

Meta-Analysis of Pain Relief Effects by Laser Irradiation on Joint Areas

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ABSTRACT

Background: Laser therapy has been proposed as a physical therapy for musculoskeletal disorders and has attained popularity because no side effects have been reported after treatment. However, its true effectiveness is still controversial because several clinical trials have reported the ineffectiveness of lasers in treating pain. **Methods:** In this systematic review, we investigate the clinical effectiveness of low-level laser therapy (LLLT) on joint pain. Clinical trials on joint pain satisfying the following conditions are included: the laser is irradiated on the joint area, the PEDro scale score is at least 5, and the effectiveness of the trial is measured using a visual analogue scale (VAS). To estimate the overall effectiveness of all included clinical trials, a mean weighted difference in change of pain on VAS was used. **Results:** MEDLINE is the main source of the literature search. After the literature search, 22 trials related to joint pain were selected. The average methodological quality score of the 22 trials consisting of 1014 patients was 7.96 on the PEDro scale; 11 trials reported positive effects and 11 trials reported negative effects. The mean weighted difference in change of pain on VAS was 13.96 mm (95% CI, 7.24–20.69) in favor of the active LLLT groups. When we only considered the clinical trials in which the energy dose was within the dose range suggested in the review by Bjordal et al. in 2003 and in World Association for Laser Therapy (WALT) dose recommendation, the mean effect sizes were 19.88 and 21.05 mm in favor of the true LLLT groups, respectively. **Conclusions:** The review shows that laser therapy on the joint reduces pain in patients. Moreover, when we restrict the energy doses of the laser therapy into the dose window suggested in the previous study, we can expect more reliable pain relief treatments.

Introduction

Low-level laser therapy (LLLT) has been used for >30 years for pain relief, and has become increasingly popular because it is a noninvasive and nonthermal treatment.¹ And although many studies using laser therapy have been conducted pertaining to the improvement of pain relief for various musculoskeletal conditions, the true effectiveness of this therapy is still controversial,² as the number of clinical trials reporting ineffectiveness is also significant; there is also a possibility that several ineffective trials might not have been reported. Hence, laser therapies have yet to receive United States Food and Drug Administration (FDA) approval, except for the treatment of carpal tunnel syndrome.³ One reason for the different outcomes in effectiveness might be the result of factors affecting the effectiveness of laser therapy. These factors can include patient diagnoses, symptoms, pain duration, laser irradiation location, distance from laser probe to skin, laser type (HeNe, GaAs, GaAsAl, Nd:YAG), wavelength, laser mode (continuous, pulsed), average power (mW), power density (mW/cm²), energy (J), energy dose (J/cm²), number of sessions, laser irradiation point size (cm²), and co-interventions (exercises, analgesics, nonsteroidal anti-inflammatory drugs [NSAIDs], and conventional physical therapies).

Studies attempting to explain mechanisms for pain relief from laser therapies have typically been based on anti-inflammatory effects⁴ or the laser's activity on the immune system.⁵ In a systematic review of LLLT for use in joint diseases by Bjordal et al.,⁶ it was reported that one of the main causes of joint disease is inflammation, and that LLLT is effective for anti-inflammation. They then hypothesized that an important factor for the treatment of joint disease is the LLLT energy dose. The study reported the use of LLLT location-specific energy doses on chronic joint disorders based on both previous laboratory trials and anatomical factors. This systematic review showed that LLLT can be effective for joint disease if the energy dose is properly selected such that it inhibits inflammatory activity in the joint capsule.

Although joint pain can be controlled by medications such as acetaminophen,⁸ NSAIDs,⁹ and corticosteroid injections,¹⁰ some patients are reluctant to use them because of the potential side effects.¹¹ In some cases, surgery is also conducted to repair damaged joints, although surgery does not always bring satisfying results.¹² For treatment of these types of joint problems, alternative treatments or physical therapies including exercise,¹³ electrical stimulation,¹⁴ acupuncture,¹⁵ laser acupuncture, and LLLT¹⁶ can be used.

Therefore, the primary objective of this study is to investigate the effectiveness of laser therapy by analyzing previous clinical trials for common patient conditions; that is, patients suffer pain in joint regions and laser irradiation is used as the treatment on joint areas. As the basis of this study, we conducted a literature search for randomized controlled clinical trials on joint areas, and selected 22 articles. Among the various joint areas investigated, our study includes finger joints, temporomandibular joints (TMJ), glenohumeral joints, knee joints, and cervical and lumbar spinal regions. Joint pain in these areas can be caused by osteoarthritis, rheumatoid arthritis, or other conditions. Note that osteoarthritis is associated with the degeneration of cartilage in the joint and is the most common cause of joint pain in people older than 60 years.¹⁷ Rheumatoid arthritis is an autoimmune and systemic inflammatory disorder;⁷ it affects synovial joints such as those in fingers, wrists, and knees.

The second objective of our study is to investigate whether we can obtain improved pain relief when certain energy doses are applied. Our study contains 15 studies not included in Bjordal et al.⁶; using these data, we subsequently validate their proposed energy doses.

Conclusions

Obtaining pain relief from LLLT might be a good alternative to the use of NSAIDs, particularly for elderly people, because laser therapy has no reported side effects.⁴⁷ In addition, clinical studies have reported that applying laser therapy in addition to exercise might show greater pain reduction effects than using laser therapy alone.^{2,22} In conclusion, investigations pertaining to laser therapies have indicated that laser irradiation on joint areas can be an effective pain relief treatment when appropriate energy doses are selected.

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Author Disclosure Statement

No competing financial interests exist.