort. During 8 weeks of treatment, the patients received 10 sessions of low level laser therapy. In the first two weeks, the subjects received two sessions per week and the followed 6 weeks, one session per week. For protection from the laser beam, all subjects wore specific protective goggles.

Group B (TPT group) received deep friction massage and ultrasonic therapy with same bracing application of group A (lateral counterforce brace, Aurafix, Turkey) during the daytime for 8 weeks. Brace removal was allowed only for bathing and sleeping. Both groups were treated under the same conditions and no complications were reported.

**Statistical analysis**

Descriptive statistics was done in the form of mean and standard deviation. Inferential statistics assessed changes of the measured variables using dependent t-test to assess changes between the two groups. ANOVA was used to assess the changes of the repeated measures within each group. Analysis was performed using SPSS version 20.0 (SPSS, Chicago, IL, USA). P<0.05 was accepted as a significant value.

**RESULTS**

At demographic and baseline characteristics of the patients, the thirty patients completed the study, with fifteen patients in the LLLT group and fifteen patients in the TPT group. The mean age of the patients was 34.8 years, with a range of 20–40 years. Their history of symptoms ranged from 3 to 7 months, with a mean of 3.7 months. There was no significant difference in any variable of the demographic data of the patients between the two groups (Table 1)

Post-intervention analysis, the elbow pain assessed utilizing VAS improved significantly in two groups at the end of treatment after 8-week intervention (p<0.05). Also, it was observed that there was significant difference between the two groups in favour to LLLT group (p<0.05) as described in Table 2.

On the contrary, the hand grip strength improved significantly only in the LLLT group after 4-week intervention and continued for the eighth week at the end of the study program (p<0.05). Comparing between the two groups, there was significant difference in favour to LLLT group (p<0.05) as demonstrated in Table 2.

As presented in Table 2, according to the patient's global assessment of improvement which evaluated on a six-point scale post-intervention, the condition worsened in the TPT group, whereas it improved in the LLLT group at 8-week compared to 4-week (p<0.05).

**Table 1 Baseline and clinical characteristics of the participating patients in the study**

| Items | LLLT group (n=15) | TPT group (n=15) | *p*-value |
|---|---|---|---|
| **Age (years)** | 35.4±3.4 | 34.2±3.2 | 0.578 |
| **Height (cm)** | 170±4.6 | 171±6.5 | 0.549 |
| **Weight (kg)** | 78.5±5.3 | 77.8±4.9 | 0.573 |
| **BMI (kg/m$^2$)** | 26.8±2.7 | 27.2±3.9 | 0.824 |
| **Clinical characteristics** | | | |
| **VAS** | 7.1 ± 1.4 | 8.1 ± 13 | 0.097 |
| **Hand grip strength** | 45.8 ± 18.6 | 43.3 ± 16.9 | 0.917 |

A significance level of p<0.05; LLLT: low-level laser therapy; TPT; traditional physiotherapy; VAS: visual analogue scale

**Table 2 Comparison between baseline and post-treatment values of the two groups.**

| Items | Period | LLLT group (n=15) | TPT group (n=15) | *p*-value |
|---|---|---|---|---|
| **VAS** | Baseline | 7.1 ± 1.4 | 8.1 ± 13 | 0.097 |
| | Week 4 | 4.4 ± 22 | 4.8 ± 2.6 | 0.189 |
| | Week 8 | 3.3 ± 1.2* | 4.7 ± 0.9* | 0.047* |
| **Hand grip strength** | Baseline | 45.8 ± 18.6 | 43.3 ± 16.9 | 0.917 |
| | Week 4 | 54.8 ± 15.1* | 46.3 ± 12 | 0.049 |
| | Week 8 | 59.3 ± 11.2* | 36.2 ± 5.2 | 0.031* |
| **Six-point scale** | Week 4 | 3.4 ± 1.1 | 3.3 ± 0.9 | 0.958 |
| | Week 8 | 2.5 ± 1.0* | 4.2 ± 1.2 | 0.042* |

A significance level of p<0.05; LLLT: low-level laser therapy; TPT; traditional physiotherapy; VAS: visual analogue scale

## DISCUSSION

The current study investigated the effects of low level laser therapy on pain, hand grip strength, and global assessment in patients with lateral epicondylitis and compared these results with a traditional physical therapy program. The results showed that low level laser therapy was more effective in management of lateral epicondylitis at least within used parameters. Particularly, the current study provided that the GaAlAs low level laser with wavelength of 904 nm reduced the pain, and improved hand grip strength.

LLLT is a conservative treatment choice for patients with LE. It is based on the belief that laser radiation and monochromatic light are able to alter cellular and tissue function in a manner dependent on the characteristics of light itself. Since LLLT works at low irradiation intensities (low energy doses), it is assumed that any biologic effects are secondary to the direct effects of photonic radiation and are not the result of thermal processes. The mechanism of pain reduction by LLLT is yet not fully understood. Different experimental studies suggested that LLLT has anti-inflammatory and analgesic effects (Honmura et al., 1993 and Coderre et al., 1993).

However, according to the results of other studies and a meta-analysis, LLLT may have some beneficial effects on pain reduction and hand grip strength (Bjordal et al., 2008), (Tumilty et al., 2010), (Oken et al., 2008), and (Lam and Cheing, 2007). It is difficult to compare our results with earlier studies, because no trials have compared a LLLT combined with brace application, in a similar setup to the present study.

Previously, Hartvig et al compared two lasers: He-Ne and infrared in patients with LE and observed that one month intervention has significant improvement in all symptoms of LE (Hartvig et al., 1989). Also, Struijs et al compared the same type of brace which used with traditional 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 (Struijs et al., 2004). However, studies on the effectiveness of bracing application in LE also have shown conflicting results.

Cochrane database systematic review provided that no definitive conclusions can be drawn concerning effectiveness of orthotic devices for the treatment of LE (Struijs et al., 2002). 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 (Stasinopoulos et al., 2005 and Basford et al., 2000). On the contrary, early research applied Laser He-Ne with wavelength of 632.8 nm and GaAlAs with wavelength of 904 nm on patients with LE and showed that the two types of laser had no beneficial effects (Haker et al., 1991).

### Strengths and limitations

The results of this study may shed light on similar applications of LLLT in other musculoskeletal conditions with similar aetiology. Shoulder impingement syndrome, Dequervain's disease, and trigger finger all share similar etiologic factors as lateral epicondylitis. LLLT can be considered as one of the physical strategies that can be used to reduce this kind of tendinopathy pain. The main limitations of this study are the relatively small study population and the lack of long-term follow-up results. Additional studies are needed to determine further effects of laser therapy in lateral epicondylitis.

## CONCLUSION

In accordance with the study outcomes, LLLT has beneficial clinical effects on pain severity, hand grip strength, and global assessment of patient improvement in adult patients with LE after 8-week intervention.

## CONFLICT OF INTEREST

The author declared that present study was performed in absence of any conflict of interest.

## ACKNOWLEGEMENT

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## AUTHOR CONTRIBUTIONS

SMA designed, performed the experiments, wrote and reviewed the manuscript and also read and approved the final version.

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