



TREATMENT OF LINGUAL NERVE PARESTHESIA THROUGH PHOTOBIMODULATION THERAPY: A CASE REPORT EMPLOYING AN APPROACH INTEGRATING EXTRAORAL AND INTRAORAL MODALITIES

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ABSTRACT

Aims: Oral nerve injuries are the primary cause of paresthesia in the head and neck regions.

To report the managing of a combined protocol involving extraoral and intraoral photobiomodulation (PBM) therapy for lingual nerve paresthesia.

Case report: A 38-year-old female patient underwent 25 PBM sessions using laser with dual wavelength infrared (810nm + 980 nm). The extraoral application included 6 seconds and 6J per point. per point, 1W, 4.91 cm², 1.2 J/cm. The intraoral protocol with 0.3W of power, a spot size of 0.38 cm², 15.78 J/cm² of energy density, 6J of energy per point, for 20 seconds.

Results: Assessment of neurosensitivity on the dorsum of the tongue was a 75% improvement. On the lateral tongue improved to 50%. In the floor of the mouth, PBM demonstrated a 25% improvement.

Conclusions: PBM is an important treatment option in the case of lingual nerve paresthesia. The use of PBM should be considered as a feasible, non-invasive treatment approach.

KEYWORDS: Paresthesia. Photobiomodulation. Oral Nerve Injuries.

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INTRODUCTION

Paresthesia is a neurosensory condition, which can be either temporary or permanent, and often occurs after oral surgical procedures due to the injury of anatomical structures of the oral cavity and their innervation¹. The lingual nerve is

responsible for the sensory innervation of the anterior two-thirds of the tongue and for the parasympathetic innervation of the sublingual and submandibular glands in the third division of the trigeminal nerve. It originates in front of the inferior alveolar nerve in the mandible

body. When the oral nerves are disturbed, tissue repair varies according to the degree of the injury²⁻³.

Several methods have been utilized for their effective recovery,

Table 1. PBM parameters

PBM PARAMETERS	INTRAORAL	EXTRA-ORAL
Wavelength (nm)	810 + 980 (50% 50%)	810 + 980 (50% 50%)
Operating mode	Pulsed	Pulsed
Frequency (hz)	50	50
Pulse duration (ms)	2	2
Duty cycle (%)	10	10
Peak power (W)	0.3	1.0
Average power (W)	0.3	1.0
Polarization	No	No
Beam area (cm ²)	0.38	4.91
Irradiated area (cm ²)	0.38	4.91
Beam shape	Circular	Circular
Beam profile	Gaussian	Gaussian
Power density (mW/cm ²)	790	204
Energy fluence or density (J/ cm ²)	15.78	1.2
Application time per point (s)	20	6
Energy per point (J)	6	6
Application technique	Contact	Contact
Number of irradiated points	9	2
Frequency of sessions	First 20 sessions:3 times a week, Last 5 sessions: 1 time a week	

such as the administration of vitamins B and C, acupuncture, and PBM⁴⁻⁵. PBM is a therapy in which non-thermal light modulates the cells and tissues without the generation of heat. Studies have shown that PBM plays a crucial role in the regeneration of peripheral nerve injuries⁶⁻⁹. However, studies on the effectiveness of extraoral and intraoral PBM in patients with oral nerve paresthesia are limited.

So, the objective of the present study is to report a case involving a 38-year-old female patient who presented with lingual nerve paresthesia and was treated with PBM therapy.

CASE REPORT

A 38-year-old female, in good general health, underwent surgical crown lengthening in her left inferior retromolar region. Articaine was used for anesthesia, and a V-shaped wedge was used to remove a distal portion of the gingiva around the second molar. While performing the procedure, the presence of the mandibular retromolar canal was noted, and precautions were taken to minimize tissue manipulation. Even though, during suture removal, the patient reported numbness, tingling, and a loss of sensation in the

lateral edge of the tongue, the floor of the mouth, and the dorsum of the tongue. A diagnosis of lingual nerve paresthesia was made, and the patient was referred for PBM therapy.

Assessment for the neurosensitivity

The Visual Analogue Scale (VAS) was used as a neurosensitivity scale for subjective neurosensory assessment of a patient's paresthesia. The scale involved a 10-centimeter instrument with divisions at 2.5-centimeter intervals, representing 5 degrees. The degree divisions were as follows: 1 (no sensation at all), 2 (almost no sensation), 3 (reduced sensation), 4 (almost normal sensation), and 5 (completely normal sensation). The patient was instructed to mark an "X" on the scale for each part of the test according to her degree of sensation. The test was performed using a thin needle on both sides of the oral cavity—on the right side without nerve damage and on the left side with paresthesia⁹.

Management of paresthesia

The PBM parameters used are described in **Table 1**. The laser employed was a gallium-aluminum

arsenide diode (Gemini EVO®, Ultradent Products, Inc.) with dual wavelengths of 810 + 980 nm. Intra-oral PBM was conducted with a 7mm tip, having 0.3W of power, a spot size of 0.38 cm², 15.78 J/cm² of energy density, 6J of energy per point, for 20 seconds. The extra-oral application was performed with a 25mm tip, featuring 1W of power, a spot size of 4.91 cm², 1.2J/cm² of energy density, 6J of energy per point, for 6 seconds (**Table 1**). The intra-oral application points were the dorsum of the tongue, lateral border of the tongue, and floor of the mouth (3 points in each region). The extra-oral application points were placed perpendicularly on the right side of the face and in the submandibular region (**Figure 1**). Initially underwent 20 PBM sessions, three times a week. Following this period, the patient received an additional 5 sessions once a week for 5 weeks. Vitamin B Complex capsules [Citoneurin® composed of vitamin B1 (thiamine nitrate) 100 mg, vitamin B6 (pyridoxine hydrochloride) 100 mg, and vitamin B12 (cyanocobalamin)



Figure 1. The intra- and extra-oral irradiation points of the unfocused high-power laser.

5,000 mcg] were also administered to the patient for 40 days.

Evaluation of the treatment

In the initial VAS scale evaluation, the patient rated the sensation in oral regions as follows: dorsum of the tongue, total absence of sensation (score 1); border of the tongue, almost no sensation (score 2); and floor of the mouth, almost no sensation (score 2). **Figure 2** depicts the VAS analysis during 25 sessions of extra- and intra-oral PBM. Overall, there was a substantial 75% improvement in the dorsum of the tongue region. The border of the tongue exhibited a 50% enhancement in sensitivity, while the floor of the mouth displayed a 25% improvement. The patient's self-report was an overall improvement in sensitivity of 60%.

DISCUSSION

The inferior lingual nerve, a branch of the third division of the trigeminal nerve, is responsible for the innervation of crucial oral regions, including the tongue, sublingual, and submandibular glands². The incidence

of paresthesia in the inferior lingual nerve after surgical procedures varies, with a reported incidence of 1 in 609,000 for nerve involvement in general and 1 in 705,000 for inferior alveolar nerve block. The use of 4% articaine solutions is implicated in most sensory damage cases³. In this context, a clinical case of lingual paresthesia caused by a gingival surgical procedure and the use of articaine, successfully managed with PBM and a vitamin B complex is presented in this clinical case.

Paresthesia represents abnormal sensations, whether spontaneous or provoked, and can manifest as a complete loss of sensation, burning, tingling, or pain in response to stimuli^{10,11}. Injury to the inferior lingual nerve commonly occurs due to direct iatrogenic damage during surgical procedures, such as third molar tooth extraction, dental implant placement, or gingival procedures. The presence of a retromolar foramen (RMF), an anatomical variation with an incidence varying from 5.4% to 26.6%, is often associated with more complications

including unexpected bleeding, hematoma formation, and nerve damage. This is attributed to the nerve's proximity to the retromolar region, approximately 7.2 millimeters away². Nerve injuries can result in a loss of sensitivity in the entire innervated area, with paresthesia being the most common manifestation.

In addition, some studies have indicated that the composition of anesthetic agents can contribute to local paresthesia. Articaine and prilocaine, especially at higher concentrations like 4%, have been associated with more cases of paresthesia in certain studies^{3,11-13}. In this clinical case, surgical procedure was performed using articaine as the anesthesia solution. Although unlikely, this may explain the paresthesia. It is crucial to emphasize that the patient did not experience a complete loss of sensitivity, indicating that there is no permanent nerve damage.

The recovery of nerve injuries and, consequently, the treatment of paresthesia have been managed through various methods like systemic medications (vitamins B and C and anti-inflammatory), local physiotherapy, electrical stimulation, acupuncture, and microsurgery, as described in the literature¹⁰. Several studies have demonstrated the effectiveness of intra-oral PBM in treating paresthesia resulting from injuries after third molar extraction, particularly injuries to the inferior alveolar nerve^{6, 14-15}. In the present clinical case, we used for the first time a combination of PBM with extra-oral defocused high-power laser with intra-oral in the management of lingual nerve paresthesia. An energy dosage of 6J was used per point and an infra-red laser for PBM to treat paresthesia, in accordance with Ozen and collaborators (2006)⁹. Although our equipment differed from that used in Ozen's study, we adjusted the parameters to obtain the dose asked on

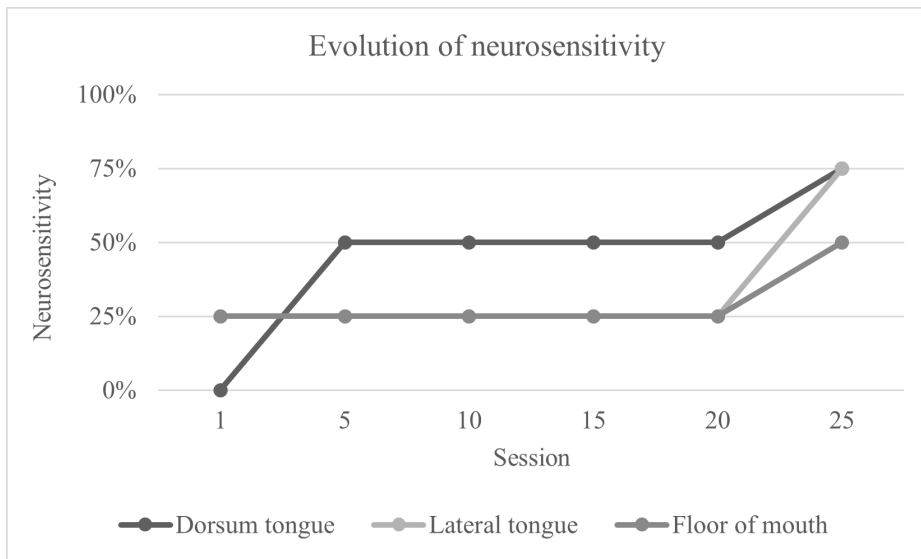


Figure 2. Graphical image showing the evolution of the patient in terms of sensitivity from the first to the last session.

therapeutic requirements⁹. To deliver 6J of energy, a device with an intra-oral tip featuring dual wavelengths of 810 + 980 nm, 0.3W of power, and 20 seconds per point was used. Additionally, extra-oral PBM irradiation was used as an adjuvant therapy to intra-oral treatment. The same 6J energy was delivered, but with a 25mm tip and 1W of power for 6 seconds. The selection of extra- and intra-oral PBM was suggested due to the anatomical position of the lingual nerve. This nerve lies below and behind the third molar, potentially meeting the periosteum of the jaw or the upper surface of the mylohyoid jaw. The lingual nerve is situated anteriorly, above the mylohyoid, on the floor of the mouth. According to the anatomy of the lingual nerve, it descends to the ventral surface of the tongue, encircling the submandibular duct before providing sensitivity to the anterior two-thirds of the tongue¹⁶.

The benefits of PBM have been extensively discussed in the literature. Its primary mechanisms involve increasing cell metabolism through the stimulation of various genes, resulting in cell proliferation, protein synthesis, collagen production, and,

consequently, tissue regeneration^{4,17}. In cases of nerve injury, PBM acts by activating axons and schwann cells, inducing myelin production, and reducing neuronal degeneration. The protective effect of PBM also helps preserve the functional activity of the injured nerve^{4,18}. In a study by Oliveira et al. (2021)¹⁵, PBM was employed with extra- and intra-oral irradiation following the nerve path. Patient received 20 sessions, twice a week, and achieved excellent results in terms of cold perception and neural regeneration very similar to results obtained in the case reported in our study.

Extra-oral PBM offers significant therapeutic advantages. Its application is simple and can cover a larger area in a shorter amount of time. Furthermore, it plays a crucial role, especially in providing energy to the tissue. However, the delivery of energy in extra-oral PBM depends on various factors, including the external layer of the skin, the presence of melanin, and fat. This necessitates further studies for the correct dosimetry and protocol of this therapy¹⁹. The use of extra-oral PBM has demonstrated effective results in other conditions, such as oral

mucositis¹⁹⁻²⁰. Nevertheless, there are very few published studies in the literature on the use of extra-oral PBM in cases of paresthesia.

In the present study we used the Visual Analog Scale (VAS) for evaluate the impact of PBM treatment. VAS is an essential tool for evaluating paresthesia and sensitivity, proving effective in assessing and standardizing signs and symptoms. Numerous studies have affirmed the reliability of this scale in assessing neurosensitivity^{8, 21}. In the presented case report, the patient initially displayed some level of sensitivity, suggesting an absence of definitive nerve damage. There is a need for additional reports to further establish the effectiveness of this approach based on the limitation of a clinical case report. However, the major merits of case reporting are detecting novelties, generating hypotheses and high applicability when other research designs are not possible to carry out^{8,21}.

Furthermore, the use of vitamin B complex is an important adjuvant in the management of paresthesia. Vitamin B plays a fundamental role in energy metabolism, especially in nervous tissue, in the treatment of injuries to other nerves such as the inferior alveolar nerve, the vitamin B complex has an important effect, reducing pain and increasing tissue regeneration^{22,23}.

However, additional reports are needed to further substantiate the effectiveness of this approach, given the inherent limitations of a clinical case report. Nevertheless, the notable strengths of case reports lie in its ability to identify novelties, generate hypotheses, and offer practical value when alternative research designs are impractical. This approach allows for a comprehensive understanding of the narrative and holds educational significance²⁴.

CONCLUSION

Our study demonstrated the effectiveness of extra- and intra-oral PBM in combination with vitamin B in managing lingual nerve paresthesia resulting from an iatrogenic injury during a dental procedure. This underscores the importance of recognizing anatomical structures for well-planned and executed surgeries. In cases of nerve damage, early diagnosis and treatment approach are crucial for success. Our findings suggest that extra- and intra-oral PBM therapy associated with vitamin B intake can be a valuable and feasible treatment option for nerve recovery. It highlights the potential of this approach in addressing and improving outcomes for patients with lingual nerve injuries.

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