Effect of laser acupuncture on humans: systematic review

Efeito da acupuntura a laser no ser humano: revisão sistemática

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ABSTRACT
Introduction: laser acupuncture is a recent technique that uses low intensity laser irradiation. Since it is painless, it can favor the adherence of patients with limitations, phobias or pain sensitivities. Objective: Synthesize scientific evidence resulting from research on the application of laser acupuncture in humans. Method: Systematic review carried out in the MEDLINE and MOSAICO databases, using the descriptors: Traditional Chinese Medicine, Acupuncture, Complementary Therapies. Results: The research resulted in the analysis of 18 articles published between 1998 and 2018, in which laser acupuncture was applied to minors, adults and the elderly, associated with osteotendineomuscular, cardiovascular, gastrointestinal, endocrine, psychiatric, respiratory and neurological disorders. Most of the analyzed studies demonstrated that the acupuncture technique was effective, however there are still gaps to be filled in the care protocols used.

keywords: Traditional Chinese Medicine, Acupuncture, Complementary Therapies.
1 INTRODUCTION

Acupuncture aims to promote preventive and curative health. For being focused on individuality, it considers that pathologies result from imbalances caused by nutritional deficiencies, sleep, sedentary lifestyle and emotional disorders, that changes the circulation of energy (Qi) in the meridians that run through the body [1,2].

It was recognized by the Unified Health System (SUS) and implemented through the National Policy on Integrative and Complementary Practices (PNPIC-SUS), what enable its use in the treatment of physical and psychological disorders [3].

The wide application of needles in acupuncture can generate intolerance due to fear and pain, making it important to know the scientific evidence that supports the application of non-invasive techniques.

This review was limited to the study of the laser acupuncture technique that employs Low Intensity Laser Therapy (LILT) in visible and infrared light lengths, in acupoints, promoting energy balance [4]. The laser (Light Amplification by Stimulated Emission of Radiation) is characterized as the amplification of the stimulated emission of optical radiation. An important discovery, especially in the areas of industry and health [5].

Non-ionizing electromagnetic radiation has properties such as monochromatism, coherence and collimation, with its own biomodulating potential, and its photochemical, photobiological and photophysical effects produce short- and long-term analgesic and anti-inflammatory responses [5,6,7]. Benefits such as safety, easy applicability, accurate dosimetry, non-invasiveness, or discomfort, facilitate the replication of studies [8].

The irradiated points activate the peripheral nervous system and causes alterations in the neurotransmitters of the central nervous system [9]. These physiological effects on the cerebral cortex after using the laserin acupoints were confirmed through observation by magnetic resonance [10].

This study is justified by the need to expand knowledge about laser acupuncture, since many people do not adhere to acupuncture with sharps due to aikimophobia. For example, the children, the elderly, and people with physical or mental limitations can resist to the needles. Thus, the work aimed to synthesize scientific evidences resulting from research about laser acupuncture application.

2 METHODS

This research, conducted through a systematic literature review, sought evidence according to an established protocol with a view to reducing bias. This provides a synthesis of knowledge and incorporation of the applicability of results from significant studies in practice [11,12].
Through the acronym PICO, the guiding question was formulated: what is the evidence reported by the literature about laser acupuncture application in humans? There was no definition of control (C), but the question was formulated based on the population (P) - human beings, on the intervention (I) - application of laser acupuncture, and (O) - clinical results.

The inclusion criteria for analyze the studies were: complete articles available online in Portuguese, Spanish or English, that reported to have used laser acupuncture in humans. Dissertations, theses and those that did not present research results, such as editorials, were excluded.

The search was used the following databases: Medical Literature Analysis and Retrieval System Online (MEDLINE) and Health Models and Traditional, Complementary and Integrative Medicines in the Americas (MOSAICO). In order to group a greater number of publications, the Boolean operator AND was used. According to the specificities of each base, combinations of descriptors were used: Traditional Chinese Medicine, Acupuncture, Complementary therapies.

The selection was carried out by two reviewers, individually, in three moments: reading the title, reading the abstract and reading the full articles. They also evaluated each research design and ranked hierarchically the articles according to the evidence classification [13]. A third researcher was used when there was no consensus between the initial choice of articles.

For data extraction, an adapted instrument [14] was used, with the information: title, authors, year of publication, place of publication (country), language, type of study, level of evidence, objective, population/sample, indication (pathology), equipment used, specific care and outcomes.

After selection, the studies were categorized, summarized, and the results were distributed in table and figures and submitted to descriptive analysis.

The research was carried out through a systematic literature review, and submission to a Research Ethics Committee was waived.

3 RESULTS

A total of 58,343 studies were located in the MOSAICO and MEDLINE databases, 7,180 using the descriptors "traditional chinese medicine AND acupuncture", 24,892 using "complementary therapies AND acupuncture" and 24,876 searching for "complementary therapies AND traditional chinese medicine", as shown in figure 1.

It was found 18 articles on laser acupuncture published from 1998 to 2018, and only one randomized clinical trial was published nationwide, in Portuguese. The majority (N=17) published in international journals, in English.
As for the level of evidence, 15 studies (83.3%) presented level 2, whose evidence derives from at least one well-designed randomized controlled clinical trial and in 3 studies (16.7%) the evidence was obtained from well-designed clinical trials no randomization (level 3).

As for the research subjects, laser acupuncture was applied in different life cycles, from minors (N=5), adults (N=11) to elderly (N=2). In the younger age group, newborns (N=1), children (N=3) and adolescents (N=1) were included. The approach with adults included healthy individuals (N=3), with a clinical history of cardiac or circulatory diseases (N=2), with osteotendinous and muscular involvement (N=3), obese women (N=2) and adults with depression (N=1). The choice of individuals over 60 years of age (N=2) used only age as an inclusion criterion.
Regarding indications for laser acupuncture, the most frequent ones were associated with osteotendinous and muscular pathologies, especially chronic ones (osteoarthritis, low back pain, myofascial and others); cardiovascular (systemic arterial hypertension, cardiac disorders, reduced heart rate, arterial stiffness); gastrointestinal (vomiting, gag reflex), endocrine (visceral obesity, postpartum weight reduction);
psychiatric (depression); respiratory (asthma); and neurological (Neonatal Withdrawal Syndrome, pain during renal biopsy).

Reported care related to laser acupuncture corresponded to: eye protection, duration of sessions, interval between interventions, time of point stimulation and dose of applied energy.

For application, ultra-low and medium power equipment was used, ranging from red to infrared and violet (blue laser), as well as diode laser with continuous laser beam and non-laser red light, in some cases, by means of arsenide devices of gallium and aluminum and needles that could emit different wavelengths.

Table 1: Distribution of articles, according to author/year, objective, type of study and outcome.

| Author(s)/year | Aim | Type of study | Outcome |
|----------------|-----|---------------|---------|
| Schlager, Offer, Baldissera/1998 | To investigate the effectiveness of P6 acupuncture on postoperative vomiting in children undergoing strabismus surgery | descriptiveexploratory | In the laser stimulation group, the incidence of vomiting was lower than in the placebo group. |
| Gruber et al/2002 | To investigate the possible protective effect of a single laser acupuncture treatment on hyperventilation-induced bronchoconstriction in pediatric and adolescent patients. | descriptiveexploratory | A single laser acupuncture treatment does not protect against exercise-induced bronchoconstriction in pediatric and adolescent patients. |
| Wosniak et al/2003 | To compare the effectiveness of low-calorie diet and low-calorie diet applied in conjunction with laser acupuncture in the treatment of visceral obesity in postmenopausal women. | Transverse | The combination of a low-calorie diet and laser acupuncture is characterized by greater efficacy than a low-calorie diet alone in reducing body weight, body mass index and waist-to-hip ratio. Laser acupuncture is an additional healing method useful in the therapy of postmenopausal visceral obesity. |
| Katsoulis et al/2010 | Evaluate the effectiveness of laser acupuncture in a pilot study. | descriptiveexploratory | Verbal scale assessment showed pain reduction from moderate to very severe initially, to moderate, mild and without pain for the three groups. Laser needle acupuncture may be a treatment option for patients interested in non-invasive complementary therapy. But due to the low number of participants, no clear conclusions can be drawn. |
Salih et al/2010 To analyze whether the perceptions reported in the two study groups (verum and sham laser) were distinguishable and whether expectation effects exhibited a considerable impact on the results.

Bergamashi et al/2011 To test the effectiveness of low-potency auriculopuncture and laser acupuncture versus placebo in improving postural control in an elderly population.

Litscher et al/2011 To investigate the effects of violet laser acupuncture on arterial stiffness and other important parameters of the functional state of the heart.

He et al/2012 Conduct pilot investigation on the effects of 2 and 100 Hz violet laser acupuncture on heart rate and its variability in healthy volunteers using a new non-invasive method.

Glazov, Yelland, Emery/2014 Determining whether laser acupuncture can have a specific effect on reducing pain and disability in the treatment of chronic low back pain.

Hinman et al/2014 Determine the effectiveness of laser and needle acupuncture for chronic knee pain.
| Authors        | Study Objective                                                                 | Study Design         | Results                                                                 |
|---------------|---------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------|
| Schmölzer et al/2015 | To assess whether a combination of laser acupuncture and drug therapy reduces the duration of therapy in newborns diagnosed with neonatal withdrawal | Retrospective        | Adjuvant laser acupuncture significantly reduced the duration of morphine therapy in neonates. |
| Chiang-Hung et al/2016 | To investigate the effect of laser acupuncture therapy on postpartum weight control. | Descriptive-exploratory | Lasercupuncture reduces postpartum weight retention, improving body mass index (BMI) and body fat percentage (BFP), but does not affect WBR after short-term treatment. |
| Helianthi et al/2016 | To compare the efficacy of active laser acupuncture with placebo in reducing pain intensity and improving functional outcome in geriatric patients with knee osteoarthritis. | Transverse           | Laser acupuncture has a more effective effect in reducing the visual analogue scale and Lequesne index in elderly patients with knee osteoarthritis compared to placebo treatment. |
| Lee et al/2016 | Compare the influences of manual acupuncture, laser acupuncture and electromagnetic field stimulation on the autonomic nervous system. | Descriptive-exploratory | Manual acupuncture and low and high frequency electromagnetic field stimulation activated the parasympathetic nervous system, while laser acupuncture activated the sympathetic nervous system. |
| Goel et al/2017 | To investigate the effect of low-intensity laser therapy (LLLT) on PC6 acupoint in suppressing the gag reflex, regulating pulse rates and oxygen saturation, reducing anxiety levels. | Descriptive-exploratory | The therapy was found to be effective in reducing anxiety levels, as observed by the modified faces anxiety rating scale. Furthermore, it was authenticated when pulse rates were reduced and oxygen saturation levels increased significantly. Also the gag reflex was controlled when laser stimulation was performed on PC6. |
| Oates Et al/2017 | Avaliar a laseracupuntura como terapia adjuvante no manejo da dor durante procedimento de biópsia renal percutânea em crianças e adolescentes. | Descriptive-exploratory | Evaluate laser acupuncture as adjuvant therapy in pain management during a percutaneous renal biopsy procedure in children and adolescents. |
| Pereira et al/2018 | Evaluate the effectiveness of a laser acupuncture protocol, developed and applied by nurses in patients with hypertension. | Descriptive-exploratory | The protocol was found to be effective. There was a reduction and control of blood pressure, indicating its use as a possible technology for the care of people with primary systemic arterial hypertension. |
Smith et al/2018  | To verify the differential effects of needle and laser acupuncture in relation to the brain effects of activating LR8, a putative acupoint for depression, using functional magnetic resonance imaging. | descriptive-exploratory | Laser and needle acupuncture at the LR8 point in healthy subjects produced different brain patterns. Laser acupuncture activated the mood-relevant precuneiform in the network in a posterior pattern, whereas needle acupuncture activated the parietal cortical region associated with the primary motor cortex. Further investigation is needed to assess the clinical relevance of these effects.

It is apprehended that laser acupuncture proved to be effective in 66.6% of cases and in 22.3% the results were not significant. In 11.1%, the outcomes demonstrated the need to expand investigations into this technique.

Assessing the outcomes, the effectiveness in reducing postoperative vomiting episodes, in postmenopausal visceral obesity therapy, sympathetic nervous system activation, pain reduction when assessed by the verbal scale, postpartum weight retention was verified and reduced levels of anxiety, as observed by the modified faces anxiety rating scale. Furthermore, with laser acupuncture, there was a significant improvement in pain after pediatric percutaneous renal biopsies, with a decrease in heart and respiratory rates. In combination with pharmacological therapy, it contributed to the reduction and control of blood pressure, as well as reducing the duration of therapy in newborns with Neonatal Withdrawal Syndrome.

On the other hand, it did not show satisfactory results in the protection against exercise-induced bronchoconstriction; showed no significant difference in the variation of total heart rate before, during or after treatment; clinical improvement of chronic low back pain was not related to laser stimulation; there was no improvement for chronic knee pain; nor did violet laser stimulation at the Baihui acupuncture point result in significant changes in heart rate and mean arterial pressure parameters, whereas the rate of brachial enlargement increased during and after violet laser acupuncture. Other studies have signaled that further investigation is needed to assess the clinical relevance of the effects in the treatment of depression. During the analysis, gaps were observed regarding information about clinical protocols and parameters in the use of this technique.

4 DISCUSSION

Laser acupuncture is indicated in anti-inflammatory, analgesic and cell regenerative therapies, since light energy can generate photobiological induction and produce biochemical and bioelectrical effects on cells [15].
Corroborating the findings of this review, the study that evaluated the efficacy of laser acupuncture in relieving nausea and vomiting in children and adolescents undergoing chemotherapy, showed it to be effective in alleviating these clinical manifestations [16].

Authors attest that the combination of a low-calorie diet and laser acupuncture offer greater efficacy than just a low-calorie diet in reducing body weight, body mass index and waist-hip ratio [17].

Improvements in anxiety levels and sleep patterns were perceived and reported by the participants of a study [18] that used laser acupuncture in the MCP-3 (Yintang) and C7 (Shenmen) acupoints, which have an action of relaxation and control of emotions.

Controlling systemic arterial hypertension largely depends on the response of peripheral vascular resistance to antihypertensive drugs. Similarly, it is believed that endogenous substances released through Traditional Chinese Medicine therapies also contribute to this homeostatic mechanism, such as Qi (energy), which promotes the circulation of Xue (blood) [19].

The results of a randomized clinical trial [20] suggest that newborns with Neonatal Withdrawal Syndrome treated with laser acupuncture associated with drug therapy required less medical treatment when compared to newborns treated only with drug therapy. Thus, laser acupuncture proved to be safe, viable, efficient and well accepted by the parents of newborns.

In another study, laser acupuncture was evaluated as an effective alternative to treat pain in children with sickle cell anemia [21]. Similarly, it demonstrates efficacy in reducing pain intensity and improving functional outcome in geriatric patients with knee osteoarthritis, in a double-blind randomized clinical trial conducted in a geriatric outpatient clinic [22].

Factors such as biological tissues (skin color) and the physical constitution of patients, such as nutritional status, interfere with the laser’s effectiveness [23].

The equipment mentioned in the studies had their wavelength range varying from violet (405 nm) to infrared (830 nm) within the electromagnetic spectrum, considered low power lasers. Even in this interval, the risk of damage to vision must be eliminated using the necessary protection [24].

Laser acupuncture has good tolerability and safety. Care can be summarized as mentioned [5]: Therapist and patient must wear protective glasses according to the type of laser used. Accidental exposure can cause eye injury due to thermal and/or photochemical damage and resulting in partial or total loss of vision. Reflective materials should be avoided in the environment and warnings should inform about stray radiation. The radius incidence angle must be positioned over the application area.

The data from this study suggest the effectiveness of the laser, since 66.6% of cases had measurable therapeutic benefits. As limitations, the search was restricted to only two databases, and, also, studies from the references of other articles were not included.
It is suggested to encourage studies to assess the effects of laser acupuncture and different care protocols, especially randomized clinical trials with a predilection for controlled ones.
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