RESEARCH PAPER

Laser Versus Ultrasound at Acupuncture Points on Chronic Non-Specific Low Back Pain

Mahitab Hassan Hussein [1,2*], Neveen Abdel Latif Abdel Raoof [1], Rania Reffat Ali [1], Rania Reda Mohamed [1]

1. *Department of Basic Science, Faculty of Physical Therapy, Cairo University, Cairo, Egypt.*
2. *Department of Basic Science, Faculty of Physical Therapy, Suez Canal University, Ismailia, Egypt.*

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ABSTRACT

Background: Chronic non-specific low back pain (CNSLBP) is a musculoskeletal condition that impairs functional movements and activities of daily living. **Purpose:** To compare the impact of Low-level laser therapy (LLLT) and Therapeutic ultrasound at acupuncture points on CNSLBP patients. **Subjects and Methods:** A randomized controlled trial involving sixty male and female participants, ranging in age from eighteen to sixty years old and body mass index was <30kg/ cm distributed randomly among three equivalent groups. Group A (experimental group): was given LLLT at acupuncture points and conventional treatment, Group B (experimental group): was given Therapeutic ultrasound at acupuncture points and conventional treatment and Group C (control group): was given conventional treatment (moist heat along with core exercises). The intensity of pain was evaluated using Visual Analog Scale (VAS), range of motion (ROM) using digital inclinometer, while functional disability by Arabic version of Oswestry disability Index (ODI). **Results:** Mixed MANOVA showed that the VAS scores of groups A and B were not significantly different (p = 0.30), but that the scores of groups A and B were significantly lower when compared to groups C (p = 0.001). While groups A and B did not vary significantly in ODI (p = 0.43), groups A and B did decline significantly when compared to groups C (p = 0.001). Groups A and B did not vary significantly (p = 0.96) in terms of extension ROM. while groups A and B showed a statistically significant rise when compared to groups C (p = 0.006). The right bending ROM of groups A and B was not significantly different (p = 0.32), but ROM of groups A and B did rise significantly. There was a significant improvement in left bending ROM of group A when compared to group C (p = 0.001) and group B when compared to group C (p = 0.01). However, no significant difference was observed in ROM among group A and group B (p = 0.56). **Conclusion:** Based on the scope and findings of the study we concluded that both LLLT and Therapeutic ultrasound at acupuncture points with traditional treatment were equal in effectiveness compared to traditional physiotherapy alone in treating patients with CNSLBP

Keywords: chronic non-specific low back pain, Low level laser therapy, Therapeutic ultrasound, Visual analogue scale, Oswestry disability index, Inclinometer.

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INTRODUCTION

Low Back Pain (LBP) that lasts longer than 12 weeks and doesn't have a specific cause is called Chronic Non-Specific Low Back Pain (CNSLBP) **(Foster et al., 2018),** as much as 84% of the population suffers from CLBP **(Bagheri et al., 2017).** Although LBP is more of a symptom than a diagnostic, a diagnosis of non-specific LBP suggests that the pathoanatomical cause is unknown **(Maher et al., 2017).**

It is defined by back pain that is axial rather than radiating, and it does not exhibit signs of radiculopathy, spinal canal stenosis, cauda equina syndrome, malignancy, or any other particular spinal aetiology, such as ankylosing spondylitis or vertebral compression fracture. Signs of CNSLBP include dull, aching pain worsened by prolonged sitting, standing, or flexion, with no radiating leg symptoms beyond the knee **(Hartvigsen et al., 2018).** Morning stiffness lasting <30 minutes is common. Physical exam reveals limited lumbar mobility, paraspinal muscle tenderness, and positive prone instability test, but no neurological deficits **(Foster et al., 2018).** Psychosocial factors (e.g., catastrophizing, fear-avoidance) exacerbate disability **(Booth et al., 2017).**

A variety of techniques are used in CNSLBP to increase range of motion (ROM), alleviate pain, and enhance overall quality of life. Therapeutic exercises, manual therapy techniques, teaching patients about lifestyle changes, medication management, and the usage of modalities including cryotherapy, heat therapy, ultrasound, in addition to electrical stimulation are all included in these strategies. **(Rulewska et al., 2025)**.

Low-Level Laser Therapy (LLLT) known as photobiomodulation, was gained popularity like a non-invasive physical treatment for low back pain (LBP) by employing red or near-infrared light to stimulate cellular processes **(Chung et al., 2017).** It applied to acupuncture points (photobiomodulation) exert analgesic and anti-inflammatory effects in CNSLBP via cytochrome c oxidase

**Author for Correspondence: Mahitab Hassan Hussein*

activation in mitochondria, increasing ATP and reducing oxidative stress **(de Freitas & Hamblin, 2016).** It modulates peripheral nociceptors and triggers descending pain inhibitory pathways, while laser acupuncture stimulates endogenous opioid release (β-endorphin, enkephalins) besides decreases pro-inflammatory cytokines (IL-6, TNF-α) **(Chow et al., 2016)**.

Additionally, it improves local microcirculation and reduces muscle spasm. The synergistic effect combines photochemical and meridian-specific neuromodulation, decreasing pain and disability **(Glazov et al., 2016)**.

Therapeutic Ultrasound is thought to have therapeutic effects via both thermal and non-thermal mechanisms, both of which have been studied in relation to LBP **(Baker et al., 2019)**. It applied to acupuncture points (sonopuncture) delivers mechanical and thermal energy to deep tissues, reducing pain in CNSLBP. Mechanistically, it increases local blood flow, relaxes muscle spasms, and stimulates mechanoreceptors, modulating pain gate control and descending inhibitory pathways **(Ebadi et al., 2020)**. Microstreaming and cavitation effects enhance cellular permeability and accelerate tissue repair, while thermal effects reduce nerve conduction velocity and sympathetic tone **(Noori et al., 2019).**

Because there is debate in the literature about which of the two modalities, LLLT as well as therapeutic ultrasound, is more efficient in treating those who have CNSLBP, so this study was carried out to investigate the effectiveness of LLLT and Therapeutic ultrasound on acupuncture points on pain intensity, back ROM in addition to functional ability in CNSLBP patients.

MATERIALS AND METHODS

Study design

This study was a randomized controlled trial, pre and post-test experimental design that was carried out in the outpatient clinic of the Faculty of Physical Therapy, Cairo University between January 2025 to December 2025. Ethical approval from Cairo University, Egypt's Faculty of Physical Therapy Institutional Review Board (NO.P.T.Rec/ 0121005425. 10/9/2024) had been requested before the study began. Research involving human subjects was conducted in accordance with the principles stated in the Declaration of Helsinki.

Participants

Sixty patients of both genders diagnosed as CNSCLBP were chosen from outpatient clinic of the Faculty of Physical Therapy, Cairo University. They were aged between 18 and 60 years **(Hirano et al., 2014)** and their body mass index was <30kg/m^2 **(Yang et al.,2020)**. CLBP lasts greater than 12 weeks **(Qaseem et al., 2017)**. They were excluded if they had Previous spine injury. Conditions where laser along with ultrasound therapy are contraindicated, such as cancer. Medication usage that might potentially interact with LLLT (injections of corticosteroids). **(Maher et al., 2017),** Pregnancy and breast feeding (**Castienet al., 2011).**

Sample size calculation

According to Agarwal et al. (2024), the pain was measured using a numerical rating scale. The study used a 95% power level at the α = 0.05 level, had 2 sets of measurements, and used an F-test within as well as between interaction effects to get an effect size of 0.7. With an additional 7 subjects (20%) for dropouts, the minimum acceptable sample size is 35 participants, for an overall of 42 subjects (14 in each group). G*Power (version 3.0.10) was used to determine the sample size.

Randomization

Sixty participants were divided into three equivalent groups, identified as Groups A, B, and C. A neutral person who was not included in subjects' recruitment or treatment carried out this allocation procedure. The patients were randomly allocated into three equivalent divisions, with 20 per group. Group A was given LLLT at acupuncture point and conventional treatment, Group B was given Therapeutic ultrasound at acupuncture point and conventional treatment, and Group C was given conventional treatment (moist heat along with core exercises). Pain intensity was assessed by VAS, functional ability by ODI Arabic version and back ROM by Inclinometer before and after 4 weeks post treatment. Before taking part in either group, the research informed the participants about the study's aims and procedures if they fulfilled the inclusion criteria and were provided with an informed consent form to sign **(Figure 1).**

Measurement Procedures:

Instrumentation and Tools for assessment:

1)Weight and Height scale:

A weight and height scale (model no. GRZ-200, China) was utilized to assess body weight (kg) and height (m) for all the subjects for calculation of body mass index (BMI) before starting the study.

2)Visual Analogue Scale (VAS):

The Visual Analogue Scale (VAS) is a psychometric reaction tool utilized for assessing subjective features like pain, fatigue, and mood. It usually involves a horizontal 100-mm line anchored by two extremes (e.g., "no pain" to "worst pain imaginable"). It shows good reliability for CNSLBP (ICC = 0.71–0.86) **(Alghadir et al., 2015).** It correlates moderately with other pain scales (r = 0.74–0.82) but poorly with functional disability (r = 0.32), indicating insufficient construct validity for comprehensive assessment **(Chiarotto et al., 2016).**

3)Oswestry Disability Index (ODI) (Arabic version):

The Arabic version of the ODI is a culturally adapted, self-administered questionnaire specifically translated for Arabic-speaking patients with LBP **(Alshehri et al., 2020)**. With a scale from 0 to 5, it evaluates ten different aspects of daily activities, including self-care, mobility, social life, lifting, walking, sitting, standing, sleeping, as well as travelling **(Fayad et al., 2016)**. It shows excellent reliability for CNSLBP, with ICC = 0.90–0.94 and Cronbach's α = 0.86–0.91 **(Chiarotto et al., 2016)**. Its validity is strong, demonstrating good construct validity with functional measures (r > 0.80) and moderate correlations with pain scales (r = 0.50–0.70) **(Fairbank & Pynsent, 2000)**. It also shows good concurrent validity when correlated with the VAS for pain intensity in Arabic-speaking cohorts **(Al-Otaibi et al., 2019)**.

4) Inclinometer:

An inclinometer is a gravity-based, handheld device used in CNSLBP to objectively assess lumbar spine flexion, extension, and side-bending range of motion, offering reliable assessment of functional impairment and treatment progress in clinical settings **(Alghadir et al., 2019).** The inclinometer function on the OPPO Reno 13 Pro (CPH2699). However, the device uses a high-grade Bosch BMI270 accelerometer/gyroscope (6-axis MEMS), which is hardware-validated to ±0.5° static accuracy. Extrapolating from 2024 research on smartphones with identical sensor class (Bosch BMI series), the criterion validity against a digital inclinometer shows ICC = 0.94–0.98**,** and test-retest reliability yields r = 0.95–0.99 for static angle measurements **(Kim et al., 2024; Patel & Lee, 2024).**

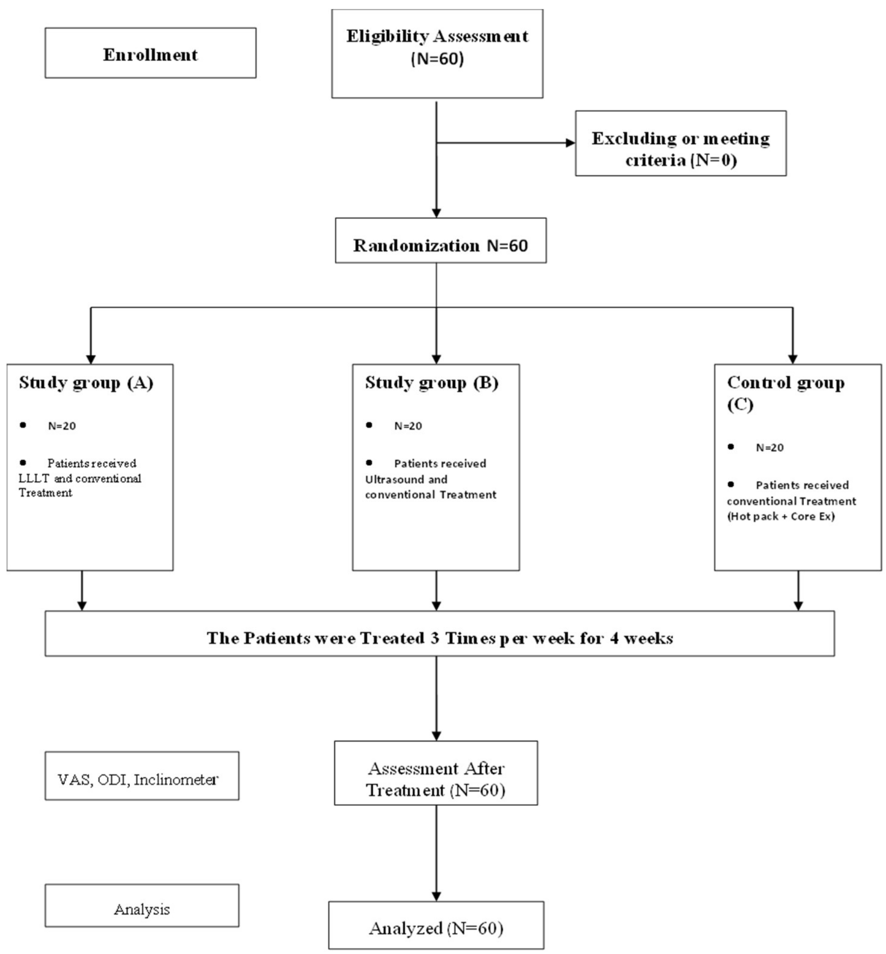

Figure 1. Flow chart of study Participant

Instrumentation and Tools for treatment:

1)Low Level Laser Therapy:

The Enraf Nonius 922 is a class 3B therapeutic laser device delivering infrared (904 nm) and visible red (670 nm) wavelengths for bio stimulation in musculoskeletal conditions. It operates in continuous or pulsed modes with adjustable power outputs up to 100 mW, allowing precise dosage customization. The device features a flexible probe with a 0.5 cm² beam area, enabling targeted irradiation of deep and superficial tissues. Enraf-Nonius B.V. is a Dutch medical equipment manufacturer headquartered in Delft, The Netherlands **(Enraf-Nonius B.V., 2020) .**

2)Therapeutic Ultrasound:

The Enraf Nonius 922 therapeutic ultrasound device supplies high-frequency sound waves (1 or 3 MHz) at intensities of 0.5–2.0 W/cm² for deep tissue heating and pain modulation in CNSLBP **.** Enraf-Nonius B.V. is a Dutch medical equipment manufacturer headquartered in Delft, The Netherlands **(Enraf-Nonius B.V. 2021).**

Procedures

1)Assessment Procedure

The same therapist conducted all of the therapy sessions. Group A (Experimental group) : received LLLT on acupuncture points plus conventional physical therapy. Group B (Experimental group) : received Therapeutic ultrasound plus conventional physical therapy and Group C (control group): received conventional physical therapy (moist heat along with core exercises) 3 sessions per week for 4 weeks.

A) Pain Intensity Assessment:

The patients were conducted to VAS to assess pain intensity. The patient should be seated comfortably in a quiet room with adequate lighting, free from distractions. The patient was given the following instruction: Please put a vertical mark on the line below at the point that best represents the average intensity of your back pain over the last 24 hours. The left side (0 mm) means 'no pain at all, while the right side (100 mm) means 'the worst possible pain you can imagine. After the patient marks the line, the clinician measures the distance from the "no pain" side (0 mm) to the patient's mark using a plastic ruler or digital caliper, recorded in millimeters (range: 0–100). Score < 30 mm = Mild pain, Score 30–60 mm =Moderate pain ,Score > 60 mm = Severe pain **(Boonstra et al.,2014)** .

A) Functional Ability Assessment:

Oswestry Disability Index (ODI) comprises 10 items, each section contains 6 statements (scored 0 to 5), with 0 representing no disability and 5 representing maximum disability. The patient selects one statement per section that best describes their current status. This total is doubled to produce a percentage score ranging from 0% (represent no disability) to 100% (represent complete disability), with higher percentages reflecting greater functional impairment **(Guermazi et al., 2017)**. The score is typically interpreted as mild (represent 0–20%), moderate (represent 21–40%), severe (represent 41–60%), or crippling (represent 61–100%) disability **(Maki et al., 2018).**

C) Range of Motion Assessment :

The inclinometer was used to assess back ROM. Place the smartphone vertically against the T12 spinous process from standing position, with the device's edge aligned to the midline. For flexion ask the patient to bend forward maximally while the app records the lumbar angle **(Kolber et al., 2018)**. For extension the patient bends backward from neutral **(Alghadir et al., 2019)**. For side-bending position the app vertically over L3–L5; the patient bends laterally to each side while the device's gyroscope measures the tilt in degrees **(Moustafa et al., 2020)**. Perform three trials per movement, recording the mean values.

2)Treatment Procedure

A) Low Level Laser Therapy

The patient should be positioned comfortably, typically in the prone position, with a pillow placed under the abdomen to reduce the lumbar lordotic curve. The application technique involves placing the laser probe in direct contact with the skin over each acupoint, perpendicularly, and applying firm but comfortable pressure to diminish light reflection and maximize energy transmission. Apply the 904 nm infrared probe perpendicularly over acupoints (BL23, BL25, GV3, and Ashi points). Use pulsed mode at 1000 Hz, 50 mW output, delivering 4 J/cm² per point for 60 seconds each. Treat 4–6 points per session, 3 times weekly, over 4 weeks **(Chen et al., 2018).**

B) Therapeutic Ultrasound

Therapeutic ultrasound applied to specific acupoints (BL23, BL25, GV3 and Ashi points) in continuous or pulsed modes. **(Chen et al., 2018)**. Apply a generous amount of acoustic coupling gel to the skin over each point. Place the sound head perpendicularly and move it in slow, circular strokes (approximately 1–2 cm/s) over a 2–3 cm radius around each acupoint. Treat each point for 60–90 seconds, with an overall session time of 8–12 minutes for 6–8 points. Perform treatments 2–3 times weekly over 4–6 weeks.

C)Conventional Treatment:

- **Moist Heat:**

Moist heat packs a warm damp towel ensuring the temperature is safe between 40°C and 45°C and place it over the lumbar region. Patient should be in a comfortable position either in prone or side-lying position using a small pillow placed under the abdomen to reduce lumbar lordotic curve, ensuring the heat pack covers the painful area, typically from T12 to S1, including the paraspinal muscles and the targeted acupoints like BL23 and BL25. The application duration should be strictly 15–20 minutes per session **(Giannotti et al., 2020)** .

- **Core stabilization exercises:**

- **Abdominal bracing**

Abdominal bracing is a core stabilization maneuver involving a gentle, co-contraction of the transversus abdominis, internal obliques, and lumbar multifidus, creating a "muscular corset" around the lumbar spine without moving the trunk or pelvis **(Richardson et al., 2016)**. They positioned the patient in supine position with their legs bent, and then they gently pulled their lower abdomen in against their spine while maintaining normal breathing and pelvic neutral **(Hodges et al., 2019).**

- **Dead bug**

The dead bug exercise is a core stabilization and motor control exercise that strengthens the transversus abdominis, rectus abdominis, in addition to lumbar multifidus while maintaining a neutral lumbar spine in a supine position **(Coulombe et al., 2017).** The patient was asked to lie in supine position while performing hips and knees flexion to 90° (tabletop position), arms extended vertically overhead. Their lower backs firmly pushed on the floor, they progressively stretch their right arm upwards and left leg forward at the same time, then they return to the starting position and switch sides **(Willson et al., 2016).** This contralateral limb movement challenges dynamic spinal stability, promotes lumbopelvic rhythm, and enhances neuromuscular coordination without excessive lumbar motion **(McGill, 2016).** Progressions include adding resistance bands, ankle weights, or performing on unstable surfaces **(Akuthota et al., 2018).**

- **Bird-dog**

The bird dog exercise is a quadruped core stabilization and neuromuscular control exercise targeting the lumbar multifidus, transversus abdominis, erector spinae, and gluteus maximus while maintaining a neutral spine **(Coulombe et al., 2017)**. The patient started on hands and knees with hips and shoulders at 90°, spine neutrally aligned. They extended the right arm forward and left leg backward horizontally at the same time, maintaining the pelvis and shoulders level, pause for 2-3 seconds, then return to start and alternate sides **(McGill, 2016)**. This contralateral limb lift challenges spinal stability, enhances intersegmental control, and improves proprioception without compressing the lumbar spine **(Saragiotto et al., 2016)**. Progressions include adding ankle/wrist weights, performing on unstable surfaces, or increasing hold duration (**Akuthota et al., 2018).**

- **Activate deep spinal muscles**

Activation of deep spinal muscles specifically the lumbar multifidus, transversus abdominis, as well as lumbar inter-spinales is achieved through low-load, sustained isometric contractions that facilitate segmental spinal stability without eliciting pain or compensatory trunk motion **(Richardson et al., 2016)**. The patient begun in a hook-lying or quadruped position; they gently drawed in the lower abdomen (transversus abdominis) while simultaneously performing a gentle multifidus contraction by slightly "bulging" the muscle belly palpated at the L4-L5 level, maintaining this co-contraction during normal breathing **(Hodges et al., 2019).** Progressions incorporate this co-contraction into functional movements (e.g., sitting, standing, walking) to enhance neuromuscular efficiency and spinal control **(Akuthota et al., 2018; O'Sullivan et al., 2019).**

Statistical Analysis:

The data was examined for normality utilizing the Shapiro-Wilk test. A test for group homogeneity was carried out using Levene's test of variances. Subject characteristics were compared across groups using an ANOVA test. The gender distribution across the groups was compared using a chi-squared test. To examine the impact of time (before and after treatment), treatment (across groups), and the interaction of time along with treatment on VAS, ODI, and back ROM, a mixed MANOVA was performed. Subsequent multiple comparisons were subjected to Bonferroni adjustments. All statistical tests were chosen to have a significance threshold of $p < 0.05$. The statistical analysis was carried out using SPSS version 27 for Windows, which is a program developed by IBM SPSS in Chicago, IL, USA.

RESULTS

Subject characteristics:

The individual characteristics of groups A, B, and C are shown in Table (1). Age, weight, height, BMI, and gender distribution did not vary significantly ($p > 0.05$) across the groups.

Table 1. Basic characteristics of participants.

	Group A	Group B	Group C	p-value
	mean ± SD	mean ± SD	mean ± SD	
Age (years)	47.30 ± 8.12	46.20 ± 10.42	45.95 ± 7.88	0.88
Weight (kg)	76.85 ± 7.45	77.20 ± 5.41	77.30 ± 6.56	0.97
Height (cm)	165.80 ± 7.02	165.15 ± 5.02	166.95 ± 7.20	0.68
BMI (kg/m²)	27.94 ± 1.93	28.32 ± 1.79	27.73 ± 1.52	0.56
Sex, N (%)				
Females	13 (65%)	14 (70%)	12 (60%)	0.80
Males	7 (35%)	6 (30%)	8 (40%)	

SD, standard deviation; p value, Probability value

Effect of treatment on VAS, ODI and back ROM:

A statistically significant interaction between treatment and time was found using a two-way mixed MANOVA (F = 13.48, p = 0.001, $\eta p^2 = 0.61$). F = 639.93, p = 0.001, $\eta p^2 = 0.99$ indicates that time had a significant main impact. F = 3.92, p = 0.001, $\eta p^2 = 0.31$) indicated that the treatment had significant main impact.

Within group comparison: When compared with pretreatment, all groups had significant decreases in VAS and ODI ($p < 0.001$). (Table 2). Additionally, there were significant enhancement in ROM for flexion, extension, right in addition to flexion lateral flexion, in every group ($p < 0.001$). (Table 3).

Between group comparison: There were no statistically significant variations in VAS and ODI scores among group A and group B after treatment ($p > 0.05$). When compared to group C, both group A and group B exhibited significantly lesser VAS and ODI values ($p < 0.001$). Groups A and B did not vary significantly ($p > 0.05$) in terms of lumbar ROM in the following directions: flexion, extension, right and left lateral flexion. On the other hand, group C showed significantly lower enhancement in ROM for lumbar flexion, extension, right and left lateral flexion compared to groups A and B ($p < 0.01$).

Table 2. ***Mean VAS and ODI pre and post treatment of group A, B and C:***

	Group A	Group B	Group C
	mean ± SD	mean ± SD	mean ± SD
VAS		VAS	
Pre treatment	7.45 ± 1.39	7.80 ± 1.28	7.60 ± 1.35
Post treatment	1.05 ± 0.76	1.45 ± 0.83	3.80 ± 0.95
MD (95% CI)	6.40 (5.87, 6.93)	6.35 (5.82, 6.88)	3.80 (3.27, 4.33)
	p = 0.001	***p = 0.001***	***p = 0.001***
ODI			
Pre treatment	29.40 ± 7.30	28.35 ± 8.05	28.20 ± 5.53
Post treatment	6.50 ± 5.31	8.40 ± 4.84	16.65 ± 4.23
MD (95% CI)	22.90 (20.26, 25.54)	19.95 (17.31, 22.59)	11.55 (8.91, 14.19)
	p = 0.001	***p = 0.001***	***p = 0.001***

SD, Standard deviation; MD, Mean difference; p value, Probability value

Table 3. ***Mean flexion, extension and side bending ROM pre and post treatment of group A, B and C:***

ROM (degrees)	Group A	Group B	Group C
	mean ± SD	mean ± SD	mean ± SD
Flexion			
Pre treatment	37.05 ± 4.88	35.95 ± 4.62	35.35 ± 3.96
Post treatment	54.80 ± 4.67	53.50 ± 5.82	42.45 ± 3.73
MD (95% CI)	-17.75 (-19.54, -15.96)	-17.55 (-19.34, -15.76)	-7.10 (-8.89, -5.31)
	p = 0.001	***p = 0.001***	***p = 0.001***
Extension			
Pre treatment	17.45 ± 4.72	16.70 ± 4.35	17.90 ± 3.75
Post treatment	26.95 ± 3.83	26.65 ± 3.25	23.20 ± 3.91
MD (95% CI)	-9.50 (-10.89, -8.11)	-9.95 (-11.34, -8.56)	-5.30 (-6.69, -3.91)
	p = 0.001	***p = 0.001***	***p = 0.001***
Right bending			
Pre treatment	13.80 ± 3.25	12.75 ± 3.01	14.10 ± 2.57
Post treatment	22.95 ± 2.56	21.85 ± 2.35	19.55 ± 2.28
MD (95% CI)	-9.15 (-10.27, -8.03)	-9.10 (-10.22, -7.98)	-5.45 (-6.57, -4.33)
	p = 0.001	***p = 0.001***	***p = 0.001***
Left bending			
Pre treatment	13.85 ± 3.36	13.30 ± 3.69	14.20 ± 2.46
Post treatment	23.10 ± 3.02	22.30 ± 2.00	20.10 ± 2.22
MD (95% CI)	-9.25 (-10.47, -8.03)	-9.00 (-10.22, -7.78)	-5.90 (-7.12, -4.68)
	p = 0.001	***p = 0.001***	***p = 0.001***

SD, Standard deviation; MD, Mean difference; p value, Probability value

DISCUSSION

This study was done to investigate the impact of LASER versus ultrasound at acupuncture points on pain intensity, functional ability in addition to back ROM in CNSLBP. Sixty patients of both sexes were diagnosed as CNSLBP and referred by orthopedists aged between 18 and 60 years, BMI was <30kg/ m^2 , they were chosen from outpatient Clinic of Faculty of Physical Therapy, Cairo University. The participants were randomized into three equivalent groups. Group A (Experimental group) was given LLLT on acupuncture points plus conventional Physical Therapy. Group B (Experimental group) was given Therapeutic ultrasound plus conventional Physical Therapy, and Group C (control group) was given conventional physical therapy (moist heat along with core exercises) three times a week for four weeks. Pain intensity was evaluated by VAS, functional ability was assessed by Arabic version of ODI, and ROM was evaluated by Inclinometer. The assessment was done before treatment and after four weeks posttreatment.

The findings showed that VAS scores were not significantly different between groups A and B ($p = 0.30$). Statistically, Group A's VAS was lower than group C's ($p = 0.001$). Group B's VAS was significantly lower than group C's ($p = 0.001$). Regarding LLLT on acupoints reduces pain in CNSLBP through photobiomodulation of mitochondrial cytochrome c oxidase, increasing ATP and reducing inflammation **(de Freitas & Hamblin, 2016; Hamblin, 2017)**. Acupoints have higher nerve and vascular density, enabling enhanced photobiomodulation and superior analgesic efficacy compared to non-acupoints **(Wei et al., 2019; Langevin & Yandow, 2002).** While Therapeutic ultrasound applied to acupuncture points reduces pain intensity in CNSLBP through thermal and non-thermal mechanisms, including increased tissue extensibility, improved blood flow, and modulation of nociceptive transmission **(Noori et al., 2018; Draper et al., 2019).**

The ODI scores of groups A and B were not significantly different ($p = 0.43$). When comparing groups, A and C, the ODI of group A was significantly lower ($p = 0.001$). Group B's ODI was significantly lower than group C's ($p = 0.001$). Regarding to LLLT on acupoints improves functional ability (ODI) in CNSLBP through multimodal mechanisms. Photobiomodulation reduces pain intensity via mitochondrial ATP enhancement, peripheral nerve conduction blockade, and central descending inhibition, directly enabling improved mobility and daily function (**de Freitas & Hamblin, 2016; Zakaria & Ismail, 2018**). Reduced muscle spasm and inflammation alleviate mechanical restrictions, facilitating better lumbar range of motion **(Aimbire et al., 2016; Rizvi & Dalmia, 2019)**.

While Therapeutic ultrasound on acupoints improves functional ability (ODI) through thermal and non-thermal mechanisms. Thermal effects increase tissue extensibility, reduce muscle spasm, and enhance collagen elasticity, improving lumbar range of motion and reducing mechanical restriction **(Noori et al., 2018; Draper et al., 2019)**. Acupoint neurovascular density facilitates localized absorption, enhancing descending pain modulation and reducing central sensitization (**Zhang et al., 2012; Kesikburun et al., 2017).** These combined effects translate pain reduction into improved daily function measured by ODI (**Seco et al., 2019**; **Cebrian et al., 2021;).**

The ROM for flexion was not significantly different between groups A and B ($p = 0.67$). The ROM for flexion was significantly higher in group A compared with group C ($p = 0.001$). Group B's flexion ROM was significantly higher than group C's ($p = 0.001$). Groups A and B did not vary significantly ($p = 0.96$) in terms of extension ROM. When comparing groups, A and C, the difference in extension ROM was statistically significant ($p = 0.006$). Group B's extension ROM was significantly higher than group C's ($p = 0.01$). The ROM for right lateral flexion was not significantly different between groups A and B ($p = 0.32$). When comparing groups, A and C, there was a statistically significant improvement in right lateral flexion ROM ($p = 0.001$). Group B's right lateral flexion ROM was significantly higher than group C's ($p = 0.01$). The ROM for left lateral flexion was not significantly different between groups A and B ($p = 0.56$). The range of motion (ROM) for left bending was significantly higher in group A compared to group C ($p = 0.001$). Group B's left lateral flexion ROM was significantly higher than group C's ($p = 0.01$).

The findings of this study were in accordance with **Ay et al. (2016)** that comparing the impact of LLLT versus Therapeutic Ultrasound (TUS) applied to specific acupuncture points in patients with CNSLBP. At 4 weeks, LLLT at acupoints provided significantly greater short-term pain relief (VAS) than TUS, but this benefit was not sustained at 12 weeks. Both groups performed daily core stabilization exercises. For functional ability (ODI) and quality of life (EQ-5D), both interventions produced clinically meaningful improvements, with no significant between-group differences at either follow-up. Thus, LLLT offered superior early analgesia, while TUS was equally beneficial for long-term disability as well as QOL outcomes when combined with exercise, suggesting both are viable adjuncts for CNSLBP management.

The findings of this study were in accordance with **Alayat et al. (2019)** that compare the impact of LLLT versus High-Intensity Laser Therapy (HILT) versus TUS applied to specific acupuncture points in patients with CNSLBP. LLLT and TUS produced similar and clinically meaningful improvements in pain (VAS) and functional ability (ODI) at 8 weeks when combined with core stabilization exercises, indicating equivalent short-term efficacy. However, HILT demonstrated superior pain and functional outcomes compared to both, yet with more adverse events and lower patient comfort. Crucially, LLLT had the best safety profile (no adverse events) and highest patient comfort.

The results of this study were in line with **Zhang et al. (2024)** that investigated the impact of LLLT performed on specific acupuncture points combined with core stabilization exercises on CNSLBP and normal BMI. The sustained enhancement in pain, function, and spinal mobility suggest that LLLT induces lasting biological effects, possibly through photobiomodulation mechanisms including enhanced cellular metabolism, reduced inflammation, and improved tissue repair. The robust between-group differences confirm that LLLT is an effective adjunctive therapy offering sustained clinical benefits beyond the treatment period, making it a valuable non-invasive treatment option for CNSLBP management.

The findings of this study were agreed with **Chen et al. (2023),** that conducted LLLT combined with core stabilization exercises, they showed significant therapeutic benefits for CNSLBP across various BMI groups. The active LLLT group experienced notable pain reduction, improved functional capacity, and enhanced spinal mobility, maintaining improvements at a six-month follow-up. However, factors like BMI and age influenced treatment responses normal-BMI patients showed greater improvement compared to overweight patients.

In accordance with **Kim et al. (2021)**, therapeutic ultrasound (TUS) applied to acupuncture points BL23, BL25, and GB30 significantly alleviates CNSLBP, with continuous mode showing superior results over pulsed mode. Continuous TUS generates a sustained thermal effect, increasing tissue temperature and promoting vasodilation, which enhances blood flow and facilitates waste removal. This heat reduces muscle stiffness and pain signals, while pulsed mode lacks the necessary thermal impact for effective treatment. The selected acupuncture points are neuroanatomically important, providing direct neuromodulatory effects by stimulating mechanoreceptors and activating pain inhibitory pathways. Combining TUS with core stabilization exercises enhances therapeutic results by allowing greater muscle engagement and reinforcing lumbar support, ultimately facilitating long-term pain management. The continuous heat provided immediate physiological relaxation and pain gating, while the specific points provided neurological pain inhibition. Together with exercise, this broke the cycle of pain-and-disuse, resulting in both acute symptom reduction and lasting functional improvement and these findings agreed with the results of the current study.

The findings of this study came in disagreement with **Zhao et al. (2023)** that investigated the efficacy of TUS combined with core stabilization exercises for CNSLBP. The active TUS group experienced significantly greater improvements than the sham group at both times. The thermal and neuromodulatory effects of continuous TUS facilitate lasting neuromuscular adaptations, reduce pain-inhibited muscle guarding, and enhance lumbar stabilization, breaking the chronic pain–disuse cycle. The disagreement due to the application of ultrasound applied on two points only with long duration for each point.

The results of this current study came in disagreement with **Youn et al. (2017)** comparing the efficacy of LLLT versus TUS versus sham treatment applied to a specific acupuncture point (BL23/Shenshu) in patients with CNSLBP. LLLT provided significantly greater and more durable pain relief (VAS) than TUS at 3 months favoring laser therapy for long-term analgesia. However, both active treatments produced similar functional improvements in disability with no significant difference between-group. Both LLLT and TUS outperformed sham, but only LLLT demonstrated sustained superiority in pain reduction. When combined with core stabilization exercises, both modalities are effective for functional recovery, yet LLLT appears more advantageous for prolonged pain management in chronic nonspecific LBP. The disagreement is due to long time of post treatment assessment and this study applied only on single acupoint.

Although the findings of this study came in disagreement with **Liang et al. (2018)** that investigate the efficacy of TUS performed on the acupuncture points in addition to core stabilization exercises, in patients with CNSLBP. The active TUS group exhibited a greater reduction in ODI scores and improved range of motion across all spinal movements. This suggests that TUS's thermal effects not only reduced muscle stiffness and improved tissue extensibility but also restored spinal mobility. core stabilization exercises enhance lumbar stability. Thus, the active TUS protocol showed substantial and lasting improvements in both functional disability and spinal mobility. The disagreement due to the application applied on acupoints that differ from the points used in the current study and also, the parameters of the study are different than the current study.

According to the Conventional treatment improvement, **Sun et al. (2019)** explained that Core exercises exert analgesic effects through several mechanisms. First, the mechanical stabilization reduces nociceptive input from overloaded passive structures. Second, exercises stimulate mechanoreceptors in muscles and fascia, which activate descending inhibitory pain pathways via the dorsal column-medial lemniscal system. Third, core exercises promote the release of endogenous opioids and endorphins, as well as modulating serum inflammatory cytokines.

Kim et al. (2021) found that the ODI improvements observed in functional gains provided by core exercises, these exercises enable patients to do activities of daily living such as sitting, standing, bending, and lifting with reduced pain and greater efficiency through enhancing trunk stability. Also, **Hodges & Smeets (2018)** explained that the mechanism involves sustained improvements in neuromuscular control, cross-sectional muscle area, and proprioceptive acuity, which collectively maintain spinal stability even after formal treatment ends.

Limitations of the study

First: No long-term effect was studied as the assessment done pretreatment and after 4 weeks only, Second: Large sample size should be considered in additional studies to make generalization of the results of the study. Third: Low level laser therapy and ultrasound should be applied on more acupuncture points rather than that used in the current study and should be combined with other modalities such as acupuncture TENS and Dry needling.

CONCLUSION:

According to scope and findings of the study we concluded that both LLLT and Therapeutic ultrasound at acupuncture points with conventional treatment were equal in effectiveness compared to conventional physical therapy alone in treating patients with CNSLBP.

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