
Use of Laser Phototherapy in The Treatment of Trigeminal Neuralgia

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ABSTRACT: Responsible for the sensory stimuli of the viscerocranium, the 5th pair of cranial nerves, called the trigeminal nerve due to its 3 branches, is a mixed-function nerve. The diagnosis of Trigeminal Neuralgia is directly related to the symptoms reported by the patient during the anamnesis. The right treatment depends on the correct diagnosis. The exact etiology of TN is still unknown. It affects around 4 to 13 individuals per 100,000 and although it seems to be a neuropathy with a low incidence, it is the most common among facial pain syndromes. A retrospective cross-sectional observational study was carried out. We used data on laser therapy treatment for Trigeminal Neuralgia, received and treated at the Laser Clinic of the Faculty of Dentistry of the Federal University of Bahia, from 2003 to 2022. A total of 119 patients with a diagnosis of Trigeminal Neuralgia were treated, most of them with unilateral pain (89%). After diagnosis, the initial irradiation protocol was determined individually. The laser frequency applied was 808 nm (infrared) due to its greater ability to penetrate and activate chromophores in nerve and bone structures. The amount of energy applied varies from case to case, usually starting with 2 or 3 J per point, which is indicated for cases of regeneration and analgesia. The final status of the treatment is based on the patient's score according to the visual analog scale, where 10 is the highest pain threshold and 0 is no pain. 65% of the patients related no pain or at least under 3 grades before the first degree Laser phototherapy is an effective means of recovery, reducing pain symptoms and improving the quality of life of patients with Trigeminal Neuralgia, and the infrared wave spectrum is the most suitable for this treatment.

KEYWORDS: Facial Pain; Trigeminal Neuralgia; Laser Therapy.

1. INTRODUCTION

Responsible for the sensory stimuli of the viscerocranium, the 5th pair of cranial nerves, called the trigeminal nerve due to its 3 branches, is a mixed-function nerve. Among the most common craniofacial pains is trigeminal neuralgia (TN), a chronic disease marked by intense pain that can be disabling and affect the patient's daily life [1, 2, 8]. It has an estimated incidence of 27 cases per 100,000 individuals and is slightly more common in females. Episodes of TN pain paroxysms last between seconds and two minutes and can be repeated daily [3].

The exact etiology of TN is still unknown. Still, it is usually associated with predisposing factors such as compression of tooth roots or nerve branches by tumors or blood vessels, trauma to the trigeminal nerve branch region, inflammation, which may or may not be associated with infections and post-surgical injuries [9].

The diagnosis of TN is directly related to the symptoms reported by the patient during the anamnesis. Professionals should pay attention to the main and differential characteristics such as a burning sensation, unilateral pain in the region of trigeminal innervation, the duration of the episode, and the sensation of an electric shock [4].

The right treatment depends on the correct diagnosis and consists of improving the patient's quality of life and reducing pain. The main current treatment is pharmacological, using anticonvulsants, which are effective in relieving neuropathic pain, especially in cases of burning sensation and perforation, followed by physiotherapy and surgical treatment using different techniques [1, 5].

The effect of photobiomodulation on the control of neuropathic pain has already been scientifically proven and described in the literature. Ibarra et al. (2020) [12] in their systematic review showed that the laser effect is associated with an acceleration of mitochondrial activity, modulation of the nociceptive information received by the neuron, as well as a reduction in the inflammatory process.

Laser therapy is an extremely safe technique due to its proven lack of harmful effects on the individual [6]. It has shown considerable patient acceptance due to its low cost, minimally invasive nature, analgesic effect on chronic and acute pain, modulation of inflammation, and contribution to the process of wound healing and tissue repair [7], which is why it has been indicated as a therapy for TN.

Use of Laser Phototherapy in The Treatment of Trigeminal Neuralgia

The therapeutic action of the laser is through low-power electromagnetic radiation, using a therapeutic wave of a specific length. The biochemical effects of the therapy are based on the absorption of light by the chromophores, causing physiological repair, bioenergetic modulation, and boosting the production of Adenosine Triphosphate - ATP, accelerating the metabolism of the diseased tissue and causing repolarization of the cell membrane [4, 13].

Kalhori, et al. (2019) [14] concluded in their studies with photobiomodulation in oral medicine the effectiveness of PBMT as an alternative treatment or in combination with other therapies in improving symptoms or in the complete treatment of oral and facial diseases, including TN.

This study aimed to evaluate the effectiveness of laser phototherapy in reducing pain in trigeminal neuralgia treated at the university laser clinic, a service accredited to the Unified Health System, between 2003 and 2023.

2. MATERIALS AND METHODS

A retrospective cross-sectional observational study was carried out. We used data on laser therapy treatment for Trigeminal Neuralgia (International Code of Diseases and Health Problems - ICD 10: 50.0), received and treated at the Laser Clinic of the Faculty of Dentistry of the Federal University of Bahia - FOUFBA, from 2003 to 2022.

After completing an anamnesis, which included socio-demographic variables, medical and dental history, medication use, and comorbidities, the patient was assessed by an experienced professional through an extra-oral and intra-oral clinical examination. These were the study variables.

The Visual Analog Scale (VAS) is used in all the consultations. It helps to assess the intensity of the pain and discomfort caused by the NT as reported by the patient: No pain (0 zero), moderate pain (5 five), and (10 ten) for severe pain. Success after the treatment was defined as no pain or, at least a reduction of 3 points of the first measurement (better pain).

After diagnosis, the initial irradiation protocol was determined individually by the Laser Center coordinator, with the dosimetry adjusted according to the severity of the symptoms. The infrared diode laser was used and the application was carried out every 48 hours, for a total of 12 sessions, after which the patient was again assessed for pain perception.

The laser frequency used and indicated for cases of trigeminal neuralgia is infrared (808nm) due to its greater ability to penetrate and activate chromophores in nerve and bone structures.

The amount of energy applied varies from case to case, generally starting at 2 or 3J per point, which is indicated for cases of regeneration and analgesia. The devices were calibrated at 100 MW of power, which corresponds proportionally to 1J = 0.10 seconds of application, delivering 100.0 J/cm².

The protocol adopted for monitoring the applications follows a total number of 12 sessions, characterizing 01 cycle. After the first application, the patient must return every 48 hours for a new application, as this average time is considered active for the chromophores after energization with laser light. At each session and before the new application, the patient assessed the level of perceived pain using the VAS scale. After a complete cycle, the patient underwent a new evaluation to ascertain the need to modify the protocol (amount of energy and application points).

Patients who agreed to the Free and Informed Consent Form (FICF), of both sexes, aged 18 and over, treated between 2003 and 2020 and 2021 and 2022 by referral from the FOUFBA clinics or by spontaneous demand via the SUS, were considered eligible to take part in the study. Patients who did not agree to the terms of free and informed consent and those who abandoned treatment during the period mentioned above were excluded from the study.

The variables defined for the following study are based on aspects of correlation with Trigeminal Neuralgia, namely age, gender, medication, reason for consultation or main complaint, and medical and dental history.

Chi-square, Student's t-test, and ANOVA with Tukey's post-test were used to identify the effectiveness of the treatment and associated variables. All the analyses were carried out using the Minitab program, version 14.

3. RESULTS AND DISCUSSION

According to Table 1, 119 patients were seen, 33 men (27.73%) and 86 women (72.27%), with an average age of approximately 58 years. Araya et al. (2019) [15] discuss various studies showing that the prevalence of TN is twice as high in females. Toledo et al. [16] in a systematic review of the prevalence of TN showed a 3:1 ratio between females and males.

The main reasons or complaints were facial pain (61.34%), diagnosis of Trigeminal Neuralgia (23.53%), odontalgia and pain in the alveolar ridge (6.72%), pain, paresthesia and paralysis of the face in branches of the trigeminal nerve with pain in the temporomandibular joint (4.20%) and complaints such as hyperesthesia in one or more branches of the Trigeminal Nerve, as well as difficulty chewing. Concerning the side of the face (47.06%) of the patients had complaints on the right, (42.86%) on the left, and (10.08%) simultaneously on both sides.

Use of Laser Phototherapy in The Treatment of Trigeminal Neuralgia

Table 1. Characterization of the population with Trigeminal Neuralgia treated at the Laser Clinic of the FOUFBA Biophotonics Centre, Salvador-BA, between 2002 and 2023.

Variables	N	%
Gender		
Female	86	72.27
Male	33	27.73
Age group		
27 to 50 years old	22	18.33
51 to 92 years old	97	81.67
Medical and Dental History		
Toothache and alveolar ridge pain	8	6.72
TMJ pain or dysfunction	6	5.04
Facial pain	73	61.34
Paresthesia in the face	1	0.84
Difficulty chewing	1	0.84
Trigeminal neuralgia	28	23.53
Hyperesthesia	2	1.68
Use of Medications		
Analgesics and anticholinergics	19	15.97
Anti-inflammatory	3	2.52
Anticonvulsants	15	12.61
Antihypertensives	22	18.49
Antidepressants and Anxiolytics	3	2.52
Antifungals	1	0.84
Anticoagulants	1	0.84
Hypoglycemic agents	2	1.68
Insulin	2	1.68
Homeopathic	2	1.68
Chemotherapy	1	0.84
Contraceptives	1	0.84
Affected side		
Right	56	47.06
Left	51	42.86
Bilaterally	12	10.08
Total	119	100

Regarding the phototherapy used, the data can be seen in Table 2. Patients irradiated with red laser corresponded to 6.72%, with infrared laser 78.16%, LED 6.72% and those who received both red and infrared laser corresponded to 8.40%. There was a similar distribution of patients who completed the 12-session cycle (43.7%), but 46.22% had fewer sessions, while 10.08% abandoned treatment.

Table 2. Characterization of laser protocols and applications in patients treated at the FOUFBA Biophotonics Center Laser Clinic, Salvador-BA, from 2002 to 2023.

Variables	N	%
Wavelength		
Red	8	6.72
Infrared	93	78.16
LED	8	6.72
Red and Infrared	10	8.40
Cycles performed		
Complete	52	43,70

Use of Laser Phototherapy in The Treatment of Trigeminal Neuralgia

Incomplete Abandoned	55 12	46,22 10,08
Total	119	100

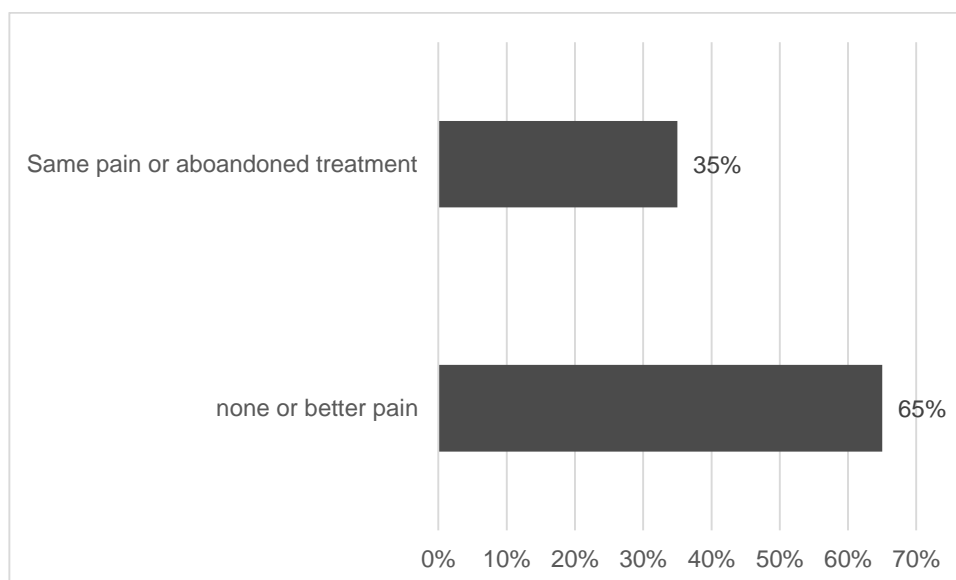
Pinheiro et al. (1998) [17] in a randomized controlled clinical trial, used the infrared laser (880 nm) in patients with maxillofacial pain and showed statistically significant results in terms of analgesia, comparing the case group to the control group. These results are in line with those presented in this study.

The laser irradiation protocols are presented in median analysis (table 3), with approximately 2.58 points or regions of laser application, with a dose per point of 23.60 J/cm², giving a total dose of 35.10 J/cm² in each session and a dose of 352.8 J/cm² at the end of the cycle.

Table 3. Characteristics in median and standard deviation analysis of laser protocols and applications in patients treated at the Laser Clinic of the Biophotonics Center of FOUFBA, Salvador-BA.

Variables	Medium (J/cm ²)	Standard Deviation (J/cm ²)
Points or regions of application	2.58	1.48
Dose per point/region	13.6	-
The total dose per session	35.1	8.39
Total of sessions	27.0	4.48
Final dose (Total dose x Total Sessions)	352.8	85.4

The final treatment situation, shown in Graph 1, is based on the patient's score on the visual analog scale, where 10 is the highest pain threshold and 0 is no pain. Of the sample (34.45%) of patients still had painful symptoms with little or no change in the VAS score, (55.47%) of the sample showed improvement or total recovery from pain, and (10.08%) of the sample abandoned treatment.



Graph 1. Final treatment status of the population with Trigeminal Neuralgia, treated at the Laser Clinic, at the FOUFBA Biophotonics Center, Salvador-BA, from 2002 to 2023.

A case-control study by Ebrahimi et al. (2018) [5] showed significant results in terms of pain reduction and control using the infrared laser, using the VAS scale to assess pain. According to the authors, the intensity of the pain decreased until the end of the patients' treatment, returning after 4 months, but with an even lower score compared to the beginning of the treatment.

Use of Laser Phototherapy in The Treatment of Trigeminal Neuralgia

.Seada, Nofel, and Sayed (2013) [18] in a clinical study, similar to the present study, with 30 patients with multiple sclerosis and Trigeminal Neuralgia, also showed positive results in pain control and improvement in quality of life after the end of the proposed treatment using low-level laser.

However, certain limitations should be noted in this study - the absence of a control group or untreated group, potential confounding effects due to concurrent medication use, and variables that are difficult to control in a cross-sectional study design. Nonetheless, photobiomodulation has proven to be an easily administered and effective treatment for pain management and quality of life enhancement in patients.

4. CONCLUSIONS

Laser phototherapy was an effective means of recovery, reducing pain symptoms (65%) and improving the quality of life of patients with Trigeminal Neuralgia. The infrared wave spectrum is the most suitable for this treatment.

The therapeutic or cyclic dose (CD) to be applied influences the positive outcome of the treatment, determined individually for each patient according to their complaints, medical and dental history, medications in use, and the affected area. Laser therapy is an alternative with great potential for use in public services, which is easily accepted by patients, easy to apply, has low maintenance costs, and contributes to treating the pathology.

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Use of Laser Phototherapy in The Treatment of Trigeminal Neuralgia

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