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*Full Length Research Paper*

## **A systematic review of laser acupuncture on the management of low back pain**

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**Acupuncture has been also used to manage patients with Low back pain (LBP). Laser acupuncture (LA), i.e., the use of laser to stimulate acupoints. It is believed that similar clinical responses to manual acupuncture could be achieved via LA. To investigate the validity of the claim, the use of LA in the management of LBP through four databases were searched. The number of publications (NP) in the Science Direct database was the highest among the databases except for the keyword laser. In general, however, the NP with laser acupuncture is very small. The results and conclusions of all the selected papers have indicated the importance of LA in improving clinical conditions of patients with LBP but with no statistical significance with Depression Anxiety Stress Scale; Personal Wellbeing Index; Numerical Pain Rating Scale; Oswestry Disability Inventory; Visual Analog Scale and Ryodoraku Values. The findings are not conclusive in evaluating the effects of LA in treating LBP. The quantification of scales has shown an improvement in the patients treated with LA, however, the same findings were also found in the control groups. As a result, more investigations on LA are needed to clarify its efficacy on LBP. To conclude, there is a scientific interest in studying the LA. It is because that LA is not invasive and it is friendly to the patients with fear of needles. Hence, it is important, to develop suitable and useful protocols on the control of laser wavelength and dose.**

**Keywords:** acupuncture, laser, laser acupuncture, low back pain

### **INTRODUCTION**

Back pain is one of the most prevalent clinical problems seen in primary care with one of the highest overall costs (Rapoport et al., 2004; Dionne et al., 2006). In particular, low back pain (LBP) affects the population of the entire

world and it is an important clinical, social and economic burden. It is a public health problem interfering with the lifestyle, activities of the work and quality of life (Deyo and Weinstein, 2001; Bener et al., 2014; Hoy et al., 2010). Bener et al. (2013) have reported that psychological distress such as anxiety, depression, and somatization were more prevalent in LBP patients in

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comparison with patients without LBP.

The variety of the pain medications, physical measures, injections, and surgery for back pain suggest that there are doubts related to the optimal and necessary therapy. Despite the rapid increases in the use of pain medications, physical agents, complementary and alternative procedures related to the Traditional Chinese Medicine (TCM), and surgery, there is no clear evidence of improved functional status or declining work disability related to back pain (Grabois, 2005; Chou et al., 2007; Glazov, 2010; Petering and Webb, 2011; Fiore et al., 2011; Ebadi et al., 2014; Chang et al., 2015; Liu et al., 2015).

TCM comprises various practices, such as Traditional Chinese Herbal Medicine, acupuncture, auriculotherapy, acupressure, massage (tui na), qi gong, moxibustion and cupping (Teng et al., 2006; Wang and Xion, 2013; Chang, 2012, 2013; Bernardo-Filho et al., 2014).

The concept of disease in TCM would be related to functional disorders due to imbalances of the Qi and Xue. The channels that would carry and transport Qi and Xue are called “meridians” and points (acupoints) in these channels can be stimulated. (Chang, 2012). In order to treat various physiological disorders due to the imbalance of Qi and Xue, the agents utilized in acupuncture to stimulate the acupoints are usually needles, but other agents can also be used, as the laser (Teng et al., 2006; Chang, 2010; Round et al., 2013; Vallone et al., 2014).

Some sources of non-ionizing radiations, such as the “Light Amplification by Stimulated Emission of Radiation (laser) (Basford, 1993; Whittaker, 2004; Rola et al., 2014) and light-emitting diodes (LED) (Park et al., 2014) have been used in health sciences (Basford, 1993; Whittaker, 2004; Rola et al., 2014, Park et al., 2014). Devices of LED, as alternative light sources, produce light with wavelengths similar to those of laser, but they are less monochromatic and lack the coherence that is a particular feature of laser light. However, LED has the advantage of being significantly less expensive than laser diodes (Hashmi et al., 2010). On the other hand, the physical properties of the laser are as follows: (i) monochromaticity, (ii) polarization, and (iii) high coherence. These properties make this electromagnetic radiation an important physical agent to be used in health sciences, with basic and clinical approaches (Basford, 1993; Whittaker, 2004; Fonseca et al., 2012, Rola et al., 2014).

In the last century Townes and Arthur L. Schawlow, in 1958, published the study of infrared and optical maser (Round et al., 2013). This was the basis for the construction of the first laser by the physicist Theodor Maiman in 1960 (Round et al., 2013, Rola et al., 2014). In the early 1960s, a Ruby laser was introduced into medicine for the photocoagulation of the retina, however due to severe side effects, the treatment was discontinued. In the late 1960s, an Argon laser was developed for the use of detached retina treatment

(Round et al., 2013). Passing along the time, laser therapy has been used in several fields of health sciences, medicine (Evans et al., 2014), dentistry (Nalcaci and Cokakoglu, 2013) and physiotherapy (Jain and Sharma, 2014). The wavelength, the output power, the power density and the energy density are important biophysical parameters to be considered in the application of the laser. The range of wavelength spectrum of a laser can vary between 240 and 3,000 nm. Laser with wavelengths over 785 nm are considered infrared laser and they are invisible light laser (Anderson and Parrish, 1981; Litscher and Opitz, 2012). The output power is the power level of the laser and it is expressed in milliwatts (mW) and the dose in a point of the skin depends on this biophysical parameter (Litscher and Opitz, 2012).

The power density, expressed in watt per  $\text{cm}^2$  ( $\text{W}/\text{cm}^2$ ) or milliwatt per  $\text{cm}^2$  ( $\text{mW}/\text{cm}^2$ ), states the intensity of the laser beam and is in indirect proportion to the diameter of the laser beam (Litscher and Opitz, 2012). The energy density is defined in wattsecond per  $\text{cm}^2$  ( $\text{Ws}/\text{cm}^2$ ) or Joule per  $\text{cm}^2$  ( $\text{J}/\text{cm}^2$ ) and it is the treatment dose. It determines the energy delivered per  $\text{cm}^2$  for the time of irradiation (Litscher and Opitz, 2012). A laser has pulsed or continuous waves, respectively, pulsed or continuous laser (Anderson and Parrish, 1981; Ando et al., 2011; Round et al., 2013). The wavelength of a laser is defined by its laser medium which can be gaseous, fluid, solid, or semiconducting (Posten et al., 2005).

Among the techniques of the complementary and alternative medicine, the acupuncture has been used to manage patients with LBP (Chang et al., 2015). Various physical agents have been suggested to treat LBP, as cold, heat, ultrasound and laser (Petering and Webb, 2011; Fiore et al., 2011; Vallone et al., 2014; Ebadi et al., 2014; Cilingir et al., 2014; Chang et al., 2015). Then, it would be interesting to use a combination of techniques, as the use of the laser to stimulate points of the meridian (acupoints), the “laser acupuncture” (LA) to the management of the LBP (Glazov, 2010). In LA, the most frequently used laser is the gas laser (mainly the Helium Neon - HeNe laser). The HeNe laser, a low-intensity (level) laser (LLL) has a wavelength of 632.8nm (Baxter et al., 2008). The Argon laser is also a low-level and gas laser and in LA its wavelength is usually 514 nm (Zalewska-Kaszubska and Obzejta, 2004). In the AlGaAs used in LA, the standardized wavelength is 780 nm (Baxter et al., 2008). In the GaAr laser used in LA, standardized wavelength is 940 nm (Baxter et al., 2008). Depending on the treatment, lasers can be of high intensity, medium or low intensity (Rola et al., 2014). Medium energy lasers are mainly used in oncology, especially as a part of photodynamic therapy (Rola et al., 2014). High-intensity (level) laser have the ability to cut, to destroy, or to cauterize tissues due to the thermal effect. The effect of LLL is mainly due to their interaction with the tissue (Round et al., 2013). LA has been used to

treat various clinical conditions such as, chronic low back pain (Glazov et al., 2009, 2014), osteoarthritis (Yurtkuran et al., 2007; Shen et al, 2009), burning mouth syndrome (Brailo et al., 2013), childhood bronchial asthma (Nedeljkovic et al., 2008; Zang et al., 2012; Elseify et al., 2013), temporomandibular dysfunction (Hotta et al., 2010, Turp, 2011, Ferreira et al., 2014), depression (Quah-Smith et al., 2013), monosymptomatic nocturnal enuresis on bladder reservoir function and nocturnal urine output (Radvanska et al., 2011), menopausal symptoms (Beyazit et al., 2010), myofascial pain of the masticatory muscles (Katsoulis et al., 2010), blood pressure and body weight (Zhang et al., 2008). Carpal tunnel syndrome (CTS) has been also treated with LA as a conservative treatment (Gerritsen et al., 2002; O'Connor et al, 2003). Fusakul et al. (2014) have evaluated the efficacy of LLL therapy alone in patients with mild to moderate CTS.

The optical properties due to biological structures and the wavelength are two important factors to be considered in penetration of the laser in the skin which is an important barrier (Whittaker, 2004). It is suggested that in body acupuncture, as the nociceptive structures lie 2-3 cm under the surface of the skin. In general, the wavelength of the laser should be between 605 and 850 nm (Anderson and Parrish, 1981). However, investigation with laser with 405 nm (penetration about 1 mm in the skin) has shown effect on the blood flow velocity in the basilar artery (Litscher and Opitz, 2012).

Putting together the information about the absence of an optimal treatment to low back pain and the clinical importance of procedure with LA, the aim of this study is to analyze the effect of the LA in the management of LBP through four databases.

## **MATERIAL AND METHODS**

### **Search Strategy Used to Find the Publications Involving Laser Acupuncture and Low Back Pain**

Three reviewers independently accessed bibliographical databases through the Universidade do Estado do Rio de Janeiro. Searches were performed in the PubMed, Scopus, Science Direct and PEDro databases on May 13th, 2015 with the keywords (i) laser, (ii) acupuncture, (iii) "low back pain", (iv) "laser acupuncture", (v) laser and "low back pain", (vi) acupuncture and "low back pain" and (vii) "laser acupuncture" and "low back pain". The number of publications (NP) was determined to each item searched in each database. About the databases used, briefly, (i) PubMed comprises more than 24 million citations for biomedical literature from MEDLINE, life science journals and online book (<http://www.ncbi.nlm.nih.gov/pubmed>), (ii) Science Direct is a leading full-text scientific database offering journal articles and book chapters from nearly 2,500 journals and more than 30,000 books (<http://www.sciencedirect.com>),

(iii) PEDro is the Physiotherapy Evidence Database and it is a free database of over 29,000 randomized trials, systematic reviews and clinical practice guidelines in physiotherapy. PEDro is produced by the Centre for Evidence-Based Physiotherapy at The George Institute for Global Health. (<http://www.pedro.org.au>) and (iv) Scopus is the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings. It delivers a comprehensive overview of the world's research output in the fields of science, technology, medicine, social sciences, and arts and humanities (<http://www.elsevier.com/online-tools/scopus>).

### **Inclusion Criteria to Select the Publications.**

To be included in this review, all studies investigating effect of "laser acupuncture" in persons with "low back pain" needed to comply with the following criteria: to be a randomized controlled trial (RCT); in the absence of RCT's, single group experimental studies were also considered (cross-over designs); published in English language. Studies were included if they included participants with "low back pain" who were submitted to "laser acupuncture". As the searches for publications were carried out independently by the three reviewers, they then decided which publications would be excluded from the search results. Papers were included for this narrative review if they met the search criteria and described a study using "laser acupuncture" used to manage people with "low back pain". Data were independently selected by three of the authors and disagreements were resolved by consensus.

### **Exclusion Criteria to Select the Publications.**

Papers were excluded if they were (i) published in a language different of the English; (ii) review articles; (iii) replies; (iv) editorials; (v) proposal of a protocol; (vi) books or chapter of books; (vii) performed with animals; (viii) with healthy people; (ix) guidelines; (x) lectures; (xi) abstracts and (xi) published with patients with other diseases.

### **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flowchart Involving the Steps in Selecting Full Papers**

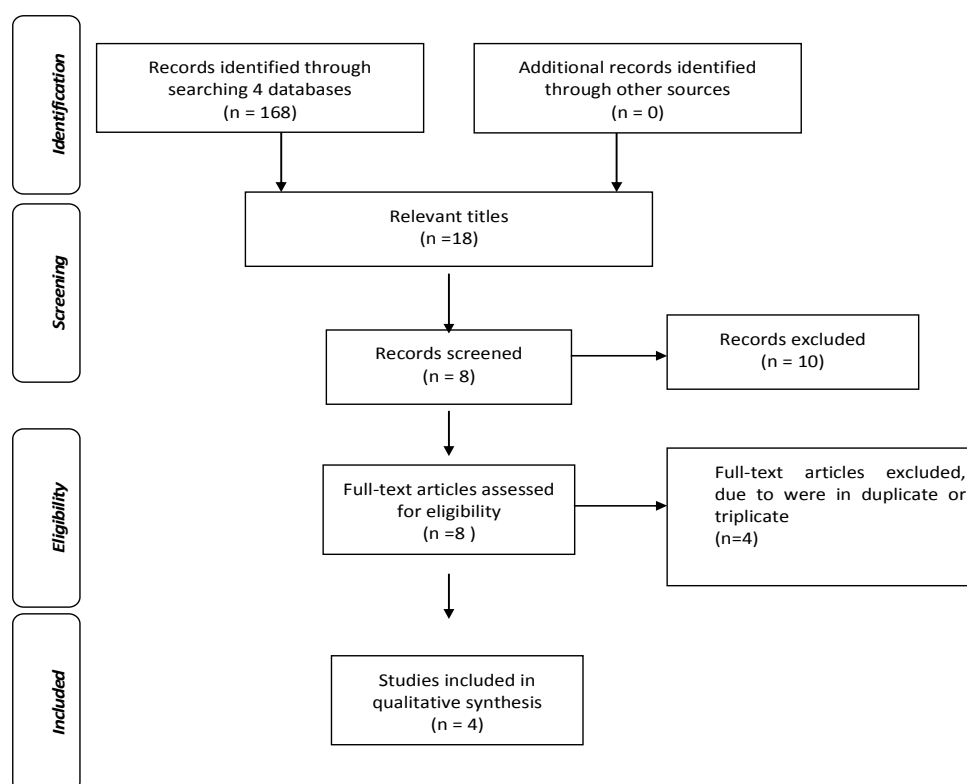
A flowchart, based in the PRISMA analysis (Liberati et al., 2009) was done to show the steps in the selection of the full papers analyzed in this review.

### **Level of Evidence of the Selected Papers**

The included studies were classified according to the National Health and Medical Research Council hierarchy of evidence (NHMRC, 2003-2007) (NHMRC, 2013). Each

**Table 1.** Number of publications in the PubMed, Scopus, Science Direct and PEDro databases

Keywords	PubMed	Scopus	Science Direct	PEDro
Laser	239,909	1,001,270	843,537	485
Acupuncture	22,450	35,280	28,895	2,915
"low back pain"	23,933	44,437	41,563	1,635
"laser acupuncture"	197	409	634	122
"low back pain" and acupuncture	529	1,383	464	177
"low back pain" and laser	136	314	2,650	43
"low back pain" and "laser acupuncture"	5	15	139	10

**Figure 1.** Flowchart indicating the steps to selected the papers analyzed in this revision.

article was assigned to a one reviewer, checked by a second reviewer and where there was disagreement a third reviewer was consulted to discuss up to consensus was reached.

### Data analysis

Data was not comparable and therefore statistical pooling not appropriate with the result that the findings of this review were summarized in a narrative form.

## RESULTS

In Table 1, the interests in investigations involving "low back pain" are demonstrated. In the database PEDro, the

NP with the selected keywords is smaller than in the other databases. Among the databases, the number of publications in the Science Direct database is the highest, exception to the keyword laser. The interest in laser is elevated considering the number of publications with this subject. However, the NP with laser acupuncture is very small. The number of studies with acupuncture is also important. Considering the three searched modalities of treatment of low back pain, acupuncture has the biggest and laser acupuncture has the smallest number of publications.

Figure 1 above shows the flowchart with the result of the search strategy using the PRISMA (54) to indicate how the papers were selected in the databases to be analyzed in this narrative review. One hundred sixty eight articles were found with the key words "low back pain"

**Table 2.** Data about the level of evidence of the studies, the aim, some antropometric findings and type of the treatment

Reference	Level of Evidence	Aim	Number of subjects/sex/age	Type of treatment
Glazov et al., 2014	II	To determine if infrared LA have a specific effect in reducing pain and disability in treatment of chronic LBP.	144 adults/72 male and 73 female/aging 18-75 years	Only LA
Glazov et al., 2009	II	The primary aim was to determine if LA is more effective than sham laser in reducing pain and disability in adults with chronic nonspecific LBP.	100 participants/ 56 females and 44 males/ age 51±12.6 years	Only LA
Lin et al., 2012	III-1	To evaluate the effect of LA and soft cupping on LBP.	60 participants/either sex)/age 63.35±11.23 years (treated group) and 64.65±13.57 years (control group)	Combined LA and soft cupping
Glazov, 2010	II	To identify predictors that, in clinical practice can influence the response to laser acupuncture.	90 participants/52 females and 38 males/ age 53.0±12.2 years (treated group) and 51.6±11.67 years (control group)	Only LA

LA - laser acupuncture, LBP- low back pain

**Table 3.** Data about the type of the laser, the power output and the additional technical information

Reference	Type of laser	Power output	Additional technical information
Glazov et al., 2014	Ga-Al-As infrared laser diode (830 nm)	20 mW	Power density at probe skin interface of 0.1 W/cm <sup>2</sup>
Glazov et al., 2009	Ga-Al-As infrared laser diode (830 nm)	10 mW	Power density at probe skin interface of 0.05 W/cm <sup>2</sup>
Lin et al., 2012	Laser therapy LA-400 that operated with a pulsed laser beam (808 nm)	40 mW	Spot size 0.8 cm <sup>2</sup> , pulse rate 20 Hz, 50% duty cycle of the pulse, 10 minutes treatment
Glazov, 2010	No informed	10 mW	No informed

LA - laser acupuncture, LBP- low back pain

and "laser acupuncture". One hundred fifty articles were excluded due to they were (a) not published in the English language, (b) replies, (c) commentaries, (d) editorials, guidelines, lectures or letters, (e) review articles, (f) abstracts, (g) proposal of a protocol, (h) books or chapter of books, (i) performed with animals, (j) performed with healthy people, or (k) published with patients with other diseases. Four were excluded due to they were in duplicate or in triplicate in the databases.

Table 2 shows the descriptions of the level of evidence of the publication, the aim of the study, some anthropometric characteristics of the participants (number, sex, and age) and type of the treatment (LA alone or LA combined with other procedure). Of the four included studies, three (Glazarov et al., 2009, 2010, 2014) were in a Level II (RCT) and one (Lin et al., 2012) conformed to Level III-1 according to the NHMRC. Three hundred ninety four subjects have participated in these investigations.

The ages of the participants varied from 18 up to 78 years old. In almost all the investigation (Glazarov et al., 2009, 2010, 2014), LA was the only method used. However in one publication (Lin et al., 2012), the LA was used with cupping. In all these studies, men and women were involved in the studies (Glazarov et al., 2009, 2010, 2014; Lin et al., 2012).

Table 3 shows information about the type of the laser, the power output and the additional technical data. Laser with wavelength of 830 nm (Glazarov et al., 2009, 2014) was used in two papers, and the 808 nm was used by a study (Lin et al, 2012). In one paper neither the type of laser and additional technical information were added (Glazov, 2010). The power output of the source of laser varied from 10 up to 40 mW.

Table 4 shows the aim of the investigation, the protocol that was used, the findings and the conclusion of each analyzed full paper. The investigations have aims with different approaches. However, all these papers present

**Table 4.** Protocol, results and conclusion of the selected papers involving laser acupuncture and low back pain

Reference	Protocol	Dose	Results	Conclusion
Glazov et al., 2014	Participants were randomised to receive eight once-weekly treatments. Laser machines stimulated points in three treatment groups: sham, low dose (J/point) and high dose. Participants were followed-up at 1 and 6 weeks, and 6 and 12 months post treatment. Primary outcomes were pain (NPRS) and disability (ODI) at 6 weeks post treatment. Secondary outcomes included numerical rating scale for limitation of activity, global assessment of improvement, analgesic usage and adverse effects after treatment.	Low dose 0.2 J/point and high dose 0.8 J/point	No difference between sham and the laser groups at 6 weeks for pain or disability were found. There was a significant reduction in mean pain and disability in all groups at 6 weeks. All secondary outcomes also showed clinical improvement over time but with no differences between groups.	LA using energy density range (0–4 J/cm <sup>2</sup> ) for the treatment of chronic nonspecific LBP resulted in clinical improvement unrelated to laser stimulation.
Glazov et al., 2009	A randomised controlled trial with the active intervention with laser for acupuncture and a sham control. The primary outcome measures were changes in pain (visual analogue scale) and disability (ODI) at the end of 5–10 treatment sessions. Secondary outcomes were patient global assessment, psychological distress (DASS) and subjective wellbeing (PWI). Follow up was performed at 6 weeks and 6 months after completion of treatment.	0.2 J/point	Although there was a significant overall improvement in pain and disability after the course of treatments, there was no significant difference between the intervention and control group in both the primary and most secondary outcome measures.	This study did not show a specific effect of LA using infrared laser at 0.2 J per point for chronic LBP. The overall intervention appeared effective because of placebo and other factors. As there was some concern about baseline inequality between the groups further research using tighter inclusion criteria should attempt to replicate the result and examine if a dose response may exist.
Lin et al., 2012	Subjects were randomly assigned to two groups: active group (real LA and soft cupping) and placebo group (sham laser and soft cupping). VAS and Ryodoraku were used to evaluate the effect of treatment on LBP in this trial. Laser was used to irradiate Weizhong (BL40) and Ashi acupoints for 10 minutes. And the Ryodoraku values were measured 2 times, that is, before and 15 minutes after treatment.	Dose was approximately 15 J/cm <sup>2</sup> .	The results show that there were significant difference between the first day baseline and the fifth day treatment in VAS in the two groups.	LA combined with soft cupping or only soft cupping was effective on low back pain. However, the Ryodoraku values of Bladder Meridian of the placebo group have been decreased apparently, and didn't come back to their original values. It means that "cupping" plays the role of "leak or purge" in TCM. Ryodoraku values of Bladder Meridian of the active group have been turned back to almost their original values; "mend or reinforcing" effect is attributed to the laser radiation.

Table 4 continue

Glazov, 2010	A secondary analysis was performed on data from participants in a trial of laser and sham laser acupuncture for chronic non-specific LBP. Multiple regression analysis was used to identify which baseline characteristics predicted pain change in the immediate, short and intermediate term. An analysis of covariance was performed based on these results to re-examine the primary result of the trial.	No informed	Strong predictors of poor response were receipt of disability support pension, headache, the regular use of analgesics or previous failed back surgery. Higher pain scores or exacerbation of pain at baseline predicted a greater proportionate pain relief after the intervention. Adjusted analysis suggested a clinically important effect of laser compared to sham ( $p < 0.05$ ), at short term follow-up only.	The findings of this study suggest which characteristics of patients with chronic LBP are more likely to respond to LA treatment, but require replication in other studies. The findings may not apply in other acupuncture interventions and treatment of different conditions. They may also be used to set selection criteria for future studies, and to aid interpreting the effect of baseline imbalances on trial results.
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DASS- Depression Anxiety Stress Scale, PWI -Personal Wellbeing Index, LA - laser acupuncture, LBP- low back pain, TCM- traditional Chinese medicine, NPRS- Numerical Pain Rating Scale, ODI- Oswestry Disability Inventory, VAS - visual analog scale

conclusions indicating the importance (no statistical significance) of the laser acupuncture to improve clinical conditions in patient with low back pain. Nevertheless, the findings presented are not conclusive.

Different tools were used to evaluate the effect of laser acupuncture in patient with low back pain (i) Depression Anxiety Stress Scale (DASS), (ii) Personal Wellbeing Index (PWI), (iii) Numerical Pain Rating Scale (NPRS), (iv) Oswestry Disability Inventory (ODI), (v) visual analog scale (VAS) and (vi) Ryodoraku values. The quantification of the various tools had shown an improvement in the patients treated with LA, however, the same findings were found in the control.

## DISCUSSION

There are several conditions that stimulate the use of the LA. LA is not invasive and is important to the patients with fear of needles. Moreover, children of all ages can be treated with this technique. In addition, there are no risks of local bleeding and infections (Baxter et al., 2008) and, in general, LA is performed in less time than needle-based acupuncture (Hu et al., 2010, 2014). Naturally, the risk of the laser to damage eyes can be minimized or avoided with the wearing, both professional and patient, of safety glasses during the treatment (Hashmi et al., 2010; Kurath-Koller et al., 2015).

As to LBP, Hoy et al. (2010) have pointed out that this clinical disorder is an extremely common problem that most people experience at some point in their lives. This clinical disorder related disability and work absence account for high economical costs in western society. The importance of studies about LBP is observed by the number of publication (about 44,000 articles in two searched database) in Table 1.

The acceptance of the laser as a physical agent in health science is demonstrated by the elevated number of publications in several databases. The use of acupuncture to manage several clinical disorders is also demonstrated due to the NP (Table 1). A variety of clinical procedures, such as medications, physical agents, surgery, alternative techniques (Grabois, 2005; Chou et al., 2007; Chang et al., 2015; Liu et al., 2015) for back pain indicates the necessity to verify the relevance of alternative procedures. Although a relevant NP is found involving acupuncture or laser in the treatment of LBP, only a very small NP is with LA (Table 1) and only four papers were selected to be discussed in this investigation (Figure 1).

The prevalence of the LBP is independent on the age and sex (Deyo and Weinstein, 2001; Rapoport et al., 2004; Dionne et al., 2006; Hoy et al., 2010; Bener et al., 2014). This fact could justify the presence of participants of women and men in the studies that were selected to be discussed. In addition, the range of the age from 18 up to 78 years old also indicates that this clinical disorder is present in the different stages of the life of a human being (Table 2).

Glazov et al. (2009, 2010, 2014) have used only LA, while Lin et al. (2012) have used also cupping. In all these LA, in general, authors have described that the wavelengths of the used laser are between 405 and 904nm (Litscher and Opitz, 2012; Round et al., 2013). Whittaker (2004) discussed about the skin barrier to laser transmission and present various considerations about the wavelengths of the laser used in LA. In our investigation (Table 2), it was found that in a paper the authors have used 808 nm (Lin et al., 2012) and in two other papers was used 830 nm (Glazov et al., 2009, 2014).

About the dose associated with the utilization of a source of laser, the World Association for Laser Therapy (WALT) (WALTZ, 2010) recommends dosage of 4 up to 16 J per 1 or 12 point or  $\text{cm}^2$  for laser treatment of different diseases obtained from 780 - 860nm GaAlAs Lasers. In Table 3, it is observed that in the publications selected dosage since 0.2 J per point up to 16  $\text{J}/\text{cm}^2$  were used. Independently of the protocols used in these investigations, the effect of the LA was not superior to the placebo, including the study with  $16\text{J}/\text{cm}^2$ . Baxter et al. (2008) (62) consider that the low dose of laser would be responsible by the response of the patients with LBP in the investigations published by Glazov et al. (2009, 2014).

Although the WALT, 2010 recommends 780 - 860nm GaAlAs lasers, continuous or pulsed laser, mean output ranging 5 - 500mW and irradiation times should range between 20 and 300 seconds, Lin et al. (2012) have not found a success using source of laser with 40 mW output power, wavelength 808 nm, spot size  $0.8\text{ cm}^2$ , pulse rate 20 Hz, 50% duty cycle of the pulse, 10 minutes treatment and dosage of approximately  $15\text{ J}/\text{cm}^2$ .

In Table 3, the clinical conclusions of the investigations indicate the importance (no statistical significance) of the laser acupuncture to improve clinical conditions in patient with low back pain. Nevertheless, the findings presented are not conclusive.

Different tools were used to evaluate the effect of LA in patient with LBP, DASS, PWI, NPRS, ODI, VAS and Ryodoraku values. The quantification of the various tools had shown an improvement in the patients treated with LA, however, the same findings were found in the control.

Putting together the findings reported in this investigation, although the importance of the LA is clear and the necessity of a viable treatment to the LBP due to this clinical disorder represents a modern epidemic. As reported by Baxter et al. (2008), LBP requires a complex, multifaceted approach to successful management. In addition, characteristics of the laser acupuncture may represent a component of this approach, at least when employed at appropriate protocols.

In conclusion, considering the number of publications, there is a scientific interest in studies involving the applications of the laser. Moreover, due to the LA is not invasive and is important to the patients with fear of needles, as well as to the children, it is relevant to develop studies so as to have suitable and useful protocols. In these protocols, the control of the wavelength of the laser, the dose and other conditions would be desirable to increase the applications of the LA in patients with LBP. It is also fitting and proper to study in the future that if LA combined with vibration of the body will be able to improve its efficacy on LBP or manual acupuncture is more economical.

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