Sakarya Tıp Dergisi
Sakarya Med J

e-ISSN: 2146-409X
Publisher: Sakarya University

Vol. 15, No. 2, 173-187, 2025
DOI: http://doi.org/10.31832/smj.1541981

Review

Laser Acupuncture for Chronic Pain

Emre Uzun[1*], İbrahim Tekeoğlu[2], Muhammed Zahid Şahin[3]

[1] Department of Physical Medicine and Rehabilitation, Sakarya Training and Research Hospital, Sakarya, Türkiye

ftremreuzun@gmail.com,
ror.org/04ttnw109

[2] Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Kütahya Health Sciences University, Kütahya, Türkiye

teke58@gmail.com,
ror.org/01fxqs415

[3] Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Sakarya University, Sakarya, Türkiye

zsahin@sakarya.edu.tr,
ror.org/04ttnw109

* Corresponding Author

Received: 09.09.2024
Accepted: 28.03.2025
Available Online: 12.06.2025

Abstract: Laser Acupuncture (LA) is a contemporary treatment approach that has been in use for approximately 50 years. Unlike traditional manual acupuncture, it offers a non-invasive and painless alternative, making it especially suitable for patients with a fear of needles. Research conducted thus far suggests that acupuncture points can be effectively stimulated by applying laser beams at specific doses for a designated period of time. Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Resistance to treatment can occur when pain transitions into a chronic state. Nearly 20% of the adult population complain of pain. About 10% of these individuals develop chronic pain within a year. Numerous treatment modalities have been used in the treatment of chronic pain. In this article, the role of LA in chronic pain is assessed in detail. Concomitantly, history, mechanism of action, treatment dose and duration, contraindications, complications, combination with other acupuncture methods, and the analgesic effect of LA are also mentioned. Utilization of LA more frequently by clinicians to treat chronic pain and further long-term randomized controlled trials will help eliminate conflicting results regarding this subject.

Keywords: Laser, Acupuncture, Chronic pain

1. INTRODUCTION

Pain is defined as an unpleasant sensory and emotional experience related to an existing or potential tissue damage.[1] This definition highlights that pain is not merely a sensation but also a reaction to it, and its experience is unique to each individual. Various factors, including biochemical, neurophysiological, environmental, cognitive, and genetic influences, can shape pain perception. Acute pain is sensed when lesions associated with tissue damage develop and usually subsides when the lesions fade away. On the other hand, chronic pain is a sensation that persists even after wounds have healed and lasts longer than expected. Approximately 20% of the adult population complains of pain. Within a year, chronic pain is seen in 10% of these individuals.[2] Pain gets more complex and resistant to treatment as it becomes chronic. Chronic pain treatment should be planned in a multifaceted way and evaluated from a holistic point of view. First of all, patient education should be provided for treatment. Staying away from a sedentary life and ensuring mobility are the most important steps. Analgesics, opioids, tricyclic antidepressants, serotonin, and noradrenalin reuptake inhibitors, and neuromodulation techniques are recommended in chronic pain. Biopsychosocial treatments are also utilized when needed.[3]

Acupuncture is a therapeutic technique that has been practiced for centuries, primarily for pain relief. Its underlying philosophy is based on the principles of traditional Chinese medicine, which focus on maintaining the continuous flow of energy, known as Qi, along specific pathways called meridians. Each meridian is believed to regulate particular organs and bodily functions. It is assumed that when a dysfunction is detected at a certain region, normal health could be achieved when the quality of the Qi flow continuity is restored.[4] The World Health Organization suggests that acupuncture can be utilized in more than 100 conditions.[5] Special needles are used in the classic acupuncture model. Laser acupuncture (LA) is a treatment method based on stimulating acupuncture points using a low-intensity non-thermal beam source.[6]

Cite as: Uzun E, Tekeoğlu İ, Şahin MZ. Laser acupuncture for chronic pain. *Sakarya Med J.* 2025;15(2):173-187. doi:10.31832/smj.1541981

Low-Level Laser Therapy (LLLT), applied at wavelengths between 600 and 1064 nm with a power density of 0.001–5 W/cm^2, is a photobiomodulation-based treatment approach shown to be effective in managing many conditions, including wound healing, pain, and nerve regeneration. LLLT can generally be applied over large areas of the body in the treatment of a specific disease or condition. More recently, Ultra Low-Level Laser Therapy (ULLLT), a form of LLLT operating at much lower power densities (~0.15 mW/cm^2) at 633 or 670 nm in continuous or pulsed mode, has demonstrated significant biological effects in osteoarthritis, balance disorders, acute/chronic joint inflammation, thermal hyperalgesia, orthodontics, cosmetic medicine, and wound healing.[7] Meanwhile, in LA, these laser systems are applied to acupuncture points, replacing needles with low-intensity laser irradiation to combine acupuncture and photobiomodulation mechanisms, offering a painless alternative particularly for patients with needle phobia, the elderly, or children.[8] Products with a gaseous medium are frequently used in LA treatment. The highly recommended ones are the Helium-Neon laser, Aluminum-Gallium-Arsenide laser, and Gallium-Arsenide laser.[9] Intensive studies have been carried out using LA on musculoskeletal pain, and it has been shown to have analgesic effects.[10] In this article, we reviwed the effects of laser acupuncture and its place in treating chronic pain.

2. HISTORY

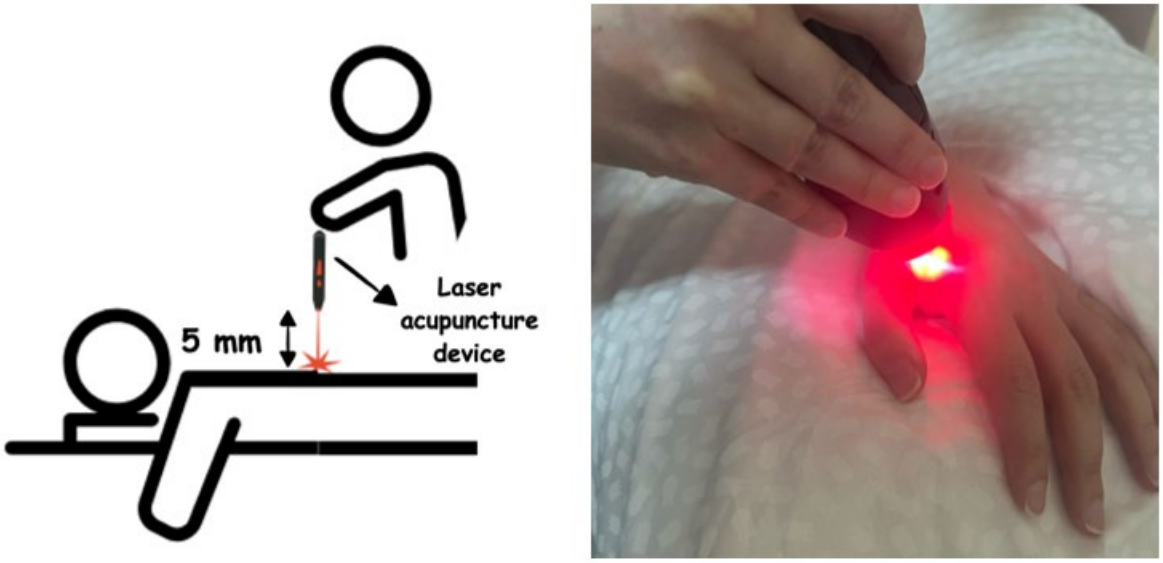
The stimulation of acupuncture points using various techniques has been practiced since ancient times. Initially, stones were utilized, followed by animal bones in early civilizations. The advent of metal tools marked the beginning of modern needle acupuncture as it is known today. To enhance the stimulation effect and elicit different physiological responses, electroacupuncture (EA) was introduced, incorporating electrical signals into metal needles. With technological advancements, LA emerged as a non-thermal technique that stimulates traditional acupuncture points using low-intensity laser beams.[11] The LA method was first introduced in the 1970s. In these years, the first commercial laser acupuncture device was invented called Akuplas.[12] The first “laser needles” were developed in the year 2001 under the commercial name Laser Needle at Paderborn University. This instrument contained 10 laser needles. Therefore it allowed to stimulate several points at the same time. It has the ability to produce red (685nm), infrared (788nm), and violet (405nm) laser beams.[13] Thereafter, more advanced and complicated devices were invented. The production of these devices led to their widespread adoption across many countries, facilitating early research on applications such as wound healing, pain relief in musculoskeletal conditions, and smoking cessation treatments.[14]

3. MECHANISM OF ACTION

In the Laser Acupuncture (LA) method, ensuring that the laser beam penetrates the skin and delivers sufficient energy to the acupuncture points is a crucial step. The effectiveness of the laser beam on the target tissue is influenced by factors such as the beam's wavelength, the depth of the target tissue, treatment dosage, duration, and the number of sessions. Notably, the penetration depth of the laser beam within the tissue is largely dependent on its wavelength. Simultaneously, the energy that reaches the target area is influenced by the tissue's ability to absorb and scatter the laser.[6] Studies indicate that in most LA applications, the laser is typically applied at a distance of 5 mm from the skin to optimize energy delivery and penetration, as shown in Figure 1.[15-17]

Figure 1.

Laser acupuncture application method



The main substances responsible for absorbing laser light are melanin and hemoglobin. Other substances such as bilirubin, carotene, lipids, and fibrous proteins are also accountable for laser light absorption. Keratin in the epidermis and collagen in the dermis are the main reasons for scattering.[18] Owing to the laser beams with a wavelength between 400-600nm that is well absorbed by hemoglobin and melanin, conveyance to the target tissue is limited. Conveyance is also limited at wavelengths above 1400 nm due to the significant amount of absorption in water. Consequently, the light that laser beams disseminate most efficiently in the tissue is red and infrared waves, which correspond to wavelengths between 600-1000nm. Red wavelengths (about 648nm) can penetrate 2-4 cm below the skin surface while infrared wavelengths can penetrate (about 810nm) up to 6cm below the skin.[11,19] Wavelengths between 405 nm and 904 nm are usually preferred in the literature for LA.[20] The optimum values for biostimulation were determined to be between 0.5 and 4 J/cm2. Thus, it is substantial for the given dose to an acupuncture point to be within this range.[21] After the laser beam penetrates the skin layer, it is less scattered in the muscle tissue. It was observed that laser beams at 600-800nm wavelengths penetrate muscle tissue 4 times greater than skin tissue in a study conducted on rabbit skeletal muscle.[22] Therefore, thinning the skin barrier will increase the laser's effectiveness. For this purpose, invasive LA applications were developed. With the help of a needle, the skin tissue is punctured and the part of the needle that is inside the body emits laser beams.[23] Age, gender, pigmentation, and anisotropy of the collagen fibers could also affect the penetration of the laser beams in addition to the factors stated above.[24] If these variables are not considered in the application and studies of LA, discrepancies in effectiveness may eventuate. The laser beam exhibits its main effect through tissue stimulation. It is postulated that low-intensity laser therapy's (LLLT) analgesic effect originates from peripheral nerve blockade, neurotransmitter modulation, muscle spasm reduction, anti-edema, and anti-inflammatory effects.[25]

Studies suggest that the de-qi sensation experienced in traditional acupuncture may present as a feeling of warmth or vibration in the area where Laser Acupuncture (LA) is applied. This sensation is typically noticed after some time into the treatment. However, it is reported to be less pronounced compared to classical acupuncture methods.[26] Qi and blood flow regulation provides therapeutic effects by regulating homeostasis according to Traditional Chinese Medicine. LA renders anti-inflammatory

and analgesic effects by mobilizing qi and hastens the treatment process.[27]

4. CONTRAINDICATIONS

Contraindications concerning laser beams have been determined in the literature instead of contraindications specific to LA therapy. Some clinicians may be cautious even though treatment is safe and the contraindications regarding laser beams are not reliable. Due to the biostimulating effect of the laser beam, it is strictly contraindicated in active malignancies. Moreover, it is not recommended to be applied to the cervical region in patients with hyperthyroidism.[28] Even though there is no clear data on lasers' reducing the seizure threshold, it is believed that it can trigger seizures, especially in certain frequencies with pulsed currents. For this reason, it should be avoided in epileptic patients.[29] It has been shown in studies carried out on chickens that laser beams applied at high intensity have teratogenic effects. Therefore it should be abstained from pregnant patients.[30] The conditions mentioned so far represent generally accepted contraindications of the laser. There are skeptical data regarding the cases where the laser is thought to be contraindicated. It has been advocated to abstain from laser therapy in situations such as patients with an active infection or contagious diseases. Though, some studies have shown that certain microorganisms are sensitive to therapeutic laser treatment.[31] It is also recommended to evade laser therapy in hematological disorders. However, when hematological disorders are mentioned, a wide range of diseases from mild hypochromic anemia to myeloblastic leukemia springs to mind. Due to the biostimulating effect of the laser, it is judicious to avoid laser use in life-threatening hematological malignancies.

There seems to be no impediment to using laser therapy in cases such as mild anemia if the application is not made directly to the bone marrow. Yet, care should still be taken to avoid possible blood loss due to the vasodilator effect of the laser beam.[32] Based on literature findings, there are recommendations against applying laser therapy to the gonadal region. Several studies suggest that laser irradiation in this area may not be appropriate due to potential risks. Therefore, while some sources may not explicitly list contraindications, it is crucial for practitioners to exercise caution and adhere to established guidelines.[33,34] Additionally, ensuring that the practitioner is experienced in the field is of utmost importance to minimize potential risks and ensure patient safety. It was shown in infertile males that laser beams have stimulative effects on reproductive cells.[35] Although the literature includes data suggesting contraindications for laser therapy in patients with pacemakers, substance addiction, cachexia, or when applied to epiphyseal regions, some experts consider this information to be unreliable.[29]

5. COMPLICATIONS

Since Laser Acupuncture (LA) is a nonthermal method used to stimulate acupuncture points, it does not cause complications commonly associated with needle acupuncture. The most frequently reported side effects of LA include tingling, fatigue, temporary pain exacerbation, insomnia, dry mouth, dizziness, and headache.[36] The visible and invisible rays of the laser beam can irritate the conjunctiva and the retina of the eye. Thus, it is mandatory for the patient and the practitioner to use goggles.[37] Noninvasive and painless LA is an excellent alternative for patients who are needle-phobic. Concomitantly, an advantage of LA over needle acupuncture is that points that are difficult to stimulate such as perineum and genital organs are safer with LA. The contraindications and complications of laser acupuncture are listed in Table 1.

Table 1.

Contraindications and complications of laser acupuncture

CONTRAINDICATIONS		COMPLICATIONS
Malignancy		Tingling
Hyperthyroidism (cervical region)		Fatigue
Epilepsy (relative contraindication)		Pain exacerbation
Pregnancy (relative contraindication)		Insomnia
Cardiac pacemaker Addicted to alcohol/drugs Cachexia Epiphysial regions	**NO CONSENSUS**	Dry mouth
		Dizziness
		Headache
		Irritation of the retina and conjunctiva of the eye

6. THE ROLE OF LA IN CHRONIC PAIN

6.1. LA in musculoskeletal pain

In 2021, Hung et al. conducted a meta-analysis to evaluate the effectiveness of Laser Acupuncture (LA) in managing musculoskeletal pain. The analysis included 20 studies, comprising 568 patients who received LA therapy and 534 patients who underwent sham treatment. The participants in the study underwent LA therapy for various conditions, including back pain, knee pain due to osteoarthritis, shoulder pain, hand and wrist pain, widespread joint pain associated with rheumatoid arthritis, temporomandibular joint pain, epicondylitis-related pain, carpal tunnel syndrome, and trapezius muscle pain caused by myofascial pain syndrome. As a result of the research, it has been shown that LA presents a better analgesic effect compared to sham therapy in all these pain models. Also, LA provides superior results concerning functional impairment and disability. Between 632.8-980nm wavelength, 4-200 mW, and 0,275-43,2 Joule energy were used in the studies included in this research. 16 of the 20 studies included in the research indicated favorable results while 4 of them showed unfavorable findings. 2 of the studies giving unfavorable results displayed the usage of lowintensity energy (0.2 Joule) and 1 study using of high-intensity energy (61.2-68.8 Joule) was seen. The fourth study showing negative results revealed that the treatment was applied in 3 sessions for 1 week only. Thus, it was determined that factors such as the application of very low or high intensity energy, seldom treatment application, and incorrect point selection are among the reasons for unfavorable outcomes .[2]

A meta-analysis assessing the effectiveness of LA in patients with knee osteoarthritis analyzed randomized, placebo-controlled trials. The findings revealed that LA treatment significantly reduced Visual Analog Scale (VAS) pain scores compared to placebo. However, no significant difference was observed in the Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain scores. The analysis included seven randomized controlled trials with a total of 395 patients. Analgesic efficacy of LA in the long term showed no significant difference in VAS and WOMAC pain scores compared to the placebo. However, in a subgroup analysis based on whether the technical characteristics of LA treatments (both applied laser parameters and stimulated acupuncture points) were appropriate or not, it was indicated that LA was superior to placebo in both VAS and WOMAC pain scores. No discrepancy was found between LA and placebo in an evaluation made with WOMAC function, stiffness, and quality of life scores. As a result, LA presented analgesic activity in knee osteoarthritis patients while no improvement in functionality was observed. Concomitantly, it cannot slow down disease progression.[38]

Another meta-analysis evaluating the effectiveness of LA found it to be beneficial for patients with myofascial pain syndrome affecting the cervical, shoulder, thoracic, and lumbar

regions. Among the nine studies analyzed, seven reported positive outcomes in the treatment of myofascial pain syndrome with LA. According to this study, the treatment should be done in 10-12 sessions, treatment dose not being below 0.5 Joule and at least 10mW of power was recommended.[39] Similarly, orofacial pain and temporomandibular dysfunction are frequently seen in Temporomandibular Myofascial Pain Dysfunction Syndrome. 24 patients were equally divided into two groups in a double-blind randomized clinical trial. One group received LLLT and the other was treated with LA. Laser treatment with a wavelength of 810 nm was applied to the trigger points of the mastication muscles for 12 sessions. The patients' maximum mouth opening (MMO) without pain and pain scores were measured. A substantial decrease in pain level was observed in both groups compared to the baseline. Higher stability in pain management was observed in the LA group compared with the LLLT group.[40]

Moreover, 9 studies were included in a meta-analysis analyzing the efficacy of manual acupuncture and LA on lateral epicondylalgia. 3 of these studies were considered as studies that evaluated the efficacy of LA.[41] A laser beam with a wavelength of 904 nm was preferred in these studies. An average output power ranging from 0.07 to 12 mW, and doses ranging from 0.004 to 0.9 Joule per spot were utilized. The acupuncture points generally used were LI 11, LI 12, SJ 5, and Ashi. All 3 studies concluded that LA therapy was ineffective in treating lateral epicondylalgia. Conversely, studies in manual acupuncture indicated substantial improvements in outcomes. The inability to transfer sufficient energy to the acupuncture points due to using very low or very high dose laser beams was thought to be the key factor for ineffectiveness. It was suggested as a result of this meta-analysis that manual acupuncture should be chosen over LA in treating lateral epicondylalgia.[42]

In another double-blinded randomized controlled study evaluating the effectiveness of LA in patients with subacromial impingement syndrome, 62 participants were divided into two groups. The treatment group (n=30) received LA therapy, while the control group (n=32) underwent sham LA treatment. LA was applied 5 sessions per week for 3 weeks to the GB 21, LI 4, LI 11, LI 14, LI 15, LI 16, SI 9, SI 10, SI 11, SJ 14, and SJ 15 points. The laser output power was adjusted to apply 4 J/cm2 for 40 seconds at continuous mode with 850nm of wavelength on each point. All patients received 20 minutes of hot pack therapy, Codman pendulum exercises, posterior capsule stretching, and isometric shoulder exercises (15 repetitions in each direction, 3 times a day for 3 weeks). Substantial improvement in pain was reported in the treatment group compared to the control group. [43]

Furthermore, in a randomized controlled study analyzing the effectiveness of ILA treatment with different wavelengths in nonspecific low back pain, 45 patients were included. The patients were divided equally into a control group, a 650nm ILA group, and an 830 nm ILA group. The ILA groups received 10 minutes of ILA and electroacupuncture (EA) therapy twice a week for 4 weeks, while the control group received sham ILA and 10 minutes of EA. Bilateral BL 23, BL 24, BL 25, and GB 30 points were preferred as treatment points. The output parameters were determined as 50Hz, 20 mW power, and 12 J energy per dot for the laser group. Improvements in both pain and functionality were observed in the ILA group compared to the control group. This condition of well-being was sustained also at the evaluation made 4 weeks post-treatment. The 650 nm ILA group and 830 nm ILA group were not compared with each other in this study. Nevertheless, it was concluded that both doses were effective in nonspecific low back pain.[23]

A study investigating the combined effects of low-level laser therapy and auricular acupressure for chronic low back pain showed significant improvements in both pain and quality of life, with benefits persisting for at least eight weeks after a four-week treatment period.[44] Similarly, LA as an adjunct to standard care for postpartum low back pain showed increased analgesic effects and reduced stress scores in another study.[45] A meta-analysis of 20 randomized controlled trials investigating LA's impact on chronic low back pain concluded that LA provided short-term pain relief, but its long-

term efficacy was limited. The exclusive inclusion of randomized controlled trials in this meta-analysis minimized bias compared to studies incorporating other designs.[46] Furthermore, a study evaluating LA effect on chronic neuropathic pain following breast cancer surgery involved treating patients at one-to-four-week intervals. Specific acupoints (ST43, Kid10, ST36, HT3, BL43, and GV14) were targeted with a 638 nm wavelength, delivering 1.2 joules per point. Among the 30 participants, 24 experienced significant reductions in pain and allodynia.[47]

LA treatment also showed significant improvements in pain and symptom severity scores in patients with fibromyalgia.[48]

6.2. LA in headache

Acupuncture is commonly used for headache management, with tension headaches being among the most prevalent types. A study assessing the effectiveness of LA included 50 patients with chronic tension headaches, who were randomly assigned to two groups. The treatment group received LA therapy at bilateral LU 7, LI 4, GB 14, and GB 20 points, administered in 10 sessions, three times per week. The results showed significant improvements in headache intensity, duration, and the number of headache days per month in the treatment group.[49] Chronic pain in pediatric patients was estimated to be 30.8% in some prevalence studies.[50] The most prevalent ones are headache (60.8%), abdominal pain (43.3%), extremity pain (33.6%), and back pain (30.2%).[51] 48 patients were divided equally into 2 groups to assess the effect of LA on chronic headaches seen in the pediatric age group. One group received LA therapy, and the other received placebo LA treatment. 30 seconds of laser beam with an output power of 30 mW, 830 nm wavelength, and a power density of 3.8 W/cm2 were determined as the parameters. The He-Gu (LI 4) and Zu San Li (ST 36) points for patients with frontal headache, Zhi Gou (SJ 5) and Yang Ling Quan (GB 34) points for patients with lateral headache, Hou Xi (SI 3) and Kun Lun (BL 60) points for patients with occipital headache and Bai Hui (DU 20) acupuncture point for patients with holocephalic headache was used. Auricular LA was applied additionally to specific acupuncture points on each patient. Patients in the LA group were treated once a week for 4 weeks. Sham LA was applied to the placebo LA group. The pain scores and the headache attack frequency in a month were noted. Patients were evaluated at the start, 1-4, 5-8, 9-12, and 13-16 weeks. The mean number of headache attacks per month was substantially decreased in the LA group. Concomitantly, a significant decrease in headache severity was seen in all measurements. In the LA group, the analgesic effect was sustained till the end of the study. No side effects were noticed in either treatment group. This study concluded that LA therapy is effective and safe in treating pediatric patients with headaches.[52]

6.3. LA in postoperative pain

Total Knee Arthroplasty (TKA) is a widely preferred surgical procedure for patients with knee osteoarthritis. However, over 80% of these patients are at risk of experiencing postoperative pain following the surgery.[53] The efficacy of LA treatment to alleviate pain and swelling after the TKA procedure was assessed in a recent study. The study was single-blind, randomized, and placebo-controlled. Randomly, 39 out of 79 patients were assigned to the study group and 40 to the control group. Hence, LA treatment was applied to the Sanyinjiao (SP 6), Taixi (KI 3), Kunlun (BL 60), Fengshi (GB 31), Futu (ST 32), and bilateral Neiguan (PC 6) acupuncture points on the side where the operation took place. Each acupuncture point was stimulated for 10 seconds with an 808 nm wavelength, 3 J energy, and a power of 300 mW. Sham LA treatment was applied to the same acupuncture points in the control group. These procedures were performed 2, 6, 10, 24, 48, and 72 hours after the operation. Pain scores were noted after 0, 2, 6, 8, 10, 12, 24, 48, and 72 hours. In the study group, a significant decrease in pain scores was observed in the 6th hour after the TKA operation compared to the control group, and this continued until the 72nd hour. Over time, the demand for morphine by the patients also decreased, and substantial differences were noted between the groups at 48 and 72 hours.[54] Reduction in pain within the first 48 hours but not after 7-21 days following the TKA operation was concluded in another systematic

review.[55] The causes of chronic pain development are not yet clarified in patients who have undergone TKA operations. However, the pain severity and presence of polyneuropathy before the operation are thought to be related to chronic pain after the operation.[56] So far, no study has yet been conducted on the effectiveness of LA treatment on chronic pain following the TKA operation. Nevertheless, managing acute pain with LA after a TKA operation can be a method to halt the development of chronic pain.

7. COMBINATION OF LA WITH OTHER ACUPUNCTURE TECHNİQUES İN CHRONIC PAIN

Despite being practiced for thousands of years, auricular acupuncture has followed a less systematic approach compared to traditional acupuncture principles. As a result, the number of scientific studies on auricular acupuncture is significantly lower than those on traditional acupuncture methods. However, due to its effectiveness in pain management, auricular acupuncture has become an established treatment option for conditions such as sciatica, osteoarthritis, headaches, neuropathic pain, cancer-related pain, and chronic pain.[57] Laser acupuncture has also taken place in auricular acupuncture with the advancement in technology and increase in research.[20] While low-level laser therapy (LLLT) is usually preferred in body acupuncture, ultra-low-level laser therapy (ULLLT) is used in auricular acupuncture. Consequently, energy and power intensities are lower compared to body LA techniques.[58] The qi sensation caused by LA treatment on auricular acupuncture points has been stated to manifest as a feeling of warmth in the ear.[26] The most important advantage of auricular LA is that it can be applied to needle phobic patients as well as pediatric patients of all ages. Concomitantly, risks such as local bleeding, infection, perichondritis, and chondritis are minimal. Also, laser acupuncture treatment requires less time than needle acupuncture.[20] Care should be taken as in all LA applications that both the practitioner and the patient wear protective goggles.

In 1990, a study was conducted to investigate the effects of laser auricular acupuncture on experimental pain thresholds in 80 healthy participants. The participants were randomly assigned to two equal groups. The experimental group received laser treatment at the Shenmen, Lung, Wrist, and Dermis points, while the control group underwent sham laser acupuncture at the same points. Each point was stimulated for 30 seconds using a continuous-wave Helium-Neon laser with a wavelength of 632.8 nm and a power output of 1 mW. To induce pain, an electrode was attached to the participants' left wrists. Cutaneous pain thresholds were measured before and immediately after the procedure. An increase in pain thresholds was observed in 71% of the patients in the experimental group. On the other hand, the increase was 33% in the control group. This study presents evidence that laser auricular acupuncture can be used in pain management.[59] Even though the utilization of laser in auricular acupuncture is recommended for acne, insomnia, alcohol addiction, and smoking cessation, clinical studies especially on pain are necessary.[20]

The summarized findings of various studies investigating the effectiveness of Laser Acupuncture (LA) in different musculoskeletal and pain conditions are presented in Table 2, providing a comprehensive overview of study designs, treatment parameters, outcome measures, and key conclusions.

Table 2.

Summary of Laser Acupuncture (LA) studies in musculoskeletal pain, headache, and postoperative pain

Study [Ref]	Condition / Population	Design / Sample Size	LA Intervention & Parameters	Comparator	Main Outcome Measures	Key Findings
Meta-analysis [2]	Musculoskeletal Pain (back pain, knee OA, shoulder pain, RA, TMD, etc.)	Meta-analysis of 20 RCTs n=568 (LA), n=534 (Sham)	- Wavelength: 632.8–980 nm - Power: 4–200 mW - Energy: 0.275–43.2 J - Various acupuncture points based on condition	Sham LA	Pain relief, functional improvement, disability	- LA > Sham in pain relief & function - 16/20 trials positive - Very low/high energy, infrequent sessions, or incorrect points linked to negative results
Meta-analysis [36]	Knee Osteoarthritis	Meta-analysis of 7 RCTs n=395 total	- LA parameters varied among studies (not specified in detail)	Placebo	VAS, WOMAC pain/function scores	- LA significantly reduced VAS pain vs. placebo - No significant difference in WOMAC pain/function - Subgroup analysis (correct parameters) → LA superiority
Meta-analysis [37]	Myofascial Pain Syndrome (cervical, shoulder, thoracic, lumbar regions)	Meta-analysis of 9 studies	- Recommended ≥10–12 sessions - Dose ≥0.5 J/point - Power ≥10 mW	Varies by study	Pain reduction	- 7/9 trials showed positive results - Adequate energy dose and sufficient session number are critical for effectiveness
Double-Blind RCT [38]	Orofacial Pain / TMD (Temporomandibular Myofascial Pain Dysfunction)	24 patients (2 groups)	- LA vs. Low-Level Laser Therapy (LLLT) - Wavelength: 810 nm - 12 sessions on trigger points of mastication muscles	LLLT group	Pain scores, MMO (Maximum Mouth Opening)	- Both groups had reduced pain - LA group had more stable long-term pain control than LLLT group
Meta-analysis [40]	Lateral Epicondylalgia	9 RCTs total; 3 on LA	- Wavelength: 904 nm - Power: 0.07–12 mW - Dose: 0.004–0.9 J/spot - Points: LI 11, LI 12, SJ 5, Ashi	Placebo or Manual Acupuncture	Pain, function	- LA deemed ineffective in all 3 studies - Possibly too low/high dose - Manual acupuncture showed significant improvement

Table 2. (Continued)

Double-Blind RCT [41]	Subacromial Impingement Syndrome	n=62 (30 LA, 32 Sham)	- 5 sessions/week × 3 weeks - Points: GB21, LI4, LI11, LI14, LI15, LI16, SI9, SI10, SI11, SJ14, SJ15 - Wavelength: 850 nm, 4 J/cm^2, 40 s each point, continuous mode	Sham LA	Pain relief	- LA group had significant pain improvement vs. sham
RCT [21]	Nonspecific Low Back Pain	n=45 (3 groups: 650 nm LA, 830 nm LA, Control)	- 2×/week × 4 weeks - Points: BL23, BL24, BL25, GB30 - 50 Hz, 20 mW, 12 J/spot - Combined with electroacupuncture	Sham LA + EA	Pain, functionality	- Both LA groups showed better pain and function outcomes vs. control - Improvements maintained at 4 weeks post-treatment
Study [42]	Chronic Low Back Pain	Not fully specified	- Low-level laser therapy (LLLT) + auricular acupressure - 4-week protocol	Not specified	Pain, quality of life	- Significant improvement in both pain and QoL - Benefits lasted ≥8 weeks after treatment
Study [43]	Postpartum Low Back Pain	Not fully specified	- LA as adjunct to standard care	Standard care only	Pain, stress scores	- LA group had improved analgesia and reduced stress
Meta-analysis [44]	Chronic Low Back Pain	20 RCTs	- LA parameters varied among trials	Placebo or sham	Pain relief (short- vs. long-term)	- LA provided short-term pain relief - Limited long-term efficacy - RCT-only inclusion minimized bias
Study [45]	Chronic Neuropathic Pain post–Breast Cancer Surgery	30 participants	- LA at ST43, Kid10, ST36, HT3, BL43, GV14 - Wavelength: 638 nm - 1.2 J/point - Treatment intervals: 1–4 weeks	None (open-label)	Pain, allodynia	- 24/30 experienced significant reduction in pain and allodynia
Study [46]	Fibromyalgia	Not fully specified	- LA interventions (details not provided)	Not specified	Pain, symptom severity	- Significant improvements in fibromyalgia-related pain and symptoms

Table 2. (Continued)

Study [47]	Chronic Tension Headache	50 patients (2 groups)	- LA at bilateral LU7, LI4, GB14, GB20 - 10 sessions, 3×/week	Control (not described)	Headache intensity, duration, monthly frequency	- Significant improvement in intensity, duration, and frequency of headaches in LA group
Study [50]	Pediatric Chronic Headache	48 patients (2 groups)	- LA (30 mW, 830 nm, 30 s/point, 3.8 W/cm^2) weekly × 4 weeks - Points based on headache location + auricular points	Sham LA	Pain severity, monthly attack frequency	- Significant decrease in severity & frequency - Analgesic effect sustained up to 16 weeks - No side effects observed
RCT [52]	Postoperative Pain after TKA	Single-blind; 79 patients (39 LA, 40 Sham)	- LA at SP6, KI3, BL60, GB31, ST32, PC6 (operative side) - 808 nm, 3 J, 300 mW, 10 s/point - Applied at 2, 6, 10, 24, 48, 72 hours post-op	Sham LA	Pain score (0–72h), morphine consumption	- Significant pain relief from 6h–72h - Less morphine demand at 48–72h
Systematic Review [53]	Postoperative Pain after TKA	Systematic review	- Various LA parameters (not detailed)	Various comparators	Pain relief over time	- Reduction in pain within first 48h - No benefit after 7–21 days

Abbreviations: LA, Laser Acupuncture; LLLT, Low-Level Laser Therapy; TMD, Temporomandibular Disorder; TKA, Total Knee Arthroplasty; RCT, Randomized Controlled Trial; RA, Rheumatoid Arthritis; OA, Osteoarthritis; VAS, Visual Analog Scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; MMO, Maximum Mouth Opening; EA, Electroacupuncture; QoL, Quality of Life.

8. DISCUSSION

LA has been utilized in therapy for nearly 50 years, providing a modern alternative to traditional needle acupuncture by addressing some of its limitations. It is particularly beneficial for patients with needle phobia, weakened immune systems, or bleeding disorders. Additionally, its non-invasive nature eliminates the risk of infection, making it a more suitable option for pediatric patients. LA targets the same acupoints as traditional acupuncture but uses laser light instead of needles, offering a painless and safe treatment experience. The effectiveness of LA depends on precise technical parameters, which are essential for achieving both peripheral and central therapeutic effects when applied correctly.

LA has shown promising potential in relieving various chronic pain conditions, particularly musculoskeletal disorders such as low back pain, knee osteoarthritis, and myofascial pain syndrome. Systematic reviews and meta-analyses indicate that when applied with optimal parameters—such as wavelength, dosage, and frequency—LLLT can effectively reduce pain intensity and enhance functional capacity. However, inconsistencies in research findings warrant careful consideration of LLLT's application. Factors such as insufficient energy levels, inadequate treatment frequency, and inaccurate acupoint selection have been linked to less favorable outcomes in some studies. Conversely, well-designed protocols employing wavelengths between 600 and 904 nm and energy densities of 0.5 to 4 J/cm^2 have consistently shown

positive analgesic effects. In conditions like lateral epicondylitis, LLLT hasn't demonstrated superiority over manual acupuncture, emphasizing the need for further research to optimize its use in such cases. Similarly, while LLLT may offer temporary relief for knee osteoarthritis, its long-term impact on disease progression remains unclear, necessitating larger-scale, placebo-controlled, long-term trials to determine its effectiveness in chronic pain management. Beyond musculoskeletal pain, LLLT has shown potential in treating other chronic pain syndromes, including tension headaches and postoperative pain. Studies indicate its effectiveness in reducing pain severity and opioid use after procedures like total knee arthroplasty. Its analgesic benefits in pediatric populations, particularly for headaches, further support its safety and versatility. Future research should explore combining LLLT with other acupuncture modalities, such as auricular acupuncture, to potentially enhance therapeutic outcomes. Additionally, establishing clear guidelines on contraindications, including its use in patients with malignancies or specific hematological conditions, is crucial for safe practice.

9. CONCLUSION

Although Laser Acupuncture (LA) has been used for many years, the literature contains conflicting data on various aspects of its efficacy. Therefore, further placebo-controlled, prospective, and long-term studies are needed to establish clearer evidence. Special attention should be given to determining the optimal dosage and treatment duration to maximize effectiveness.

Article Information Form

Acknowledgments

We thank Dr. Tuğba Yağan and Dr. Ayşenur İmamoğlu Baba for their assistance during the data analysis process of the manuscript.

Authors' Contribution

Study design: EU, MZS, IT; Data collection and analysis: EU, MZS, IT; Manuscript writing: EU, MZS; Critical revisions for important intellectual content: EU, MZS, IT.

The Declaration of Conflict of Interest/ Common Interest

No conflict of interest or common interest has been declared by authors.

Artificial Intelligence Statement

No artificial intelligence tools were used while writing this article.

Copyright Statement

REFERENCES

1. Merskey HE. Classification of chronic pain: Descriptions of chronic pain syndromes and definitions of pain terms. *Pain*. 1986.
2. Hung YC, Lin PY, Chiu HE, Huang PY, Hu WL. The effectiveness of laser acupuncture for treatment of musculoskeletal pain: A meta-analysis of randomized controlled studies. *J Pain Res*. 2021;14:1707–1719.
3. Hylands-White N, Duarte RV, Raphael JH. An overview of treatment approaches for chronic pain management. *Rheumatol Int.* 2017;37:29–42.
4. Wu JN. A short history of acupuncture. *J Altern Complement Med.* 1996;2(1):19–21.
5. Organization WH. Acupuncture: Review and analysis of reports on controlled clinical trials. 2002.
6. Whittaker P. Laser acupuncture: Past, present, and future. *Lasers Med Sci.* 2004;19:69–80.
7. Giuliani A, Lorenzini L, Alessandri M, Torricella R, Baldassarro VA, Giardino L, et al. In vitro exposure to very low-level laser modifies expression level of extracellular matrix protein RNAs and mitochondria dynamics in mouse embryonic fibroblasts. *BMC Complement Altern Med.* 2015;15:1-7.
8. Yang J, Mallory MJ, Wu Q, Bublitz SE, Do A, Xiong, D, et al. The safety of laser acupuncture: A systematic review. *Med Acupunct.* 2020;32(4):209–217.
9. Posten W, Wrone DA, Dover JS, Arndt KA, Silapunt S, Alam M. Low-level laser therapy for wound healing: Mechanism and efficacy. *Dermatol Surg.* 2005;31(3):334–340.

10. Wu SY, Kuo CE, Hung YC, Hu WL. Managing pain with laser acupuncture. *Pain Manag*. 2016;10:62863.
11. White A, Ernst EA. Brief history of acupuncture. *Rheum.* 2004;43(5):662–663.
12. Miklánek J, Kriz V. 1st Experiences with the utilization of lasers for acupuncture. The akuplas device. *Fysiatr Reumatol Vestn*. 1978;56(1):36–40.
13. Litscher G, Huang T, Wang L, Zhang W. Violet laser acupuncture—Part 1: Effects on brain circulation. *J Acupunct Meridian Stud*. 2010;3(4):255–259.
14. Snyder-Mackler L, Bork C, Bourbon B, Trumbore D. Effect of Helium-Neon laser on musculoskeletal trigger points. *Phys Ther*. 1986;66(7):1087–1090.
15. Irnich D, Cummings M, Behrens N, Molzen H, König A, Gleditsch J et al. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. Commentary: Controls for acupuncture can we finally see the light? *BMJ.* 2001:322(7302):1574.
16. Shin JY, Ku B, Kim JU, Lee YJ, Kang JH, Heo H et al. Short-term effect of laser acupuncture on lower back pain: A randomized, placebo-controlled, double-blind trial*. J Evid Based Complementary Altern Med.* 2015;2015:808425.
17. Irnich D, Salih N, Offenbächer M & Fleckenstein J. Is sham laser a valid control for acupuncture trials? *J Evid Based Complementary Altern Med*. 2011;2011:485945.
18. Lister T, Wright PA, Chappell PH. Optical properties of human skin. *J Biomed Opt*. 2012;17(9):090901–090901.
19. Anderson RR. Optics of the skin. In *Clinical Photomedicine*. Routledge; 2018:19–35.
20. Round R, Litscher G, Bahr F. Auricular acupuncture with laser. *Evid Based Complement Alternat Med*. 2013;2013:1–22.
21. Tuner J, Hode L. *The Laser Therapy Handbook: A Guide for Research Scientists, Doctors, Dentists, Veterinarians and Other Interested Parties Within the Medical Field.* Prima Books AB; 2004.
22. Wilson BC, Jeeves WP, Lowe DM. In vivo and post mortem measurements of the attenuation spectra of light in mammalian tissues. *Photochem Photobiol*. 1985;42(2):153–162.
23. Kim JH, Na CS, Cho MR, Park GC, Lee JS. Efficacy of invasive laser acupuncture in treating chronic non-specific low back pain: A randomized controlled trial. *PloS One*. 2022;17(5):e0269282.
24. Branchet MC, Boisnic S, Frances C, Robert AM. Skin thickness changes in normal aging skin. *Gerontology.* 1990;36(1):28–35.
25. Hamblin MR, Huang Y. *Handbook of Photomedicine*. CRC Press; 2013.
26. Litscher G. Yes, There is deqi sensation in laser acupuncture. *Evid Based Complement Alternat Med.* 2013;2013:1–4.
27. Hu WL, Chang CH, Hung YC, Tseng YJ, Hung IL, Hsu SF. Laser acupuncture therapy in patients with treatment-resistant temporomandibular disorders. *PloS One*. 2014;9(10):e110528.
28. Pontinen PJ. Low level laser therapy as a medical treatment modality. *Tampera.* 1992;11–211.
29. Godbold JC, Riegel RJ. Contraindications, special considerations, and precautions. In: Riegel RJ, Godbold JC, eds. *Laser Therapy in Veterinary Medicine*. Wiley; 2017:67-73.
30. Avila R, Samar ME, Juri H, De Fabro SP, Centurión C. Structural changes induced by He-Ne laser on the chick embryo ovary. *Rev Fac Cienc Medicas Cordoba Argent*. 1992;50(1):7–10.
31. Hubacek J, Cerna I. Wachstumsbeeinflussung einiger mikroben durch He-Ne laser. *Acta Univ Palacky Olomouc Fac Med.* 1984;107:321–326.
32. Martin DM, Baxter GD, Allen JM, McCoy P, Ravey J, Diamantopoulos C. Effect of laser pulse repetition rate upon peripheral blood flow in human volunteers. *Laser Surg Med.* 1991;I3:83.
33. Mussttaf RA, Jenkins DFL, Jha AN. Assessing the impact of low level laser therapy (LLLT) on biological systems: A review. *Int J Radiat Biol.* 2019;95(2):120-143.

34. Chon TY, Mallory MJ, Yang J, Bublitz SE, Do A, Dorsher PT. Laser acupuncture: A concise review. *Med Acupunct.* 2019;31(3):164-168.
35. Hasan P, Rijadi SA, Purnomo S, Kainama, H. The possible application of low reactive-level laser therapy (LLLT) in the treatment of male ınfertility: A preliminary report. *Laser Ther.* 2004;14:65-66.
36. Glazov G, Yelland M, Emery J. Low-dose laser acupuncture for non-specific chronic low back pain: A double-blind randomised controlled trial. *Acupunct Med*. 2014;32(2):116–123.
37. Prohaska J, Hohman MH. Laser Complications. 2023 Aug 28. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
38. Chen Z, Ma C, Xu L, Wu Z, He Y, Xu K et al. Laser acupuncture for patients with knee osteoarthritis: A systematic review and meta-analysis of randomized placebo-controlled trials. *Evid Based Complement Alternat Med.* 2019;2019:1–10.
39. Baxter GD, Bleakley C, McDonough S. Clinical effectiveness of laser acupuncture: A systematic review. *J Acupunct Meridian Stud*. 2008;1(2):65–82.
40. Khalighi HR, Mortazavi H, Mojahedi SM, Azari-Marhabi S, Parvaie P, Anbari F. The efficacy of low-level diode laser versus laser acupuncture for the treatment of myofascial pain dysfunction syndrome (MPDS). *J Dent Anesth Pain Med.* 2022;22(1):19.
41. Haker E, Lundeberg T. Laser treatment applied to acupuncture points in lateral humeral epicondylalgia. A double-blind study. *Pain*. 1990;43(2):243-247.
42. Chang WD, Lai PT, Tsou YA. Analgesic effect of manual acupuncture and laser acupuncture for lateral epicondylalgia: A systematic review and meta-analysis. *Am J Chin Med*. 2014;42(06):1301–1314.
43. Kibar S, Konak HE, Evcik D, Ay S. Laser acupuncture treatment improves pain and functional status in patients with subacromial impingement syndrome: A randomized, double-blind, sham-controlled study. *Pain Med.* 2017;18(5):980–987.
44. Yang HH, Chung YC, Szeto PP, Yeh ML, Lin JG. Laser acupuncture combined with auricular acupressure improves low-back pain and quality of life in nurses: A randomized controlled trial. *J Integr Med*. 2023;21(1):26-33.
45. Cheng HY, Wu BY, Tung TH, Shieh C, Liu CT. Laser acupuncture analgesia on postpartum low back pain: A prospective randomized controlled study. *Pain Manag Nurs*. 2023;24(1):89-95.
46. Mao X, He H, Ding J. Efficacy of laser acupuncture for treatment of chronic low back pain: A systematic review and meta-analysis. *Pain Manag Nurs*. 2024;25(5):529-537.
47. Relf IRN, Brahmanand T. Reductions in chronic postsurgical neuropathic pain and mechanical allodynia in breast cancer patients treated with laser acupuncture: A retrospective observational study. *Clin Breast Cancer*. 2024:S1526-8209(24)00264-7.
48. Boggiss ÉA, Rosário RC, De Lima RA, Silva PA, Moreira RM, Da Silva KP, et al. Pulsed laser acupuncture in the treatment of pain and heart rate variability in fibromyalgia patients: A pilot randomized clinical trial. *J Lasers Med Sci.* 2022;13.
49. Ebneshahidi NS, Heshmatipour M, Moghaddami A, Eghtesadi-Araghi P. The effects of laser acupuncture on chronic tension headache – a randomised controlled trial. *Acupunct Med*. 2005;23(1):13–18.
50. Roth-Isigkeit A, Thyen U, Stöven H, Schwarzenberger J, Schmucker P. Pain among children and adolescents: Restrictions in daily living and triggering factors. *Pediatrics.* 2005;115(2):e152–e162.
51. Young L, Kemper KJ. Integrative care for pediatric patients with pain. *J Altern Complement Med.* 2013;19(7):627–632.
52. Gottschling S, Meyer S, Gribova I, Distler L, Berrang J, Gortner L, et al. Laser acupuncture in children with headache: A double-blind, randomized, bicenter, placebo-controlled trial. *Pain*. 2008;137(2):405–412.
53. Luo J, Min S. Postoperative pain management in the postanesthesia care unit: An update. *J Pain Res.* 2017;10:2687–2698.

54. Huang CH, Yeh ML, Chen FP, Wu D. Low-level laser acupuncture reduces postoperative pain and morphine consumption in older patients with total knee arthroplasty: A randomized placebo-controlled trial. *J Integr Med*. 2022;20(4):321–328.
55. Chen Z, Shen Z, Ye X, Xu Y, Liu J, Shi X et al. Acupuncture for rehabilitation after total knee arthroplasty: A systematic review and meta-analysis of randomized controlled trials. *Front Med.* 2021;7:602564.
56. Wylde V, Beswick A, Bruce J, Blom A, Howells N, Gooberman-Hill R. Chronic pain after total knee arthroplasty. *EFORT Open Rev*. 2018;3(8):461–470.
57. Asher GN, Jonas DE, Coeytaux RR, Reilly AC, Loh YL, Motsinger-Reif AA, et al. Auriculotherapy for pain management: A systematic review and meta-analysis of randomized controlled trials. *J Altern Complement Med.* 2010;16(10):1097–1108.
58. Bergamaschi M, Ferrari G, Gallamini M, Scoppa F. Laser acupuncture and auriculotherapy in postural instability a preliminary report. *J Acupunct Meridian Stud*. 2011;4(1):69–74.
59. King, CE, Clelland JA, Knowles CJ, Jackson JR. Effect of helium-neon laser auriculotherapy on experimental pain threshold. *Phys Ther.* 1990;70(1):24–30.