Int. J. Odontostomat.,
17(3):384-391, 2023.

Photobiomodulation in the Treatment of Bell's Palsy: An Integrative Review

Fotobiomodulación en el Tratamiento de la Parálisis de Bell: una Revisión Integradora

Elaine Bezerra de Oliveira[1]; Vanessa Beatriz Jales Rego[1]; Beatriz Diniz Duarte[2]; Priscila Leone Inácio[2]; Moisés Willian Aparecido Gonçalves[3] & William Alves de Melo Júnior[4]

OLIVEIRA, E. B.; REGO, V. B. J.; DUARTE, B. D.; INÁCIO, P. L.; GONÇALVES, M. W. A. & ALVES DE MELO JÚNIOR, W. Photobiomodulation in the treatment of Bell's Palsy: an integrative review. *Int. J. Odontostomat., 17(3)*:384-391, 2023.

ABSTRACT: Bell's palsy is defined as a lower motor neuron palsy that develops from a non-suppurative inflammation of the facial nerve at the stylomastoid foramen. The objective of this integrative review was to determine the effects of photobiomodulation as a therapeutic method for Bell's palsy. This qualitative study provided a broader understanding of the subject studied. Searches for articles were carried out in PubMed databases via Medline, LILACS, IBES, Scopus, Web of Science, Embase, and CENTRAL using MeSH and DeCS descriptors to determine the search terms. A total of 143 articles were found. After applying the inclusion and exclusion criteria, 7 articles were included. Therefore, it can be concluded that the application of low-level laser in the treatment of Bell's palsy is effective since the studies indicated significant and relevant improvements for the recovery of these patients when associating the laser with other types of treatments.

KEY WORDS: low-level light therapy, photobiomodulation therapy, Bell´s palsy, therapeutics.

INTRODUCTION

Bell's palsy (BP), discovered in the 19th century by the Scottish anatomist Charles Bell, is considered the most frequent acute mononeuropathy (Zhang *et al*., 2020).

This syndrome results in a unilateral paralysis of the muscles innervated by the facial nerve (Rowland *et al*., 2018) responsible for facial expressions (Tortora & Derrickson, 2016). Thus, Bell's palsy corresponds to an acute, self-limiting form of lower motor neuron palsy that develops due to non-suppurative inflammation of the facial nerve at the stylomastoid foramen, in which patients develop ipsilateral hemifacial palsy and loss of taste sensation in the anterior ? of the tongue (Kandakurti *et al*., 2020).

The possible etiologies of Bell's palsy are related to ischemic neuropathy, facial nerve swelling due to inflammation, and microcirculatory insufficiency (Celik *et al*., 2017). In addition, it can occur due to herpes simplex virus (HSV) infection (Tortora & Derrickson, 2016), diabetes, and hypertension (Rowland *et al*., 2018).

It is estimated that the incidence rate of Bell's palsy is 15 to 30 cases per 100,000 inhabitants, being more prevalent in the age group of 15 to 40 years of age (Zhao *et al*., 2017). It is independent of sex and geographic region, however, during pregnancy, the risk is three times greater, especially in the third trimester or in the first postpartum week (Corrêa *et al*., 2021).

Generally, the most common clinical features are muscle weakness, sensitivity to sound, flaccid eyebrow, inability to close the eyes, disappearance of the nasolabial fold, and mouth drawn to the unaffected side

[1] Universidade Federal de Campina Grande (UFCG), Centro de Saúde e Tecnologia Rural, Patos, Paraíba, Brazil.
[2] Universidade Estadual da Paraíba (UEPB), Campina Grande, Paraíba, Brazil.
[3] Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM), Diamantina, Minas Gerais, Brazil.
[4] Universidade Federal de Campina Grande (UFCG), Centro de Ciências Biológicas e da Saúde, Campina Grande, Paraíba, Brazil.

Received: 2022-12-20 Accepted: 2023-03-21

(Corrêa *et al*., 2021). These clinical manifestations have an acute onset, lasting one or two days, with a progressive course, reaching maximum clinical paralysis in up to three weeks, from the first day of visible weakness (Corrêa *et al*., 2021). In addition, other associated manifestations may include decreased tearing, excessive salivation, and difficulty speaking, eating, and drinking (Kandakurti *et al*., 2020).

According to some studies, the treatment for Bell's palsy corresponds to something complex that starts with medications such as steroidal anti-inflammatory drugs and, if necessary, antivirals and vitamins. In addition, physical therapy and speech therapy are of great importance during treatment, as they help the patient to perform speech, swallowing, and chewing exercises, which are usually performed with difficulty (de Lima *et al*., 2020). However, despite corticosteroid therapy and facial expression exercises in treatment, about 30 % of participants with Bell's palsy achieve incomplete recovery from facial palsy (Kandakurti *et al*., 2020).

There are also manual therapeutic resources, cryotherapy, kinesiotherapy, electrothermal and phototherapy, facial mime exercises, proprioceptive neuromuscular reeducation (PNF) (Tavares *et al*., 2018), and laser therapy (Vanderlei *et al*., 2019). These resources are essential in the rehabilitation process, as they promote evident and beneficial results for the patient (Tavares *et al*., 2018).

Laser therapy is a therapeutic modality that can be used in the treatment of Bell's palsy (Alayat *et al*., 2014). As it is a painless, non-invasive, and non-thermal phototherapy, it can be used on any type of patient, especially for hypertensive and diabetic patients, for whom treatment with corticosteroids is contraindicated (Quinn & Cramp, 2003).

The effect of laser on Bell's palsy is related to the acceleration of axon growth, myelination, regeneration after injury, and maintenance of functional nerve activity, which translates into anti-inflammatory and regenerative effects (Vanderlei *et al*., 2019). Low-level laser therapy (LLLT) - currently known as photobiomodulation - directly interferes with the nerve structure, increasing the healing rate of blockage of communication (Chow *et al*., 2019), in addition to dilating the arterial and capillaries vessels, thus increasing microcirculation and the speed of nerve regeneration of tissues in the irradiated region (de Oliveira Júnior *et al*., 2010).

Therefore, this study aimed to carry out an integrative literature review on photobiomodulation in the treatment of Bell's palsy. The results of this study can be used to demonstrate the effectiveness of this method in clinical practice.

MATERIAL AND METHOD

This is an integrative review of the literature, of a qualitative nature, which provides a broader understanding of the subject studied.

For this, the PICO strategy (population, intervention, comparison, and outcome) was used: (P) patients with Bell's palsy, (I) photobiomodulation, (C) placebo, and (O) therapeutic effect. Therefore, the question that underlies the research was: “What is the therapeutic effect of the use of photobiomodulation in patients with Bell's palsy?”.

For the eligibility of articles, the following inclusion criteria were applied: studies that evaluated the therapeutic effect of photobiomodulation in patients with Bell's palsy, regardless of the year of publication of the study, the age of the patients, and associated therapies. Studies that evaluated patients with Bell's palsy and who did not undergo treatment with photobiomodulation, as well as case reports, were excluded.

Article searches were performed in PubMed databases via Medline, LILACS, IBES, Scopus, Web of Science, Embase, and Cochrane Central Registry of Controlled Trials (CENTRAL), using the MeSH and DeCS descriptors to determine the search terms. The Boolean operators (“AND” and “OR”) were applied, combined with the descriptors, as shown in Table I (supplementary material). There was no restriction on language and year of publication of the studies. The articles found were exported to the Rayyan QCRI website (Ouzzani *et al*., 2016) and duplicates were removed by two independent reviewers (E.B; V.B.). The reading of titles and abstracts was performed following the eligibility criteria and then a complete reading of the articles selected at this stage was carried out, also by two reviewers independently (E.B; V.B.). When a study was not chosen for selection, a third reviewer (B.D.) was consulted.

The following data were extracted from the studies by two independent reviewers (E.B; V.B.):

authors, year of publication, country of origin, study design, participant characteristics (sample size, age, and sex), laser application protocol, and main results. Such elements were descriptively tabulated in this article. In addition, after selecting the studies, the methodological quality, and risks of bias of each article included were analyzed, according to the most appropriate method for each type of study design.

RESULTS

A total of 143 articles were found, divided into the following databases PubMed via Medline (14), LILACS (2), IBECS (8), Scopus (24), Web of Science (8), Embase (30), and CENTRAL (57), as the search strategy described in Table I (supplementary material). The search for articles took place between March and July 2022.

Table I. Search strategy and terms used.

Database	Terms of the search
PubMed	((Therapeutics) OR (Therapeutic) OR (Therapy) OR (Therapies) OR (Treatment) OR (Treatments)) AND ((Low-Level Light Therapy) OR (Light Therapies, Low-Level) OR (Light Therapy, Low-Level) OR (Low Level Light Therapy) OR (Low-Level Light Therapies) OR (Therapies, Low-Level Light) OR (Therapy, Low-Level Light) OR (Photobiomodulation Therapy) OR (Photobiomodulation Therapies) OR (Therapies, Photobiomodulation) OR (Therapy, Photobiomodulation) OR (LLLT) OR (Laser Therapy, Low-Level) OR (Laser Therapies, Low-Level) OR (Laser Therapy, Low Level) OR (Low-Level Laser Therapies) OR (Laser Irradiation, Low-Power) OR (Irradiation, Low-Power Laser) OR (Laser Irradiation, Low Power) OR (Low-Power Laser Therapy) OR (Low Power Laser Therapy) OR (Laser Therapy, Low-Power) OR (Laser Therapies, Low-Power) OR (Laser Therapy, Low Power) OR (Low-Power Laser Therapies) OR (Low-Level Laser Therapy) OR (Low Level Laser Therapy) OR (Low-Power Laser Irradiation) OR (Low Power Laser Irradiation) OR (Laser Biostimulation) OR (Biostimulation, Laser) OR (Laser Phototherapy) OR (Phototherapy, Laser)) AND ((Bell Palsy) OR (Bell Palsies) OR (Palsies, Bell) OR (Palsy, Bell) OR (Facial Neuropathy, Inflammatory, Acute) OR (Facial Paralysis, Idiopathic) OR (Facial Paralyses, Idiopathic) OR (Idiopathic Facial Paralyses) OR (Idiopathic Facial Paralysis) OR (Paralyses, Idiopathic Facial) OR (Paralysis, Idiopathic Facial) OR (Inflammatory Facial Neuropathy, Acute) OR (Acute Inflammatory Facial Neuropathy) OR (Facial Neuropathy, Idiopathic Acute) OR (Idiopathic Acute Facial Neuropathy) OR (Bell's Palsy) OR (Bell's Palsies) OR (Bells Palsy) OR (Palsies, Bell's) OR (Palsy, Bell's) OR (Acute Idiopathic Facial Neuropathy) OR (Herpetic Facial Paralysis) OR (Facial Paralyses, Herpetic) OR (Facial Paralysis, Herpetic) OR (Herpetic Facial Paralyses) OR (Paralyses, Herpetic Facial) OR (Paralysis, Herpetic Facial)).
CENTRAL	((Therapeutics) OR (Therapeutic) OR (Therapy) OR (Therapies) OR (Treatment) OR (Treatments)) AND ((Low-Level Light Therapy) OR (Light Therapies, Low-Level) OR (Light Therapy, Low-Level) OR (Low Level Light Therapy) OR (Low-Level Light Therapies) OR (Therapies, Low-Level Light) OR (Therapy, Low-Level Light) OR (Photobiomodulation Therapy) OR (Photobiomodulation Therapies) OR (Therapies, Photobiomodulation) OR (Therapy, Photobiomodulation) OR (LLLT) OR (Laser Therapy, Low-Level) OR (Laser Therapies, Low-Level) OR (Laser Therapy, Low Level) OR (Low-Level Laser Therapies) OR (Laser Irradiation, Low-Power) OR (Irradiation, Low-Power Laser) OR (Laser Irradiation, Low Power) OR (Low-Power Laser Therapy) OR (Low Power Laser Therapy) OR (Laser Therapy, Low-Power) OR (Laser Therapies, Low-Power) OR (Laser Therapy, Low Power) OR (Low-Power Laser Therapies) OR (Low-Level Laser Therapy) OR (Low Level Laser Therapy) OR (Low-Power Laser Irradiation) OR (Low Power Laser Irradiation) OR (Laser Biostimulation) OR (Biostimulation, Laser) OR (Laser Phototherapy) OR (Phototherapy, Laser)) AND ((Bell Palsy) OR (Bell Palsies) OR (Palsies, Bell) OR (Palsy, Bell) OR (Facial Neuropathy, Inflammatory, Acute) OR (Facial Paralysis, Idiopathic) OR (Facial Paralyses, Idiopathic) OR (Idiopathic Facial Paralyses) OR (Idiopathic Facial Paralysis) OR (Paralyses, Idiopathic Facial) OR (Paralysis, Idiopathic Facial) OR (Inflammatory Facial Neuropathy, Acute) OR (Acute Inflammatory Facial Neuropathy) OR (Facial Neuropathy, Idiopathic Acute) OR (Idiopathic Acute Facial Neuropathy) OR (Bell's Palsy) OR (Bell's Palsies) OR (Bells Palsy) OR (Palsies, Bell's) OR (Palsy, Bell's) OR (Acute Idiopathic Facial Neuropathy) OR (Herpetic Facial Paralysis) OR (Facial Paralyses, Herpetic) OR (Facial Paralysis, Herpetic) OR (Herpetic Facial Paralyses) OR (Paralyses, Herpetic Facial) OR (Paralysis, Herpetic Facial)).
Web of Science	TI=(((Therapeutics) OR (Therapeutic) OR (Therapy) OR (Therapies) OR (Treatment) OR (Treatments)) AND ((Low-Level Light Therapy) OR (Light Therapies, Low-Level) OR (Light Therapy, Low-Level) OR (Low Level Light Therapy) OR (Low-Level Light Therapies) OR (Therapies, Low-Level Light) OR (Therapy, Low-Level Light) OR (Photobiomodulation Therapy) OR (Photobiomodulation Therapies) OR (Therapies, Photobiomodulation) OR (Therapy, Photobiomodulation) OR (LLLT) OR (Laser Therapy, Low-Level) OR (Laser Therapies, Low-Level) OR (Laser Therapy, Low Level) OR (Low-Level Laser Therapies) OR (Laser Irradiation, Low-Power) OR (Irradiation, Low-Power Laser) OR (Laser Irradiation, Low Power) OR (Low-Power Laser Therapy) OR (Low Power Laser Therapy) OR (Laser Therapy, Low-Power) OR (Laser Therapies, Low-Power) OR (Laser Therapy, Low Power) OR (Low-Power Laser Therapies) OR (Low-Level Laser Therapy) OR (Low Level Laser Therapy) OR (Low-Power Laser Irradiation) OR (Low Power Laser Irradiation) OR (Laser Biostimulation) OR (Biostimulation, Laser) OR (Laser Phototherapy) OR (Phototherapy, Laser)) AND ((Bell Palsy) OR (Bell Palsies) OR (Palsies, Bell) OR (Palsy, Bell) OR (Facial Neuropathy, Inflammatory, Acute) OR (Facial Paralysis, Idiopathic) OR (Facial Paralyses, Idiopathic) OR (Idiopathic Facial Paralyses) OR (Idiopathic Facial Paralysis) OR (Paralyses, Idiopathic Facial) OR (Paralysis, Idiopathic Facial) OR (Inflammatory Facial Neuropathy, Acute) OR (Acute Inflammatory Facial Neuropathy) OR (Facial Neuropathy, Idiopathic Acute) OR (Idiopathic Acute Facial Neuropathy) OR (Bell's Palsy) OR (Bell's Palsies) OR (Bells Palsy) OR (Palsies, Bell's) OR (Palsy, Bell's) OR (Acute Idiopathic Facial Neuropathy) OR (Herpetic Facial Paralysis) OR (Facial Paralyses, Herpetic) OR (Facial Paralysis, Herpetic) OR (Herpetic Facial Paralyses) OR (Paralyses, Herpetic Facial) OR (Paralysis, Herpetic Facial))).
Scopus	KEY ((Therapeutics) OR (Therapeutic) OR (Therapy) OR (Therapies) OR (Treatment) OR (Treatments)) AND KEY ((Low-Level Light Therapy) OR (Light Therapies, Low-Level) OR (Light Therapy, Low-Level) OR (Low Level Light Therapy) OR (Low-Level Light Therapies) OR (Therapies, Low-Level Light) OR (Therapy, Low-Level Light) OR (Photobiomodulation Therapy) OR (Photobiomodulation Therapies) OR (Therapies, Photobiomodulation) OR (Therapy, Photobiomodulation) OR (LLLT) OR (Laser Therapy, Low-Level) OR (Laser Therapies, Low-Level) OR (Laser Therapy, Low Level) OR (Low-Level Laser Therapies) OR (Laser Irradiation, Low-Power) OR (Irradiation, Low-Power Laser) OR (Laser Irradiation, Low Power) OR (Low-Power Laser Therapy) OR (Low Power Laser Therapy) OR (Laser Therapy, Low-Power) OR (Laser Therapies, Low-Power) OR (Laser Therapy, Low Power) OR (Low-Power Laser Therapies) OR (Low-Level Laser Therapy) OR (Low Level Laser Therapy) OR (Low-Power Laser Irradiation) OR (Low Power Laser Irradiation) OR (Laser Biostimulation) OR (Biostimulation, Laser) OR (Laser Phototherapy) OR (Phototherapy, Laser)) AND KEY ((Bell Palsy) OR (Bell Palsies) OR (Palsies, Bell) OR (Palsy, Bell) OR (Facial Neuropathy, Inflammatory, Acute) OR (Facial Paralysis, Idiopathic) OR (Facial Paralyses, Idiopathic) OR (Idiopathic Facial Paralyses) OR (Idiopathic Facial Paralysis) OR (Paralyses, Idiopathic Facial) OR (Paralysis, Idiopathic Facial) OR (Inflammatory Facial Neuropathy, Acute) OR (Acute Inflammatory Facial Neuropathy) OR (Facial Neuropathy, Idiopathic Acute) OR (Idiopathic Acute Facial Neuropathy) OR (Bell's Palsy) OR (Bell's Palsies) OR (Bells Palsy) OR (Palsies, Bell's) OR (Palsy, Bell's) OR (Acute Idiopathic Facial Neuropathy) OR (Herpetic Facial Paralysis) OR (Facial Paralyses, Herpetic) OR (Facial Paralysis, Herpetic) OR (Herpetic Facial Paralyses) OR (Paralyses, Herpetic Facial) OR (Paralysis, Herpetic Facial)).

Database	Terms of the search
Embase	((Therapeutics) OR (Therapeutic) OR (Therapy) OR (Therapies) OR (Treatment) OR (Treatments)) AND ((Low-Level Light Therapy) OR (Light Therapies, Low-Level) OR (Light Therapy, Low-Level) OR (Low Level Light Therapy) OR (Low-Level Light Therapies) OR (Therapies, Low-Level Light) OR (Therapy, Low-Level Light) OR (Photobiomodulation Therapy) OR (Photobiomodulation Therapies) OR (Therapies, Photobiomodulation) OR (Therapy, Photobiomodulation) OR (LLLT) OR (Laser Therapy, Low-Level) OR (Laser Therapies, Low-Level) OR (Laser Therapy, Low Level) OR (Low-Level Laser Therapies) OR (Laser Irradiation, Low-Power) OR (Irradiation, Low-Power Laser) OR (Laser Irradiation, Low Power) OR (Low-Power Laser Therapy) OR (Low Power Laser Therapy) OR (Laser Therapy, Low-Power) OR (Laser Therapies, Low-Power) OR (Laser Therapy, Low Power) OR (Low-Power Laser Therapies) OR (Low-Level Laser Therapy) OR (Low Level Laser Therapy) OR (Low-Power Laser Irradiation) OR (Low Power Laser Irradiation) OR (Laser Biostimulation) OR (Biostimulation, Laser) OR (Laser Phototherapy) OR (Phototherapy, Laser)) AND ((Bell Palsy) OR (Bell Palsies) OR (Palsies, Bell) OR (Palsy, Bell) OR (Facial Neuropathy, Inflammatory, Acute) OR (Facial Paralysis, Idiopathic) OR (Facial Paralyses, Idiopathic) OR (Idiopathic Facial Paralyses) OR (Idiopathic Facial Paralysis) OR (Paralyses, Idiopathic Facial) OR (Paralysis, Idiopathic Facial) OR (Inflammatory Facial Neuropathy, Acute) OR (Acute Inflammatory Facial Neuropathy) OR (Facial Neuropathy, Idiopathic Acute) OR (Idiopathic Acute Facial Neuropathy) OR (Bells Palsy) OR (Bells Palsies) OR (Bells Palsy) OR (Palsies, Bells) OR (Palsy, Bells) OR (Acute Idiopathic Facial Neuropathy) OR (Herpetic Facial Paralysis) OR (Facial Paralyses, Herpetic) OR (Facial Paralysis, Herpetic) OR (Herpetic Facial Paralyses) OR (Paralyses, Herpetic Facial) OR (Paralysis, Herpetic Facial))
LILACS	((Therapeutics) OR (Therapeutic) OR (Therapy) OR (Therapies) OR (Treatment) OR (Treatments)) AND ((Low-Level Light Therapy) OR (Light Therapies, Low-Level) OR (Light Therapy, Low-Level) OR (Low Level Light Therapy) OR (Low-Level Light Therapies) OR (Therapies, Low-Level Light) OR (Therapy, Low-Level Light) OR (Photobiomodulation Therapy) OR (Photobiomodulation Therapies) OR (Therapies, Photobiomodulation) OR (Therapy, Photobiomodulation) OR (LLLT) OR (Laser Therapy, Low-Level) OR (Laser Therapies, Low-Level) OR (Laser Therapy, Low Level) OR (Low-Level Laser Therapies) OR (Laser Irradiation, Low-Power) OR (Irradiation, Low-Power Laser) OR (Laser Irradiation, Low Power) OR (Low-Power Laser Therapy) OR (Low Power Laser Therapy) OR (Laser Therapy, Low-Power) OR (Laser Therapies, Low-Power) OR (Laser Therapy, Low Power) OR (Low-Power Laser Therapies) OR (Low-Level Laser Therapy) OR (Low Level Laser Therapy) OR (Low-Power Laser Irradiation) OR (Low Power Laser Irradiation) OR (Laser Biostimulation) OR (Biostimulation, Laser) OR (Laser Phototherapy) OR (Phototherapy, Laser)) AND ((Bell Palsy) OR (Bell Palsies) OR (Palsies, Bell) OR (Palsy, Bell) OR (Facial Neuropathy, Inflammatory, Acute) OR (Facial Paralysis, Idiopathic) OR (Facial Paralyses, Idiopathic) OR (Idiopathic Facial Paralyses) OR (Idiopathic Facial Paralysis) OR (Paralyses, Idiopathic Facial) OR (Paralysis, Idiopathic Facial) OR (Inflammatory Facial Neuropathy, Acute) OR (Acute Inflammatory Facial Neuropathy) OR (Facial Neuropathy, Idiopathic Acute) OR (Idiopathic Acute Facial Neuropathy) OR (Bell's Palsy) OR (Bell's Palsies) OR (Bells Palsy) OR (Palsies, Bell's) OR (Palsy, Bell's) OR (Acute Idiopathic Facial Neuropathy) OR (Herpetic Facial Paralysis) OR (Facial Paralyses, Herpetic) OR (Facial Paralysis, Herpetic) OR (Herpetic Facial Paralyses) OR (Paralyses, Herpetic Facial) OR (Paralysis, Herpetic Facial))
IBECS	((Therapeutics) OR (Therapeutic) OR (Therapy) OR (Therapies) OR (Treatment) OR (Treatments)) AND ((Low-Level Light Therapy) OR (Light Therapies, Low-Level) OR (Light Therapy, Low-Level) OR (Low Level Light Therapy) OR (Low-Level Light Therapies) OR (Therapies, Low-Level Light) OR (Therapy, Low-Level Light) OR (Photobiomodulation Therapy) OR (Photobiomodulation Therapies) OR (Therapies, Photobiomodulation) OR (Therapy, Photobiomodulation) OR (LLLT) OR (Laser Therapy, Low-Level) OR (Laser Therapies, Low-Level) OR (Laser Therapy, Low Level) OR (Low-Level Laser Therapies) OR (Laser Irradiation, Low-Power) OR (Irradiation, Low-Power Laser) OR (Laser Irradiation, Low Power) OR (Low-Power Laser Therapy) OR (Low Power Laser Therapy) OR (Laser Therapy, Low-Power) OR (Laser Therapies, Low-Power) OR (Laser Therapy, Low Power) OR (Low-Power Laser Therapies) OR (Low-Level Laser Therapy) OR (Low Level Laser Therapy) OR (Low-Power Laser Irradiation) OR (Low Power Laser Irradiation) OR (Laser Biostimulation) OR (Biostimulation, Laser) OR (Laser Phototherapy) OR (Phototherapy, Laser)) AND ((Bell Palsy) OR (Bell Palsies) OR (Palsies, Bell) OR (Palsy, Bell) OR (Facial Neuropathy, Inflammatory, Acute) OR (Facial Paralysis, Idiopathic) OR (Facial Paralyses, Idiopathic) OR (Idiopathic Facial Paralyses) OR (Idiopathic Facial Paralysis) OR (Paralyses, Idiopathic Facial) OR (Paralysis, Idiopathic Facial) OR (Inflammatory Facial Neuropathy, Acute) OR (Acute Inflammatory Facial Neuropathy) OR (Facial Neuropathy, Idiopathic Acute) OR (Idiopathic Acute Facial Neuropathy) OR (Bell's Palsy) OR (Bell's Palsies) OR (Bells Palsy) OR (Palsies, Bell's) OR (Palsy, Bell's) OR (Acute Idiopathic Facial Neuropathy) OR (Herpetic Facial Paralysis) OR (Facial Paralyses, Herpetic) OR (Facial Paralysis, Herpetic) OR (Herpetic Facial Paralyses) OR (Paralyses, Herpetic Facial) OR (Paralysis, Herpetic Facial))

During the identification, 48 duplicates were excluded, and 2 articles could not be exported. Thus, 93 studies were selected for reading of the titles and abstracts. Based on the eligibility criteria, 25 studies were selected for full-text reading. Finally, 7 articles were included for review and discussion (Fig. 1).

The studies included are from different countries, such as Mexico, Saudi Arabia, Cuba, Turkey, Iraq, Egypt, and Japan, published between 1993 and 2022, in English and Spanish.

The main reason for excluding articles during the eligibility stage was the study design being a case report, which is understood as a study with low scientific evidence. Furthermore, it is noteworthy that there are still few studies on photobiomodulation therapy in the treatment of Bell's Palsy.

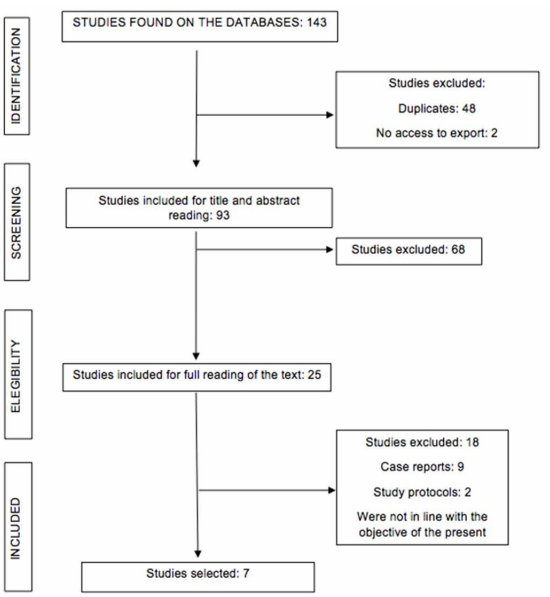

Fig. 1. Study selection flowchart.

In the evaluation of the methodological quality of the included studies, of the 7 clinical trials, 6 presented evaluations with high methodological quality and only 1 article with low quality, through an analysis of the PEDro Scale (Table II).

The characteristics and results of the articles included are described in Table III (supplementary material).

DISCUSSION

Bell's Palsy (BP) is responsible for approximately 60 to 75 % of the unilateral acute facial paralysis cases, affecting individuals of both sexes and, mainly, between 30 to 50 years of age. Many therapeutic modalities have been used to treat BP, such as photobiomodulation therapy (PBM), which is considered non-invasive and painless and can be applied to any patient (Alayat *et al*., 2014).

The effectiveness of PBM therapy, formerly known as low-level laser therapy (LLLT), in patients with BP was compared with the stellate ganglion block (SGB) by Murakami *et al*. (1993). The diode laser system, the GaAlAs system, was used, with an output power of 60mW at 830 nm in continuous wave. The laser-treated patients demonstrated faster initial recovery and slightly better final paralysis scores than the SGB group, as well as an 80 % efficacy, according to the Facial Palsy Rating Scale. The results indicated that PBM enhances the improvement of facial paralysis, avoids the side effects observed in some drug therapies, and can be easily applied in patients in whom SGB is considered a high-risk procedure.

In a clinical trial by Macías-Hernandez *et al*. (2012), 21 patients, who had not yet started any other type of therapy, were divided into treatment groups with laser application and control/placebo, submitted to a therapy session for 15 days with a GaAsAl laser with a wavelength of 830 nm and output power of 30mW. In this case, they applied initial assessments and others after 15, 30, and 60 days, to investigate muscle strength, and the presence of epiphora, dysgeusia, and dysacusis. Regarding muscle strength, only two patients in the control group remained with muscle weakness and no patient in the PBM treatment group presented this phenomenon after 60 days. This study did not show statistically significant differences between the groups, only an enhancement in the recovery of patients, through the association of conventional treatment with low-level laser.

On the other hand, Castillo *et al*. (2012) developed a clinical trial with high methodological quality, involving a total of 153 patients divided into 4 groups undergoing different combinations of therapies for BP. The laser protocol adopted for the treatment was the punctual laser technique, through the facial nerve path, 40mW output power, and 670 nm wavelength. The group submitted to conventional therapy, low-level laser, and magnetic field obtained a more significant improvement. However, this study did not obtain favorable results in the group applying PBM therapy and conventional treatment.

Alayat *et al*. (2014) evaluated a treatment regimen that started 3 to 5 days after the initial diagnosis of BP during its subacute phase, where they investigated and compared the effects of low-level laser therapy (LLLT), high-level laser therapy (HILT), facial massage and exercises. For the LLLT, the GaAs laser was used with infrared waves with a wavelength of 830 nm and output power of 100mW applied for 2 min and 5s per point on 8 facial points on the affected side, for 6 weeks, with a total of 18 sessions (3 sessions/week). Thus, the study found that laser therapy is a more effective treatment for BP, compared to the isolated therapeutic approach of massage and facial exercises, however, HILT showed better results when compared to LLLT.

From this perspective, Ordahan & Karahan (2017) carried out a randomized clinical study with 46 patients with subacute BP, in which a group with a

Table II. Methodological quality - PEDro Scale.

Study	1*	2	3	4	5	6	7	8	9	10	11	Total
Murakami *et al.*, 1993				X						X	X	3
Castillo *et al*., 2012	X	X		X	X			X	X	X	X	7
Macías-Hernandez *et al.,* 2012	X			X	X	X		X	X	X	X	7
Alayat *et al.*, 2014	X	X	X	X	X	X		X	X	X		8
Ordahan & Karahan, 2017	X	X	X	X		X		X	X	X	X	8
Alyassiri & Zaidan, 2019	X			X				X	X	X		4
Shoman *et al.*, 2022	X	X	X	X		X	X	X	X	X	X	9

Table III. Characteristics of studies included.

Article	Authors and year of publication	Country of origin	Study design	Sample, age, sex	Low power laser application protocol	Main results
Effects of low power laser in the treatment of acute peripheral facial paralysis	Macías-Hernández *et al*., 2012	Mexico	Randomized double-blind controlled clinical trial.	Patients over 18 years of age, of both sexes, diagnosed with idiopathic peripheral facial palsy with less than 7 days of evolution were induded.	The experimental treatment was applied with a wavelength of (-)830nm GaAsAl laser with an output power of 30mW. The GaAsAl laser with-630nm was applied at a dose of 20 J/cm on the facial nerve. Both groups received one therapy session per day for 15 days. All patients were instructed to do thermotherapy and facial exercises at home twice a day for an additional 30 days.	Twenty-one patients were included, 10 in the control group and 11 in the experimental group. Both groups showed significant improvement in muscle strength before and after treatment (P<.001). The laser group achieved 94.84 % recovery vs 87.83% in the control group (P=.24). Regarding dysgeusia, dysacusis and epiphora, both groups showed 100 % improvement.
Utilidad del campo magnético y el láser en el tratamiento de la parálisis facial periférica idiopática	Castillo *et al*., 2012	Cuba	Prospective, randomized, controlled, single-blind study.	The Sample consisted of 66 men (43%) and 87 women (57%). The mean age of the patients was 44 years (20-59 years of age).	The punctual laser technique was used, throughout the facial nerve course, with the Lasermed 670 equipment, using a space of 1.5 cm for each point and an extra point at the exit of the nerve. Deposits of 14 J/cm were made, with an output power of 40 mW, for a variable time, starting with 30 s and increasing by 15 s every 5 sessions until reaching 1 min. The laser wavelength was 670 nm.	Patients in groups C (magnetic field + conventional therapy) and D (conventional therapy + laser + magnetic field) had a better outcome than those in groups A (conventional therapy) and B (laser + conventional therapy) (higher Sunnybrook score and less synkinesis). Specifically, the patients from group D showed better general recovery in 3 months. The treatment combined with conventional therapy + laser + magnetic field therapy was more beneficial than the separate combination of each of these two physical agents with conventional therapy.
Efficacy of high and low level laser therapy in the treatment of Bell's palsy: a randomized double blind placebo - controlled trial.	Alayat *et al*., 2014	Egipt	Randomized double-blind placebo - controlled study	52 patients, mean age of 43 years of age, both sexes.	Gallium arsenide (GaAs) diode laser (BTL-5000 laser) used with infrared waves of the wavelength of 830 nm and output power of 100 mW, average power density of 10 J/cm2, frequency of 1 kHz, and 80% duty cycle. Laser in direct contact with the superficial roots of the facial nerve on the affected side. Application for 2 min and 5 s per point for 8 points with a total energy of 80 J. It was applied in a total of 18 treatment sessions over a period of 6 consecutive weeks (three sessions/week). Calibration of the laser equipment was performed by the manufacturing company using a thermal energy meter.	Both high-level and low-level laser therapy significantly improved the recovery of patients with Bell's palsy. In addition, high-level laser therapy was the most effective treatment modality compared to low-level laser therapy, massage, and exercises.
Role of low-level laser therapy added to facial expression exercises in patients with idiopathic facial (Bell's) palsy	Ordahan & Karahan, 2017	England	Randomized controlled clinical trial.	The sample consisted of 46 patients (mean age of 41 ± 9,7 years of age; 40 women and 6 men.	Laser treatment was administered at a wavelength of 830 nm, an output power of 100 Mw, and a frequency of 1 kHz using a gallium aluminum arsenide diode laser (GaAlAs, infrared laser). A mean energy density of 10 J/cm_ was administered at eight points on the affected side of the face three times a week for a total of 6 weeks.	Facial improvement rate was assessed using the facial disability index (FDI) before, 3 weeks after, and 6 weeks after treatment. In the present study, it was shown that photobiomodulation resulted in a significant improvement in functional facial movements and decreased recovery time for patients with BP. The findings further indicate that treatment combined with photobiomodulation, and exercise therapy is associated with significant improvements in the facial disability index.
Comparison between the beneficial Effects of Low Level Laser Therapy (Diode Laser) and Transcutenous Electrical Nerve Stimulation in Recovery of Patients with Bell's palsy	Alyassiri & Zaidan, 2019	Iraq	Randomized controlled clinical trial.	The age range of patients with Bell's palsy was (20-70) years of age, the mean ± SD for patients with Bell's palsy was (43.6 ± 15. 6). For healthy individuals, the age range was (20 -70) years of age with mean ± SD was (45.4± 15.9). No distinction between the sexes.	Photobiomodulation was performed.	The results of this study showed that the cure rate was higher among patients who underwent photobiomodulation after treatment compared to patients in the TENS therapy group. Recommended laser therapy increased anti-inflammatory effects, including growth factors and cytokines such as basic fibroblast growth factor (bFGF), platelet-derived growth factor (PDGF), and transforming growth factor beta (TGF-_), and reduced the levels of pro-inflammatory cytokines, such as interleukin-1, alpha (1L-1_), 1L-1 beta (1L-1_). Low-level laser therapy aided healing and improved conditions due to reduced facial nerve inflammation by mitochondrial stimulation that increased adenosine triphosphate (ATP) production and inhibition of inflammatory cytokines.
A Study on the Effect of 850 nm Low-Level Diode Laser versus Electrical Stimulation in Facial Nerve Regeneration for Patients with Bell's Palsy.	Shoman; Hassan; Kassab, 2022	Egipt	Prospective, randomized, single-blind, controlled study	The sample consisted of 45 patients with Bell's Palsy between 18 and 60 years of age, of both sexes.	An aluminum gallium arsenide diode laser with a wavelength of 850 nm was used, with a power density of 1 W/cm2. Twelve applications were carried out with sessions twice a week over six successive weeks. Each session lasted 8 min (1 min/point) for 8 points.	Photobiomodulation in addition to medication, facial exercise, and massage resulted in significant improvement in functional facial movements and increased recovery rate for patients with BP when compared to Electrical Stimulation and/or medication, facial exercise, and massage.
Diode Low Reactive Level Laser Therapy And Stellate Ganglion Block Compared In The Treatment Of Facial Palsy.	Murakami et al., 1993	Japan	Randomized, controlled and single-blind study.	52 patients presenting Periferic Bell's Palsy were selected, the age and the sex of the participants were not informed.	Diode low reactive level laser therapy (LLLT) was applied, the system used was the GaAlAs, Model 2001 (Mochida, Tokyo, Japan), giving an output power of 60 mW at 830 nm in continuous wave, applied in the technique of contact. LLLT was indicated from the corners of the mouth to the neck, following the anatomical course of the affected nerves.	Infrared diode LLLT alone, LLLT + stellate ganglion block (SGB), and SGB alone were applied. The SGB group showed a gradual improvement, with a relatively higher improvement in the SGB + LLLT group. Patients treated with LLLT demonstrated faster initial recovery and slightly better final paralysis scores than the SGB group, although the differences were not statistically significant.

therapy consisting only of facial exercises and another with this treatment associated with PBM was divided. Patients were followed up for 6 weeks, using the 830 nm wavelength GaAlAs laser, administered on eight points on the affected side of the face three times a week, to assess the effectiveness of laser therapy along with conventional treatment of facial exercises.

Alyassiri & Zaidan (2019) performed a clinical trial on BP patients, who were divided between PBM and Transcutaneous Electrical Nerve Stimulation (TENS) treatments. The results of this study elucidated a significant difference in the healing and recovery process among patients in the PBM group (75 %) after treatment. In addition, the cure rate among patients treated with PBM was higher after treatment when compared to patients in the TENS therapy group. However, the protocols for the application of certain treatments were not described, making an effective comparison between the other studies unfeasible.

Shoman *et al*. (2022), performed a randomized clinical trial using PBM (GaAsAl) with a wavelength of 850 nm and applications of 12 sessions (two sessions/ week) during 8 min, where 1 min was applied at each point of the facial nerve path and perioral muscles, to compare the effectiveness of this therapeutic alternative with electrical stimulation (ES) in the treatment of BP. The 45 patients in the research were divided into 3 groups submitted to treatment with (A) PBM and conventional treatment, (B) ES and conventional treatment, and (C) drug treatment associated with physical therapy. Thus, the study found statistically favorable results for the PBM group in terms of increasing muscle action potential amplitude, reducing nerve action potential latency, and increasing the Sunnybrook Scale, a scale that assesses facial function in three domains.

Given the advantages of applying the PBM, the degree of facial recovery was assessed by the Facial Disability Index (FDI) (Alayat *et al*., 2014; Ordahan & Karahan, 2017) and the House-Brackmann Scale (HBS) (Alayat *et al*., 2014) before therapy, 3 and 6 weeks after treatment in all patients, showing a significant improvement in the recovery of BP. Alyassiri & Zaidan (2019) also employed HBS and concluded that the proportion of healing (recovery) was significantly higher among patients in the PBM group (75 %) after treatment. The Sunnybrook Facial Grading System Scale was used by Castillo *et al*. (2012), where the facial symmetry at rest, the degree of voluntary movement of the facial muscles, and the degree of synkinesis associated with each voluntary movement were quantified. This test was applied at baseline, 1 and 3 months after starting treatment, achieving 100 % recovery in 25 patients. Also, Macías-Hernandez *et al*. (2012) adopted the Lovett Scale to assess muscle strength. The study achieved a high recovery rate and a positive effect, considering PBM therapy to be safe and effective.

Study limitations and implications for future studies. Some limitations can be found in studies in the literature on the effectiveness of low-level laser in patients with BP. Among them, small samples, the association of many treatments, and the absence of studies with photobiomodulation therapy applied in isolation can be highlighted.

For future studies, standardization of the laser application protocol is essential, as to the wavelength, type of laser, and the number of sessions required since these factors directly influence the outcome of the treatment.

CONCLUSION

After the analysis of the studies, it was concluded that the application of low-level laser in the treatment of BP proved to be effective, as well as contributing to a greater recovery of patients when compared to other types of treatments. The literature presents several therapeutic modalities that can be used in the treatment of Bell's palsy and, among these, photobiomodulation stands out as a non-invasive and painless therapy that can be performed on any patient. However, it is still necessary to carry out more scientific studies with results in clinical practice so that a greater number of patients are submitted to and benefit from this therapeutic approach.

OLIVEIRA, E. B.; REGO, V. B. J.; DUARTE, B. D.; INÁCIO, P. L.; GONÇALVES, M. W. A. & ALVES DE MELO JÚNIOR, W. Fotobiomodulación en el tratamiento de la parálisis de Bell: una revisión integradora. *Int. J. Odontostomat., 17(3)*:384-391, 2023.

RESUMEN: La parálisis de Bell se define como una parálisis de la neurona motora inferior que se desarrolla a partir de una inflamación no supurativa del nervio facial en el agujero estilomastoideo. El objetivo de esta revisión integradora fue determinar los efectos de la fotobiomodulación como método terapéutico para la parálisis de Bell. Este estudio cualitativo proporcionó una com-

prensión más amplia del tema estudiado. Las búsquedas de artículos se realizaron en las bases de datos PubMed a través de Medline, LILACS, IBES, Scopus, Web of Science, Embase y CENTRAL utilizando los descriptores MeSH y DeCS para determinar los términos de búsqueda. Se encontraron un total de 143 artículos. Después de aplicar los criterios de inclusión y exclusión, se incluyeron 7 artículos. Por tanto, se puede concluir que la aplicación de láser de baja intensidad en el tratamiento de la parálisis de Bell es eficaz debido a que los estudios indicaron mejoras significativas y relevantes para la recuperación de estos pacientes al asociar el láser a otro tipo de tratamientos.

PALABRAS CLAVE: terapia de luz de bajo nivel. terapia de fotobiomodulación. parálisis de bell. terapéutica.

REFERENCES

Alayat, M.; Elsodany, A. & El Fiky, A. Efficacy of high and low level laser therapy in the treatment of Bell's palsy: a randomized double blind placebo-controlled trial. *Lasers Med. Sci., 29(1)*:335-42, 2014.

Alyassiri, A. M. H. & Zaidan, T. F. Comparison between the beneficial effects of low level laser therapy (diode laser) and transcutenous electrical nerve stimulation in recovery of patients with Bell's palsy. *Indian J. Forensic Med. Toxicol., 13(1)*:332, 2019.

Castillo, M. D.; del Rio, M. S.; García, A. J. D.; Quevedo, A. G. & López, J. V. S. Utilidad del campo magnético y el láser en el tratamiento de la parálisis facial periférica idiopática. *Fisioterapia., 35(6)*:252-7, 2012.

Celik, O.; Eskiizmir, G.; Pabuscu,Y.; Ulkumen, B. & Toker , G. T. The role of facial canal diameter in the pathogenesis and grade of Bell's palsy: a study by high resolution computed tomography. *Braz. J. Otorhinolaryngol., 83(3)*:261-8, 2017.

Chow, R.; Armati, P.; Laakso, E. L.; Bjordal, J. M. & Baxter, G. D. Inhibitory effects of laser irradiation on peripheral mammalian nerves and relevance to analgesic effects: a systematic review. *Photomed. Laser Surg., 29(6)*:365-81, 2019.

Corrêa, P. F.; Comarella, G. T.; Caproni F. M.; Koga, V. A.; Almeida, T. Q.; de Oliveira, F. G.; Maia, T. A. & Baião, P. A. M. Evidências sobre a patogênese, o diagnóstico e as características clínicas da paralisia de Bell. *Braz. J. Surg. Clin. Res., 35(3)*:35-41, 2021.

de Lima, P. N.; Gusmão, R. M.; Siqueira, N. C. G. & Varejão, L. C. Toxina botulínica como alternativa no tratamento da paralisia facial de Bell: revisão de literatura. *Braz. J. Dev., 6(12)*:95667-81, 2020.

de Oliveira Júnior, G. C.; do Santo, L. A. E; de Sá, H. P.; Nunes, H. M.; Alves, W. S. & Carvalho, K. C. Efeito da laserterapia de baixa potência na inflamação pulmonar em rattus novergicus. *Consc. Saúde, 9(4)*:659-66, 2010.

Kandakurti, P.; Shanmugam, S.; Basha, S. A.; Amaravadi, S. K.; Suganthirababu, P.; Gopal, K. & George, G. S. The effectiveness of low-level laser therapy combined with facial expression exercises in patients with moderate-to-severe Bell's palsy: A study protocol for a randomised controlled trial. *Int. J. Surg. Protoc., 24*:39-44, 2020.

Macías-Hernández, S. I.; Lomelí-Rivas, A.; Baños, T.; Flores, J.; Sánchez, M. & Miranda-Duarte, A. Efectos del láser de baja potencia en el tratamiento de la parálisis facial periférica aguda. *Rehabilitación (Madr.), 46(3)*:187-92, 2012.

Murakami, F.; Kemmotsu O.; Kawano, Y.; Matsumura, C.; Kaseno, S. & Imai, M. Diode low reactive level laser therapy and stellate ganglion block compared In the treatment of facial palsy. *Laser Ther., 5(3)*:131-5, 1993.

Ordahan, B. & Karahan, A. Y. Role of low-level laser therapy added to facial expression exercises in patients with idiopathic facial (Bell's) palsy. *Lasers Med. Sci., 32*:931-6, 2017.

Ouzzani, M.; Hammady, H.; Fedorowicz, Z. & Elmagarmid, A. Rayyan—a web and mobile app for systematic reviews. *Syst. Rev., 5*:210, 2016.

Quinn, R. & Cramp, F. The efficacy of electrotherapy for Bell's palsy: a systematic review. *Phys. Ther. Rev., 8(3)*:151-64, 2003.

Rowland, L. P. & Pedley, T. A. *Merritt – Tratado de Neurologia*. Rio de Janeiro, Guanabara Koogan, 2018. pp.743-4.

Shoman, A.; Hassan, A. & Kassab, A. A study on the effect of 850 nm low-level diode laser versus electrical stimulation in facial nerve regeneration for patients with Bell's palsy. *ORL J. Otorhinolaryngol. Relat. Spec., 84(5)*:370-7, 2022.

Tavares, A. D. C.; de Souza, W. P. & de Jesus, E. A. Intervenção fisioterapêutica no tratamento de paciente com paralisia facial periférica: estudo de caso. *Saúde Pesq., 11(1)*:179-89, 2018.

Tortora, G. J. & Derrickson, B. Princípios de Anatomia e Fisiologia. Rio de Janeiro, Guanabara Koogan, 2016.

Vanderlei, T.; Bandeira, R. N.; Canuto, M. S. B. & Alves, G. A. S. Laserterapia de baixa potência e paralisia facial periférica: revisão integrativa da literatura. Terapia a laser e Paralisia de Bell. *Disturb. Comun., 31(4)*:557-64, 2019.

Zhang, W.; Xu, L.; Luo, T.; Wu, F.; Zhao, B. & Li, X. The etiology of Bell's palsy: a review. *J. Neurol., 267(7)*:1896-905, 2020.

Zhao, H.; Zhang, X.; Tang, Y. D.; Zhu, J.; Wang, X. H. & Li, S. T. Bell's palsy: clinical analysis of 372 cases and review of related literature. *Eur. Neurol., 77(3-4)*:168-72, 2017.

Corresponding author:
Elaine Bezerra de Oliveira
Universidade Federal de Campina Grande
Centro de Saúde e Tecnologia Rural
Departamento de Odontologia
Avenida Universitária, Santa Cecília, s/n
58708-110, Patos
Paraíba
BRAZIL

E-mail: elainnebezerra@gmail.com