Arthritis - General

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Low-level laser therapy for zymosan-induced arthritis in rats: Importance of illumination time.

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BACKGROUND: It has been proposed for many years that low-level laser (or light) therapy (LLLT) can ameliorate the pain, swelling, and inflammation associated with various forms of arthritis. Light is thought to be absorbed by mitochondrial chromophores leading to an increase in adenosine triphosphate (ATP), reactive oxygen species and/or cyclic AMP production and consequent gene transcription via activation of transcription factors. However, despite many reports about the positive effects of LLLT in arthritis and in medicine in general, its use remains controversial. For all indications (including arthritis) the optimum optical parameters have been difficult to establish and so far are unknown. METHODS: We tested LLLT on rats that had zymosan injected into their knee joints to induce inflammatory arthritis. We compared illumination regimens consisting of a high and low fluence (3 and 30 J/cm(2)), delivered at high and low irradiance (5 and 50 mW/cm(2)) using 810-nm laser light daily for 5 days, with the positive control of conventional corticosteroid (dexamethasone) therapy. RESULTS: Illumination with 810-nm laser was highly effective (almost as good as dexamethasone) at reducing swelling and a longer illumination time (10 or 100 minutes compared to 1 minute) was more important in determining effectiveness than either the total fluence delivered or the irradiance. LLLT induced reduction of joint swelling correlated with reduction in the inflammatory marker serum prostaglandin E2 (PGE2). CONCLUSION: LLLT with 810-nm laser is highly effective in treating inflammatory arthritis in this model. Longer illumination times were more effective than short times regardless of total fluence or irradiance. These data will be of value in designing clinical trials of LLLT for various arthritides.

LASER THERAPY IN RHEUMATOLOGY

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Barabas irradiated first the joints of rheumatoid arthritis (RA) patients without skin ulcer. In the first open study objectively the range of motion and circumference of the treated joints were measured, Ritchie index as semiobjective parameter, subjective parameters as joint tenderness and pain on a visual analogous scale (VAS) were registered. The walking time was registered as a functional disability parameter. Laboratory activity parameters and the 99mTechnetium index was measured. The second part of the clinical study was double blinded, Infra Red (10mW and 100 mW) lasers were used versus dummy devices with the same outlook. The third part of the study were in vitro experiments. Synovial membranes of rheumatoid arthritis patients The DNA/RNA ratio of the RA group was compared to the control group. Significant difference was detected between the two groups. The fourth phase of clinical studies was to detect the effects of laser irradiation in other rheumatic diseases: psoriatic arthritis, sacroileitis, osteoarthritis, entesopathy, tenosynovitis, bursitis calcarea, fibromyalgia, localised muscle spasm, periarthritis humeroscapularis etc. The different wavelengths (604, 630, 660, 670, 690, 750, 780, 790, 820, 830, 904, 1053, 1219 nm,) were compared (30 - 100 mW) with other physiotherapy modalities, like ultrasound. Acknowledgement: The Central Research Institute of the Hungarian Academy of Sciences and LASOTRONIC AG (Switzerland) was helping the research.

THE EFFICACY OF LASER THERAPY FOR MUSCULOSKELETAL AND SKIN DISORDERS: A CRITERIA-BASED META-ANALYSIS OF RANDOMIZED CLINICAL TRIALS

Beckerman H, de Bie RA, Bouter LM, et al.

The efficacy of laser therapy for musculoskeletal and skin disorders has been assessed on the basis of the results of 36 randomized clinical trials (RCTs) involving 1,704 patients. For this purpose, a criteria-based meta-analysis that took into account the methodological quality of the individual trials was used. The studies with a positive outcome were generally of a better quality than the studies with a negative outcome. No clear relationship could be demonstrated between the laser dosage applied and the efficacy of laser therapy, or between the dosage and the methodological score. In general, the methodological quality of these studies appeared to be rather low. Consequently, no definite conclusions can be drawn about the efficacy of laser therapy for skin disorders. The efficacy of laser therapy for musculoskeletal disorders seems, on average, to be larger than the efficacy of a placebo treatment. More specifically, for rheumatoid arthritis, post-traumatic joint disorders, and myofascial pain, laser therapy seems to have a substantial specific therapeutic effect. Further RCTs, avoiding the most prevalent methodological errors, are needed in order to enable the benefits of laser therapy to be more precisely and validly evaluated.

Physical Therapy. 72(7):483-91, 1992 Jul. (60 ref)

Laser therapy is effective for degenerative osteoarthritis

Stelian J, Gil I, Habot B et al. Improvement of pain and disability in elderly patients with degenerative osteoarthritis of the knee treated with narrow-band light therapy. J Am Geriatr Soc. 1992; 40: 23-26.

In an Israeli study the effect of laser therapy in degenerative osteoarthritis (DOA) of the knee was investigated in a double blind study among 50 patients. One group received infrared (GaAlAs) and one red (HeNe) laser. Only the first group could be blinded, while the latter was open. Patients were treated twice daily, 15 minutes each time, for 10 days. The patients treated themselves after instruction. Total dose for each session was 10.3 J for red and 11.1 for infrared. Continuous mode was used for 7.5 minutes, pulsed for 7.5 minutes, rationale not stated. There was a significant pain reduction in the laser groups as compared to the placebo groups. There was no significant difference between the red and the infrared group. The Disability Index Questionnaire also revealed an improvement in the laser groups. All patients in the placebo group required analgesics within two months after laser therapy while the patients in the laser group were pain free ranging from 2 months to 1 year.

Clinical efficacy of low power laser therapy in osteoarthritis

Marks R, de Palma F. Physiotherapy Research International. 1999; 4 (2): 141-57. Review article:

Of the various physical interventions used to relieve the symptoms of osteoarthritis, a common degenerative joint disease causing considerable pain and disability, low power laser therapy has been reported to be extremely successful in Russia and Eastern Europe. Although the overall number of studies was small, this literature review and analysis highlights the relevant controlled clinical trials and related basic research in English-language publications. This review indicates that, despite their shortcomings, the six studies analysed did report post-treatment improvements in a variety of osteoarthritic problems, including pain, mobility, tenderness and function, with few adverse effects. Possible mechanisms documented for the observed results included peripheral nerve stimulation, resolution of inflammation, enhanced chondrocyte proliferation and increased matrix synthesis. Not all studies were affirmative and few detailed how reliable their measurements were. Clearly, much more work is needed in this area.

THE EFFECT OF LOW POWER LASER THERAPY ON OSTEOARTHRITIS OF THE KNEE

Basirnia A., Sadeghipoor G., Esmaeeli Djavid G. et al.

Treatment was performed on 20 patients, aging from 42 to 60 years. All patients had received conservative treatment with poor results. Laser device used for this treatment was pulsed IR diode laser; 810 nm wavelength once per day for 5 consecutive days, followed by a 2-day interval .The total number of applications was 12 sessions. Irradiation was performed on 5 periarticular tender points, each for 2 min. The treatment outcome (pain relief and functional ability) was observed and measured according to the

following methods: 1) Numerical rating scales (NRS), 2) Self assessment by the patient, 3) Index of severity for osteoarthritis of the knee (ISK), 4) Analgesic requirements. We achieved significant improvement in pain relief and quality of life in 70% of patients, comparing to their previous status ($p<0.05$). There was no significant change in range of motion of the knee

A systematic review of low level laser therapy with location-specific doses for pain from chronic joint disorders.

Australian J Physiother. 2003; 49: 107-116. Bjordal J M, Couppè, C, Chow R, Tunér J, Ljunggren A E.

The authors investigated if low level laser therapy of the joint capsule can reduce pain in chronic joint disorders (CJD). A literature search identified 88 randomised-controlled trials, of which 20 trials included patients with CJD. Six trials had to be excluded for not irradiating the joint capsule. Three trials used doses lower than a denominated a priori dose range for reducing inflammation in the joint capsule. These trials found no significant difference between active and placebo treatments. The remaining 11 trials, including 565 patients, were of acceptable methodological quality with an average PEDro score of 6.9 (range 5-9). In these trials, LLLT within the suggested dose-range was administered to the knee, temporomandibular and zygapophyseal joints. The results showed a mean weighted difference in change of pain on VAS by 45.6 % (95 % CI 35.0 to 56.2) in favour of LLLT. Global status was improved for 33.4 % (95% CI 20.9 to 45.9) more patients in the LLLT group. LLLT with the suggested dose range significantly reduces pain in CJD, but the heterogeneity in patient samples, treatment procedures and trial design calls for cautious interpretation of the results.

The effect of laser therapy in complex treatment of patients with rheumatoid arthritis.

Korolkova O M et al.

115 patients with rheumatoid arthritis (RA) of II-III degrees were treated with basic RA medications and infrared laser. In a control group of 20 patients only basic medication was given. 10 areas of the body were irradiated daily, increasing the dose every day during a period of 8-10 days. The effectiveness of the therapy was controlled through laboratory tests on i.a. inflammatory agents and the activity of lipid peroxidation. The results were statistically significant. The best effect was found in patients with degree II RA. Steroid medication could be reduced 8-10 days earlier in this group of patients and in some cases the medication could even be excluded. Degree III patients had a more moderate benefit of the laser treatment.

Vopr-Kurortol-Fizioter-Lech-Fiz-Kult. 1999; (3): 35-43.

The interauricular laser therapy of rheumatoid arthritis). Interaurikuliarnaia lazernaia terapiia revmatoidnogo artrita.

Sidorov-V-D, Mamiliaeva-D-R, Gontar-E-V, Reformatskaia-SIu.

Investigations have proved the ability of interauricular low- intensity infrared laser therapy (0.89 nm, 7.6 J/cm) to produce anti- inflammatory, immunomodulating action in patients with rheumatoid arthritis. The method has selective, pathogenetically directed immunomodulating effect the mechanism of which is similar to that of basic antirheumatic drugs and of intravenous laser radiation of blood. This laser therapy can be used as an alternative to intravenous blood radiation being superior as a noninvasive method. Interauricular laser therapy can potentiate the effects of nonsteroid anti-inflammatory drugs, cytostatics and diminish their side effects.

CLINICAL APPLICATION OF GaAIAs 830 NM DIODE LASER IN TREATMENT OF RHEUMATOID ARTHRITIS

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The authors have been involved in the treatment of rheumatoid arthritis (RA), in particular chronic poly-arthritis and the associated pain complaints. The biggest problem facing such patients is joint contracture, leading to bony ankylosis. This in turn severely restricts the range of motion (ROM) of the RA-affected joints, thereby seriously restricting the patient's quality of life (QOL). The authors have determined that in these cases, daily rehabilitation practice is necessary to maintain the patient's QOL at a reasonable level. The greatest problem in the rehabilitation practice is the severe pain associated with RA-affected joints, which inhibits restoration of mobility and improved ROM. LLLT or low reactive level laser therapy has been recognized in the literature as having been effective in pain removal and attenuation. The authors accordingly designed a clinical trial to assess the effectiveness of LLLT in RA related pain (subjective self-assessment) and ROM improvement (objective documented data). From July 1988 to June 1990, 170 patients with a total of 411 affected joints were treated using a GaAlAs diode laser system (830 nm, 60 mW C/W). Patients mean age was 61 years, with a ratio of males: females of 1: 5.25 (16%: 84%). Effectiveness was graded under three categories: excellent (remarkable improvement), good (clearly apparent improvement), and unchanged (little or no improvement). For pain attenuation, scores were: excellent&emdash;59.6%; good&emdash;30.4%; unchanged&emdash;10%. For ROM improvement the scores were: excellent&emdash;12.6%; good&emdash;43.7%; unchanged&emdash;43.7%. This gave a total effective rating for pain attenuation of 90%, and for ROM improvement of 56.3%.

Lasers Surg Med 1980;1(1):93-101

LASER THERAPY OF RHEUMATOID ARTHRITIS.

Goldman JA, Chiapella J, Casey H, Bass N, Graham J, McClatchey W, Dronavalli RV, Brown R, Bennett WJ, Miller SB, Wilson CH, Pearson B, Haun C, Persinski L, Huey H, Muckerheide M

Thirty people with classical or definite rheumatoid arthritis received laser exposure to a Q-switch neodymium laser that operated at 1.06 micrometer with an output of 15 joules/cm2 for 30 nsec. One hand was lased at the proximalinterphalangeal (PIP) and metacarpal phalangeal (MCP) joints, whereas the
other hand was sham lased. The patient, physician, and occupational therapy evaluators did not know which hand was being lased. Twenty-one patientsnoted improvement of both their MCP and PIP joints of both hands during laser therapy. Twenty-seven noted improvement of their PIP joints and 26
noted improvement of the MCP joints during therapy. Heat, erythema, pain, swelling, and tenderness all improved with time in both hands, but the lased hand had more significant improvement in erythema and pain. There was also significant improvement in grasp and tip pressure on the lased side. The level of circulating immune complexes as measured by platelet aggregation decreased during lasing. The improvement may be related to laser exposure. The exact role that laser radiation has upon rheumatoid arthritis and its mechanism of action remain

ACTION OF 904 NM DIODE LASER IN ORTHOPAEDICS AND TRAUMATOLOGY

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Objective: The semiconductor or laser diode (GaAs, 904 nm) is the most appropriate choice in pain-reduction therapy.
Summary Background Data: Low power density laser acts on the Prostaglandins synthesis, increasing the change of PGG2 and PGH2 Periossidos into PGI2 (also called Prostaciclyn or Endoprostol). The last one is the main product of the Arachidonic acid into the endothelial cells and into the smooth muscular cells of the vessel walls having a vasodilating and anti-inflammatory action.
Methods: Treatment was carried out on 447 cases and 435 patients (250 women and 185 men) in the period between 20.05.1987 and 31.12.1999. The patients, whose age ranged from 25 to 70, with a mean age of 45 years, were suffering from rheumatic, degenerative and traumatic pathologies as well as cutaneous ulcers. The majority of the patients had been seen by orthopaedists and rheumatologists and had undergone x-ray examination. All patients had received drug-based treatment and/or physiotherapy, with poor results. Two thirds were experiencing acute symptomatic pain, while the others presented a chronic pathology with recurrent crises. We used a pulsed diode laser, GaAs 904 nm wavelength. Frequency of treatment: 1 application per day for 5 consecutive days, followed by a 2-day interval. In the evaluation of the results the following parameters have been considered: disappearance of spontaneous and induced pain, anatomic and functional evaluation of the joints, muscular growth, verbal rating scales, hand dinamometer, patient's pain diary.

Results: Very good results were achieved especially with cases of symptomatic osteoarthritis of the cervical vertebrae, with sport-related injuries, with epicondylitis, and with cutaneous ulcers; also, last but not of least importance, with cases of osteoarthritis of the coxa.
Conclusions: Treatment with 904 nm diode laser has substantially reduced the symptoms as well as improved the quality of life of the patient, thus postponing the need for surgery

Aust J Physiother. 2003;49(2):107-16.

A systematic review of low level laser therapy with location-specific doses for pain from chronic joint disorders.

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We investigated if low level laser therapy (LLLT) of the joint capsule can reduce pain in chronic joint disorders. A literature search identified 88 randomised controlled trials, of which 20 trials included patients with chronic joint disorders. Six trials were excluded for not irradiating the joint capsule. Three trials used doses lower than a dose range nominated a priori for reducing inflammation in the joint capsule. These trials found no significant difference between active and placebo treatments. The remaining 11 trials including 565 patients were of acceptable methodological quality with an average PEDro score of 6.9 (range 5-9). In these trials, LLLT within the suggested dose range was administered to the knee, temporomandibular or zygapophyseal joints. The results showed a mean weighted difference in change of pain on VAS of 29.8 mm (95% CI, 18.9 to 40.7) in favour of the active LLLT groups. Global health status improved for more patients in the active LLLT groups (relative risk of 0.52; 95% CI 0.36 to 0.76). Low level laser therapy with the suggested dose range significantly reduces pain and improves health status in chronic joint disorders, but the heterogeneity in patient samples, treatment procedures and trial design calls for cautious interpretation of the results.

Cochrane Database Syst Rev. 2003;(2):CD002046.

Low level laser therapy (Classes I, II and III) for treating osteoarthritis.

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BACKGROUND: Osteoarthritis (OA) affects a large proportion of the population. Low Level Laser Therapy (LLLT) is a light source that generates extremely pure light, of a single wavelength. The effect is not thermal, but rather related to photochemical reactions in the cells. LLLT was introduced as an alternative non-invasive treatment for OA about 10 years ago, but its effectiveness is still controversial. OBJECTIVES: To assess the effectiveness of LLLT in the treatment of OA. SEARCH STRATEGY: We

searched MEDLINE, EMBASE, the Cochrane Musculoskeletal registry, the registry of the Rehabilitation and Related Therapies field and the Cochrane Controlled Trials Register up to December 31, 2002. SELECTION CRITERIA: Following an a priori protocol, only controlled clinical trials of LLLT for the treatment of patients with a clinical diagnosis of OA were eligible. Abstracts were excluded unless further data could be obtained from the authors. DATA COLLECTION AND ANALYSIS: Two reviewers independently selected trials and abstracted data using predetermined forms. Heterogeneity was tested with Cochran's Q test. A fixed effects model was used throughout for continuous variables, except where heterogeneity existed, in which case, a random effects model was used. Results were analyzed as weighted mean differences (WMD) with 95% confidence intervals (CI), where the difference between the treated and control groups was weighted by the inverse of the variance. Standardized mean differences (SMD) were calculated by dividing the difference between treated and control by the baseline variance. SMD were used when different scales were used to measure the same concept (e.g. pain). Dichotomous outcomes were analyzed with odds ratios. MAIN RESULTS: Five trials were included, with 112 patients randomized to laser, 85 patients to placebo laser. Treatment duration ranged from 4 to 10 weeks. Pain was assessed by four trials. The pooled estimate (random effects) of three trials showed no statistically different effect on pain measured using a scale (SMD: -0.2, 95% CI: -1.0, +0.6), but there was statistically significant heterogeneity (p>0,05). Two of the trials showed no effect and one demonstrated very beneficial effects with laser. In another trial, with no scale-based pain outcome, significantly more patients reported pain relief (yes/no) with laser with an odds ratio of 0.05, (95% CI: 0.0 to 1.56). Other outcomes of joint tenderness, joint mobility and strength were not significant. REVIEWER'S CONCLUSIONS: For OA, the results are conflicting in different studies and may depend on the method of application and other features of the LLLT application. Clinicians and researchers should consistently report the characteristics of the LLLT device and the application techniques used. New trials on LLLT should make use of standardized, validated outcomes. Despite some positive findings, this meta-analysis lacked data on how LLLT effectiveness is affected by four important factors: wavelength, treatment duration of LLLT, dosage and site of application over nerves instead of joints. There is clearly a need to investigate the effects of these factors on LLLT effectiveness for OA in randomized controlled clinical trials.

Radiol Med (Torino). 1998 Apr;95(4):303-9.

[Low-level laser therapy in osteoarticular diseases in geriatric patients]

[Article in Italian]

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INTRODUCTION: Laser light absorption through the skin causes tissue changes, targeting the nervous, the lymphatic, the circulatory and the immune systems with an antalgic, anti-inflammatory, anti-edemic effect and stimulating tissue repair. Therefore low level laser therapy is now commonly used in numerous rehabilitation centers, including the "Istituto Gerontologico Pio Albergo Trivulzio", Milan, Italy. However, to activate the treatment program, the basic medical research results must always be considered to choose the best optical wavelength spectrum, technique and dose, for rehabilitative laser therapy. We analyzed the therapeutic effects of different wavelengths and powers in various treatment schedules. In particular, a protocol was designed to test such physical parameters as laser type, doses and individual schedule in different pathologic conditions. We report the results obtained with low level laser therapy in the rehabilitation of geriatric patients, considering the various physical and technical parameters used in our protocol. MATERIAL AND METHODS: We used the following laser equipment: an HeNe laser with 632.8 nm wavelength (Mectronic), a GaAs Laser with 904 nm wavelength (Mectronic) and a CO2 Laser with 10,600 nm wavelength

(Etoile). To evaluate the patient clinical status, we use a different form for each involved joint; the laser beam is targeted on the region of interest and irradiation is carried out with the sweeping method or the points technique. Irradiation technique, doses and physical parameters (laser type, wavelength, session dose and number) are indicated on the form. The complete treatment cycle consists of 5 sessions per week--20 sessions in all. At the end of the treatment cycle, the results were scored on a 5-grade semiquantitative scale--excellent, good, fair, poor and no results. We examined 3 groups of patients affected with gonarthrosis (149 patients), lumbar arthrosis (117 patients), and algodystrophy (140 patients) respectively. RESULTS: In gonarthrosis patients, the statistical analysis of the results showed no significant differences between CO2 laser and GaAs laser treatments ($p = .975$), but significant differences between CO2 laser and HeNe laser treatments ($p = .02$) and between GaAs laser and HeNe laser treatments ($p = .003$). In lumbar arthrosis patients treated with GaAs or HeNe laser, significant differences were found between the two laser treatments and the combined sweeping-points techniques appeared to have a positive trend relative to the sweeping method alone, especially in sciatic suffering. In the algodystrophy syndrome, in hemiplegic patients, significant differences were found between CO2 and HeNe laser treatments ($p = .026$), between high and low CO2 laser doses ($p = .024$), and between low CO2 laser dose and high HeNe laser dose ($p = .006$). CONCLUSIONS: Low level laser therapy can be used to treat osteoarticular pain in geriatric patients. To optimize the results, the diagnostic picture must be correct and a treatment program defining the physical parameters used (wavelength, dose and irradiation technique) must also be designed.