Use of Photobiomodulation for Anesthesia Puncture Pain Reduction: A Case Report

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Abstract

The objective of this study is to evaluate the effect of photobiomodulation (PBM) on pain control during pterygomandibular puncture. A patient received anesthesia on both sides of the mouth in a randomized manner. On the right side, an 808nm infrared low-level laser was applied before local anesthesia. On the left side, a sham laser was applied using the same technique. There was a 50% reduction in pain levels on the PBM-treated side compared to the sham PBM side, as measured by the visual analog scale. Sensitivity tests revealed that anesthesia was more effective on the PBM side. There was no significant difference in blood pressure before and after anesthesia on either side. While these findings are based on a single case report, they suggest that photobiomodulation before anesthesia may alleviate puncture pain associated with anesthesia. Nevertheless, further well-designed clinical trials are necessary to confirm the effectiveness of this complementary therapy.

INTRODUCTION

Dental fear and phobia are highly prevalent in adults worldwide. Generally, this fear can be linked to trauma and is directly associated with dental care. Anxious patients have lower treatment adherence, which can lead to oral health issues and reduced quality of life [1,2]. Pain is commonly cited as the primary reason for this fear, with local anesthetic injection being the procedure most dreaded by patients [3,4].

The pterygomandibular is a challenging technique. Some students and novice professionals may struggle to identify anatomical landmarks accurately. Additionally, anatomical variations of the mandibular foramen can sometimes occur. Consequently, it is frequent to repeat or supplement anesthesia, increasing patient fear.

Other techniques have been developed to alleviate pain puncture. However, there is currently no standardized injection method or established protocol [5,6,7].

Photobiomodulation is a technique that employs low-level lasers for therapeutic purposes, serving as a complementary therapy across multiple health specialties [8,9]. In dentistry, it can be applied to many procedures, but its most effective effect is on pain management. This technique is safe and lacks contraindications or adverse effects. Some wavelengths were tested for this protocol [10,11,12,13,14,15], however, the lack of evidence on this topic, highlights the need for randomized and controlled clinical trials.

This study aims to provide a case report detailing the use of photobiomodulation as an adjunct for pain control during pterygomandibular puncture.

CASE REPORT

Patient M.R.F, male, 54 years old, with controlled systemic hypertension. He presented subgingival calculus and scaling, and root planning was performed. Bilateral pterygomandibular anesthesia was performed by the same operator. This study was accepted by the Ethics Committee (5.598.425) and followed CARE checklist (Figure 1)

Clinical features

The patient has expressed fear and discomfort with the anesthetic procedure since he was a child. In their own words, they stated, "I would prefer to feel pain during cleaning and restoration than to take anesthesia."

It used a carpule with a backflow prevention mechanism, two long needles, two tubes of Mepivacaine 2% with epinephrine 1:100,000, a low-power laser device (MMOptics^{TM}), and protective eyewear. (Figure 2-A).

To eliminate any potential placebo effect, the patient was blind to the procedures. A website *https://www.sealedenvelope.com* was employed to determine the initial treatment on the right side. Therefore, the right side was laser sham, while the left side was effective laser.

Figure 2- A) Materials used; B) Positioning of the laser; C) Puncture site

Photobiomodulation

It was observed that most studies used the infrared laser with high energy doses [10,11, 12,13,14,15]. Thus, the protocol of choice was adapted and described in Table 1 [13]. The laser was applied before anesthesia at the indicated site (Figure 2-B) and then anesthetized at the same site (Figure 2-C).

Table 1 – Dosimetric parameters

Pain assessment

The pain was measured using the visual analog scale (VAS), which consists of a 10cm line, from 0 (no pain) to 10 (the worst pain). The patient was instructed to mark a vertical line at the point that best matched the intensity of pain at that exact moment after the injection, on both sides.

Anesthetic Latency Time

To measure the beginning of the anesthesia effect, a digital stopwatch was used by an assistant who measured the results about sensibility in 2 and 5 minutes, according to professional orientation and the perception that the patient reported.

Blood Pressure

For safety reasons, blood pressure was measured before and after the procedure by the dental surgeon with a manual sphygmomanometer.

RESULTS

On the laser side, the pain sensation was 4,2 cm on VAS scale while on the sham side, it was 8,4 cm, 50% reduction in the pain sensation on the photobiomodulation side (Figure 3).

Figure 3- VAS (Visual Analog Scale)

A) Laser sham side: 8,4cm (VAS); B) Laser side: 4,2cm (VAS)

Supplementary anesthesia was not necessary on any side. The patient felt discomfort during the procedure on the sham side, while on the laser side, it was not reported. Concerning anesthesia duration time, on the laser side, the anesthetic latency time was better, the sensation of the lip, mucosa, and pulp test, and the time to anesthesia was quickly compared to the A-laser sham side.

No difference could be observed between blood pressure before and after anesthesia at either time point.

All the results obtained are shown in the table below (Table 2).

Table 2- Case report results

DISCUSSION

There is a demand for pre-procedure local anesthesia therapy to address the fear and trauma experienced by many patients during this procedure. This therapy should provide a safe, side-effect-free solution that effectively alleviates pain caused by needle punctures and eliminates the need for repeated anesthesia [2].

The effectiveness of the use of Photobiomodulation is already proven, and numerous well-designed studies have obtained positive results, especially in pain control. However, to date, there are no well-designed studies on the relationship between photobiomodulation and its action in local anesthesia [8,9].

This study found a 50% improvement in the patient's perception of pain, in line with other studies with anesthesia that have shown positive results. Sensitivity tests showed that anesthesia was more effective on the laser side, and there was no difference in blood pressure before and after anesthesia.

Given all other the studies found, it was not possible to find other outcomes evaluated, that is, it was not possible to compare results about anesthetic latency or the possible change in blood pressure. Studies that evaluate more than one outcome and not only pain are necessary since this is an area of application of photobiomodulation where there is a shortage of studies.

Even though this case report had positive results, we cannot state that the application of photobiomodulation before anesthesia is determinant to reduce pain and increase the effectiveness of local anesthesia since it also depends on the technique performed and possible anatomical changes of the patient, and this case, we evaluated only one patient. For this reason, more studies are needed to evaluate the mechanism of action of photobiomodulation in anesthesia and well-designed clinical studies to prove this possible effect.

Acknowledgments

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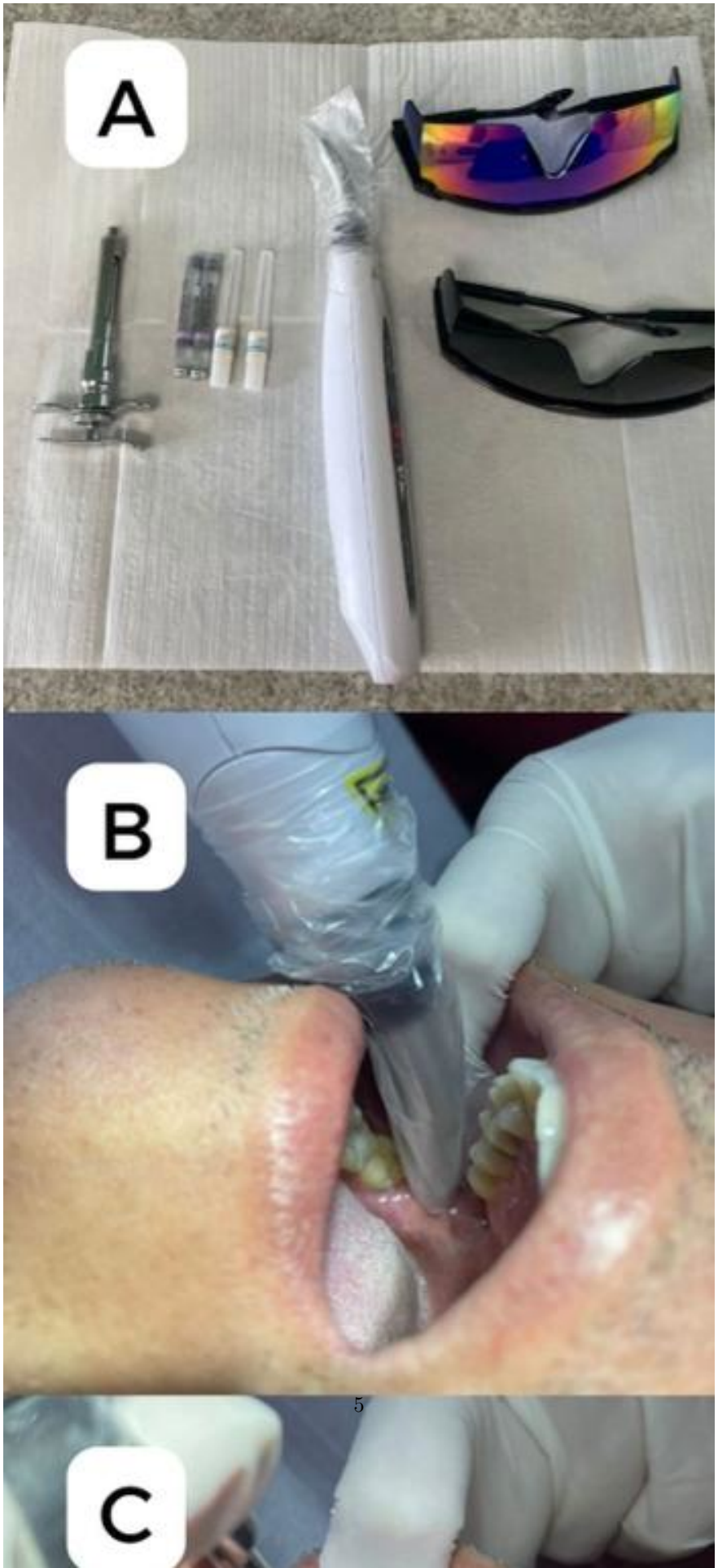
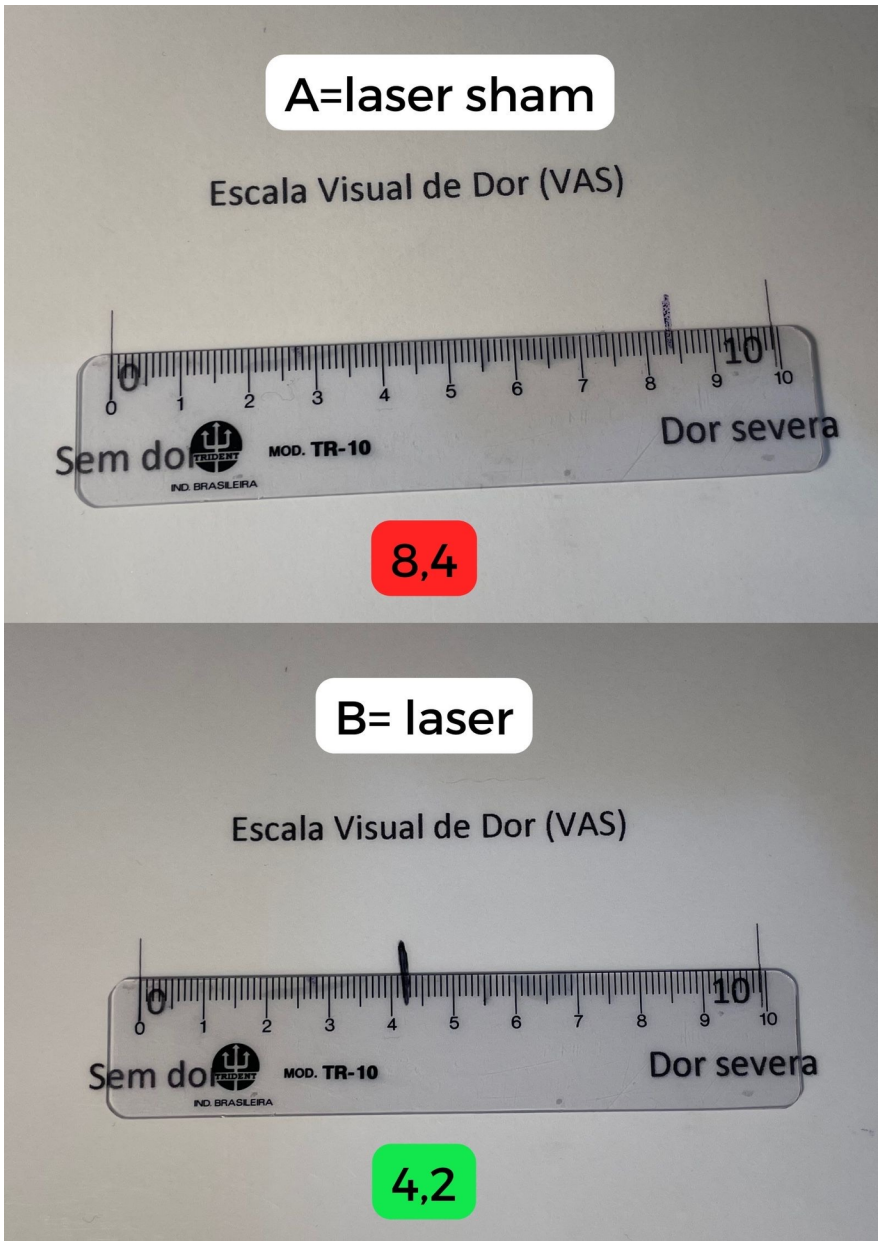
CARE case report guidelines

CARE Checklist of information to include when writing a case report BY-NC-ND ✓

Topic	Item	Checklist item description	Reported on Line
Title	1	The diagnosis or intervention of primary focus followed by the words "case report"	1
Key Words	2	2 to 5 key words that identify diagnoses or interventions in this case report, including "case report"	23
Abstract (no references)	3a	Introduction: What is unique about this case and what does it add to the scientific literature?	6
	3b	Main symptoms and/or important clinical findings	
	3c	The main diagnoses, therapeutic interventions, and outcomes	8
	3d	Conclusion—What is the main "take-away" lesson(s) from this case?	17
Introduction	4	One or two paragraphs summarizing why this case is unique (may include references)	1
Patient Information	5a	De-identified patient specific information	33
	5b	Primary concerns and symptoms of the patient	34
	5c	Medical, family, and psycho-social history including relevant genetic information	33
	5d	Relevant past interventions with outcomes	38
Clinical Findings	6	Describe significant physical examination (PE) and important clinical findings	33
Timeline	7	Historical and current information from this episode of care organized as a timeline	
Diagnostic Assessment	8a	Diagnostic testing (such as PE, laboratory testing, imaging, surveys)	
	8b	Diagnostic challenges (such as access to testing, financial, or cultural)	
	8c	Diagnosis (including other diagnoses considered)	34
	8d	Prognosis (such as staging in oncology) where applicable	
Therapeutic Intervention	9a	Types of therapeutic intervention (such as pharmacologic, surgical, preventive, self-care)	52
	9b	Administration of therapeutic intervention (such as dosage, strength, duration)	56
	9c	Changes in therapeutic intervention (with rationale)	53
Follow-up and Outcomes	10a	Clinician and patient-assessed outcomes (if available)	67
	10b	Important follow-up diagnostic and other test results	84
	10c	Intervention adherence and tolerability (How was this assessed?)	
	10d	Adverse and unanticipated events	
Discussion	11a	A scientific discussion of the strengths AND limitations associated with this case report	86
	11b	Discussion of the relevant medical literature with references	91
	11c	The scientific rationale for any conclusions (including assessment of possible causes)	
	11d	The primary "take-away" lessons of this case report (without references) in a one paragraph conclusion	
	12	The patient should share their perspective in one to two paragraphs on the treatment(s) they received	84
Patient Perspective	13	Did the patient give informed consent? Please provide if requested	
Informed Consent			Yes ☑ No ☐





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