ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 08 | August - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EFFICACY OF HIGH INTENSITY LASER THERAPY IN BACK PAIN: AN EVIDENCE BASED STUDY

Physiotherapy

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ABSTRACT

Background: Back pain is the leading cause of activity limitation and work absence throughout much of the world, and it causes an enormous economic burden on individuals, families, communities, industry and governments. High Intensity Laser Therapy (HILT) has photochemistry effects that stimulate oxidation of mitochondria and ATP creation by delivering high energy output inside tissues. HILT can cause quick absorption of edema and removal of exudates through increased metabolism and blood circulation. Although many nonsurgical treatments for chronic back pain have been introduced so far, there is a paucity of research on HILT. **Methodology:** This Evidence based study was conducted from 2011 to 2023. Search engines used to find appropriate articles were: PubMed, Google Scholar, PEDro, ResearchGate, ScienceDirect. Key words used were: Back pain, HILT, High Intensity Laser Therapy, Laser Therapy. Articles were assessed via 2 scales: Centre for Evidence-Based Medicine's (CEBM's) Levels of Evidence and PEDro scale. **Result:** Total 136 articles were found, out of which 15 articles were relevant and from those 9 articles were included in this evidence-based study. From total 9 studies, there is 2 Systematic review and meta-analysis, 1 Systematic review, 3 Randomized controlled trials and 2 Comparative studies. Their Level of evidence was 1a, 1b and 2a. **Conclusions:** High intensity laser therapy can be considered a complimentary modality for effective management of low back pain to improve pain and function. When compared or combined with other modalities such as ultrasound and tens it improves pain and function more efficiently.

KEYWORDS

Back Pain, HILT, High Intensity Laser Therapy , Laser Therapy

INTRODUCTION

Low back pain is the leading cause of activity limitation and work absence throughout much of the world, and it causes an enormous economic burden on individuals, families, communities, industry and governments. Until 10 years ago, it was largely thought of as a problem confined to Western countries; however, since that time an increasing amount of research has demonstrated that low back pain is also a major problem in low and middle income countries.

Studies suggest that low back pain may arise from any one of a number of anatomical structures, including bones, intervertebral discs, joints, ligaments, muscles, neural structures and blood vessels. In a minority of instances, approximately 5–15%, low back pain can be attributed to a specific cause such as an osteoporotic fracture, neoplasm or infection .[1] For the remaining 85–95% of cases, the specific cause of low back pain is unclear.

The search for causes of low back pain continues through causal inference, which is a process whereby several criteria are examined to assess causation. These include assessment of bias and confounding; demonstrating a temporal relationship (i.e., the cause must precede the effect); plausibility; consistency with other studies; the strength of the association (i.e., the relative risk); the dose– response relationship (i.e., does increased exposure lead to increased effect); and reversibility (i.e., does removal of the exposure reduce the disease risk)[2]. Due to methodological heterogeneity in studies that have investigated causation of low back pain, it is difficult to draw any conclusions about causality.

Many studies have significant bias and confounding and relatively few cohort studies have been conducted. It has also been difficult to determine a temporal relationship between risk factors and low back pain (e.g., depression and low back pain), and it has been difficult to quantify exposure variables (e.g., in the occupational setting: the frequency/amount of lifting).[3]

There are a number of psychosocial factors associated with low back pain, including stress, anxiety, depression and certain types of pain behaviour; however, the direction for these relationships is often unclear. Evidence shows that psychosocial factors are also significantly associated with the transition from acute to chronic low back pain. Psychosocial workplace factors have also been shown to be important risk factors for low back pain. In two systematic reviews, it was found that job dissatisfaction, monotonous tasks, poor work relations, lack of social support in the workplace, demands, stress and perceived ability were associated with an increased occurrence of low back pain. Job dissatisfaction has also been shown to be associated with transition from acute to chronic low back pain.[4]

Other occupational factors have been shown to be associated with low back pain. One study demonstrated a clear correlation between physical demands of work and the prevalence of low back pain (with the exception of lifetime prevalence in female workers). They found the point prevalence of low back pain was 39% in manual workers, but only 18.3% in male sedentary workers. More recently, a systematic review found that manual handling, bending, twisting and whole-body vibration are risk factors for low back pain. Although the data on occupational risk in low-income countries are relatively limited, it has been estimated that 80–90% of the population in these areas are involved in 'heavy work', which suggests this may have a significant impact on the occurrence of low back pain.[5]

More recently, the pulsed neodymium-doped yttrium aluminium garnet (Nd:YAG) laser, a form of high-intensity laser therapy (HILT), was introduced to the field of physical therapy. This laser works with high peak power (3 kW), and a wavelength of 1,064 nm, and is considered to be a nonpainful and noninvasive therapeutic modality. It is able to stimulate areas that are difficult to reach with the low-power laser, such as the large and/or deep joints . The use of the pulsed Nd:YAG laser has been increasing, with patients reporting significant pain reduction. Studies have documented the anti-inflammatory, anti-oedematous, and analgesic effects of the Nd:YAG laser, justifying its use in patients with pain issues.

High Intensity Laser Therapy (HILT) has photochemistry effects that stimulate oxidation of mitochondria and ATP creation by delivering high energy output inside tissues. HILT can cause quick absorption of edema and removal of exudates through increased metabolism and blood circulation. Although many nonsurgical treatments for chronic back pain have been introduced so far, there is a paucity of research on HILT.[6]

METHODOLOGY

Study Design:

An Evidence Based Study. This was conducted according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) guidelines. (Figure 1).

Literature Search:

A specified literature search was performed from 2011 to 2023 (12 years). Literature was searched using following search engines: Google Scholar, PEDro, PubMed, ResearchGate, ScienceDirect

KEY WORDS USED FOR THE SEARCH WERE:
Back Pain, HILT, High Intensity Laser Therapy, Laser Therapy

ASSESSMENT OF METHODOLOGICAL QUALITY:
Data was assessed using 2 parameters: (1) Centre for Evidence-Based Medicine's (CEBM's) Levels of Evidence and (2) PEDro scale

1. The CEBM Levels of Evidence scale: It assesses quality based on study design, which categorize the studies in a scale ranging from 1 to 5 with further subdivision for each

2. The PEDro scale: It assesses methodological quality and consists of a checklist of 11criteria, 10 of which are scored. For each criterion the study met, 1 point was awarded. The points were presented as a score out of 10. For this review, investigations with PEDro scores of 6 to 10 were considered high quality, of 4 to 5 were considered moderate quality, and of 0 to 3 were considered low quality.

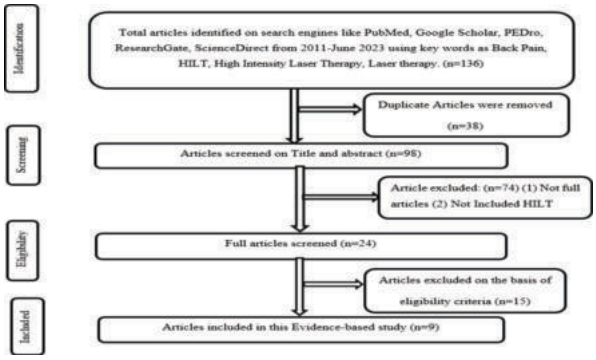

Figure 1: Preferred Reporting Items For Systematic Reviews And Meta-analysis (PRISMA)

Table 1: Characteristics Of Included Studies

Sr No.	TITLE	Study design & Duration	Articles Or Sample Size	Pedro And Level Of Evidence
1	The effectiveness of high intensity laser therapy in management of spinal disorders	Systemic review and meta-analysis	6	1a
2	The effectiveness of laser therapy on the management of chronic low back pain	Systemic review	397	1a
3	Effectiveness of high intensity laser therapy in the treatment of musculoskeletal disorders	Systemic review meta-analysis of randomized controlled trial	12 studies selected including 736 participants	1a
4	Short-term effect of high intensity laser therapy versus ultrasound therapy in treatment of low back pain	A randomized controlled trial	30	8/10 1b
5	Comparison of two different electrotherapy methods in low back pain treatment	Comparative study	40	5/10 2a
6	Long-term effect of high –intensity laser therapy in the treatment of patients with chronic low back pain	A randomized blinded placebo-controlled trial	72	5/10 2a
7	Effect of high intensity laser therapy on pain and function of patients with chronic back pain	Comparative study	20	3/10 2b
8	Comparison of high intensity laser therapy and combination of transcutaneous nerve stimulation and ultrasound treatment in patients with chronic lumbar radiculopathy	A randomized single-blinded study	54	5/10 2a
9	Laser photo biomodulation is more effective than ultrasound therapy in patients with chronic non-specific low back pain	Comparative study	45	4/10 2a

RESULTS
Evidences were reviewed and analysis was done on the basis of PEDro score and CEBM's Level of Evidence Scale. Risk of bias is also assessed.

Total 136 articles were found, out of which 15 articles were relevant and from those 9 articles were included in this evidence-based study and other articles were excluded.

From total 9 studies, there is 3 meta-analysis and systematic reviews, 3 comparative study, 3 Randomized controlled trial. All studies shown that High Intensity Laser Therapy is effective in management of Low back pain.

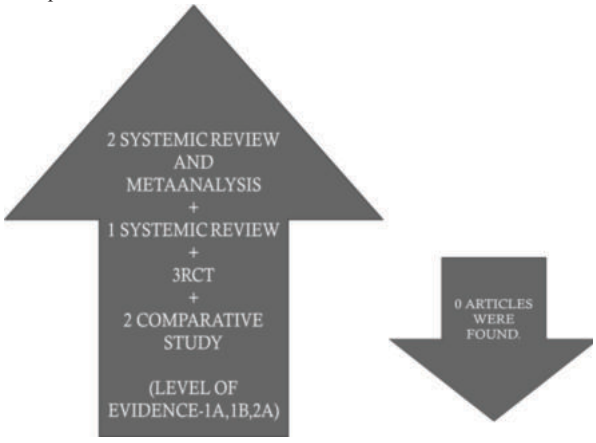

Figure 2: Result of Evidence Based Study

DISCUSSION
This evidence-based study included total 9 studies, there is 2 Systematic review and meta-analysis, 1 Systematic review, 3 Randomized controlled trials and 2 Comparative studies.

Laser treatment is noninvasive, painless, and can be easily administered in primary care settings for a wide range of conditions [7]. It has been reported that the use of laser therapy significantly reduces pain levels in both acute and chronic conditions such as rheumatoid arthritis, chronic osteoarthritis, carpal tunnel syndrome, fibromyalgia, knee injury, shoulder pain, and postoperative pain [8]. Although low level laser therapy does not elevate tissue temperatures more than a few degrees [9], studies have found that the treatment has the potential to reduce inflammation, pain and improve function [10]. Low level laser therapy significantly increases microcirculation, activates angiogenesis, and stimulates immunological processes and nerve regeneration. Moreover, it has an analgesic effect through stimulating an increased production of endorphins. More recently, the pulsed neodymium-doped yttrium aluminum garnet (Nd:YAG) laser, a form of high-intensity laser therapy (HILT), was introduced to the field of physical therapy. This laser works with high peak power (3 kW), and a wavelength of 1,064 nm, and is considered to be a nonpainful and noninvasive therapeutic modality. It is able to stimulate areas that are difficult to reach with the low-power laser, such as the large and/or deep joints. The use of the pulsed Nd:YAG laser has been increasing, with patients reporting significant pain reduction [37]. Studies have documented the anti-inflammatory, anti-oedematous, and analgesic effects of the Nd:YAG laser, justifying its use in patients with pain issues [11].

HILT has been known to reduce heat accumulation in tissues and to have photothermal and photochemical effects in deep tissues for limited periods.[12] These properties favor treatment of deep tissues and structures by increasing cell metabolism, vascular permeability, and blood flow.[13] The pain control effect achieved by HILT might be attributed to multiple mechanisms. In the central nervous system, the secretion of endogenous opioids such as b-endorphins is increased by

laser therapy and these could centrally inhibit pain sensations.[14] In the peripheral nervous system, substance P sensitizes pain transmitting neurons and leads to hyperalgesia; however, laser therapy has been reported to decrease the secretion of substance P by peripheral receptors.[15] Laser therapy might increase the latency and decrease the conduction velocity of sensory nerves by inhibiting Ae- and C-fiber transmission; these in turn may decrease the transmission of pain signals.[16] In tissues, laser therapy may also reduce the release of histamine and bradykinin in injured tissues and increase the pain threshold.[17] These multiple actions of laser therapy may represent the underlying mechanisms involved in the control the pain in MSD. In addition, a decrease in pain sensation has a significant effect on the increase of range of motion and the quality of life of the patient.[18] Thus, functional ability in patients with MSD could also be also improved.

According to the Arndt-Schulz principle, excessive energy delivered to tissues may produce adverse effects to the human body [19]. There was no definite HILT protocol existing for the treatment of spinal disorders, with the frequency of sessions as well as the duration of study varying between studies; one session daily was given for patients for one week [20], for two weeks, three weeks or two sessions/week for 4–6 weeks [21]. The current systematic review showed variation in laser source, wavelength, power, fluency, radiant exposure, application area, energy and time delivered to patients. Furthermore, there were variations in terms of treatment protocol, frequency and duration. All these variations may explain the heterogeneity in the meta-analysis. Some studies used the term intensity or the power density, that is the power per unit area, which may considered as incorrect terminology used to describe the laser type [22]. There is no definite limit to differentiate between LLLT and HILT. In addition, the term intensity does not distinguish between the radiant exitance (emitted light) from the energy density of irradiance, which is the irradiated light arriving that depends on the beam area (light exit) [23]. Such a term may lead to confusion and may be an improper laser description or title. Therefore, future studies should use such terms with caution.

CONCLUSION

High intensity laser therapy can be considered a complimentary modality for effective management of low back pain to improve pain and function. When compared or combined with other modalities such as ultrasound and tens it improves pain and function more efficiently.

Conflict Of Interest:
There Is No Conflict Of Interest.

Abbreviations

LBP: Low back pain, CNSLBP: Chronic Non-specific Low back pain, PEDro: Physiotherapy Evidence Database, CINAHL: Cumulative Index Of Nursing And Allied Health Literature, CEBM: Center Of Evidence Based Medicine, TENS: Transcutaneous Electrical Nerve Stimulation, US: Ultrasound, IFT: Interferential Therapy, HMP: Hot Moist Pack, VAS: Visual Analogue Scale, NPRS: Numeric Pain Rating Scale, ODI: Oswestry Disability Index, MODI: Modified Oswestry Disability Index, PPA: Pain Pressure Algometer, BDI: Back Depression Inventory, RMQ: Ronald Morris Questionnaire, MPQ: Mcgill Pain Questionnaire, RCT: Randomized Controlled Trial, SWD: Short Wave Diathermy, ROM: Range of Motion

Ethical Approval

Ethical approval was not required.

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