Case report

Photobiomodulation Therapy in Bell´s palsy: a case report

ABSTRACT

Aims: The primary concern for patients with Bell's palsy is the impact on their ability to express facial emotions, which significantly affects well-being and self-esteem. Facial expressions are essential for social connections, and the growing use of online work tools and social networks amplifies their importance.
Study design: Case Report
Methodology: Red PBM (660 nm ± 10 nm) was applied to the temporal, zygomatic, mandibular, and cervical regions (2 J per point, 2 points per region), while infrared PBM (808 nm ± 10 nm) was administered to the temporal, supra-auricular, submandibular, and posterior cervical ganglia regions (2 J per point, 2 points per region). A total of 10 points were treated with red PBM and 8 with infrared PBM.
Results: This case report describes the successful use of a four-sessions photobiomodulation (PBM) protocol with red and infrared lasers on facial regions affected by Bell's palsy, leading to notable improvements in smile symmetry, eyebrow movement, and eye closure. Since the first session, patient presented visible improvements in smile, eyebrow arching and eye closure.
Conclusion: These results suggest that PBM may be an effective tool for managing facial paralysis, offering patients a non-invasive treatment option with minimal adverse effects. Further clinical trials are recommended to explore its broader therapeutic potential.

Keywords: Photobiomodulation; Bell's palsy; Facial expressions; Facial paralysis

1. INTRODUCTION

Bell's facial paralysis or peripheral facial paralysis (PFP) is defined as an idiopathic peripheral paralysis of one of the seventh facial nerves, with a sudden onset. Approximately 40,000 people in United States are affected by PFP annually (1,2).Various etiological factors are associated to the PFP, including trauma, viral infection, inflammation, metabolic alterations, tumors, toxins, congenital factors, both acute or chronic otitis media, and environmental factors such as cold exposure(3). Recently, it was hypothesized that the risk of PFP might increase following COVID-19 vaccination; however, no evidence has been found to support this association (4).

The PFP involves an inflammatory process of the nervous facialis, resulting in paralysis and loss of facial expression, either partially or fully (2). This condition compromises aesthetics and significantly impacts the patient's psychosocial well-being (5). There is a notable association between PFP mental health disorders, anxiety, depression and significant disruptions in social activities, public behavior, professional performance, and interpersonal communication (6,7) . While most patients experience natural recovery within

a few weeks to months, some individuals may suffer long-lasting effects, underscoring the need for effective treatments.

The primary treatment options for Bell's palsy focus on reducing inflammation, promoting nerve recovery, and minimizing complications. These approaches include the use of corticosteroids and antiviral medications (3), facial exercises and physical therapy (8) , and botulinum toxin injections (8, 9, 10). Other treatment options have also been proposed, such as osteopathic treatment (11,12).

Photobiomodulation (PBM) is a therapeutic approach that utilizes laser or light emitting diodes (LEDs) to modulate mitochondrial function, cell signaling, metabolism, and oxidative stress leading to increased ATP production (13,.14)As a result, PBM has been reported to exhibit analgesic, anti-inflammatory, and tissue-healing effects (15, 16).Dueto the non-invasive nature and minimal adverse events, PBM has been extensively investigated as treatmentmodality for various diseases and inflammatory conditions, including adverse events associated to medical procedures (17-26).

In this context, PBM is considered a promising adjunct therapy for the treatment of PFP given its ability to modulate inflammation, promote tissue repair, and restore physiological homeostasis (11). A recent systematic review assessed the evidence regarding the PBM´s effects on facial nerve function and symptom severity in patients with Bell's palsy (3). The review reportedpositive outcomes in the majority of the studies, although the magnitude of improvement and treatment parameters varied. While PBM appears to be effective for Bell´s Palsy, no standardized treatment protocol has yet been proposed. This case report aims to illustrate the use of PBM in the treatment of PFP, empoyinga specific treatment regimen.

2. PRESENTATION OF THE CASE

This case report was written based upon the Case Reports Guideline (CARE) (27,28)(1,2). The patient D. L. F., 27 years old, Fitzpatrick skin type IV,presented to the clinic with left-sided facial paralysis and pain in the left posterior cervical area. The patient reported an onset of symptoms with loss of sensation in the tongue and severe pain in the left cervical region, following a period of intense stress. The patient had difficulty chewing and closing his eye, and felt anxious and uncomfortable due to his aesthetic conditions.The physician observed the patient's anxiety and discomfort related to aesthetic changes during consultations, which were further corroborated by the patient's self-reported dissatisfaction. However, no specific validated tool was utilized for objective assessment. Pain levels were evaluated using the Visual Analog Scale (VAS), while facial function, including muscle strength and the presence of facial paresis or paralysis, was assessed through facial expressions such as smiling and blinking, with findings documented through photographic records.

To determine the severity of the paralysis, patient performed facial expressions, such as smiling and blinking, which were documented though photographs. The patient presented with grade IV on the House-Brackmann (HB) facial nerve classification (29,30) indicating a moderately severe injury with obvious asymmetry, no forehead movement, and weakness with possible disfiguring synkinesis - Table 1. This scale, though initially created to classify the recovery of the facial nerve recovery post-surgery, is the most cited in literature for analyzing mimic muscles movements.The Committee on Facial Nerve Disorders recommends this system for evaluating and reporting all facial nerve recovery results. The HB classification can also serve as a prognostic tool for PFP; a grade higher

than II three months after symptom onset signals possible recovery with potential sequelae. The likelihood of recovery to HB I decreases as the severity of paralysis increases.

Table 1: House-Brackmann Grading Scale (30).

Grade	Description	Characteristics
I	Normal	Normal Facial Function
II	Mild Disfunction	Slight weakness on close inspection; normal tone and symmetry at rest
III	Moderate Disfunction	Obvious weakness +/- asymmetry, but not disfiguring; synkinesis, contracture or hemifacial spasm; complete eye closure with effort
IV	Moderately Severe Disfunction	Obvious weakness or disfiguring asymmetry; normal symmetry and tone at rest; incomplete eye closure
V	Severe Disfunction	Barely perceptible motion; asymmetry at rest
VI	Total paralysis	No movement

PBM therapy was initiated 7 days after the patient began pharmacological treatment prescribed by the physician (Prednisolone 40mg, Acyclovir 400mg, Alginac® 1000mg – a combination of Cyanocobalamin, Diclofenac sodium, Pyridoxine andThiamine). The PBM was applied using red (660 nm ± 10 nm) and infrared (808 nm ± 10 nm)diode lasers, each with a continuouspower output of 100 mW ± 20% (Elite, DCM, São Carlos, Brazil). Red PBM was applied to 2 points per region, targeting the temporal, greater and lesser zygomatic, marginal mandibular, and cervical regions, delivering 2 J per point(20 s, spot area at the target 0.023 cm^2, 86 J/cm^2, 20J per session). Infrared PBM was similarly applied to 2 points per region, targeting the temporal, supra-auricular, submandibular, and posterior cervical ganglia regions, also delivering 2 J per point(20 s, spot area at the target 0.023 cm^2, 86 J/cm^2, 8J per session). In total, 10 points were treated with red PBM and 8 with infrared PBM. The PBM sessions were repeated at 72-hour intervals, following the same protocol, for four additional sessions (Figure 1).

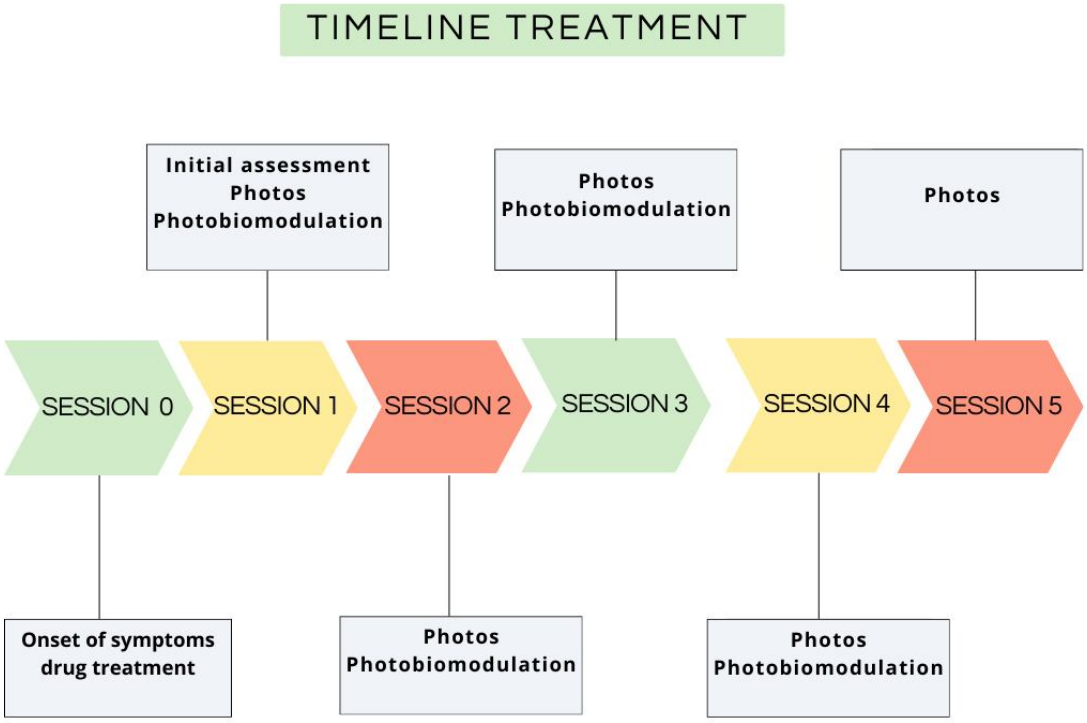

Fig.1. Timeline of the treatment. The four PBM sessions were performed with 72hour interval, while the fifth session was a photo documentation consultation, with no PBM application.

The initial facial analysis showed significant asymmetry. In the upper third, the left eyebrow was immobile when patient attempted to raise it, while the right eyebrow moved. The left eye exhibited minimal movement and was widely open. Analysis of the middle and lower thirds of the face revealed lip incompetence, with the left lip lower and the incisor teeth barely visible when smiling (Figure 2). After the first session, the patient's cervical pain subsided, and visible improvements were noted in his smile, eyebrow arching, and eye closure. Also, photographs were taken and the patient reported a reduction in discomfort.

By the time of subsequent sessions, even more significant improvements were observed (figures 2 and 3). The patient reported improved chewing function and noticeable positive progress in his psychosocial condition. Upon returning 72 hours after the last session, the patient showed significant improvement in his smile, eyebrow arching, blinking and self-esteem. He reported being able to work again, sleeping better, eating well, and experiencing high satisfaction with the treatment results. The patient tolerated the procedures without any discomfort or adverse effects.

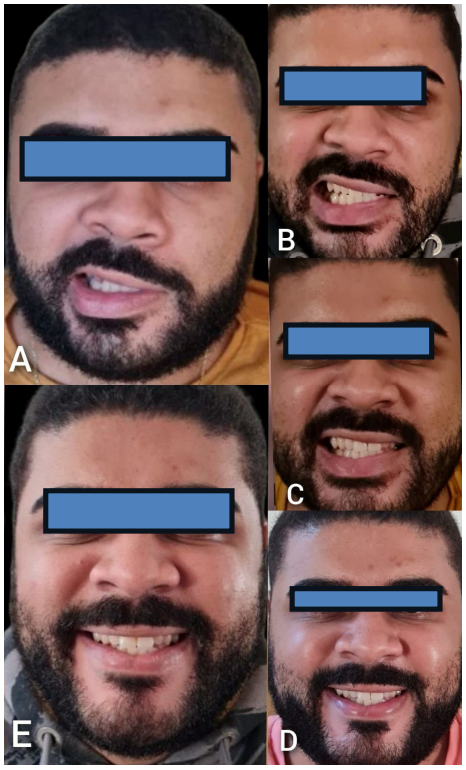

Fig. 2. Evolution of the smile after 4 PBM sessions. A) Before treatment; B) After 1 session; C) After 2 sessions; D) After 3 sessions; E) After 4 sessions.

Fig. 3. Visible improvements in eyebrow arching. A) Before treatment; B) after 1 session; C) After 2 sessions; D) After 3 sessions; E) After 4 sessions.

3. DISCUSSION

Photobiomodulation promotes tissue repair by stimulating cellular metabolism, increasing local microcirculation, and restoring physiological balance. When the facial nerve is inflamed, muscle functions are compromised, altering functional performance and significantly impacting the individual's social life.

In this case report, infrared PBM was applied to enhance regenerative capacity of certain nerve structures, promoting stimulated nerve function. PBM may favor reinnervation and induce damaged nerve tissue to endogenously produce proteins associated with nerve growth. The red PBM is known have anti-inflammatory effects, reducing the levels of pro-inflammatory cytokines and modulate the inflammatory process (15, 31). Early intervention in cases of Bell's palsy is crucial for preventing long-term sequelae. The combination of pharmacological treatment with early PBM can significantly enhance recovery outcomes. Studies have shown that early treatment with corticosteroids and antiviral agents can reduce nerve inflammation and viral load (32). However, integrating PBM to traditional treatment has potential synergistic effects.

The selection of appropriate PBM parameters, such as wavelength, dosage, and treatment frequency, is critical for maximizing therapeutic outcomes. Considering that early intervention is critical for preventing long-term sequelae in Bell's palsy, a short interval between sessions (72 hours) was selected. The number of sessions was determined based on the patient's clinical improvement, as previously described by Aimiri and coworkers (3). Research by Hamblin indicates that specific wavelengths, particularly in the red and near-infrared spectrum, can penetrate tissues effectively and stimulate cellular repair mechanisms (14, 31). Our use of dual wavelengths aimed to leverage these findings, providing a comprehensive treatment protocol. The light parameters were chosen based on literature suggesting that PBM's anti-inflammatory and stimulatory effects are found at 1-5 J range.This approach aligns with previous studies who indicated that low energy doses of up to 8J are effective for stimulatory PBM, aiming to increase ATP production, and enhance metabolism and cell proliferation. An energy dose of 2 J was chosen, falling within the established range (1–5 J) known for its anti-inflammatory effects. This resulted in an application duration of 20 seconds, aligning with values commonly reported for this therapeutic purpose (3). Parameters can vary significantly between studies, and no standard dosage or application technique has been consolidated. Recently, 4J per point was used and found effective results after seven sessions (33). In contrast, this study achieved resolution of facial paralysis with a lower radiant energy (2J) in just four sessions. These finding suggest that PBM is a promising adjuvant therapy for the treatment of PFP, particularly in cases where traditional treatments have not been satisfactory.

The strengths of the study include the resolution of the case with few PBM sessions and the absence of side effects. This study has several limitations. As a clinical case report, it lacks standardized and scientifically validated methods for patient evaluation and progress assessment, particularly in terms of muscle strength and psychosocial conditions. Given the subjective nature of these evaluations, they are influenced by key confounding factors typical of non-controlled trials, such as the natural course of the disease, the Hawthorne effect, regression to the mean, and the placebo effect (34). Nevertheless, the authors aim to encourage the development of randomized controlled trials with robust methodological designs, appropriate sample sizes, and validated assessment tools to enable broader generalization of the findings.

Additionally, an important factor to consider in future studies is the patient's Fitzpatrick skin type. In this case, the patient had Fitzpatrick skin type IV, characterized by higher melanin levels, which can act as a physical barrier to light penetration and potentially

influence the effectiveness of PBM (35). Furthermore, the wavelength of the incident light should be carefully considered, as longer wavelengths penetrate deeper into tissues. These factors should be systematically evaluated to develop optimized treatment protocols tailored to different skin types.Moreover, future research should include a broader range of skin types, account for variations in baseline health conditions among patients, and incorporate long-term follow-up evaluations. Such efforts will provide a more comprehensive understanding of PBM's efficacy and safety across diverse patient populations.

The patient was very pleased with the treatment results, especially the resolution of facial asymmetry. He was able to return to work, socialize, eat properly, and experienced a significant improvement in self-esteem. This case underscores the importance of addressing issued that affect the social life and dignity of individuals. This study highlights the importance of early treatment for Bell's facial paralysis to prompt a quick response. PBM was effective in reversing the paralysis and improving the patient's self-esteem and social.

4. CONCLUSION

It was reported the effective treatment of Bell's facial palsy with PBM protocol adjuvant to the pharmacological therapy. The authors emphasize the importance of the early treatment for reversing the condition. Further research on this subject is suggested, especially robust and low bias randomized controlled trials, focusing on the PBM treatment efficacy and the clinical implications of the biopsychosocial approach to Bell's Facial Palsy.

CONSENT

The patient has given informed consent for publication of this case report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the the Research Ethics Committee of Universidade Nove de Julho (UNINOVE) and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.This case report was approved by the number 7.088.804.

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