

**BIBLIOGRAFIA [estesa]**

## [ Title

Low-level laser therapy in ankle sprains: a randomized clinical trial.

**Author**

de Bie RA; de Vet HC; Lenssen TF; van den Wildenberg FA; Kootstra G; Knipschild PG

**Address**

Department of Epidemiology, Maastricht University, The Netherlands.

**Source**

Arch Phys Med Rehabil, 1998 Nov, 79:11, 1415-20

**Abstract**

**OBJECTIVE:** To test the efficacy of low-level laser therapy on lateral ankle sprains as an addition to a standardized treatment regimen, a trial was conducted in which high-dose laser (5J/cm<sup>2</sup>), low-dose laser (0.5J/cm<sup>2</sup>), and placebo laser therapy (0J/cm<sup>2</sup>) at skin level were compared. **DESIGN:** Randomized, double-blind, controlled clinical trial with a follow-up of 1 year. Patients, therapists, assessors, and analysts were blinded to the assigned treatment. **SETTING:** An ambulatory care setting. **PATIENTS:** After informed consent and verification of exclusion criteria, 217 patients with acute lateral ankle sprains were randomized to three groups from September 1, 1993, through December 31, 1995. **INTERVENTIONS:** Twelve treatments of 904nm laser therapy in 4 weeks as an adjunct to a standardized treatment regimen of 4 weeks of brace therapy combined with standardized home exercises and advice. The laser therapy device used was a 904nm Ga-As laser, with 25-watt peak power and 5,000 or 500Hz frequency, a pulse duration of 200nsec, and an irradiated area of 1cm<sup>2</sup>. **PRIMARY OUTCOME MEASURES:** Pain and function as reported by the patient. **RESULTS:** Intention-to-treat analysis of the short-term results showed no statistically significant difference on the primary outcome measure, pain ( $p = .41$ ), although the placebo group showed slightly less pain. Function was significantly better in the placebo group at 10 days ( $p = .01$ ) and 14 days ( $p = .03$ ) after randomization. The placebo group also performed significantly better on days of sick leave ( $p = .02$ ) and at some points for hindrance in activities in daily life and pressure pain, as well as subjective recovery ( $p = .05$ ). Intention-to-treat analysis showed that total days of absenteeism from work and sports were remarkably lower in the placebo group than in the laser groups, ranging from 3.7 to 5.3 and 6 to 8 days, respectively. The total number of relapses at 1 year in the low-dose laser group ( $n = 22$ ) was significantly higher ( $p = .04$ ) than in the other two groups (high laser,  $n = 13$ ; placebo,  $n = 13$ ). Subgroup analysis to correct for possible confounders did not alter these findings. **CONCLUSIONS:** Neither high- nor low-dose laser therapy is effective in the treatment of lateral ankle sprains.

**Language of Publication**

English

**Unique Identifier** 99037665

## [ Title

Lateral epicondylalgia: report of noneffective midlaser treatment.

**Author**

Haker EH; Lundeberg TC

**Address**

Department of Physiology II, Karolinska Institutet, Stockholm, Sweden.

**Source**

Arch Phys Med Rehabil, 1991 Nov, 72:12, 984-8

**Abstract**

This study was carried out to explore the pain-alleviating effect of Ga-As + He-Ne laser (gallium-arsenide + helium-neon) in lateral epicondylalgia. A Space Mid Laser Mix 5-up laser was used. The probe consisted of five Ga-As emitters and one He-Ne emitter in the center. The parameters for Ga-As were wavelength, 904nm; average output power, 4mW, peak power, 10W; pulse frequency, 3800Hz; pulse duration, 180nsec; divergence, 70mrad. The He-Ne parameters were wavelength, 632.8nm; continuous; power output, 5mW, divergence 60mrad. A pen laser (Ga-As) was also included in the equipment. Two machines were available; one of them had no output in the Ga-As diodes, and the He-Ne emitter was replaced with a red light emitter. Fifty-eight patients were consecutively assigned to two groups for laser or placebo. The probe was applied perpendicularly over the painful area for eight minutes, and then the pen probe was applied to two acupuncture points, LI 11 and LI 12, for two minutes per point. The treatments were given three to four times weekly, ten treatments in all. Follow-ups were done after 3, 6, and 12 months. The treatment procedure was performed exactly according to the manufacturer's manual for this diagnosis. No other therapeutic measures were used, and medication use was proscribed during the treatments and the follow-up period. The statistical analysis showed no significant differences in subjective or objective outcome between the laser and placebo treatments after the treatment period. However, the objective outcome indicated a difference in favor of the placebo treatment (p less than .06).(ABSTRACT TRUNCATED AT 250 WORDS)

**Language of Publication**

English

**Unique Identifier** 92061529

[[ Title

Influence of low level laser irradiation on biochemical processes in brainstem and cortex of intact rabbits.

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**Author**

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**Source**

Vojnosanit Pregl, 1997 Nov, 54:6, 533-40

**Abstract**

The influence of low level laser (LLL) irradiation at wavelength at 660 and 904 nm on oxidative stress (lipid peroxidation activity-LP, production of superoxide anion radicals-NBT reduction), activity of enzymes of antioxidative defense (superoxide dismutase-SOD, glutathione reductase-GR) and functional activity of sodium pump (Na+K+ ATPase) in relation with applied wavelength of LLL was investigated. The investigation was performed at the adult rabbits (n = 21) classified in three groups: control group (C), the group of rabbits irradiated with LLL wavelength 904 nm (CL1) and the group of rabbits irradiated with LLL wavelength 660 nm (CL2). The irradiation was performed in the upper cervical region in the anatomical projection of the brainstem. It was established that LLL induced oxidative stress in the brainstem and the cortex of treated rabbits, independently of applied wavelength of laser beams. The registered changes in functional activity of sodium pump were dependent on the applied wavelength. The irradiation at 904 nm caused the significant increase of the substrate uptake rate of sodium pump in the brainstem tissue. The irradiation at 660 nm caused the "competitive inhibition" of the sodium pump. Decrease of norepinefrine content in the brainstem of treated rabbits pointed on the indirect mechanism of functional activity of sodium pump as well as the oxidative stress.

**Language of Publication**

ENG; LA=SCR

**Unique Identifier** 98142928

[[ Title

[Histopathological study of changes in tissues adjacent to the dental pulp during restoration with composite materials using traditional technics and using controlled polymerization with infrared 904 nm. laser light]

**ASS. CO. LASER**

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**Author**

Benedicenti A; Gherlone EF; Martino AR; Verrando M; Piccirillo M; De Angelis P; Rinaldi F

**Address****Source**

Parodontol Stomatol (Nuova), 1984 Sep, 23:3, 149-53

**Abstract**

Abstract unavailable online.

**Language of Publication**

Italian

**Unique Identifier** 86041514

**Title**

[A preparation method using infrared 904 nm. laser light on the latero-posterior teeth with the latest generation composite materials]

**Author**

Benedicenti A; Gherlone EF; Martino AR; Gaurneri L; Rinaldi F; Brega G

**Address****Source**

Parodontol Stomatol (Nuova), 1984 Sep, 23:3, 141-7

**Abstract**

Abstract unavailable online.

**Language of Publication**

Italian

**Unique Identifier** 86041513

**Title**

[Evaluation of the analgesic effect of 904 nm light laser in 2 cases of essential trigeminal neuralgia using telethermographic imaging]

**Author**

Benedicenti A; Brunetti C; Guainazzo G; Verrando M

**Address****Source**

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Parodontol Stomatol (Nuova), 1984 May, 23:2, 91-7

**Abstract**

Abstract unavailable online.

**Language of Publication**

Italian

**Unique Identifier** 86041503

[[ **Title**

[Effect of a 904 nm laser on microcirculation and arteriovenous circulation as evaluated using telethermographic imaging]

**Author**

Benedicenti A; Verrando M; Cherlone F; Brunetti O

**Address**

**Source**

Parodontol Stomatol (Nuova), 1984 May, 23:2, 167-78

**Abstract**

Abstract unavailable online.

**Language of Publication**

Italian

**Unique Identifier** 86041485

[[ **Title**

[Therapy of apical periodontitis using electropharmacophoresis and a 904 nm laser]

**Author**

Coriani S; Silvestrini Biavati P; Gatti PL; Tadiotto F

**Address**

**Source**

Parodontol Stomatol (Nuova), 1984 May, 23:2, 135-8

**Abstract**

Abstract unavailable online.

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**Language of Publication**

Italian

**Unique Identifier** 86041479[ **Title**

Treatment of medial and lateral epicondylitis--tennis and golfer's elbow--with low level laser therapy: a multicenter double blind, placebo-controlled clinical study on 324 patients.

**Author**

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**Source**

J Clin Laser Med Surg, 1998 Jun, 16:3, 145-51

**Abstract**

**BACKGROUND AND OBJECTIVE:** Among the other treatment modalities of medial and lateral epicondylitis, low level laser therapy (LLLT) has been promoted as a highly successful method. The aim of this clinical study was to assess the efficacy of LLLT using trigger points (TPs) and scanner application techniques under placebo-controlled conditions. **STUDY DESIGN/MATERIAL AND METHODS:** The current clinical study was completed at two Laser Centers (Locarno, Switzerland and Opatija, Croatia) as a double-blind, placebo controlled, crossover clinical study. The patient population (n = 324), with either medial epicondylitis (Golfer's elbow; n = 50) or lateral epicondylitis (Tennis elbow; n = 274), was recruited. Unilateral cases of either type of epicondylitis (n = 283) were randomly allocated to one of three treatment groups according to the LLLT technique applied: (1) Trigger points; (2) Scanner; (3) Combination Treatment (i.e., TPs and scanner technique). Bilateral cases of either type of epicondylitis (n = 41) were subject to crossover, placebo-controlled conditions. Laser devices used to perform these treatments were infrared (IR) diode laser (GaAlAs) 830 nm continuous wave for treatment of TPs and HeNe 632.8 nm combined with IR diode laser 904 nm, pulsed wave for scanner technique. Energy doses were equally controlled and measured in Joules/cm<sup>2</sup> either during TPs or scanner technique sessions in all groups of patients. The treatment outcome (pain relief and functional ability) was observed and measured according to the following methods: (1) short form of McGill's Pain Questionnaire (SF-MPQ); (2) visual analogue scales (VAS); (3) verbal rating scales (VRS); (4) patient's pain diary; and (5) hand dynamometer. **RESULTS:** Total relief of the pain with consequently improved functional ability was achieved in 82% of acute and 66% of chronic cases, all of which were treated by combination of TPs and scanner technique. **CONCLUSIONS:** This clinical study has demonstrated that the best results are obtained using combination treatment (i.e., TPs and scanner technique). Good results are obtained from adequate treatment technique correctly applied, individual energy doses, adequate medical education, clinical experience, and correct approach of laser therapists. We observed that under- and overirradiation dosage can result in the absence of positive therapy effects or even opposite, negative (e.g., inhibitory) effects. The current clinical study provides further evidence of the efficacy of LLLT in the management of lateral and medial epicondylitis.

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## Language of Publication

English

**Unique Identifier** 98416293

## [[ Title

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

## Author

Giavelli S; Fava G; Castronuovo G; Spinoglio L; Galanti A

## Address

Dipartimento di Radiologia e Laserterapia, Istituto Gerontologico Pio Albergo Trivulzio, Milano.

## Source

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

## Abstract

**INTRODUCTION:** Laser light absorption through the skin causes tissue changes, targeting the nervous, the lymphatic, the circulatory and the immune systems with an analgesic, 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

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the algodystrophy syndrome, in hemiplegic patients, significant differences were found between CO<sub>2</sub> and HeNe laser treatments ( $p = .026$ ), between high and low CO<sub>2</sub> laser doses ( $p = .024$ ), and between low CO<sub>2</sub> 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.

### Language of Publication

Italian

**Unique Identifier** 98340896

### [ Title

[Laser in periodontology: theoretical-experimental approach. 3. Experimental study of the effects of He-Ne (638 nm) and infrared diodic (904 nm) lasers on the gingival mucosa of rats]

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### Author

Caruso F; Gaeta GM; Chieffi Baccari G; Guida L; Iuorio G

### Address

Università degli Studi di Napoli.

### Source

Arch Stomatol (Napoli), 1990 Apr, 31:2, 277-89

### Abstract

Medical and surgical laser-therapy is becoming more and more important in various branches of Medicine, however independently from clinical results still very little is known about physical-biological interaction between laser beam and living matter. The aim of this study is of finding tissutal and cellular effects of stimulation with soft and mid laser. The study started from an original work carried out at the Institute of Biology of the 1st Faculty of Medicine and Surgery of Naples University from which appears the possibility of visualizing the stage of nuclear active synthesis of the cell, simply by Maloory tricromic colouring. By this method the cellular nucleuses take, usually, a red colour, however in presence of an increase of the RNA nuclear synthesis the nucleuses take a typical blue colour. The importance of the study induced us to research the presence in the oral mucose of the rat after radiation as an effect of biostimulation. The results of this study showed an increase of the epithelial cheratine and a variation of the disposition and of the number of the precheratine grains in treated site. The blue nucleuses have been found at the basal level without any difference between treated and control site. On the other hand their presence is the normal consequence of the epithelial evolution which starts from the basal level which is the most active in the stage of nuclear synthesis.

### Language of Publication

Italian



**Unique Identifier** 91273477

[[ **Title**

Low power laser biostimulation of chronic oro-facial pain. A double-blind placebo controlled cross-over study in 40 patients.

**Author**

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University Hospital, Rigshospitalet,  
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**Source**

Pain, 1990 Nov, 43:2, 169-79

**Abstract**

The efficacy of low power laser stimulation in the treatment of chronic oro-facial pain conditions was investigated in a double-blind placebo controlled modified cross-over study in 40 patients. The laser was an invisible infrared (IR) diode laser with an emission at 904 nanometer (nm). Treatment effect was evaluated by means of VAS-scales and global assessment of pain. Outcome of treatment was correlated to changes in urinary excretion of 5-hydroxyindoleacetic acid (5-HIAA). The clinical impression was that placebo was superior to laser stimulation. No statistically significant difference between the analgesic effect of the laser and placebo irradiation was found on VAS-scales. A significant ( $P = 0.05$ ) increase in 5-HIAA excretion was found in the placebo group. It is concluded that the possibility of a substantial placebo response should be taken into consideration using 904 nm (IR) lasers for pain treatment in patients with this type of chronic oro-facial pain.

**Language of Publication**

English

**Unique Identifier** 91204302

[[ **Title**

[Combined low-power laser therapy and local infiltration of corticosteroids in the treatment of radial-humeral epicondylitis]

**Author**

Konstantinovic L; Antonic M; Brdarecki Z

**Address**

Vojnomedicinska akademija, Klinika za fizikalnu medicinu i rehabilitaciju, Beograd.

**Source**

Vojnosanit Pregl, 1997 Sep, 54:5, 459-63

#### **Abstract**

The prospective study included 32 patients with radiohumeral epicondylitis. They are by single-blind method divided into three groups: Group I (n = 11) was treated with low power laser therapy (904 nm, 5 kHz, in the dose of 1 J/cm<sup>2</sup>); Group II (n = 11) was treated with corticosteroid infiltration and group III (n = 10) was treated with combination of initial infiltration and subsequent laser therapy. The estimation of therapy effect was done by pain intensity follow-up with modified McGill's questionnaire. The results of the first control examination, 7 days after the therapy onset, demonstrated significantly higher analgesic effect to be achieved in the group of patients treated with combination of corticosteroid infiltration and laser therapy. Similar results were noticed in the other two groups after the repeated same treatment.

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#### **Language of Publication**

Roman Serbo-Croatian

**Unique Identifier** 98066399

#### **Title**

Effect of diodes-laser silver arsenide-aluminium (Ga-Al-As) 904 nm on healing of experimental wounds.

#### **Author**

Longo L; Evangelista S; Tinacci G; Sesti AG

#### **Address**

Laser Therapy Unit, Villa Donatello, Firenze, Italy.

#### **Source**

Lasers Surg Med, 1987, 7:5, 444-7

#### **Abstract**

Diodes-laser silver arsenide-aluminium (Ga-Al-As) 904 nm, which was used because of its properties of good tissue penetration and manageability, applied 5 min daily for 5 days at 3,000 Hz of frequency (energy density = 3 J), promoted healing of experimental wounds in rats from both a microscopic and histologic point of view. The same laser applied in these experimental conditions (number of rats was eight for each group) at the same energy density (3 J) for 10 min daily during 5 days at 1,500 Hz of frequency did not affect the experimental wounds.

#### **Language of Publication**

English

**Unique Identifier** 88093449

[[ Title

Is low-energy laser treatment effective in lateral epicondylalgia?



Author

Haker E; Lundeberg T

Address

Source

J Pain Symptom Manage, 1991 May, 6:4, 241-6

Abstract

The aim of this double-blind study was to explore the pain-alleviating effect of low energy laser in lateral epicondylalgia. Forty-nine patients were consecutively assigned at random to two groups, laser or placebo. The Mid 1500 Irradia laser was used with the following parameters: wavelength 904 nm; average power output 12 mW; peak value 8.3 W; frequency 70 Hz (pulse train 8000 Hz). The laser (Ga-As) was locally applied to 6 sites on and around the epicondyle. Each point was treated for 30 sec, resulting in a dose of 0.36 J/point and an area of treatment of 0.2 mm2. Patients were treated 2-3 times weekly, for a total of 10 treatments. Follow-ups were done after three and 12 mo. The statistical analysis showed that the laser treated group had a significant improvement in some objective outcomes after the treatment period and at the 3 mo follow-up, but there were no significant differences in the subjective outcomes between the groups. Irradia laser treatment may be a valuable therapy in lateral epicondylalgia, if carried out as described in this study. However, further studies are necessary before low energy laser can be employed as a pain-relieving method.

Language of Publication

English

Unique Identifier 91231731

[[ Title

[Use of soft laser in the treatment of oral symptoms]

Author

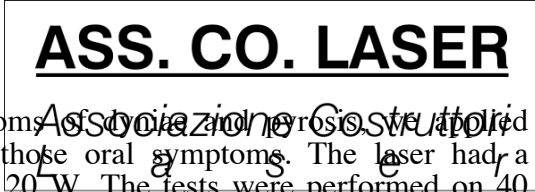
Cekic Arambasin A; Durdevic Matic A; Mravak Stipetic M; Bilic A

Address

Source

Acta Stomatol Croat, 1990, 24:4, 281-8

Abstract



Due to insufficient casual therapy of oral symptoms infrared soft laser in treatment of patients with those oral symptoms. The laser had a wavelength of 904 nm and a radiation strength of 20 W. The tests were performed on 40 persons with stomatopyrosis and stomatodinae symptoms, under application of laser through 5 days consecutively with radiation of mucosa lasting 3 minutes on 1 cm2. The testing group was represented by persons exclusively under the laser therapy and the control group was

represented by 30 persons, who were under a medicamentose therapy with vasodilatator applied with iontophoresis. By persons with stomatopyrosis and stomatodinae symptoms analgetic effect was attained through the therapy with the laser already after the first application, and the pain and aches intensity was relieved every day during the therapy, by stomatodinae to complete healing. The obtained differences in the intensity of symptoms before and after the therapy were statistically important. The thermoesthesiometric determination of laser efficiency by vasodilatation showed differences which were not important, although the temperature during the therapy has slightly increased for 0.1 degrees C. The soft laser can be used as an effective remedy in the treatment of oral symptoms of stomatopyrosis and stomatodinae.

### Language of Publication

Roman Serbo-Croatian

**Unique Identifier** 92058398

### [[ Title

Laser treatment applied to acupuncture points in lateral humeral epicondylalgia. A double-blind study.

### Author

Haker E; Lundeberg T

### Address

Department of Physiology II, Karolinska Institutet, Stockholm, Sweden.

### Source

Pain, 1990 Nov, 43:2, 243-7

### Abstract

Forty-nine patients suffering from lateral humeral epicondylalgia were enrolled in a double-blind study to observe the effects of Ga-As laser applied to acupuncture points. The Mid 1500 IRRADIA laser machine was used, wavelength: 904 nm, mean power output: 12 mW, peak value: 8.3 W; frequency: 70 Hz (pulse train). Localization of points: LI 10, 11, 12, Lu 5 and SJ 5. Each point was treated for 30 sec resulting in a dose of treatment of 0.36 J/point. The patients were treated 2-3 times weekly with 10 treatments in all. Follow-ups were done after 3 months and 1 year. No significant differences were observed between the laser and the placebo group in relation to the subjective or objective outcome after 10 treatments or at the follow-ups.

### Language of Publication

English

**Unique Identifier** 91204310

### [[ Title

Effects of low power 904 nm radiation on rat fibroblasts explanted and in vitro cultured.

### Author



Continenza MA; Ricciardi G; Franchitto A

**Address**

University of L'Aquila, Surgery Department, Italy.

**Source**

J Photochem Photobiol B, 1993 Aug, 19:3, 231-4

**Abstract**

In this study, 904 nm radiation was used on rat fibroblasts, explanted and in vitro cultured, to verify the action of various factors on cell growth. Parameters which can modify the behaviour of cultured cells, including the pulse repetition rate and the intensity of the radiation, the distance between the source and the irradiated dishes, the daily duration of exposure and the length of treatment, were studied. The most effective values of the intensity and pulse repetition rate which stimulate cell growth were  $3 \times 10^{-4}$  W m<sup>-2</sup> and 1.6 kHz respectively; the best stimulation was obtained at a sample-source distance of 0.1 m. The duration of daily exposure had no significant effect, whereas the best stimulus of cell growth was obtained by extending the treatment to 12 days.

**Language of Publication**

English

**Unique Identifier** 94046198

[[ **Title**

Low level laser therapy with trigger points technique: a clinical study on 243 patients.

**Author**

Simunovic Z

**Address**

Laser Center, Locarno, Switzerland.

**Source**

J Clin Laser Med Surg, 1996 Aug, 14:4, 163-7

**Abstract**

Among the various methods of application techniques in low level laser therapy (LLLT) (HeNe 632.8 nm visible red or infrared 820-830 nm continuous wave and 904 nm pulsed emission) there are very promising "trigger points" (TPs), i.e., myofascial zones of particular sensibility and of highest projection of focal pain points, due to ischemic conditions. The effect of LLLT and the results obtained after clinical treatment of more than 200 patients (headaches and facial pain, skeletomuscular ailments, myogenic neck pain, shoulder and arm pain, epicondylitis humery, tenosynovitis, low back and radicular pain, Achilles tendinitis) to whom the "trigger points" were applied were better than we had ever expected. According to clinical parameters, it has been observed that the rigidity decreases, the mobility is restored



(functional recovery), and the spontaneous or induced pain decreases or even disappears, by movement, too. LLLT improves local microcirculation and it can also improve oxygen supply to hypoxic cells in the TP areas and at the same time it can remove the collected waste products. The normalization of the microcirculation, obtained due to laser applications, interrupts the "circulus vitiosus" of the origin of the pain and its development (Melzak: muscular tension > pain > increased tension > increased pain, etc.). Results measured according to VAS/VRS/PTM: in acute pain, diminished more than 70%; in chronic pain more than 60%. Clinical effectiveness (success or failure) depends on the correctly applied energy dose--over/underdosage produces opposite, negative effects on cellular metabolism. We did not observe any negative effects on the human body and the use of analgesic drugs could be reduced or completely excluded. LLLT suggests that the laser beam can be used as monotherapy or as a supplementary treatment to other therapeutic procedures for pain treatment.

### Language of Publication

English

**Unique Identifier** 98117748

### [[ Title

[Determination of the mean effective power of the 904-nm IR laser]

### Author

Palano D; Maiolani S; Molinari G; Peruzzi M; Majni G

### Address

### Source

Minerva Stomatol, 1988 Jan, 37:1, 29-32

### Abstract

Abstract unavailable online.

### Language of Publication

Italian

**Unique Identifier** 88201814

### [[ Title

Infrared laser diode irradiation has no behavioral or biochemical effect on pain in the sciatic nerve ligation-induced mononeuropathy in rat.

### Author

Parris WC; Janicki PK; Johnson BW Jr; Mathews L

**Address**

Department of Anesthesiology, Vanderbilt University Medical Center, Nashville, Tennessee 37232-2125, USA.

**Source**

Anesth Prog, 1994, 41:4, 95-9

**Abstract**

The aim of this study was to evaluate the effect of acute and repeated (5 days) treatment with various types of infrared (IR) diode lasers and probes (single- vs cluster-beam) on the pain response in rats with peripheral mononeuropathy produced by sciatic nerve ligation. Male Sprague-Dawley rats were anesthetized with sodium pentobarbital, and the mid-thigh was surgically exposed to reveal the sciatic nerve, around which four ligatures were loosely tied. On postoperative day 5, the skin over the sciatic nerve lesion was subjected to a 30-min daily local exposure from a 904-nm IR diode laser (700 Hz, average output power 10 mW) with a single-beam probe, a 830-nm IR diode laser (700 Hz) with either a single-beam (average output power 50 mW) or cluster-beam probe (average output power 15 mW), or placebo for 5 consecutive days. Two pain responses (foot-withdrawal time and the hind-paw elevation time) were measured on both sides using the radiant heat method on days 5 and 9. In addition, cold allodynia was measured on day 9 of treatment by placing the rats on a chilled metal plate (4 degrees C) and measuring the duration of elevation of either of the hind paws. On day 9, the animals were sacrificed for collection of the samples of brain and lumbar spinal cord for the determination of the tissue concentrations of dynorphin A1-8-like immunoactivity (DYN) using specific radioimmunoassay (RIA). The hind-paw withdrawal and elevation times on the right side in all groups subjected to the various methods of IR laser irradiation did not differ significantly as compared with the placebo-treated group when measured on days 5 and 9 after surgery. No statistically significant differences in withdrawal response and elevation time of the unaffected left hind paw were noted either. The measurement of cold allodynia similarly failed to reveal any effect in laser-treated groups versus placebo. The RIA analysis found that tissue concentrations of DYN were significantly elevated in the spinal cord ipsilaterally to the ligation side, as compared with the contralateral side, in all rats with sciatic nerve ligation. All modalities of IR diode laser treatment did not produce any significant difference in the brain and spinal cord level of DYN on postoperative day 9 in all treatment groups. It is concluded that repeated IR diode laser treatment did not reduce hyperalgesia induced by sciatic nerve ligation in rats.

**Language of Publication**

English

**Unique Identifier** 97089051

**[[ Title**

Effect of low-energy laser power on the bone marrow of the rat.

**Author**

Pyczek M; Sopala M; Dabrowski Z

**Address**

Institute of Human Physiology, Academy of Physical Education, Kraków, Poland.

**Source**

Folia Biol (Krakow), 1994, 42:3-4, 151-6

**Abstract**

The effect of low power laser light upon the haematopoietic system of rats and also upon the basic haematological parameters was studied. A HeliumNeon continuous emission laser (632.8 nm; max. power 5 mW) and a Gallium arsenide semiconductor pulse laser (904 nm; power 80 mW; pulse duration 200 ns) were used as light sources. Intact skin on the hind legs of rats was exposed, over a section of the femur. Peripheral blood analysis carried out before and after the experiments. These indicated that AsGa laser light induced a decrease in bone marrow mastocytes and peripheral blood basophils with an increase in the number of eosinophils. An increase in mitotic activity in the bone marrow was observed in the exposed groups of animals. No significant changes in Hb, Ht, erythrocyte or reticulocyte levels in the peripheral blood were noted, nor was there an increase in megakaryocyte emperipoiesis.

**Language of Publication**

English

**Unique Identifier** 95369532

**Title**

What is the efficacy of "soft" and "mid" lasers in therapy of tendinopathies? A double-blind study.

**Author**

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**Address**

Department of Orthopedics, Grosshadern Hospital, Munich University Medical School, Federal Republic of Germany.

**Source**

Arch Orthop Trauma Surg, 1987, 106:6, 358-63

**Abstract**

The efficacy of "athermic" lasers (HeNe  $\lambda = 632.8$  nm and IR diode  $\lambda = 904$  nm) in the treatment of tendinopathies was investigated in a randomized double-blind study. On 10 consecutive days, 64 patients (32 therapy, 32 placebo) were treated for 15 minutes each with a switched-on or switched-off laser under otherwise identical conditions. The extent of movement in involved joints (neutral 0 method) and rating on a pain scale for resting pain, movement pain, and pressure pain before treatment, after treatment, and 2 weeks after



conclusion of therapy, as well as infrared thermography, served to check therapy. After the end of therapy, a significant reduction ( $P = \text{less than } 0.001$ ) of 50% was shown for resting pain as well as reductions of 30% for movement and 30% for pressure pain. This result was identical in the therapy group and in the placebo group. There was also no indication of a different result of therapy between the therapy and placebo groups with regard to the thermographic control and the extent of movement. The breakdown of the data in terms of age, sex, and duration of disease did not provide any indications of different results for placebo or therapy. It was striking that the patients who reported sensations during or after the treatment (irrespective of whether pleasant or unpleasant) had a greater reduction of pain than the patients without sensations. This laser therapy thus did not show any effect above and beyond that in the untreated group in our double-blind clinical study.

### Language of Publication

English

**Unique Identifier** 88133287

### [[ Title

[Analgesic effect of 904-nm laser radiation (IR) in oral surgery]

### Author

Peres F; Felino A; Carvalho JF

### Address

### Source

Rev Port Estomatol Cir Maxilofac, 1985 Jul, 26:3, 205-17

### Abstract

Abstract unavailable online.

### Language of Publication

Portuguese

**Unique Identifier** 86096142

### [[ Title

Treatment of chronic back pain in horses. Stimulation of acupuncture points with a low powered infrared laser.

### Author

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New Bolton Center, Philadelphia 19348.

**Source**

Vet Surg, 1987 Jan, 16:1, 106-10

**Abstract**

Fourteen horses that could not perform at their expected standards due to chronic back pain of 4 to 48 months duration, and had not obtained lasting improvement from other forms of therapy, were treated by stimulating nine acupuncture points using a low powered infrared laser (300 microW, 904 nm). The treatments were performed weekly, and consisted of stimulating each point for 2 minutes with a pulse frequency of 360 pulses per second. After completion of a mean of 11 treatments, clinical signs of back pain were alleviated in 10 of the 14 horses, there was no change in three, and one was lost to follow-up. Of the 10 horses who were training and competing, four won. One year after treatment was discontinued, 9 of these 10 horses continued to perform at a standard acceptable to the owner.

**Language of Publication**

English

**Unique Identifier** 89163151

[[ **Title**

Low energy laser irradiation fails to modulate the inflammatory function of human monocytes and endothelial cells.

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**Address**

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**Source**

Lasers Surg Med, 1996, 19:2, 207-15

**Abstract**

**BACKGROUND AND OBJECTIVE:** In view of the important regulatory role of cytokines in wound healing and inflammation, we investigated the effects of low energy laser irradiation on cytokine release by human peripheral blood monocytes (M phi) and human umbilical vein endothelial cells (HUVEC) in vitro. Also, the effects of laser light on the expression of endothelial adhesion molecules, another important feature of inflammatory and regenerative responses, were assessed. **STUDY DESIGN/MATERIALS AND METHODS:** Cells were irradiated with a pulsed GaAs-laser (904 nm) at energy densities 0 (= sham), 0.3, 3.0, or 9.0 J/cm<sup>2</sup> and subsequently incubated in absence or presence of endotoxin (M phi) or

the proinflammatory cytokines TNF alpha and IL-1 beta (HUVEC). RESULTS: Irradiation at any of the dosages used did not significantly affect spontaneous or endotoxin-induced release of TNF alpha, IL-6, and IL-8 by M phi. Similarly, secretion of IL-6 and IL-8 by resting or cytokine-activated HUVEC after either single or repeated laser treatment was unchanged as compared to sham-irradiated controls. Moreover, laser treatment did not induce de novo expression or upregulation of the endothelial adhesion molecules E-selectin, ICAM-1, and VCAM-1, and it failed to modify their expression in response to stimulation with TNF alpha or IL-1 beta. CONCLUSION: We conclude that with the specific laser parameters and dose-regimen used, low energy laserlight does not affect the inflammatory function of human monocytes and endothelial cells in vitro.

### **Language of Publication**

English

**Unique Identifier** 97042726

### **Title**

Effects of the infrared laser therapy at treated and non-treated trigger points.

### **Author**

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Department of Physical Medicine and Rehabilitation, University Central Hospital, Kuopio, Finland.

### **Source**

Acupunct Electrother Res, 1989, 14:1, 9-14

### **Abstract**

For reliability of the pain threshold measurement there were measured first 390 trigger points of 22 healthy students twice at each point. The reliability of two different measurements was found to be perfect. Infrared (904 nm) laser therapy was compared to placebo laser at the trigger points. Our study tested eighteen patients (11 men and 7 women), with 31 active trigger points in the muscles of the infraspinatus, extensor carpi radialis, levator scapulae, trapezius and tibialis anterior. Trigger points were randomly managed by infrared laser (dose 1.5J/point and place laser. The study was carried out by double-blind and cross-over principle. The responses of the management were documented by the pain threshold meter measurements of these trigger points before and after the treatments, and then fifteen minutes later. The trigger points of the other side of the body were also measured from the same muscles. In the results there were observed highly significant changes between the laser and placebo groups immediately after the treatment, 0.97 (SE 0.16) kg/cm<sup>2</sup> (p less than 0.001). The differences between these two treatments were greater after fifteen minutes of the therapy--1.87 (SE 0.30) kg/cm<sup>2</sup> (p less than 0.001). At the non-treated trigger points, the significant increase of the values was seen after fifteen minutes (p less than 0.05). Our research study results suggest that infrared laser had an effect at the trigger points and that the treatment significantly increased the pain threshold.

### **Language of Publication**

English

**Unique Identifier** 89300440

**Title**

Low power laser therapy of shoulder tendonitis.

**Author**

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**Source**

Scand J Rheumatol, 1989, 18:6, 427-31

**Abstract**

30 patients with supraspinatus or bicipital tendonitis were randomly allocated to active infrared laser therapy at 904 nm three times weekly for 2 weeks, dummy laser or drug treatment for 2 weeks. Objectively maximum active extension, flexion and abduction of the shoulder, and subjectively pain stiffness movement and function were measured at 0 and 2 weeks. Significant improvement of active over dummy laser was noted for all seven assessments. Active laser therapy produced significant improvement over drug therapy for all three objective measures and pain. Naproxen sodium significantly improved only movement and function compared to dummy laser. These results demonstrate the effectiveness of laser therapy in tendonitis of the shoulder.

**Language of Publication**

English

**Unique Identifier** 90140590

**Title**

[Personal experience in clinical use of low power laser therapy]

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**Source**

Przeł Lek, 1995, 52:1, 13-5

**Abstract**

The results of our own clinical trials regarding therapeutical effects of low power lasers in the treatment of some diseases of motional system, skin and lesions of peripheral circulation were presented in the paper. The laser therapy was used in over 320 patients in period of last

3 years. The infra-red laser (wave-length 904 nm, mean power 4 mW) was used. The procedures were performed daily, for 5 days a week in 2 stages: the scan of sore region (3-min.) and the irradiation of trigger points (2-3 min. each). As a result of 10-25 procedures a significant clinical improvement in 65-90% patients was obtained. On the base of obtained results one can conclude that low-power laser therapy could make a useful supplementary method of treatment of overloading syndrome of motional system, postthrombotic syndrome, lymphatic edema and trophic lesions of skin.

### **Language of Publication**

Polish

**Unique Identifier** 95304071

### **Title**

Dose and temporal parameters in delaying injured optic nerve degeneration by low-energy laser irradiation.

### **Author**

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### **Source**

Lasers Surg Med, 1993, 13:6, 611-7

### **Abstract**

Low-energy laser irradiation has been reported to postpone the degenerative processes in crushed optic nerves of rats, which are part of the nonregenerable mammalian central nervous system. In the present study, we evaluated the optimal irradiation parameters for this purpose. Optic nerves of 141 rats were subjected to crush injury and then irradiated through the eye, starting at different points of time before or after the injury, for different durations and periods, using various intensities of either helium-neon laser or noncoherent infrared light (904 nm). The effect was evaluated by measurements of the compound action potentials of the nerve segments between the site of injury and the optic chiasm. The compound action potential amplitude of the crushed nonirradiated nerves, as measured 2 weeks after the injury, was found to be 0.51 +/- 0.30 mV, in contrast to 3.10 +/- 1.03 mV measured in 232 normal nerves. Irradiation with a 10.5 mW helium-neon laser for 2 and 3 min once a day for 14 consecutive days resulted in maximal preservation of action potentials (1.78 +/- 0.72 and 1.95 +/- 0.71 mV, respectively). Irradiations beginning immediately prior to the injury were as effective as irradiations beginning soon after it. Irradiations for longer than 3 min or twice a day aggravated the damage. Noncoherent infrared light was ineffective or adversely affected the injured nerves. Our experiments suggest that optimal delay of posttraumatic optic nerve degeneration in rats is attainable with 10.5 mW helium-neon laser irradiations for 2 or 3 min once a day for 14 consecutive days.

**Language of Publication**

English

**Unique Identifier** 94125851

**Title**

Effect of semiconductor GaAs laser irradiation on pain perception in mice.

**Author**

Zarkovic N; Manev H; Pericic D; Skala K; Jurin M; Persin A; Kubovic M

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Ruder BoÅaskoviÆc Institute, Zagreb, Yugoslavia.

**Source**

Lasers Surg Med, 1989, 9:1, 63-6

**Abstract**

The influence of subacute exposure (11 exposures within 16 days) of mice to the low power (GaAs) semiconductive laser-stimulated irradiation on pain perception was investigated. The pain perception was determined by the latency of foot-licking or jumping from the surface of a 53 degrees C hot plate. Repeated hot-plate testing resulted in shortening of latencies in both sham- and laser-irradiated mice. Laser treatment (wavelength, 905 nm; frequency, 256 Hz; irradiation time, 50 sec; pulse duration, 100 nsec; distance, 3 cm; peak irradiance, 50 W/cm<sup>2</sup> in irradiated area; and total exposure, 0.41 mJ/cm<sup>2</sup>) induced further shortening of latencies, suggesting its stimulatory influence on pain perception. Administration of morphine (20 mg/kg) prolonged the latency of response to the hot plate in both sham- and laser-irradiated mice. This prolongation tended to be lesser in laser-irradiated animals. Further investigations are required to elucidate the mechanism of the observed effect of laser.

**Language of Publication**

English

**Unique Identifier** 89180665