Wound healing of animal and human body sport and traffic accident injuries using low-level laser therapy treatment: a randomized clinical study of seventy-four patients with control group

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Article Abstract

BACKGROUND AND OBJECTIVE: The main objective of current animal and clinical studies was to assess the efficacy of low level laser therapy (LLLT) on wound healing in rabbits and humans. STUDY DESIGN/MATERIALS AND METHODS: In the initial part of our research we conducted a randomized controlled animal study, where we evaluated the effects of laser irradiation on the healing of surgical wounds on rabbits. The manner of the application of LLLT on the human body are analogous to those of similar physiologic structure in animal tissue, therefore, this study was continued on humans. Clinical study was performed on 74 patients with injuries to the following anatomic locations: ankle and knee, bilaterally, Achilles tendon; epicondylus; shoulder; wrist; interphalangeal joints of hands, unilaterally. All patients had had surgical procedure prior to LLLT. Two types of laser devices were used: infrared diode laser (GaAlAs) 830 nm continuous wave for treatment of trigger points (TPs) and HeNe 632.8 nm combined with diode laser 904-nm pulsed wave for scanning procedure. Both were applied as monotherapy during current clinical study. The results were observed and measured according to the following clinical parameters: redness, heat, pain, swelling and loss of function, and finally postponed to statistical analysis via chi2 test. RESULTS: After comparing the healing process between two groups of patients, we obtained the following results: wound healing was significantly accelerated (25%-35%) in the group of patients treated with LLLT. Pain relief and functional recovery of patients treated with LLLT were significantly improved comparing to untreated patients. CONCLUSION: In addition to accelerated wound healing, the main advantages of LLLT for postoperative sport- and traffic-related injuries include prevention of side effects of drugs, significantly accelerated functional recovery, earlier return to work, training and sport competition compared to the control group of patients, and cost benefit.

Laser-Accelerated INFLAMMATION/PAIN REDUCTION AND HEALING

Pract Pain Manag. Nov/Dec 2003;3(6):20-25.

Richard Martin

Article Abstract

Low Level Laser Therapy (LLLT) precipitates a complex set of physiological interactions at the cellular level that reduces acute inflammation, reduces pain, and accelerates tissue healing.

Therapeutic Laser in Veterinary Medicine.

Vet Clin North Am Small Anim Pract. October 2014;45(1):45-56.

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Article Abstract

: Laser therapy is an increasingly studied modality that can be a valuable tool for veterinary practitioners. Mechanisms of action have been studied and identified for the reduction of pain and inflammation and healing of tissue. Understanding the basics of light penetration into tissue allows evaluation of the correct dosage to deliver for the appropriate condition, and for a particular patient based on physical properties. New applications are being studied for some of the most challenging health conditions and this field will continue to grow. Additional clinical studies are still needed and collaboration is encouraged for all practitioners using this technology.

Anti-inflammatory effects of low-level laser therapy (LLLT) with two different red wavelengths (660 nm and 684 nm) in carrageenan-induced rat paw edema

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Article Abstract

It has been suggested that low-level laser therapy (LLLT) can modulate inflammatory processes. The aim of this experiment was to investigate what effects red laser irradiation with two different wavelengths (660 nm and 684 nm) on carrageenan-induced rat paw edema and histology. Thirty two male Wistar rats were randomly divided into four groups. One group received a sterile saline injection, while inflammation was induced by a sub-plantar injection of carrageenan (1 mg/paw) in the three other groups. After 1 h, LLLT was administered to the paw in two of the carrageenan-injected groups. Continuous wave 660 nm and 684 nm red lasers respectively with mean optical outputs of 30 mW and doses of 7.5 J/cm(2) were used. The 660 nm and 684 nm laser groups developed significantly ($p<0.01$) less edema (0.58 ml [SE+/-0.17] ml and 0.76 ml [SE+/-0.10] respectively) than the control group (1.67 ml [SE+/-0.19]) at 4h after injections. Similarly, both laser groups showed a significantly lower number of inflammatory cells in the muscular and conjunctive sub-plantar tissues than the control group. We conclude that both 660 nm and 684 nm red wavelengths of LLLT are effective in reducing edema formation and inflammatory cell migration when a dose of 7.5 J/cm(2) is used.

Influence of laser (λ670 nm) and dexamethasone on the chronology of cutaneous repair.

Photomed Laser Surg. October 2010;28(5):639-46.

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Article Abstract

OBJECTIVE: This study aimed to assess the effect of LLLT associated with and without dexamethasone on inflammation and wound healing in cutaneous surgical wounds. BACKGROUND: Limited studies are directed at the possible interference of laser photobiomodulation on the formation of myofibroblasts, associated with an antiinflammatory drug. METHODS AND MATERIALS: Standard skin wounds were performed on 80 Wistar rats, distributed into four groups: no treatment (sham group), laser only (λ670 nm, 9 mW, 0.031 W/cm(2), 4 J/cm(2), single dose after surgery), dexamethasone only (2 mg/kg 1 h before surgery), and laser with dexamethasone. Tissue was examined histologically to evaluate edema, presence of polymorphonuclear, mononuclear cells, and collagen. The analysis of myofibroblasts was assessed by immunohistochemistry and transmission electron microscopy. The intensity was rated semiquantitatively. RESULTS: The results showed that laser and dexamethasone acted in a similar pattern to reduce acute inflammation. Collagen synthesis and myofibroblasts were more intense in the laser group ($p = 0.048$), whereas animals treated with dexamethasone showed lower results for these variables. In a combination of therapies, the synthesis of collagen and actin and desmin-positive cells was less than laser group. CONCLUSIONS: Laser was effective in reducing swelling and polymorphonuclear cells and accelerated tissue repair, even in the presence of dexamethasone.

The effect of low-level laser in knee osteoarthritis: a double-blind, randomized, placebo-controlled trial.

Photomed Laser Surg. August 2009;27(4):577-84.

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Article Abstract

INTRODUCTION: Low-level laser therapy (LLLT) is thought to have an analgesic effect as well as a biomodulatory effect on microcirculation. This study was designed to examine the pain-relieving effect of LLLT and possible microcirculatory changes measured by thermography in patients with knee osteoarthritis (KOA). MATERIALS AND METHODS: Patients with mild or moderate KOA were randomized to receive either LLLT or placebo LLLT. Treatments were delivered twice a week over a period of 4 wk with a diode laser (wavelength 830 nm, continuous wave, power 50 mW) in skin contact at a dose of 6 J/point. The placebo control group was treated with an ineffective probe (power 0.5 mW) of the same appearance. Before examinations and immediately, 2 wk, and 2 mo after completing the therapy, thermography was performed (bilateral comparative thermograph by AGA infrared camera); joint flexion, circumference, and pressure sensitivity were measured; and the visual analogue scale was recorded.

RESULTS: In the group treated with active LLLT, a significant improvement was found in pain (before treatment [BT]: 5.75; 2 mo after treatment : 1.18); circumference (BT: 40.45; AT: 39.86); pressure sensitivity (BT: 2.33; AT: 0.77); and flexion (BT: 105.83; AT: 122.94). In the placebo group, changes in joint flexion and pain were not significant. Thermographic measurements showed at least a 0.5 degrees C increase in temperature--and thus an improvement in circulation compared to the initial values. In the placebo group, these changes did not occur. CONCLUSION: Our results show that LLLT reduces pain in KOA and improves microcirculation in the irradiated area.

Low-Level Laser Therapy Facilitates Superficial Wound Healing in Humans: A Triple-Blind, Sham-Controlled Study.

J Athl Train. September 2004;39(3):223-229.

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Article Abstract

OBJECTIVE: Low-level laser therapy (LLLT) has been promoted for its beneficial effects on tissue healing and pain relief. However, according to the results of in vivo studies, the effectiveness of this modality varies. Our purpose was to assess the putative effects of LLLT on healing using an experimental wound model.
DESIGN AND SETTING: We used a randomized, triple-blind, placebo-controlled design with 2 within-subjects factors (wound and time) and 1 between-subjects factor (group). Data were collected in the laboratory setting.
SUBJECTS: Twenty-two healthy subjects (age = 21 +/- 1 years, height = 175.6 +/- 9.8 cm, mass = 76.2 +/- 14.2 kg).
MEASUREMENTS: Two standardized 1.27-cm(2) abrasions were induced on the anterior forearm. After wound cleaning, standardized digital photos were recorded. Each subject then received LLLT (8 J/cm(2); treatment time = 2 minutes, 5 seconds; pulse rate = 700 Hz) to 1 of the 2 randomly chosen wounds from either a laser or a sham 46-diode cluster head. Subjects reported back to the laboratory on days 2 to 10 to be photographed and receive LLLT and on day 20 to be photographed. Data were analyzed for wound contraction (area), color changes (chromatic red), and luminance.
RESULTS: A group x wound x time interaction was detected for area measurements. At days 6, 8, and 10, follow-up testing revealed that the laser group had smaller wounds than the sham group for both the treated and the untreated wounds ($P < .05$). No group x wound x time differences were detected for chromatic red or luminance.
CONCLUSIONS: The LLLT resulted in enhanced healing as measured by wound contraction. The untreated wounds in subjects treated with LLLT contracted more than the wounds in the sham group, so LLLT may produce an indirect healing effect on surrounding tissues. These data indicate that LLLT is an effective modality to facilitate wound contraction of partial-thickness wounds.