

# Low Level Laser Versus Transcutaneous Electrical Nerve Stimulation on Post Herpetic Neuralgia

MARWA LOTFY MOHAMED AHMED<sup>1</sup>, WAFAA HUSSEIN BORHAN<sup>2</sup>, MAHA HUSSEIN RAGAIA<sup>3</sup>, HUSSEIN GAMAL HUSSEIN MOGAHED<sup>2</sup>

<sup>1</sup>Department of Physical Therapy for surgery, Faculty of Physical Therapy, Deraya University, Elminia, Egypt.

<sup>2</sup>Department of Physical Therapy for surgery, Faculty of Physical Therapy, Cairo University, Cairo, Egypt.

<sup>3</sup>Department of Dermatology, Faculty of Medicine, Minia University, Elminia, Egypt.

Corresponding author: Marwa Lotfy Mohamed Ahmed, Email: [Marwalotfy1994@gmail.com](mailto:Marwalotfy1994@gmail.com), Cell: +20 101 424 4888

## ABSTRACT

**Background:** Post herpetic neuralgia (PHN), a common neuropathic pain syndrome, usually occurs in patients with acute herpes zoster after resolving skin eruption. Persistent severe pain has a huge impact on a patient's physical function, mental health, and social communication ability, and also places a heavy burden on patients' families and on society.

**Objective:** The current study was conducted to compare the efficacy of low level laser therapy (LLLT) versus transcutaneous electrical nerve stimulation (TENS) in the treatment of post-herpetic neuralgia

**Subjects and Methods:** Fifty patients suffering from pain post herpetic neuralgia. Their ages ranged from 40 to 80 years. They were selected randomly from outpatient clinic in Deraya university referred by dermatologist then divided into two equal groups. Group (A) composed of 25 patients with post herpetic neuralgia and they received low level laser therapy LLLT in addition to traditional medical treatment and Group (B) composed of 25 patients with post herpetic neuralgia and they received Transcutaneous electrical nerve stimulation in addition to traditional medical treatment. Both modalities were applied once daily, 3 times a week for 20 minutes for 4 successive weeks. Visual analog scale (VAS) and pain pressure threshold (PPT) had been assessed before and after interventions.

**Results:** There was a significant decrease in VAS and a significant increase in PPT post treatment compared with that pre treatment in group A and B ( $p < 0.001$ ). The percent of change in VAS and PPT in group A was 88.97 and 522.22% respectively, while that in group B was 82.39 and 462.79% respectively.

**Conclusion:** Both LLLT and TENS were effective improving the post-herpetic neuralgia but LLLT was more effective.

**Keywords:** Low level laser therapy, transcutaneous electrical nerve stimulation, post herpetic neuralgia, visual analog scale and pain pressure threshold

## INTRODUCTION

Herpes zoster (HZ) is a common disease worldwide, with symptoms such as localized, painful cutaneous vesicular eruption, leading the patients to live with diminished quality of life. HZ mainly affected people aged 50 years or older and immunocompromised patients. Post herpetic neuralgia (PHN), a neuropathic pain syndrome and the most common complication of HZ. <sup>1</sup> Post herpetic neuralgia (PHN) is persistent intractable pain in the affected area for more than one month after recovery from herpes zoster. <sup>2</sup> Its clinical manifestations include persistent or intermittent burning pain at the original lesion and stabbing or sharp shooting pain with hyperalgesia or allodynia. <sup>3</sup> PHN is one of the most common complications of herpes zoster. Persistent severe pain has a huge impact on a patient's physical function, mental health, and social communication ability, and also places a heavy burden on patients' families and on society. <sup>4</sup> Post herpetic neuralgia (PHN), a common neuropathic pain syndrome, usually occurs in patients with acute herpes zoster after resolving skin eruption. <sup>5</sup> PHN has a broad spectrum of clinical manifestations ranging from a mild and transient tingling sensation to chronic and severe pain. The pain associated with PHN often causes much distress and becomes refractory to any available treatments. <sup>6</sup> Pain is defined as burning or electric shock-like and may be associated with hyperalgesia or allodynia, Periods of randomly occurring day and night burning, stabbing, and shooting pains continue for months or years after the acute stage. The area concerned is hyper-esthetic and non-noxious stimuli may cause painful reaction that may be triggered by light touch, clothing rubbing against the skin, noise, temperature changes, sweating and emotional upsets. <sup>7</sup> Pharmacologic treatment can be limited by side-effects. The therapy often includes a number of drugs orally administered, local agents, and antidepressant. <sup>8</sup> Low level laser therapy (LLLT) is a non-invasive, painless, light-based therapy. LLLT uses infrared to relieve inflammation process and to diminish pain in patients with PHN. New anecdotal reports have suggested that LLLT is effective in relieving various types of neuralgia and the use of LLLT for pain management is increasing. This evidence-based

case report aims to assess whether the involvement of LLLT will increase the PHN treatments' efficacy. <sup>9</sup> Transcutaneous electrical nerve stimulation (TENS) is a non pharmacologic analgesic technique that has shown efficacy in transiently relieving neuropathic pain. <sup>10</sup> TENS is an adjunctive therapy that is administered at a strong but non painful stimulation intensity that can achieve pain relief. <sup>11</sup> and is often used in combination with conventional treatment of PHN pain relief. <sup>10</sup>

## MATERIALS AND METHODS

**Subjects:** Fifty patients male and female complaining from pain post herpetic neuralgia were participated in this study. They were selected randomly from out clinic Deraya University referred by dermatologist then divided into two equal groups each group one has patients. Their ages ranged from 40 to 80 years. The patients with active herpes, current skin infection at site, with cardiac pacemakers or malignancy were excluded from the study. This study was conducted under the ethical committee No: P.T. REC/012/003624. Faculty of Physical Therapy, Cairo University.

Design of study was pre and post experimental design. They were divided into two groups equal in number, Group A (**Experimental group A**): This group includes 25 patients with post herpetic neuralgia and they received low level laser therapy LLLT with medical treatment in addition traditional medical treatment.

**Group B (Experimental group B):** This group includes 25 patients with post herpetic neuralgia and they received Transcutaneous electrical nerve stimulation (TENS) with medical treatment in addition traditional medical treatment. Duration of treatment was 20 minutes three time per week for four week.

### Materials:

1 Visual analogue scale (VAS): It was used to assess pain intensity for both groups A and B before and after treatment.

2 An electronic algometer: Force one gauge- model FDI" (Wagner instruments, Greenwich, CT, USA). It was used to measure tenderness by determining the pain pressure threshold using a pressure probe for both groups A and B before and after treatment.

3 LLLT Chattanooga low level laser: It was used to deliver 850 nm laser irradiation. This device gave an incident output power in continuous wave. It was used in treatment of patients in group A.

4 TENS ITO physio therapy rehabilitation ES-5200 units: It was used in treatment of patients in group B.

**Procedures:** All patients in both groups A and B were informed about the procedures of the protocol of the study and each patient assigned the informed consent form before beginning of the study.

**A- Evaluation procedures:**

1 VAS: Before beginning and after the end of therapy, pain was measured by VAS for each patient in both groups (A&B). VAS is considered the 'gold standard' technique and is used particularly in pain-related research. It consists of a 100 mm unmarked line with standardized wording: 'no pain' on the left of the line, and 'worst pain imaginable' on the right—the patient then places a mark on the line corresponding to their level of pain.<sup>12</sup>

2 Electronic Algometer: It was used to measure tender point by determining the pain pressure threshold using a pressure probe, that's placed on the trigger point. The score is calculated according to the amount of pressure. It was used for both groups A and B before and after treatment.<sup>13</sup>

**B- Treatment procedures:** Low Level Laser Therapy Laser cluster diode: (Ga Al As diode system) model 27808, Chattanooga DJO., LLC Vista A Ga Al As laser is used in this study with 850 nm wavelength. The laser dose (energy density) used in the present study was 3.6 J/cm2 per tender point and it was applied for 1 min. The laser application was conducted over the affected side .time session /20 minutes. LLLT was performed 3 times a week for four weeks. The patient was placed into a comfortable supported position that allows the vision of the treated area. Both the therapist and patient wear protective eye glasses during the treatment and the patient was asked not to look to laser rays.<sup>14</sup> Transcutaneous electrical nerve stimulation (TENS ) ITO physio therapy rehabilitation ES-5200 units have been utilized by placing electronic patches over the affected area and stimulating the skin beneath the patch in an effort to reduce the pain the stimulation was administered conventional TENS Frequency/ 70 Hz, intensity of maximum tolerable paraesthesia but without causing muscle contraction or fasciculation time session / 20 minutes repetition 3 times a week for four weeks.<sup>15</sup>

**Statistical Analysis:** Unpaired t-test was conducted for comparison of age between groups. Chi- squared test was carried out for comparison of sex distribution between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. Unpaired t-test was conducted to compare mean values of VAS and PPT between group A and B. Paired t-test was conducted for comparison between pre and post treatment in each group. The level of significance for all statistical tests was set at p < 0.05. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

**RESULTS**

**Subject characteristics:** Table (1) showed the subject characteristics of the group A and B. There was no significant difference between groups in age and sex distribution (p > 0.05).

Table 1: Comparison of subject characteristics between group A and B:

	Group A	Group B	p-value
	Mean ± SD	Mean ± SD	
Age (years)	53.92 ± 8.63	57.08 ± 8.39	0.19
Sex			0.57
Females	14 (56%)	12 (48%)	
Males	11 (44%)	13 (52%)	

SD, standard deviation; p value, probability value

Table 2: Mean VAS and PPT pre and post treatment of group A and B:

	Group A	Group B	MD	t-value	p value
	Mean ± SD	Mean ± SD			
VAS					
Pre treatment	5.44 ± 1	5.68 ± 0.74	-0.24	-0.95	0.34
Post treatment	0.6 ± 0.57	1 ± 0.64	-0.4	-2.31	0.02
MD	4.84	4.68			
% of change	88.97	82.39			
t- value	30.25	42.02			
	p = 0.001	p = 0.001			
PPT (kg)					
Pre treatment	0.45 ± 0.22	0.43 ± 0.18	0.02	0.23	0.81
Post treatment	2.8 ± 0.3	2.42 ± 0.4	0.38	3.78	0.001
MD	-2.35	-1.99			
% of change	522.22	462.79			
t- value	-39.74	-26.49			
	p = 0.001	p = 0.001			

SD, standard deviation; MD, mean difference; p-value, probability value

**Effect of treatment on VAS and PPT: Within group comparison:** There was a significant decrease in VAS and a significant increase in PPT post treatment compared with that pre treatment in group A and B (p < 0.001). The percent of change in VAS and PPT in group A was 88.97 and 522.22% respectively, while that in group B was 82.39 and 462.79% respectively. (Table 2)

**Between groups comparison:** There was no significant difference between groups pre-treatment (p > 0.05). Comparison between groups post treatment revealed a significant decrease in VAS and a significant increase in PPT of group A compared with that of group B (p < 0.05). (Table 2)

**DISCUSSION**

The results of this study found that there was a significant decrease in VAS and a significant increase in PPT post treatment compared with that pre treatment in group A and B (p < 0.001). The percent of change in VAS and PPT in group A was 88.97 and 522.22% respectively, while that in group B was 82.39 and 462.79% respectively. Between groups, before treatment there was no significant difference in mean values of VAS and pressure algometer while after treatment, there was significant difference between both groups (A and B) (group A more decrease VAS and more increase in pressure algometer). Wavelength in laser therapy is also very important because it determines the depth of laser penetration into the tissue which is also affected by the absorption and scattering of light in the tissue. When irradiated on the skin, the laser light will interact with the main chromophores, namely hemoglobin, melanin, water, and fat. The wavelength with a low absorption rate on the chromophores will be better because it can penetrate deeper into the tissue. The recommended wavelength is 600-1100 nm so that it can penetrate through the layers of the epidermis, dermis, and hypodermis to reach blood vessels and nerves.<sup>14</sup> Since 1980, LLLT have been applied for PHN. Although many of the direct effects of low level Laser irradiation at a cellular and local level have been elucidated by leading photo biologists, the systemic effect of LLLT and its physiological pathways remain unclear. LLLT is effective for PHN in the acute and chronic phase and the results demonstrate a significant reduction in PHN pain intensity and other complaints therefore LLLT will appear to be a valuable method for treating PHN.<sup>19</sup> Sasaki et al.,<sup>16</sup> demonstrated that among 123 patient treated by LLLT showed an overall total improvement of 60.16% and it was concluded that LLLT was effective for PHN for the acute and chronic phase, but LLLT was particularly effective for the acute onset patient whose onset before treatment was 6

months or less. Also, the current results were supported by Mukhtar et al.,<sup>14</sup> who found the efficacy of laser therapy in treating PHN was successfully proven by a study conducted on 15 patients, where the sample was PHN patients who were refractory to various drugs for 1 month – 1 year. The results of this study found that 11 of 15 patients who received laser therapy for 16 sessions in 8 weeks stated that they were pain free and the remaining 4 reported significant pain reduction (more than 50%). The therapy used in this study was low-intensity laser therapy with utilizing gallium arsenide (Al Ga As) diode laser that emit red color a wavelength of 650 nm and a power of 3.6 J/cm<sup>2</sup> for 1 minute at the pain area in CW mode. Proved itself an excellent therapeutic modality for the relief of pain in post-herpetic neuralgia patients, which may replace pain management medicines in future.

Additionally, the current findings were in link with Mendlik and Uritsky,<sup>17</sup> that LLLT was very effective in terms of pain relief in patients with post-herpetic neuralgia. It had therefore been suggested that neural activity inhibition might be responsible for the therapeutic effect and that laser irradiation selectively inhibited nociceptive signals at the peripheral nerves. Lin, et al.<sup>18</sup> have suggested that TENS must be considered as a first-line treatment, given its non-invasiveness, low cost, and safety. TENS was used for many types of painful conditions, particularly neuropathic pain<sup>19, 20</sup>. Proper application of TENS has been found to relieve multiple neuropathic pain disorders such as carpal tunnel syndrome, diabetic neuropathy,<sup>21,22</sup> sciatica, radiculopathy and post-herpetic neuralgia (PHN).<sup>18, 23</sup>

Barbarisi et al.,<sup>24</sup> TENS was more effective at reducing pain in conjunction with pregabalin compared to pregabalin and a placebo for the following 4 weeks.

Stepanović et al.,<sup>23</sup> showed that TENS was effective in reducing the incidence of PHN, but PHN was not preventable with TENS use. Xu et al.,<sup>25</sup> investigated the effect of TENS in combination with medication for treatment of PHN in the facial area. Both studied used high frequency TENS for 30 minutes per day for a period of 4 to 8 weeks. Suszyński et al. investigated the effect of TENS plus subcutaneous injection of cobalamin alone or with lidocaine. The results of this study showed improvement in pain intensity mean allodynia, paresthesia scores, and quality of life. Results of these previous studies supported the findings of the current study, which make TENS a preferable, noninvasive, affordable modality with no side effects more than medications and other invasive modalities.<sup>26</sup>

## CONCLUSION

This study has clinical significance based on its results, both LLLT and TENS were valuable tools in decrease pain post-herpetic neuralgia as manifested by the highly significant decrease in VAS and increase in PPT. but LASRER is considered more effective.

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