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Musculoskeletal Pain Syndromes (Chronic and Acute)

Low Level Light Therapy (LLLT) has been shown to be effective in a variety of musculoskeletal conditions and associated pain presentations .

In Rheumatoid Arthritis, LLLT can benefit not only the pain of acute small joint inflammation but also the chronic pain . In a review article on rheumatology (3), some 18 papers were considered. All studies involved double-blind trials with LLLT in chronic rheumatoid, and reported significant improvement in pain (80% success rate in relieving pain). Upon comparing LLLT to a similar rate of pain attenuation using anti-inflammatory drugs (NSAIDs), the LLLT was free of any side-effects while 20% of patients treated with NSAIDs suffered unacceptable side-effects of medication . In another study of 170 patients with rheumatoid arthritis using LLLT (4), pain attenuation of up to 90% was noted.

Trellis et al (6) used LLLT for osteoarthritis of the knee in 40 patients. He reported a significant reduction of 82% of the patients with improved joint mobility. Among 36 randomized patients, with pain caused by cervical osteoarthritis, those who received Infra-Red and Low Level Laser treatment improved 75% compared with the group receiving mock treatment (31%) . Similarly, a study of 60 patients with Cervical Osteoarthritis, Low Pulsed Laser was successful in relieving pain and in improving function .

The results of a study show that cervical myofascial pain is significantly improved at 3-month with Diode laser. A similar successful LLLT treatment has been described for whiplash injuries.

In a randomized study with 30 patients with supraspinatus or bicipital tendonitis, the results demonstrated the effectiveness of laser therapy in tendonitis of the shoulder . Another study with a patient population (n = 324), with either medial epicondylitis (Golfer's elbow; n = 50) or lateral epicondylitis (Tennis elbow; n = 274), and randomly allocated , provides further evidence of the efficacy of LLLT in the management of lateral and medial epicondylitis .

Treatment with low-level laser therapy (LLLT) was shown effective in treating Carpal Tunnel Syndrome pain . Another study, significant decreases in McGill Pain Questionnaire scores, median nerve sensory latency, and Phalen and Tinel signs were observed after treatment series with Low Level Laser Therapy. Patients could perform their previous work (computer typist, handyman) and were stable for 1 to 3 years .

In acute trauma there is a soft tissue injury comprising swelling, haematoma, pain and reduced mobility. Sporting injuries and domestic accidents usually involve damage to muscles, joint ligaments and tenclass. In the absence of bone fracture or other injury demanding priority treatment, LLLT should be instituted at the earliest opportunity. Kumar reported a comparative study in 50 patients with inversion injuries of the ankle. He found

that compared to conventional physiotherapy, the LLLT treated patients showed a more rapid resolution of symptoms and an earlier return to full weight-bearing.

Fibromyalgia (FM) is characterized by widespread pain in the body, associated with particular tender points. It is often accompanied by disturbed sleep patterns, fatigue, headaches, irritable bowel and bladder syndrome, morning stiffness, anxiety and depression. FM can cause a high level of functional disability and have a significantly negative effect on quality of life. One study suggests that "Laser Therapy is effective on pain, muscle spasm, morning stiffness, fatigue, depression and total tender point number in Fibromyalgia".

A randomized controlled study with 63 with non-radiating low back pain showed that LLLT significantly improved pain and function.

In summary, the bulk of published work to date supports the use of LLLT for treatment of a variety of musculoskeletal conditions and associated pain. Moreover, the LLLT proved to be not only more effective than conventional methods, but more economical as well. The added advantage of absence of side effects, non-invasive nature of therapy and the ease of application, ensures good patient acceptance of the treatment modality.

Low Level Laser Therapy for Head, Neck and Facial Pain

Prof P.F. Bradley: The clinical application of low incident power density laser radiation for the treatment of acute and chronic pain is now a well established procedure. This paper reviews the currently available English speaking literature and summarises a selection of serious scientific papers which report a beneficial effect following the treatment of a wide variety of acute and chronic syndromes whose main presenting symptom is pain.

Head and Neck Clinical Applications of LLLT

LLLT is proving useful in a wide variety of painful conditions in the Head and Neck but the following are particular applications:

1. TM Joint Pain Dysfunction
2. Post Herpetic Neuralgia
3. Trigeminal Neuralgia
4. Painful Ulcerative Conditions
5. Pain of Advanced Oro Facial Cancer

The Ability of Low Level Laser Therapy (LLLT) to Mitigate Fibromyalgic Pain.

The CFIDS Chronicle Physicians' Forum Fall 1993. Douglas Ashendorf, MD, FAAPMR Newark, New Jersey

Results have suggested that the pain relieving properties of LLLT have been the most consistent benefit. The duration of benefit has varied from one hour to one week, and seems to increase as treatment progresses.

Other areas of improvement were not as clear. Improvement in sleep was observed with some regularity although this was undoubtedly due in part to decreased pain. The "non-restorative" sleep complaints were less regularly improved. Improvement with regard to abnormal sensations in the limbs (paresthesia and subjective swelling) appears to be fairly consistent. Improvements in fatigue, mood and headache.

Although the pilot study is incomplete, I believe that these early findings warrant the further investigation of laser therapy for patients with fibromyalgia. This is further supported by the relatively few and harmless side effects of this therapy, the fact that equipment and operating costs are reasonable, and the reality that there are few effective alternative treatments for fibromyalgia patients.

Carpal Tunnel Study Results Released

Laser Focus World: A physician at UMDNJ-Robert Wood Johnson Medical School is evaluating a "cold" laser to treat patients with carpal tunnel syndrome, a debilitating nerve condition that causes severe pain and numbness in the hand.

Clinical results of a double-blind study of 11 patients afflicted with carpal tunnel syndrome who were treated with a diode-laser device manufactured by Lasermedics (Missouri City, TX) showed that after six to 15 treatments, nine of the 11 patients experienced relief of pain and other associated symptoms as well as normalization of abnormal latencies.

The study was conducted by Michael L. Weintraub, a neurologist from Briarcliff, NY, and reported in the February 1996 issue of Neurology.

The patients all used a 30mW 830nm, a hand-held, battery-operated, nonsurgical laser device that employs the process of photo-biostimulation.

Dr. Weintraub concluded that the results of his study support the efficacy and safety of laser-light treatment in carpal tunnel syndrome.

Physiotherapist Shows Lasers Relieve Pain

A physiotherapist at Royal Brisbane Hospital (Australia) recently received a PhD from the University of Queensland for demonstrating that laser treatment prompts the release of endorphins into the bloodstream. Endorphins are a type of natural morphine that dulls pain. Physiotherapist Liisa Laakso studied the effects of lasers on 56 people who suffered myofascial pain syndrome, a chronic hypersensitivity often secondary to a person's

primary painful affliction, such as arthritis. Previous experiments linking endorphin release and lasers have only been done on rats.

In the study, Laakso applied different doses and wavelengths of a laser diode to "trigger points" on the body and took blood samples measuring endorphin levels in these subjects and a control group. The control group reported some pain relief - most likely a placebo effect - but endorphins were present. Those patients that underwent laser treatment reported pain reduction of up to 78%, and endorphins were present in their blood.

The effect of infra-red laser irradiation on the duration and severity of postoperative pain: a double blind trial.

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This trial was designed to test the hypothesis that LLLT reduces the extent and duration of post-operative pain. Twenty consecutive patients for elective cholecystectomy were randomly allocated for either LLLT or as controls. The trial was double blind. Patients for LLLT received 6-8-min treatment (GaAlAs: 830 nm: 60 mW CW: CM) to the wound area immediately following skin closure prior to emergence from GA. All patients were prescribed on demand post-operative analgesia (IM or oral according to pain severity). Recordings of pain scores (0-10) and analgesic requirements were noted by an independent assessor. There was a significant difference in the number of doses of narcotic analgesic (IM) required between the two groups.

Controls n = 5.5; LLLT n = 2.5. No patient in the LLLT group required IM analgesia after 24 h. Similarly the requirement for oral analgesia was reduced in the LLLT group.

Controls n = 9; LLLT n = 4. Control patients assessed their overall pain as moderate to severe compared with mild to moderate in the LLLT group.

Efficacy of laser irradiation on the area near the stellate ganglion is dose-dependent: double-blind crossover placebo-controlled study.

Toshikazu Hashimoto, Osamu Kemmotsu, Hiroshi Otsuka, Rie Numazawa, and Yoshihiro Ohta, Department of Anaesthesia, Hokkaido University Hospital, Sapporo, Japan.

In the present study we evaluate the effects of laser irradiation on the area near the

stellate ganglion on regional skin temperature and pain intensity in patients with postherpetic neuralgia. A double blind, crossover and placebo-controlled study was designed to deny the placebo effect of laser irradiation.

Eight inpatients (male 6, female 2) receiving laser therapy for pain attenuation were enrolled in the study after institutional approval and informed consent. Each patient received three sessions of treatment on a separate day in a randomised fashion. Three minutes irradiation with a 150 mW laser (session 1), 3 minutes irradiation with a 60 mW laser (session 2), and 3 minutes placebo treatment without laser irradiation. Neither the patient nor the therapist was aware which session type was being applied until the end of the study. Regional skin temperature was evaluated by thermography of the forehead, and pain intensity was recorded using a visual analogue scale (VAS). Measurements were performed before treatment, immediately after (0 minutes) then 5, 10, 15, and 30 min after treatment. Regional skin temperature increased following both 150 mW and 60mW laser irradiation, whereas no changes were obtained by placebo treatment. VAS decreased following both 150 mW and 60 mW laser treatments, but no changes in

VAS were obtained by placebo treatment. These changes in the temperature and VAS were further dependent on the energy density, i.e. the dose.

Results demonstrate that laser irradiation near the stellate ganglion produces effects similar to stellate ganglion block. Our results clearly indicate that they are not placebo effects but true effects of laser irradiation.

Successful management of female office workers with "repetitive stress injury" or "carpal tunnel syndrome" by a new treatment modality- application of low level lasers for pain.

E. Wong G LEE J. Zu CHERMAN and D. P. MASON

Western Heart Institute and St. Mary's Spine Center St. Mary's Medical Center. San Francisco. CA. USA and Head and Neck Pain Center, Honolulu HL. USA

Female office workers with desk jobs who are incapacitated by pain and tingling in the hands and fingers are often diagnosed by physicians as "repetitive stress injury" (RSI) or "carpal tunnel syndrome" (CTS). These patients usually have poor posture with their head and neck stooped forward and shoulders rounded; upon palpation. they have pain and tenderness at the spinous processes C5 - T1 and the medial angle of the scapula. In 35 such patients we focused the treatment primarily at the posterior neck area and not the wrists and hands. A low level laser (100 mW) was used and directed at the tips of the spinous processes C5 - T1.

The laser rapidly alleviated the pain and tingling in the arms, hands and fingers, and diminished tenderness at the involved spinous processes. Thereby, it has become apparent that many patients labelled as having RSI or CTS have predominantly cervical radicular dysfunction resulting in pain to the upper extremities which can be managed by low level laser.

Successful long-term management involves treating the soft tissue lesions in the neck combined with correcting the abnormal head, neck and shoulder posture by taping, cervical collars, and clavicle harnesses as well as improved work ergonomics.

Physiological responses in chronic pain patients

Scott D. Fender and David Diffie / Pain Research Group, Arvada, Colorado, U.S.A.

Use of Low Reactive Level Laser Therapy (LLLT) utilising helium-neon lasers has increased lately especially in pain control. New protocols are being developed aimed at a complex of primary and secondary symptomologies. One of these protocols Stellate Ganglion Stimulation has shown in our research a unique set of developments. Targeting the area of the stellate ganglion is showing great promise in the rehabilitation of patients with a history of chronic musculoskeletal pain syndromes, but several patients with pre-existing psychological symptomology have exacerbated during the initial stages of utilization of this protocol.

Patients with a history of psychological diagnosis for dysthymia, anxiety, post traumatic stress disorder or minor diffuse brain injury have shown an exacerbation of these symptomologies during the initial phases of stimulation treatment. Overall, response to this form of therapy seems to be positive but some patients require dermatomal and/or site-specific therapy to maximize outcome. With specific psychological treatment combined with a more conservative amount of stimulation initially the increase in these symptoms shows a tendency to remit with the pain response. Our continued research is currently focusing on the mechanisms for this type of response as well as protocol refinement to maximize its effectiveness.

Low reactive-level laser therapy in the treatment of neurogenic facial pain

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Neurogenic facial pain has been one of the more difficult conditions to treat, but the introduction of laser therapy now permits a residual group of patients hitherto untreatable to achieve a life free from or with less pain. The present investigation was designed as a double-blind, placebo controlled study to determine whether low reactive-level laser

therapy (LLLT) is effective for the treatment of trigeminal neuralgia. Two groups of patients (14 and 16) were treated with two probes. Neither the patients nor the dental surgeon were aware of which was the laser probe until the investigation had been completed. Each patient was treated weekly for five weeks.

The results demonstrate that of 16 patients treated with the laser probe, 10 were free from pain after completing treatment and 2 had noticeably less pain, while in 4 there was little or no change. After a one year follow-up, 6 patients were still entirely free from pain. In the group treated with the placebo system, i.e. the non-laser probe, one was free from pain, 4 had less pain, and the remaining 9 patients had little or no recovery. After one year only one patient was still completely free from pain. The use of analgesics was recorded and the figures confirmed the fact that LLLT is effective in the treatment of trigeminal neuralgia. It is concluded that the present study clearly shows that LLLT treatment, given as described, is an effective method and an excellent supplement to conventional therapies used in the treatment of trigeminal neuralgia.

Mechanistic approach to GaAIs diode laser effects on production of reactive oxygen species from human neutrophils as a model for therapeutic modality at cellular level.

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*Department of Hygiene, Hirosaki University School of Medicine. Hirosaki; '-Shioto Clinic Coshogawara, Aomori; Department of Industrial Health. The Institute of Public Health, Tokyo. Japan.

There have been many reports on the applications of low reactive level laser (LLL) therapy for pain attenuation or pain removal. Our group has reported previously on the effects of in vitro irradiation of LLLT particularly on the phagocytic activity of human Neutrophils, using luminol-dependent chemiluminescence (LmCL) for measurement of reactive oxygen species (ROS) production from human Neutrophils. However, the mechanisms of the attenuation of phagocytic activity of NEUTROPHILS by LLL irradiation is not yet full understood.

In this study, we used luminol-dependent and lucigenin-dependent chemiluminescence (LgCL) for detection of affected ROS producing process of human Neutrophils by LLL irradiation. Two soluble action stimuli, N-formyl-Met-Leu-Phe (fMLP) and phorbol myristate acetate (PMA) were used to avoid the possible influence of lag-time from recognition to uptake of particles at the ROS production.

In case of using fMLP as a stimulus, the maximum luminescence intensity of LULL was increased but LgCL luminescence was decreased by LLL irradiation. When PMA was used

as a stimulus, the times to reach the maximum luminescence intensity of LmCL and LgCL were shortened by LLL irradiation, but there was no effect on the maximum luminescence intensity of both.

These results suggest that LLL irradiation enhances the ROS production activity of human Neutrophils by the activation of the superoxide converting system, the active element in which is mainly myeloperoxidase. LLL irradiation enabled a more rapid activation of the superoxide production system, NADPH -oxidase.

Pain scores and side effects in response to low level laser therapy (LLLT) for physical trigger points.

E Liisa Laakso Carolyn Richardson, and Tess Cramond

1: Physiotherapy Department, Royal Brisbane Hospital, Brisbane; 2: Physiotherapy Department, University of Queensland, Brisbane; and 3: Pain Clinic, Royal Brisbane Hospital, Brisbane, Queensland, Australia.

Clinically, Low Level Laser Therapy - LLLT has been used successfully in the treatment of chronic pain but many have questioned the scientific basis for its use. Many studies have been poorly designed or poorly controlled.

A double-blind, placebo-controlled, random allocation study was designed to analyse the effect of second daily infrared (IR) laser (820 nm, 25 mW) and visible red laser (670 nm, 10 mW) at 1 J/cm² and 5 J/cm² on chronic pain. Forty-one consenting subjects with chronic pain conditions exhibiting myofascial trigger points in the neck and upper trunk region underwent five treatment sessions over a two week period. To assess progress, pain scores were measured using visual analogue scales before and after each treatment. The incidence of side effects was recorded.

All groups demonstrated significant reductions in pain over the duration of the study with those groups which received infrared (820 nm) laser at 1 J/cm² and 5 J/cm² demonstrating the most significant effects ($p < 0.001$). Only those subjects who had active laser treatment experienced side effects.

Results indicated that responses to LLLT at the parameters used in this study are subject to placebo and may be dependant on power output, dose and/or wavelength.

Low level laser therapy of tendinitis and myofascial pains a randomized, double-blind, controlled study.

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1: Akersberga Health Care Centre,

2: Danderyd University Hospital, Danderyd, and

3: Vaxholm Health Care Centre, Stockholm, Sweden.

The purpose of this randomised, double-blind study was to examine the effect of GaAs laser therapy for tendonitis and myofascial pain in a sample from the general population of Akersberga in the northern part of Greater Stockholm.

176 patients (of an original group of 200) completed the scheduled course of treatment. The patients were assigned randomly to either a laser group (92 patients, of whom 74 had tendonitis, completed the study) or a placebo group (84 patients, of whom 68 had tendonitis, completed the study). All 176 patients received six treatments during a period of 3-4 weeks. Their pain was estimated objectively using a pain threshold meter, and subjectively with a visual analogue scale before, at the end of, and four weeks after the end of treatment.

Laser therapy had a significant, positive effect compared with placebo measured from the first assessment to the third assessment, four weeks after the end of treatment. Laser treatment was most effective on acute tendonitis.

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)

LLLT using a diode laser in successful treatment of a herniated lumbar/sacral disc, with magnetic resonance imaging (MRI) assessment

Tatsuhide Abe. Abe Orthopaedic Clinic Futuoka City Fukuoka Prefecture Japan X12' A 40-year-old woman presented at the Abe Orthopedic Clinic with a 2-year history of lower back pain and pain in the left hip and leg diagnosed as a ruptured disc between the 5th lumbar/1st sacral vertebrae. The condition had failed to respond to conventional treatment methods including pelvic traction, nonsteroid anti-inflammatory drugs and aural block anesthetic injections.

MRI scans were made of the affected disc, showing it protruding on the left side through the aural membrane. The gallium aluminum arsenide (GaAlAs) diode laser (830 nm, 60 mW) was used in outpatient therapy and after 7 months, the patient's condition had dramatically improved demonstrated by motility exercises. This improvement was confirmed by further MRI scans, which showed clearly the normal condition of the previously herniated L5/S1 disc.

Physiological responses in chronic pain patients LLLT protocol

Scott D. Fender and David Diffie. Pain Research Group, Arvada, Colorado, U.S.A.

Use of Low Reactive Level Laser Therapy (LLLT) utilising helium-neon lasers has increased lately especially in pain control. New protocols are being developed aimed at a complex of primary and secondary symptomologies. One of these protocols, Stellate Ganglion Stimulation, has shown in our research a unique set of developments.

Targeting the area of the stellate ganglion is showing great promise in the rehabilitation of patients with a history of chronic musculoskeletal pain syndromes, but several patients with preexisting psychological symptomology have exacerbated during the initial stages of utilization of this protocol. Patients with a history of psychological diagnosis for dysthymia, anxiety, post traumatic stress disorder or minor diffuse brain injury have shown an exacerbation of these symptomologies during the initial phases of stimulation treatment.

Overall, response to this form of therapy seems to be positive but some patients require dermatomal and/or site-specific therapy to maximize outcome. With specific psychological treatment combined with a more conservative amount of stimulation initially the increase in these symptoms shows a tendency to remit with the pain response.

Our continued research is currently focusing on the mechanisms for this type of response as well as protocol refinement to maximize its effectiveness.

Clinical application of GaAIs 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 GaAIs 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 - 59.6%; good - 30.4%; unchanged - 10%.

For ROM improvement the scores were: excellent - 12.6%; good - 43.7%; unchanged - 43.7%. This gave a total effective rating for pain attenuation of 90%, and for ROM improvement of 56.3%.

Mechanisms of the analgesic effect of therapeutic lasers in vivo

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1: Outpatient Department of Radiobiology, Institute of Biophysics, First Medical Faculty, and 2: Department of Functional Anatomy, Second Medical Faculty and Faculty of Physical Education Charles University, Prague, Czech Republic

The analgesic effects in the course of application of therapeutic lasers to affected tissue have been described in a number of works in the literature. Although a few scientific-based reports have appeared, those on laser-induced analgesia are mainly clinical works describing the effect of the therapy which, however, do not study the mechanism of the laser action.

There are several different possible responses induced by non-invasive low level laser therapy (LLLT). The purpose of the present communication is to review the arrangement and characterization of these responses. By being aware of these effects, the laser therapist can acquire a physiological and morphological scheme making possible the appropriate choice of the site of application of LLLT, choice of the irradiation technique, and selection of appropriate doses.

Achilles Tendinopathy Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Achilles Tendinopathy. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Low level laser therapy reduces : Inflammation in activated achilles tendinitis

BJORDAL Jan Magnus ; IVERSEN Vegard ; BRANDAO MARTINS-LOPES Rodrigo Alvaro ;

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Society of Photo-Optical Instrumentation Engineers, Bellingham, ETATS-UNIS (2001) (Revue)

Objective: Low level laser therapy (LLLT) has been forwarded as therapy for osteoarthritis and tendinopathy. Results in animal and cell studies suggest that LLLT may act through a biological mechanism of inflammatory modulation. The current study was designed to investigate if LLLT has an anti-inflammatory effect on activated tendinitis of the Achilles tendon.

Methods: Seven patients with bilateral Achilles tendonitis (14 tendons) who had aggravated symptoms by pain-inducing activity immediately prior to the study. LLLT (1.8 Joules for each of three points along the Achilles tendon with 904nm infrared laser) and placebo LLLT were administered to either Achilles tendons in a random order to which patients and therapist were blinded. Inflammation was examined by 1) mini-invasive microdialysis for measuring the concentration of inflammatory marker PGE2 in the peritendinous tissue, 2) ultrasound with Doppler measurement of peri- and intratendinous blood flow, 3) pressure pain algometry and 4) single hop test.

Results: PGE2- levels were significantly reduced at 75, 90 and 105 minutes after active LLLT compared both to pre-treatment levels ($p=0.026$) and to placebo LLLT ($p=0.009$). Changes

in pressure pain threshold (PPT) were significantly different ($P=0.012$) between groups. PPT increased by a mean value of 0.19 kg/cm^2 [95%CI:0.04 to 0.34] after treatment in the active LLLT group, while pressure pain threshold was reduced by -0.20 kg/cm^2 [95%CI:-0.45 to 0.05] after placebo LLLT.

Conclusion: LLLT can be used to reduce inflammatory musculoskeletal pain as it reduces inflammation and increases pressure pain threshold levels in activity-induced pain episodes of Achilles tendinopathy.

Effects of Low-Level Laser Therapy and Eccentric Exercises in the Treatment of Recreational Athletes With Chronic Achilles Tendinopathy

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Background: Eccentric exercises (EEs) are recommended for the treatment of Achilles tendinopathy, but the clinical effect from EE has a slow onset.

Hypothesis: The addition of low-level laser therapy (LLLT) to EE may cause more rapid clinical improvement.

Study Design: Randomized controlled trial; Level of evidence, 1.

Methods: A total of 52 recreational athletes with chronic Achilles tendinopathy symptoms were randomized to groups receiving either EE + LLLT or EE + placebo LLLT over 8 weeks in a blinded manner. Low-level laser therapy ($\lambda = 820 \text{ nm}$) was administered in 12 sessions by irradiating 6 points along the Achilles tendon with a power density of 60 mW/cm^2 and a total dose of 5.4 J per session.

Results: The results of the intention-to-treat analysis for the primary outcome, pain intensity during physical activity on the 100-mm visual analog scale, were significantly lower in the LLLT group than in the placebo LLLT group, with 53.6 mm versus 71.5 mm ($P = .0003$) at 4 weeks, 37.3 mm versus 62.8 mm ($P = .0002$) at 8 weeks, and 33.0 mm versus 53.0 mm ($P = .007$) at 12 weeks after randomization. Secondary outcomes of morning stiffness, active

dorsiflexion, palpation tenderness, and crepitation showed the same pattern in favor of the LLLT group.

Conclusion: Low-level laser therapy, with the parameters used in this study, accelerates clinical recovery from chronic Achilles tendinopathy when added to an EE regimen. For the LLLT group, the results at 4 weeks were similar to the placebo LLLT group results after 12 weeks.

Acute Respiratory Distress Disorder Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Acute Respiratory Distress Disorder. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Acute Respiratory Distress Syndrome Successfully Treated with Low Level Laser Therapy

Chan Gunn, Institute for the Study and Treatment of Pain

Abstract Acute respiratory distress syndrome (ARDS) is a medical emergency, which may be precipitated by an acute injury to the lung. The injury can also follow direct chest trauma from aspiration of gastric contents or inhalation of toxic gasses. ARDS is not itself a specific disease but a syndrome - a group of symptoms and signs that make up one of the most important forms of respiratory failure. ARDS is devastating because it can develop quite suddenly in persons whose lungs had been perfectly normal - it kills at least 60% of its victims. The fundamental problem is the sudden appearance of large amounts of fluid in the lung preventing blood from entering the alveoli and decreasing oxygen extraction resulting in hypoxemia.

The tragic feature of ARDS is that it drowns its victim. The appearance of fluid in the lungs - a lethal situation - is from neuro-inflammation.

Important to keep in mind when treating ARDS are: a) Inflammation and Inflammatory exudates Gap Formation, b) Interstitial and Alveolar Inflammation, c) Inflammation and the Nervous System, d) Cholinergic anti-inflammatory pathway. Neuro-inflammation can be relieved by stimulation of the vagus nerve. Low-level laser therapy, a simple modality with few undesirable side effects, is used to relieve respiratory distress.

Alcoholism Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Alcoholism. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Acupuncture for alcohol withdrawal: a randomized controlled trial

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Background and Aims: Previous trials on acupuncture in alcohol addiction were in outpatients and focused on relapse prevention. Rates of dropout were high and interpretation of results difficult. We compared auricular laser and needle acupuncture with sham laser stimulation in reducing the duration of alcohol withdrawal.

Methods: Inpatients undergoing alcohol withdrawal were randomly allocated to laser acupuncture (n = 17), needle acupuncture (n = 15) or sham laser stimulation (n = 16). Attempts were made to blind patients, therapists and outcome assessors, but this was not feasible for needle acupuncture. The duration of withdrawal symptoms (as assessed using a nurse-rated scale) was the primary outcome; the duration of sedative prescription was the secondary outcome. Results: Patients randomized to laser and sham laser had identical withdrawal symptom durations (median 4 days). Patients randomized to needle stimulation had a shorter duration of withdrawal symptoms (median 3 days; P = 0.019 versus sham intervention), and tended to have a shorter duration of sedative use, but these differences diminished after adjustment for baseline differences.

Conclusions: The data from this pilot trial do not suggest a relevant benefit of auricular laser acupuncture for alcohol withdrawal. A larger trial including adequate sham interventions is needed, however, to reliably determine the effectiveness of any type of auricular acupuncture in this condition.

Alzheimer's Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Alzheimer's Syndrome. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

The Efficacy of 904 nm Laser Therapy for Alzheimer's Diseases

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Prof. Masayuki Inoue, Secretary of JLPLTPA*

Preface: Although we had reported about the possible efficacy of low power laser therapy (LPLT) for Senile Dementia(S D) 3 times from 1993 at the annual meetings of Japan Society for Laser Medicine, there was no practically useful treatment found for Alzheimer's disease(AD) and Parkinson disease and other Senile Dementia even after the start of elderly-care-insurance system in Japan. As we have continued above said laser therapy for SD at home care visit of elderly persons and felt very useful and effective, we would like to report about recent situation of laser therapy for AD patients.

Especially recently, the number of Alzheimer's disease patients is increasing by the arrival of super-aged world in Japan. However the cause of this disease is not known and there is no effective treatment established at present. As to the mechanism of LPLT, its main mechanism is mostly elucidated by the progress in the field of Molecular biology and widely used for the removal of pain, decrease of swelling and treatment of wound. However its application for the treatment of Brain diseases is hardly practiced.

We have continued the treatment of Senile Dementia patients by LPL considering it as to be one of practical and effective treatment of this disease LPLT is very useful for the medical treatment of the senile dementia patients at home for the expansion of ADL, pain relief, mitigation of inflammation, prevention of bed sore, the treatment of hemiplegia in a brain blood vessel obstacle and the braking of aggravation of Alzheimer's disease without any fear of side effects by the irradiation of LPL to the head of patients. It will be not to exaggerate to say LPLT can be one of main treatments of senior patients at home in near future.

Object of study: To study the practical usefulness of LPLT for the treatment of Alzheimer's disease patients at home in terms of improvement of ADL and QOL and also for the reduction of burden of families of the care of patients.

Method of treatment: 15 Alzheimer's disease patients, 5 male and 10 female, received irradiation of LPL for 2 minutes at each points, 2-3 times a week for one year. Laser irradiation points were as follows. Acupuncture points established as effective based on long history of Oriental medicine . (1) Acupuncture point to improve blood circulation (2) Acupuncture point for the treatment of stroke (3) Acupuncture point for adjustment of blood pressure (4) Acupuncture point for adjustment of balance of autonomous nerve. (the forehead, the right and left temple, occiput).

In addition, the method (based on papers in Russia and Armenia that intravenous LPL irradiation improved the viscosity of blood) of irradiating LPL to the place which touches the pulse of an artery under collarbone was used as an additional medical treatment point.

LPL instrument: LTU-904H made by RianCorp Pty Ltd in Australia.

Laser Type: Gallium Arsenide Laser diode (Ga-As)

Laser Wavelength: 904nm

Peak Power: 5W

Pulse frequency: Low 2500 Hz, High 5000Hz

Pulse duration: 200 nanoseconds

Average power: Low 2.5mW, High 5mW

The evaluation method: Since the improvement and maintenance of Alzheimer patients in the care at home was the major subject of this study, the impression by care workers about the situation of patients was recorded as data of patients. Evaluation items were orientation, conversation capability, cooperativeness, the lack of composure, social role and activity, clothes and dress and leisure activities. Completely no change was 0 point, slight effective was 1 point and clearly effective was evaluated as 2 points. Summed up values were used for the judgment of the efficacy of LPL treatment for each patient and total evaluation of usefulness of LPL therapy for Alzheimer's disease.

Result: Among evaluation items, cooperativeness and the lack of composure were observed as useful as an effect, the effect appeared half a year after and continued after one year and later on.

It was suggested that LPLT was useful for the improvement of orientation disturbance, normalization of clothing and the dress. Because, many families and the care workers talked us LPL was very helpful since the present condition could be maintained, without getting worse.

After the start of LPL treatment, It was reported that the coldness of hands and legs of patients vanished and joints and muscular stiffness were also mitigated. Therefore, the joint movable region was also secured comparatively. Also in excretion care, it became very easy to carry out the care of patients. It was able to say about all patients that their expression became quiet and came to show understanding to directions of a care worker. It is suggested by this that LPLT as one of practical treatment of patients at home by the improvement of care power at home.

Discussion: Since the senile-dementia-of-Alzheimer-type has a feature of advance of condition and it was said that condition became gradually critical, we tried this treatment expecting the maintenance of condition, and examination whether there was any delay effect. It is considered to have been suggested at least there was an effect of maintaining present condition in a certain field.

About the effect over the brain of laser irradiation, it was reported at the annual meeting of Japan Society for Laser Surgery and Medicine meeting in 1991 by Jun-Ichi Nishimura et al., of Department of Physiology, Yokohama City University School of Medicine. The 780 nm wavelength and 1mW laser irradiation to the inner core of rats made the increase of cerebral blood flows at hippocampus by the amount of about 20% in average (control:15, laser:15). Although after 30 minute it was confirmed having maintained the increase of 10%. In 1992 at the same medical conference, Takayuki Obata et. al., of the same University reported that laser irradiation of 780nm wavelength 10mW to the head surface of rats activated cranial nerves activities (control:16, laser:15).

These reports suggested the possible usefulness of LPL treatment to Senile Dementia and other brain diseases patients. Unfortunately these findings did not much attention of medical world In Japan. However, recently a possibility that ATP and cell membrane potential of brain neuron could be controlled specifically by the irradiation of near infrared lasers (830nm wavelength) on the surface of heads of rats was reported by Oda-Mochizuki etc.al. at Ritsumeikan University, Synchrotron Light Life Science Center. It was suggested by this research center that the condition of Epilepsy could be stabilized by Irradiating infrared laser from out side of heads of patients and decreasing the unusual excitement of cerebral neurons and in case of cerebral infarction, the aggravation of progress of Necrosis and Apoptosis of cerebral neurons could be stopped by making stabilize the electric potential of cell membrane of cerebral neurons.

Development of future research in this field is expected as what supports scientifically the medical treatment of LPL and the result of condition improvements, such as Senile Dementia, brain blood vessel obstacles, hemiplegia and Parkinson patients. Although the wavelength of LPL used for Examination of the validity of LPL to Senile Dementia Patients"

which we announced at the annual meetings of Japan Society for Laser Surgery and Medicine meeting over three years from 1993, was 780nm and out put was 10mW, and 1mw. The LPL used for this examination was of the wavelength of 904nm and the peak value of a pulse was 5W and the average output was 5mW. However, the same medical treatment effect was confirmed. Although it is thought that there was no wavelength dependability of laser to the efficacy over the Alzheimer's diseases of LPL(780,830,904nm lasers are equally effective for pain removal and wound healing), how is it sure enough? A question remains.

By this examination, at least following effects were confirmed. Namely (1) the advance of condition of Alzheimer's diseases has been blocked (2) and the expression of patients changed to smiling from disinterestedness, cooperativeness came out, an understanding came to be shown to a partner (3) We received comments from many families that the care of patients became much easier than before. It is considered that the head irradiation of near infrared laser light makes the cerebral blood flow improve, activates nerve activities and have applied brakes to the advance of the apoptosis of brain cells as animal experiments are proving. Since the medical treatment efficacy is seldom acknowledged to middle degree class and a serious patient, although it is hard to call it the fundamental cure for Alzheimer's disease by the present method, if medical a treatment is started in early stage and continued, it may be possible to call it one of practical cures which can stop subsequent advance of disease.

Based on this experience, collecting newest information overseas, research results in the biology field, we will continue to study the possible LPL method for the dramatic cure of Alzheimer's diseases by changing the wavelength of laser, the output and the irradiation method and also combination with other therapies.

Arteriosclerosis Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Arteriosclerosis. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Low Level Laser Therapy in the Treatment of Arteriosclerosis of the Lower Limbs

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Abstract: Twenty patients with arteriosclerosis in the lower limbs were treated by low level laser therapy with lumbar paravertebral application a 20mW continuous wave He-Ne laser(632nm) and simultaneously a 250mW continuous diode laser (830 nm) was applied transcutaneously to the lumbar region by the scanner for 30 minutes 6 days per week for 2 months. The mean value of percentage of success was 87.2%. The results of the study indicate that low level laser therapy can influence beneficially arteriosclerosis in the lower limbs which is generally difficult to treat.

Introduction: Arteriosclerosis is a chronic obliterative disease affecting the lower portion of

the aorta, its main branches and the arteries supplying the extremities. The condition occurs predominantly in patients between the ages of 45 and 70 years. It is present much more frequently in males than in females. It may be caused by an error in the metabolism of lipids (Oliver, 1955). Buck (1959) believed that the abnormal vascularization of the arterial wall has also been proposed as a significant factor in the development of the disease. Also, the Question of heredity as a factor in the pathogenesis of the disease must be raised (McKusick, 1958). The patient complains of pain in the extremities typical of intermittent claudication and difficulty in walking, finally rest pain is experienced particularly at night, characterized by a sensation of coldness or burning, hyperesthesia and tingling (Abramson, 1974). The purpose of the study was to evaluate the efficacy of low power laser in the treatment of arteriosclerosis. Materials and methods Twenty patients with arteriosclerosis of the lower limbs from the out-patient clinic of the General medicine Department of both Tanta University Hospital and Alhikmah Hospital, Mansoura were included in the study. The male to female ratio was 4:1. The ages ranged from 45 to 69 years. The duration of symptoms ranged from one to 8 months (table 1). The patients were experiencing pain in both calf muscles after walking distances (claudication distance) ranging from 200 to 500 meters. Three patients experienced rest pain at night. Clinical examinations revealed palpable walls of superficial arteries, particularly the dorsalis pedis. In the study, the claudication distance was determined for every patient in meters prior to treatment. Control normal individuals within the patients' age group walked an average of 1500 meters without experiencing calf pain.

Results: Pain was relieved in 16 patients who received 3 to 7 courses of treatment. Eight patients were able to walk 1500 meters without experiencing any pain in the calf muscles, hence their rate of success was 100%. The remaining patients showed improvement from 73% to 95 (table 2). Three patients discontinued treatment for reasons not related to the treatment. One patient, age 69, with 4 months duration and claudication distance of 240 meters showed no improvement after receiving 7 courses of treatment. The mean rate of success was 87.2%.

Discussion: It was not easy to discuss the treatment of arteriosclerosis and only in the last 20 years have advancements been made. Although physical therapy is only part of the total management of arteriosclerosis of the lower limbs, it could play an important role in the management. No references were found in literature concentrating the use of low level laser therapy in the management of arteriosclerosis. This work has shown that low level laser therapy is capable of increasing the circulation in muscles and, with prolonged treatment, a considerable significant improvement in circulation can be achieved in cases of arteriosclerosis. Low level laser therapy not only influences the superficial circulation but also deep circulation. The mechanism of this action is probably due to the sympathetic effect, but it could also be used on the action of normal skin excitation. It can be assumed that apart from the increase in the pain threshold (Nikolova, 1968) and muscular excitation threshold, there is also an increase in the threshold for sympathetic stimulation (Pabst, 1960). By this paravertebral application, we must concede more importance to the sympathetic action, than to the direct action on the vasometer assumed by some authors (Monode, 1951; Zinn, 1956). The results obtained in the treatment of arteriosclerosis by means of low level laser therapy are certainly based on a number of different effects. First, there is sympathetic action. Also, the analgesic action of this type of current deserves special attention, since it is the cause of the subjective improvement which frequently precedes the objective improvement in cases of severe arteriosclerosis when pain is felt while resting. Also, rest pain did not mean the presence of

irreversible pathologic change as the three patients with rest pain showed a good degree of improvement. The patient who showed no improvement after 7 courses of treatment may have an irreversible pathologic change and, this age of 69 years may have also contributed to the failure of treatment.

Conclusion: Low level laser therapy may be considered in the treatment of peripheral arteriosclerosis.

Application of laser acupuncture in the treatment of periarthritis humeroscapularis.

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The effect of low intensity semi conductor laser was used as treatment methods for periarthritis humeroscapularis. The CC laser (Computer Controlled laser) was applied. Laser therapy has positive biological effects and antiinflammatory, antioedema effects and analgesia. We treated 18 patients with periarthritis humeroscapularis, 14 were female patients.

The laser was locally applied at the AC points Sj 14, Sj 15, Li 15, Li 10, Sj 5, Si 3, three times a week for the first week and twice a week for the second and the third week. After first treatment 12 of patients had pain - alleviating effect. After 6-7 treatments all had pain - alleviating effect and complete recovery of shoulder's motor activity. Low intensity therapy has its place for treatment of periarthritis humeroscapularis.

Treatment of the acute Periarthritis humeroscapular with laserpuncture.

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The periarthritis humeroscapular is a syndrome that contains very precise affections: the bursitis, the calcified tendinitis of supraespinoso, the bicipital tendinitis, among others. Pain and limitation of the joint movements of the shoulder characterize it. The treatment with laser of low power can produce resolution of the lesion, whenever it is made in early phases of the disease. In this study we propose the use of the laserpuncture, due to our accumulated experience in the treatment of these affection in acute phase, with acupuncture. A prospective study was carried out during 2 years (1997 - 1999), where 62 patients were selected because they accomplished the Approaches of Inclusion for the study. The sample was divided by aleatory assignment in 2 Groups of Treatment. Th study Group I was treated with laserpuncture, using Cuban laser equipment of HeNe of 632,8 nm and a dose of joule/cm² was applied, and the Control Group II was treated with acupuncture needles. The conventional medical treatment was suspended. Daily sessions were given from Monday to Friday, for two weeks, until a total of 10. Both techniques demonstrated to be effective in the treatment of these affections, improving the clinical and radiological symptoms significantly when the treatment sessions was concluded. The patients accepted the laserpuncture better because of its painless character, less time of application, and the absence of bleeding and stress.

Arthritis-Cervical Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Arthritis-Cervical. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

The clinical efficacy of low-power laser therapy (LLLT) 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. Clin Rheumatol 2001;20(3):181-4

Pain is a major symptom in cervical osteoarthritis (COA). Low-power laser (LLLT) 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.

Arthritis-Rheumatoid Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Arthritis-Rheumatoid. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

50 year old female patient diagnosed as having Class 3 RA inflammatory phase of steady development. Probes used in treatments were 820nm (50mW) and 31 cluster probe with the 820nm probe being administered on each interphalangeal joint (30 seconds per point) followed by the cluster (one minute) over the whole hand. The pulsing frequency was 20 Hz and administration of treatment three times per week. Total number of treatments were 12 over a one month period.

You can see the improvement in treatment of condition and the third picture shows the progress at 13 treatments. After 6 months follow up it was found the initial inflammation was beginning to creep back, but the overall condition was much improved in comparison with the original status of patient with no LLLT treatment.

Beneficial Effects of Laser Therapy in the Early Stages of Rheumatoid Arthritis Onset

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LLLT Original Articles, Laser therapy Volume. 11-2, pg.79

The purpose of this study was to determine the effects of laser therapy in pain reduction and/or recovery of patients at the onset of Rheumatoid Arthritis (RA), comparatively with the traditional non-steroidal anti-inflammatory drugs (NSAIDs). Fifty-nine patients with RA of 6-12 months duration were included in the study. The patients were divided into 3 groups: Group 1 (21 patients) received laser therapy; Group 2 (18 patients) was submitted to placebo laser therapy and NSAIDs medication; Group 3 (20 patients) was treated only with NSAIDs. Physical therapy was instituted in all three groups. GaAlAs diode laser of 830 nm wavelength and 200mW maximum output power was used. Group 1 received laser therapy once each day, eight days per month, for a total of 32 treatments during a four-month period. The parameters used were 2-4 J/cm² energy density, and a frequency of 5 Hz or 10 Hz depending on the number and severity of pain in the affected joints. Placebo laser treatment was given to group 2. the functional activity score, the acute pain phase reactants (ESR and C-reactive protein), T-lymphocytes and NK (natural killer) cells were estimated. Synovial biopsies and Magnetic Resonance Imaging (MRI) of the synovial membrane were performed as well. The analysis of the clinical and biological parameters at the end of treatment showed a statistically significant decrease of duration of morning stiffness, of pain at rest and during movements, and improved acute phase reactants.

The overall efficacy rate in these studies was 86% in the first group, 50% in laser placebo group and 40% in the NSAIDs-treated third group. After four months of treatment, our investigations showed that 830 nm infrared laser therapy promoted the restoration of function, relieved pain and limited the complications of RA.

The Effects of Laser Therapy in the Early Stages of Rheumatoid Arthritis Onset

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1.PURPOSE:

To study the effects of laser therapy, in comparison with other modality trials (NSAIDs), at the onset of (RA).

2.SUBJECTS and METHODS:

In the study 59 patients were included, in the first 6 - 12 months from RA onset. The patients were divided into three groups: Group 1 (21 patients) received laser therapy; Group 2 (18 patients) was submitted to placebo laser therapy and NSAIDs medication; Group 3 (20 patients) was treated only with NSAIDs. Physical therapy was instituted in all three groups.

A GaAlAs diode laser (830 nm, maximum output power 200 mW) was used. During 4 months, courses of laser therapy - once daily for 8 days, monthly - were administered to Group 1 and laser placebo Group 2. The density of energy (2 - 4 J/cm²) and frequency (5 Hz or 10 Hz) were dependent on the number and severity of pain in affected joints.

3.RESULTS:

The analysis of the clinical and biological parameters at the end of treatment showed a statistical significant decrease of duration of morning stiffness of pain at rest and during movements and improved acute phase reactants. The overall efficacy rate in these studies was 86% in group 1, 50% in the placebo laser group, and 40% in group 3.

4.DISCUSSION and CONCLUSIONS:

After 4 months of treatment, our investigations showed that infra-red laser therapy was able to restore function, to relieve pain and to avoid the complications of the disease or NSAIDs therapy (digestive or renal) at RA onset, being the most perspective modality of treatment.

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.

The interauricular laser therapy of rheumatoid arthritis.

Sidorov-V-D, Mamiliaeva-D-R, Gontar-E-V, Reformatskaia-Slu.
Vopr-Kurortol-Fizioter-Lech-Fiz-Kult. 1999; (3): 35-43.

Investigations have proved the ability of interauricular low- intensity infrared laser therapy (0.89 μ m, 7.6 J/cm²) 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 GaAlAs 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—59.6%; good—30.4%; unchanged—10%. For ROM improvement the scores were: excellent—12.6%; good—43.7%; unchanged—43.7%. This gave a total effective rating for pain attenuation of 90%, and for ROM improvement of 56.3%.

LASER THERAPY OF RHEUMATOID ARTHRITIS.

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

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 patients noted 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.

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, peri-arthritis 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.

Low level laser therapy (classes I, II and III) in the treatment of rheumatoid arthritis.

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BACKGROUND: Rheumatoid arthritis (RA) affects a large proportion of the population. Low Level Laser Therapy (LLLT) was introduced as an alternative non-invasive treatment for RA about 10 years ago. 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. The effectiveness of LLLT for rheumatoid arthritis is still controversial.

OBJECTIVES: To assess the effectiveness of LLLT in the treatment of RA.

SEARCH STRATEGY: We searched MEDLINE, EMBASE, the registries of the Cochrane Musculoskeletal group and the field of Rehabilitation and Related Therapies as well as the Cochrane Controlled Trials Register up to January 30, 2000.

SELECTION CRITERIA: Following an a priori protocol, we selected only randomized controlled trials of LLLT for the treatment of patients with a clinical diagnosis of RA were

eligible. Abstracts were excluded unless further data could be obtained from the authors.

DATA COLLECTION AND ANALYSIS: Two reviewers independently select trials for inclusion, then extracted data and assessed quality 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: A total of 204 patients were included in the five placebo-controlled trials, with 112 randomized to laser therapy. Relative to a separate control group, LLLT reduced pain by 70% relative to placebo and reduced morning stiffness duration by 27.5 minutes (95%CI: 2.9 to 52 minutes) and increased tip to palm flexibility by 1.3 cm (95% CI: 0. 8 to 1.7 cm). Other outcomes such as functional assessment, range of motion and local swelling did not differ between groups. There were no significant differences between subgroups based on LLLT dosage, wavelength, site of application or treatment length. For RA, relative to a control group using the opposite hand, there was no difference between the control and treatment hand, but all hands improved in terms of pain relief and disease activity.

REVIEWER'S CONCLUSIONS: In summary, LLLT for RA is beneficial as a minimum of a four-week treatment with reductions in pain and morning stiffness. On the one hand, this meta-analysis found that pooled data gave some evidence of a clinical effect, but the outcomes were in conflict, and it must therefore be concluded that firm documentation of the application of LLLT in RA is not possible. 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.

THE EFFECTIVENESS OF LASER THERAPY IN COMPLEX TREATMENT OF PATIENTS WITH RHEUMATOID ARTHRITIS

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The purpose of this research is to evaluate the effectiveness of laser therapy among patients with different extents of rheumatoid arthritis (RA) disease. There has been a study of 115 patients with RA activity II-III (the main group) who apart from the basic therapy also received laser treatment.

The apparatus ALT "Mustang" with the power of 2-10 W and infrared wave range has been used. The laser influence has been aimed at the area of a damaged joint. The duration of laser influence is from 5 to 17 minutes, adding 1-2 minutes daily. The number of fields is 10, the number of treatment procedures -8-10, The control group consists of 20 patients with

RA (basic therapy only).

The control of effectiveness of the therapy was based on the complex laboratory data, including definition of non-specific factors of inflammation and the factors of activity of lipid peroxidation.

The greatest effect of the therapy has been achieved in the main group of patients with activity II. In comparison with the control group we managed to receive improvement 8-10 days earlier which allowed us to reduce the demand of steroids and in case of 20 patients even cancel taking them. We received statistically reliable fall of the activity of inflammation and lipid peroxidation. More moderate effect of the therapy was reached treating patients from the main group with activity III.

THE USE OF SUPRAVASCULAR BLOOD RADIATION WITH INFRARED LASER FOR TREATMENT OF SECONDARY VASCULITIS IN PATIENTS WITH RHEUMATOID ARTHRITIS

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The purpose of this work was to study the opportunity of the use of supravascular blood radiation with infrared laser (IR-laser) for the treatment of secondary vasculitis in patients with rheumatoid arthritis (RA). The investigation included 12 patients with RA and secondary vasculitis signs. They received a course of supravascular blood radiation with IR-laser (wavelength 820-850 nm, 7-10 procedures). Control group consisted of 8 patients. Placebo laser therapy (LT) was administered to 7 patients. Such characteristics as hemostasis properties, a state of microcirculation in bulbar conjunctiva vessels were studied in all patients before and after treatment. It was revealed significant decrease of both XIIa-depended fibrinolysis and Willibrand's factor level. The improvement of blood rheological properties was confirmed by a decrease of erythrocyte aggregation and improvement of its deformability. Bulbar conjunctival microscopia revealed significant diminution of intravascular change index, significant increase of arteriola-venula ratio. The improvement of nephritis manifestations (significant decrease of proteinuria level). The changes of hemostasis parameters microcirculation system were not significant in patients receiving both placebo LT and conventional therapy. Conclusions: 1) It was revealed significant diminution of endothelium lesion and XIIa-depended fibrinolysis restoration after IR-laser therapy in patients with RA and secondary vasculitis. 2) Both microcirculation state in bulbar conjunctiva vessels and blood rheological properties significantly improve after IR-laser therapy. It is confirmed by a significant improvement of erythrocyte deformability and a decrease of its aggregation. 3) IR-laser therapy leads to urinary syndrome regression.

DIAGNOSTIC SIGNIFICANCE OF THE IMMUNITY INDICES INVESTIGATION IN THE USE OF LASER THERAPY IN PATIENTS WITH RHEUMATOID ARTHRITIS AND THE DISEASE COURSE PROGNOSIS

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The results of the examination of the patients with rheumatoid arthritis (RA) have shown the systemic lesion of all the links of the immune system. Many-sided positive influence of

low energy laser irradiation on the impairment of immune homeostasis has been shown. The aim of the investigation was to study the possibility of the low energy laser irradiation use in patients with RA depending on some immunity indices and the disease course prognosis. 60 patients with RA at the age of more than 16 years old having inflammatory process activity of the I-II degrees according to the RA criteria of the American Rheumatological Association classification have been examined. 30 patients of the control group underwent the conventional treatment with non-steroid antiinflammatory drugs, basic treatment with delagil and physiotherapy. 30 patients of the main group underwent the conventional treatment and laser therapy on the joints by the infra-red laser installation "UZOR" with the wavelength of 0,89 μm , the output power of 2 mW in combination with the above-vein blood irradiation by the helium-neon laser installation "ALOK-1" with the output power of 0,6 mW. The treatment was carried out daily during 15 days. The immunity indices analysis before and after the treatment in both groups has established their obvious improvement in patients treated by laser irradiation: T-lymphocytes (CD3 ($p < 0.05$), immunoglobulins ? ($p < 0.05$), T-helpers inductors (CD4+) ($p < 0.05$). The positive dynamics of the immunity indices in the studied group correlated with the clinical improvement of the patients condition and depended on the marked immunity indices changes before the treatment, such as T-lymphocytes (CD3), Thelpers inductors (CD4+), immunoglobulins C. The marked positive dynamics of the above-mentioned indices were not observed in the control group.

Asthma Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat Asthma. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Treatment of bronchial asthma with low-level laser in attack-free period at children

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Proc. SPIE Vol. 4166, p. 303-308, Laser Florence '99: A Window on the Laser Medicine World,
Leonardo Longo; Alfons G. Hofstetter; Mihail L. Pascu; Wilhelm R. Waidelich; Eds.
06/2000 SPIE (c) 2000 SPIE--The International Society for Optical Engineering. Downloading
of the abstract is permitted for personal use only. 2000SPIE.4166..303A*

Bronchial asthma is a common disease in both the pediatric and adult populations, characterized by wide variations over short periods of time in resistance to airflow in intrapulmonary airways. A primary goal in the use of low-level laser therapy (LLLT) was the safe, effective and rapid palliation of symptoms owing to tracheal or bronchial obstruction. We have investigated the effects of LLLT comparatively with other modality trials in children's asthma. In the study were included 98 patients aged 10-18 years diagnosed with moderate or severe asthma, in attack-free period. The patients were divided into 3 groups. Group 1 received only laser therapy using extra meridian acupuncture points and scanning technique. Group 2 was treated only with inhaled Serevent 2 X 25 micrometers, two times daily, 3 months. Group 3 was treated with Theophylline retard in dosage of 15-mg/kg/12 h, 3 months. At the end of treatment we remarked a noticeable improvement of the clinical, functional and immunological

characteristics at 83 percent of patients in group 1, comparatively with only 70 percent (group 2) and 53 percent (group 3). The LLLT had a very good action on bronchial patency, displayed an immunocorrecting action and is recommended in attack-free periods at children.

The following is a summary of some of the clinical studies that were conducted using cold laser to treat blood irritation. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Effect of Low-Level Laser Radiation on Some Rheological Factors in Human Blood: An in Vitro Study

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Objective: The purpose of this study was to investigate the in vitro effects of low-level laser radiation (LLLR) on some rheological factors of the human blood, such as complete blood count (CBC) parameters and blood sedimentation rate (BSR). We were mainly concerned with the alterations caused by LLLR action on blood cells (erythrocytes and leukocytes) of fresh blood obtained from apparently healthy adult patients. We used low doses ranging between 0.80 J/cm² and 4.40 J/cm², at the very low-power densities of the laser radiation, so as not to damage the cell structure and not to alter in an undesired manner their functions.

Methods: Blood samples were taken from 22 volunteers. Where health problems existed, they were indicated for each case. The parameters mentioned above were measured before (control samples) and after irradiation. A He-Ne laser, operating in continuous wave, as a radiation source (632.8 nm, 1 mW, intensity of 8x10⁻² W/cm², mean power density incident on blood samples around 30 mW/cm², beam spot diameter 2 mm) was used. The measurements were performed immediately after irradiation. Only the erythrocyte complex was irradiated. EDTA anticoagulant was used. Results: The measurements using a computerized hemoanalyzer type SERONO showed significant differences between control and irradiated blood samples concerning the following parameters: RBC (in 22% of cases), HGB (47.3%), HCT (84.2%), RDW (11%), PLT (5.26%), MPV (33.3%), WBC (5.26%), MONO (26.3%), and GRAN (63.15%). In the case of BSR (44%), the significant differences were noticed especially in the cases of patients suffering from some acute or chronic diseases. Nonsignificant differences were noticed in the cases of MCV, MCH, MCHC, RDW, and LYMPH.

Conclusions: This study has shown that LLLR, even though used at low doses and low power densities, produced some changes of the rheological factors of the blood, as follows: a revitalizing and regenerating effect on mitosis stimulation and a nondamaging and biostimulating effect on the cell membrane (by keeping unmodified MCV, MCH, and MCHC). In 3 cases out of 22, hemolysis (complete or partially) occurred, but we are not yet sure whether this was caused by laser exposure or by certain environmental physical factors

Blood Trauma Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat blood trauma. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Intravascular laser irradiation of blood in treatment of traumatic abdominal organs injuries

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Khirurgiia (Mosk). 1998;(5):40-2.*

The application of intravascular laser irradiation of the blood (ILIB) in combined postoperative intensive care in 28 patients with traumatic injuries of parenchymal organs and severe intraabdominal bleeding (more than 20% CBV) contributed to substantial improvement of the results of treatment and reduction of complications rate. ILIB boosts functional activity of leucocytes, normalizes the system of hemostasis and antioxidant defense.

Laser radiation to correct disorders of blood albumin transport in severe mechanical trauma

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The paper provides evidence for that it is expedient to perform multi-stage intravascular low-intensity laser blood radiation in patients with severe mechanical trauma and massive blood loss in the early posttraumatic period. The use of laser radiation at a wavelength of 632.0 nm by inserting a disposable light guide (its end power was 1.5-2.0 mW, and the duration of a session--30 min) as part of complex therapy in this group of patients romotes the increase of plasma albumin transport ability and the general stimulation of natural detoxifixation mechanisms.

Bronchitis Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat bronchitis. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

The use of the low level laser therapy (LLLT) in the treatment of some pulmonary diseases (10 - years experience)

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The purpose of the present study was to compare the efficacy of the treatment of some pulmonary diseases with or without LLLT. 130 patients (49 of them with acute pneumonia, 42 - with chronic bronchitis, 39 - with chronic bronchial asthma) received LLLT and drug therapy, and 30 patients received only drug therapy (control group). The obtained results on the use of LLLT show that the period of convalescence in patients with both pneumonia and exacerbation of chronic bronchitis was lower with 4 - 6 days compared with control group. 68% patients with chronic bronchitis have staunch remission more than three month. Patients with bronchial asthma reported the decreasing of both number of bronchospasm and doses of bronchodilators and glucocorticoids after LLLT. They have no exacerbation of asthma during 3 - 6 months; then these patients need the repetition of LLLT. In conclusion, LLLT is the suitable and effective complement to the treatment of pulmonary diseases.

Burn Scars Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat burn scars. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Low Level Laser Therapy's conservative approach to the burn scar

K . Gaida / Burns , Volume 30 , Issue 4 , Pages 362 – 367

Burn scars are known to be difficult to treat because of their tendency to worsen with hypertrophy and contracture. Various experimental and clinical efforts have been made to alleviate their effects but the problem has not been solved.

Since patients keep asking for Low Level Laser Therapy (LLLT) and believe in its effectiveness on burn scars, and since former studies show contradictory results of the influence of LLLT on wound healing, this prospective study was designed to objectify the effects of LLLT on burn scars.

Nineteen patients with 19 burn scars were treated with a 400mW 670nm Softlaser twice a week over 8 weeks. In each patient a control area was defined, that was not irradiated. Parameters assessed were the Vancouver Scar Scale (VSS) for macroscopic evaluation and the Visual Analogue Scale (VAS) for pruritus and pain. Photographical and clinical assessments were recorded in all the patients.

Seventeen out of 19 scars exhibited an improvement after treatment. The average rating on the VSS decreased from 7.10 ± 2.13 to 4.68 ± 2.05 points in the treated areas, whereas the VSS in the control areas decreased from 6.10 ± 2.86 to 5.88 ± 2.72 . A correlation between scar duration and improvement through LLLT could be found. No negative effects of LLLT were reported. The present study shows that the 400mW 670nm softlaser has a positive, yet sometimes limited effect on burn scars concerning macroscopic appearance, pruritus, and pain.

Candida Albicans Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat candida albicans. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Effect of low-level laser therapy on Candida albicans growth in patients with denture stomatitis.

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PMID: 15954824 [PubMed - indexed for MEDLINE]

OBJECTIVE: The purpose of our report is to present the effect of low-level laser therapy on Candida albicans growth and palatal inflammation in two patients with denture stomatitis.

BACKGROUND DATA: The most common oral mucosal disorder in denture wearers is denture stomatitis, a condition that is usually associated with the presence of the yeast Candida albicans. Different treatment methods have been suggested to treat this symptom, none of which is proven to be absolutely effective.

METHODS: Two denture-wearing patients, both with palatal inflammation diagnosed as Newton type II denture stomatitis were treated with low-power semiconductor diode laser (BTL-2000, Prague, Czech Republic) at different wavelengths (685 and 830 nm) for 5 d consecutively. In both patients, palatal mucosa and acrylic denture base were irradiated in noncontact mode (probe distance of 0.5 cm from irradiated area) with different exposure times-5 min (830 nm, 3.0 J/cm², 60 mW) and 10 min (685 nm, 3.0 J/cm², 30 mW). The effect of laser light on fungal growth in vivo was evaluated after the final treatment using the swab method and semiquantitative estimation of Candida albicans colonies growth on agar plates. The severity of inflammation was evaluated using clinical criteria.

RESULTS: After lowlevel laser treatment, the reduction of yeast colonies on the agar plates was observed and palatal inflammation was diminished.

CONCLUSION: LLLT is effective in the treatment of denture stomatitis. Further placebo controlled studies are in progress.

Carpal Tunnel Syndrome Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat carpal tunnel syndrome. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

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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.

Cerebral Circulation Cold Laser Clinical Studies

The following is a summary of some of the clinical studies that were conducted using cold laser to treat cerebral circulation. These studies are presented here to demonstrate the wide uses of a cold lasers in the treatment of different medical conditions.

Specific Effects of Laserpuncture on the Cerebral Circulation

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Acupuncture is a form of traditional Chinese medicine that has developed over thousands of years. We studied the effects of laser puncture, needle acupuncture, and light stimulation on cerebral blood flow in 15 healthy volunteers (mean age 25.0±1.9 years,

5 female, 10 male) with non-invasive transcranial Doppler sonography. In addition 40-Hz stimulus-induced brain oscillations, heart rate, blood pressure, peripheral and cerebral oxygen saturation, and the bispectral index of the EEG were recorded.

Stimulation with light significantly increased blood flow velocity in the posterior cerebral artery ($p < 0.01$, ANOVA). Similar but less pronounced effects were seen after needle acupuncture ($p < 0.05$, ANOVA) and laserpuncture (n.s.) of vision-related acupuncture points. Furthermore both, laserpuncture and needle acupuncture, **led to a significant increase in the amplitudes of 40-Hz cerebral oscillations.**

Stimulation of vision-related acupuncture points with laser light or needle acupuncture elicits specific effects in specific areas of the brain. The results indicate that the brain plays a key intermediate role in acupuncture. However, brain activity of itself does not explain anything about the healing power of acupuncture.