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Physiotherapy

Physiotherapy xxx (2014) xxx–xxx

Efficacy of low-level laser therapy applied at acupuncture points in knee osteoarthritis: a randomised double-blind comparative trial☆

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Abstract

Objective To evaluate the efficacy of low-level laser therapy (LLLT) applied to acupuncture points on the knee joint in combination with exercise and advice in patients with knee osteoarthritis.

Design Randomised, double-blind, comparative clinical trial.

Participants Forty-nine patients with knee osteoarthritis were assigned at random into two groups: active laser group ($n = 26$) and placebo laser group ($n = 23$).

Intervention Using a gallium aluminium arsenide laser device, patients received either active or placebo LLLT at five acupuncture points on the affected knee during nine sessions.

Outcome measures Patients were assessed using a visual analogue scale (VAS) and the Saudi Knee Function Scale (SKFS) at baseline, the fifth treatment session, the last treatment session, 6 weeks post intervention and 6 months post intervention.

Results VAS scores showed a significant improvement in the active laser group compared with the placebo laser group at 6 weeks post intervention [mean difference −1.3, 95% confidence interval (CI) of the difference −2.4 to −0.3; $P = 0.014$] and 6 months post intervention (mean difference −1.8, 95% CI of the difference −3.0 to −0.7; $P = 0.003$) using the independent samples test. SKFS scores also showed a significant improvement in the active laser group compared with the placebo laser group at the last treatment session (median difference −15, 95% CI of the difference −27 to −2; $P = 0.035$) and 6 months post intervention (median difference −21, 95% CI of the difference −34 to −7; $P = 0.006$) using the Mann–Whitney U test.

Conclusions The results demonstrate that short-term application of LLLT to specific acupuncture points in association with exercise and advice is effective in reducing pain and improving quality of life in patients with knee osteoarthritis.

Keywords: Low-level laser therapy (LLLT); Laser therapy; Phototherapy; Acupuncture for knee joint; Laser acupuncture; Osteoarthritis of knee

Introduction

The prevalence of osteoarthritis is increasing rapidly, affecting approximately 14% of US adults [1,2]. In the UK and Australia, 40% of the population aged >65 years have symptoms associated with knee or hip osteoarthritis [3,4]. However, in Saudi Arabia, the incidence of knee osteoarthritis approaches 61% in individuals aged 66 to 75 years [5].

There are no disease-modifying treatments for osteoarthritis [6,7]. Non-steroidal anti-inflammatory drugs, the most commonly prescribed medications for knee osteoarthritis, are associated with serious side effects [6,8]. Elderly patients with osteoarthritis typically suffer comorbidities that increase the risk of drug-to-drug interactions [2,6].

As a result, both patients and health professionals are seeking alternative therapies with good effects, less toxicity and lower cost. Several modalities, such as acupuncture, transcutaneous electrical nerve stimulation and low-level laser therapy (LLLT), are non-pharmacological interventions that have been classified as non-invasive, safe treatments for osteoarthritis [9]. However, LLLT has advantages because it can be used where other modalities are contraindicated. LLLT can be applied to patients with pacemakers, metal implants,

☆ Clinical Trial Registration Number: ISRCTN24010862.

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0031-9406/$ – see front matter.
http://dx.doi.org/10.1016/j.physio.2013.09.007

Please cite this article in press as: Al Rashoud AS, et al. Efficacy of low-level laser therapy applied at acupuncture points in knee osteoarthritis: a randomised double-blind comparative trial. Physiotherapy (2014), http://dx.doi.org/10.1016/j.physio.2013.09.007

burns and wounds, and to anatomically dangerous areas. It is a low-cost, short-application, non-infectious treatment (e.g. in cases of human immunodeficiency virus infection and hepatitis). Furthermore, LLLT has no heat or vibration, and is invisible above 770 nm, making it ideal to blind in randomised controlled trials [10–12].

Acupuncture has been shown to be effective in pain relief and dysfunction associated with musculoskeletal conditions, including knee osteoarthritis [13]. Recent studies have clearly shown that laser light can be used successfully as an alternative to metal needles (laser acupuncture) for effective acupuncture treatment. Furthermore, LLLT is safer and requires less time than needle acupuncture, and can avoid the pain and psychological fear of traditional acupuncture [10,11,14]. Tascioglu *et al.* [15] reported that several studies have shown that LLLT has anti-inflammatory, anti-oedema effects, and plays a role in pain reduction without side effects. Nonetheless, the results using LLLT on patients with knee osteoarthritis are conflicting. Although many studies showed significant improvement [16–19], others did not [20,21].

To the authors' knowledge, only two published studies have tested the efficacy of LLLT when applied to acupuncture points in patients with knee osteoarthritis, and only one acupuncture point was stimulated in each of these studies [19,21]. Results from both studies were conflicting; furthermore, one of them was a pilot study [19]. It has been recommended that randomised controlled trials are needed to investigate how the effectiveness of LLLT is affected by four important factors: wavelength, treatment duration, dosage and site of application (e.g. nerves instead of joints) [17]. The efficacy of LLLT for osteoarthritis, as well as its association with exercise, has been questioned previously [16].

The aim of this study was to evaluate the efficacy of LLLT when applied to five acupuncture points in combination with exercise and advice for patients with knee osteoarthritis. A randomised, double-blind, comparative trial was undertaken, where both groups received conventional treatment for osteoathritis in the form of exercise and advice. The trial compared a placebo laser group with an active laser group, which received active LLLT on specific acupuncture points in addition to exercise and advice.

Methods

Research design

Randomised, double-blind, comparative trial.

Patient recruitment

This study was conducted by a trained physiotherapist at the Physiotherapy Department of the Security Forces Hospital, Riyadh, Saudi Arabia from August 2010 to February 2011. In total, 49 patients completed the study. Inclusion criteria included female or male patients with knee osteoarthritis according to the American College of Rheumatology criteria [22], an average pain intensity of ≥ 3 on a 10-cm visual analogue scale (VAS), ability to perform all movements included in the evaluation forms, ability to read or understand the patient information sheets, and ability to sign a consent form. For those patients with bilateral knee osteoarthritis, the most painful knee was assessed.

Exclusion criteria included previous knee surgery, serious valgus or varus deformity, disease where laser treatment is contraindicated (cancer, uncontrolled diabetes mellitus, hypertension, etc.), and current use of medications that might interfere with LLLT treatment (e.g. corticosteroid injections) [17,21]. Patients were allowed to take analgesics as required for severe pain, and to discontinue any other medication related to their knee pain; their physicians were consulted about this point. Ethical approval was granted by the Research Committee of the Security Forces Hospital. Each participant signed an informed consent form before the study.

Randomisation

Before starting the study, a randomisation list was produced using software-generated randomised numbers; the randomisation depended on random blocks of 10 [23]. Patients were assigned at random to the active laser group ($n = 26$) or the placebo laser group ($n = 23$). Participants were enrolled by the research assistant.

Laser device and its parameters

This study used a gallium aluminium arsenide laser device (Endolaser 476, Enraf Nonius, Rotterdam, The Netherlands) with a single 30-mW diode probe, producing infra-red laser with a wavelength of 830 nm and an irradiation area of 0.28 cm^2. The probe and laser device were checked regularly to ensure proper function.

Treatment procedure

Patients received treatment in a supine position, with the affected knee slightly flexed and supported by a rolled towel. The investigator, research assistant and patients wore protective goggles to shield their eyes from active laser radiation. On the affected knee, the laser probe was placed sequentially and perpendicularly in full contact with the skin at five acupuncture points, commonly used for treating knee osteoarthritis [24–26] (Fig. A, see online supplementary material). In the active laser group, an active continuous laser beam irradiated each point for 40 seconds with a dose of 1.2 J/point, 6 J per session for each patient; this dose is somewhat lower than that recommended by the World Association for Laser Therapy for a 830-nm laser [27]. The energy density was 4 J/cm^2. The same procedures were applied to patients in the placebo laser group, but the device was inactive and only produced visible red light.

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