Original Article

Systematic Review On Effectiveness Of Low-Level Laser Therapy In The Treatment Of Bell's Palsy

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Abstract

Background: Bell's palsy is a condition characterized by the sudden onset of facial paralysis or weakness, often linked to viral infections such as herpes simplex. Low-level laser therapy (LLLT) has emerged as a potential treatment due to its anti-inflammatory and nerve-regenerative properties. This systematic review evaluates the effectiveness of LLLT in improving outcomes for patients with Bell's palsy.

Objective: The objective of this systematic review was to assess the efficacy of LLLT in treating Bell's palsy by comparing its outcomes with control treatments in randomized controlled trials (RCTs).

Methods: A comprehensive literature search was conducted across databases such as PubMed, Google Scholar, ScienceDirect, and PEDro, using keywords like "Bell's Palsy," "Low-Level Laser Therapy," and "randomized controlled trial." Five RCTs were included, comprising a total of 349 participants, with 155 in the LLLT groups and 194 in control groups. Data were extracted using a modified Cochrane template and analyzed using SPSS version 25, focusing on outcome measures such as the House-Brackmann Scale and Sunnybrook Facial Grading System.

Results: LLLT showed significant improvements in facial function compared to control treatments, with effect sizes favoring LLLT (Effect size: 0.65, 95% CI: 0.35-0.95, p<0.001). The review identified moderate heterogeneity (I^2 = 48%).

Conclusion: LLLT appears to be a promising non-invasive treatment for Bell's palsy, enhancing facial nerve function and recovery. Further high-quality RCTs are needed to standardize treatment protocols and confirm these findings.

1 Introduction

Bell's palsy is a neurological disorder characterized by sudden, temporary paralysis or weakness of the facial muscles, usually affecting one side of the face. It is a condition that results from dysfunction of the seventh cranial nerve, also known as the facial nerve, and its precise etiology remains largely idiopathic (1). Although the specific causes are often unknown, viral infections, particularly those related to the herpes simplex virus, are frequently implicated. The condition affects individuals of all ages but is most commonly diagnosed in adults between 30 and 45 years of age. Epidemiological data suggest an annual incidence of 15 to 23 cases per 100,000 people, with a recurrence rate of approximately 12% (2). Despite the prevalence of Bell's palsy, its pathogenesis is not fully understood, making treatment approaches varied and often debated.

The sudden onset of Bell's palsy, characterized by facial droop and the inability to close the eyelid on the affected side, can be alarming and is often mistaken for more serious neurological conditions such as a stroke. However, Bell's palsy is typically self-limiting, with most patients experiencing significant recovery within three to six months, although some may suffer from residual facial weakness or other complications (3). While corticosteroids are commonly prescribed to reduce inflammation and edema of the facial nerve, their efficacy in hastening recovery remains under scrutiny. This uncertainty has spurred interest in alternative therapies, such as physical therapy, acupuncture, and recently, low-level laser therapy (LLLT).

Low-level laser therapy is a non-invasive treatment modality that employs low-intensity light to promote tissue healing and reduce inflammation without generating heat. This therapy is predicated on the concept of photobiomodulation, where light energy is absorbed by cellular photoreceptors, leading to a cascade of intracellular events that enhance cell proliferation, repair, and survival (4). LLLT has

been proposed as a potential treatment for Bell's palsy due to its purported ability to stimulate nerve regeneration, decrease inflammatory cytokines, and improve microcirculation in affected tissues (5). Several randomized controlled trials (RCTs) have explored the efficacy of LLLT in Bell's palsy patients, yielding mixed results that necessitate further systematic evaluation to ascertain its therapeutic value.

The present systematic review aims to critically assess the effectiveness of LLLT in the treatment of Bell's palsy by synthesizing data from available RCTs. By examining parameters such as wavelength, intensity, and duration of LLLT application, this review seeks to determine the optimal therapeutic protocols and identify the clinical outcomes associated with LLLT use. Moreover, it evaluates whether LLLT offers significant improvements in facial nerve function, muscular strength, and quality of life compared to conventional therapies or placebo controls (6). This review addresses the existing research gaps by highlighting variations in study design, methodological quality, and outcome measures, thus providing a comprehensive overview of LLLT as a treatment modality for Bell's palsy.

In summary, while Bell's palsy remains a common yet poorly understood condition, the exploration of novel therapeutic interventions like LLLT represents a promising avenue for enhancing patient outcomes. By consolidating current evidence and identifying areas for future research, this systematic review contributes to a better understanding of the role of LLLT in managing Bell's palsy and informs clinical decision-making processes. Further high-quality RCTs with standardized protocols are warranted to validate the efficacy of LLLT and to establish its place in the therapeutic landscape for Bell's palsy (7).

2   Material and Methods

The systematic review was conducted following established protocols to ensure a comprehensive and unbiased evaluation of the available literature on the effectiveness of low-level laser therapy (LLLT) in the treatment of Bell's palsy. The study was designed to include randomized controlled trials (RCTs) that evaluated the efficacy of LLLT compared to placebo or other therapeutic interventions for patients diagnosed with Bell's palsy. The review adhered to the guidelines set forth by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to maintain transparency and reproducibility in the research process (1).

The literature search was conducted across multiple electronic databases, including PubMed, Google Scholar, ScienceDirect, and PEDro. Keywords and MeSH terms such as "Bell's Palsy," "Low-Level Laser Therapy," and "randomized controlled trial" were used to identify relevant studies published up to 2023. The search was restricted to articles published in English. Studies were included if they were RCTs that assessed the efficacy of LLLT for Bell's palsy and provided quantitative outcomes. Studies were excluded if they were non-randomized, lacked a control group, or did not report relevant clinical outcomes (2).

Data extraction was performed independently by two reviewers using a modified Cochrane data extraction template. The extracted data included study characteristics, participant demographics, intervention details (wavelength, intensity, duration), outcome measures (such as the House-Brackmann Scale, Sunnybrook Facial Grading System, and Facial Disability Index), and results. Discrepancies between reviewers were resolved through discussion or consultation with a third reviewer. The methodological quality of the included studies was assessed using the Physiotherapy Evidence Database (PEDro) scale, which evaluates criteria such as random allocation, concealed allocation, blinding, and data analysis (3).

The study adhered to the ethical principles outlined in the Declaration of Helsinki. Although the review utilized publicly available data from published studies, ethical approval was obtained from the University of Faisalabad's ethical review board to ensure compliance with research standards and ethical guidelines. No individual patient data were accessed during the study, thus protecting participant confidentiality.

Data analysis was performed using SPSS version 25. Descriptive statistics were used to summarize the characteristics of the included studies. Meta-analysis was conducted where appropriate, using random-effects models to account for variability among studies. Heterogeneity was assessed using the I^2 statistic, with values greater than 50% indicating substantial heterogeneity. Publication bias was evaluated through visual inspection of funnel plots and Egger's test. Statistical significance was set at $p < 0.05$ for all analyses (4).

The review aimed to provide an evidence-based assessment of the effectiveness of LLLT in treating Bell's palsy, identifying research gaps, and guiding future investigations. By systematically synthesizing the existing literature, the study sought to determine whether LLLT offers significant benefits over traditional therapies and to establish optimal treatment protocols for clinical practice (5).

3   Results

The results of this systematic review provide a comprehensive analysis of the efficacy of low-level laser therapy (LLLT) in the treatment of Bell's palsy, based on data extracted from randomized controlled trials (RCTs). The review identified five RCTs that met the inclusion

criteria, involving a total of 349 participants, with 155 in the experimental groups receiving LLLT and 194 in the control groups receiving alternative treatments or placebo.

The quality assessment of the included RCTs was conducted using the Physiotherapy Evidence Database (PEDro) scale. The studies scored between 6 and 9 out of a possible 10, indicating a moderate to high methodological quality. The primary areas of methodological strength included random allocation, concealed allocation, and similar baseline characteristics across groups. However, blinding of participants and therapists was inconsistently applied, potentially influencing the outcomes.

The studies varied in their methodological approaches, including differences in LLLT parameters such as wavelength, intensity, and duration. The wavelengths used in the studies ranged from 805 to 830 nm, with power densities of approximately 1W applied for durations of about 1 minute per motor point or acupuncture site, typically over a period of 6 to 8 weeks.

The efficacy of LLLT was assessed using various outcome measures, including the House-Brackmann Scale (HBS), Sunnybrook Facial Grading System (SFGS), and Facial Disability Index (FDI). The results are summarized in Table 1 below.

Table 1: Summary of Efficacy Outcomes for LLLT in Bell's Palsy

Study ID	Sample Size	HBS Improvement	SFGS Improvement	FDI Improvement	P-value
Study 1	72 (36/36)	Significant	Significant	Not significant	<0.05
Study 2	80 (40/40)	Not significant	Significant	Not significant	>0.05
Study 3	67 (32/35)	Significant	Significant	Significant	<0.01
Study 4	65 (30/35)	Significant	Not significant	Not significant	<0.05
Study 5	65 (27/38)	Significant	Significant	Significant	<0.01

The findings indicate that LLLT significantly improved facial function in patients with Bell's palsy when compared to certain control treatments, particularly in studies utilizing the Sunnybrook Facial Grading System and House-Brackmann Scale. However, two studies reported no significant difference in FDI score improvements between the LLLT and control groups, suggesting variability in treatment efficacy across different outcome measures.

A meta-analysis was performed on the data from studies reporting on HBS and SFGS outcomes, which revealed a pooled effect size favoring LLLT over control treatments (Effect size: 0.65, 95% CI: 0.35-0.95, p<0.001), with moderate heterogeneity (I^2 = 48%).

4 Discussion

The systematic review demonstrated that low-level laser therapy (LLLT) is a promising treatment modality for Bell's palsy, offering significant improvements in facial nerve function. This finding is in alignment with previous studies that have identified LLLT as effective in enhancing nerve regeneration and reducing inflammation in various neurological conditions (2). The mechanisms underlying these benefits are linked to photobiomodulation, where specific wavelengths of light energy stimulate cellular processes, thereby promoting tissue repair and reducing inflammatory mediators. These physiological effects are particularly relevant in Bell's palsy, where inflammation of the facial nerve often contributes to the paralysis observed in patients (6).

Despite these promising results, the current body of research on LLLT for Bell's palsy exhibits several limitations. A major challenge identified was the heterogeneity of LLLT treatment protocols across the reviewed studies, including variations in wavelengths, power densities, and treatment durations. This variability complicates direct comparisons and highlights the necessity for standardized treatment protocols to ascertain the optimal parameters for LLLT application. Additionally, the methodological quality of some studies was undermined by issues such as inadequate blinding and small sample sizes, which could potentially introduce bias and affect the reliability of the results (3).

The systematic review further underscored the need for high-quality randomized controlled trials to address these limitations. Future research should focus on larger sample sizes and more rigorous study designs to validate the efficacy of LLLT and establish its role within clinical practice. Longitudinal studies examining the long-term effects of LLLT on facial nerve recovery and quality of life in Bell's palsy patients would be particularly valuable, as current studies often lack follow-up data to assess sustained outcomes (5).

Moreover, while LLLT showed significant improvements in several outcome measures, such as the Sunnybrook Facial Grading System and House-Brackmann Scale, some studies did not report significant differences in the Facial Disability Index, indicating variability in the therapy's effectiveness across different measures. This discrepancy suggests that patient-specific factors, such as the severity of nerve damage and the duration of symptoms, might influence the responsiveness to LLLT and should be considered in future studies (7).

Overall, the systematic review highlights the potential of LLLT as a non-invasive and effective treatment for Bell's palsy, particularly when integrated into a comprehensive treatment plan that includes conventional therapies. The findings provide a basis for developing clinical guidelines that incorporate LLLT, promoting a multidisciplinary approach to enhance patient outcomes. Further research should continue to explore the mechanisms of LLLT at the molecular level, which could offer deeper insights into its therapeutic potential and guide the development of optimized treatment regimens for Bell's palsy and other neurological disorders (4).

5   Conclusion

In conclusion, this systematic review highlights the potential benefits of low-level laser therapy (LLLT) as a non-invasive treatment option for Bell's palsy, demonstrating its ability to improve facial nerve function and accelerate recovery when compared to some traditional therapies. Despite the promising results, the variability in treatment protocols and methodological limitations of the studies underscore the need for further research to establish standardized guidelines and confirm these findings. The integration of LLLT into clinical practice could offer a valuable adjunctive therapy for enhancing patient outcomes, emphasizing the importance of a multidisciplinary approach in the management of Bell's palsy. As healthcare continues to evolve, the exploration of innovative and non-invasive treatments like LLLT can significantly contribute to improving the quality of life for patients suffering from this condition, thereby advancing human healthcare practices.

6   References

1   Yavagal PC. Systematic Review and Appraisal of Laser Photobiomodulation in Increasing Recovery Rates of Facial Palsy Patients. 2024.

2   Wu D, et al. Efficacy of Laser Acupuncture and Photobiomodulation Therapy for Bell's Palsy: A Randomized Controlled Trial. 2024.

3   Kim JH. A Comprehensive Analysis of Randomized Controlled Trials: Laser Therapy of Facial Palsy. 2023.

4   Ala Szczepura AJ, et al. Telerehabilitation for Patients with Facial Palsy: Cochrane Review and Meta-Analysis. 2022.

5   Shoman A, Hassan A, Kassab A. Effects of Low-Level Diode Laser Therapy Combined with Electrical Stimulation on Facial Nerve Regeneration in Bell's Palsy Patients. ORL Journal. 2022.

6   Salaheldien Alayat M, et al. Effects of MLS Laser Therapy on Idiopathic Bell's Palsy: A Randomized Double-Blind Placebo-Controlled Trial. 2022.

7   Raied R, et al. Effectiveness of Exercise, LLLT, and IDC in Improving Facial Function in Bell's Palsy. 2022.

8   Hajer MS, et al. High-Intensity Laser Therapy for Persistent Bell's Palsy: A Comparative Study. 2022.

9   Oliveira C. Effect of Electrostimulation Applied on Bell's Palsy: A Systematic Review. 2022.

10   Pasquale C. Case Series on Idiopathic Facial Paralysis Treated with Photobiomodulation. 2022.

11   Kuzmičić S. Chronic Bell's Palsy Rehabilitation: Case Report and Literature Review. 2022.

12   Tharani G, et al. Comparison of Galvanic Stimulation and Laser Therapy in Bell's Palsy Patients in South India. 2022.

13   Javath JM, et al. Effectiveness of Electrical Stimulation and Low-Level Laser Therapy in the Management of Acute Bell's Palsy: A Randomized Clinical Trial. Int J Res Basic Med Sci. 2021.

14   Kim, et al. Laser Therapy for Facial Palsy: Protocol for a Systematic Review and Meta-Analysis. Medicine. 2020.

15   Javaherian M, et al. Efficacy of Low-Level Laser Therapy in Bell's Palsy: A Systematic Review. 2020.

16   Kottaras A, et al. Laser Therapy in Bell's Palsy: An Evidence-Based Review. 2021.

17   Tonne G. Effects of Laser Acupuncture Therapy for Insufficient Bell's Palsy Recovery: A Sham-Controlled Randomized Double-Blind
      Study. 2021.

18   Kandakurti K, et al. Using Low-Level Laser Therapy and Facial Expressions to Address Moderate to Severe Bell's Palsy: A
      Randomized Controlled Trial. Int J Surg Protocols. 2020.

19   Farhoudi F, et al. Cure Effect of Low-Level Laser Treatment for Bell's Palsy in Diabetics: Clinical Interventional Assessment. 2020.

20   Rongchao Z, et al. Comparing the Effectiveness of Acupuncture and Medications in the Treatment of Bell's Palsy: A Systematic Review
      and Meta-Analysis of RCTs. 2019.

21   Kumar S, et al. Efficacy of Class IV Laser Treatment in Bell's Palsy: A Case Series Analysis. 2019.

22   Rothschild D, Ng SY. Cautious and Secure Treatment for Bell's Palsy Using Low-Energy Infrared Laser Treatment. 2018.

23   Ordahan B, Yagher A. Examination of Efficiency of Low-Level Laser Treatment Added to Conventional Facial Exercises in Early
      Recovery of Bell's Palsy. Lasers Med Sci. 2017.

24   Li P, et al. Effectiveness of Acupuncture in Treating Bell's Palsy: A Systematic Review and Meta-Analysis. 2015.

25   Hamed M, et al. Efficacy of Low-Level Laser Therapy Compared with High-Intensity Laser Therapy for Patients with Bell's Palsy.
      2014.

16   Kottaras A, et al. Laser Therapy in Bell's Palsy: An Evidence-Based Review. 2021.

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