

Low Level Laser Therapy (LLLT) **AKA** **Low Power Laser (LPL), Cold Laser or PhotoMedicine (PM)**

Low Level Laser Therapy is nothing more than shining a high intensity light into the area of interest, it's just that this "light" is very intense, "monochromatic" (one wavelength), coherent (all the photons are in phase and synchronized) and is applied with a very specific dose in mind. It is painless, non-toxic, non-invasive, without drugs and very safe if applied by a trained practitioner.

In short, **LLLT reduces healing duration 30-40%** and the **injured tissues are stronger than if they had not been exposed to LLLT**. Listed below you'll find a brief synopsis of what LLLT is and for those wanting hard data, you'll find a number of research abstracts from PubMedline that document and prove the effectiveness of LLLT.

What is Laser Therapy?

Laser Therapy is the application of red and near infra-red light over injuries or lesions to improve wound / soft tissue healing and give relief for both acute and chronic pain. It is now officially referred to as (Low Level Laser Therapy) LLLT.

Laser Therapy is used to:

- **Increase the speed, quality and tensile strength of tissue repair**
- **Give pain relief**
- **Resolve inflammation**
- **An alternative to needles for acupuncture**

The red and near infrared light (600nm-1000nm) can be produced by laser or high intensity LED.

The intensity of LLLT lasers is not high like a surgical laser*. There is no heating effect.

The effect is photochemical (like photosynthesis in plants)

Red light aids the production of ATP thereby providing the cell with more energy which in turn means the cell is in optimum condition to play it's part in a natural healing process.

*LLLT devices are typically delivering 5mW -1000mW (0.2 -> 1.0 Watts).

How long are the treatments?

Treatments can vary in time from seconds to minutes depending on the condition. Research studies show that there may be a dose dependent response, so it may be more effective to treat at lower doses at multiple intervals then to treat a single time with a high dose.

Laser Therapy is Popularly Used For:

- * Pain Relief (muscles, joints, nerves)
- * Whiplash
- * Plantar fasciitis
- * Wound Healing
- * Trauma
- * Arthritis
- * Migraine headaches
- * Lower back pain
- * Repetitive Stress Injuries (RSI)
- * Carpal Tunnel Syndrome (CTS)
- * Tendonitis
- * Fibromyalgia / Myofascial Pain
- * Sprains and strains
- * Post-operative pain
- * Post-operative wounds
- * Knee, foot, ankle pain
- * Tennis Elbow
- * Golfer's Elbow
- * TMJ
- * Soft tissue injuries
- * Swelling
- * Burns
- * Pressure sores
- * Herpes simplex
- * Acne
- * Rotator Cuff Injury

How does LLLT work?

Like photosynthesis - the correct wavelengths and power of light at certain intensities for an appropriate period of time can increase ATP production and cell membrane perturbation could lead to permeability changes and second messenger activity resulting in functional changes such as increased syntheses increased secretion and motility changes. Red and near infrared light seem to be the most ideal wavelengths.

Red light and near infrared light acts on the mitochondria and at the cell membrane. In in-vitro and animal LLLT wound healing studies comparing wavelengths, red consistently is more effective. Shorter wavelengths are not as good and are more expensive to produce and have poor penetration; overall, they are a poor choice. Near infrared light, while not quite as good, do penetrate better than the red wavelengths and are available in higher powers and at low prices. According to live in-vivo experiments at Uniformed Services University Bethesda Maryland (a US military research centre) 810nm is the best penetrating wavelength. It also happens to work well in LLLT nerve regeneration studies they are doing.

Clinical Effects of LLLT

An appropriate dose of light can improve speed and quality of acute and chronic wound healing, soft tissue healing, pain relief improve the immune system and nerve regeneration. Applications with good RCT evidence include Venous Ulcers, Diabetic Ulcers, Osteoarthritis, tendonitis, Post Herpetic Neuralgia (PHN, shingles) & postoperative pain.

To paraphrase NASA research:

"Low-energy photon irradiation by light in the far-red to near-IR spectral range with low-energy (LLLT) lasers or LED arrays has been found to modulate various biological processes in cell culture and animal models. This phenomenon of photobiomodulation has been applied clinically in the treatment of soft tissue injuries and the acceleration of wound healing. The mechanism of photobiomodulation by red to near-IR light at the cellular level has been ascribed to the activation of mitochondrial respiratory chain components, resulting in initiation of a signaling cascade that promotes cellular proliferation and cytoprotection."

"A growing body of evidence suggests that cytochrome oxidase is a key photoacceptor of light in the far-red to near-IR spectral range. Cytochrome oxidase is an integral membrane protein that contains four redox active metal centers and has a strong absorbance in the far-red to near-IR spectral range detectable in vivo by near-IR spectroscopy."

"Moreover, 660–680 nm of irradiation has been shown to increase electron transfer in purified cytochrome oxidase, increase mitochondrial respiration and ATP synthesis in isolated mitochondria, and up-regulate cytochrome oxidase activity in cultured neuronal cells."

"LED photostimulation induces a cascade of signaling events initiated by the initial absorption of light by cytochrome oxidase. These signaling events may include the activation of immediate early genes, transcription factors, cytochrome oxidase subunit gene expression, and a host of other enzymes and pathways related to increased oxidative metabolism."

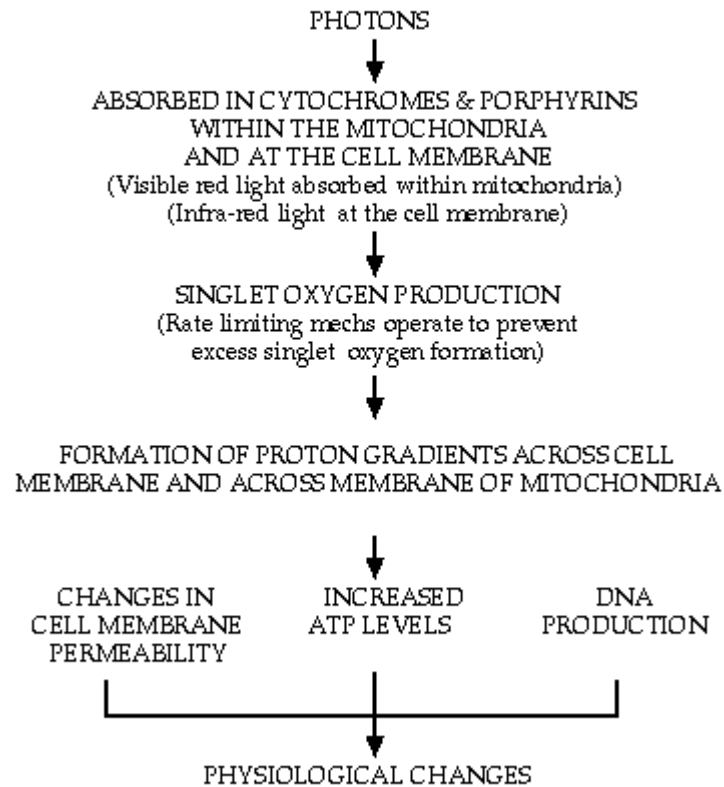
"In addition to increased oxidative metabolism, red to near-IR light stimulation of mitochondrial electron transfer is known to increase the generation of reactive oxygen species. These mitochondrially generated reactive oxygen species may function as signaling molecules to provide communication between mitochondria and the cytosol and nucleus."

Therapeutic photobiomodulation for methanol-induced retinal toxicity.

Proc Natl Acad Sci U S A. 2003 Mar 18; 100(6): 3439-44. Epub 2003 Mar 07.

HOW DOES IT WORK?

The effects of low energy, Red and Infra-Red light are photochemical (not thermal). It triggers normal cellular function.



RESEARCH ABSTRACTS

Neurol Res. 2002 Jun;24(4):355-60.

Transplantation of embryonal spinal cord nerve cells cultured on biodegradable microcarriers followed by low power laser irradiation for the treatment of traumatic paraplegia in rats.

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This pilot study examined the effects of composite implants of cultured embryonal nerve cells and laser irradiation on the regeneration and repair of the completely transected spinal cord. Embryonal spinal cord nerve cells dissociated from rat fetuses and cultured on biodegradable microcarriers and embedded in hyaluronic acid were implanted in the completely transected spinal cords of 24 adult rats. For 14 consecutive post-operative days, 15 rats underwent low power laser irradiation (780 nm, 250 mW), 30 min daily. Eleven of the 15 (73%) showed different degrees of active leg movements and gait performance, compared to 4 (44%) of the 9 rats with implantation alone. In a control group of seven rats with spinal cord transection and no transplantation or laser, six (86%) remained completely paralyzed. Three months after transection, implantation and laser irradiation, SSEPs were elicited in 69% of rats ($p = 0.0237$) compared to 37.5% in the nonirradiated group. The control group had no SSEPs response. Intensive axonal sprouting occurred in the group with implantation and laser. In the control group, the transected area contained proliferating fibroblasts and blood capillaries only. This suggests: 1. These in vitro composite implants are a regenerative and reparative source for reconstructing the transected spinal cord. 2. **Post-operative low power laser irradiation enhances axonal sprouting and spinal cord repair.**

PMID: 12069281 [PubMed - indexed for MEDLINE]

Photomed Laser Surg. 2004 Jun;22(3):199-204.

A histologic assessment of the influence of low-intensity laser therapy on wound healing in steroid-treated animals.

Pessoa ES, Melhado RM, Theodoro LH, Garcia VG.

Dental School of Marilia, University of Marilia, Marilia, SP, Brazil.

OBJECTIVE: The aim of the present study was to evaluate the effect of low-intensity laser therapy on the wound healing process treated with steroid. **BACKGROUND DATA:** Various biological effects have been associated with low-level laser therapy (LLLT). **MATERIALS AND METHODS:** Forty-eight rats were used, and after execution of a wound on the dorsal region of each animal, they were divided into 4 groups ($n = 12$), receiving the following treatments: G1 (control), wounds and animals received no treatment; G2, wounds were treated with LLLT; G3, animals received an intraperitoneal injection of steroid dosage (2 mg/kg of body weight); G4, animals received steroid and wounds were treated with LLLT. The laser emission device used was a GaAAs (904 nm), in a contact mode, with 2.75 mW gated with 2.900 Hz during 120 sec (33

J/cm²). After the period of 3, 7, and 14 days, the animals were sacrificed and the parts sent to histological processing and dyed using hematoxylin and eosin (HE) and Masson trichromium (MT) techniques. RESULTS: The results have shown that the wounds treated with steroid had a delay in healing, while LLLT accelerated the wound healing process. Also, wounds treated with laser in the animals treated with steroid presented a differentiated healing process with a larger collagen deposition and also a decrease in both the inflammatory infiltrated and the delay on the wound healing process. CONCLUSION: **LLLT accelerated healing, caused by the steroid, acting as a biostimulative coadjuvant agent, balancing the undesirable effects of cortisone on the tissue healing process.**

PMID: 15315726 [PubMed - in process]

Lasers Surg Med. 2004;34(3):285-9.

Comparison of single and multiple applications of GaAlAs laser on rat medial collateral ligament repair.

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BACKGROUND AND OBJECTIVES: To examine single versus multiple applications of the gallium aluminum arsenide (GaAlAs) laser on the healing of surgically injured medial collateral ligaments (MCLs) in rats. **STUDY DESIGN/MATERIALS AND METHODS:** Sixteen rats were studied, with 12 receiving surgical transection to their right MCL and 4 receiving a sham injury. Group 1 (n = 4) received a single dose of GaAlAs laser therapy (wavelength 660 nm, average power 8.8 mW, pulse 10 kHz, dosage 31.6 J/cm²) directly to their MCL during surgery. Group 2 (n = 4) received 9 doses of GaAlAs laser therapy applied transcutaneously on alternate days (wavelength 660 nm, average power 8.8 mW, pulse 10 kHz, dosage 3.5 J/cm²). The controls (Group 3, n = 4) received one session of placebo laser at the time of surgery, with the laser equipment shut down, while the sham injured Group 4 (n = 4) received no treatment. Biomechanical tests for structural stiffness, ultimate tensile strength (UTS), and load-relaxation were done at 3 weeks after injury. The stiffness and UTS data were normalized by expressing as a percentage of the left side of each animal before statistical analysis. **RESULTS:** The load-relaxation data did not show any differences between the groups (P = 0.18). The normalized stiffness levels of Groups 2 (81.08±11.28%) and 4 (92.66±13.19%) were significantly higher (P = 0.025) than that of the control Group 3 (58.99±15.91%). The normalized UTS of Groups 2 (81.38±5.68%) and 4 (90.18±8.82%) were also significantly higher (P = 0.012) than that of the control (64.49±9.26%). Although, Group 1 had higher mean stiffness and UTS values than the control, no statistically significant difference was found between these two groups. **CONCLUSIONS:** **Multiple laser therapy improves the normalized strength and stiffness of repairing rat MCLs at 3 weeks after injury. The multiple treatments seem to be superior to a single treatment when the cumulative dosages are comparable between the two modes of application.** Copyright 2004 Wiley-Liss, Inc.

Low-level laser irradiation attenuates production of reactive oxygen species by human neutrophils.

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OBJECTIVE: The aim of this study was to examine the effects of low-level laser therapy (LLLT) on production of reactive oxygen (ROS) species by human neutrophils. **BACKGROUND DATA:** LLLT is an effective therapeutic modality for inflammatory conditions. **MATERIALS AND METHODS:** The laser device used was the infrared diode laser (GaAlAs), 830-nm continuous wave (150 mW/cm²). After irradiation, ROS production by neutrophils was measured using luminol-dependent chemiluminescence (LmCL) and expression of CD11b and CD16 on neutrophil surface was measured by flow cytometry. **RESULTS:** The LmCL response of neutrophils was reduced by laser irradiation at 60 min prior to the stimulation with opsonized zymosan and calcium ionophore. The attenuating effect of LLLT was larger in neutrophils of smokers than non-smokers, while the amount of produced ROS was larger in neutrophils of smokers. Expression of CD11b and CD16 on neutrophil surface was not affected by LLLT. **CONCLUSION: Attenuation of ROS production by neutrophils may play a role in the effects of LLLT in the treatment of inflammatory tissues. There is a possible usage of LLLT to improve wound healing in smokers.**

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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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.**

Publication Types:
Clinical Trial
Randomized Controlled Trial

Eur J Haematol. 2004 Mar;72(3):222-4.

Successful treatment of oral lesions of chronic lichenoid graft-vs.-host disease by the addition of low-level laser therapy to systemic immunosuppression.

Chor A, de Azevedo AM, Maiolino A, Nucci M.

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We report a case of severe oral stomatitis caused by lichenoid chronic graft-vs.-host disease in which low-level laser therapy applied to the oral mucosa, in addition to standard systemic immunosuppressive treatment, **resulted in quick healing and symptomatic relief.**

Publication Types:
Case Reports

Clin Oral Implants Res. 2004 Jun;15(3):325-32.

Low-level laser therapy stimulates bone-implant interaction: an experimental study in rabbits.

Khadra M, Ronold HJ, Lyngstadaas SP, Ellingsen JE, Haanaes HR.

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The aim of the present study was to investigate the effect of low-level laser therapy (LLLT) with a gallium-aluminium-arsenide (GaAlAs) diode laser device on titanium implant healing and attachment in bone. This study was performed as an animal trial of 8 weeks duration with a blinded, placebo-controlled design. Two coin-shaped titanium implants with a diameter of 6.25 mm and a height of 1.95 mm were implanted into cortical bone in each proximal tibia of twelve New Zealand white female rabbits (n=48). The animals were randomly divided into irradiated and control groups. The LLLT was used immediately after surgery and carried out daily for 10 consecutive days. The animals were killed after 8 weeks of healing. The mechanical strength of the attachment between the bone and 44 titanium implants was evaluated using a tensile pullout test. Histomorphometrical analysis of the four implants left in place from four rabbits was then performed. Energy-dispersive X-ray microanalysis was applied for analyses of calcium and phosphorus on the implant test surface after the tensile test. The mean tensile forces, measured in Newton, of the irradiated implants and controls were 14.35 (SD+/-4.98) and 10.27 (SD+/-4.38), respectively, suggesting a gain in functional attachment at 8 weeks following LLLT (P=0.013). The histomorphometrical evaluation

suggested that the irradiated group had more bone-to-implant contact than the controls. The weight percentages of calcium and phosphorus were significantly higher in the irradiated group when compared to the controls ($P=0.037$) and ($P=0.034$), respectively, suggesting that bone maturation processed faster in irradiated bone. **These findings suggest that LLLT might have a favorable effect on healing and attachment of titanium implants.**

J Clin Laser Med Surg. 1999 Feb;17(1):29-33.

Low power laser therapy and analgesic action.

Tam G.

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 prostaglandin (PG) synthesis, increasing the change of PGG₂ and PGH₂ into PG₁₂ (also called prostacyclin, or epoprostenol). The last is the main product of the arachidonic acid into the endothelial cells and into the smooth muscular cells of vessel walls, that have a vasodilating and anti-inflammatory action. **METHODS:** Treatment was performed on 372 patients (206 women and 166 men) during the period between May 1987 and January 1997. The patients, whose ages ranged from 25 to 70 years, with a mean age of 45 years, suffered from rheumatic, degenerative, and traumatic pathologies as well as cutaneous ulcers. The majority of patients had been seen by orthopedists and rheumatologists and had undergone x-ray examination. All patients had received drug-based treatment and/or physiotherapy with poor results; 5 patients had also been irradiated with He:Ne and CO₂ lasers. Two-thirds were experiencing acute symptomatic pain, while the others suffered long-term pathology with recurrent crises. We used a pulsed diode laser, GaAs 904 nm wavelength once per day for 5 consecutive days, followed by a 2-day interval. The average number of applications was 12. We irradiated the trigger points, access points to the joint, and striated muscles adjacent to relevant nerve roots. **RESULTS:** We achieved very good results, especially in cases of symptomatic osteoarthritis of the cervical vertebrae, sport-related injuries, epicondylitis, and cutaneous ulcers, and 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 these patient, ultimately postponing the need for surgery.**

Publication Types:

Case Reports

Clin Rheumatol. 2001;20(3):181-4.

The clinical efficacy of low-power laser therapy on pain and function in cervical osteoarthritis.

Ozdemir F, Birtane M, Kokino S.

Department of Physical Therapy and Rehabilitation, Medical Faculty of Trakya University, Edirne, Turkey.

Pain is a major symptom in cervical osteoarthritis (COA). Low-power laser (LPL) therapy has been claimed to reduce pain in musculoskeletal pathologies, but there have been concerns about this

point. The aim of this study was to evaluate the analgesic efficacy of LPL therapy and related functional changes in COA. Sixty patients between 20 and 65 years of age with clinically and radiologically diagnosed COA were included in the study. They were randomised into two equal groups according to the therapies applied, either with LPL or placebo laser. Patients in each group were investigated blindly in terms of pain and pain-related physical findings, such as increased paravertebral muscle spasm, loss of lordosis and range of neck motion restriction before and after therapy. Functional improvements were also evaluated. **Pain, paravertebral muscle spasm, lordosis angle, the range of neck motion and function were observed to improve significantly in the LPL group, but no improvement was found in the placebo group. LPL seems to be successful in relieving pain and improving function in osteoarthritic diseases.**

Publication Types:
Clinical Trial
Randomized Controlled Trial

J Clin Laser Med Surg. 1997;15(5):217-20.

Laser therapy for fibromyositic rheumatisms.

Longo L, Simunovic Z, Postiglione M, Postiglione M.

Institute for Laser Medicine, Florence, Italy.

BACKGROUND AND OBJECTIVES: The objectives of this study is to treat the cases of fibromyositic rheumatisms untreatable with other therapies. The authors chose defocalized laser beams because some experimental studies had showed their analgesic and anti-phlogistic effects on experimental phlogosis. Since 1980 non-surgical laser effects were often noncomparable because of the lack of common treatment protocols. This summarizes fifteen years of clinical observations as to the purpose of identifying some indications on laser treatment of defined pathologies included in fibromyositic rheumatism. **STUDY DESIGN/MATERIALS AND METHODS:** 846 patients with different types of fibromyositic rheumatisms were submitted to defocalized laser therapy from 1980 to 1995. Criteria for selection included age, sex, and pathological pictures. Control groups were used to compare results with those of traditional methods. Diodes and CO2 lasers were employed, to exploit the photothermic and photochemical effects of the laser radiations to the fullest extent. **RESULTS:** On the whole, results were positive in comparison with other methods both as regards recovery time and persistence of results. Results were evaluated on the basis of subjective (such as local pain) and objective (hypomotility, phlogosis) criteria. **CONCLUSIONS: Results obtained (approximately 2/3 of the patients benefited from the treatment) indicate that there are greater advantages in use of laser over other presently available methods.** Standardalization of treatment protocols deserves further studies.

[The prevention of inflammatory complications in mandibular fractures by using infrared laser and magnetic-laser radiation]

[Article in Russian]

Makarenkov VV, Shargorodskii AG.

A total of 102 patients with mandibular fractures were treated by multiple-modality treatment including infrared (IR) laser exposure and magnetic and laser therapy (MT). For monitoring the treatment efficacy and predicting its results, nonspecific defense factors and intensity of free-radical oxidation (FRO) in the saliva were assessed. **IR laser and MT by the Ulei-2K device stimulated local defense factors, decreased the intensity of salivary FRO, and thus promoted the healing of mandibular fractures.**

1: J Clin Laser Med Surg. 2001 Dec;19(6):305-14.

Effect of NASA light-emitting diode irradiation on wound healing.

Whelan HT, Smits RL Jr, Buchman EV, Whelan NT, Turner SG, Margolis DA, Cevenini V, Stinson H, Ignatius R, Martin T, Cwiklinski J, Philippi AF, Graf WR, Hodgson B, Gould L, Kane M, Chen G, Caviness J.

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OBJECTIVE: The purpose of this study was to assess the effects of hyperbaric oxygen (HBO) and near-infrared light therapy on wound healing. **BACKGROUND DATA:** Light-emitting diodes (LED), originally developed for NASA plant growth experiments in space show promise for delivering light deep into tissues of the body to promote wound healing and human tissue growth. In this paper, we review and present our new data of LED treatment on cells grown in culture, on ischemic and diabetic wounds in rat models, and on acute and chronic wounds in humans. **MATERIALS AND METHODS:** In vitro and in vivo (animal and human) studies utilized a variety of LED wavelength, power intensity, and energy density parameters to begin to identify conditions for each biological tissue that are optimal for biostimulation. **Results:** LED produced in vitro increases of cell growth of 140-200% in mouse-derived fibroblasts, rat-derived osteoblasts, and rat-derived skeletal muscle cells, and increases in growth of 155-171% of normal human epithelial cells. Wound size decreased up to 36% in conjunction with HBO in ischemic rat models. LED produced improvement of greater than 40% in musculoskeletal training injuries in Navy SEAL team members, and decreased wound healing time in crew members aboard a U.S. Naval submarine. LED produced a 47% reduction in pain of children suffering from oral mucositis. **CONCLUSION:** **We believe that the use of NASA LED for light therapy alone, and in conjunction with hyperbaric oxygen, will greatly enhance the natural wound healing process, and more quickly return the patient to a preinjury/illness level of activity. This work is supported and managed through the NASA Marshall Space Flight Center-SBIR Program.**

Publication Types:

Review

Review, Tutorial

In Vivo. 2004 Jul-Aug;18(4):489-95.

Effect of Ga-as laser on the regeneration of injured sciatic nerves in the rat.

Bae CS, Lim SC, Kim KY, Song CH, Pak S, Kim SG, Jang CH.

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Laser irradiation is one of the therapeutic methods for the recovery of degenerated peripheral nerves. The aim of the present study was to determine if low-power laser treatment stimulates the regeneration process of damaged nerves. A standardized crush to the sciatic nerve was applied to cause extensive axonal degeneration. After this procedure, low-power infrared laser irradiation was administered transcutaneously to the injured sciatic nerve, 3 minutes daily to each of four treatment groups for 1, 3, 5 and 7 weeks, respectively. A nerve conduction study was done, and a morphological assessment was performed using both light and electron microscopy. With trauma of the nerve, both amplitude of compound motor action potential and nerve conduction velocity decreased significantly compared to the pre-trauma state. Morphologically, the numbers of myelinated axons and degenerated axons were decreased and increased, respectively, compared with the control. Typical aspects were of onion skin-type lamellation, fragmentation, edematous swelling and rarefaction in the myelin sheath. **All these parameters recovered almost to the level of the pre-trauma state with laser irradiation, in direct proportion to the time spent for treatment. These results suggest that low-power infrared laser irradiation can relieve the mechanical damage of sciatic nerves and stimulate the regeneration of peripheral nerves.**

Vopr Kurortol Fizioter Lech Fiz Kult. 2002 Jul-Aug;(4):25-7.

[Laser therapy and electric stimulation in rehabilitation treatment of peripheral neuropathy]

[Article in Russian]

Miriutova NF, Abdulkina NG, Luksha LV, Levitskii EF.

73 patients with compression-ischemic myeloradiculopathy received treatment including infrared laser radiation on the paravertebral fields, motor points of the affected nerves and biologically active points Y63, Y67, YB34, YB42, YB43, E34, E42 (1.0-5.0 mW/cm²; 5 and 5000 Hz), electrostimulation of motor nerve points and innervated by them muscles by double square impulses with a fixed gap 5 ms. **Impulse infrared laser therapy relieves pain syndrome, stimulates repair processes in the affected nerve structures. Further modified electric stimulation activates a regenerative growth of the nerve fibers, reinnervation of the limb muscles.**

Carpal tunnel syndrome pain treated with low-level laser and microamperes transcutaneous electric nerve stimulation: A controlled study.

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OBJECTIVE: To investigate whether real or sham low-level laser therapy (LLLT) plus microamperes transcutaneous electric nerve stimulation (TENS) applied to acupuncture points significantly reduces pain in carpal tunnel syndrome (CTS). **DESIGN:** Randomized, double-blind, placebo-control, crossover trial. Patients and staff administered outcome measures blinded. **SETTING:** Outpatient, university-affiliated Department of Veterans Affairs medical center. **PARTICIPANTS:** Eleven mild to moderate CTS cases (nerve conduction study, clinical examination) who failed standard medical or surgical treatment for 3 to 30 months. **INTERVENTION:** Patients received real and sham treatment series (each for 3-4wk), in a randomized order. Real treatments used red-beam laser (continuous wave, 15mW, 632.8nm) on shallow acupuncture points on the affected hand, infrared laser (pulsed, 9.4W, 904nm) on deeper points on upper extremity and cervical paraspinal areas, and microamps TENS on the affected wrist. Devices were painless, noninvasive, and produced no sensation whether they were real or sham. The hand was treated behind a hanging black curtain without the patient knowing if devices were on (real) or off (sham). **MAIN OUTCOME MEASURES:** McGill Pain Questionnaire (MPQ) score, sensory and motor latencies, and Phalen and Tinel signs. **RESULTS:** Significant decreases in MPQ score, median nerve sensory latency, and Phalen and Tinel signs after the real treatment series but not after the sham treatment series. Patients could perform their previous work (computer typist, handyman) and were stable for 1 to 3 years. **CONCLUSIONS:** **This new, conservative treatment was effective in treating CTS pain; larger studies are recommended.** Copyright 2002 by the American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation

Carpal tunnel syndrome: clinical outcome after low-level laser acupuncture, microamps transcutaneous electrical nerve stimulation, and other alternative therapies--an open protocol study.

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OBJECTIVE: Outcome for carpal tunnel syndrome (CTS) patients (who previously failed standard medical/surgical treatments) treated primarily with a painless, noninvasive technique utilizing red-beam, low-level laser acupuncture and microamps transcutaneous electrical nerve stimulation (TENS) on the affected hand; secondarily, with other alternative therapies. **DESIGN:** Open treatment protocol, patients diagnosed with CTS by their physicians. **SETTING:** Treatments performed by licensed acupuncturist in a private practice office. **SUBJECTS:** Total of 36 hands (from 22 women, 9 men), ages 24-84 years, median pain duration, 24 months. Fourteen hands failed

1-2 surgical release procedures. INTERVENTION/TREATMENT: Primary treatment: red-beam, 670 nm, continuous wave, 5 mW, diode laser pointer (1-7 J per point), and microamps TENS (< 900 microA) on affected hands. Secondary treatment: infrared low-level laser (904 nm, pulsed, 10 W) and/or needle acupuncture on deeper acupuncture points; Chinese herbal medicine formulas and supplements, on case-by-case basis. Three treatments per week, 4-5 weeks. OUTCOME MEASURES: Pre- and posttreatment Melzack pain scores; profession and employment status recorded. RESULTS: Posttreatment, pain significantly reduced ($p < .0001$), and 33 of 36 hands (91.6%) no pain, or pain reduced by more than 50%. The 14 hands that failed surgical release, successfully treated. Patients remained employed, if not retired. Follow-up after 1-2 years with cases less than age 60, only 2 of 23 hands (8.3%) pain returned, but successfully re-treated within a few weeks. CONCLUSIONS: **Possible mechanisms for effectiveness include increased adenosine triphosphate (ATP) on cellular level, decreased inflammation, temporary increase in serotonin. There are potential cost-savings with this treatment (current estimated cost per case, \$12,000; this treatment, \$1,000). Safe when applied by licensed acupuncturist trained in laser acupuncture; supplemental home treatments may be performed by patient under supervision of acupuncturist.**

Vopr Kurortol Fizioter Lech Fiz Kult. 1995 Sep-Oct;(5):10-3.

[The action of low-intensity infrared laser radiation on skin afferents]

[Article in Russian]

Ponomarenko GN, Enin LD.

Laser radiation modulates functional characteristics of mechanoreceptors. This inhibits impulse activity of the nerve endings from pain focus and reduces pain sensitivity of skin afferents, excitability of conductive nerve fibers. Changes in sensitivity become more pronounced with increasing duration of the exposure. By means of reflectory mechanism laser radiation may cause other general reactions of the body and enhance immune response of the skin.