Photobiomodulation and eccentric exercise for Achilles tendinopathy: a randomized controlled trial.

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BACKGROUND: The common regime of eccentric exercise in use for Achilles tendinopathy is somewhat arduous and compliance issues can arise. This is the first study to investigate the effectiveness of a regime of fewer exercise sessions combined with photobiomodulation for the treatment of Achilles tendinopathy. METHODS: A double blind randomized controlled trial and intention-to-treat analysis were performed. Eighty participants, 18-65 years with Achilles tendinopathy and symptoms for longer than 3 months, were included in the trial. Participants randomized into one of four groups; 1 (Placebo + Ex Regime 1) or 2 (Laser + Ex Regime 1) or 3 (Placebo + Ex Regime 2) or 4 (Laser + Ex Regime 2). The primary outcome measure was the Victorian Institute of Sports Assessment-Achilles (VISA-A) questionnaire. Outcomes were collected at baseline, week 4 and week 12. RESULTS: Sixteen participants were lost to follow-up at 12 weeks, 4 of which due to adverse reactions. As per intention to treat, missing data were imputed, 80 participants were included in the final analysis. For VISA-A at 12 weeks, group 4 achieved significant gains over the other 3 groups: group 1 (18.5 [9.1, 27.9]), group 2 (10.4 [1.5, 19.2]), group 3 (11.3 [3.0, 19.6]). There was a moderate effect size in favour of exercise twice per week (7.2 [-1.8, 16.2], ES .7). CONCLUSIONS: Twice-daily exercise sessions are not necessary as equivalent results can be obtained with two exercise sessions per week. The addition of photobiomodulation as adjunct to exercise can bring added benefit.

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Effects of low-intensity non-coherent light therapy on the inflammatory process in the calcaneal tendon of ovariectomized rats.

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The aim of this experimental study was to investigate the effects of low-intensity light-emitting diode (LED) phototherapy on the inflammatory process in the calcaneal tendon of ovariectomized rats (OVX) through the involvement of the inflammatory mediators interleukin (IL)-6, IL-10, and tumor necrosis factor-alpha (TNF-alpha). Thirty-five female Wistar rats were divided into 4 groups: 3 groups of OVX rats totaling 30 rats (untreated OVX rats [OVX injury group], treated OVX rats [OVX LED group], and control OVX rats; subgroups existed based on the sampling times, which were 3, 7, and 14 days) and 1 group of non-OVX rats (not OVX; n = 5). Tendon injury was induced by trauma using a 208-g mass placed at 20 cm from the right tendon of each animal with energy of 0.70 J. The animals were treated 12 h after tendonitis with LED therapy and every 48 h thereafter until euthanasia (at 3, 7, or 14 days). The tendons were dissected and stored in liquid nitrogen at -196 degrees C, thawed only at the time of immunoenzymatic testing (ELISA). Groups treated with LED showed a decrease in the number of pro-inflammatory cells, IL-6, and TNF-alpha ($p < 0.05$), and an increase in IL-10 ($p < 0.05$) when compared to the not OVX group ($p < 0.05$). It was concluded that low-intensity LED treatment using the parameters and wavelength of 945 nm in the time periods studied reduced the release of IL-6 and TNF-alpha and increased the release of IL-10, thereby improving the inflammatory response in OVX rats.

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Two-year follow-up of low-level laser therapy for elderly with painful adhesive capsulitis of the shoulder.

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INTRODUCTION: This paper reports on the medium-term mean 2-year prospective follow-up of a patient cohort of 35 unselected elderly patients with mean age of 65 years who visited our tertiary referral pain center for painful adhesive capsulitis of the shoulder managed with low-level laser therapy (LLLT). MATERIALS AND METHODS: All patients in this prospective cohort study had documentation of the diagnosis by contrast-enhanced magnetic resonance imaging before study entry and all had failed to respond to a combination of conventional physical therapy and nonsteroidal anti-inflammatory medications for not fewer than 4 weeks. LLLT, at a wavelength of 810 nm emitted from a GaAlAs semiconductor laser device with 5.4 J per point and a power density of 20 mW/cm(2), was employed to irradiate six predetermined anatomic points and two acupuncture points. The treatment regimen consisted of three sessions of treatment per week for 8 consecutive weeks. Each treatment session lasted 180 seconds. Serial clinical assessment was undertaken using the Constant-Murley shoulder score. RESULTS: A total of 50 painful shoulder joints were treated, as a number of elderly presented with bilateral symptoms. All but four painful shoulders showed significant improvement in Constant-Murley shoulder score at the end of 8-weeks' LLLT treatment and, surprisingly, the improvement was found maintained at follow-up assessments at 1 year and 2 years. CONCLUSION: We conclude that LLLT is a viable option in the conservative treatment of shoulder pain arising from adhesive capsulitis of the shoulder in the elderly, with a positive clinical result of more than 90% and with clinical efficacy both in the short-term and the medium-term.

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Evaluation of low-level laser therapy, platelet-rich plasma, and their combination on the healing of Achilles tendon in rabbits.

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Tendon repair is still one of the challenges for rehabilitation. Various treatments for tendon injuries have been used in recent decade. This study was established to investigate the effects of low-level laser therapy (LLLT), platelet-rich plasma (PRP) treatment alone, and using combined method on the healing of Achilles tendon in rabbits. Seventy-two healthy mature male white New Zealand rabbits were divided randomly into four groups of 18 animals each: control: partial tenotomy with no treatment, only 1 mL normal saline was injected on days 1, 8, and 15 at the site of splitting; PRP: partial tenotomy with PRP treatment on days 1, 8, and 15 at the site of splitting; LLLT: partial tenotomy with LLLT (K30 hand-held probe, AZOR, Technica, Russia, 650 nm, 30 mW, surface area = 1 cm(2), 60 S/cm(2), energy density = 1.8 J/cm(2)) for 15 consecutive days; LLLT + PRP: partial tenotomy with LLLT + PRP. At the end of trial, the rabbits were euthanatized and tendon specimens were harvested and were submitted for histopathological evaluation, hydroxyproline levels, and biomechanical measurement. The Tukey post hoc test was performed. The results for these parameters showed that PRP or LLLT alone has significant advantages over untreated animals ($P < 0.05$). Furthermore, it was found that the combined treatment with PRP and LLLT is even more efficient. There was no significant difference ($P > 0.05$) between the two groups of LLLT and PRP. However, the treatments combining PRP and LLLT showed significant results in comparison of PRP or LLLT alone ($P < 0.05$). Our results demonstrate that the healing time of injured tendon decreases by using the two therapies combined.

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Effect of MLS((R)) laser therapy with different dose regimes for the treatment of experimentally induced tendinopathy in sheep: pilot study.

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OBJECTIVE: The aim of this preliminary study was to investigate the effect of Multiwave Locked System (MLS((R))), a particular model of low-level laser, in the acute phase of collagenase-induced tendon lesions in six adult sheep randomly assigned to two groups. BACKGROUND DATA: Tendon injuries are common among human athletes and in sport horses, require a long recovery time, and have a high risk of relapse. Many traditional treatments are not able to repair the injured tendon tissue correctly. In recent years, the use of low-level laser therapy (LLLT) produced interesting results in inflammatory modulation in different musculoskeletal disorders. METHODS: Group 1 received 10 treatments of MLS laser therapy at a fluence of 5 J/cm(2) on the left hindlimb. Group 2 received 10 treatments of MLS laser therapy at a fluence of 2.5 J/cm(2) on the left hindlimb. In every subject in both groups, the right hindlimb was considered as the control leg. RESULTS: Clinical follow-up and ultrasonography examinations were performed during the postoperative period, and histological examinations were performed at day 30 after the first application of laser therapy. In particular, results from histological examinations indicate that both treatments induced a statistically significant cell number decrease, although only in the second group did the values return to normal. Moreover, the MLS laser therapy dose of 2.5 J/cm(2) (group 2) caused a significant decrease of vessel area. CONCLUSIONS: In this study, clinical and histological evaluation demonstrated that a therapeutic dose <5 J/cm(2) furnished an anti-inflammatory effect, and induced a decrease of fibroblasts and vessel area. Overall, our results suggest that MLS laser therapy was effective in improving collagen fiber organization in the deep digital flexor tendon.

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The Effects of LLLT on Pain Associated With Tendinopathy: A Critically Appraised Topic.

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Tendinopathies plague many active individuals, causing pain and reducing sport activity by decreasing ROM and strength. Tendinopathy refers specifically to disease of the tendon.2 Tendinopathy may be characterized by three degrees of severity; with pain being involved in all degrees. Tendinopathy was chosen for this clinical appraisal topic (CAT) in order to focus on one specific type of musculoskeletal injury. Tendinopathies are clinically relevant to the athletic trainer and sports medicine rehabilitation expert. The potential benefits of managing pain associated with tendinopathy has been investigated using LLLT and is still somewhat inconclusive. Further exploration; however, into the clinical effectiveness of using LLLT is warranted. Cellular respiration and metabolism is thought to be increased by LLLT; acting on the mitochondrial cytochromes. The effects LLLT may have on cellular activity could increase blood flow, and in return reduce the pain spasm cycle; resulting in an appropriate healing environment for the tendon. The purpose of this CAT is to identify the clinical effectiveness of LLLT on pain associated with tendinopathy and to identify the parameters utilized to achieve any statistically significant and clinically effective pain outcomes. Understanding the clinical effectiveness of studies may provide necessary information that could change a clinician's clinical practice. Extensive investigation of the study confidence interval and point estimate are necessary to determine clinical effectiveness. Confidence intervals that do not overlap between treatment group and placebo show the greatest potential for clinical effectiveness.

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The Efficacy of Low-Level Laser Therapy for Shoulder Tendinopathy: A Systematic Review and Meta-Analysis of Randomized Controlled Trials.

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BACKGROUND AND PURPOSE: Low-level laser therapy (LLLT) is proposed as a treatment for tendinopathies. This is the first systematic review focusing solely on LLLT treatment effects in shoulder tendinopathy. METHODS: A systematic review with meta-analysis and primary outcome measures pain relief on 100-mm visual analogue scale (VAS) and relative risk for global improvement. Two independent assessors rated the included studies according to the PEDro scale. Intervention quality assessments were performed of LLLT dosage and treatment procedures according to World Association for Laser Therapy guidelines. The included trials were sub-grouped by intervention quality and use of other physiotherapy interventions. RESULTS: Seventeen randomized controlled trials (RCTs) met the inclusion criteria, and 13 RCTs were of high and 4 RCTs of moderate methodological quality. Significant and clinically important pain relief was found with weighted mean differences (WMD) over placebo, for LLLT as monotherapy at 20.41 mm (95% CI: 12.38 to 28.44) and as adjunct to exercise therapy at 16.00 mm (95% CI: 11.88 to 20.12). The WMD when LLLT was used in a multimodal physiotherapy treatment regime reached statistical significance over placebo at 12.80 (95% CI: 1.67-23.94) mm pain reduction on VAS. Relative risks for global improvement were statistically significant at 1.96 (95% CI: 1.25-3.08) and 1.51 (95% CI: 1.12-2.03), for laser as monotherapy or adjunctive in a physiotherapy regime, respectively. Secondary outcome measures of shoulder function were only significantly in favour of LLLT when used as monotherapy. Trials performed with inadequate laser doses were ineffective across all outcome measures. CONCLUSION: This review shows that optimal LLLT can offer clinically relevant pain relief and initiate a more rapid course of improvement, both alone and in combination with physiotherapy interventions. Our findings challenge the conclusions in previous multimodal shoulder reviews of physiotherapy and their lack of intervention quality assessments.

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Effectiveness of Passive Physical Modalities for Shoulder Pain: A Systematic Review by the Ontario Protocol for Traffic Injury Management Collaboration.

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BACKGROUND: Shoulder pain is a common musculoskeletal condition in the general population. Passive physical modalities are commonly used to treat shoulder pain. However, previous systematic reviews report conflicting results. PURPOSE: To evaluate the effectiveness of passive physical modalities for the management of soft tissue injuries of the shoulder. DATA SOURCES: MEDLINE, EMBASE, CINAHL, PsycINFO, and the Cochrane Central Register of Controlled Trials from January 1st, 1990 to April 18th, 2013. STUDY SELECTION: Randomized controlled trials (RCTs), cohort and case-control studies were eligible. Random pairs of independent reviewers screened 1470 of 1760 retrieved articles after removing 290 duplicates. Twenty-two articles were eligible for critical appraisal. We critically appraised the eligible studies using the Scottish Intercollegiate Guidelines Network criteria. Of those, 11 studies had a low risk of bias. DATA EXTRACTION: The lead author extracted data from low risk of bias studies and built evidence tables. A second reviewer independently checked the extracted data. DATA SYNTHESIS: We synthesized the findings of low risk of bias studies according to principles of best evidence synthesis. We found that pre-tensioned tape, ultrasound and interferential current are not effective to manage shoulder pain. However, diathermy and corticosteroid injections lead to similar outcomes. Low-level laser therapy provides short-term pain reduction for subacromial impingement syndrome. Extracorporeal shock-wave therapy is not effective for subacromial impingement syndrome but it provides benefits for persistent shoulder calcific tendonitis. LIMITATIONS: Non-English studies

The low level laser therapy (LLLT) operating in 660 nm reduce gene expression of inflammatory mediators in the experimental model of collagenase-induced rat tendinitis.

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Tendinopathy is a common disease with a variety of treatments and therapies. Laser therapy appears as an alternative treatment. Here, we investigate the effects of laser irradiation in an experimental model of tendinitis induced by collagenase injection on rats' Achilles tendon, verifying its action in important inflammatory markers. Male Wistar rats were used and divided into five groups: control saline (C), non-treated tendinitis (NT) and tendinitis treated with sodium diclofenac (D) or laser (1 J) and (3 J). The tendinitis was induced by collagenase (100 mug/tendon) on the Achilles tendon, which was removed for further analyses. The gene expression for COX-2; TNF-alpha; IL-6; and IL-10 (RT-PCR) was measured. The laser irradiation (660 nm, 100 mW, 3 J) used in the treatment of the tendinitis induced by collagenase in Achilles tendon in rats was effective in the reduction of important pro-inflammatory markers such as IL-6 and TNF-alpha, becoming a promising tool for the treatment of tendon diseases.

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Electrotherapy modalities for adhesive capsulitis (frozen shoulder).

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BACKGROUND: Adhesive capsulitis (also termed frozen shoulder) is a common condition characterised by spontaneous onset of pain, progressive restriction of movement of the shoulder and disability that restricts activities of daily living, work and leisure. Electrotherapy modalities, which aim to reduce pain and improve function via an increase in energy (electrical, sound, light, thermal) into the body, are often delivered as components of a physical therapy intervention. This review is one in a series of reviews which form an update of the Cochrane review 'Physiotherapy interventions for shoulder pain'. OBJECTIVES: To synthesise the available evidence regarding the benefits and harms of electrotherapy modalities, delivered alone or in combination with other interventions, for the treatment of adhesive capsulitis. SEARCH METHODS: We searched CENTRAL, MEDLINE, EMBASE, CINAHL Plus and the ClinicalTrials.gov and World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP) clinical trials registries up to May 2014, unrestricted by language, and reviewed the reference lists of review articles and retrieved trials to identify any other potentially relevant trials. SELECTION CRITERIA: We included randomised controlled trials (RCTs) and controlled clinical trials using a quasi-randomised method of allocation that included adults with adhesive capsulitis and compared any electrotherapy modality to placebo, no treatment, a different electrotherapy modality, or any other intervention. The two main questions of the review focused on whether electrotherapy modalities are effective compared to placebo or no treatment, or if they are an effective adjunct to manual therapy or exercise (or both). The main outcomes of interest were participant-reported pain relief of 30% or greater, overall pain, function, global assessment of treatment success, active shoulder abduction, quality of life, and the number of participants experiencing any adverse event. DATA COLLECTION AND ANALYSIS: Two review authors independently selected trials for inclusion, extracted the data, performed a risk of bias assessment, and assessed the quality of the body of evidence for the main outcomes using the GRADE approach. MAIN RESULTS: Nineteen trials (1249 participants) were included in the review. Four trials reported using an adequate method of allocation concealment and six trials blinded participants and personnel. Only two electrotherapy modalities (low-level laser therapy (LLLT) and pulsed electromagnetic field therapy (PEMF)) have been compared to placebo. No trial has compared an electrotherapy modality plus manual therapy and exercise to manual therapy and exercise alone. The two main questions of the review were investigated in nine trials.Low quality evidence from one trial (40 participants) indicated that LLLT for six days may result in improvement at six days. Eighty per cent (16/20) of participants reported treatment success with LLLT compared with 10% (2/20) of participants receiving placebo (risk ratio (RR) 8.00, 95% confidence interval (CI) 2.11 to 30.34; absolute risk difference 70%, 95% CI 48% to 92%). No participants in either group reported adverse events.We were uncertain whether PEMF for two weeks improved pain or function more than placebo at two weeks because of the very low quality evidence from one trial (32 participants). Seventy-five per cent (15/20) of participants reported pain relief of 30% or more with PEMF compared with 0% (0/12) of participants receiving placebo (RR 19.19, 95% CI 1.25 to 294.21; absolute risk difference 75%, 95% CI 53% to 97%). Fifty-five per cent (11/20) of participants reported total recovery of joint function with PEMF compared with 0% (0/12) of participants receiving placebo (RR 14.24, 95% CI 0.91 to 221.75; absolute risk difference 55%, 95% CI 31 to 79).Moderate quality evidence from one trial (63 participants) indicated that LLLT plus exercise for eight weeks probably results in greater improvement when measured at the fourth week of treatment, but a similar number of adverse events, compared with placebo plus exercise. The mean pain score at four weeks was 51 points with placebo plus exercise, while with LLLT

Effect of phototherapy with light-emitting diodes (890 nm) on tendon repair: an experimental model in sheep.

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The effect of phototherapy with 890-nm light-emitting diodes (LEDs) on the healing of experimentally induced tendinitis in sheep was evaluated in this study. Partial tenotomies measuring 0.2 cm wide x 0.5 cm long were performed on the second third of the superficial digital flexor tendons of 10 healthy sheep. The animals were divided into two groups: "treated" (TG), treated with LEDs at the aforementioned wavelength, and "control" (CG), a control group treated with a placebo. Kinesiotherapy, which consisted of 5-min walks on grassy ground, was performed on both groups. B-mode and power Doppler ultrasonographies (US) were performed to evaluate the tendon healing process during the first 14 days after surgery and on the 21st and 28th postoperative days. Biopsies were performed on day 28 for the histopathological assessment of neovascularisation and the pattern of the tendon fibres. The absence of lameness and a significant improvement ($p < 0.05$) in the sensitivity to pain during palpation were observed in the treated group. Furthermore, a significant reduction in oedema and an increased number of vessels ($p < 0.05$) were observed in this group with the B-mode and power Doppler US, respectively. No significant difference in the evolution of the lesion was found. There was a histological difference ($p < 0.05$) in neovascularisation in the treated group. Phototherapy with 890-nm light-emitting diodes decreases the inflammatory process.

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Low-level laser therapy in IL-1beta, COX-2, and PGE2 modulation in partially injured Achilles tendon.

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This study evaluated IL-1beta, COX-2, and PGE2 modulation in partially injured Achilles tendons treated with low-level laser therapy (LLLT). Sixty-five male Wistar rats were used. Sixty were submitted to a direct injury on Achilles tendon and then distributed into six groups: LASER 1 (a single LLLT application), LASER 3 (three LLLT applications), and LASER 7 (seven LLLT applications) and Sham 1, 3, and 7 (the same injury but LLLT applications were simulated). The five remaining animals were allocated at control group (no procedure performed). LLLT (780 nm) was applied with 70 mW of mean power and 17.5 J/cm2 of fluency for 10 s, once a day. The tendons were surgically removed and assessed immunohistochemically for IL-1beta, COX-2, and PGE2. In comparisons with control (IL-1beta: 100.5 +/- 92.5 / COX-2: 180.1 +/- 97.1 / PGE2: 187.8 +/- 128.8) IL-1beta exhibited (mean +/- SD) near-normal level ($p > 0.05$) at LASER 3 (142.0 +/- 162.4). COX-2 and PGE2 exhibited near-normal levels ($p > 0.05$) at LASER 3 (COX-2: 176.9 +/- 75.4 / PGE2: 297.2 +/- 259.6) and LASER 7 (COX-2: 259.2 +/- 190.4 / PGE2: 587.1 +/- 409.7). LLLT decreased Achilles tendon's inflammatory process.

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Tendinitis, an open avenue for low-level laser therapy.

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Low-Level Laser Therapy on Tissue Repair of Partially Injured Achilles Tendon in Rats.

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Abstract Objective: The aim of this study was to assess the alignment and type of collagen (I and III) in partially injured Achilles tendons of rats treated with low-level laser therapy (LLLT). Background: Achilles tendons present high indices of injury and their regeneration process may take a long time. LLLT has been used to accelerate and enhance injured Achilles tendon repair. Methods: Sixty-five male Wistar rats were distributed into seven groups: LASER 1, 3, and 7 (the rat's Achilles tendons were partially injured and submitted to treatment for 1, 3, or 7 days, respectively); a Sham group 1, 3, and 7 for each of LASER group (same injury, but the LLLT was only simulated), and five remaining animals were allocated to the control group (no procedures were performed). The 780 nm LLLT was applied once a day, with 70 mW of mean power, fluence of 17.5 J/cm2 for 10 sec. After the rats were euthanized, the tendons were surgically removed and assessed by birefringence technique (collagen alignment) and picrosirius red (collagen I and III). Results: Sham versus LASER analysis did not show differences ($p>0.05$) for collagen alignment. The collagen composition (median) was significantly different ($p<0.05$) for LASER 3 (I: 16.5; III: 83.5) versus Sham 3 (I: 12.5; III: 87.5) and LASER 7 (I: 20.2; III: 79.8) versus Sham 7 (I: 10.2; III: 89.8). LASER groups exhibited a higher percentage of type I collagen and a lower percentage of type III collagen. Conclusions: LLLT stimulated collagen I proliferation, improving the injured Achilles tendons' healing process.

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Evaluating the effect of low-level laser therapy on healing of tentomized Achilles tendon in streptozotocin-induced diabetic rats by light microscopical and gene expression examinations.

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Tendon healing is impaired in individuals diagnosed with diabetes mellitus (DM). According to research, there is considerable improvement in the healing of surgically tenotomized Achilles tendons following low-level laser therapy (LLLT) in non-diabetic, healthy animals. This study uses light microscopic (LM) and semi-quantitative reverse transcription PCR (RT-PCR) analyses to evaluate the ability of LLLT in healing Achilles tendons from streptozotocin-induced diabetic (STZ-D) rats. A total of 88 rats were randomly divided into two groups, non-diabetic and diabetic. DM was induced in the rats by injections of STZ. The right Achilles tendons of all rats were tenotomized 1 month after administration of STZ. Laser-treated rats were treated with a helium-neon (He-Ne) laser that had a 632.8-nm wavelength and 7.2-mW average power. Experimental group rats received a daily dose of 0.014 J (energy density, 2.9 J/cm2). Control rats did not receive LLLT. Animals were sacrificed on days 5, 10, and 15 post-operatively for semi-quantitative LM and semi-quantitative RT-PCR examinations of transforming growth factor-beta1 (TGF-beta1) gene expression. The chi-square test showed that LLLT significantly reduced inflammation in non-diabetic rats compared with their non-diabetic controls ($p = 0.02$). LLLT significantly decreased inflammation in diabetic rats on days 5 ($p = 0.03$) and 10 ($p = 0.02$) compared to the corresponding control diabetic rats. According to the student's t test, LLLT significantly increased TGF-beta1 gene expression in healthy ($p = 0.000$) and diabetic ($p = 0.000$) rats compared to their relevant controls. The He-Ne laser was effective in altering the inflammatory reaction and increasing TGF-beta1 gene production.

Lasers Med Sci 2014 Mar 13

http://www.ncbi.nlm.nih.gov/pubmed/?term=24622817

Lateral epicondylalgia: midlife crisis of a tendon.

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The pathogenesis and management of lateral epicondylalgia, or tennis elbow, a common ailment affecting middle-aged subjects of both genders continue to provoke controversy. Currently it is thought to be due to local tendon pathology, pain system changes, and motor system impairment. Its diagnosis is usually clinical, based on a classical history, as well as symptoms and signs. In selected cases, additional imaging (X-rays, ultrasound, and magnetic resonance imaging) can help to confirm the diagnosis. Different treatment modalities have been described, including the use of orthotics, non-steroidal anti-inflammatory drugs, steroid injections, topical glyceryl trinitrate, exercise therapy, manual therapy, ultrasound therapy, laser therapy, extracorporeal shockwave therapy, acupuncture, taping, platelet-rich plasma injections, hyaluronan gel injections, botulinum toxin injections, and surgery. Nevertheless, evidence to select the best treatment is lacking and the choice of therapy depends on the experience of the management team, availability of the equipment and expertise, and patient response. This article provides a snapshot of current medical practice for lateral epicondylalgia management.

Hong Kong Med J 2014 Apr 20(2) 145-51

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Mast cell curve-response in partial achilles tendon rupture after 830 nm phototherapy.

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OBJECTIVE: The aim of this study was to quantify mast cells at different time intervals after partial Achilles tendon rupture in rats treated with low-level laser therapy (LLLT). BACKGROUND DATA: There is a high incidence of lesions and ruptures in the Achilles tendon that can take weeks and even months to heal completely. As the mast cells help in the healing repair phase, and LLLT has favorable effects on this tissue repair process, study of this modality on the quantity of mastocytes in the ruptured tendon is relevant. METHODS: Sixty Wistar rats were subjected to partial Achilles' tendon rupture by direct trauma, randomized into 10 groups, and then divided into the group treated with 80 mW aluminum gallium arsenide infrared laser diode, continuous wave, 2.8 W/cm(2) power density, 40 J/cm(2) energy density, and 1.12 J total energy, and the simulation group. Both the groups were subdivided according to the histological assessment period of the sample, either 6 h, 12 h, 24 h, 2 days, or 3 days after the rupture, to quantify the mastocytes in the Achilles' tendon. RESULTS: The group subjected to LLLT presented a greater quantity of mastocytes in the periods of 6 h, 12 h, 24 h, 2 days, and 3 days after rupture, compared with the simulation groups, but differences were detected between the sample assessment periods only in the simulation group. CONCLUSIONS: LLLT was shown to increase the quantity of mastocytes in the assessment periods compared with the simulation groups.

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CHELT therapy in the treatment of chronic insertional Achilles tendinopathy.

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The application of laser therapy on soft tissue is used for pain relief, anti-inflammation action and biostimulation. The efficiency of High Energy Laser Therapy has not yet been studied on Achilles tendinopathy. The aim of the study is to evaluate the effectiveness of a flow of Cold air and High Energy Laser Therapy (CHELT) versus Extracorporeal Shock Waves Therapy (ESWT) in the treatment of Achilles tendinopathy. In this prospective, clinical trial, 60 subjects affected by insertional Achilles tendinopathy were enrolled and randomized to CHELT (30 subjects) or to ESWT (30 subjects). In CHELT group the patients received ten daily sessions of 1,200 J and 12 W of laser therapy (wavelength of 1,084, 810 and 980 nm) added to a flow of cold air at -30 degrees C. In the ESWT group, the patients received three sessions at 3- to 4-day intervals of 1,600 impulses with an energy flux density (EFD) of 0.05-0.07 mJ/mm2. Both groups of participants performed stretching and eccentric exercises over a 2-month period. The visual analogue scale (VAS), the Ankle-Hindfoot Scale, and the Roles and Maudsley Score were measured before treatment (T0), and at end of the treatment session (T1) and 2 (T2) and 6 months (T3) after treatment during the follow-up examinations. In both groups, we found a statistically significant improvement of the VAS at T1, T2 and T3 ($p < 0.01$). The difference between the two groups was statistically significant in favour of the CHELT group ($p < 0.001$). At 2 months, the CHELT group was statistically better for Ankle-Hindfoot Scale and the Roles and Maudsley Score ($p < 0.05$) and at 6 months only for the Roles and Maudsley Score ($p < 0.001$). High Energy Laser Therapy gave quicker and better pain relief. It also gave the patient a full functional recovery and greater satisfaction.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=24352875

The effectiveness of physiotherapeutic interventions in treatment of frozen shoulder/adhesive capsulitis: A systematic review.

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BACKGROUND AND OBJECTIVE: Frozen shoulder is a common condition, yet its treatment remains challenging. In this review, the current best evidence for the use of physical therapy interventions (PTI) is evaluated.METHOD: MEDLINE, CINAHL, Cochrane, PEDro, ProQuest, Science Direct, and Sport Discus were searched for studies published in English since 2000. RESULTS: 39 articles describing the PTI were analyzed using Sackett's levels of evidence and were examined for scientific rigor. The PTI were given grades of recommendation that ranged from A to C. CONCLUSIONS: Therapeutic exercises and mobilization are strongly recommended for reducing pain, improving range of motion (ROM) and function in patients with stages 2 and 3 of frozen shoulder. Low-level laser therapy is strongly suggested for pain relief and moderately suggested for improving function but not recommended for improving ROM. Corticosteroid injections can be used for stage 1 frozen shoulder. Acupuncture with therapeutic exercises is moderately recommended for pain relief, improving ROM and function. Electro- therapy can help in providing short-term pain relief. Continuous passive motion is recommended for short-term pain relief but not for improving ROM or function. Deep heat can be used for pain relief and improving ROM. Ultrasound for pain relief, improving ROM or function is not recommended.

J Back Musculoskelet Rehabil 2013 Nov 27

http://www.ncbi.nlm.nih.gov/pubmed/?term=24284277

Management of tennis elbow.

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CLINICAL QUESTION: What is the best treatment for tennis elbow? RESULTS: Despite a wealth of research, there is no true consensus on the most efficacious management of tennis elbow especially for effective long-term outcomes. Corticosteroid injections do show large pain-relieving effects in the short term but are associated with risks of adverse events and long-term reoccurrence. Advice with a "wait and see" approach is recommended as the first-line treatment in primary care for most cases. In the medium term physiotherapy and or low-level laser therapy may be effective. IMPLEMENTATION: Rule out alternative diagnosis. Onward referral may be indicated if the condition does not resolve after 12 months.

Open Access J Sports Med 2011 2 53-9

http://www.ncbi.nlm.nih.gov/pubmed/?term=24198571

Analysis of the effect of phototherapy in model with traumatic Achilles tendon injury in rats.

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The aim of this study was to investigate the effect of low-intensity laser (LILT) infrared (830 nm) therapy in tendon inflammation, tendinitis induced by mechanical trauma in rat Achilles tendon. For this, we used 65 young male Wistar rats, weighing +/-300 g divided into different groups: C = control (n = 5) and experimental (n = 10/group), with two different times of sacrifice such as treated with L = laser, D = treated with diclofenac, and T = untreated injured. The tendon inflammation was induced by controlled contusion in the medial region of the Achilles tendon of the animals. The treated groups received some kind of intervention every 24 h, all groups were sacrificed on the 7th or 14th day after the trauma. The tendons were dissected, extracted, and sent for analysis. Histological analysis of the L group showed a decrease in the number of inflammatory cells in relation to other groups in both periods studied. The comparative results between the number of inflammatory cells in the control and treated groups at 7 and 14 days showed statistically significant differences. Qualitative analysis findings obtained by the picrosirius red technique under polarized light showed that in 7 days, the T group presented collagen types I and III in the same proportion; group D presented a predominance of type III fibers, while in group L, type I collagen predominated. The 14-day group D showed collagen types I and III in the same proportion, while in group L, there was a predominance of type I fibers. Biomechanical analysis showed that 7-day groups L and C showed similar stiffness and increased breaking strength. The 14-day groups L and C showed greater rupturing strength as well as increased stiffness angle. Group D showed a decrease of maximum traction strength and degree of rigidity. It was concluded that treatment with LIL in the parameters used and the times studied reduces migration of inflammatory cells and improves the quality of repair while reducing the functional limitations.

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Biomechanical and biochemical protective effect of low-level laser therapy for Achilles tendinitis.

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For three decades, low level laser therapy (LLLT) has been used for treatment of tendinitis as well as other musculoskeletal diseases. Nevertheless, the biological mechanisms involved remain not completely understood. In this work, the effects of LLLT and of the widely used nonsteroidal anti-inflammatory drug, diclofenac, have been compared in the case of collagenase-induced Achilles tendinitis. Wistar rats were treated with diclofenac or laser therapy. The tensile behavior of tendons was characterized through successive loading-unloading sequences. The method considered 11 characteristic parameters to describe the mechanical behavior. It was shown that during the acute inflammatory process of the tendon, the mechanical properties were significantly correlated to the high levels of MMP-3, MMP-9 and MMP-13 expression presented in a previous paper (Marcos, R.L., et al., 2012). The treatment by non-steroidal anti-inflammatory drugs such as diclofenac sodium produces a low protective effect and can affect the short-term biochemical and biomechanical properties. On the contrary, it is shown that LLLT exhibits the best results in terms of MMPs reduction and mechanical properties recovery. Thus, LLLT looks to be a promising and consistent treatment for tendinopathies.

J Mech Behav Biomed Mater 2013 Sep 9 29C 272-285

http://www.ncbi.nlm.nih.gov/pubmed/?term=24126100

Pulsed LLLT improves tendon healing in rats: a biochemical, organizational, and functional evaluation.

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In the last decades, the tendon injuries have increased substantially. Previous results suggested that low-level laser treatment (LLLT) promotes synthesis of extracellular matrix and improves the functional properties of the tendon. The aim of this study was to evaluate the effects of different protocols of LLLT on partially tenotomized tendons. Adult male rats were divided into the following: G1-intact, G2-injured, G3-injured + LLLT (4 J/cm2 continuous), G4-injured + LLLT (4 J/cm2 at 20 Hz). G2, G3, and G4 were euthanized 8 days after injury. G5-injured, G6-injured + LLLT (4 J/cm2 continuous), and G7-injured + LLL (4 J/cm2 at 20 Hz until the seventh day and 2 kHz from 8 to 14 days). G5, G6, and G7 were euthanized on the 15th day. Glycosaminoglycan (GAG) level was quantified by dimethylmethylene blue method and analyzed on agarose gel. Toluidine blue (TB) stain was used to observe metachromasy. CatWalk system was used to evaluate gait recovery. Collagen organization was analyzed by polarization microscopy. The GAG level increased in all transected groups, except G5. In G6 and G7, there was a significant increase in GAG in relation to G5. In G3 and G4, the presence of dermatan sulfate band was more prominent than G2. TB stains showed intense metachromasy in the treated groups. Birefringence analysis showed improvement in collagen organization in G7. The gait was significantly improved in G7. In conclusion, pulsed LLLT leads to increased organization of collagen bundles and improved gait recovery.

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A knowledge translation initiative to enhance evidence-informed clinical management of achilles tendinopathy: the purpose, process and outcomes of the bc tendinopathy toolkit.

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INTRODUCTION: Translation of knowledge to practice in health care is a significant challenge.1(-)3 This presentation describes the purpose, process and preliminary outcomes of a knowledge translation (KT) initiative undertaken by a unique partnership of physical therapy researchers, educators and expert clinicians to address the gap between evidence and practice in the management of Achilles tendinopathy. METHODS: Physiotherapy clinicians in British Columbia requested evidence-informed guidance on the management of tendinopathy. To address this need, the provincial Physical Therapy Knowledge Broker assembled a team of researchers, educators and expert clinicians with the mandate to develop, disseminate and implement a toolkit of decision aids to guide clinical decision-making for Achilles Tendinopathy. The process to develop the toolkit involved the following components: (1) identification of the purpose and scope of the project (2) agreement on the processes for selection of content and format (3) creation of a mechanism for resolution of conflicting opinion (4) an iterative feedback process with stakeholders and (4) the incorporation of concepts and strategies from the knowledge translation and implementation science literature to support the stages of knowledge synthesis, dissemination and implementation.1(-)4 RESULTS: The 'Tendinopathy Toolkit' included: (1) a tabulated summary of the evidence for manual therapy, exercise, low level laser therapy, ultrasound, extracorporeal shock wave therapy, iontophoresis using dexamethasone, taping, orthotics, night splints and braces, heel raise inserts, needling techniques, and the appropriate outcome measures for this population (targeted 'take home messages' and clinical implications for each were also included); (2) an algorithm to guide the sequence of interventions; (3) and appendices including (a) exercise programmes (b) low level laser dosage calculation (c) tabulated details for each article reviewed and (d) a review of common medical interventions. The second phase of the initiative-utilization of strategies to enhance implementation and uptake of the toolkit-is currently being undertaken. DISCUSSION: Clinicians want to provide evidence-informed management of tendinopathy but many struggle with accessing, appraising and synthesising the vast array of literature available on this topic. This KT initiative highlights the need for, challenges associated with, evidence-informed process for and positive response to the development of decision aids synthesising the current evidence to guide clinical management of this patient population.

Br J Sports Med 2013 Jun 47(9) e2

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Effects of low-power LED and therapeutic ultrasound in the tissue healing and inflammation in a tendinitis experimental model in rats.

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This work evaluated the anti-inflammatory response of low-power light-emitting diode (LED) and ultrasound (US) therapies and the quality and rapidness of tendon repair in an experimental model of tendinitis, employing histomorphometry and Raman spectroscopy. Tendinitis was induced by collagenase into the right tendon of 35 male Wistar rats with an average weight of 230 g. The animals were randomly separated into seven groups of five animals each: tendinitis without treatment-control (TD7 and TD14, where 1 and 2 indicated sacrifice on the 7th and 14th day, respectively), tendinitis submitted to US therapy (US7 and US14) and tendinitis submitted to LED therapy (LED7 and LED14). Contralateral tendons of the TD group at the 14th day were used as the healthy group (H). US treatment was applied in pulsed mode at 10 %, 1 MHz frequency, 0.5 W/cm2, 120 s. LED therapy parameters were 4 J/cm2, 120 s, daily dose at the same time and same point. Sacrifice was performed on the 7th or 14th day. Histomorphometric analysis showed lower number of fibroblasts on the 14th day of therapy for the US-treated group, compared to the TD and LED, indicating lower tissue inflammation. Raman showed that the LED group had an increase in the amount of collagen I and III from the 7th to the 14th day, which would indicate more organized fibers and a better quality of the healing, and US showed lower collagen I synthesis in the 14th day compared to H, indicating a lower tissue reorganization.

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Management of chronic tendon injuries.

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Chronic tendon injuries present unique management challenges. The assumption that these injuries result from ongoing inflammation has caused physicians to rely on treatments demonstrated to be ineffective in the long term. Nonsteroidal anti-inflammatory drugs should be limited in the treatment of these injuries. Corticosteroid injections should be considered for temporizing pain relief only for rotator cuff tendinopathy. For chronic Achilles tendinopathy (symptoms lasting longer than six weeks), an intense eccentric strengthening program of the gastrocnemius/ soleus complex improved pain and function between 60 and 90 percent in randomized trials. Evidence also supports eccentric exercise as a first-line option for chronic patellar tendon injuries. Other modalities such as prolotherapy, topical nitroglycerin, iontophoresis, phonophoresis, therapeutic ultrasound, extracorporeal shock wave therapy, and low-level laser therapy have less evidence of effectiveness but are reasonable second-line alternatives to surgery for patients who have persistent pain despite appropriate rehabilitative exercise.

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Intense pulsed light treatment of chronic mid-body Achilles tendinopathy: A double blind randomised placebo-controlled trial.

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We conducted a randomised controlled trial to determine whether active intense pulsed light (IPL) is an effective treatment for patients with chronic mid-body Achilles tendinopathy. A total of 47 patients were randomly assigned to three weekly therapeutic or placebo IPL treatments. The primary outcome measure was the Victorian Institute of Sport Assessment - Achilles (VISA-A) score. Secondary outcomes were a visual analogue scale for pain (VAS) and the Lower Extremity Functional Scale (LEFS). Outcomes were recorded at baseline, six weeks and 12 weeks following treatment. Ultrasound assessment of the thickness of the tendon and neovascularisation were also recorded before and after treatment. There was no significant difference between the groups for any of the outcome scores or ultrasound measurements by 12 weeks, showing no measurable benefit from treatment with IPL in patients with Achilles tendinopathy.

Bone Joint J 2013 Apr 95-B(4) 504-9

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Low-level light-emitting diode therapy increases mRNA expressions of IL-10 and type I and III collagens on Achilles tendinitis in rats.

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The present study investigated the effects of low-level light-emitting diode (LED) therapy (880 +/- 10 nm) on interleukin (IL)-10 and type I and III collagen in an experimental model of Achilles tendinitis. Thirty male Wistar rats were separated into six groups (n = 5), three groups in the experimental period of 7 days, control group, tendinitis-induced group, and LED therapy group, and three groups in the experimental period of 14 days, tendinitis group, LED therapy group, and LED group with the therapy starting at the 7th day after tendinitis induction (LEDT delay). Tendinitis was induced in the right Achilles tendon using an intratendinous injection of 100 muL of collagenase. The LED parameters were: optical power of 22 mW, spot area size of 0.5 cm(2), and irradiation time of 170 s, corresponding to 7.5 J/cm(2) of energy density. The therapy was initiated 12 h after the tendinitis induction, with a 48-h interval between irradiations. The IL-10 and type I and III collagen mRNA expression were evaluated by real-time polymerase chain reaction at the 7th and 14th days after tendinitis induction. The results showed that LED irradiation increased IL-10 ($p < 0.001$) in treated group on 7-day experimental period and increased type I and III collagen mRNA expression in both treated groups of 7- and 14-day experimental periods ($p < 0.05$), except by type I collagen mRNA expression in LEDT delay group. LED (880 nm) was effective in increasing mRNA expression of IL-10 and type I and III collagen. Therefore, LED therapy may have potentially therapeutic effects on Achilles tendon injuries.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=23404386

Low-level laser therapy combined with platelet-rich plasma on the healing calcaneal tendon: a histological study in a rat model.

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The objective of this study was to investigate the effects of low-level laser therapy (LLLT) treatment alone (lambda = 660 nm and lambda = 830 nm) or associated with platelet-rich plasma (PRP). We used 54 male rats divided into six groups, with nine animals each: group 1, partial tenotomy; group 2 (GII), PRP; group 3 (GIII): lambda660 nm; group 4 (GIV), lambda830 nm; group 5 (GV), PRP + lambda660 nm; and group 6 (GVI), PRP + lambda830 nm. The protocol used was power density 0.35 W/cm(2), energy 0.2 J, energy density 7.0 J/cm(2), time 20 s per irradiated point, and number of points 3. Animals in groups GII, GV, and GVI received treatment with PRP, consisting of a single dose of 0.2 mL directly into the surgical site, on top of the tenotomy. Animals were killed on the 13th day post-tenotomy and their tendons were surgically removed for a quantitative analysis using polarization microscopy. The percentages of collagen fibers of types I and III were expressed as mean +/- SD. Higher values of collagen fibers type I were obtained for groups GV and GVI when compared with all other groups ($p < 0.05$), whereas groups GIII and GIV showed no significant difference between them ($p > 0.05$). For collagen type III, a significant difference was observed between GII and all other groups ($p < 0.5$), but no significant difference was found between GIII and GIV and between GV and GVI. Results showed that the deposition of collagen type I was higher when treatment with PRP and LLLT was combined, suggesting a faster regeneration of the tendon.

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Birefringence and Second Harmonic Generation on Tendon Collagen Following Red Linearly Polarized Laser Irradiation.

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Regarding the importance of type I collagen in understanding the mechanical properties of a range of tissues, there is still a gap in our knowledge of how proteins perform such work. There is consensus in literature that the mechanical characteristics of a tissue are primarily determined by the organization of its molecules. The purpose of this study was to characterize the organization of non-irradiated and irradiated type I collagen. Irradiation was performed with a linearly polarized HeNe laser (lambda = 632.8 nm) and characterization was undertaken using polarized light microscopy to investigate the birefringence and second harmonic generation to analyze nonlinear susceptibility. Rats received laser irradiation (P = 6.0 mW, I = 21.2 mW/cm(2), E approximately 0.3 J, ED = 1.0 J/cm(2)) on their healthy Achilles tendons, which after were extracted to prepare the specimens. Our results show that irradiated samples present higher birefringence and greater non-linear susceptibility than non-irradiated samples. Under studied conditions, we propose that a red laser with polarization direction aligned in parallel to the tendon long axis promotes further alignment on the ordered healthy collagen fibrils towards the electric field incident. Thus, prospects for biomedical applications for laser polarized radiation on type I collagen are encouraging since it supports greater tissue organization.

Ann Biomed Eng 2012 Dec 18

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LLLT improves tendon healing through increase of MMP activity and collagen synthesis.

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The Achilles tendon has a high incidence of rupture, and the healing process leads to a disorganized extracellular matrix (ECM) with a high rate of injury recurrence. To evaluate the effects of different conditions of low-level laser (LLL) application on partially tenotomized tendons, adult male rats were divided into the following groups: G1, intact; G2, injured; G3, injured + LLL therapy (LLLT; 4 J/cm(2) continuous); G4, injured + LLLT (4 J/cm(2), 20 Hz); G5, injured; G6, injured + LLLT (4 J/cm(2) continuous); and G7, injured + LLLT (4 J/cm(2), 20 Hz until the 7th day and 2 kHz from 8 to 14 days). G2, G3, and G4 were euthanized 8 days after injury, and G5, G6, and G7 were euthanized on the 15th day. The quantification of hydroxyproline (HOPro) and non-collagenous protein (NCP), zymography for matrix metalloproteinase (MMP)-2 and MMP-9, and Western blotting (WB) for collagen types I and III were performed. HOPro levels showed a significant decrease in all groups (except G7) when compared with G1. The NCP level increased in all transected groups. WB for collagen type I showed an increase in G4 and G7. For collagen type III, G4 presented a higher value than G2. Zymography for MMP-2 indicated high values in G4 and G7. MMP-9 increased in both treatment groups euthanized at 8 days, especially in G4. Our results indicate that the pulsed LLLT improved the remodeling of the ECM during the healing process in tendons through activation of MMP-2 and stimulation of collagen synthesis.

Lasers Med Sci 2012 Nov 21

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Effectiveness of Low-Level Laser Therapy Combined with an Exercise Program to Reduce Pain and Increase Function Among Adults with Shoulder Pain: A Critically Appraised Topic.

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CLINICAL SCENARIO: Shoulder pain is a common musculoskeletal condition that affects up to 25% of the general population. Shoulder pain can be caused by any number of underlying conditions including subacromial impingement syndrome, rotator cuff tendinitis and biceps tendinitis. Regardless of the specific pathology, pain is generally the number one symptom associated with shoulder injuries and can severely affect daily activities and quality of life of patients with these conditions. Two of the primary goals in the treatment of these conditions is reducing pain and increasing shoulder ROM. Conservative treatment has traditionally included a therapeutic exercise program targeted at increasing range of motion, strengthening the muscles around the joint, proprioceptive training or some combination of those activities. In addition, these exercise programs have been supplemented with other interventions including non-steroidal anti-inflammatory drugs, corticosteroid injections, manual therapy, activity modification and a wide array of therapeutic modalities (e.g., cryotherapy, EMS, ultrasound). Recently, low-level laser therapy (LLLT) has been utilized as an additional modality in the conservative management of patients with shoulder pain. However, the true effectiveness of LLLT on decreasing pain and increasing function in patients with shoulder pain is unclear.

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Treatment for insertional Achilles tendinopathy: a systematic review.

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PURPOSE: Systematically search and analyse the results of surgical and non-surgical treatments for insertional Achilles tendinopathy. METHODS: A structured systematic review of the literature was performed to identify surgical and non-surgical therapeutic studies reporting on ten or more adults with insertional Achilles tendinopathy. MEDLINE, CINAHL, EMBASE (Classic) and the Cochrane database of controlled trials (1945-March 2011) were searched. The Coleman methodology score was used to assess the quality of included articles, and these were analysed with an emphasis on change in pain score, patient satisfaction and complication rate. RESULTS: Of 451 reviewed abstracts, 14 trials met our inclusion criteria evaluating 452 procedures in 433 patients. Five surgical techniques were evaluated; all had a good patient satisfaction (avg. 89 %). The complication ratio differed substantially between techniques. Two studies analysed injections showing significant decrease in visual analogue scale (VAS). Eccentric exercises showed a significant decrease in VAS, but a large group of patients was unsatisfied. Extracorporeal shockwave therapy (ESWT) was superior to both wait-and-see and an eccentric training regime. One study evaluated laser CO(2), TECAR and cryoultrasound, all with significant decrease in VAS. CONCLUSIONS: Despite differences in outcome and complication ratio, the patient satisfaction is high in all surgical studies. It is not possible to draw conclusions regarding the best surgical treatment for insertional Achilles tendinopathy. ESWT seems effective in patients with non-calcified insertional Achilles tendinopathy. Although both eccentric exercises resulted in a decrease in VAS score, full range of motion eccentric exercises shows a low patient satisfaction compared to floor level exercises and other conservative treatment modalities.

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Conservative management of midportion Achilles tendinopathy: a mixed methods study, integrating systematic review and clinical reasoning.

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BACKGROUND: Clinicians manage midportion Achilles tendinopathy (AT) using complex clinical reasoning underpinned by a rapidly developing evidence base. OBJECTIVES: The objectives of the study were to develop an inclusive, accessible review of the literature in combination with an account of expert therapists' related clinical reasoning to guide clinical practice and future research. METHODS: Searches of the electronic databases, PubMed, ISI Web of Science, PEDro, CINAHL, EMBASE, and Google Scholar were conducted for all papers published from inception to November 2011. Reference lists and citing articles were searched for further relevant articles. Inclusion required studies to evaluate the effectiveness of any conservative intervention for midportion AT. Exclusion criteria included in vitro, animal and cadaver studies and tendinopathies in other locations (e.g. patella, supraspinatus). From a total of 3497 identified in the initial search, 47 studies fulfilled the inclusion criteria. Studies were scored according to the PEDro scale, with a score of >/= 8/10 considered of excellent quality, 5-7/10 good, and </= 4/10 poor. The strength of evidence supporting each treatment modality was then rated as 'strong', 'moderate', 'limited', 'conflicting' or 'no evidence' according to the number and quality of articles supporting that modality. Additionally, semi-structured interviews were conducted with physiotherapists to explore clinical reasoning related to the use of various interventions with and without an evidence base, and their perceptions of available evidence. RESULTS: Evidence was strong for eccentric loading exercises and extracorporeal shockwave therapy; moderate for splinting/bracing, active rest, low-level laser therapy and concentric exercises (i.e. inferior to eccentric exercise). In-shoe foot orthoses and therapeutic ultrasound had limited evidence. There was conflicting evidence for topical glycerin trinitrate. Taping techniques and soft-tissue mobilization were not yet examined but featured in case studies and in the interview data. Framework analysis of interview transcripts yielded multiple themes relating to physiotherapists' clinical reasoning and perceptions of the evidence, including the difficulty in causing pain while treating the condition and the need to vary research protocols for specific client groups--such as those with the metabolic syndrome as a likely etiological factor. Physiotherapists were commonly applying the modality with the strongest evidence base, eccentric loading exercises. Barriers to research being translated into practice identified included the lack of consistency of outcome measures, excessive stringency of some authoritative reviews and difficulty in accessing primary research reports. The broad inclusion criteria meant some lower quality studies were included in this review. However, this was deliberate to ensure that all available research evidence for the management of midportion AT, and all studies were evaluated using the PEDro scale to compensate for the lack of stringent inclusion criteria. CONCLUSION: Graded evidence combined with qualitative analysis of clinical reasoning produced a novel and clinically applicable guide to conservative management of midportion AT. This guide will be useful to novice clinicians learning how to manage this treatment-resistant condition and to expert clinicians reviewing their evidence-based practice and developing their clinical reasoning. Important areas requiring future research were identified including the effectiveness of orthoses, the effectiveness of manual therapy, etiological factors, optimal application of loading related to stage of presentation and how to optimize protocols for different types of patients such as the older patient with the metabolic syndrome as opposed to the athletically active.

Sports Med 2012 Nov 1 42(11) 941-67

Low-level laser therapy in experimental model of collagenase-induced tendinitis in rats: effects in acute and chronic inflammatory phases.

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A variety of treatments for tendinopathies is currently used or has been trialed. However, in fact, there is a remarkably little evidence that any conventional therapies are effective. In the last years, low-level laser therapy (LLLT) has been showing interesting results in inflammatory modulation in different musculoskeletal disorders, but the optimal parameters and mechanisms behind these effects are not fully understood. The aim of this study is to investigate if the LLLT modulates the acute and chronic phase of collagenase-induced tendinitis in rat by interfering in mRNA expression for matrix metalloproteinases (MMP13 and MMP1), vascular endothelial growth factor (VEGF), and anti-inflammatory mediator (interleukin (IL)-10). For such, tendinitis was induced by collagenase injection in male Wistar rats. Animals were treated with LLLT (780 nm, potency of 22 mW, 107 mW/cm(2), energy density of 7.5 J/cm (2), and energy delivered of 1.54 J) with different number of treatments in accordance with the inflammatory phase analyzed. LLLT was able to modulate mRNA gene expression of IL-10, VGEF, MMP1, and MMP13 both in acute than in chronic inflammatory phase ($p < 0.05$). Our results suggest that LLLT with parameters employed in the present study was able to modulate IL-10, VEGF, MMP1, and MMP13 mRNA gene expression both in acute than in chronic tendon inflammation. However, further studies are needed to establish optimal parameters for LLLT.

Lasers Med Sci 2012 Aug 28

http://www.ncbi.nlm.nih.gov/pubmed/?term=22926534

Management of chronic Achilles tendinopathy.

Tendons transmit force between muscles and bones and, when stretched, store elastic energy that contributes to movement.(1) The tendinous portion of the gastrocnemius and soleus muscles merge to form the Achilles tendon, which is the largest and strongest in the body, but one of the most frequently injured.(2,3) Conservative management options for chronic Achilles tendinopathy include eccentric (lengthening) exercises, extracorporeal shockwave therapy (ESWT), topical nitroglycerin, low level laser therapy, orthoses, splints or injections (e.g. corticosteroids, hyperosmolar dextrose, polidocanol, platelet-rich plasma), while a minority of patients require surgery (using open, percutaneous or endoscopic methods).(4-8) Here we assess the management options for patients with chronic Achilles tendinopathy (lasting over 6 weeks).

Drug Ther Bull 2012 Aug 50(8) 93-6

http://www.ncbi.nlm.nih.gov/pubmed/?term=22875366

Physical therapies for Achilles tendinopathy: systematic review and meta-analysis.

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ABSTRACT: Achilles tendinopathy (AT) is a common condition, causing considerable morbidity in athletes and non-athletes alike. Conservative or physical therapies are accepted as the first line approach for management of AT. Despite a growing volume of research in AT, there remains a lack of high quality studies evaluating their efficacy. Previous systematic reviews provide preliminary evidence for non-surgical interventions for AT, but lack key quality components as outlined in the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) Statement. This study aims to conduct a systematic review and meta-analysis (where possible) of the evidence for physical therapies for AT management. A comprehensive strategy was used to search 11 electronic databases from inception to September 13th 2011. Search terms included Achilles, tendinopathy, pain, physical therapies, electrotherapy and exercise (English language full-text publications, human studies). Reference lists of eligible papers were hand-searched. Randomised controlled trials (RCTs) were included if they evaluated at least one non-pharmacological, non-surgical intervention for AT using at least one outcome of pain and/or function. Two independent reviewers screened 2852 search results, identifying 23 suitable studies. Two independent reviewers assessed methodological quality and risk of bias using a modified PEDro scale. One reviewer extracted study characteristics and data for effect size calculations. Methodological quality ranged from 2 to 12 (/14). Four studies were excluded due to high risk of bias, leaving 19 studies. Evidence from meta-analyses supports the use of shock wave therapy (SWT) for outcomes of pain and function (standardised mean difference -0.46, 95% confidence interval -0.88 to -0.04) and pain (-0.50, -0.90 to -0.10) at 16 weeks, and laser therapy (LT) with eccentric exercise at 12 weeks (-0.51, -0.95 to -0.06), but did not support the addition of night splints to eccentric exercise. Effect sizes from individual studies support the use of eccentric exercise, while limited evidence suggests microcurrent therapy to be an effective intervention. Practitioners should consider SWT and LT as initial interventions for AT, in conjunction with eccentric exercise. Further high-quality RCTs following CONSORT guidelines are required to establish the efficacy of other physical therapies and determine optimal clinical pathways for AT.

J Foot Ankle Res 2012 Jul 2 5(1) 15

http://www.ncbi.nlm.nih.gov/pubmed/?term=22747701

Low-level laser therapy in collagenase-induced achilles tendinitis in rats: Analyses of biochemical and biomechanical aspects.

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NSAIDs are widely prescribed and used over the years to treat tendon injuries despite its well-known long-term side effects. In the last years several animal and human trials have shown that low-level laser therapy (LLLT) presents modulatory effects on inflammatory markers, however the mechanisms involved are not fully understood. The aim of this study was to evaluate the short-term effects of LLLT or sodium diclofenac treatments on biochemical markers and biomechanical properties of inflamed Achilles tendons. Wistar rats Achilles tendons (n = 6/group) were injected with saline (control) or collagenase at peritendinous area of Achilles tendons. After 1 h animals were treated with two different doses of LLLT (810 nm, 1 and 3 J) at the sites of the injections, or with intramuscular sodium diclofenac. Regarding biochemical analyses, LLLT significantly decreased ($p < 0.05$) COX-2, TNF-alpha, MMP-3, MMP-9, and MMP-13 gene expression, as well as prostaglandin E(2) (PGE(2)) production when compared to collagenase group. Interestingly, diclofenac treatment only decreased PGE(2) levels. Biomechanical properties were preserved in the laser-treated groups when compared to collagenase and diclofenac groups. We conclude that LLLT was able to reduce tendon inflammation and to preserve tendon resistance and elasticity. (c) 2012 Orthopaedic Research Society. Published by Wiley Periodicals, Inc. J Orthop Res.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=22674405

Interferential light therapy in the treatment of shoulder tendinopathies: a randomized controlled pilot study.

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Objectives: To test the safety of the diode light therapy and evaluate the advantages of the interferential effect of two light probes versus a conventional light probe in the relief of shoulder pain and disability caused by shoulder tendinopathies.Design: Randomized single-blind pilot study.Setting: Clinical electrotherapy unit.Participants: A total of 30 patients with shoulder pain from tendinopathies. Interventions: The patients were randomly assigned into two groups. Group 1 (n = 15) received interferential light therapy generated by two independent and identical cluster probes composed of light emitting and superluminescent diodes. Similarly, two applicators were applied in group 2 (n = 15), but only one was active, as in conventional clinical therapy. Each multi-diode cluster probe was composed of seven light-emitting diodes at 600 nm and 12 superluminescent diodes at 950 nm.Main outcome measures: Pain was evaluated by visual analogue scale (VAS) at day, at night and during several shoulder movements. Shoulder functional status was measured by means of the University California Los Angeles scale (UCLA).Results: Comparison between both treatments using the Mann-Whitney U-test showed better results for the interferential treatment. There were significant differences in pain reduction during abduction ($P < 0.05$) and external rotation ($P < 0.05$), with pain reductions in abduction and external rotation of 1.5 (+/- 1.3) and 0.5 (+/- 1.0) respectively.Conclusion: Interferential light therapy was safe and effective regarding the shoulder pain reduction during abduction and external rotation movements. The estimated size sample needed for future two-treatment parallel-design studies will require about 60 patients.

Clin Rehabil 2012 May 29

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Effect of Low-Level Laser Therapy (660 nm) on Acute Inflammation Induced by Tenotomy of Achilles Tendon in Rats.

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In this study we aimed to analyze the effects of low-level laser therapy (LLLT) (660 nm) on levels of protein expression of inflammatory mediators after cutting Achilles tendon of rats. Thirty Wistar male rats underwent partial incisions of the left Achilles tendon, and were divided into three groups of 10 animals according to the time of euthanasia after injury: 6, 24 and 72 hours. Each group was then divided into control group and LLLT group (treated with 100 mW, 3.57 W/cm(2) , 0.028 cm(2), 214 J/cm(2) , 6 J, 60 sec, single point). In LLLT group animals were treated once time per day until the time of euthanasia established for each group. The group treated with LLLT showed a significant reduction of IL-1beta compared to control groups at three time points (6h: p=0.0401; 24h: p=0.0015; 72h: p=0.0463). The analysis of IL-6 showed significant reduction only in the LLLT group at 72 h compared to control group (p=0.0179) while IL-10 showed a significant increase in the treated group compared with control group at three experimental times (6h: p=0.0007; 24h: p=0.0256; 72h: p<0.0001). We conclude that LLLT is an important modulator of inflammatory cytokines release after injury in Achilles tendon. (c) 2012 Wiley Periodicals, Inc. Photochemistry and Photobiology (c) 2012 The American Society of Photobiology.

Photochem Photobiol 2012 May 21

http://www.ncbi.nlm.nih.gov/pubmed/?term=22621670

Clinical effectiveness of low-level laser therapy as an adjunct to eccentric exercise for the treatment of achilles' tendinopathy: a randomized controlled trial.

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Tumilty S, McDonough S, Hurley DA, Baxter GD. Clinical effectiveness of low-level laser therapy as an adjunct to eccentric exercise for the treatment of Achilles' tendinopathy: a randomized controlled trial. OBJECTIVE: To investigate the effectiveness of low-level laser therapy (LLLT) as an adjunct to a program of eccentric exercises for the treatment of Achilles' tendinopathy. DESIGN: Randomized controlled trial with evaluations at baseline and 4, 12, and 52 weeks. SETTING: Primary care clinic. PARTICIPANTS: Participants with midportion Achilles' tendinopathy were randomly assigned to 2 groups (LLLT n=20: mean age +/- SD, 45.6+/-9.1y; placebo n=20: mean age +/- SD, 46.5+/-6.4y). The 12-week evaluation was completed by 36 participants (90%), and 33 participants (82.5%) completed the 52-week evaluation. INTERVENTION: Both groups of participants performed eccentric exercises over a 3-month period. In addition, they received either an active or placebo application of LLLT 3 times per week for the first 4 weeks; the dose was 3J per point. MAIN OUTCOME MEASURES: The primary outcome was the Victorian Institute of Sport Assessment-Achilles' questionnaire (VISA-A) score at 12 weeks; secondary outcome was a visual analog scale for pain. Outcomes were measured at baseline and 4, 12, and 52 weeks. RESULTS: Baseline characteristics exhibited no differences between groups. At the primary outcome point, there was no statistically significant difference in VISA-A scores between groups (P>.05). The difference in VISA-A scores at the 4-week point significantly favored the placebo group (F(1)=6.411, sum of squares 783.839; P=.016); all other outcome scores showed no significant difference between the groups at any time point. Observers were blinded to groupings. CONCLUSIONS: The clinical effectiveness of adding LLLT to eccentric exercises for the treatment of Achilles' tendinopathy has not been demonstrated using the parameters in this study.

Arch Phys Med Rehabil 2012 May 93(5) 733-9

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Interferential laser therapy in the treatment of shoulder pain and disability from musculoskeletal pathologies: a randomised comparative study.

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BACKGROUND: Interference is an important feature of the waves. When two or more in phase light waves meet, a new and reinforced wave is generated. Shoulder pain is a common clinical problem and laser is one of the treatments frequently used to relieve it. OBJECTIVE: To test the safety of interferential laser therapy generated by two independent low level lasers and compare its effectiveness with conventional single laser therapy in the reduction of shoulder musculoskeletal pain and associated disability. DESIGN: Randomised and single-blind controlled clinical trial. SETTING: Physiotherapy Unit and Rehabilitation Department of Ramon y Cajal University Hospital (Madrid). PARTICIPANTS: 200 patients with shoulder musculoskeletal pain were randomly assigned in two groups, 100 people each. INTERVENTIONS: Group I, experimental (n=100) received interferential laser, placing two probes opposite each other over the shoulder joint. Group II, control (n=100) received conventional laser therapy, using a single probe along with a second inactive dummy probe. Lasers used were GaAlAs diode (810 nm, 100 mW), in continuous emission. Laser was applied in contact mode through ten sessions, on 5 shoulder points (7 Joules/point) per session. MAIN OUTCOME MEASURES: Visual Analogue Scale (VAS) score and Shoulder Pain Disability index (SPADI), recorded before and after laser treatment. RESULTS: There were no differences between both groups in the reduction of pain, either assessed by VAS scale (median difference=0, 95% CI of the difference =-.6 to .5, p=0.81) or SPADI index (median difference = .4, 95% CI of the difference =-2.9 to 3.8, p=0.80), using the Mann-Whitney U-test. Comparison between the scores recorded before and after the treatment, within each group, showed significant differences for VAS during movement (median difference=3, 95% CI of the difference =2.07 to 4, p<0.001) and SPADI index (median difference=3.5, 95% CI of the difference =2.67 to 3.85, Wilcoxon test, p<0.001), for both groups. CONCLUSIONS: In this study, the application of two low level lasers in order to generate interference inside the irradiated tissue showed to be a safe therapy. Both interferential and conventional laser therapy reduced shoulder pain and disability. Nevertheless, differences between them were not detected. Future research in this field could include applying this technique with other laser parameters or application forms.

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An investigation of the transmission and attenuation of intense pulsed light on samples of human Achilles tendon and surrounding tissue.

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BACKGROUND: Light therapy is a common mode of treatment for musculoskeletal injuries but the depth of penetration of light radiation is controversial. Evidence exists for the efficacy of intense pulsed light (IPL) treatment for the rejuvenation of skin (superficial tissue) but it is not known if the IPL can penetrate deeper. If the IPL can penetrate to the depth of the Achilles tendon it may provide a potential management options in the treatment of a chronic mid-body Achilles tendinopathy. OBJECTIVES: To examine if any optical radiation produced by an IPL transmits to the depth of the Achilles tendon when applied cutaneously to excised samples of human Achilles tissue. A secondary aim was to establish the relative amount of optical radiation that was attenuated within the tendon. MATERIALS AND METHODS: Three samples of human Achilles tendon and surrounding tissue were harvested following elective lower limb amputation operations. Each sample was irradiated 2-6 cm above the insertion into the calcaneus (area of an Achilles tendinopathy) with IPL (model iPulse; Cyden Ltd, Wales, UK) set at a single pulse of 25 millisecond, wavelength range 530-1,110 nm and fluence of 13 J/cm(2) . The transmission of light radiation was evaluated using (a) standard SLR digital camera, (b) spectrometer, and (c) an external energy meter. RESULTS: Light radiation was found to have transmitted through each of the three tissue samples by all three instruments. There were observable differences in the color of light detected for the control photo and the IPL irradiated tissue samples photographs. The percentage of fluence that was detected to have transmitted through the tissue samples by the energy meter was 4-8.1% and wavelengths between 645 and 843 nm were detected to have transmitted through the tissue by the spectrometer. In addition, the percentage of light radiation that attenuated with the tendon was 10.2 -17.32%. CONCLUSION: The results of this study provides evidence that IPL penetrates to the depth of the Achilles tendon and attenuates with the tendon. IPL has potential to produce physiological effects in the treatment of patients with a chronic mid-body Achilles tendinopathy. Lasers Surg. Med. (c) 2012 Wiley Periodicals, Inc.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=22505339

The beneficial effects of adding low level laser to ultrasound and exercise in Iranian women with shoulder tendonitis: A randomized clinical trial.

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Objectives: A randomized, double-blind, clinical trial study was conducted with the aim of determining the efficacy of adding laser (830 nm) to ultrasound (US) and exercise for the management of shoulder tendonitis. Methods: 42 subjects (n=21, in adding laser group and n=21, in US and exercise group) received a course of 10 sessions treatment over one month in the shoulder region. Outcome measures such as Visual Analogue Scale (VAS), Tenderness Severity Scale (TSS), Constant Murley Score (CMS) and Manual Muscle Testing (MMT) were performed before treatment and at the end of 4 weeks treatment. In addition, follow up were performed 2 months after the end of treatment based on the degree of pain improvement. Results: VAS, TSS and CMS improved significantly (P=0.001) in both groups, however the muscle strengths only improved significantly in adding laser group (P< 0.01).Conclusion: It seems that both protocols of physical therapy interventions were effective in relieving the signs and symptoms of shoulder tendonitis. Furthermore, adding low level laser therapy (LLLT) to the US and exercise was more efficient in improving the muscle strength in patients with shoulder tendonitis over a period of three months. However, it should be emphasized that, the current results might be due to the effects of laser and exercise instead of laser, us and exercise (as we had no independent group for US).

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http://www.ncbi.nlm.nih.gov/pubmed/?term=22398262

The effectiveness of nonoperative treatment for frozen shoulder: a systematic review.

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OBJECTIVE: To systematically review the evidence for the effectiveness of nonoperative interventions in the management of frozen shoulder (adhesive capsulitis). DATA SOURCES: The Cochrane Library, PubMed, EMBASE, CINAHL, and Pedro were searched for randomized controlled trials (RCTs) and systematic reviews of interventions for primary adhesive capsulitis (search words included frozen shoulder, shoulder pain, and periarthritis) up to April 2008. STUDY SELECTION: Selection criteria required that studies included patients with frozen shoulder; the disorder was not caused by acute trauma or systemic disease; an intervention for treating adhesive capsulitis was evaluated; the outcome measures included pain, function, or recovery and were reported separately for patients in the study with adhesive capsulitis; and the article was written in English, French, German, or Dutch. Two reviewers independently selected relevant studies from the search results and resolved disagreements by consensus. The findings from 5 Cochrane reviews and 18 recent additional RCTs were included. DATA EXTRACTION: Information on the study population, interventions, outcome measures, and results was extracted by 1 reviewer and checked by a second. Methodologic quality was assessed independently by 2 reviewers. Heterogeneity of the studies was such that the data could not be quantitatively assessed. The level of evidence was ranked as strong, moderate, limited, or conflicting, depending on the consistency of positive findings and the quality of the RCTs; as no differences in effectiveness found; and as no evidence for the intervention from reviews or RCTs. MAIN RESULTS: There was strong evidence in the short term for the effectiveness of intra-articular steroid injections for pain but not range of motion and moderate evidence for steroid injections for pain in the medium term. No differences were found on range of motion between steroid injections and manipulation. There was moderate evidence in favor of arthrographic distension compared with steroid injections in the short term. Among physiotherapy interventions, there was strong evidence in favor of laser therapy compared with placebo in producing a good outcome and some evidence for reduced pain and disability. There was moderate evidence for several mobilization techniques in the short and long term and in combination with exercise. There was moderate evidence in the short term for the effectiveness of oral steroids compared with placebo or no treatment for pain relief and range of motion and for suprascapular nerve block compared with acupuncture, placebo, or steroid injections for pain relief. CONCLUSIONS: Pain, range of motion, and overall outcome in adhesive capsulitis were most effectively improved by steroid injections, laser therapy, some mobilization techniques, arthrographic distension, and suprascapular nerve block. Most effects were shown in the short term, although physiotherapy did show effects in the longer term.

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Effect of low-level laser therapy on healing of tenotomized Achilles tendon in streptozotocin-induced diabetic rats.

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Diabetes mellitus (DM) is associated with musculoskeletal damage. Investigations have indicated that healing of the surgically tenotomized Achilles tendon was considerably augmented following low-level laser therapy (LLLT) in non-diabetic, healthy animals. The aim of the present study was to evaluate the effect of LLLT on the Achilles tendon healing in streptozotocin-induced diabetic (STZ-D) rats via a biomechanical evaluating method. Thirty-three rats were divided into non-diabetic (n = 18) and diabetic (n = 15) groups. DM was induced in the rats by injections of STZ. The right Achilles tendons of all rats were tenotomized 1 month after STZ injections. The two experimental groups (n = 6 for each group) of non-diabetic rats were irradiated with a helium-neon (He-Ne) laser at 2.9 and 11.5 J/cm(2) for ten consecutive days. The two experimental groups of diabetic rats (n = 5 for each group) were irradiated with a He-Ne laser at 2.9 and 4.3 J/cm(2) for ten consecutive days. The tendons were submitted to a tensiometric test. Significant improvements in the maximum stress (MS) values (Newton per square millimeter) were found following LLLT at 2.9 J/cm(2) in both the non-diabetic (p = 0.031) and diabetic (p = 0.019) experimental groups when compared with their control groups. LLLT at 2.9 J/cm(2) to the tenotomized Achilles tendons in the non-diabetic and diabetic rats significantly increased the strength and MS of repairing Achilles tendons in our study.

Lasers Med Sci 2012 Feb 28

http://www.ncbi.nlm.nih.gov/pubmed/?term=22370620

Effects of a Therapeutic Laser and Passive Stretching Program for Treating Tendon Overuse.

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Abstract Objective: This study investigated the effects of a therapeutic laser, passive stretching, and their combined treatment on the strength of Achilles tendons with overuse pathologies. Background data: Tendinopathy involving overuse is usually treated with exercise and stretching, but there has been no report on the treatment effect of a therapeutic laser combined with passive stretching on managing this condition. Despite the beneficial effect of a therapeutic laser on healing tendons that have had traumatic injury, its effect on degenerative tendons is not known. Methods: Twenty-five mature Sprague-Dawley (SD) rats were used, with 20 subjected to daily bipedal downhill running for 8 weeks, to induce Achilles overuse, and 5 as normal controls. The exercised rats were divided into four groups: 1, laser treatment; 2, passive stretching; 3, combined laser and stretching; and 4, no treatment, running controls. GaAlAs laser with 660 nm wavelength was applied to both Achilles tendons for 50 sec for Groups 1 and 3. Passive stretching of 20 times/10 sec of maximum ankle plantar flexion was applied to Groups 2 and 3. Treatments were applied after each running session for a a total of 56 treatment sessions. On week 9, the tendons were tested for load-relaxation, stiffness, and ultimate strength. Results: Stiffness was different (p=0.01), difference in ultimate strength was marginally insignificant (p=0.07), and load-relaxation difference was not significant among groups. Post-hoc analyses revealed that the mean stiffness of all the four exercise groups was lower than the normal control, whereas the ultimate strength from the laser and combined laser and stretching was not different from that of the normal control group, but was higher than that of the passive stretching and no treatment groups. Conclusions: We conclude that a therapeutic laser and combined laser with passive stretching might slow down the decrease in Achilles tendon strength but would not be able to stop the pathological changes of overuse from developing.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=22235970

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

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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/cm(2) 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 +/- 2.2 vs. 5 +/- 2.6, $p = 0.029$ and 4.4 +/- 3.1 vs. 8.5 +/- 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 +/- 31.6 vs. 132.80 +/- 31.3) and external rotation (78.0 +/- 19.5 vs. 76.3 +/- 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.

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Comparison of the effects of low energy laser and ultrasound in treatment of shoulder myofascial pain syndrome: a randomized single-blinded clinical trial.

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BACKGROUND: Myofascial pain syndrome (MPS) is one of the most prevalent musculoskeletal diseases. MPS impaired quality of life in the patients. There is a lot of controversy about different treatment options which include medical treatments, physical therapy, injections, ultrasound and laser. The effects of laser in MPS are challenging. AIM: To assess the effects of laser and ultrasound in treatment of MPS. DESIGN: Randomized single blinded clinical trial SETTING: Outpatient physical therapy clinic at university hospital POPULATION: Sixty three subjects (females: 46, males: 17), (age range: 17-55 year old) who had a diagnosis of definite MPS were entered in the study. METHODS: We measured the pain intensity at rest, during activity and at night using Visual Analogue Scale (VAS) questionnaire. The patients also filled the Neck Disability Index (NDI) form and the pain threshold provoked by pressure was determined using algometric assessment. Then, the patients were categorized randomly in groups A, B and C (receiving laser therapy, ultrasound and sham laser therapy, respectively). Six weeks after the initial visit, they were visited again and filled the forms again. RESULTS: Ultrasound was effective in VAS improvement during activity (46%), at rest (39%) and at night (35%). It also improved NDI scores (34%) and algometric assessment (37%). Laser was effective in VAS improving during activity (54%), at night (51%) and at rest (51%) and also improved NDI scores (73%). It was also found effective in algometric assessment improvement (105%). Laser resulted in more NDI score and algometric assessment improvements comparing to ultrasound ($p<0.05$). CONCLUSION: This study introduces laser as one of the preferred treatments of myofascial pain syndrome in shoulder.

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Infrared (810 nm) low-level laser therapy in rat Achilles tendinitis: A consistent alternative to drugs.

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Non-steroidal anti-inflammatory drugs (NSAID) are widely used and can reduce musculoskeletal pain in spite of the cost of adverse reactions like gastrointestinal ulcers or cardiovascular events. The current study investigates if a safer treatment such as low-level laser therapy (LLLT) could reduce tendinitis inflammation, and whether a possible pathway could be through inhibition of either of the two cyclooxygenase isoforms in inflammation. Wistar rats (6 animals/group) were injected with saline (control) or collagenase in their Achilles tendons. Then we treated them with three different doses of infrared LLLT (810nm; 100mW; 10s, 30s and 60s; 5W/cm(2) ; 1J, 3J, 6J) at the sites of the injections, or intramuscular diclofenac, a non-selective COX inhibitor/NSAID. We found that LLLT-dose of 3J significantly reduced inflammation through less COX-2-derived gene expression and PGE(2) production, and less edema formation compared to non-irradiated controls. Diclofenac controls exhibited significantly lower PGE(2) cytokine levels at 6h than collagenase control, but cyclooxygenase isoform 1-derived gene expression and cytokine PGE(2) levels were not affected by treatments. As LLLT seems to act on inflammation through a selective inhibition of the COX-2 isoform in collagenase-induced tendinitis, LLLT may have potential to become a new and safer non-drug alternative to coxibs.

Photochem Photobiol 2011 Sep 12

http://www.ncbi.nlm.nih.gov/pubmed/?term=21910734

Tennis elbow.

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INTRODUCTION: Lateral pain in the elbow affects up to 3% of the population, and is considered an overload injury of the extensor tendons of the forearm where they attach at the lateral epicondyle. Although usually self-limiting, symptoms may persist for over 1 year in up to 20% of people. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical question: What are the effects of treatments for tennis elbow? We searched: Medline, Embase, The Cochrane Library, and other important databases up to November 2009 (Clinical Evidence reviews are updated periodically, please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 80 systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: acupuncture, autologous whole blood injections, corticosteroid injections, combination physical therapies, exercise, extracorporeal shock wave therapy, iontophoresis, low-level laser therapy, manipulation, non-steroidal anti-inflammatory drugs (oral and topical), orthoses (bracing), platelet-rich plasma injections, pulsed electromagnetic field treatment, surgery, and ultrasound.

BMJ, Clin Evid 2011

http://www.ncbi.nlm.nih.gov/pubmed/?term=21708051

Different Power Settings of LLLT on the Repair of the Calcaneal Tendon.

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Abstract Objective: The purpose of this study was to evaluate the effect of an 830-nm GaAlAs diode laser operating at output powers of 40, 60, 80, and 100 mW and energy density of 30 J/cm(2) on the repair of partial calcaneal tendon ruptures in rats. Methods: A partial tendon rupture was induced in all animals, which were treated with laser irradiation for 5 consecutive days. Six days after injury, the injured tendons were removed and examined by polarized light microscopy. Collagen fiber organization was evaluated by birefringence measurements, and collagen content was determined by Picrosirius Red staining. Results: It was observed that the higher the output power (60-100 mW) the greater the amount of type III collagen ($p<0.01$). The amount of type I collagen was significantly greater ($p=0.05$) in the 80 mW group than in the control group (sham stimulation). A non-statistically significant improvement in the realignment of collagen fibers was observed in the irradiated groups. Conclusions: Low-level laser therapy resulted in significantly greater amounts of type III collagen (output powers of 60 mW or more) and type I collagen (output power of 80 mW), however, no significant differences between groups were found in the realignment of collagen fibers.

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Comparison of the effects of low energy laser and ultrasound in treatment of shoulder myofascial pain syndrome: a randomized single-blinded clinical trial.

Rayegani SM, Bahrami MH, Samadi B, Sedighipour L, Mokhtarirad MR, Eliaspoor D

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BACKGROUND: Myofascial pain syndrome (MPS) is one of the most prevalent musculoskeletal diseases. MPS impaired quality of life in the patients. There is a lot of controversy about different treatment options which include medical treatments, physical therapy, injections, ultrasound and laser. The effects of laser in MPS are challenging. AIM: To assess the effects of laser and ultrasound in treatment of MPS. DESIGN: Randomized single blinded clinical trial SETTING: Outpatient physical therapy clinic at university hospital POPULATION:Sixty three subjects (females: 46, males: 17), (age range: 17-55 year old) who had a RESULTS: Ultrasound was effective in VAS improvement during activity (46%), at rest (39%) and at night (35%). It also improved NDI scores (34%) and algometric assessment (37%). Laser was effective in VAS improving during activity (54%), at night (51%) and at rest (51%) and also improved NDI scores (73%). It was also found effective in algometric assessment improvement (105%). Laser resulted in more NDI score and algometric assessment improvements comparing to ultrasound ($p<0.05$). CONCLUION: This study introduces laser as one of the preferred treatments of myofascial pain syndrome in shoulder.

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An experimental study of low-level laser therapy in rat Achilles tendon injury.

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The aim of this controlled animal study was to investigate the effect of low-level laser therapy (LLLT) administered 30 min after injury to the Achilles tendon. The study animals comprised 16 Sprague Dawley male rats divided in two groups. The right Achilles tendons were injured by blunt trauma using a mini guillotine, and were treated with LLLT or placebo LLLT 30 min later. The injury and LLLT procedures were then repeated 15 hours later on the same tendon. One group received active LLLT (lambda = 904 nm, 60 mW mean output power, 0.158 W/cm(2) for 50 s, energy 3 J) and the other group received placebo LLLT 23 hours after LLLT. Ultrasonographic images were taken to measure the thickness of the right and left Achilles tendons. Animals were then killed, and all Achilles tendons were tested for ultimate tensile strength (UTS). All analyses were performed by blinded observers. There was a significant increase in tendon thickness in the active LLLT group when compared with the placebo group ($p < 0.05$) and there were no significant differences between the placebo and uninjured left tendons. There were no significant differences in UTS between laser-treated, placebo-treated and uninjured tendons. Laser irradiation of the Achilles tendon at 0.158 W/cm(2) for 50 s (3 J) administered within the first 30 min after blunt trauma, and repeated after 15 h, appears to lead to edema of the tendon measured 23 hours after LLLT. The guillotine blunt trauma model seems suitable for inflicting tendon injury and measuring the effects of treatment on edema by ultrasonography and UTS. More studies are needed to further refine this model.

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Conservative Management of Achilles Tendon Wounds: Results of a Retrospective Study.

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Achilles tendon wounds are therapeutically challenging. The tendon`s functional importance, the paucity of soft tissue surrounding the ankle, and common patient comorbidities often limit surgical reconstructive procedure options. Depending on wound depth and overall patient health, secondary intention healing of these wounds can take many months. At the authors' wound care center, patients who are referred with recalcitrant, deep Achilles tendon wounds and who are able to visit the center two to three times per week are offered a protocol of topical hyperbaric oxygen (THBO) followed by low-level laser therapy (LLLT) and moisture-retentive dressings. A retrospective study was conducted to evaluate the outcomes of patients who received treatment for a deep Achilles tendon wound during the years 2004 through 2008. Patients who were seen but did not obtain care at the center were contacted via telephone. Of the 80 patients seen, 15 were referred for amputation, 52 obtained treatment elsewhere, and 13 received the THBO/LLLT protocol. Patient median age was 73 years (range 52-90 years) and most (85%) had diabetes mellitus. Average wound size was 90 cm2 (range 6.25-300 cm2) with an average duration of 11.7 months (range 2-60 months) before treatment. Complete re-epithelialization was achieved in 10 patients (77%) following a mean treatment time of 19 +/- 10 weeks (range 5-42 weeks). Of those, seven remained ambulatory and ulcer-free at mean follow-up of 3.3 +/- 1.8 years. Eight of the 52 patients (15%) who were not treated in the authors' center reported their ulcer was healed and 15 (29%) underwent amputation. Considering the severity of these wounds, the observed treatment outcomes are encouraging and may present a reasonable alternative for some patients with Achilles tendon wounds. Research is needed to clarify the role of these modalities in the conservative treatment of patients with Achilles tendon ulceration.

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Conflicting findings on effectiveness of low level laser therapy for tendinopathy.

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Low-level laser therapy (LLLT; 780 nm) acts differently on mRNA expression of anti- and pro-inflammatory mediators in an experimental model of collagenase-induced tendinitis in rat.

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Low-level laser therapy (LLLT) has been found to produce anti-inflammatory effects in a variety of disorders. Tendinopathies are directly related to unbalance in expression of pro- and anti-inflammatory cytokines which are responsible by degeneration process of tendinocytes. In the current study, we decided to investigate if LLLT could reduce mRNA expression for TNF-alpha, IL-1beta, IL-6, TGF-beta cytokines, and COX-2 enzyme. Forty-two male Wistar rats were divided randomly in seven groups, and tendinitis was induced with a collagenase intratendinea injection. The mRNA expression was evaluated by real-time PCR in 7th and 14th days after tendinitis. LLLT irradiation with wavelength of 780 nm required for 75 s with a dose of 7.7 J/cm(2) was administered in distinct moments: 12 h and 7 days post tendinitis. At the 12 h after tendinitis, the animals were irradiated once in intercalate days until the 7th or 14th day in and them the animals were killed, respectively. In other series, 7 days after tendinitis, the animals were irradiated once in intercalated days until the 14th day and then the animals were killed. LLLT in both acute and chronic phases decreased IL-6, COX-2, and TGF-beta expression after tendinitis, respectively, when compared to tendinitis groups: IL-6, COX-2, and TGF-beta. The LLLT not altered IL -1beta expression in any time, but reduced the TNF-alpha expression; however, only at chronic phase. We conclude that LLLT administered with this protocol reduces one of features of tendinopathies that is mRNA expression for pro-inflammatory mediators.

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Collagen changes and realignment induced by low-level laser therapy and low-intensity ultrasound in the calcaneal tendon.

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BACKGROUND AND OBJECTIVE: The treatment of calcaneal tendon injuries requires long-term rehabilitation. Ultrasound (US) and low-level laser therapy (LLLT) are the most used and studied physical agents in the treatment of tendon injuries; however, only a few studies examined the effects of the combination of US and LLLT. Therefore, the purpose of this study was to investigate which treatment (the exclusive or combined use of US and LLLT) most effectively contribute to tendon healing. STUDY DESIGN/MATERIALS AND METHODS: This was a controlled laboratory study with 50 rats whose Achilles tendon was injured by direct trauma. The rats were randomly divided into five groups and treated for 5 consecutive days, as follows: group 1 (control) received no treatment; group 2 was treated with US alone; group 3 was treated with LLLT alone; group 4 was treated first with US followed by LLLT; and group 5 was treated first with LLLT followed by US. On the sixth post-injury day, the tendons were removed and examined by polarized light microscopy. The organization of collagen fibers was assessed by birefringence measurements. Picrosirius-stained sections were examined for the presence of types I and III collagen. RESULTS: There was a significantly higher organization of collagen fibers in group 2 (US) than in the control group (P = 0.03). The amount of type I collagen found in groups 2 (US), 3 (LLLT), and 5 (LLLT + US) was significantly higher than that in the control group (P <or= 0.01), but no significant differences were found between treatment groups. There were no differences in the amount of type III collagen between groups. CONCLUSION: Ultrasound, LLLT, and the combined use of LLLT and US resulted in greater synthesis of type I collagen; US was also effective in increasing collagen organization in the early stages of the healing process.

Lasers Surg Med 2010 Aug 42(6) 559-65

http://www.ncbi.nlm.nih.gov/pubmed/?term=20662033

Anti-inflammatory effects of low-level light emitting diode therapy on Achilles tendinitis in rats.

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BACKGROUND AND OBJECTIVES: The present study investigated the effects of low-level light emitting diode (LED) therapy (880 +/- 10 nm) on inflammatory process in a experimental model of Achilles tendinitis induced by collagenase. STUDY DESIGN/MATERIALS AND METHODS: Fifty-six male Wistar were separated into seven groups (n = 8), three groups in the experimental period of 7 days and four groups in the experimental period of 14 days, the control group (CONT), tendinitis group (TEND), LED therapy group (LEDT) for both experimental periods, and LED therapy group 7th to 14th day (LEDT delay) for 14 days experimental period. The LED parameters was 22 mW CW of optical output power, distributed in an irradiation area of 0.5 cm(2), with an irradiation time of 170 seconds, the applied energy density was 7.5 J/cm(2) in contact. The therapy was initiated 12 hours after the tendinitis induction, with a 48-hour interval between the irradiations. The histological analysis and inflammatory mediators were quantified. RESULTS: Our results showed that LED decreases the inflammatory cells influx and mRNA expression to IL-1 beta, IL-6, tumor necrosis factor-alpha (TNF-alpha) in both phase, and cyclooxygenase -2 (COX-2) just in initial phase ($P < 0.05$). CONCLUSION: Our results suggest that the anti-inflammatory therapy with low-power LED (880 nm) enhanced the tissue response in all groups. We can conclude that the LED was able to reduce signs of inflammation in collagenase-induced tendinitis in rats by reducing the number of inflammatory cells and decrease mRNA expression of cytokines.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=20662032

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

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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.

Br J Sports Med 2010 Jul 20

http://www.ncbi.nlm.nih.gov/pubmed/?term=20647296

Review conclusion for low-level laser therapy in shoulder impingement syndrome appears to be sensitive to alternative interpretations of trial results.

Bjordal JM

J Rehabil Med 2010 Jul 42(7) 700-1; author reply 701-2

http://www.ncbi.nlm.nih.gov/pubmed/?term=20603704

Low Level Laser Treatment of Tendinopathy: A Systematic Review with Meta-analysis.

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Abstract Objectives: To assess the clinical effectiveness of Low Level Laser Therapy (LLLT) in the treatment of tendinopathy. Secondary objectives were to determine the relevance of irradiation parameters to outcomes, and the validity of current dosage recommendations for the treatment of tendinopathy. Background: LLLT is proposed as a possible treatment for tendon injuries. However, the clinical effectiveness of this modality remains controversial, with limited agreement on the most efficacious dosage and parameter choices. Method: The following databases were searched from inception to 1(st) August 2008: MEDLINE, PubMed, CINAHL, AMED, EMBASE, All EBM reviews, PEDro (Physiotherapy Evidence Database), SCOPUS. Controlled clinical trials evaluating LLLT as a primary intervention for any tendinopathy were included in the review. Methodological quality was classified as: high (>/=6 out of 10 on the PEDro scale) or low (<6) to grade the strength of evidence. Accuracy and clinical appropriateness of treatment parameters were assessed using established recommendations and guidelines. Results: Twenty-five controlled clinical trials met the inclusion criteria. There were conflicting findings from multiple trials: 12 showed positive effects and 13 were inconclusive or showed no effect. Dosages used in the 12 positive studies would support the existence of an effective dosage window that closely resembled current recommended guidelines. In two instances where pooling of data was possible, LLLT showed a positive effect size; in studies of lateral epicondylitis that scored >/=6 on the PEDro scale, participants' grip strength was 9.59 kg higher than that of the control group; for participants with Achilles tendinopathy, the effect was 13.6 mm less pain on a 100 mm visual analogue scale. Conclusion: LLLT can potentially be effective in treating tendinopathy when recommended dosages are used. The 12 positive studies provide strong evidence that positive outcomes are associated with the use of current dosage recommendations for the treatment of tendinopathy.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=19708800

Effectiveness of interventions of specific complaints of the arm, neck, or shoulder (CANS): musculoskeletal disorders of the hand.

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OBJECTIVES: The aim of this study was to provide an evidence-based overview of the effectiveness of (conservative and surgical) interventions for the 4 specific pain disorders of the hand: trigger finger, primary Raynaud's phenomenon, Dupuytren disease, and De Quervain's disease. This information can help clinicians in the selection of interventions in daily practice, and may give direction to future research. METHODS: Relevant review publications and randomized clinical trials (RCTs) in PubMed were searched. Data extraction and quality assessment were performed. To summarize the results of the included reviews and RCTs, a best-evidence synthesis was used. RESULTS: For primary Raynaud's phenomenon (1 review, 20 RCTs), we found strong evidence for calcium channel blockers and moderate evidence for laser therapy. Limited evidence was found for Ketanserin, Prozasin, Buflomedil, transdermal glyceryl trinitrate patches, Ginkgo biloba, and behavioral treatment with temperature feedback. Other interventions did not show clear favorable treatment effects. For Trigger finger one very small RCT was found that showed limited evidence for steroid injection. For Dupuytren disease (4 RCTs) limited evidence was found in favor of use of staples versus sutures in the Dupuytren's surgery, and for intermittent compression on the postoperative hand after surgery. For other interventions no clear positive effects could be demonstrated. For De Quervain's disease (2 RCTs), we found no efficacy of Nimesulide as addition to a Triamcinolone injection, and no clear differences between a corticosteroid injection and a splint in pregnant patients or patients breast-feeding. DISCUSSION: Well-designed and well-conducted RCTs are clearly needed in this field.

Clin J Pain 2009 Jul-Aug 25(6) 537-52

http://www.ncbi.nlm.nih.gov/pubmed/?term=19542803

Comparing the effects of exercise program and low-level laser therapy with exercise program and polarized polychromatic non-coherent light (bioptron light) on the treatment of lateral elbow tendinopathy.

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BACKGROUND DATA: The use of low-level laser therapy (LLLT) and polarized polychromatic non-coherent light as supplements to an exercise program has been recommended for the management of lateral elbow tendinopathy (LET). OBJECTIVE: To investigate whether an exercise program supplemented with LLLT is more successful than an exercise program supplemented with polarized polychromatic non-coherent light in treating LET. MATERIALS AND METHODS: Patients with unilateral LET for at least 4 wk were sequentially allocated to receive either an exercise program with LLLT or an exercise program with polarized polychromatic non-coherent light. The exercise program consisted of eccentric and static stretching exercises of wrist extensors. In the LLLT group a 904-nm Ga-As laser was used in continuous mode, and the power density was 130 mW/cm(2), and the dose was 0.585 J/point. In the group receiving polarized polychromatic non-coherent light the Bioptron 2 was used to administer the dose perpendicularly to the lateral epicondyle at three points at an operating distance of 5-10 cm for 6 min at each position. The outcome measures were pain and function and were evaluated at baseline, at the end of the treatment (week 4), and 3 mo after the end of treatment (week 16). RESULTS: Fifty patients met the inclusion criteria. At the end of treatment there was a decline in pain and a rise in function in both groups compared with baseline ($p < 0.0005$ on the paired t-test). There were no significant differences in the reduction of pain and the improvement of function between the groups at the end of treatment and at the 3-mo follow-up ($p > 0.0005$ on the independent t-test). CONCLUSIONS: The results suggest that the combination of an exercise program with LLLT or polarized polychromatic non-coherent light is an adequate treatment for patients with LET. Further research to establish the relative and absolute effectiveness of such a treatment approach is needed.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=19473072

Effect of low level laser therapy (830 nm) with different therapy regimes on the process of tissue repair in partial lesion calcaneous tendon.

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BACKGROUND AND OBJECTIVE: Calcaneous tendon is one of the most damaged tendons, and its healing may last from weeks to months to be completed. In the search after speeding tendon repair, low intensity laser therapy has shown favorable effect. To assess the effect of low intensity laser therapy on the process of tissue repair in calcaneous tendon after undergoing a partial lesion. STUDY DESIGN/MATERIALS AND METHODS: Experimentally controlled randomized single blind study. Sixty male rats were used randomly and were assigned to five groups containing 12 animals each one; 42 out of 60 underwent lesion caused by dropping a 186 g weight over their Achilles tendon from a 20 cm height. In Group 1 (standard control), animals did not suffer the lesion nor underwent laser therapy; in Group 2 (control), animals suffered the lesion but did not undergo laser therapy; in Groups 3, 4, and 5, animals suffered lesion and underwent laser therapy for 3, 5, and 7 days, respectively. Animals which suffered lesion were sacrificed on the 8th day after the lesion and assessed by polarization microscopy to analyze the degree of collagen fibers organization. RESULTS: Both experimental and standard control Groups presented significant values when compared with the control Groups, and there was no significant difference when Groups 1 and 4 were compared; the same occurred between Groups 3 and 5. CONCLUSION: Low intensity laser therapy was effective in the improvement of collagen fibers organization of the calcaneous tendon after undergoing a partial lesion.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=19347936

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.

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

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The effectiveness of low-level laser therapy on shoulder function in subacromial impingement syndrome.

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Purpose. To investigate the effectiveness of low-level laser therapy (LLLT) in addition to exercise programme on shoulder function in subacromial impingement syndrome (SAIS). Method. Sixty-seven patients with SAIS were randomly assigned to either a group that received laser (n = 34) or a group that received placebo Laser (n = 26). Pain, functional assessment, disability and muscle strength of shoulder were assessed before and after a 3-week rehabilitation programme. Besides Laser or placebo Laser, superficial cold and progressive exercise programme were administered to both groups, 5 days a week, for 3 weeks. A progressive exercise programme that was done daily twice under supervision in clinic and at home was given to the patients. Results. After the treatment, all outcome measurements had shown significant improvement except muscle strength in both the groups. When the parameters of the improvement were compared, there were no significant differences between the two groups after treatment. Conclusion. We concluded that there is no fundamental difference between LLLT and placebo LLLT when they are supplementing an exercise programme for rehabilitation of patients with shoulder impingement syndrome.

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Low-level laser irradiation promotes cell proliferation and mRNA expression of type I collagen and decorin in porcine Achilles tendon fibroblasts in vitro.

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Achilles tendon problems are commonly encountered in sports medicine and low-level laser therapy (LLLT) is widely used in rehabilitative applications to decrease pain, reduce inflammatory processes, and promote tissue healing. This study examined the effects on the proliferation of porcine Achilles tendon fibroblasts and gene expression, using different doses of low-level laser irradiation (LLLI). Four groups of identically cultured fibroblasts were exposed to LLLI and harvested after 24 h. The control group (Group 1) was subjected to no LLLI. Other groups received 1 J/cm2 (Group 2), 2 J/cm2 (Group 3), and 3 J/cm2 (Group 4), respectively. Cell proliferation and mRNA expressions of type I collagen and decorin were then measured. When compared to the control group, the cell proliferation of irradiated Achilles tendon fibroblasts in the other three groups increased significantly by 13% +/- 0.8% (Group 2), 30% +/- 0.4% (Group 3), and 12% +/- 0.6% (Group 4) respectively. But progressively higher laser intensity did not achieve a correspondingly higher cell proliferation effect in Achilles tendon fibroblasts. The mRNA expressions of decorin and type I collagen in fibroblasts with LLLI were significantly higher ($p < 0.05$). Therefore, suitable dosages of LLLI may result in more effective tissue healing by promoting type I collagen and decorin synthesis. However, these positive effects of LLLI on the repair of the Achilles tendon in humans should be further investigated in clinic.

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The effects of low-level light emitting diode on the repair process of Achilles tendon therapy in rats.

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Thirty Wistar rats (350 +/- 20 g) were subjected to total Achilles tendon tenotomy of the right fore limb. They were submitted to a daily dose of 20 J/cm(2) light emitting diode (LED) (640 +/- 20 nm) therapy. The LED was applied punctually and transcutaneously to the lesioned region. The animals were separated into six groups, C1 and L1, C2 and L2, C3 and L3. The C groups were used for control and the L groups, treated for 7, 14 and 21 consecutive days, respectively. The animals were killed on the 7th, 14th and 21st days after surgery. After the animals had been killed, their tendons were extracted and dissected, fixed in formaldehyde at 10%, and sent for histological analysis by light microscopy in which the repair process was analysed. This study demonstrated that LED interfered in the repair process of the tendon tissue, reducing the number of fibroblasts in the initial periods and improving the quality of the repair in all periods studied.

Lasers Med Sci 2008 Sep 16

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A systematic review with procedural assessments and meta-analysis of low level laser therapy in lateral elbow tendinopathy (tennis elbow).

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BACKGROUND: Recent reviews have indicated that low level level laser therapy (LLLT) is ineffective in lateral elbow tendinopathy (LET) without assessing validity of treatment procedures and doses or the influence of prior steroid injections. METHODS: Systematic review with meta-analysis, with primary outcome measures of pain relief and/or global improvement and subgroup analyses of methodological quality, wavelengths and treatment procedures. RESULTS: 18 randomised placebo-controlled trials (RCTs) were identified with 13 RCTs (730 patients) meeting the criteria for meta-analysis. 12 RCTs satisfied half or more of the methodological criteria. Publication bias was detected by Egger's graphical test, which showed a negative direction of bias. Ten of the trials included patients with poor prognosis caused by failed steroid injections or other treatment failures, or long symptom duration or severe baseline pain. The weighted mean difference (WMD) for pain relief was 10.2 mm [95% CI: 3.0 to 17.5] and the RR for global improvement was 1.36 [1.16 to 1.60]. Trials which targeted acupuncture points reported negative results, as did trials with wavelengths 820, 830 and 1064 nm. In a subgroup of five trials with 904 nm lasers and one trial with 632 nm wavelength where the lateral elbow tendon insertions were directly irradiated, WMD for pain relief was 17.2 mm [95% CI: 8.5 to 25.9] and 14.0 mm [95% CI: 7.4 to 20.6] respectively, while RR for global pain improvement was only reported for 904 nm at 1.53 [95% CI: 1.28 to 1.83]. LLLT doses in this subgroup ranged between 0.5 and 7.2 Joules. Secondary outcome measures of painfree grip strength, pain pressure threshold, sick leave and follow-up data from 3 to 8 weeks after the end of treatment, showed consistently significant results in favour of the same LLLT subgroup ($p < 0.02$). No serious side-effects were reported. CONCLUSION: LLLT administered with optimal doses of 904 nm and possibly 632 nm wavelengths directly to the lateral elbow tendon insertions, seem to offer short-term pain relief and less disability in LET, both alone and in conjunction with an exercise regimen. This finding contradicts the conclusions of previous reviews which failed to assess treatment procedures, wavelengths and optimal doses.

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Treatment of tendinopathy: what works, what does not, and what is on the horizon.

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Tendinopathy is a broad term encompassing painful conditions occurring in and around tendons in response to overuse. Recent basic science research suggests little or no inflammation is present in these conditions. Thus, traditional treatment modalities aimed at controlling inflammation such as corticosteroid injections and nonsteroidal antiinflammatory medications (NSAIDS) may not be the most effective options. We performed a systematic review of the literature to determine the best treatment options for tendinopathy. We evaluated the effectiveness of NSAIDS, corticosteroid injections, exercise-based physical therapy, physical therapy modalities, shock wave therapy, sclerotherapy, nitric oxide patches, surgery, growth factors, and stem cell treatment. NSAIDS and corticosteroids appear to provide pain relief in the short term, but their effectiveness in the long term has not been demonstrated. We identified inconsistent results with shock wave therapy and physical therapy modalities such as ultrasound, iontophoresis and low-level laser therapy. Current data support the use of eccentric strengthening protocols, sclerotherapy, and nitric oxide patches, but larger, multicenter trials are needed to confirm the early results with these treatments. Preliminary work with growth factors and stem cells is promising, but further study is required in these fields. Surgery remains the last option due to the morbidity and inconsistent outcomes. The ideal treatment for tendinopathy remains unclear. LEVEL OF EVIDENCE: Level II, systematic review.

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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.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=18341417

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 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.

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Laser therapy in the treatment of achilles tendinopathy: a pilot study.

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OBJECTIVE: To test the feasibility of a randomized controlled trial to assess the clinical effectiveness of low-level laser therapy (LLLT) when used in addition to eccentric exercise in the management of Achilles tendinopathy. BACKGROUND DATA: LLLT has emerged as a possible treatment modality for tendon injuries. Over the past 20 years only three human studies have investigated LLLT for Achilles tendinopathy. MATERIALS AND METHODS: Twenty patients were randomized into an active laser or placebo group; all patients, therapists, and investigators were blinded to allocation. All patients were given a 12-week eccentric exercise program and irradiated three times per week for 4 wk with either an active or placebo laser at standardized points over the affected tendons. Irradiation parameters in the active treatment group were: 810 nm, 100 mW, applied to six points on the tendon for 30 s, for a total dose of 3 J per point and 18 J per session. Outcome measures were the VISA-A questionnaire, pain, and isokinetic strength. Patients were measured before treatment and at 4 and 12 wk. Analysis of covariance was used to analyze data, using the effects of baseline measurements as a covariate. RESULTS: Within groups, there were significant improvements ($p < 0.05$) at 4 and 12 wk for all outcome measures, except eccentric strength for the placebo group at 4 wk ($p = 0.11$). Based on the results of the current study, recruitment of 20 subjects per group would be required to perform an adequately powered study based on minimally important clinical differences in VISA-A scale. CONCLUSION: This study has demonstrated the feasibility of undertaking a randomized controlled trial of LLLT for Achilles tendinopathy. Conclusions regarding effectiveness cannot be made due to the low statistical power of this pilot study.

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The effect of mastectomy and radiotherapy for breast carcinoma on soft tissues of the shoulder and its joint mobility among Egyptian patients.

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Patients with post mastectomy soft tissue shoulder disorders usually benefit from various lines of physiotherapy treatment. However, the controversy about their efficacy persists. The aim of this work was to study and assess the efficacy of each, and to identify the best intervention. One hundred female patients with ipsilateral post mastectomy shoulder problems were enrolled in the study, from September 2003 until December 2004. They were followed up for 32 weeks. Mastectomy, both radical and conservative and axillary lymph node clearance, was the standard surgery applied for operable breast carcinoma in this series. Clinical examination was followed by testing for the shoulder complaint by measuring maximal protrusion at the inferior scapular angle, scapular stabilization and the lift-off tests. Approved physiotherapy modalities were then applied, viz: no treatment (randomly chosen 12 patients), passive and active motion therapy (14 patients), oral diclofenac sodium (19 patients), local triamcinilone injection (40 patients) and manually applied low intensity laser therapy (15 patients). Assessment was by determining overall success rate for each intervention modality. Intervention outcome was assessed at 8, 16, and 32 weeks as shown by physical examination using the healthy shoulder as a reference, and by measuring restricted mobility during passive lateral rotation and glenohumeral abduction. "Success rate" was determined separately for each group at the end of the intervention period. The applied surgery was followed by radiotherapy in 96%, chemotherapy in 24% and both in 11%. The presenting post mastectomy symptoms at the shoulder were pain (100%), shoulder weakness (88%), winging of the scapula (11%) and inability to perform everyday shoulder movements (23%). Evaluation was by overall improvement score. The results were: 14.3% for untreated patients, 43.3% for those treated by motion therapy, 42% for diclofenac therapy, 80.7% for local triamcinolone, and lastly 68% for low intensity laser therapy. All treatment regimens for shoulder disabilities in those patients gave little long-term advantage, local steroid injections were the most effective. Low level laser therapy may augment its effect. It is concluded that all treatment regimens provide little long-term advantage; however, trimcinilone local injections may be the most useful in terms of pain relief and improvement in shoulder movement.

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Comparative study using 685-nm and 830-nm lasers in the tissue repair of tenotomized tendons in the mouse.

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OBJECTIVE: The objective of this study was to evaluate the effects of 685- and 830-nm laser irradiations, at different fluences on the healing process of Achilles tendon (Tendon calcaneo) of mice after tenotomy. BACKGROUND DATA: Some authors have shown that low-level laser therapy (LLLT) is able to accelerate the healing process of tendinuos tissue after an injury, increasing fibroblast cell proliferation and collagen synthesis. However, the mechanism by which LLLT acts on healing process is not fully understood. METHODS: Forty-eight male mice were divided into six experimental groups: group A, tenomized animals, treated with 685 nm laser, at the dosage of 3 J/cm(2); group B, tenomized animals, treated with 685-nm laser, at the dosage of 10 J/cm(2); group C, tenomized animals, treated with 830-nm laser, at dosage of 3 J/cm(2); group D, tenomized animals, treated with 830-nm laser, at the dosage of 10 J/cm(2); group E, injured control (placebo treatment); and group F, non-injured standard control. Animals were killed on day 13 post-tenotomy, and their tendons were surgically removed for a quantitative analysis using polarization microscopy, with the purpose of measuring collagen fibers organization through the birefringence (optical retardation [OR]). RESULTS: All treated groups showed higher values of OR when compared to injured control group. The best organization and aggregation of the collagen bundles were shown by the animals of group A (685 nm, 3 J/cm(2)), followed by the animals of group C and B, and finally, the animals of group D. CONCLUSION: All wavelengths and fluences used in this study were efficient at accelerating the healing process of Achilles tendon post-tenotomy, particularly after the 685-nm laser irradiation, at 3 J/cm(2). It suggests the existence of wavelength tissue specificity and dose dependency. Further studies are required to investigate the physiological mechanisms responsible for the effects of laser on tendinuos repair.

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An in-vivo experimental evaluation of He-Ne laser photostimulation in healing Achilles tendons.

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There is no method of treatment that has been proven to accelerate the rate of tendon healing or to improve the quality of the regenerating tendon. Low level laser photostimulation has gained a considerable attention for enhancing tissue repair in a wide spectrum of applications. However, there is controversy regarding the effectiveness of laser photostimulation for improvement of the healing process of surgically repaired tendons. Accordingly, the present study was conducted to evaluate the role of helium-neon (He-Ne) laser photostimulation on the process of healing of surgically repaired Achilles tendons. Thirty unilateral Achilles tendons of 30 Raex rabbits were transected and immediately repaired. Operated Achilles tendons were randomly divided into two equal groups. Tendons at group A were subjected to He-Ne laser (632.8 nm) photostimulation, while tendons at group B served as a control group. Two weeks later, the repaired Achilles tendons were histopathologically and biomechanically evaluated. The histopathological findings suggest the favorable qualitative pattern of the newly synthesized collagen of the regenerating tendons after He-Ne laser photostimulation. The biomechanical results support the same favorable findings from the functional point of view as denoted by the better biomechanical properties of the regenerating tendons after He-Ne laser photostimulation with statistical significance ($p <or= 0.01$) at most of the biomechanical parameters. He-Ne laser photostimulation reported a great value after surgical repair of ruptured and injured tendons for a better functional outcome. It could be applied safely and effectively in humans, especially with respect to the proposed long-term clinical outcome.

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

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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+/-SD, age 20.9+/-3.1 y, height 171.0+/-3.9 cm, body mass 63.4+/-3.5 kg and 14 females: age 21.2+/-1.7 y, height 162.0+/-7.8 cm, body mass 56.2+/-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 (intraclass 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.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=16858211

A randomised, placebo controlled trial of low level laser therapy for activated Achilles tendinitis with microdialysis measurement of peritendinous prostaglandin E2 concentrations.

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BACKGROUND: Low level laser therapy (LLLT) has gained increasing popularity in the management of tendinopathy and arthritis. Results from in vitro and in vivo studies have suggested that inflammatory modulation is one of several possible biological mechanisms of LLLT action. OBJECTIVE: To investigate in situ if LLLT has an anti-inflammatory effect on activated tendinitis of the human Achilles tendon. SUBJECTS: Seven patients with bilateral Achilles tendinitis (14 tendons) who had aggravated symptoms produced by pain inducing activity immediately before the study. METHOD: Infrared (904 nm wavelength) LLLT (5.4 J per point, power density 20 mW/cm2) and placebo LLLT (0 J) were administered to both Achilles tendons in random blinded order. RESULTS: Ultrasonography Doppler measurements at baseline showed minor inflammation through increased intratendinous blood flow in all 14 tendons and measurable resistive index in eight tendons of 0.91 (95% confidence interval 0.87 to 0.95). Prostaglandin E2 concentrations were significantly reduced 75, 90, and 105 minutes after active LLLT compared with concentrations before treatment ($p = 0.026$) and after placebo LLLT ($p = 0.009$). Pressure pain threshold had increased significantly ($p = 0.012$) after active LLLT compared with placebo LLLT: the mean difference in the change between the groups was 0.40 kg/cm2 (95% confidence interval 0.10 to 0.70). CONCLUSION: LLLT at a dose of 5.4 J per point can reduce inflammation and pain in activated Achilles tendinitis. LLLT may therefore have potential in the management of diseases with an inflammatory component.

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Effect of In-Ga-Al-P diode laser irradiation on angiogenesis in partial ruptures of Achilles tendon in rats.

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OBJECTIVE: This study was conducted to analyze the effect of different irradiances of low-level laser therapy (LLLT) on angiogenesis after partial rupture of Achilles tendon of rats. BACKGROUND DATA: METHODS: Ninety-six animals were divided into three groups subject to treatment during 3, 5, and 7 days post-lesion. Thirty-two animals were used in each group. The groups were further divided into four subgroups with eight animals in each, receiving In-Ga-Al-P laser (660 nm) treatment at (1) mean output of 10 mW, (2) 40 mW during 10 sec, (3) a sham subgroup, and (4) a non-treatment subgroup. Each animal was subjected to a lesion of the Achilles tendon by dropping a 186-g weight from a 20-cm height over the tendon. Treatment was initiated 6 h post-injury for all the groups. Blood vessels were colored with India ink injection and were examined in a video microscope. RESULTS: Laser exposure promoted an increase in blood vessel count when compared to controls. The 40-mW group showed early neovascularization, with the greatest number of microvessels after three laser applications. The 10-mW subgroup showed angiogenesis activity around the same time as the sham laser group did, but the net number of vessels was significantly higher in the former than in the controls. After seven irradiations, the subgroup receiving 40 mW experienced a drop in microvessel number, but it was still higher than in the control groups. CONCLUSIONS: LLLT of different intensities seems to promote neovascularization in damaged Achilles tendons of rats after partial rupture compared to controls.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=16262576

Low-power laser treatment for shoulder pain.

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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.

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

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Low-level laser therapy (LLLT) prevents oxidative stress and reduces fibrosis in rat traumatized Achilles tendon.

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BACKGROUND AND OBJECTIVES: The present study investigated the effects of low-level laser therapy (LLLT) on oxidative stress and fibrosis in an experimental model of Achilles tendon injury induced by a single impact trauma. STUDY DESIGN/MATERIALS AND METHODS: Male Wistar rats were randomly divided into four groups (n = 8): control, trauma, trauma+LLLT for 14 days, and trauma+LLLT for 21 days. Achilles tendon traumatism was produced by dropping down a load with an impact kinetic energy of 0.544 J. A low level Ga-As laser was applied with a 904 nm wavelength, 45 mW average power, 5 J/cm (2) dosage, for 35 seconds duration, continuously. Studies were carried out at day 21. RESULTS: Histology showed a loss of normal architecture, with inflammatory reaction, angiogenesis, vasodilatation, and extracellular matrix formation after trauma. This was accompanied by a significant increase in collagen concentration when compared the control group. Oxidative stress, measured by the concentration of thiobarbituric acid reactive substances and hydroperoxyde-initiated chemiluminiscence, was also significantly increased in the trauma group. Administration of LLLT for 14 or 21 days markedly alleviated histological abnormalities reduced collagen concentration and prevented oxidative stress. Superoxide dismutase activity was significantly increased by LLLT treatment over control values. CONCLUSION: LLLT by Ga-As laser reduces histological abnormalities, collagen concentration, and oxidative stress in an experimental model of Achilles tendon injury. Reduction of fibrosis could be mediated by the beneficial effects on the oxidant/antioxidant balance.

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Effectiveness of low-level laser therapy for lateral elbow tendinopathy.

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OBJECTIVE: Our aim was to determine the effectiveness of low-lever laser therapy (LLLT) in the management of lateral elbow tendinopathy (LET) and to provide recommendations based on this evidence. BACKGROUND DATA: LET is a common clinical condition, and a wide array of physiotherapy treatments is used for treating LET. METHODS: Randomized controlled trials (RCTs) identified by a search strategy in six databases were used in combination with reference checking. RCTs that included LLLT, patients with LET, and at least one of the clinically relevant outcome measure were selected. Aqualitative analysis of the selected studies was conducted using the Chalmers' technique. RESULTS: Nine RCTs fulfilled the criteria and were included in the review. Although these studies had satisfactory methodology, shortcomings were not absent; poor results were revealed as to the effectiveness of LLLT for LET management. CONCLUSIONS: LLLT need not be ruled out for LET as it is a dose-response modality, and the optimal treatment dose has obviously not yet have been discovered. Further research with well-designed RCTs is needed to establish the absolute and relative effectiveness of this intervention for LET.

Photomed Laser Surg 2005 Aug 23(4) 425-30

http://www.ncbi.nlm.nih.gov/pubmed/?term=16144488

Cryoultrasound therapy and tendonitis in athletes: a comparative evaluation versus laser CO2 and t.e.ca.r. therapy.

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Aim of this study is to compare the different kinds of tendonitis in athletes using cryoultrasound therapy, lasertherapy CO2 and t.e.ca.r. therapy (transfert energetic capacitive and resistive). Forty five athletes were selected; they were all affected by severe insertional tendonitis of the Achilles tendon (15 of them), of the patellar tendon (15 of them) and of the epicondylar region (15 of them) during the last two months. They were divided into three groups. The first group underwent a treatment of 12 lasertherapy CO2 sessions, the second group 12 cryoultrasound therapy sessions and the last group 12 t.e.ca.r. therapy sessions. Each patient was registered by an independent observer according to the pain before (initial V. A.S.) and after treatment (final V.A.S.) using the analogic visual range from 0 (lack of pain) to 10 (unbearable pain) and the indicator of efficacy (difference between initial V.A.S. and final V.A.S./initial V. A.S.x 100). The obtained results were expressed as a difference between the two V.A.S. values and as a parameter of effectiveness (value ranging from 0 to 100) in order to correlate the initial condition of the patients with the performed physiotherapic treatment. The obtained V.A.S. score was submitted to statistic evaluation by analysis of variance through repeated measures, taking into consideration a value of $p<0.05$. Possible differences among the group of patients were shown by analysis of variance through one single way by comparison among groups. Every patient benefited from the treatment. Analyzing the initial and final V.A.S. values in the three groups, statistically significant variations emerged ($p<0.05$). A meaningful difference resulted among the different kinds of treatment; a marked difference was noticed between laser CO2 and cryoultrasound therapy ($p<0.01$). No statistically significant differences were observed between t.e.ca.r. and laser CO2 therapy or between t.e.ca.r. and cryoultrasound therapy. It must be admitted that the mean difference between initial and final V.A.S. is higher in the Cryoultrasound group (7.40), than in the Laser group (6.33) compared to t.e.ca.r. group (6.74). This result would explain a higher range of effectiveness in the Cryoultrasound group (85) compared to the laser CO2 (71.9) and t. e.ca.r. group (77.3). It can be asserted that cryoultrasound is a useful instrument for the physician working in the sports field. It offers advantages in comparison with laser CO2. It does not show significant differences with t.e.ca.r. therapy, although it shows a better mean range of effectiveness.

Acta Biomed 2005 Apr 76(1) 37-41

http://www.ncbi.nlm.nih.gov/pubmed/?term=16116824

The use of polarized polychromatic non-coherent light as therapy for acute tennis elbow/lateral epicondylalgia: a pilot study.

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OBJECTIVE: The aim of this study was to assess the efficacy of polarized, polychromatic, non-coherent, low energy light (Bioptron 2, Bioptron AG, Switzerland) in the treatment of acute tennis elbow. BACKGROUND: Tennis elbow, or lateral epicondylitis, is one of the most common lesions affecting the arm. A plethora of treatment regimes have been described for this condition, but no specific therapy has emerged as a gold standard. METHODS: A pilot study was carried out with 25 patients who had acute tennis elbow. Bioptron 2 device was applied over lateral epicondyle three times per week for 4 weeks. Pain on VAS, function on VAS, and painfree grip strength were measured at the beginning (week 0) and at the end of the study (week 4). RESULTS: The pain on VAS was reduced at the end of treatment ($t(24) = 3.84$, $p = 0.001$). Function on VAS was increased at the end of treatment ($t(24) = 4.23$, $p < 0.001$). Pain-free grip strength was increased at the end of treatment ($t(24) = 4.23$, $p < 0.004$). CONCLUSION: Although the results suggested that the Bioptron 2 could reduce patients' symptoms with acute tennis elbow, future controlled studies are needed to establish the relative and absolute effectiveness of Bioptron 2.

Photomed Laser Surg 2005 Feb 23(1) 66-9

http://www.ncbi.nlm.nih.gov/pubmed/?term=15782036

Comparison of the effects of laser, ultrasound, and combined laser + ultrasound treatments in experimental tendon healing.

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BACKGROUND AND OBJECTIVE: Therapeutic ultrasound (US) and laser (L) treatments accelerate and facilitate wound healing, and also have beneficial effects on tendon healing. This randomized control study was designed to evaluate the effects of low-intensity US and low-level laser therapy (LLLT) on tendon healing in rats. STUDY DESIGN/MATERIALS AND METHODS: Eighty-four healthy male Swiss-Albino rats were divided into three groups consisting of 28 rats, the left Achilles tendons were used as treatment and the right Achilles tendons as controls. The right and left Achilles tendons of rats were traumatized longitudinally. The treatment was started on postinjury day one. We applied the treatment protocols including low-intensity US treatment in Group I (US Group), Sham US in Group II (SUS Group), LLLT in Group III (L Group), Sham L in Group IV (SL Group), US and LLLT in Group V (US + L Group), and Sham US and Sham L in Group VI (SUS + SL Group). The US treatment was applied with a power of 0.5 W/cm2, a frequency of 1 MHz, continuously, 5 minutes daily. A low-level Ga-As laser was applied with a 904 nm wavelength, 6 mW average power, 1 J/ cm2 dosage, 16 Hz frequency, for 1 minute duration, continuously. In the control groups, the similar procedures as in the corresponding treatment groups were applied with no current (Sham method). The treatment duration was planned for 9 days (sessions) in all groups, except the rats used for biochemical evaluation on the 4th day of treatment, which were treated for 4 days. We measured the levels of the tissue hydroxyproline for biochemical evaluation on the 4th, 10th, and 21st days following the beginning of treatment and the tendon breaking strength on the 21st day following the beginning of treatment for biomechanical evaluation. Seven rats in each group were killed on the 4th, 10th, and 21st days for biochemical evaluation and on the 21st day for biomechanical evaluation. RESULTS: The hydroxyproline levels were found to be significantly increased in the treatment groups on the 10th and 21st days compared to their control groups ($P < 0.05$). In comparison of the treatment groups on the 4th, 10th, and 21st days of the treatment, the levels of tissue hydroxyproline were found to be more increased in combined US+L Group compared with US Group and L Group, but the difference was not significant ($P > 0.05$). In comparison of the tendon breaking strengths, it was found as significantly increased in the treatment groups compared with their control groups ($P < 0.05$), although there was no significant difference between the treatment groups. CONCLUSIONS: Although US, L, and combined US + L treatments increased tendon healing biochemically and biomechanically more than the control groups, no statistically significant difference was found between them. Also we did not find significantly more cumulative positive effects of combined treatment. As a result, both of these physical modalities can be used successfully in the treatment of tendon healing.

Lasers Surg Med 2004 35(1) 84-9

http://www.ncbi.nlm.nih.gov/pubmed/?term=15278933

Investigation of the supplementary effect of GaAs laser therapy on the rehabilitation of human digital flexor tendons.

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OBJECTIVE: To investigate the effect of laser photostimulation in rehabilitation of human digital flexor tendons with a placebo-controlled double-blind prospective study model. BACKGROUND DATA: Low-energy laser therapy has been applied in several rheumatoid and soft tissue disorders with a varying rate of success and it has also been shown to have a positive effect on tendon healing in animal experiments, but no clinical study on laser photostimulation in the treatment of human tendons has been reported to date. MATERIALS AND METHODS: This study was performed in a total of 25 patients with 41 digital flexor tendon injuries in five anatomical zones. In Group I (21 digits in 13 patients), whirlpool and infrared GaAs diode laser with a frequency of 100 Hz. was applied between the 8th and 21st days postoperatively and all patients were given the Washington rehabilitation program until the end of the 12th week. In Group II (20 digits in 12 patients), the same treatment protocol was given but the laser instrument was switched off during applications. RESULTS: The results of the study showed a significant improvement in the laser-treated group only for the parameter of edema reduction ($p < 0.01$) but the difference between the two groups was non-significant for pain reduction, hand grip strength, and functional evaluation performed according to Strickland and Buck-Gramcko systems using total active motion and fingertip-to distal palmar crease distance parameters ($p > 0.05$). CONCLUSIONS: Significant improvement obtained in edema reduction both immediately and 12 weeks after supplementary GaAs laser application in our study has been interpreted as an important contribution to the rehabilitation of human flexor tendon injuries because edema is known to have a detrimental effect on functional recovery during both early and late stages of tendon healing. However, our study has failed to show a significant positive effect of supplementary GaAs laser application on the other functional recovery parameters of human flexor tendon injury rehabilitation and we suggest further clinical study in this topic be done using different laser types and dosages in order to delineate the role of this promising treatment modality.

J Clin Laser Med Surg 2004 Apr 22(2) 105-10

http://www.ncbi.nlm.nih.gov/pubmed/?term=15165384

Physiotherapy interventions for shoulder pain.

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BACKGROUND: The prevalence of shoulder disorders has been reported to range from seven to 36% of the population (Lundberg 1969) accounting for 1.2% of all General Practitioner encounters in Australia (Bridges Webb 1992). Substantial disability and significant morbidity can result from shoulder disorders. While many treatments have been employed in the treatment of shoulder disorders, few have been proven in randomised controlled trials. Physiotherapy is often the first line of management for shoulder pain and to date its efficacy has not been established. This review is one in a series of reviews of varying interventions for shoulder disorders, updated from an earlier Cochrane review of all interventions for shoulder disorder. OBJECTIVES: To determine the efficacy of physiotherapy interventions for disorders resulting in pain, stiffness and/or disability of the shoulder. SEARCH STRATEGY: MEDLINE, EMBASE, the Cochrane Clinical Trials Regiter and CINAHL were searched 1966 to June 2002. The Cochrane Musculoskeletal Review Group's search strategy was used and key words gained from previous reviews and all relevant articles were used as text terms in the search. SELECTION CRITERIA: Each identified study was assessed for possible inclusion by two independent reviewers. The determinants for inclusion were that the trial be of an intervention generally delivered by a physiotherapist, that treatment allocation was randomised; and that the study population be suffering from a shoulder disorder, excluding trauma and systemic inflammatory diseases such as rheumatoid arthritis. DATA COLLECTION AND ANALYSIS: The methodological quality of the included trials was assessed by two independent reviewers according to a list of predetermined criteria, which were based on the PEDro scale specifically designed for the assessment of validity of trials of physiotherapy interventions. Outcome data was extracted and entered into Revman 4.1. Means and standard deviations for continuous outcomes and number of events for binary outcomes were extracted where available from the published reports. All standard errors of the mean were converted to standard deviation. For trials where the required data was not reported or not able to be calculated, further details were requested from first authors. If no further details were provided, the trial was included in the review and fully described, but not included in the meta-analysis. Results were presented for each diagnostic sub group (rotator cuff disease, adhesive capsulitis, anterior instability etc) and, where possible, combined in meta-analysis to give a treatment effect across all trials. MAIN RESULTS: Twenty six trials met inclusion criteria. Methodological quality was variable and trial populations were generally small (median sample size = 48, range 14 to 180). Exercise was demonstrated to be effective in terms of short term recovery in rotator cuff disease (RR 7.74 (1.97, 30.32), and longer term benefit with respect to function (RR 2.45 (1.24, 4.86). Combining mobilisation with exercise resulted in additional benefit when compared to exercise alone for rotator cuff disease. Laser therapy was demonstrated to be more effective than placebo (RR 3.71 (1.89, 7.28) for adhesive capsulitis but not for rotator cuff tendinitis. Both ultrasound and pulsed electromagnetic field therapy resulted in improvement compared to placebo in pain in calcific tendinitis (RR 1.81 (1.26, 2.60) and RR 19 (1.16, 12.43) respectively). There is no evidence of the effect of ultrasound in shoulder pain (mixed diagnosis), adhesive capsulitis or rotator cuff tendinitis. When compared to exercises, ultrasound is of no additional benefit over and above exercise alone. There is some evidence that for rotator cuff disease, corticosteroid injections are superior to physiotherapy and no evidence that physiotherapy alone is of benefit for Adhesive Capsulitis REVIEWER'S CONCLUSIONS: The small sample sizes, variable methodological quality and heterogeneity in terms of population studied, physiotherapy intervention employed and length of follow up of randomised controlled trials of physiotherapy interventions results in little overall evidence to guide treatment. There is evidence to support the use of some interventions in specific and

[Laser therapy of epicondylitis of the shoulder]

Vainshtein, KA

Vopr Kurortol Fizioter Lech Fiz Kult 2002 May-Jun -3 45-6

http://www.ncbi.nlm.nih.gov/pubmed/?term=12221852

Shoulder disorders: a state-of-the-art review

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This paper provides an up-to-date overview of the occurrence, diagnosis, risk factors, prognostic indicators and outcome of shoulder disorder (SD), and of the validity and reproducibility of diagnostic classifications and diagnostic imaging techniques for SD. Furthermore, the available evidence on the effectiveness of non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections and physiotherapy for SD is summarized on the basis of randomized controlled trials with an acceptable quality of their methods. The annual incidence of SD is estimated at about 7%, its 1-year period prevalence at about 51% and its lifetime prevalence at about 10%. While approximately 50% of all patients with SD seek medical care, about 95% are treated in primary health care. Of all new episodes of SD presenting to primary care, approximately 50% seem to resolve within 6 months, while about 40% seem to persist for up to 12 months. Several prognostic indicators for a favourable or a poor outcome of SD have been identified, but a comprehensive prognostic model is not available. While evidence for the prognostic validity of popular diagnostic classifications of SD is lacking, their reproducibility has been shown to be poor. The accuracy and clinical usefulness of diagnostic imaging techniques appear to be sufficiently verified for SD in secondary care, while their clinical usefulness in primary care and prognostic validity are not. NSAIDs and steroid injections for SD have been shown to be effective within 6 weeks, but their effect on long-term outcome remains unclear. There is very limited evidence for the effectiveness in SD of physiotherapy, including exercise therapy, ultrasound, electrotherapy, laser, mobilization and manipulation.

Baillieres Clin Rheumatol 1999 Jun 13(2) 287-309

http://www.ncbi.nlm.nih.gov/pubmed/?term=10445116

Treatment of medial and lateral epicondylitis--tennis and golfer's elbow--with low level laser therapy: a multicenter double blind, placebo-controlled clinical study on 324 patients.

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BACKGROUND AND OBJECTIVE: Among the other treatment modalities of medial and lateral epicondylitis, low level laser therapy (LLLT) has been promoted as a highly successful method. The aim of this clinical study was to assess the efficacy of LLLT using trigger points (TPs) and scanner application techniques under placebo-controlled conditions. STUDY DESIGN/MATERIAL AND METHODS: The current clinical study was completed at two Laser Centers (Locarno, Switzerland and Opatija, Croatia) as a double-blind, placebo controlled, crossover clinical study. The patient population (n = 324), with either medial epicondylitis (Golfer's elbow; n = 50) or lateral epicondylitis (Tennis elbow; n = 274), was recruited. Unilateral cases of either type of epicondylitis (n = 283) were randomly allocated to one of three treatment groups according to the LLLT technique applied: (1) Trigger points; (2) Scanner; (3) Combination Treatment (i.e., TPs and scanner technique). Bilateral cases of either type of epicondylitis (n = 41) were subject to crossover, placebo-controlled conditions. Laser devices used to perform these treatments were infrared (IR) diode laser (GaAlAs) 830 nm continuous wave for treatment of TPs and HeNe 632.8 nm combined with IR diode laser 904 nm, pulsed wave for scanner technique. Energy doses were equally controlled and measured in Joules/cm2 either during TPs or scanner technique sessions in all groups of patients. The treatment outcome (pain relief and functional ability) was observed and measured according to the following methods: (1) short form of McGill's Pain Questionnaire (SF-MPQ); (2) visual analogue scales (VAS); (3) verbal rating scales (VRS); (4) patient's pain diary; and (5) hand dynamometer. RESULTS: Total relief of the pain with consequently improved functional ability was achieved in 82% of acute and 66% of chronic cases, all of which were treated by combination of TPs and scanner technique. CONCLUSIONS: This clinical study has demonstrated that the best results are obtained using combination treatment (i.e., TPs and scanner technique). Good results are obtained from adequate treatment technique correctly applied, individual energy doses, adequate medical education, clinical experience, and correct approach of laser therapists. We observed that under- and overirradiation dosage can result in the absence of positive therapy effects or even opposite, negative (e.g., inhibitory) effects. The current clinical study provides further evidence of the efficacy of LLLT in the management of lateral and medial epicondylitis.

J Clin Laser Med Surg 1998 Jun 16(3) 145-51

http://www.ncbi.nlm.nih.gov/pubmed/?term=9743652

Biochemistry and biomechanics of healing tendon: Part II. Effects of combined laser therapy and electrical stimulation.

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PURPOSE: In previous studies we demonstrated that early mechanical loading and laser photostimulation independently promoted tendon healing. Thus, we tested the hypothesis that a combination of laser phototherapy and mechanical load would further accelerate healing of experimentally tenotomized and repaired rabbit Achilles tendons. METHODS: Following surgical tenotomy and repair, the tendons of experimental and control rabbits were immobilized in polyurethane casts for 5 d. The repaired tendons of experimental rabbits received mechanical load via electrical stimulation-induced contraction of the triceps surae for 5 d. In addition, experimental tendons were treated with daily doses of 1 J.cm-2 low intensity helium-neon laser throughout the 14-d experimental period. RESULTS: The combination of laser photostimulation and mechanical load increased the maximal stress, maximal strain, and Young's modulus of elasticity of the tendons 30, 13, and 33%, respectively. However, MANOVA revealed no statistically significant differences in these biomechanical indices of repair of control and experimental tendons. Biochemical assays showed a 32% increase in collagen levels ($P < 0.05$) and an 11% decrease in mature cross-links in experimental tendons compared with that in controls ($P > 0.05$). Electron microscopy and computer morphometry revealed no significant differences in the morphometry of the collagen fibers and no visible differences in the ultrastructure of cellular and matrical components of control and experimental tendons. CONCLUSIONS: These findings indicate that the combination of laser photostimulation and early mechanical loading of tendons increased collagen production, with marginal biomechanical effects on repaired tendons.

Med Sci Sports Exerc 1998 Jun 30(6) 794-800

http://www.ncbi.nlm.nih.gov/pubmed/?term=9624633

Combined ultrasound, electrical stimulation, and laser promote collagen synthesis with moderate changes in tendon biomechanics.

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The biomechanical, biochemical, and ultrastructural effects of a multitherapeutic protocol were studied using regenerating rabbit Achilles tendons. The multitherapeutic protocol was composed of low-intensity Ga:As laser photostimulation, low intensity ultrasound, and electrical stimulation. Achilles tendons of 63 male New Zealand rabbits were tenotomized, sutured, immobilized, and subjected to the multitherapeutic protocol for five days, after which casts were removed and the therapy was continued for nine more days without electrical stimulation. The tendons were excised and compared with control tendons. Multitherapy treatment produced a 14% increase in maximal strength, a 42% increase in load-at-break, a 20% increase in maximal stress, a 45% increase in stress-at-break, a 21% increase in maximal strain, and a 14% increase in strain-at-break. Similarly, multitherapy treatment was associated with an increase in Young's modulus of elasticity of 31%, an increase in energy absorption at maximum load of 9%, and an increase in energy absorption at load-at-break of 11%. Biochemical analysis of the tendons showed an increase of 23% in the total amount of collagen in the multitherapy-treated tendons, with fewer mature crosslinks (decrease of 6%). Electron micrographs revealed no ultrastructural or morphologic changes in the tendon fibroblasts or in the extracellular matrix. The improvements measured in tendons receiving multitherapy were consistent but less remarkable compared with our earlier works with single modality protocols. The results warrant the hypothesis that the beneficial effects of ultrasound and laser photostimulation on tendon healing may counteract one another when applied simultaneously.

Am J Phys Med Rehabil 1997 Jul-Aug 76(4) 288-96

http://www.ncbi.nlm.nih.gov/pubmed/?term=9267188

Physiotherapy for patients with soft tissue shoulder disorders: a systematic review of randomised clinical trials.

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OBJECTIVE: To assess the effectiveness of physiotherapy for patients with soft tissue shoulder disorders. DESIGN: A systematic computerised literature search of Medline and Embase, supplemented with citation tracking, for relevant trials with random allocation published before 1996. SUBJECTS: Patients treated with physiotherapy for disorders of soft tissue of the shoulder. MAIN OUTCOME MEASURES: Success rates, mobility, pain, functional status. RESULTS: Six of the 20 assessed trials satisfied at least five of eight validity criteria. Assessment of methods was often hampered by insufficient information on various validity criteria, and trials were often flawed by lack of blinding, high proportions of withdrawals from treatment, and high proportions of missing values. Trial sizes were small: only six trials included intervention groups of more than 25 patients. Ultrasound therapy, evaluated in six trials, was not shown to be effective. Four other trials favoured physiotherapy (laser therapy or manipulation), but the validity of their methods was unsatisfactory. CONCLUSIONS: There is evidence that ultrasound therapy is ineffective in the treatment of soft tissue shoulder disorders. Due to small trial sizes and unsatisfactory methods, evidence for the effectiveness of other methods of physiotherapy is inconclusive. For all methods of treatment, trials were too heterogeneous with respect to included patients, index and reference treatments, and follow up to merit valid statistical pooling. Future studies should show whether physiotherapy is superior to treatment with drugs, steroid injections, or a wait and see policy.

BMJ 1997 Jul 5 315(7099) 25-30

http://www.ncbi.nlm.nih.gov/pubmed/?term=9233322

A double-blind study of the effectiveness of low level laser treatment of rotator cuff tendinitis.

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Thirty-five patients with rotator cuff tendinitis were randomly allocated to active (CB Medico Master III 830 nm Ga As AL diode) laser or dummy laser treatment twice weekly for 8 weeks. Movement range, painful arc score, resisted movement score and responses to visual analogue scales for night pain, rest pain, movement pain and functional limitation were measured second weekly. All responses improved from baseline but there was no difference between the two groups. These results fail to demonstrate the effectiveness of laser therapy in rotator cuff tendinitis.

Br J Rheumatol 1993 Aug 32(8) 740-2

http://www.ncbi.nlm.nih.gov/pubmed/?term=8348278

[Treatment of chronic shoulder tendinitis]

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The authors review current treatment modalities and present a study comparing supervised exercises and arthroscopic surgery in patients with rotator cuff disease. Exercises supervised by a physiotherapist emphasize relearning of normal patterns of movement and local endurance training to improve tendon and muscle tissue, and are supplemented by ergonomic advice. The clinician should try to elucidate whether the patient is supposed to benefit solely from information and self-treatment. For several of the currently used treatment modalities, such as ultrasound, soft laser, heat and massage, no effect has been documented. Surgery should be reserved for persons who do not benefit from supervised exercises. Careful rehabilitation is necessary for patients who report having a physically demanding job.

Tidsskr Nor Laegeforen 1994 Feb 20 114(5) 575-7

http://www.ncbi.nlm.nih.gov/pubmed/?term=8209342

[Laser therapy of Achilles tendinitis]

Darre EM, Klokker M, Lund P, Rasmussen JD, Hansen K, Vedtofte PE

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The effects of low level laser treatment in soldiers with achilles tendinitis were studied in a prospective, randomized and double blind trial. Eighty-nine soldiers were enrolled in the study. Forty-six were randomized to treatment with active laser and 43 to treatment with placebo laser. No statistically significant differences in the number of consultations, morning stiffness, tenderness, crepitation, swelling, redness, VAS-score of pain and degree of unfitness for duty were found between the two treatment groups.

Ugeskr Laeger 1994 Nov 7 156(45) 6680-3

http://www.ncbi.nlm.nih.gov/pubmed/?term=7839480

Effect of laser versus placebo in tennis elbow.

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The purposes of this study were to compare the pain alleviating effects of laser treatment and placebo in tennis elbow. Also, the effects of laser radiation on the radial sensory nerve conduction, and the temperature changes in the tissue surrounding the treated radial nerve were studied. The results show that laser treatment is not significantly better than placebo in treating tennis elbow. Furthermore, no significant change was noted in the evoked sensory potential as well as subcutaneous temperatures in either experimental or control groups as a result of the applications of the laser radiation treatment.

Scand J Rehabil Med 1987 19(3) 135-8

http://www.ncbi.nlm.nih.gov/pubmed/?term=3441775

Low power laser therapy of shoulder tendonitis.

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30 patients with supraspinatus or bicipital tendonitis were randomly allocated to active infrared laser therapy at 904 nm three times weekly for 2 weeks, dummy laser or drug treatment for 2 weeks. Objectively maximum active extension, flexion and abduction of the shoulder, and subjectively pain stiffness movement and function were measured at 0 and 2 weeks. Significant improvement of active over dummy laser was noted for all seven assessments. Active laser therapy produced significant improvement over drug therapy for all three objective measures and pain. Naproxen sodium significantly improved only movement and function compared to dummy laser. These results demonstrate the effectiveness of laser therapy in tendonitis of the shoulder.

Scand J Rheumatol 1989 18(6) 427-31

http://www.ncbi.nlm.nih.gov/pubmed/?term=2694356

[Low energy laser treatment--effect in localized fibromyalgia in the neck and shoulder regions]

Thorsen H, Gam AN, Jensen H, Hojmark L, Wahlstrom L

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The effect of low-level laser therapy (GaAlAs, 830 nm, continuous) for chronic myofascial pain in the neck and shoulder girdle was assessed in a double-blind randomized study with 36 female participants. Treatments were given six times during two weeks with a total effect of 4.5-22.5 J per treatment depending on the number of tender points. No significant effect was found, neither in pain relief nor in tablet intake between the laser and the placebo group. None of the participants reported any side-effects.

Ugeskr Laeger 1991 Jun 17 153(25) 1801-4

http://www.ncbi.nlm.nih.gov/pubmed/?term=1853462

Low level laser versus placebo in the treatment of tennis elbow.

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The effect of low level laser (GaAs) on lateral epicondylitis was investigated in a double-blind, randomized, controlled study. Thirty patients were assigned equally to a laser (n = 15) or a placebo laser (n = 15) group. All patients received eight treatments and were evaluated subjectively and objectively before, at the end of, and four weeks after treatment. Patients also completed a follow-up questionnaire on an average of five to six months after treatment. A significant improvement in the laser compared to the placebo group was found on visual analog scale (p = 0.02) and grip strength (p = 0.03) tests four weeks after treatment. In this study low level laser therapy was shown to have an effect over placebo; however, as a sole treatment for lateral epicondylitis it is of limited value. Further studies are needed to evaluate the reliability of our findings and to compare laser to other established treatment methods.

Scand J Rehabil Med 1992 24(1) 37-42

http://www.ncbi.nlm.nih.gov/pubmed/?term=1604260

Low level laser therapy for myofascial pain in the neck and shoulder girdle. A double-blind, cross-over study.

Thorsen H, Gam AN, Svensson BH, Jess M, Jensen MK, Piculell I, Schack LK, Skjott K

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In a controlled, cross-over study the effect of low level laser therapy (LLLT) was evaluated. During a five weeks period forty-seven female laboratory technicians received six laser and six placebo treatments to tender points in the neck and shoulder girdle. Subjects rated the placebo treatment significantly more beneficial than LLLT ($p = .04$). There was no reduction in consumption of analgesics associated with either laser or placebo treatment. The results indicate no beneficial effect of LLLT for myofascial pain.

Scand J Rheumatol 1992 21(3) 139-41

http://www.ncbi.nlm.nih.gov/pubmed/?term=1604252

Conservative therapy for tennis elbow.

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Tennis elbow is a common overuse syndrome. It is accompanied by degenerative changes in the enthesis of the extensor carpi radialis brevis muscle. It may be best diagnosed clinically by eliminating other possible causes of lateral elbow pain. Physical methods should always be selected as initial treatment. Immobilisation is the initial advice that most doctors give: ultrasound has been shown to be effective in a placebo-controlled, double-blind trial, and low energy laser has been found to reduce objective but not subjective symptoms. Other forms of physical treatment like electrotherapy, thermotherapy and massages can be tried, even though proof of their efficacy needs to be established more firmly. When physical treatments have failed, steroid injections can help. If symptoms still persist, then surgery is called for. There are still many open questions surrounding the syndrome of tennis elbow. Research into this common soft tissue disease should be intensified.

Br J Clin Pract 1992 Spring 46(1) 55-7

http://www.ncbi.nlm.nih.gov/pubmed/?term=1419555

Low level laser therapy for tendinopathy: evidence of a dose-response pattern

Bjordal J M, Couppe C, Ljunggren A E

This review assessed the effects of low-level laser therapy (LLLT) on pain from tendinopathy. The authors concluded that LLLT can reduce pain in subacute and chronic tendinopathy if a valid treatment procedure and location-specific dose is used. Differences among the studies were not examined and only the short-term outcomes were assessed. The authors' conclusions may not be reliable.

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Low Power Laser Therapy of Shoulder Tendonitis

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Laser light has gained popularity its t iie", (lici-iij-)y lot- soft tissue disorders despite a scarcity of studies

LOW LEVEL LASER VERSUS PLACEBO.IN THE TREATMENT OF TENNIS ELBOW

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ABSTRACT. The effect of low level laser (GaAs) on

lateral epicondylitis was investigated in a double-blind, ' randomized, controlled study. Thirty patients were assigned equally to a laser (n=15) or a placebo laser (n=15) group. All patients received eight treatments and were evaluated subjectively and objectively before, at the end of, and four weeks after treatment. Patients also completed a follow-up questionnaire on an average of five to six months after treatment. A significant improvement in the laser compared to the placebo group was found on visual analog scale (p=0.02) and grip strength (p=0.03) tests four weeks after treatment. In this study low level laser therapy was shown to have an effect over placebo; however, as a sole treatment for lateral epicondylitis it is of limited value. Further studies are needed to evaluate the reliability of our findings and to compare laser to other established treatment methods.

Key words: low level laser, tennis elbow, epicondylitis.

From the mid-eighties the interest in low level laser therapy has increased considerably (2 1). Most scientific work in this field has utilized continuous Hel ium_ neon (HeNe) lasers with red light and/or pulsed Gaiiium-arsenide (GaAs) lasers with infrared light. The use of low level laser therapy is, however, hampered by the lack of systematic tests and investigations on the mechanisms and medical effects of low level laser light. Doubt has been raised about the efficacy of infrared lasers in pain (23), woundhealing (32), knee arthrosis (19) and nerve conduction (16, 26). Others have found effects in the treatment of woundhealing (12), pain (7) and rheumatoid arthritis (10, 15). In addition there exists a substantial amount of research that focus on the therapeutic use of HeNe lasers.
Few studies have focused on laser therapy for tendinitis (13, 14, 17, 18, 25, 30). The therapeutic effect of this treatment is'reported to range from none (25,
30) to 80% cure rate (14). Two studies on lateral

epicondylitis, commonly named tennis elbow, have given contradictory results. In one study, 30% of the patients were cured and another 68% improved at one month follow-up (I 7), whereas in a similiar study no significant improvement was noted (25).

Laser Versus Ultrasound In The Treatment Of Supraspinatus Tendinosis Randomised Controlled Trial

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Summary Thirty-six patients were randomly assigned to three groups to compare the effectiveness of low power laser therapy, ultrasound and no therapy for supraspinatus tendinosis. All three groups were given the same advice and educational material.
Measurements were taken before and after treatment for muscle weakness secondary to pain, disability and tenderness. Treatment for the experimental groups comprised nine therapeutic doses over a three-week period of either laser therapy or ultrasound; the control group had no treatment for three weeks.
The degree of muscle weakness, pain functional disability and tenderness for the three groups, was similar before treatment. Comparisons after treatment showed that the laser group had less muscle weakness ($p<0.01$) and pain ($p<0.01$) than the ultrasound and control groups and had less disability ($p<0.05$) and tenderness ($p<0.01$) after treatment than the control group.
These data suggest that the dose if laser therapy used in the study, advice and education improve the symptoms of supraspinatuc tendinosis. Ultrasound also improved the control group that received advice only. Based on these results laser therapy should be the treatment of choice for suraspinatus tendinosis rather than ultrasound.

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Low level laser therapy for tendinopathy. Evidence of a dose - response pattern

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To investigate if low level laser therapy (LLLT) can reduce pain from tendinopathy, we performed a review of randomized placebo-controlled trials with LLLT for tendinopathy. A literature search for trials published after 1980 using LLLT was conducted on Medline, Embase, Cochrane Library and handsearch of physiotherapy journals in English and Scandinavian languages. Validity assessment of each trial was done according to predefined criteria for location-specific dosage and irradiation of the skin directly overlying the affected tendon..
The literature search identified 78 randomized controlled trials with LLLT, of which 20 included tendinopathy. Seven trials were excluded for not meeting validity criteria on treatment procedure or trial design. Twelve of the remaining thirteen trials investigated the effect of LLLT for patients with subacute and chronic tendinopathy provided a pooled mean effect of 21 % [5.9-36.1, 95%CI]. If only results from the nine trials adhering to assumed optimal treatment parameters were included, the mean effect over placebo increased to 32 % [23.0-41.0, 95% CI].
Low level laser therapy can reduce pain in subacute and chronic tendinopathy if a valid treatment procedure and location-specific dose is used.

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The Effectiveness Of Low Level Laser Therapy (Lllt) For Shoulder Periarthritis

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Abstract
The effectiveness of low level laser therapy (LLLT) for pain relief and improved range of motion (ROM) in shoulder periarthritis was investigated, and serum prostaglandin E2 (PGE2) levels were measured to evaluate the underlying mechanism of LLLT action. This study included 40 women with a mean age of 62.7 years and mean symptom duration of 2.8 months. LLLT was effective in 32 patients (80%). In the “effective” treatment group, visual analog scale (VAS) pain scores, range of abduction, flexion, and internal rotation, and serum PGE2 levels improved significantly. A correlation was observed between improvement in each ROM and VAS scores, and both were useful as indices of symptom improvement and treatment efficacy. PGE2 also decreased significantly after laser therapy and played a role in pain symptoms, but there was no correlation with improvement in the ROM or VAS scores. Thus, serum PGE2 levels did not reflect the degree of shoulder function or pain. In the “ineffective” treatment group, no improvement, no correlation between ROM and VAS scores, and no change in serum PGE2 levels after laser therapy were observed. This seems to represent a special group.

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the Effectiveness of Low Level Laser Therapy (LLLT) for Shoulder Periarthritis

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http://www.jstage.jst.go.jp/article/islsm/18/1/18_39/_article

Efficacy of Low Level Laser Therapy for Treatment Myofascial Trigger Points of Shoulder Pain

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Abstract: Myofascial trigger points (MTrPs) are recognized by many clinicians to be one of the most common causes of pain and dysfunction in the musculoskeletal system. Low-level laser Therapy (LLLT) is a relatively uncommon, non-invasive treatment for musculoskeletal pain, in which non-thermal laser irradiation is applied to sites of pain. Forty patients with MTrPs of shoulder pain were randomly assigned into active laser group (ALG, n = 20) and placebo laser group (PLG, n = 20). In ALG, patients were received Gallium-Arsenide I.R laser of 904 nm wave length with 3J / point for 90 sec pulse exercise therapy and in PLG, patients were received placebo laser pulse exercise therapy. Stretching and strengthening exercises program was done daily under supervision in clinic and at home for all patients. Pain intensity by visual analogue scale (VAS), active shoulder flexion and abduction by electrogonimeter and pain pressure threshold (PPT) of trigger points by electronic digital algometer were measured before and after 4-weeks of treatment. After treatment, all the outcome measurements had shown significant improvement in both groups except PPT was significantly increased in active laser group only ($p < 0.0001$). When the improved parameters were compared between the two groups, there were significant differences after treatment in favor of active laser group ($p < 0.01$). LLLT plus exercise could be effective method to decrease pain, increase shoulder range of motion and increase PPT of trigger point of shoulder pain compared with placebo laser pulse exercise.

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The efficacy of low-level laser therapy in supraspinatus tendinitis

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Twenty-four subjects were randomly assigned to two groups to assess the effectiveness of low-power laser therapy for supraspinatus tendinitis. A low- power laser using a 820 nm, 40 mW probe operating at 5000 Hz to produce a dose of 30 J/cm2 was used to treat one group (L); the other group was treated with a similar, but dummy, laser (DL). The design of the trial was double-blind; patients, therapists and assessors being ignorant of the form of treatment used. The two groups each received a course of nine treatments and identical advice and educational material. Perceived pain was assessed and tenderness and secondary muscle weakness measured before and after the course of treatment.

The data revealed that the L group had less pain ($p < 0.05$), less secondary weakness ($p < 0.01$) and tenderness ($p < 0.05$) after the treatment than before. No such changes occurred in the DL group; indeed, secondary weakness and tenderness increased slightly in the latter group after treatment.

The degree of pain, tenderness and weakness of the two groups was similar before treatment. Comparing the two groups after treatment, L had less pain ($p < 0.05$) and less weakness ($p < 0.001$) than DL.

These data suggest that, in this small group of patients, laser therapy, advice and education improved certain symptoms of supraspinatus tendinitis, while the same advice and education but treatment with a dummy laser had no such beneficial consequences. Based on the results, low-power laser therapy with the parameters and dosage used in this study is recommended as a useful treatment for tendinitis, but the trial was limited by small numbers.

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http://cre.sagepub.com/content/9/2/126.abstract