Low Level Laser Therapy for the treatment of Trigeminal Neuralgia after Oral surgeries: Two Different Applications

Intsar S. Waked, Asmaa F. Attalla, Marwa M. Eid

Intsar S. Waked
Assistant Professor of Physical Therapy, Faculty of Physical Therapy, Cairo University, Egypt.

Asmaa F. Attalla
Lecturer of Physical Therapy, Department of physical Therapy for surgery, Faculty of Physical Therapy, Cairo University, Egypt.

Marwa M. Eid
Lecturer of Physical Therapy, Department of physical Therapy for surgery, Faculty of Physical Therapy, Cairo University, Egypt.

Correspondence Author:
Intsar S. Waked
Email:
I.waked@mu.edu.sa
Mobile phone
+966532107885

Abstract

Background: Trigeminal neuralgia is an inflammation of the trigeminal nerve, causing intense facial pain.

Objectives: The major purposes of this study were to evaluate the effect of laser therapy in Trigeminal neuralgia and to compare between different points of application.

Materials and Methods: Forty five patients suffering from trigeminal neuralgia post oral surgery were selected after initial evaluation and diagnosis, patients were randomly divided into three groups of equal number. (E1); received LLLT through trigger point application and (E2); received LLLT through nerve path application while Control group (C) received placebo LLLT. The intensity of pain was measured by numerical rating scale.

Results: The results of study showed that there were significant reduction of pain in experimental groups (E1& E2) with percentage of improvement 45% & 34% respectively more than control group (C).

Conclusion: LILT was more effective than placebo in trigeminal neuralgia and the trigger points application was superior to nerve path application.

Keywords: Low level laser Therapy, Trigeminal Neuralgia, Numerical rating scale , Trigger point application.

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Introduction

Trigeminal Neuralgia (TN) is defined by International Association for the study of pain (IASP) as sudden, usually unilateral, severe, brief, stabbing and recurrent pains in the distribution of one or more branches of the trigeminal nerve[1]. Also International Headache Society (IHS) describes TN as a unilateral disorder characterized by brief electric shock-like pains, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve in the second edition[2].

Although the exact pathogenesis is unknown, it is however, generally accepted that focal demyelination in the root of the trigeminal nerve is involved. Of course, any injury to the trigeminal nerve may also cause the condition. Trigeminal Neuropathy or Post-traumatic TN may develop following cranio-facial trauma (such as from a car accident), dental trauma, or sinus trauma[3]. After oral injuries as mandibular fractures, impaction and osteotomy, paresthesias and trigeminal neuralgia may occur as a result of the surgery, in particular in the mandibular region[4].

Trigeminal Neuralgia (TN) may occur spontaneously or be triggered by daily activities, such as washing, shaving, talking, brushing teeth, eating and drinking. This pain usually occurs only few seconds. Its frequency varies from a single attack during the day to more than one attack per minute that affects the individual's quality of life[5].

Trigeminal Neuralgia (TN) is associated with decreased quality of life and impairment of daily function. It impacts upon employment in 34% of patients and depressive symptoms are common. The condition may be severely disabling with high morbidity particularly among the elderly[6,7].

When the cause of the TN is identifiable, treatment involves elimination of the cause. In idiopathic cases, however, a variety of medicinal and surgical treatment should be considered. These kinds of patients can be managed medically with medicines such as carbamazepine[8]. Although medication is the first line of treatment, tolerance may develop as the treatment period and the need for extra dosage increase, which leads to more side effects. Nearly 50% of TN sufferers are not satisfied with medical therapy, because of incomplete control of pain or drug-related side effects. The common drug-related side effects are drowsiness, fatigue, dizziness, nausea, nystagmus, memory loss, and a sense of exhaustion. This necessitates finding of an alternative treatment[9].

Low level laser Therapy (LLLT) is considered as part of light therapy. It is used by physiotherapists to treat a wide variety of acute and chronic pain, by dentists to treat inflamed oral tissues and to heal diverse ulcerations, by dermatologists to treat edema, burns and dermatitis, by rheumatologists to relieve pain and treat chronic

inflammation and autoimmune disease, and by other specialists, as well as general practitioner[10].

The effect of LLLT on trigeminal neuralgia remains controversial. However some studies[11,12,13] reported that laser therapy was associated with significant reduction in the intensity and frequency of pain compared with other treatment strategies, another study[14] revealed no significant difference in analgesic effect between laser and placebo groups. There exist various studies about effect of LLLT on trigeminal neuralgia, which discuss the numbers of sessions and wavelengths and duration of irradiations. However few studies exist regarding points of applications of Laser. Therefore the purposes of this study were to compare the effect of laser application with placebo and to compare between different points of application.

Materials and Methods

Subjects

This study was conducted at Dental departments of the Specialized Medical Center of Military Production and Al Kasr Al-Ainy Hospital, Egypt during the period between 2012 and 2014. Forty five patients of both sexes suffering from trigeminal neuralgia post oral surgery were randomly selected for participation in this study. Diagnosis was carried out by a neurologist through the use of physical examination and magnetic resonance imaging (MRI). Classical TN was diagnosed according to the International Classification of Headache Disorders Criteria. At the first interview the physician should record carefully the occurrence of paroxysmal, lancinating pains, provoking stimuli, trigger points, direction of spread. The aggravating factors such as dental malocclusion and temporo mandibular dysfunction, especially in edentulous patients, may precipitate attacks of trigeminal neuralgia which should be recognized and treated. The inclusion criteria for this study,(1) Age ranged from 25-50 years, (2) all patients had postoperative trigeminal neuralgia nearly one month after surgery, (3) Patients should be conscious, cooperative and were able to follow instructions, (4) All patients were informed on the objectives of the study and signed patient consent form was documented before the patient participation in the study.

The exclusion criteria for this study (1) Pregnant and Lactating mother, (2) patients with history of cancer or receiving chemotherapy, (3) patients who had any severe medical disorders such as renal, neurological, psychological, obstructive and restrictive chest diseases(4) patients who had open wound or ulcers, (5) patients who had inflammation within treatment area,(6) alcoholics, drug addicts and smokers patients. (7) patients with artificial pacemaker (8) Patients also were excluded if they had TN secondary to multiple sclerosis, herpes zoster or any another causes other than oral surgery (9) the presence of a malignant tumor, such as an infiltrating lesion at the base of skull was also excluded.

After initial evaluation and diagnosis, patients were randomly divided into three groups of equal number. Experimental Group (E1); consisted of 15 patients that received Helium Neon LLLT through trigger point application (TPA). Experimental Group (E2); consisted of 15 patients that received Helium Neon LLLT through nerve path application (NPA). Control group (C) consisted of 15 patients that received placebo LLLT.

A research assistant carried out the selection of the patients in order to establish a double-blind design. Randomization was done with the help of a computer generated sequence of distribution. The treatment was performed three times per week on consecutive days for eight weeks of total twenty four sessions. Measurements were done for all patients pretest and after 8 weeks by scoring the severity of pain through numerical rating scale. During the course of this study, patients were also requested not to take analgesic drugs nor to receive any other form of therapy.

Methods

Measurement of severity of pain Numerical rating scale (NRS) is an uni-dimensional measure of pain intensity in adults, including those with chronic pain. The numerical rating scale is a segmented numeric version of the visual analog scale (VAS) in which a respondent selects a whole number (0 –10 integers) that best reflects the intensity of their pain. Similar to the pain VAS, the NRS is anchored by terms describing pain severity extremes as shown Fig (1). It is 11-point numeric scale (NRS 11) [15]. Patients were asked to rate their pain, using numerical rating scale, from 0 to 10, with 0 being no pain at all and 10 being the worst pain imaginable. Pain assessment was done before treatment, after 4 weeks and after 8 weeks of treatment for all patients.

Treatment procedures

For Experimental (E1) group; every patient was placed in a comfortable position, the area to be treated was cleaned and patient was instructed to wear protective goggles before Helium Neon laser device (ASA Massimo zucch design, Bravo Terza serie. **Fig 2**) was switched on.

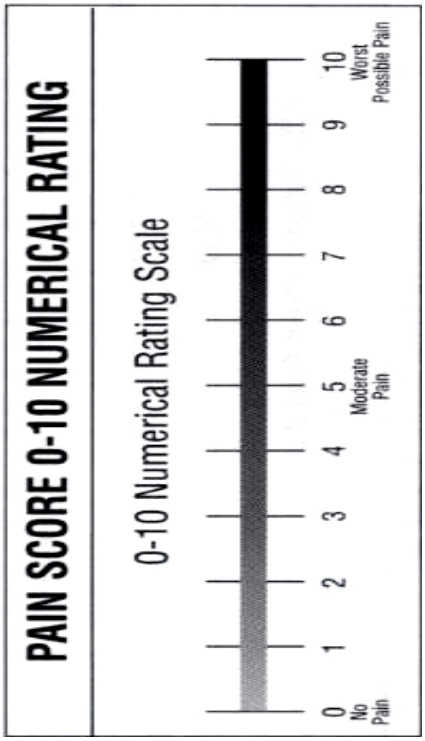

Fig (1): Numerical rating scale (NRS) adopted from [15]

Parameters used were frequency 100, D 2, MJ.288.0, Time, 15min, 3 times per week for 8 weeks. Trigger point's application (TPA) was used for E1, the probe was placed contact extra-orally over the most trigger points.

For Experimental (E2) group, same as E1 but the laser probe was applied following the path of the trigeminal nerve branches (NPA), **Fig** (3). For control (C) group, placebo technique was followed, the same procedures as experimental groups but laser devise was not turned on.

Fig(2)**:** Low level Laser device

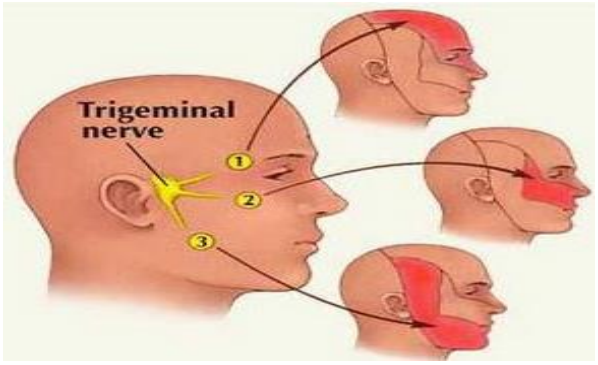

Fig (3): Pathway of trigeminal nerve branches adopted from [16]

Statistical Analysis

Continuous variables were presented as mean and standard deviation while categorical variables were described by frequency and percentage. Paired T-test was used to test the differences in outcome measures within group. Analysis of Variance (ANOVA) test was used for comparison between E1, E2 & C groups while independent t –test was used to compare the effect between both groups. Differences were assumed significant at p value <0.05. Statistical analysis were performed using Statistical package for the Social Sciences (SPSS) version 20.0.

Results

Among 48 patients, 3 patients were excluded because they had contraindications. 45 patients were classified randomly into 3 groups of equal number. Experimental Group 1 (E1) received LILT through TPA, Experimental Group 2 (E2) received LILT through NPA and Control Group received placebo LILT. All 45 patients completed the treatment procedures and analysis. Table (1) showed demographic and clinical characteristics at baseline of treatment. The three groups were comparable in respect to age ($p = 0.946$), Sex ($p = 0.297$), duration ($p = 0.974$), pain intensity ($p = 0.499$) . There were no significant differences as p value > 0.05.

Table (2) represent statistical analysis of pain intensity pre & post treatment within each group. There was significant reduction of pain after treatment in (E1) group with the percentage of improvement was 45%. For (E2) group there was significant reduction in pain intensity with the percentage of improvement was 34% while for group (C) there was no significant difference

pre & post treatment, p value=0.057. When comparing (E1) & (E2) post treatment there were significant differences p =0.030. Also there were significant differences when comparing group (C) with either (E1) or (E2). Results showed significant differences when comparing three groups together post treatment Table (3).

Table 1 represent demographic and clinical characteristics of patients at baseline of treatment .

Variable	E1 (TPA) (15)	E2(NPA) (15)	Control (15)	P value
Age (years)	38.93±7.23	39.80±7.18	39.20±7.40	0.946*
Sex (N) % • **Male** • **Female**	 8 (53.3%) 7 (46.7%)	 6 (40%) 9 (60%)	 5 (33.3%) 10 (66.7%)	0.297*
Duration post-surgery (day)	22.46±6.85	22.60±7.99	22.00±7.69	0.974*
Pain Intensity (Pre)	8.26±0.69	8.40±1.12	8.73±1.22	0.499*

* No significant difference

Table (2) represents pain intensity pre & post treatment within each group

	E1 (TPA)		E2(NPA)		Control	
	pre	post	pre	post	pre	post
Pain Intensity	8.3±0.69	4.5±1.1	8.40±1.12	5.5±1.45	8.73±1.22	8.1±0.83
P value	0.000**		0.000**		0.057*	
Percentage of improvement	45%		34%		7%	

* No significant difference ** Significant difference

Table (3) represents P value between groups post treatment.

Comparative Groups	P value between groups
E1 & E2	0.030**
E1 & C	0.000**
E2 & C	0.001**
E1 & E2 & C	0.000**

** Significant difference

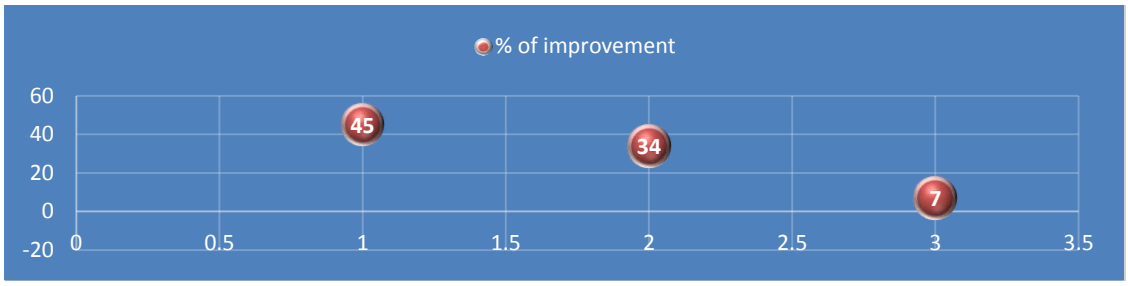

Figure 4: Percentage of improvement in 3 groups

Discussion

Among neuropathic pains trigeminal neuralgia (TN) has a peculiar profile. It is not accompanied by sensory deficit, at least as it can be judged by careful clinical examination. The mechanism of pain production in (TN) remains controversial. Any disease or injury of trigeminal nerve increases afferent firing in the nerve, also failure of central inhibitory mechanisms may be involved. Some authors speculate that chronic irritation of the trigeminal nerve apparently leads to both a failure of segmental inhibition of the trigeminal nucleus, and ectopic action potentials in the trigeminal nerve.[17]

In the last 30 years, many nonsurgical therapies have been suggested for the treatment of trigeminal neuralgia including pharmacological therapy and low level laser therapy (LLLT). Lasers have been used surprisingly little in the treatment of TN and neuralgias in general[18]. A few studies revealed that between laser and placebo group there were no significant difference with respect to the analgesic effect[19].

In the current study 45 patients were classified randomly into 3 groups. E1 received LILT through application over trigger points, E2 received LILT through application over nerve path and C group received placebo LILT through the same laser devise. Pain Intensity was measured before and after treatment by pain rating scale. When comparing the results between 3 groups after treatment, there significant reduction of pain in E1& E2 groups more than C group (p value <0.05), this confirmed the efficacy of LILT in the treatment of TN.

The suggested mechanism of LILT for relieving of pain may be due to its effect on prostaglandin (PG) synthesis, increase in the change of PG type G and PG type H2 into PG type I2, increase in beta-endorphins level in CSF, increase in glucocorticoids urinary secretion, increase in pain threshold in nerve fibers, increase in serotonin urinary secretion, decrease in histamine and serotonin secretion, decrease in bradykinin synthesis, change in norepinephrine and epinephrine activity, increase in ATP production, increase in local microcirculation[20,21].

The results of this study were in consistent with the results of previous studies. Eckedral[22] designed a double-blind, placebo controlled study to investigate effectiveness of low-level laser therapy (LLLT) on TN in Denmark. Sixteen patients suffering from TN were radiated with laser for 5 weeks (830 nm, 30 mW) and compared with 14 patients as control group. After one year follow-up they got to the point that LLLT is an effective method and an excellent supplement to conventional methods for TN therapy.

In a study of Samosiuk et al[23], 137 patients with typical TN were divided into 4 groups. 30 patients (G1) received EHF therapy (extremely high frequency puncture), 30 patients exposed to laser (G2), 67 patients treated with combination of laser and EHF-puncture (G3), 10 patients were in control group received physiotherapy. All patients were given carbamazepine. Best results were given from G3 which 31% of cases could stop carbamazepine and the rest of them could reduce its dose by 50-70%.

In the current study when comparing the results of E1& E2 post treatment, There were significant reduction of pain in E1 more than E2 (p value <0.05), this supported that the application of Laser over trigger points was more effective than application over nerve path. Simunovic[24] believed in his study that He-Ne laser is the most proper laser for TN and radiation in trigger points is more effective than any other points. He also reported that laser improves local microcirculation and it can also improve oxygen supply to hypoxic cells in the trigger point (TP) areas and at the same time it can remove the collected waste products. The normalization of the microcirculation, obtained due to laser applications, interrupts the "circulus vitiosus" of the origin of the pain and its development.

Regarding side effects, our study reported that no one did not report any discomfort or side effect during the laser treatment. From results of the current and previous studies it was concluded that LILT was more effective than placebo and the Trigger points application of laser more effective than nerve path application.

Conflict of interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript

Source of funding

This research received no specific grant from any funding agency in the public, commercial, or not / for profit sectors.

Ethical clearance

We certify that this study involving human subjects is in accordance with Helsinky declaration of 1975 as revised in 2000 and it has been approved by the relevant ethical committee

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