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Review Article

Adjunctive Approach to Therapeutic Laser and Exercise Therapies in Alleviating Pain and Disability in Patients with Low Back Pain: A Systematic Review

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Low back pain (LBP), a globally prevalent musculoskeletal condition, affects mobility, mental well-being, and overall quality of life. It is generally caused by disc degeneration, muscular strain, ligamentous sprain, or a disease located at the lumbar spine. Owing to this disability, the social and occupational interactions of an individual might get affected. Modern medicine frequently combines exercise therapy with light amplification by stimulated emission of radiation (LASER) therapy, especially high intensity LASER therapy (HILT) or low level LASER therapy (LLLT), to increase the efficacy of the treatment modalities for LBP. This review aimed to determine the effect of the combined approach of LASER and exercise therapies in managing pain and reducing disability in patients with LBP. PubMed, Google Scholar, Cochrane Library, MEDLINE, and PEDro were searched for full-text research articles published from 2000 to 2023. Overall, 3,913 records were screened from these databases and six high methodological quality studies (PEDro ≥ 5) were included in this review after eligibility assessment. Review manager 5.4.1 was utilized to evaluate the overall quality of the review articles. In conclusion, HILT and LLLT serve as effective adjuncts to exercise therapy in treating LBP, contributing to pain reduction and disability alleviation.

Keywords: Disability evaluation, Exercise therapy, LASER therapy, Low back pain

INTRODUCTION

Healing damaged tissue is still a problem across the world. One innovation that helps to simplify and accelerate the tissue repair process is the light amplification by stimulated emission of radiation (LASER). In 1917, Albert Einstein provided the theoretical framework that would lead to the invention of LASER. Maiman put Einstein theory into practice in 1960 when he published the first paper on stimulated light emission in the visible band of spectrum (λ = 694 nm) which resulted from the stimulation of a ruby crystal by a helical photographic flash lamp, from which the LASER energy excited [1].

Typically, LASERS are machines that produce electromagnetic radiations with fairly constant wavelength, phase and polarization [2]. In this emerging era, LASER therapy is widely used as a treatment method to treat various musculoskeletal conditions because LASER therapy aims of photoactivating cellular systems which promotes decrease in edema, the induction of analgesia acceleration of tissue repair process, resulting in normalization of damaged area [1]. In the acute and chronic painful musculoskeletal conditions, both low level LASER therapy (LLLT) and high intensity LASER therapy (HILT) have reported positive effects in decreasing pain and inducing tissue healing through its bio stimulation effects. The benefit of HILT over LLLT is that it can reach and stimulate the large area and deeper joints, which are challenging for LLLT to do so [3].

Pain is an obnoxious sensory and emotional incident linked to actual or potential harm to a body part [4]. Low back pain (LBP) is a significant health issue in all developed nations, and it is typically addressed in basic health care facilities [5]. It is a collection of symptoms from several causes that manifest as pain in the lumbar or lumbosacral spine either alone or in conjunction with leg pain [6]. Back pain affects more than 84% of people at some point in their life time. With an estimated global lifetime prevalence of 70%-85%, it is growing to be significant public health concern [7]. In general, chronic low back pain (CLBP) is thought to have mechanical origins and is unrelated to an underlying illness like an infection, tumor or fracture. It is frequently believed to be cause by disc degeneration, muscular strain, ligamentous sprain or disease related to the location of spine. Many of the authors have reported that exercise therapy is one of the most used conservative treatment for LBP [8]. The role and benefit of exercise therapy for those with LBP has been substantiated by several systematic reviews.

However, it is reported that exercise therapy alone done not appear to be enough to treat LBP in some circumstances rather it must be combined with both pharmacological and non-pharmacological modalities [9]. In both acute and chronic illness, many literatures have proved that LASER therapy significantly alleviates pain without using any systematic drug. It is becoming evident that LASER therapy may also be a successful supplementary or alternative treatment for CLBP [10].

Moreover, there is a lack of data which supporting the combined approach of LASER therapy with exercise therapy in the management of LBP. Assuming the same, the aim of the present study is to investigate significant internet databases for the original full texted paper on the effectiveness of LASER therapy as an adjunctive to exercise therapy in alleviating pain and reducing disability in management of patient with LBP.

MATERIALS AND METHODS

1. PROSPERO registration

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were taken into consideration when designing and carrying out the process [11]. Additionally, this review has been recorded in The International Prospective Registration of Systemic Review (PROSPERO) as per the updated PRISMA with number CRD42023443762.

2. Search strategy

Authors independently performed a comprehensive search of the literature by using Medical subject Heading keyword in electronic databases like PubMed, Cochrane library, Google Scholar, MEDLINE and PEDro in between August 2023 to September 2023. In order to achieve accuracy, the database searches were restricted to the full texted English language literature. The following search phrases were used to find articles: LASER therapy, exercise therapy, low back pain, and disability. The most effective search approach, which produced the greatest quantity and most relevant results, was "LASER therapy AND exercise therapy." The intervention, combined approach, comparator, population and outcome measure was used to generate the review question, which reads as follows 'What is the effect of therapeutic LASER combined with exercise therapy in reducing pain and disability in low back pain' and 'Is there any difference between LLLT and HILT combined with exercise therapy (LLLT + Ex or HILT + Ex) in the treatment of low back pain and disability.' The search approach was designed in this way to minimise the likelihood of potential selection and selection bias.

3. Study selection criteria

Following this, the inclusion criteria for the eligible article are 1) Full text randomised clinical and controlled trials which assessing the efficacy of LLLT and HILT in conjunction with exercise therapy in LBP; 2) adults more than eighteen years old having chronic or nonspecific LBP (nsLBP) persisted for 12 weeks or more; 3) the LASER group subjects were given either LLLT + Ex or HILT + Ex; 4) studies included exercises like strengthening, stabilizing, mobilizing and stretching of abdominal, back and lower extremity; 5) participants in the another group received LASER therapy alone or exercise therapy with placebo or without placebo LASER; and 6) studies in which outcome measures were related to pain and low back disability. Randomised cross-over trial, quasi-experimental design, review articles and letter to editor were excluded. The authors carefully examined the aforementioned eligibility requirements while conducting separate database searches and trial selection.

4. Selection process

Initially, the paper's titles and abstracts that were found through the search were filtered and assessed separately for the selection criteria. In the second stage, the complete texts of the chosen papers were obtained and examined by the author to determine whether they met the eligibility requirements. The included papers were confirmed, and the PRISMA flowchart provides an overview of the decisions made during the selection process.

5. Risk of bias assessment

To analyse risk of bias in trials, the quality of each randomized clinical/control trials (RCT) was assessed by using review manager 5.4.1. Under its six assessment domains—sequence creation, allocation concealment, participant blinding, outcome assessor blinding, inadequate outcome data, and selective outcome reporting—all of the included RCTs were assessed. Based on its score, each domain was then classified as high, low, or unclear risk of bias.

6. Data synthesis

PEDro scale is used to independently assess the main methodological quality of chosen research papers to lessen risk of bias within the studies and to assess the quality of each studies. PEDro had a methodological quality rating of 0-2 = unacceptable, reject; 3-5 = low quality (substantial risk of bias); 6-8 = reasonable quality with (moderate risk of bias); and 9-10 = superior quality; minimal chance of bias.

7. Data extraction

The procedure of extracting and analyzing data aimed to gather pertinent information that was part of the chosen studies. Authors independently evaluated and extracted data from the full text papers. Following data were collected: 1) extensive details regarding the study, 2) surname of the first author, 3) year of publication, 4) country, 5) participants' attributes (gender and age), 6) details of intervention (LASER therapy + Ex), 7) sample size, and 8) outcome score. The authors double-checked the articles that would be reviewed. The data presented by the authors is limited to patients with LBP who have received both exercise treatment and LASER therapy adjunctively.

RESULTS

PRISMA guideline was followed in conducting search and selecting procedures for the studies (Fig. 1). Out of five databases, the search technique found 35,280 records. After the duplicate articles were eliminated, 3,913 articles in total were evaluated for abstracts and titles. Taking out an additional 3,500 records whose titles and abstracts did not match the inclusion requirements, leaves 413 possibly admissible data. Of these, 200 records could not be obtained, leaving 213 records whose eligibility was evaluated. Of the records that were left, 51 papers does not concerning LASER + Ex in a group, 50 were published in other language, 64 were abstracts only, 38 were recorded protocol types, and 4 had different study designs. So a total of 6 articles remained for further review. Out of these studies, three assessed the effectiveness of LLLT + Ex, two looked into HILT + Ex, and one examined the differences between LLLT + Ex and HILT + Ex in treating LBP.

1. Characteristics of the included studies

The characteristics of the included studies displayed in Table 1 [12-17]. All the studies included in this systematic review were published between 2003-2020. Studies have sample sizes ranging up to 54 to 100. The studies included were from Egypt, Iran, Turkey, Macedonia, Italy, and Saudi Arabia. Participants in each study were aged between 18 to 65 years.

The LASER therapy with exercise therapy was considered an intervention in each study, either LLLT with exercise therapy or HILT with exercise therapy. To measure the effectiveness of LASER therapy with exercise therapy as combined intervention to LBP in each study, the intensity of pain is measured with either visual analog scale or numeric pain rating scale and low back disability is measured by Ro-

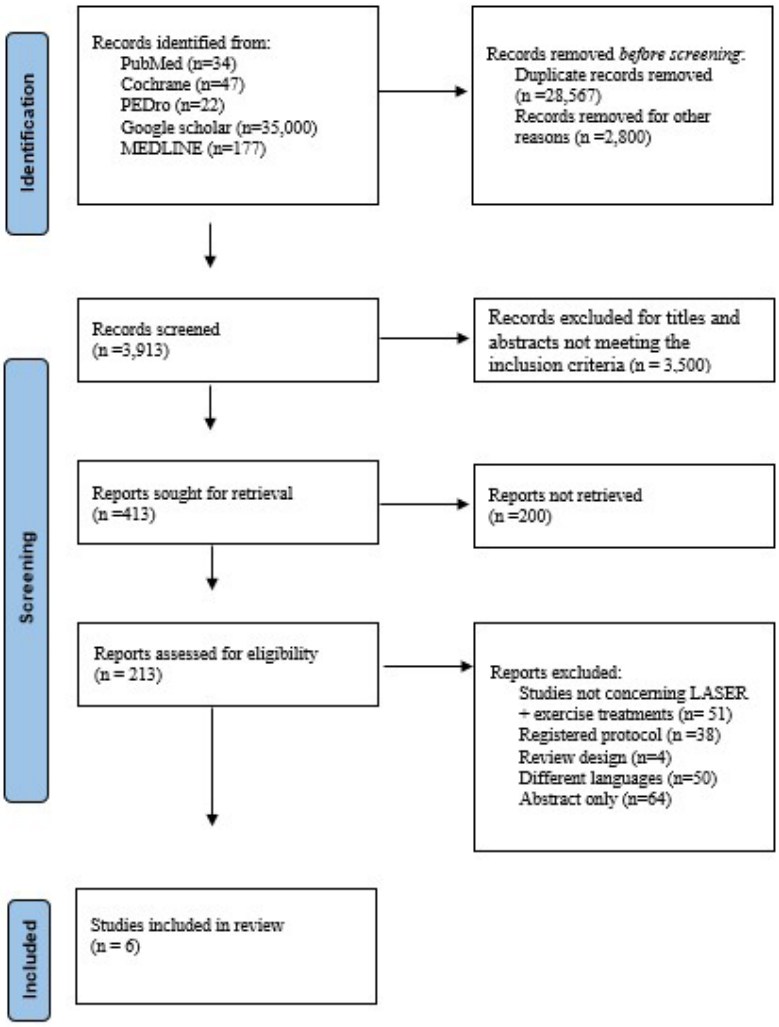

Fig. 1. PRISMA 2020 flow chart. PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses. LASER: light amplification by stimulated emission of radiation.

land disability questionnaire, Modified Oswestry disability questionnaire and Oswestry disability questionnaire as a outcome measure.

2. LASER intervention

Table 2 [12-17] provides summary of differences in LASER parameters among the chosen investigations. The LLLT + Ex trials represents a significant range in LASER parameters: mode continuous, wavelength from 850 to 980 nm, energy density from 1 to 50 J/cm^2, power output from 50 mW to 200 W, and therapeutic sessions from 2 to 5 within 6 to 12 weeks of involvement [12-15]. In contrast, the LASER settings used in the HILT + Ex trials were more uniform: 1,064 nm wavelength, energy density of 1.50 to 1,780 J/cm^2, power output from 4 W to 3 kW, 2 to 10 therapy sessions, and intervention period of 2 to 12 weeks [12,16,17]. According to World Association for Photobiomodulation Therapy (WALT) guidelines for treatment dosage for LLLT [18], three of the four studies that looked into LLLT + Ex followed the dose recommendations [12-14], and just one study did not [15]. The WALT recommendations do not apply to the studies that looked at HILT + Ex.

3. Exercise intervention

The included studies suggested exercise regimens included home-based exercise (HBE) and semi-supervised exercise program. The duration of time spent exercising under supervision were varied from two session per day to two sessions per week. Four of the six studies adopted a approach of home based exercise program in which the physiotherapist led the first session of the exercises, which the patient completed on his own at home [12,14,15,17]. The participant's exercise regimen was verified by a family member. The remaining two studies adopted a approach of semi-supervised exercise program in which therapist observe and ensures that each exercise was followed correctly [13,16]. The components of exercise program were elaborated in Table 1 [12-17].

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Table 1. Characteristics of included studies

Author	Objective of the study	Participant age (yr)/ Group (n)	Intervention of HILT + Ex or LLLT + Ex	Outcome measure used for pain intensity and low back disability	Findings of LLLT + Ex/ HILT + Ex	Conclusion
Abdelbasset et al. (2020) [12], Saudi Arabia	To assess how HILT and LLLT differ in their effects on chronic nsLBP	25-40/LLLT + Ex (20); HILT + Ex (20); Ex (20)	Group LLLT received GaAIAs diode LASER for 30 minutes per session. Group HILT received gallium arsenide diode LASER in which the device probe is placed vertically and moved horizontally across the impacted region. The application period lasted for 15 minutes. Home exercise training includes strengthening exercise for core and back muscles and stretching exercise for back muscles. Duration of whole treatment was 2 sessions/week for 12 weeks	VAS ODI	Both LLLT + Ex and HILT + Ex group represents significant improvements in VAS scores and ODI scores, with no significant differences between group	When treating chronic nsLBP, HILT, and LLLT had the same results. Patients with chronic nsLBP benefited equally from HILT and LLLT
Gocevska et al. (2019) [16], Macedonia	To compare the effects of HILT against US in management of patient with CLBP	25-65/HILT + Ex (27); US + Ex (27)	Group HILT + Ex received HILT which was applied by scanning regime. Using contact method, longitudinal scanning was carried out in the low back region of L1-S1. Treatment last for 15 minutes. Overall duration of LASER therapy was 10 sessions in two weeks. Strengthening exercises for the abdominal, back, lumbar, and gluteal muscles was prescribed for 15 minutes once a day	NPRS ODI	The HILT + Ex group shows greater improvement in pain scores and shows statistically significant improvement in ODI scores	In the treatment of CLBP, HILT appears to be beneficial, safe, and successful treatment option with Ex which should never be ignored
Vallone et al. (2014) [13], Italy	To assess the effectiveness of GaAIAs diode LASER therapy combined with exercise therapy in the management tof CLBP	> 18/LLLT + Ex (50); Ex (50)	Group LLLT + Ex received GaAIAs LASER in which the six painful spot in the paravertebral region of L2-S3 are exposed to radiation in stationary contact mode from a single probe treatment time planned was 1 minute per spot. Exercise therapy includes core strengthening and stretching of posterior hip and knee muscle. 2-3 stretches with each 20 seconds hold is given to all muscles. Each strengthening exercises consist of five repetitions. Whole duration of treatment was 3 sessions/ week for 3 weeks	VAS	LLLT + Ex group shows statistical significant decrease in pain scores as compare to Ex group	LLLT coupled with Ex regimens seem to be beneficial in lowering pain, and this could be a promising new therapy approach for CLBP rehabilitation
Alayat et al. (2014) [17], Egypt	To find out the effectiveness of HILT alone and in conjunction with exercise for patients with CLBP	20-50/HILT + Ex (28); PL + Ex (24); HILT (20)	Group HILT + Ex receives pulsed Nd:YAG LASER treatment which was performed transversely and longitudinally in the paravertebral region of lower back region of L1-L5 and S1. Treatment last for 15 minutes. Overall duration of LASER therapy was 3 sessions/week for 4 weeks. Exercise therapy includes stabilising, mobilising, strengthening, and stretching of back, abdominal and pelvic muscles. Performed for two times daily for 4 weeks	VAS RDQ MODQ	The HILT + Ex group showed a larger significant decrease in VAS and no significant difference in RDQ and MODQ	It has been found that combined use of HILT and Ex is clinically significant, improving functional disability and CLBP, and these improvements can remain up to 3 months

Table 1. Continued

Author	Objective of the study	Participant age (yr)/ Group (n)	Intervention of HILT + Ex or LLLT + Ex	Outcome measure used for pain intensity and low back disability	Findings of LLLT + Ex/ HILT + Ex	Conclusion
Djavid et al. (2007) [14], Iran	To evaluate the adjuvant effect of LLLT in CLBP	20-60/LLLT (20); LLLT + Ex (21); PL + Ex (20)	Group LLLT + Ex received GaAIAs LASER in which the laser probe was used to irradiate the 8 points in the paravertebral region (L2 to S1-S2) in contact mode. Treatment last for 20 minutes. Overall duration of LASER therapy was 2 sessions/week for 6 weeks. Strengthening, moving, coordinating, and stabilising the muscles in the back, pelvis, abdomen, and lower limbs are all included in exercise therapy	VAS ODI	In long term, LLLT + Ex may reduce pain and low back disability more than exercise alone	When this therapy combination is used, LLLT seems to be an effective approach for lowering pain and low back disability in patients with CLBP
Gur et al. (2003) [15], Turkey	To find out the effectiveness of LLLT in treating CLBP	20-50/LLLT + Ex (25); LLLT (25); Ex (25)	Group LLLT + Ex received gallium arsenide LASER which was designed to stimulate the pain points of L4 to S1 apophyseal capsules, dorsolumbar fascia, ligaments, hamstring, and gastro soleus muscle. Overall duration of LASER therapy is 5 sessions/week for 4 weeks. Exercise therapy include lumbar, hip and knee ROM and strengthening of extremity muscles were given 2 sessions a day making total of 40 sessions for 4 weeks	VAS RDQ ODI	Pain levels in the LLLT + Ex and LLLT group decrease more. And no significant difference was observed for ODI and RDQ among groups	When treating CLBP, LLLT appears to be useful strategy for lowering pain and functional impairment. However, LLLT does not add any advantages to exercise therapy

HILT: high intensity LASER therapy, Ex: exercise, LLLT: low level LASER therapy, nsLBP: nonspecific low back pain, GaAIAs: gallium aluminium arsenide LASER, LASER: light amplification by stimulated emission of radiation, VAS: visual analog scale, ODI: Oswestry disability index, US: ultrasound, CLBP: chronic low back pain, NPRS: numeric pain rating scale, PL: placebo, RDQ: Roland disability questionnaire, MODQ: modified Oswestry disability questionnaire, ROM: range of motion.

Table 2. Technical parameters of LASER therapy in included studies

No.	Author	LASER therapy	Power output (W)	Wavelength (nm)	Energy density (J/cm^2)	Frequency (Hz)	Mode	Spot size (cm^2)	Irradiation time per point (min)
1.	Abdelbasset et al. (2020) [12]	LLLT	0.8	850	50	1,000	Continuous mode	1	-
		HILT	12	1,064	150	-	Bio stimulating mode	1	-
2.	Gocevska et al. (2019) [16]	HILT	4	-	1.50	-	Continuous mode	-	-
3.	Vallone et al. (2014) [13]	LLLT	20	980	37.5	-	Continuous mode	32	1
4.	Alayat et al. (2013) [17]	HILT	3,000	1,064	510-1,780	10-40	Pulsed mode	0.2	-
5.	Djavid et al. (2007) [14]	LLLT	0.05	870	27	-	Continuous mode	0.2211	2.5
6.	Gur et al. (2003) [15]	LLLT	10	-	1	2,100	-	-	4

LASER: light amplification by stimulated emission of radiation, LLLT: low level LASER therapy, HILT: high intensity LASER therapy.

Table 3. Methodological quality evaluation of included studies via PEDro scale

Author	PEDro scale											Score
	1	2	3	4	5	6	7	8	9	10	11	
Abdelbasset et al. (2020) [12]	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	8/10
Gocevska et al. (2019) [16]	Y	Y	N	Y	N	N	N	Y	N	Y	Y	6/10
Vallone et al. (2014) [13]	Y	Y	Y	N	N	N	N	Y	N	Y	Y	6/10
Alayat et al. (2013) [17]	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	8/10
Djavid et al. (2007) [14]	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	10/10
Gur et al. (2003) [15]	Y	N	N	Y	N	N	Y	Y	N	Y	Y	6/10

Y: yes, N: no.

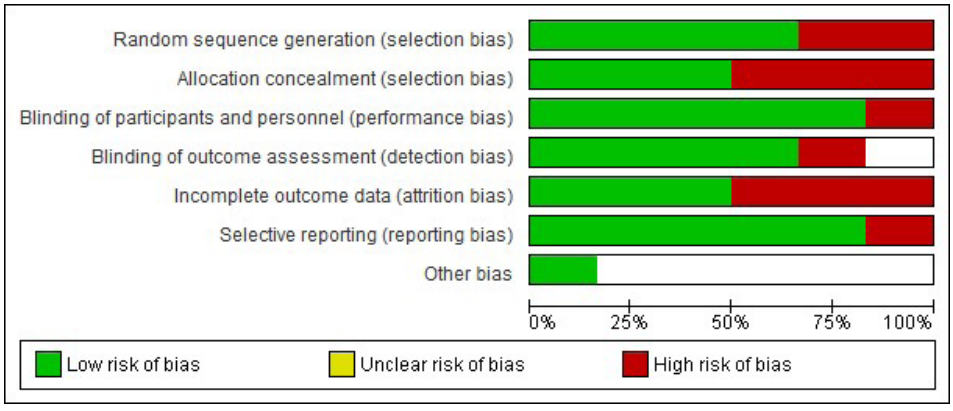

Fig. 2. Risk of bias graph.

4. Methodological quality within studies

The PEDro scores of all the studies that were part of this review varied from 6 to 10, which indicates good methodological quality as depicted in Table 3 [12-17].

5. Risk of bias within studies

For both random sequence creation and allocation concealment, the risk for selection bias was moderate. Since the study's participant blinding was disclosed, performance bias most likely had the lowest chance of bias. Because the authors of studies failed to attain blinding of the assessor and also reported incomplete study protocols and important outcomes, they presented a moderate risk or uncertain danger for detection bias and reporting bias. Other items also exhibited unknown risk as can be seen in Fig. 2, which summarize risk of bias. Three studies had low risk of bias [13,14,17], two studies had some concern of bias [15,16], and only one study had high risk of bias [12].

DISCUSSION

This systematic review is conducted to find out the combined effect of LASER therapy plus exercise therapy on alleviating pain and disability in patients with LBP. Six original research papers with good methodological quality were

included in this analysis: three studies looked into LLLT + Ex, two studies tested HILT + Ex, and one study analysed both. It is not surprising that there are less HILT articles because LLLT was developed before HILT. However, the extent to which the results may be implemented can be limited as many number of studies are excluded. Few studies are included in this review as strict criteria enhances the quality of analysis by ensuring that only relevant and high-quality data are considered but on the other hand there may not be enough data present to generalise these findings with confidence to a wider population.

Approximately 90% of people have low back discomfort, making it a highly prevalent condition [19]. It is said to be a main contributor to disability and missed work time [20]. The frequency of LBP is increased by jobs involving lifting, bending, extended sitting, heavy lifting, bus driving, obesity and smoking [21,22]. Furthermore, to deal with this condition a multidisciplinary therapy plan is customised based on the unique needs, goals, and experiences of patient. Among all the acceptable treatments, LASER therapy is found to be proven effective and long lasting treatment for low back ache [23,24].

Abdelbasset et al. [12] performed randomized comparative study in 2020 to compared the beneficial outcome responses of LLLT to HILT in chronic nsLBP. They included both male and female population which were randomized in three groups in which patients mean age were 32.4±3.7 and 33.6±4 in LLLT + Ex and HILT + Ex group. It was concluded that both LLLT + Ex and HILT + Ex shows significant improvement in pain intensity and disability ($p < 0.001$). However, while comparing post intervention assessment of the HILT + Ex and LLLT + Ex groups, it revealed non-significant differences ($p > 0.05$) [12]. Similarly Gocevska et al. [16] conducted a study in 2019 in which they comparing the clinical effects of HILT with ultrasound (US) in management of patients with CLBP. Both male and female patients were recruited and gets randomized into two of groups in which the mean age in HILT + Ex group was 55.4±6.7. After treatment they find out that HILT + Ex group shows greater improvement in pain scores ($p = 0.0001$) and in disability scores ($p = 0.0001$) [16]. Another study is performed by Vallone et al. [13] in 2014 to evaluate the combined effect of GaAIAs LASER and exercise therapy in treatment of patients with nonspecific chronic low back pain (NSCLBP). They randomized the patients into two groups in which one of the groups is treated with LLLT + Ex treatment. After the treatment they concluded that LLLT + Ex group shows a bigger reduction in pain intensity scores concluding a more significant improvement ($p < 0.001$) [13]. Alayat et al. [17] performed study in 2014 to evaluate the effect of HILT alone or in combination with exercise therapy in CLBP. Only male patients were recruited and gets randomized in three groups in which the group 1 is treated with HILT + Ex having mean age of 33.4286±4.40. After treatment they find out that when compared to other groups, the HILT + Ex group experienced a more significant reduction in pain ($p < 0.0001$) and disability scores [17]. Djavid et al. [14] conducted randomized controlled trial in 2007 to find out the combined effect of LLLT with exercise therapy in CLBP. Both male and female were randomized into three groups in which patients mean age in LLLT + Ex group was 38±7. It was concluded that no differences were seen between groups for any outcome measure right after the intervention. However, in LLLT + Ex group pain intensity were reduced by 1.8 cm ($p = 0.03$) and disability is reduced by 9.4 points ($p = 0.03$) [14]. Gur et al. [15] performed a study in 2003 to determine the clinical effectiveness of LLLT for the therapy of CLBP. Both male and females are included and randomized into three groups in which one of them is treated with LLLT + Ex. Mean age of the patients was 35.2±10.51. After analysis it was discovered that no significant variation observed among any of the treatment groups ($p > 0.05$), but pain levels in LLLT + Ex groups decrease more than other compared groups. In terms of low back disability the author concluded no significant differences seen among any of the therapy groups ($p > 0.05$) [15]. Furthermore in addition to this findings, it was found that three of the six studies had evaluated the long term effect of LASER + Ex intervention. Two of the studies have evaluated the long term effect of intervention at 12 weeks which stated that despite the fact that their effects were still noticeably less than at baseline, this intervention had no long-term effect [14,17]. Additionally, according to one study, the intervention's effects persisted for the next three months [16].

This combination therapy provides better results and guide therapist in the field of physiotherapy. Some of the other systematic reviews are published in the context of LASER therapy and exercise therapy such as, a systematic review and meta-analysis published in 2015 on the effectiveness of LLLT in NSCLBP in which the author conclude that LLLT is a useful technique for NSCLBP sufferers to relieve pain. Still, there isn't enough proof to establish its impact on function [25]. Another systematic review and meta-analysis published in 2023 on the effects of HILT in LBP management in which the author finds that the LBP intensity of the patients receiving HILT was statistically considerably lower than patients in the control group [26]. Furthermore, a systematic review was published in 2021 which assess how exercise therapy affects pain and functional limits in adults with NSCLBP in which author conclude that when it comes to treating persistent LBP, exercise therapy is probably more beneficial than doing nothing, receiving standard care, or taking a placebo [27]. None of systematic review is published which investigated the combined effects of LASER therapy

and exercise therapy in treating LBP and disability. All the systematic reviews published in the context of LBP were analyses the individual effects of LASER therapy and exercise therapy, but this review aims to find out the combined effect of LASER therapy and exercise therapy. As mentioned above, LASER + Ex group shows greater improvements in reducing pain and alleviating disability in LBP patients. The therapeutic results of LASER therapy, particularly with regards to its capacity to stimulate and reduce inflammation at the tissue and cellular levels, may be responsible for improvements in the generally reported results [28]. In contrast to LLLT, HILT penetrates five times deeper and may produce large amount of energy in a comparatively shorter length of time [29]. Additionally, the application of HILT having wavelength of 1,064 nm or greater may directly affect nerve terminals to promote the inhibition of pain [28]. Moreover, HILT is able to exhibit photo-thermal effects—which cause local tissue relaxation and favourable alterations in blood flow—through deep tissue penetration with dispersed LASER light (quick absorption of oedema and clearance of exudates) [28,29]. Owing to these benefits, HILT can be used for more extensive regions, such the lower back [30]. In addition, it is hypothesised that the benefits of LASER therapy, particularly with regard to pain management, may enhance exercise compliance by reducing pain-induced limitation and enabling more intensive low back rehabilitation.

The present evaluation revealed a notable distinction in the exercise delivery techniques employed by the two LASER treatments, despite the crucial fact that both employed a combination of supervised exercise sessions and HBE. Furthermore, it was discovered that in treatment of LBP, the results from a well-structured home based exercise were similar to those from supervised exercise sessions [31]. Regarding exercise mode, majority of included studies indicated strengthening exercises as the primary components of the exercise regimen, which is consistent with the clinical guidelines of acute, subacute and chronic LBP [32]. Additionally, out of 6 studies, 4 studies included population from middle east countries which can limit the applicability of this results to worldwide population because the results may not fairly apply to populations from other areas or nations when the bulk of the research are focused on a particular area, like the region of the middle east. This results from the fact that cultural, social, economic, and environmental variables might change greatly between locations, impacting intervention responses, behaviours, and health outcomes.

STRENGTHS AND LIMITATIONS

The present systematic review is strengthened by the author's thorough search for relevant publications to research question and their adherence to methodological suggestions for best practices. To best of our knowledge, this one is a unique systematic review which listing the studies focusing on the combined effectiveness of LASER therapy and exercise therapy as an intervention for managing LBP. The current systematic review has some limitations, to begin with the study's strength was impacted by the small number of included research articles as it may limit the generalizability of results, additionally this review lacks in assessing the combined effect of LASER therapy and exercise therapy in lumbar range of motion.

CONCLUSION

According to the current analysis, combining LASER therapy with exercise therapy shown to be more successful in lowering pain and minimising disability in treatment of patients with LBP. When combined with exercise therapy, both LLLT and HILT improves LBP and disability. Both HILT + Ex and LLLT + Ex play a significant role in improving health-related quality of life for those with LBP. However, the authors also finds that when comparing the beneficial effects of HILT + Ex and LLLT + Ex none of them is found to be superior.

Both LASER therapy as well as exercise therapy in combination have the best results in the effective betterment in lower back pain and disability. Future studies are necessary to find out and evaluate advanced treatments that are effective and to comprehend the unique rehabilitation requirements for LBP patients.

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- **Authors' contributions:** D.C. participated in conceptualization of the study, data searching, drafting methodology, and data extraction. S.S. participated in data curation, formal analysis, and editing of final draft.
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