

Effects of low-level laser therapy in combination with physiotherapy in the management of rotator cuff tendinitis.

Eslamian F, Shakouri SK, Ghojzadeh M, Nobari OE, Eftekharsadat B.

Source

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Abstract

Rotator cuff tendinitis is one of the main causes of shoulder pain. The objective of this study was to evaluate the possible additive effects of low-power laser treatment in combination with conventional physiotherapy endeavors in these patients. A total of 50 patients who were referred to the Physical Medicine and Rehabilitation Clinic with shoulder pain and rotator cuff disorders were selected. Pain severity measured with visual analogue scale (VAS), abduction, and external rotation range of motion in shoulder joint was measured by goniometry, and evaluation of daily functional abilities of patients was measured by shoulder disability questionnaire. Twenty-five of the above patients were randomly assigned into the control group and received only routine physiotherapy. The other 25 patients were assigned into the experimental group and received conventional therapy plus low-level laser therapy (4 J/cm²) at each point over a maximum of ten painful points of shoulder region for total 5 min duration). The above measurements were assessed at the end of the third week of therapy in each group and the results were analyzed statistically. In both groups, statistically significant improvement was detected in all outcome measures compared to baseline ($p < 0.05$). Comparison between two different groups revealed better results for control of pain (reduction in VAS average) and shoulder disability problems in the experimental group versus the control (3.1 \pm 2.2 vs. 5 \pm 2.6, $p = 0.029$ and 4.4 \pm 3.1 vs. 8.5 \pm 5.1, $p = 0.031$, respectively) after intervention. Positive objective signs also had better results in the experimental group, but the mean range of active abduction (144.92 \pm 31.6 vs. 132.80 \pm 31.3) and external rotation (78.0 \pm 19.5 vs. 76.3 \pm 19.1) had no significant difference between the two groups ($p = 0.20$ and 0.77, respectively). As one of physical modalities, gallium-arsenide low-power laser combined with conventional physiotherapy has superiority over routine physiotherapy from the view of decreasing pain and improving the patient's function, but no additional advantages were detected in increasing shoulder joint range of motion in comparison to other physical agents.

Clin Rheumatol. 2011 Oct;30(10):1341-6. Epub 2011 May 4.

Additive effects of low-level laser therapy with exercise on subacromial syndrome: a randomised, double-blind, controlled trial.

Abrisham SM, Kermani-Alghoraishi M, Ghahramani R, Jabbari L, Jomeh H, Zare M.

Source

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Abstract

The subacromial syndrome is the most common source of shoulder pain. The mainstays of conservative treatment are non-steroidal anti-inflammatory drugs and exercise therapy. Recently, low-level laser therapy (LLLT) has been popularized in the treatment of various musculoskeletal disorders. The aim of this study is to evaluate the additive effects of LLLT with exercise in comparison with exercise therapy alone in treatment of the subacromial syndrome. We conducted a randomised clinical study of 80 patients who presented to clinic with subacromial syndrome (rotator cuff and biceps tendinitis). Patients were randomly allocated into two groups. In group I (n=?40), patients were given laser treatment (pulsed infrared laser) and exercise therapy for ten sessions during a period of 2 weeks. In group II (n=?40), placebo laser and the same exercise therapy were given for the same period. Patients were evaluated for the pain with visual analogue scale (VAS) and shoulder range of motion (ROM) in an active and passive movement of flexion, abduction and external rotation before and after treatment. In both groups, significant post-treatment improvements were achieved in all parameters (P=?0.00). In comparison between the two groups, a significant improvement was noted in all movements in group I (P=?0.00). Also, there was a substantial difference between the groups in VAS scores (P=?0.00) which showed significant pain reduction in group I. This study indicates that LLLT combined exercise is more effective than exercise therapy alone in relieving pain and in improving the shoulder ROM in patients with subacromial syndrome.

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in an active and passive movement of flexion, abduction and external rotation before and after treatment. In both groups, significant post-treatment improvements were achieved in all parameters ($P=0.00$). In comparison between the two groups, a significant improvement was noted in all movements in group I ($P=0.00$). Also, there was a substantial difference between the groups in VAS scores ($P=0.00$) which showed significant pain reduction in group I. This study indicates that LLLT combined exercise is more effective than exercise therapy alone in relieving pain and in improving the shoulder ROM in patients with subacromial syndrome.

Br J Sports Med. 2010 Jul 20. [Epub ahead of print]

Frozen shoulder: the effectiveness of conservative and surgical interventions—systematic review.

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Abstract

Background A variety of therapeutic interventions is available for restoring motion and diminishing pain in patients with frozen shoulder. An overview article concerning the evidence for the effectiveness of these interventions is lacking. **Objective** To provide an evidence-based overview regarding the effectiveness of conservative and surgical interventions to treat the frozen shoulder. **Methods** The Cochrane Library, PubMed, Embase, Cinahl and Pedro were searched for relevant systematic reviews and randomised clinical trials (RCTs). Two reviewers independently selected relevant studies, assessed the methodological quality and extracted data. A best-evidence synthesis was used to summarise the results. **Results** Five Cochrane reviews and 18 RCTs were included studying the effectiveness of oral medication, injection therapy, physiotherapy, acupuncture, arthrographic distension and suprascapular nerve block (SSNB). **Conclusions** We found strong evidence for the effectiveness of steroid injections and laser therapy in short-term and moderate evidence for steroid injections in mid-term follow-up. Moderate evidence was found in favour of mobilisation techniques in the short and long term, for the effectiveness of arthrographic distension alone and as an addition to active physiotherapy in the short term, for the effectiveness of oral steroids compared with no treatment or placebo in the short term, and for the effectiveness of SSNB compared with acupuncture, placebo or steroid injections. For other commonly used interventions no or only limited evidence of effectiveness was found. Most of the included studies reported short-term results, whereas symptoms of frozen shoulder may last up to 4 years. High quality RCTs studying long-term results are clearly needed in this field.

Bosn J Basic Med Sci. 2009 Feb;9(1):59-65.

Laser therapy of painful shoulder and shoulder-hand syndrome in treatment of patients after the stroke.

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The common complication after stroke is pain and dysfunction of shoulder of paralyzed arm, as well as the swelling of the hand. The aim of this study was to determine the effects of LASER therapy and to correlate with electrotherapy (TENS, stabile galvanization) in subjects after stroke. We analyzed 70 subjects after stroke with pain in shoulder and oedema of paralyzed hand. The examinees were divided in two groups of 35, and they were treated in the Clinic for Physical Medicine and Rehabilitation in Tuzla during 2006 and 2007. Experimental group (EG) had a treatment with LASER, while the control group (CG) was treated with electrotherapy. Both groups had kinesis therapy and ice massage. All patients were examined on the admission and discharge by using the VAS, DASH, Barthel index and FIM. The pain intensity in shoulder was significantly reduced in EG ($p < 0,0001$), swelling is lowered in EG ($p = 0,01$). Barthel index in both groups was significant higher ($p < 0,01$). DASH was significantly improved after LASER therapy in EG ($p < 0,01$). EG had higher level of independency ($p < 0,01$). LASER therapy used on EG shows significantly better results in reducing pain, swelling, disability and improvement of independency.

Phys Ther. 2009 Jul;89(7):643-52. Epub 2009 May 29.

Short-term effects of high-intensity laser therapy versus ultrasound therapy in the treatment of people with subacromial impingement syndrome: a randomized clinical trial.

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Abstract

BACKGROUND: Subacromial impingement syndrome (SAIS) is a painful condition resulting from the entrapment of anatomical structures between the anteroinferior corner of the acromion and the greater tuberosity of the humerus.

OBJECTIVE: The aim of this study was to evaluate the short-term effectiveness of high-intensity laser therapy (HILT) versus ultrasound (US) therapy in the treatment of SAIS.

DESIGN: The study was designed as a randomized clinical trial.

SETTING: The study was conducted in a university hospital. **PATIENTS:** Seventy patients with SAIS were randomly assigned to a HILT group or a US therapy group.

INTERVENTION: Study participants received 10 treatment sessions of HILT or US therapy over a period of 2 consecutive weeks. **MEASUREMENTS:** Outcome measures were the Constant-Murley Scale (CMS), a visual analog scale (VAS), and the Simple Shoulder Test (SST).

RESULTS: For the 70 study participants (42 women and 28 men; mean [SD] age=54.1 years [9.0]; mean [SD] VAS score at baseline=6.4 [1.7]), there were no between-group differences at baseline in VAS, CMS, and SST scores. At the end of the 2-week intervention, participants in the HILT group showed a significantly greater decrease in pain than participants in the US

therapy group. Statistically significant differences in change in pain, articular movement, functionality, and muscle strength (force-generating capacity) (VAS, CMS, and SST scores) were observed after 10 treatment sessions from the baseline for participants in the HILT group compared with participants in the US therapy group. In particular, only the difference in change of VAS score between groups (1.65 points) surpassed the accepted minimal clinically important difference for this tool. LIMITATIONS: This study was limited by sample size, lack of a control or placebo group, and follow-up period.

CONCLUSIONS: Participants diagnosed with SAIS showed greater reduction in pain and improvement in articular movement functionality and muscle strength of the affected shoulder after 10 treatment sessions of HILT than did participants receiving US therapy over a period of 2 consecutive weeks.

Photomed Laser Surg. 2008 Apr;26(2):99-105.

Low-power laser treatment in patients with frozen shoulder: preliminary results.

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OBJECTIVE: In this study I sought to test the efficacy of low-power laser therapy (LLLT) in patients with frozen shoulder. Background Data: The use of low-level laser energy has been recommended for the management of a variety of musculoskeletal disorders.

MATERIALS AND METHODS: Sixty-three patients with frozen shoulder were randomly assigned into one of two groups. In the active laser group (n = 31), patients were treated with a 810-nm Ga-Al-As laser with a continuous output of 60 mW applied to eight points on the shoulder for 30 sec each, for a total dose of 1.8 J per point and 14.4 J per session. In the placebo group (n = 32), patients received placebo laser treatment. During 8 wk of treatment, the patients in each group received 12 sessions of laser or placebo, two sessions per week (for weeks 1-4), and one session per week (for weeks 5-8).

RESULTS: Relative to the placebo group, the active laser group had: (1) a significant decrease in overall, night, and activity pain scores at the end of 4 wk and 8 wk of treatment, and at the end of 8 wk additional follow-up (16 wk post-randomization); (2) a significant decrease in shoulder pain and disability index (SPADI) scores and Croft shoulder disability questionnaire scores at those same intervals; (3) a significant decrease in disability of arm, shoulder, and hand questionnaire (DASH) scores at the end of 8 wk of treatment, and at 16 wk posttreatment; and (4) a significant decrease in health-assessment questionnaire (HAQ) scores at the end of 4 wk and 8 wk of treatment. There was some improvement in range of motion, but this did not reach statistical significance.

CONCLUSIONS: The results suggested that laser treatment was more effective in reducing pain and disability scores than placebo at the end of the treatment period, as well as at follow-up.

EMLA Laser Health J 2007;2:46-67
European Medical Laser Association (EMLA)

Effects of LLLT on the periartthritis of the shoulder: A clinical study on different treatments with low level laser therapy, corticosteroid injections or a wait-and-see policy

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Low level laser irradiation is a treatment method widely used in medical science. Many disorders, such as osteoarthritis and musculoskeletal conditions with pain, have been treated with LLLT. With respect to pain the action of the laser interferes in the cytokines TNF- α , interleukin-1, interleukin-6 that drive inflammation in the arthritis and are secreted from CD4 and T cells. LLLT also increases the endorphin synthesis in the dorsal horn of the spinal cord, stopping the production of bradykinin and serotonin, and increases the production of nitric oxide into the endothelia cells and into the smooth muscular cells of the vessels walls having a vasodilatory, anti-inflammatory and analgesic action.

Patients, suffering from periartthritis of the shoulder of at least 6 weeks' duration, were recruited by family doctors. We randomly allocated eligible patients to 6 weeks of treatment n. 20 (33%) with corticosteroid injection, n. 21 (35%) with LLLT and with wait-and-see policy n.19 (31%). We applied a number of 12 sessions with infrared Diode Laser Ga-As (904 nm), 60 W maximum power, peak power per pulse 27 W, pulse frequency 1280 Hz, average point region 2-8 J; dose/point = 3-4 J; total energy density 24 J/cm². Outcome measures included general improvement, severity of the main complaint, pain, shoulder disability, and patient satisfaction. Severity of shoulder complaints, abduction and elevation of the arm, and the pressure pain threshold were assessed. The principal analysis was done on an intention treatment basis. We assessed all outcomes at 3, 6, 12, 26, 52 weeks.

We randomly assigned 60 patients. At 6 weeks, corticosteroid injections were significantly better than all other therapy options for all outcome measures. Success rates were 90% (18) compared with 52% (11) for LLLT and 35% (7) for wait-and-see policy. Long-term differences between injections and LLLT were significantly in favour of LLLT. Success rate at 52 weeks were 14 (70%) for injections, 19 (90.5%) for LLLT, and 16 (83%) for wait-and-see policy. Low Level Laser Therapy had better results than a wait-and-see policy, but differences were not significant ($p < 0.001$).

Patients should be properly informed about the advantages and disadvantages of the treatment options for the periartthritis of the shoulder. The decision to treat with LLLT or to adopt a wait-and-see policy might depend on available resources, since the relative gain of Low Level Laser Therapy is better, but also small at long-term.

Clin J Sport Med. 2006 Jul;16(4):293-7.

Comparison in the effect of linear polarized near-infrared light irradiation and light exercise on shoulder joint flexibility.

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Abstract

OBJECTIVE: This study aimed at comparing the effect of linear polarized near-infrared light irradiation (PL irradiation) and bicycle exercise with 50%HRreserve on the flexibility of the shoulder joint.

DESIGN: Placebo-controlled trial.

SETTING: Twenty-four healthy young adults (10 males: mean \pm -SD, age 20.9 \pm -3.1 y, height 171.0 \pm -3.9 cm, body mass 63.4 \pm -3.5 kg and 14 females: age 21.2 \pm -1.7 y, height 162.0 \pm -7.8 cm, body mass 56.2 \pm -7.2 kg).

INTERVENTIONS: PL-irradiation (100%, 1800 mW), placebo-irradiation (10%,180 mW), and light exercise (50%HRreserve) for 10 minutes. **OUTCOME**

MEASUREMENTS AND RESULTS: The shoulder joint angles were measured twice-before and after each intervention. We measured the angles when the right shoulder joint extended forward and flexed backward maximally without support, and analyzed these shoulder joints and range of motion. Trial-to-trial reliability (intra-class correlations) of each joint angle was very high, over 0.98. All joint angles showed significant changes, and values in post-PL-irradiation and postlight exercise were significantly greater than that in postplacebo-irradiation. Shoulder forward flexion and backward extension angles had significantly greater change rates in PL-irradiation and light exercise than placebo-irradiation, and their range of motion angle was in the order of PL-irradiation, light exercise, and placebo-irradiation.

CONCLUSIONS: It is suggested that PL-irradiation produces almost the same effect on shoulder joint range of motion as light exercise.

Photomed Laser Surg. 2005 Oct;23(5):459-64.

Low-power laser treatment for shoulder pain.

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Abstract

OBJECTIVE: The objective of this study is to investigate the effect of low-power gallium-arsenide laser treatment on the patients with shoulder pain.

BACKGROUND DATA: Low-energy laser therapy has recently been popularized in the treatment of various rheumatologic, neurologic, and musculoskeletal disorders such as osteoarthritis, rheumatoid arthritis, fibromyalgia, carpal tunnel syndrome, rotator cuff tendinitis, and chronic back pain syndromes.

METHODS: A total of 40 patients who applied to our clinic with shoulder pain and complied with the selection criteria were included in the study. The patients were randomly assigned into Group I (n = 20, laser treatment) and Group II (n = 20, control). In Group I, patients were given laser treatment and an exercise protocol for 10 sessions during a period of 2 weeks. Laser was applied over tuberculum majus and minus, bicipital groove, and anterior and posterior faces of the capsule, regardless of the existence of sensitivity, for 1 min at each location at each session with a frequency of 2000 Hz using a GaAs diode laser instrument (Roland Serie Elettronica Pagani, wavelength 904 nm, frequency range of 5-7000 Hz, and maximum peak power of 27 W, 50 W, or 27 x 4 W). In Group II, placebo laser and the same exercise protocol was given for the same period. Patients were evaluated according to the parameters of pain, palpation sensitivity, algometric sensitivity, and shoulder joint range of motion before and after treatment.

RESULTS: Analysis of measurement results within each group showed a significant posttreatment improvement for some active and passive movements in both groups, and also for algometric sensitivity in Group I ($p < 0.05-0.01$). Posttreatment palpation sensitivity values showed improvement in 17 patients (85%) for Group I and six patients (30%) for Group II. Comparison between two groups showed superior results ($p < 0.01$ and $p < 0.001$) in Group I for the parameters of passive extension and palpation sensitivity but no significant difference for other parameters.

CONCLUSIONS: The results of our study have shown better results in palpation sensitivity and passive extension, but no significant improvement in pain, active range, and algometric sensitivity in laser treatment group compared to the control group in the patients with shoulder pain.

J Sports Med Phys Fitness. 2002 Dec;42(4):438-45.

Effect of linear polarized near-infrared light irradiation on flexibility of shoulder and ankle joints.

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Abstract

BACKGROUND: There is a possibility that heat stimulus by linear polarized near-infrared light irradiation (PL: Super Lizer HA-30, Tokyo Medical Laboratory) improves the range of joint motion, because the flexibility of soft-part tissues, such as a muscle or a tendon, is improved by increasing the muscle temperature. The purpose of this study was to examine the influence of PL-irradiation on the ranges of shoulder and ankle motions.

METHODS: Experimental design: 30 healthy young adults (15 males: mean \pm -SD, age 19.1 \pm -0.8 yrs, height 173.3 \pm -4.6 cm, body mass 68.5 \pm -8.0 kg and 15 females: mean \pm -SD, age 19.2 \pm -0.7 yrs, height 162.3 \pm -4.5 cm, body mass 58.1 \pm -6.6 kg) participated in the experiment under PL-irradiation and no-irradiation (placebo) conditions. Measures: the angles of shoulder and ankle joint motions were measured twice, before and after the PL- and placebo-irradiations. The angle of a motion was defined as the angle connecting 3 points at linearity as follows: for the shoulder, the greater trochanter, acromion, and caput ulnare, and

for the ankle, the knee joint, fassa of lateral malleolus and metacarpal bone. Each angle was measured when a subject extended or flexed maximally without support.

RESULTS: The trial-to-trial reliability of each range of joint motion was very high. All parameters in PL-irradiation were significantly larger in postirradiation than pre-irradiation, and the value of postirradiation in PL-irradiation was significantly greater than that for placebo. The ranges of shoulder and ankle motions in placebo-irradiation were also significantly greater in postirradiation than pre-irradiation. Moreover, the change rate for each range of joint motion between pre- and postirradiations was significantly greater in PL-irradiation in both joints. In PL-irradiation, most subject's motions were greater in postirradiation than pre-irradiation, but not in the placebo-irradiation. The effect of PL-irradiation tended to be greater on subjects with a small range of a joint motion.

CONCLUSIONS: It is considered from the present results that the ranges of shoulder and ankle motions became greater with PL-irradiation, and is effective as a warming-up method.

J Clin Laser Med Surg. 1996 Aug;14(4):163-7.

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

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Among the various methods of application techniques in low level laser therapy (LLLT) (HeNe 632.8 nm visible red or infrared 820-830 nm continuous wave and 904 nm pulsed emission) there are very promising "trigger points" (TPs), i.e., myofascial zones of particular sensibility and of highest projection of focal pain points, due to ischemic conditions. The effect of LLLT and the results obtained after clinical treatment of more than 200 patients (headaches and facial pain, skeletomuscular ailments, myogenic neck pain, shoulder and arm pain, epicondylitis humery, tenosynovitis, low back and radicular pain, Achilles tendinitis) to whom the "trigger points" were applied were better than we had ever expected. According to clinical parameters, it has been observed that the rigidity decreases, the mobility is restored (functional recovery), and the spontaneous or induced pain decreases or even disappears, by movement, too. LLLT improves local microcirculation and it can also improve oxygen supply to hypoxic cells in the TP areas and at the same time it can remove the collected waste products. The normalization of the microcirculation, obtained due to laser applications, interrupts the "circulus vitiosus" of the origin of the pain and its development (Melzak: muscular tension > pain > increased tension > increased pain, etc.). Results measured according to VAS/VRS/PTM: in acute pain, diminished more than 70%; in chronic pain more than 60%. Clinical effectiveness (success or failure) depends on the correctly applied energy dose—over/underdosage produces opposite, negative effects on cellular metabolism. We did not observe any negative effects on the human body and the use of analgesic drugs could be reduced or completely excluded. LLLT suggests that the laser beam can be used as monotherapy or as a supplementary treatment to other therapeutic procedures for pain treatment.

THE USE OF LOW LEVEL LASER THERAPY (LLLT) IN THE TREATMENT OF TRIGGER POINTS THAT ARE ASSOCIATED WITH ROTATOR CUFF TENDONITIS.

Al-Shenqiti, J Oldham

60 patients were randomly allocated to either sham or laser therapy. The active laser parameters included a wavelength 820 nm, power output 100 mW, frequency 5000 Hz (modulated) and energy density 32 J/cm². 12 treatments were given over four weeks. The blinded outcome measures were pain, range of motion (ROM), functional activities and pressure pain threshold (PPT). Outcome measures were carried out pre and post treatment, then 3 months later. Considerable improvement in pain ($p < 0.001$) was seen for the laser compared to sham group post treatment, and at follow-up (6 points on a 10 VAS compared to 2 points respectively). Similarly, significant differences in favour of laser were seen for ROM ($p < 0.01$), functional activities ($p < 0.001$) and PPT ($p < 0.05$).

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.

The Biological Effects of Laser Therapy and Other physical Modalities on Connective Tissue Repair Processes

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Connective tissue injuries, such as tendon rupture and ligamentous strains, are common. Unlike most soft tissues that require 7-10 days to heal, primary healing of tendons and other dense connective tissues take as much as 6 – 8 weeks during which they are inevitably protected in immobilization casts to avoid re-injury. Such long periods of immobilization impair functional rehabilitation and predispose a multitude of complications that could be minimized if healing is quickened and the duration of cast immobilization reduced. In separate studies, we tested the hypothesis that early function, ultrasound, 632.8 nm He-Ne laser, and 904 nm Ga-As laser, when used singly or in combination, promote healing of experimentally severed and repaired rabbit Achilles tendons as evidenced by biochemical, biomechanical, and morphological indices of healing. Our results demonstrate that: (1) appropriate doses of each modality, i.e., early functional activities, ultrasound, He-Ne and Ga-As laser therapy augment collagen synthesis, modulate maturation of newly synthesized collagen, and overall, enhance the biomechanical characteristics of the repaired tendons. (2) Combinations of either of the two lasers with early function and either ultrasound or electrical stimulation further promote collagen synthesis when compared to functional activities alone. However, the biomechanical effects measured in tendons receiving the multi-therapy were similar, i.e., not better than the earlier single modality trials. Although tissue repair processes in humans may differ from that of rabbits, these findings suggest that human cases of connective tissue injuries, e.g., Achilles tendon rupture, may benefit from appropriate doses of He-Ne laser, Ga-As laser, and other therapeutic modalities, when used singly or in combination. Our recent meta-analysis of the laser therapy literature further corroborate these findings.

LLLT is as well documented as NSAIDs and steroid injections for shoulder tendinitis/bursitis and epicondylalgia.

The Norwegian physiotherapist Jan M Bjordal published his thesis “Low level laser therapy in shoulder tendinitis/bursitis, epicondylalgia and ankle sprain” in 1997, at the Division of Physiotherapy Science, University of Bergen. It has also been published in Physical Therapy Reviews. 1998; 3: 121-132.

Here is the Conclusion of the thesis: "A systematic review has been performed on the effect of LLLT for three diagnoses. LLLT was evaluated on similar criteria for methodological assessments of trials as previously established for medical interventions. No evidence was found to indicate that randomized controlled trials on LLLT for tendinitis/bursitis of the shoulder, lateral epicondylalgia and ankle sprains were methodologically inferior to RCTs on medical interventions. The clinical effects of LLLT were found to be supported by scientific evidence regarding short (0-4 weeks) and medium term (<3 months) efficacy for subacute or chronic lateral epicondylitis, and short term efficacy (>3 months) for subacute or chronic lateral epicondylitis, and short term efficacy (> 3 months) for subacute or chronic shoulder tendinitis/bursitis. The evidence of effect from LLLT for acute ankle sprain is inconclusive, although there seems to be a slight tendency in favour of LLLT. Adverse effects of LLLT are rarely seen and only in minor forms (nausea, headache) compared to medication, where more serious gastrointestinal discomfort or ulcers are not uncommon. It has also been shown that trials in favour of active treatment had more treatments per week than the trials showing no difference in effect. In short one could say that LLLT should be used much in the same way as NSAID are used for short periods of time. Most trials showing significant effects used an IR 904 nm laser, but some results in favour of IR lasers with wavelengths of 780, 820 and 830 nm were also observed. Clinical effects of LLLT were best in subacute conditions. In chronic conditions a higher dosage and more treatments seem to be needed. The results of the high quality LLLT trials were all in favour of treatment with confidence intervals not including zero, and the trials came from several different research groups. Evidence was found to be at the highest or the second highest level depending on what level of clinical significance is decided according to the classification of Oxman (1994) and McQuay (1997). The review found little support for the alleged large placebo effects of LLLT. In chronic cases the placebo effect is probably less than 10%, after the natural history of the complaints is taken into account."

In the "Summary of discussion on clinical effect estimates for LLLT" the author writes:

"The majority of the included LLLT-trials found significant clinical effect from LLLT. Seven of the eleven LLLT-trials with acceptable methods included calculations of 95% confidence limits above zero, and one LLLT-trial on ankle sprain included zero (Axelsen & Bjerno 1993). The clinical effect estimates from LLLT-trials for shoulder tendinitis/bursitis are similar or higher than for NSAID or steroid injections. For lateral epicondylalgia estimates for short term clinical effects are similar or lower for LLLT than for steroid injections, but medium clinical effect estimates are similar or higher for LLLT. Recurrence of symptoms in lateral epicondylalgia is less likely after LLLT than after steroid injections. Evidence of clinical effects from ankle sprain is inconclusive. Adverse effects from LLLT are seldom seen and they appear less serious than for patients treated with NSAID and steroid injections."