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Effectiveness of low-level laser therapy for pain and disability in knee osteoarthritis: systematic review and meta-analysis of randomized placebo-controlled studies

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Associated data

Complementary materials

Declaration on data availability

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Objectives

Low-level laser therapy (LLLT) is not recommended in the treatment guidelines for the treatment of severe knee osteoarthritis (KOA). We investigated whether there is a dose-response relationship between LLLT and KOA in KOA.

draft

Systematic review and meta-analysis.

Data sources

Eligible articles were made available through PubMed, Embase, the Cumulative Index to the Literature on Nursing and Related Health Issues, the Physiotherapy Evidence Database and the Cochrane Central Register of Controlled Studies February 18, 2019, reference lists, a book, citations and experts in the field identified.

Selection criteria for the selection of studies

We only included randomized, placebo-controlled studies of participants with KOA, based on the American College of Rheumatology and / or Kellgren / Lawrence criteria, in which the LLLT was applied to the participants' knees. There were no language restrictions.

Data extraction and synthesis

The included studies were synthesized using meta-analyzes of random effects and divided into subgroups by dose, using the treatment recommendations of the World Association for Laser Therapy. The Cochrane tool was used to determine the risk of preload.

Results

22 studies (n = 1063) were meta-analyzed. The risk of distortion was negligible. Overall, the pain from LLLT compared to placebo at the end of therapy (14.23 mm visual analog scale (VAS; 95% CI 7.31 to 21.14)) and at follow-up examinations 1-12 weeks later (15 , 92 mm VAS (95% CI 6.47 to 25.37)) significantly reduced. The subgroup analysis showed that the pain caused by the recommended LLLT doses compared to placebo at the end of therapy (18.71 mm (95% CI 9.42 to 27.99)) and during the follow-up examinations 2-12 weeks after the end of therapy (23.23 mm VAS (95% CI 10.60 to 35.86)) were significantly reduced. The pain reduction compared to the recommended LLLT doses reached its peak during the follow-up examinations 2-4 weeks after the end of therapy (31.87 mm VAS significantly above placebo (95% CI 18.18 to 45.56)). The LLLT also significantly reduced disability. No adverse events were reported.

conclusion

LLLT reduces pain and disability in KOA at 4-8 J with a wavelength of 785-860 nm and at 1-3 J with a wavelength of 904 nm per treatment site.

PROSPERO registration number

CRD42016035587.

Key words: phototherapy, laser therapy, knee osteoarthritis, systematic review, meta-analysis

Strengths and Limitations of this Study

The review was carried out in accordance with a detailed a-priori published protocol which contained, for example, criteria for laser dose subgroups.
There were no language restrictions; four (18%) of the included studies were reported in non-English.
A number of meta-analyzes were performed to assess the effect of low-level laser therapy on pain over time.
In each case three people independently extracted the result data from the included study articles in order to ensure high reproducibility of the meta-analyzes.
The overview lacks quality of life analyzes, a detailed analysis of the time-effect analysis of the disability and direct comparisons between low-level laser therapy and other interventions.

The influence of radiation with a low-level diode laser on the proteoglycan content in arthritic cartilage in rabbits

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Abstract: The course of osteoarthritis was investigated using an animal experimental osteoarthritis model, taking into account macroscopic aspects and the proteoglycan and glycosaminoglycan levels. Based on these parameters, the influence of a diode laser with low power and a wavelength of 692.6 nm on the course of osteoarthritis was investigated. Thirty days after the joint instability operation, another operation was performed in which the femoral condyles were irradiated with different energy densities. Seven days after the second operation, macroscopic findings were made and the proteoglycan content was determined on the basis of the quantitative determination according to Taylor and Jeffre.

Macroscopically, a progressively increasing severity of the cartilage changes in the course of the osteoarthritis and a decrease in the proteoglycan content was found. The changes in the irradiated joints were found to be less severe, with the higher energy density having a greater positive impact of statistical significance.

 Keywords:
cartilage; Laser; Proteoglycans; Spectrophotometry

Low-Level Laser Therapy for Zymosan-Induced Arthritis in Rats: Importance of Illumination

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Biostimulation;
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Zymosan-induced arthritis;
Photobiomodulation;
Cold laser;
Prostaglandin E2
short version

background

For many years it has been suggested that low-level laser (or light) therapy (LLLT) can reduce the pain, swelling, and inflammation associated with various forms of arthritis. It is believed that light is

absorbed by the mitochondrial chromophores, leading to an increase in adenosine triphosphate (ATP), reactive oxygen species and / or cyclic AMP production and the resulting gene transcription through activation of transcription factors. However, despite many reports of the beneficial effects of LLLT in arthritis and in medicine in general, its use remains controversial. For all indications (including arthritis) the optimal optical parameters have been difficult to determine and are previously unknown.

Methods

We tested the LLLT on rats that had been injected with zymosan in their knee joints to cause inflammatory arthritis. We compared lighting regimes consisting of a high and a low fluence (3 and 30 J / cm2) that were administered at high and low irradiance levels (5 and 50 mW / cm2) using 810 nm laser light daily for 5 days, with the positive control of conventional corticosteroid (dexamethasone) therapy.

Results

Illumination with an 810 nm laser was highly effective (almost as good as dexamethasone) at reducing swelling, and longer illumination time (10 or 100 minutes versus 1 minute) was more important than either that in determining effectiveness total fluence delivered or the irradiance. The LLLT-induced reduction in joint swelling correlated with the reduction in the inflammation marker serum prostaglandin E2 (PGE2).

conclusion

The 810 nm laser LLLT is very effective in treating inflammatory arthritis in this model. Longer times of illumination were more effective than short times, regardless of total fluence or irradiance. These data will be useful in planning clinical trials of LLLT for various types of arthritis. Laser surgery. Med. 39: 543-550, 2007.
