# LOW-LEVEL LASER THERAPY AS A FORM OF TREATMENT FOR LOW BACK PAIN: AN INTEGRATIVE REVIEW

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**Eduardo Filoni[1], Alfredo Ribeiro Filho[2], Paulo Celso Pardi[3], Cristina Braga[4], Fabrício Vieira Cavalcante[5], Clayton Gomes Crozariol[6], Adriana Paula Jordão Isabella[7], Renata Salani[8], Aloísio Olímpio[9], Cristina Nunes Capeloa[10], Christian Douradinho[11], Carlos Alberto Ocon[12] and Márcio Fernandes da Cunha[13]**

[1] Doctor of Science
Cruzeiro do Sul University
E-mail: edufiloni@hotmail.com.br
[2] Master in Pharmacy Uniban
Universidade Nove de Julho.
E-mail: arfmm@uol.com.br
[3] Dr. in Sciences (Morphology) from the Federal University of São Paulo (UNIFESP)
Eniac University Center of Excellence
E-mail: drpaulopardi@gmail.com contacted
[4] Dr. in Health Sciences from the Institute of Medical Assistance to the State Public Servant of S. Paulo (IAMSPE)
Nove de Julho University, Institute of Medical Assistance to the State Public Servant of S. Paulo
E-mail: cris.br@terra.com.br
[5] Master in Collective Health (Epidemiology)
University of Brasília (UnB)
E-mail: fabricioocavalcante@gmail.com
[6] Specialist in Adult and Pediatric Cardio-Pneumofunctional Physiotherapy at Faculdade Santa Marcelina (FASM).
Professor at the City University of São Paulo (UNICID)
E-mail: clayton.ef.fisio@gmail.com
[7] Dr. in Biophotonics
Nove de Julho University (UNINOVE)
E-mail: apji@uninove.br
[8] PhD in Biophotonics Applied to Health Sciences from Universidade Nove de Julho (UNINOVE)
Hospital Sírio Libanês
E-mail: renata.salani@hsl.org.br
[9] Specialist in Collective Health from the Faculty of Medical Sciences of the State University of Campinas (UNICAMP)
State University of Campinas (UNICAMP)
E-mail: aloisio6@unicamp.br
[10] Dr. in Biophotonics Applied to Health Sciences
Nove de Julho University (UNINOVE)
E-mail: cristina.capeloa@uni9.pro.br
[11] Master in Medical Sciences Focus on Gerontology from the Faculty of Medicine of the University of São Paulo (FMUSP)
Nove de Julho University
E-mail: c.douradinho@uni9.pro.br
[12] Doctor of Health Sciences in Medicine
Nove de Julho University (UNINOVE)
E-mail: cocion@uni9.pro.br
[13] Master of Science in Health Sciences
Cruzeiro do Sul University
E-mail: marciofdc@terra.com.br

## ABSTRACT

Introduction: Low back pain is an important cause of disability, occurring in high prevalence in all cultures, negatively influencing people's quality of life. The low-level laser has been shown to be an appropriate choice for reducing pain. The objective of the present study was to evaluate the use of low-level laser in low back pain. Method: Integrative review using articles in Lilacs, Medline, Scielo, Cochrane Library and journals. The inclusion criteria for the clinical studies in this review were: being a randomized clinical study investigating the effect of low-level laser on low back pain, alone or as part of a treatment program; assess at least one of the following outcomes: pain, disability, and quality of life. Studies located in the period from 2013 to 2033 were included. Results and Discussion: The studies showed the role of LLLT in reducing inflammation, changing endorphin levels, reducing pain, and accelerating recovery of nerve conduction. Final Considerations: Most of the articles showed favorable effects of low-level laser on low back pain with adjuvant therapies.

**Keywords:** Low Back Pain. Lumbago. Rehabilitation. Low Intensity Laser. Laser therapy.

## INTRODUCTION

The term low back pain refers to pain in the lumbar spine, being one of the most common symptoms of spinal dysfunctions. This is a dysfunction that affects both sexes, and can range from acute pain, if it lasts less than four weeks; subacute, lasting up to 12 weeks; and chronic, if it persists for more than 12 weeks (Pires; Samulski, 2006).

Chronic low back pain is a symptom, not a disease, that is characterized by pain, which can result from various causes. Due to the complexity of low back pain, we can classify them etiologically as structural; traumatic, musculoskeletal; Degenerative; Rheumatic; birth defects; Inflammatory; Neoplastic; reflex visceral; bone diseases; and metabolic (Costa; Palma, 2005; Caetano *et al,* 2006)

Low back pain can be caused by several factors and modified by psychosocial disorders. Studies show that around 50% to 90% of adult individuals may have low back pain at some point in their lives. In industrialized countries, low back pain is one of the leading causes of disability in individuals under the age of 45. The incidence seems to be equal in men and women, however women have a higher incidence of complaints after 60 years of age, authors state that this fact is due to osteoporosis. Low back pain is the main cause of absenteeism from work, being a cause of disability in individuals in the productive age group, causing considerable damage to the economy (Imamura; Kaziyama; Imamura, 2001); (Helfenstein; Goldenfum; Siena, 2010).

The recurrence of low back pain is a condition that can bring numerous limitations to the patient, so 90% of patients recover spontaneously within 4 to 7 weeks, however, although recovery is rapid, the tendency for recurrence of painful symptoms can occur in 50% of individuals who presented an acute episode within 1 year Recent studies, Evaluating patients followed for 6 months to 2 years, they observed that 40% to 44% of patients have chronic pain. It is estimated that 1% to 3% of patients with low back pain may be amenable to a surgical procedure. (Imamura; Kaziyama; Imamura, 2001); (Helfenstein; Goldenfum; Siena, 2010); (Da Silva; Reis, 2021).

Physical therapy intervention is important for the treatment of the cause of low back pain, as it provides pain relief, through resources that reduce muscle contracture, improve trophism, and increase flexibility and global relaxation, improving posture and improving the quality of life of patients (Lima, 2023).

Low-level laser, proposed in the studies in this review, has been widely used in patients with musculoskeletal disorders. Among the main therapeutic effects of this type of laser are the anti-inflammatory action, analgesia, and modulation of cellular activity (Lira, 2023); (Dos Santos; Invention, 2024).

For safe and effective use of low-power laser, several points still need to be clarified and standardized. Some of these topics relate to the type of LLLT, wavelength, and dose employed, which can alter the desirable effects during the application of such a resource (Yang, 2022).

Photobiomodulation therapy applied in the form of low-intensity light amplification by stimulated emission of radiation (LASER) and light-emitting diode (LED) has been shown to reduce inflammation and swelling, promote healing, and reduce pain for a number of musculoskeletal conditions. There is evidence that photobiomodulation therapy reduces pain intensity in non-specific knee pain, osteoarthritis, post-total hip arthroplasty pain, fibromyalgia, temporomandibular diseases, neck pain, and low back pain (De Oliveira *et al*, 2022).

Low back pain is an important cause of disability, occurring in high prevalence in all cultures, negatively influencing people's quality of life (Valadares *et al*, 2020).

There are several therapeutic resources available for the treatment of low back pain, such as surgical and drug measures. However, physiotherapy works through conservative treatment, with electro-thermophototherapeutic resources, kinesiotherapy through exercise programs aimed at better muscle conditioning, postural alignment, relaxation and symptomatic pain relief. However, its eligibility will depend on the patient's clinical condition and the evaluation carried out by the physiotherapist (Lima *et al*, 1999).

Among the various electro-thermophototherapeutic resources used, low-level laser has been gaining prominence in recent decades (Fumache *et al*, 2021).

The low-level laser has proven to be a very suitable choice for reducing pain. Because it is not an invasive procedure, it has shown good results in pain treatments in the area of Medicine. Therefore, its use for the treatment of low back pain is proposed, which, among the musculoskeletal pathologies, deserves special attention and can be considered a public health problem (Lino *et al*, 2023); (Ocon *et al* , 2024); (Pires *et al*, 2024); (Isabella *et al,* 2024)

Considering the aggravating factors of low back pain and the concern to verify the applicability of this resource, this study intends, through a literature review, to describe the effects of the use of therapeutic laser on low back pain.

In view of the above, the objective of the present study was to describe the effects of the use of low-level laser in patients with low back pain through an integrative review.

## METHOD

For this study, the authors opted for an integrative review, a methodology that offers the synthesis of knowledge and the incorporation of the applicability of results of significant studies into the scope of the topic in question. The method emerges as an instrument of Evidence-Based Practice (EBP), which began with the work of epidemiologist Archie Cochrane, which is characterized by an approach focused on clinical care and teaching based on knowledge and the quality of evidence. With a broad methodological approach regarding reviews, allowing the inclusion of experimental and non-experimental studies for a complete understanding of the phenomenon analyzed. It can combine theoretical and empirical literature, as well as incorporate concept definition, review of theories and evidence, and analysis of methodological problems of a particular topic (Whittemore *et al*, 2005); (Brevidelli; Domenico, 2008). In this study, articles in Lilacs, Medline, SciELO, Cochrane Library and PubMed databases were used.

The descriptors for searching for articles were: "low back pain", "low back pain", "rehabilitation", "low-level laser", "laser therapy". The inclusion criteria for the clinical studies in this review were: studies investigating the effect of low-level laser on low back pain, alone or as part of a treatment programme; assess at least one of the following outcomes: pain, disability, and quality of life. Studies located from 2010 to 2023 were included.

Among the publications identified, Portuguese and English were selected. After analyzing the 238 articles found, only 7 were used in this study.

## RESULTS AND DISCUSSION

Because low back pain is one of the causes of musculoskeletal disability and is responsible for being the main chronic disease worldwide, several electro-thermophototherapeutic resources have currently been investigated in order to promote the relief of pain symptoms in patients diagnosed with this disease. One of the treatments that has been giving excellent results is photobiomodulation (FBM) by low-intensity laser (LLLT) and/or intense pulsed light (LED), effective to treat the signs and symptoms of low back pain due to its photobiomodulatory effects.

Chart 1 shows the studies used to carry out this article.

Chart 1 – EFFECT OF LOW-INTENSITY LASER ON LOW BACK PAIN – São Paulo, 2023.

| *AUTHORS* | *EVALUATION METHOD* | *COMBINATION THERAPY* | *RESULTS* |
|---|---|---|---|
| Konstantinovic et al., 2010 | Pain (VAS), movement (Schober), functionality (Oswestry), quality of life (SF-36). Applied before and after intervention. | Group A (182):nimesulide and active LLLT Group B(182):nimesulide (COX-2 inibidor) Grupo C(182):nimesulida and LBI placebo | Improvement in the 3 groups, more in group A. Group C better than group B- Placebo effect |
| Jovicic *et al., 2012* | Pain (VAS), movement (Schober),Straight leg raise (NASS),manual muscle test. Applied before and after intervention. | Uncombined therapy. Active LBI only. | The 3 energy doses of LBI were equally effective in relieving pain, but the 4 J dose was more effective in improving activities of daily living and lumbar mobility. |
| Momenzadeh S *et al*., 2012 | Pain(Vas),Disability(ODI)Applied before and after intervention at 6 weeks and after 6 weeks without intervention-12 weeks | Group 1(20):Active LBI Group 2(20):Active LBI + exercise Group 3(20): LLLT placebo + exercise | The disability of patients in groups 1 and 2 in the 6th week showed significant improvement compared to the beginning. The rate of pain and disability in the 12th week of the study improved significantly compared to the 6th week of the study in groups 1 and 2. |
| Hsieh R.; Lee, W.C., 2014. | Dor(Vas), incapacidade(Disability Oswestry),s Questionar Fear Avoidance Belifs | Group 1(25):LBI ativa + hot pack Group 2(25):LBI placebo + hot pack | The combination of the LLLT and hot pack reduces low back pain compared to placebo |
| Bagg *et al,* (2022) | The control group included sham laser and short-wave diathermy applied to the lumbar region and sham non-invasive brain stimulation | A total of 276 adults were randomized (in a 1:1 ratio) to clinician-administered intervention or sham procedure and clinician-administered care control groups, using laser and physical activity. | The primary outcome is that graded sensorimotor retraining, compared to a sham procedure and attention control, significantly improved pain intensity at 18 weeks with the aid of the laser. |
| Yang *et al*, (2023). | Randomized clinical trial. | Low-level laser acupuncture combined with auricular acupressure (LLLT) on pain intensity. | A 4-week LBI intervention reduced pain intensity and pain interference with the improvement in the quality of life of the group studied. |

Source: Authors

In the study by Konstantinovic *et al*, (2010) the effects of low-level laser therapy LBI or LLLT in patients with acute low back pain and radiculopathy were investigated. A randomized, double-blind, placebo-controlled clinical trial compared three groups: one treated with nimesulide and active LLLT, another with nimesulide alone, and a third with nimesulide and placebo LLLT. The results showed that the group that received active LLLT

showed statistically significant improvement in all measured parameters, including pain intensity and lumbar mobility, compared to the other groups. The study concluded that LLLT, used as an adjunctive therapy to nimesulide, significantly improves the treatment of acute low back pain with radiculopathy.

In 2012, Jovicic *et al*. evaluated 66 patients with low back pain and acute low back pain and low back pain treated with LLLT. Patients were randomly divided into 3 groups that received three different doses of LLLT, with the following parameters: 904 nm, 3000 Hz, 25 mW, energy dose of 0.1J per point in the first group, J per point in the second group, and 4J per point in the third group. The authors noted that the three energy doses of LBP were equally effective at relieving pain, but the 4J dose was more effective at improving activities of daily living and lower back mobility.

Momenzade *et al*. (2012) reported that LLLT combined with physical exercise can be effective in low back pain, investigating 60 patients who were divided into 3 groups. One group, LBI only; another, placebo LLLT + physical exercise and the third group, placebo LLLT + physical exercise. Therapy was performed 2 times a week for 6 weeks. Pain and disability were measured at week 6 and week 12.

The disability of patients in groups 1 and 2 at week 6 showed a significant improvement compared to the beginning of the study. The rate of pain and disability at week 12 improved significantly from week 6 of the study in groups 1 and 2.

In the short term, Hsieh and Ru-Lan (2013) researched the action of LLLT on low back pain 3 times a week for 2 weeks. 50 patients received active 890 nm sessions or placebo combined with surface heat (hot pack) and were able to verify through the results that the combination of LLLT and hot pack reduces low back pain compared to treatment with hot pack and placebo. In order to analyze the effect of LLLT on low back pain, we initially sought to observe the laser parameters. Thus, the treatment protocol was verified that displayed the parameters of each laser in the selected articles. Through these data, it was observed which parameters were most used among the studies, as well as the method chosen to better evaluate the effect of LLLT on low back pain.

During the application of LLLT, in order to obtain the appropriate biological response, it is necessary to achieve the optimal radiation dose, the correct wavelength, and the number of applications sufficient to produce a therapeutic effect. In the present study, few laser parameters were analyzed, since only those most evidenced among the articles were used. This is due to the lack of standardization of treatment protocols and insufficient data among the studies (Rodrigues *et al*, 2020).

Studies have shown the role of LLLT in reducing inflammation, changing endorphin levels, reducing pain, and accelerating recovery of nerve conduction (Rodrigues *et al*, 2020); (Parizotto, 2001); (Momenzade *et al*. 2012).

Most of the articles showed favorable effects of low-level laser on low back pain, and when used with adjuvant therapies it has an improvement in quality of life (Rodrigues *et al*, 2020); (Parizotto, 2001); (Bertolini *et al*, 2008)..

Physical therapy intervention is important for the treatment of the cause of low back pain, as it provides pain relief through resources that reduce muscle contracture, improve trophism and increase flexibility and global relaxation, improving posture and improving the quality of life of patients (Parizotto, 2001).

The low-level laser, proposed in the studies in this review, is widely used in patients with musculoskeletal disorders. Among the main therapeutic effects of this type of laser are the anti-inflammatory action, analgesia and modulation of cellular activity (Parizotto, 2001).

For safe and effective use of low-power laser, several points still need to be clarified and standardized. Some of these topics are related to the type of LLLT, wavelength and dose used, which can alter the desirable effects during the application of such a resource (Bertolini *et al*, 2008).

Photobiomodulation therapy applied in the form of low-intensity light amplification by stimulated emission of radiation (LASER) and light-emitting diode (LED) has been shown to reduce inflammation and swelling, promote healing, and reduce pain for a number of musculoskeletal conditions. There is evidence that photobiomodulation therapy reduces pain intensity in non-specific knee pain, osteoarthritis, post-total hip arthroplasty pain, fibromyalgia, temporomandibular diseases, neck pain, and low back pain (De Oliveira *et al*, 2022).

According to Jovicic, *et al* (2012) the efficacy of different doses of low-level LLLT laser therapy in the treatment of acute low back pain with radiculopathy was observed. A randomized, double-blind study with 66 patients divided into three groups received varying doses of LLLT (0.1 J, 1 J, and 4 J per point). The results showed that all doses were effective in reducing pain, but the 4 J dose showed better results in improving lumbar function and mobility.

In the study by Bagg *et al,* (2022) the authors highlight the importance of the effects of altered neural processing, defined as alteration of neural networks responsible for pain perceptions and conducted a parallel, randomized, 2-group clinical trial recruiting participants with chronic low back pain (> 3 months) nonspecific from primary and community care settings. A total of 276 adults were randomized (in a 1:1 ratio) to the

intervention or sham procedure and attentional control groups administered by clinicians at a medical research institute in Sydney, Australia. The first participant was randomized on December 10, 2015, and the last was randomized on July 25, 2019. The follow-up was completed on 3 February 2020. In this study, participants randomized to the intervention group (n = 138) were invited to participate in 12 weekly clinical sessions and training in their homes and were instructed to move and practice physical activity in the case of low back pain. Participants randomized to the control group (n = 138) were asked to participate in 12 weekly clinical sessions and training also in their homes that required similar time to the intervention but did not focus on education, movement, and physical activity. The control group included sham laser and shortwave diathermy applied to the lumbar region and sham non-invasive brain stimulation. The primary result was that graduated sensorimotor retraining, compared to a sham procedure and attention control, significantly improved pain intensity at 18 weeks with the aid of the laser

Yang *et al* (2023) in their study analyzed low back pain (LBP) in nurses, which is a major health problem that affects quality of life and work capacity, with consequences for their economic status, and evaluated the effect of the effect of low-level laser acupuncture combined with auricular acupressure (AAL) on pain intensity, Pain interference and quality of life in nurses with low back pain. This was a randomized clinical trial in which a convenience sample of nurses from a teaching hospital in Taiwan, China, was recruited. Participants were randomly assigned to the LAA group (n = 38) receiving low-level laser acupuncture and auricular acupressure for 4 weeks, and the control group (n = 38) receiving only sham laser acupuncture treatment with no laser energy output. The authors were able to conclude that the 4-week LAA intervention reduced pain intensity and pain interference, and improved quality of life for hospital nurses with low back pain. These effects were maintained continuously for at least 4 weeks after the intervention. Nonpharmacologic intervention, LAA, may be another effective, feasible, and noninvasive analgesic intervention for low back pain.

The heterogeneity in the results of treatment with the use of laser therapy may be due to the variation of parameters and protocols. It is important that in the next studies, all the parameters of laser application are discussed.

Although the reviewed articles presented a great variability in the physical parameters of the laser, it was possible to observe that there were favorable effects on pain, disability, and quality of life of patients with low back pain.

## FINAL CONSIDERATIONS

Low-level laser has been frequently used in physical therapy treatment, due to its characteristics of relieving pain, stimulating tissue repair, reducing edema and hyperemia in anti-inflammatory processes, preventing infections, in addition to acting on paresthesias, according to this study we could observe the effectiveness of this therapy and that it can be used with adjuvant therapies.

Considering that low back pain reaches considerable levels in the world population in this study, we can observe in this study. that there are still few publications related to the subject, especially clinical trials, reproduction of results, wide variety of parameters, lack of detailed description; pointing out the need for special attention to the subject addressed, especially new research that seeks the standardization and efficacy of laser in acute and chronic low back pain. The articles used showed favorable effects of low back laser in the treatment of acute and chronic low back pain.

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