TENDONOPATHIES RESEARCH ABSTRACTS

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Tendonopathies

Low Level Laser Therapy can be Effective for Tendonitis –A Meta Analysis

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Purpose:
To investigate if low level laser therapy (LLLT) with previously defined optimal treatment parameters can be effective for tendonitis.

Material:
Randomized controlled trials with LLLT for tendonitis.

Method:
Literature search for trials published after 1980 using LLLT on Medline, Embassy, Cochrane Library and hand search of physiotherapy journals in English and Scandinavian languages. Only trials that compared laser exposure of the skin directly over the injured tendon with optimal treatment parameters with identical placebo treatment were included.

Results:
The literature search identified 77 randomized controlled trials with LLLT, of which 18 included tendonitis. Three trials were excluded for lack of placebo control, of which one trial was comparative; another lacked patients with tendonitis in the treatment group, while the last unwittingly gave the placebo group active treatment. Four trials used too high power density or dose, and three trials did not expose the skin directly overlying the injured tendon. The remaining eight trials were included in a statistical pooling, where the mean effect of LLLT over placebo in tendonitis was calculated to 32% [25.0-39.0, 95% CI].

Conclusion:
Low level laser therapy with optimal treatment procedure/ parameters can be effective in the treatment of tendonitis.

Level Laser Therapy In Tendon Injuries? – A Review of In Vitro and In Vivo Trials

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Purpose:
To investigate the effect of different laser treatment parameters on fibroblast inflammation and production of collagen fibers.

Material:
Controlled in vitro or in vivo trials with low level laser therapy (LLLT)

Method:
Literature search for trials published after 1980 using LLLT on Medline, Embase, Cochrane Library and hand search of physiotherapy journals in English and Scandinavian languages. Optimal treatment parameters regarding timing, treatment frequency, dose and power density at target tissue were synthesized.

Results:
The literature search identified 31 controlled trials with LLLT on collagen tissue. Three in vitro trials were performed on stretch-induced and inflammation in fibroblast cultures and five in vitro trials were performed on collagen production. Optimal dose and power density for inhibition of prostaglandin PGE2 and interleukin 1- beta production was found to be 3.2-6.3 J/cm2 and 5.3 mW/cm2 measured at the target fibroblast cells after 5 days of irradiation. Data on upper range limits for anti-inflammatory treatment were inconclusive. Optimal dose and power density for collagen production was found to be in the range 0.2-2.0 J/cm2 and 2 –20 mW/cm2 measured at the target fibroblast cells. Daily treatment for 2 weeks with optimal parameters yielded a maximum increase in collagen production of 37%. The results from three in vivo trials showed similar increase in collagen production. Doses in excess of 4.5 J/cm2 and power densities higher than 30 mW/cm2 inhibited fibroblast metabolism and decreased collagen production.

Conclusion:
There is evidence of a dose-response pattern for LLLT in the treatment of tendon injuries during the proliferative phase of regeneration

Laser Photostimulation of Collagenous Tissues Repair Processes in Patients and Experimental Animal Models of Tendon Repair and Diabetic Skin Ulcers

Enwemeka ES, PhD, FACSM, Reddy GK, PhD, Stehno-Bittel L, PhD, Thomas J, MD

North American Association of Laser Therapy (NALT) Annual Conference (2002) Atlanta, Georgia.

Connective tissues are notorious for their slow rates of healing. As a result, they are often protected in immobilization casts for long periods of time after surgery. The long period of immobilization predisposes a multitude of complications, including muscle atrophy, osteoarthritis, skin necrosis, infection, tendo-cutaneous adhesion, re-rupture, and thrombophlebitis.

If healing can be quickened, then, the duration of cast immobilization can be reduced to minimize the deleterious effects of immobilization. In several experiments, we studied the effects of HeNe, GaAs, and GaAlAs lasers on tissue repair. Furthermore, we tested the hypothesis that early weight-bearing, ultrasound, HeNe laser, and GaAs laser, when used singly or in combination, accelerate the healing process of experimentally tenotomized and repaired rabbit Achilles tendons as evidenced by biochemical, biomechanical, and morphological indices of healing.

Our results demonstrate that:
(1) Laser therapy of appropriate intensity promotes skin and tendon tissue repair processes;
(2) Appropriate doses of each modality, i.e., early weight-bearing, ultrasound, HeNe and GaAs laser therapy augment collagen synthesis, modulate maturation of newly synthesized collagen, and overall, enhance the biomechanical characteristics of the repaired tendons;
(3) Combinations of either of the two lasers with early weight-bearing and either ultrasound or electrical stimulation further promote collagen synthesis when compared to early weight-bearing alone.

However, the biomechanical effects measured in tendons receiving the multi-modality therapy were similar, i.e., not better than the earlier single modality trials. In other experiments, we tested the hypotheses that appropriate doses of laser therapy promote tissue repair in a rat model of experimental diabetes, and also in clinical cases of healing-resistant diabetic ulcers.

Our experimental diabetic ulcers healed faster with laser therapy, as did some human cases of diabetic leg ulcers. Our recent meta-analyses of the laser therapy literature corroborate these results, and support the widely held belief that appropriate intensities of laser therapy accelerate healing of collagenous tissues, i.e., skin, bones, tendons, ligaments, and cartilage.

Low Level Laser Therapy (LLLT) of Tendonitis and Myofascial Pains – A Randomized, Double-blind, Controlled Study

Logdberg-Andersson M, Mutzell S, and Hazel A

Laser therapy (1997) 9: 79-86.

The purpose of this randomized, 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.

Low Level Laser Therapy for Tendonopathy. Evidence of a Dose-Response Pattern

Bjordal J M, Couppé C, Ljunggren E

Physical Therapy Reviews (2001) 6: 91-99.

To investigate whether low-level laser therapy can reduce pain from tendonopathy, the authors performed a review of randomized placebo-controlled trials with laser therapy for tendonopathy. Validity assessment of each trial was done acc. to predefined criteria for location-specific dosage and irradiation of the skin directly overlying the affected tendon. The literature search identified 78 randomized control trials of which 20 included tendonopathy. Seven trails were excluded for not meeting the validity criteria on treatment procedure and trial design. 12 of the remaining 13 trials investigated the effect of laser therapy for patients with subacute and chronic tendonopathy and provided a pooled mean effect of 21%. If results from only the nine trials adhering to assumed optimal treatment parameters were included, the mean effect over placebo increased to 32%. Laser therapy can reduce pain in subacute and chronic tendonopathy if a valid treatment procedure and location-specific dose is used.

Effects of Skin-Contact Monochromatic Infrared Irradiation on Tendonitis, Capsulitis, and Myofascial Pain

Thomasson TL

Journal of Neurology Orthopedic Medicine Surgery (1996) 16(4): 242-245.

Skin-contact monochromatic infrared irradiation has recently become available via adaptation of superluminous diode technology. Craniofacial and cervical myalgias, insertion tendonitis, and dysfunctions of the temporomandibular joints are addressed. This article attempts to establish protocol guidelines and reports patient responses to this very effective, noninvasive, physiotherapeutic treatment modality. Both surgical and nonsurgical cases are reported, and clinical applications as well as home unit use is evaluated. Details on technique are given, and contraindications are outlined. Particular advantages are rapid patient response, operator-friendly technique, diversity of application parameters, and the opportunity to manage both acute and chronic conditions in the absence of oral or injectable pharmacology.

Discussion:
Wavelength-dependent photobiostimulation responses are a part of our everyday life. Increased melanin production, color recognition, and synthesis of vitamin D are a few examples. In this study, the excellent results of the infrared portion of the electromagnetic spectrum on pain relief seem to be related to several factors. One of these is the opportunity to place the infrared irradiation in direct contact with the patient's skin for extended periods of time without harm to the patient. Another factor is the delivery of the irradiation perpendicular to all target areas via flexible pads containing the superluminous diodes. Consistent, homogenous dosage delivery form patient to patient and condition to condition allows ease of establishing application protocols and uniform comparison of treatment results between practitioners. The consistent results from diagnosis to diagnosis indicate commonality of effects on inflammatory processes, regardless of site or etiology.

Since nearly all patients treated (91.9%) had a history of some type of previous therapeutic intervention, the results indicate a high rate of successful conservative treatment whether or not the diagnosis were new or subjected to previous applied standard treatment parameters. This is a great benefit, as skin-contact monochromatic infrared irradiation can be considered as a first line of physiotherapeutic treatment for soft tissue disorders encountered in pain management. The absence of technique-sensitive application and lack of harmful patient side effects enables this modality to be easily delegated to auxiliary personnel or to home use, and the rapid patient response is certainly an aid in pain-patient management.

The vast majority of supportive research regarding photobiostimulation has been limited to evaluation of effects of low level laser therapy. This is primarily because, until recently, lasers were the only convenient means of delivering effective monochromatic irradiation. However, with recent developments in superluminous diodes technology, we can now deliver effective, safe, user-friendly skin-contact monochromatic infrared irradiation with energy densities previously limited to laser irradiation. This eliminates or reduces the restrictions of immobility, hand-held delivery, or high cost some laser systems impose. Basford, Smith, Karu, and Baxter have indicated that the effects are not necessarily due to the unique qualities of laser irradiation, but are primarily wavelength dependent. It has been previously reported that these excellent responses to treatment may be partially due to increase fibroblastic activity, respiratory chain photobioactivation, bioactivation of serotonin, improved lymphatic evacuation, or increased circulation. Whatever may be the mechanism(s) involved, this easy, safe, and effective modality is an extremely valuable tool for eliminating or reducing pain, inflammation, edema, and loss of range of motion.

Possibilities of the analgesic therapy of ultrasound and non-invasive laser of plantar fasciitis

Hronkova H, Navratil L, Skopek J, Kymplova J

Laser Partner Clinicexperience (2000) No. 21, 19.

Objective:
To compare the effectiveness of the two therapeutic approaches, ultrasound and low level laser used in patients suffering from calcar calcaneus-plantar fasciitis.

Methods:
171 patients with calcar calcaneus and plantar facilities diagnosed with the x-ray were divided into four groups**.**

Group A - 60 patients treated with ultrasound therapy (UST). Ultrasound with the output of 1 W per cm^2 was applied for 5 minutes in each of 10 applications and the head of device pointed to the place of maximum pain;

Group B - 61 patients were treated with low level laser therapy (LLLT) without any additional treatment including pharmacotherapy. Laser with 870 nm of wavelength, output of 200 mW, was applied on the place of maximum pain. Energy density of 9 J/cm^2 in the series of 10 laser applications every other day was used.

Group C - 8 patients where previous UST had no or minimal effect and therefore LLLT was subsequently applied the same way as in the group B. Laser was applied not earlier than 14 days after the ultrasound.

Group D (Control) - In this group of 52 patients the sham laser radiation (no laser beam) was applied whereas patient and personnel could not identify whether the laser was shamed or not. This group is used as control “placebo” group.
The effectiveness of the treatment was determined according to the evaluation of the patient using certain criteria described in the table.

Results:
The complete disappearance of pain was seen in 50% of patients, partial improvement in 16.6% and no effect in 33.3% of patients treated with US.
In *Group B*, where LLLT has been used, 64% of patients described disappearance of pain, 26% with improvement and in 10% of patients this therapy brought no effect.
In the *Group C* of previous UST and subsequent use of LLLT, 75% of patients evaluated their treatment as successful. In 25% however, laser had no effect.
In summary, 69 patients were treated with LLLT from which 67% described complete pain relief, 20% partial improvement and in 13% laser brought no effect.
In the *Group D* there were 50 patients treated with sham laser and full effect was seen in 18% of them, partially reduced pain in 42% and without any effect in 40%.

Discussion and Conclusions:
The results show that the LLLT is a good therapeutic approach in the treatment of pain in patients suffering from calcar-calcaneus – plantar faciitis. The treatment with laser was significantly more successful then the ultrasound therapy, which is currently the most common therapy used for plantar fasciitis.

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