# Effects of neuromuscular electrical stimulation and low-level laser therapy on neuromuscular parameters and health status in elderly women with knee osteoarthritis: A randomized trial.

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OBJECTIVE: To determine the effects of neuromuscular electrical stimulation and low-level laser therapy on neuromuscular parameters and health status in elderly subjects with knee osteoarthritis. DESIGN: A randomized evaluator-blinded clinical trial. SUBJECTS: Forty-five elderly women with knee osteoarthritis. METHODS: Subjects were randomized into 1 of the following 3 intervention groups: electrical stimulation group (18-32 min pulsed current, stimulation frequency 80 Hz, pulse duration 400 mus, stimulation intensity 40% of maximal isometric voluntary contraction), laser group (dose 4-6 J per point, 6 points at the knee joint) or combined group (electrical stimu-lation plus laser therapy). The outcomes included muscle thickness and anatomical cross-sectional area (ultrasonography), knee extensors' electrical activity (electromyography), torque (dynamometry) and health status (Western Ontario and McMaster Universities Osteoarthritis Index). All groups underwent a 4-week control period (without intervention) followed by an 8-week intervention period. RESULTS: Muscle thickness and anatomical cross-sectional area increased in the electrical stimulation and combined groups. All groups presented similar improvements in torque, electrical activity and health status. CONCLUSION: Electrical stimulation alone or in combination with laser therapy generated positive effects on all evaluated parameters. Laser therapy increased health status and electrical activity, but had no effect on muscle mass.

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# Positive effects of low level laser therapy (LLLT) on Bouchard's and Heberden's osteoarthritis.

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BACKGROUND AND OBJECTIVE: Osteoarthritis (OA) is a common chronic disorder. While research usually focuses on OA of the large joints, OA of the hand receives relatively little attention resulting in a lack of a therapeutic gold standard. Low level laser therapy (LLLT)/photobiomodulation therapy has been successfully used to treat a variety of medical conditions. Nevertheless, its merits in the treatment of (hand) OA remain controversial. The aim of the present study was to examine the longitudinal effect of LLLT on the three major hand OA symptoms-pain, swelling, reduced joint mobility-in patients suffering from Bouchard's and Heberden's OA. STUDY DESIGN/MATERIALS AND METHODS: Thirty-four patients (32 females) aged 61.21 +/- 2.13 years were administered 5-10 LLLT sessions to 85 joints (47 proximal and 38 distal interphalangeal joints). Therapy took place twice a week. Pain (Visual Analogue Scale), ring size (perimeter in mm), and range of motion (extension/flexion) were measured at baseline and after five treatments for all patients, and additionally after seven sessions and 8 weeks after treatment ended for patients who received more than five and seven treatments, respectively. Eighteen patients (37 joints) received only five treatments, 10 patients (29 joints) were administered seven treatments, and six patients (19 joints) were administered 10 LLLT sessions. RESULTS: LLLT significantly reduced pain and ring size and increased range of motion after five and seven treatments (all P's $< 0.001$). The effects were very large (all eta2 's $> 0.14$). No further significant change occurred between 7 and 10 treatments. The effects achieved after seven sessions persisted for 8 weeks. CONCLUSIONS: LLLT is a safe, non-invasive, efficient and efficacious means to reduce pain and swelling and to increase joint mobility in patients suffering from Heberden's and Bourchard's OA. Further randomized controlled studies are needed to examine medium- to long-term effects as well as the ideal LLLT parameters. Lasers Surg. Med. (c) 2016 Wiley Periodicals, Inc.

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# Does addition of low-level laser therapy (LLLT) in conservative care of knee arthritis successfully postpone the need for joint replacement?

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The current study evaluates whether the addition of low-level laser therapy into standard conventional physical therapy in elderly with bilateral symptomatic tri-compartmental knee arthritis can successfully postpone the need for joint replacement surgery. A prospective randomized cohort study of 100 consecutive unselected elderly patients with bilateral symptomatic knee arthritis with each knee randomized to receive either treatment protocol A consisting of conventional physical therapy or protocol B which is the same as protocol A with added low-level laser therapy. The mean follow-up was 6 years. Treatment failure was defined as breakthrough pain which necessitated joint replacement surgery. After a follow-up of 6 years, patients clearly benefited from treatment with protocol B as only one knee needed joint replacement surgery, while nine patients treated with protocol A needed surgery ($p < 0.05$). We conclude low-level laser therapy should be incorporated into standard conservative treatment protocol for symptomatic knee arthritis.

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# Can combined use of low-level lasers and hyaluronic acid injections prolong the longevity of degenerative knee joints?

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BACKGROUND: This study evaluated whether half-yearly hyaluronic acid injection together with low-level laser therapy in addition to standard conventional physical therapy can successfully postpone the need for joint replacement surgery in elderly patients with bilateral symptomatic tricompartmental knee arthritis. METHODS: In this prospective, double-blind, placebo-controlled study, 70 consecutive unselected elderly patients with bilateral tricompartmental knee arthritis were assigned at random to either one of two conservative treatment protocols to either one of the painful knees. Protocol A consisted of conventional physical therapy plus a sham light source plus saline injection, and protocol B consisted of protocol A with addition of half-yearly hyaluronic acid injection as well as low-level laser treatment instead of using saline and a sham light source. Treatment failure was defined as breakthrough pain necessitating joint replacement. RESULTS: Among the 140 painful knees treated with either protocol A or protocol B, only one of the 70 painful knees treated by protocol B required joint replacement, whereas 15 of the 70 painful knees treated by protocol A needed joint replacement surgery ($P<0.05$). CONCLUSION: We conclude that half-yearly hyaluronic acid injections together with low-level laser therapy should be incorporated into the standard conservative treatment protocol for symptomatic knee arthritis, because it may prolong the longevity of the knee joint without the need for joint replacement.

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# Aerobic exercise training and low-level laser therapy modulate inflammatory response and degenerative process in an experimental model of knee osteoarthritis in rats.

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OBJECTIVE: The aim of this study was to evaluate the effects of an aerobic exercise training and low-level laser therapy (LLLT) (associated or not) on degenerative modifications and inflammatory mediators on the articular cartilage using an experimental model of knee OA. MATERIAL AND METHODS: Fifty male Wistar rats were randomly divided into five groups: control group (CG); knee OA control group (OAC); OA plus exercise training group (OAT); OA plus LLLT group (OAL); OA plus exercise training associated with LLLT group (OATL). The exercise training (treadmill; 16 m/min; 50 min/day) and the laser irradiation (two points-medial and lateral side of the left joint; 24 sessions) started 4 weeks after the surgery, 3 days/week for 8 weeks. RESULTS: The results showed that all treated groups showed (irradiated or not) a better pattern of tissue organization, with less fibrillation and irregularities along the articular surface and chondrocytes organization, a lower degenerative process measured by OARSI score and higher thickness values. Additionally, all treated group showed a reduced expression in IL-1beta, caspase-3 and MMP-13 compared to OAC. Moreover, a lower caspase-3 expression was observed in OATL compared to OAL and OAT. CONCLUSION: These results suggest that exercise training and LLLT were effective in preventing cartilage degeneration and modulating inflammatory process induced by knee OA.

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# Comparative evaluation of low-level laser and systemic steroid therapy in adjuvant-enhanced arthritis of rat temporomandibular joint: A histological study.

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BACKGROUND: Low-level laser therapy (LLLT) has shown a promising effect in ameliorating symptoms of rheumatoid arthritis (RA). The aim of this investigation was to compare the early and late anti-inflammatory effects of LLLT and betamethasone in RA. MATERIALS AND METHODS: In this animal experimental study, after inducing a model of RA in temporomandibular joint (TMJ) of 37 Wistar rats using adjuvant injection, they were randomly distributed into three experimental groups of 12 animals each: (1) LLLT group; (2) steroid group which received a single dose of betamethasone systemically; and (3) positive control group, which did not receive any treatment. One rat served as the negative control. Half of the animals in all the experimental groups were sacrificed on the 21(st) day after RA induction (early phase), and the other half were sacrificed 2 weeks later (late phase). Then, the severity of TMJ inflammation was assessed histologically in each group on a semi-quantitative scale. Kruskal-Wallis and Mann-Whitney tests were used to compare differences (alpha = 0.05). RESULTS: The LLLT and steroid groups showed significantly ($P < 0.05$) lower inflammation mean scores in both early (5.66 [+/-1.86] and 1.66 [+/-1.21], respectively) and late phases of evaluation (1.16 [+/-1.47] and 6.50 [+/-1.04], respectively) compared to positive control group in early and late stages of assessment (11.66 [+/-3.50] and 8.66 [+/-1.36], respectively). However, the best results ($P < 0.005$) were achieved in early phase of the steroid group as well as late phase of the LLLT group. CONCLUSION: Within limitations of this study, it may be concluded that LLLT method has a long-term promising effect on reducing inflammation severity of TMJ similar to betamethasone in earlier stages.

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# Effectiveness of low-level laser therapy in patients with knee osteoarthritis: a systematic review and meta-analysis.

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OBJECTIVE: To investigate the efficacy of low-level laser therapy (LLLT) treatment of knee osteoarthritis (KOA) by a systematic literature search with meta-analyses on selected studies. DESIGN: MEDLINE, EMBASE, ISI Web of Science and Cochrane Library were systematically searched from January 2000 to November 2014. Included studies were randomized controlled trials (RCTs) written in English that compared LLLT (at least eight treatment sessions) with sham laser in KOA patients. The efficacy effective size was estimated by the standardized mean difference (SMD). Standard fixed or random-effects meta-analysis was used, and inconsistency was evaluated by the I-squared index (I2). RESULTS: Of 612 studies, nine RCTs (seven double-blind, two single-blind, totaling 518 patients) met the criteria for inclusion. Based on seven studies, the SMD in visual analog scale (VAS) pain score right after therapy (RAT) (within 2 weeks after the therapy) was not significantly different between LLLT and control (SMD = -0.28 [95% CI = -0.66, 0.10], I2 = 66%). No significant difference was identified in studies conforming to the World Association of Laser Therapy (WALT) recommendations (four studies) or on the basis of OA severity. There was no significant difference in the delayed response (12 weeks after end of therapy) between LLLT and control in VAS pain (five studies). Similarly, there was no evidence of LLLT effectiveness based on Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain, stiffness or function outcomes (five and three studies had outcome data right after and 12 weeks after therapy respectively). CONCLUSION: Our findings indicate that the best available current evidence does not support the effectiveness of LLLT as a therapy for patients with KOA.

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# [Comparison of the effect of laser and magnetic therapy for pain level and the range of motion of the spine of people with osteoarthritis lower back].

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Increased expression of degenerative disease of the lumbar spine is an onerous task, which reduces the efficiency of the activity and life of many populations. It is the most common cause of medical visits. In 95% of cases the cause of complaints is a destructive process in the course of degenerative intervertebral disc called a lumbar disc herniation. Protrusion of the nucleus pulposus causes severe pain and impaired muscle tone, often more chronic and difficult to master. Successful treatment of lumbar disc herniation constitutes a serious interdisciplinary problem. It is important to properly planned and carried out physiotherapy. Based on the number of non-invasive methods, to reduce muscle tension, mute pain and alleviation of inflammation. It is the treatment safe, effective, and at the same time, which is their big advantage, readily available and cheap. It is worth noting that not every method has the same efficiency. The question that the methods are effective in relieving pain and helping to effectively increase the range of motion led to a comparison of two methods - Low Level Laser Therapy (LLLT) and pulsating magnetic field therapy. AIM: The aim of the study was to compare the efficacy of LLLT and pulsating magnetic field therapy in combating pain and increase range of motion of the spine of people with degenerative spine disease of the lower back. MATERIALS AND METHODS: 120 patients with diagnose lumbar disc herniation whit no nerve roots symptoms. Patients were divided into two Groups: A and B. Group A of 60 patients were subjected to laser therapy (lambda=820nm, P=400mW, Ed=6-12 J/cm(2)) and the second Group B of 60 patients too, to pulsating magnetic fields procedures (5mT, 30 Hz, 15 minutes). Every patient before rehabilitation started and right after it has finished has undergone examination. Subjective pain assessment was carried out using a modified Laitinen questionnaire and Visual Analogue Scale of Pain intensity. Spine mobility was evaluated whit the Schober test and the Fingertip-to-floor-test. The obtained results were subjects to statistical analysis. RESULTS: Research shows that both low energy laser and pulsating magnetic field physical attributes are effective methods for the treatment of pain and restricted mobility of the spine caused by disc herniation. Careful analysis emphasizes greater efficiency laser for pain. In contrast, a statistically greater improvement in global mobility of the spine, as well as flexion and extension of the lumbar recorded in group B, where the applied pulsating magnetic field. CONCLUSIONS: Both laser and magnet therapy reduces pain and improves mobility of the spine of people with degenerative spine disease of the lower back. Comparison of the effectiveness of both methods showed a greater analgesic effect of laser treatment, and greater mobility of the spine was observed under the influence of pulsating magnetic field therapy.

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# Current Understanding of Pathogenesis and Treatment of TMJ Osteoarthritis.

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Osteoarthritis is a common disease that can cause severe pain and dysfunction in any joint, including the temporomandibular joint (TMJ). TMJ osteoarthritis (TMJOA) is an important subtype in the classification of temporomandibular disorders. TMJOA pathology is characterized by progressive cartilage degradation, subchondral bone remodeling, and chronic inflammation in the synovial tissue. However, the exact pathogenesis and process of TMJOA remain to be understood. An increasing number of studies have recently focused on inflammation and remodeling of subchondral bone during the early stage of TMJOA, which may elucidate the possible mechanism of initiation and progression of TMJOA. The treatment strategy for TMJOA aims at relieving pain, preventing the progression of cartilage and subchondral bone destruction, and restoring joint function. Conservative therapy with nonsteroidal anti-inflammatory drugs, splint, and physical therapy, such as low-energy laser and arthrocentesis, are the most common treatments for TMJOA. These therapies are effective in most cases in relieving the signs and symptoms, but their long-term therapeutic effect on the pathologic articular structure is unsatisfactory. A treatment that can reverse the damage of TMJOA remains unavailable to date. Treatments that prevent the progression of cartilage degradation and subchondral bone damage should be explored, and regeneration for the TMJ may provide the ideal long-term solution. This review summarizes the current understanding of mechanisms underlying the pathogenesis and treatment of TMJOA.

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# Effect of low-level laser therapy in an experimental model of osteoarthritis in rats evaluated through Raman spectroscopy.

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OBJECTIVE: This work aimed to investigate the biochemical changes associated with low-level laser therapy (LLLT) using 660 and 780 nm, on a well-established experimental model of osteoarthritis (OA) in the knees of rats with induced collagenase, using histomorphometry and Raman spectroscopy. MATERIALS AND METHODS: Thirty-six Wistar rats were divided into four groups: control (GCON, n=9), collagenase without treatment (GCOL, n=9), collagenase with LLLT 660 nm treatment (G660, n=8), and collagenase with LLLT 780 nm treatment (G780, n=10). LLLT protocol was: 30 mW power output, 10 sec irradiation time, 0.04 cm(2) spot size, 0.3 J energy, 0.75 W/cm(2) irradiance, and 7.5 J/cm(2) fluence per session per day, during 14 days. Then, knees were withdrawn and submitted to histomorphometry and Raman spectroscopy analysis. Principal components analysis (PCA) and Mahalanobis distance were employed to characterize the spectral findings. RESULTS: Histomorphometry revealed a significant increase in the amount of collagen III for the group irradiated with 660 nm. The Raman bands at 1247, 1273, and 1453 cm(-1) (from principal component score PC2), attributed to collagen type II, and 1460 cm(-1) (from PC3), attributed to collagen type III, suggested that the LLLT causes acceleration in cellular activity, especially on the cells that repair cartilage, accelerating the breakdown of cartilage destroyed by collagenase and stimulating the fibroblast to synthesize repairing collagen III. CONCLUSIONS: LLLT accelerated the initial breakdown of cartilage destroyed by collagenase and stimulated the fibroblast to synthesize the repairing collagen III, suggesting a beneficial effect of LLLT on OA.

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# Low Level Laser Therapy for chronic knee joint pain patients.

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BACKGROUND AND AIMS: Chronic knee joint pain is one of the most frequent complaints which is seen in the outpatient clinic in our medical institute. In previous studies we have reported the benefits of low level laser therapy (LLLT) for chronic pain in the shoulder joints, elbow, hand, finger and the lower back. The present study is a report on the effects of LLLT for chronic knee joint pain. MATERIALS AND METHODS: Over the past 5 years, 35 subjects visited the outpatient clinic with complaints of chronic knee joint pain caused by the knee osteoarthritis-induced degenerative meniscal tear. They received low level laser therapy. A 1000 mW semi-conductor laser device was used to deliver 20.1 J/cm(2) per point in continuous wave at 830nm, and four points were irradiated per session (1 treatment) twice a week for 4 weeks. RESULTS: A visual analogue scale (VAS) was used to determine the effects of LLLT for the chronic pain and after the end of the treatment regimen a significant improvement was observed ($p<0.001$). After treatment, no significant differences were observed in the knee joint range of motion. Discussions with the patients revealed that it was important for them to learn how to avoid postures that would cause them knee pain in everyday life in order to have continuous benefits from the treatment. CONCLUSION: The present study demonstrated that 830 nm LLLT was an effective form of treatment for chronic knee pain caused by knee osteoarthritis. Patients were advised to undertake training involving gentle flexion and extension of the knee.

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# Laser therapy reduces gelatinolytic activity in the rat trigeminal ganglion during temporomandibular joint inflammation.

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OBJECTIVES: To investigate whether low-level laser therapy (LLLT) alters the expression and activity of MMP-2 and MMP-9 in the trigeminal ganglion (TG) during different stages of temporomandibular joint (TMJ) inflammation in rats. It also evaluated whether LLLT modifies mechanical allodynia and orofacial hyperalgesia. MATERIALS AND METHODS: Wistar rats (+/-250 g) were divided into groups that received saline (SAL) or complete Freund's adjuvant (CFA, 50 mul) in the TMJ, and that later underwent LLLT (20 J cm-2 ) at their TMJ or not (groups SAL, SAL + LLLT, CFA, and CFA + LLLT). LLLT was applied on days 3, 5, 7, and 9 after SAL or CFA. Mechanical allodynia was evaluated on days 1, 3, 5, 7, and 10; orofacial hyperalgesia was assessed on day 10. Gelatin zymography and in situ zymography aided quantification of MMPs in the TG. RESULTS: Low-level laser therapy abolished the reduction in the mechanical orofacial threshold and the increase in orofacial rubbing during the orofacial formalin test induced by CFA. LLLT also decreased the CFA-induced rise in the levels of MMP-9 and MMP-2 as well as the gelatinolytic activity in the TG. CONCLUSION: Low-level laser therapy could constitute an adjuvant therapy to treat temporomandibular disorders and prevent inflammation-induced alterations in the levels of MMP-2 and MMP-9 and in the gelatinolytic activity in TGs.

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# Monochromatic Infrared Photo Energy versus Low Level Laser Therapy in Patients with Knee Osteoarthritis.

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INTRODUCTION: Knee osteoarthritis (KO) is the most common joint disease for which there is no optimal treatment. Monochromatic infrared photo energy (MIPE) is a relatively new light modality used to reduce pain and increase circulation. Low Level Laser Therapy (LLLT) is another light modality used to reduce pain in KO. METHODS: The aim of this study was to compare the effects of the MIPE and LLLT in improving pain and function in KO. Sixty participants with KO completed the program and were randomly assigned into two groups. Group 1 (experimental, n=30) received MIPE and exercises. Group 2 (control, n=30) received LLLT and exercises. Both groups received two visits per week for six weeks. Outcome included pain intensity measured on a visual analogue scale and physical function measured with the lower extremity functional scale, before and after the 12 therapy sessions (6 weeks after the start of the intervention). RESULTS: There were statistically significant improvements in pain intensity and lower extremity functional scale scores ($p<0.05$) in each group. However, no significant differences were recorded between the groups ($p>0.05$). CONCLUSION: Therefore, MIPE and LLLT reduce pain and improve function in KO; however, there are no differences between the two modalities in reducing pain and increasing physical function in KO.

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# Effect of low-level laser on healing of temporomandibular joint osteoarthritis in rats.

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OBJECTIVE: Temporomandibular disorders (TMD) are clinical conditions characterized by pain and sounds of the temporomandibular joint (TMJ). This study was designed to assess the effect of low-level laser therapy (LLLT) on healing of osteoarthritis in rats with TMD. MATERIALS AND METHODS: Thirty-two male Wistar rats (250-200 g) were housed in standard plastic cages. After injection of Complete Freund's adjuvant into the TMJ, rats were randomly divided into two groups of 16 (case and control) and anesthetized; then osteoarthritis was induced via intraarticular injection of 50 microl of Complete Freund's adjuvant; into the bilateral TMJs. In the case group, LLLT was done transcutaneously for 10 minutes daily, starting the day after the confirmation of osteoarthritis. Exposure was performed for 10 minutes at the right side of the TMJ with 880 nm low-level laser with 100 mW power and a probe diameter of 0.8 mm. Control rats were not treated with laser. RESULTS: After three days of treatment the grade of cartilage defects, number of inflammatory cells, angiogenesis, number of cell layers and arthritis in rats in the case group were not significantly different compared with controls ($P>0.05$). After seven days, the grade of cartilage defects, number of inflammatory cells, number of cell layers, and arthritis in the case group improved compared to controls ($P<0.05$); angiogenesis in both groups was similar. CONCLUSION: Treatment of TMD with LLLT after 7 days of irradiation with a wavelength of 880 nm was associated with a greater improvement compared to the control group.

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# Healing effects and superoxide dismutase activity of diode/Ga-As lasers in a rabbit model of osteoarthritis.

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BACKGROUND/AIM: Osteoarthritis is a major cause of pain and disability in joints. The present study investigated the effects of differences of wavelengths and continuous versus pulsed delivery modes of low-level laser therapy (LLT) in a rabbit model of osteoarthritis. Comparison of the healing effects and superoxide dismutase (SOD) activity between therapy using diode and Ga-As lasers was our primary interest. MATERIALS AND METHODS: Simple continuous wave (808-nm diode) and super-pulsed wave (904-nm Ga-As) lasers were used. Osteoarthritis was induced by injecting hydrogen peroxide into the articular spaces of the right stifle in rabbits. The rabbits were randomly assigned to four groups: normal control without osteoarthritis induction (G1), osteoarthritis-induction group without treatment (G2), osteoarthritis induction with diode irradiation (G3), and osteoarthritis induction with Ga-As irradiation (G4). Laser irradiation was applied transcutaneously for 5 min every day for over four weeks, starting the first day after confirmation of induction of osteoarthritis. The induction of osteoarthritis and effects of LLT were evaluated by biochemistry, computed tomography, and histological analyses. RESULTS: The SOD activity in G3 and G4 rabbits at two and four weeks after laser irradiation was significantly higher than that of G1 animals ($p<0.05$). However, there was no significant difference between G3 and G4 animals. Moreover, there were significant differences at two and four weeks between the control and osteoarthritis-induction groups, but no significant difference between G3 and G4 in the computed tomographic analyses and histological findings. CONCLUSION: These results indicate that diode and Ga-As lasers are similarly effective in healing and inducing SOD activity for LLT applications in a rabbit model of OA.

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# Musculoskeletal Atrophy in an Experimental Model of Knee Osteoarthritis: The Effects of Exercise Training and Low-Level Laser Therapy.

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OBJECTIVE: The aim of this study was to evaluate the effects of an exercise training protocol and low-level laser therapy (and the association of both treatments) on musculoskeletal atrophy using an experimental model of knee osteoarthritis (OA). DESIGN: Fifty male Wistar rats were randomly divided into five groups: control group, knee OA control group, OA plus exercise training group, OA plus low-level laser therapy group, and OA plus exercise training associated with low-level laser therapy group. The exercise training and the laser irradiation started 4 wks after the surgery, 3 days per week for 8 wks. The exercise was performed at a speed of 16 m/min, 3 days per week, 50 mins per day, for 8 wks. Laser irradiation was applied at two points of the left knee joint (medial and lateral), for 24 sessions. RESULTS: The results showed that both trained groups (irradiated or not) presented a significant increase in the muscle cross-sectional area and a decrease in muscle fiber density compared with the knee OA control group. Moreover, both trained and laser-irradiated groups demonstrated decreased muscle-specific ring-finger protein 1 and atrogin-1 immunoexpression. CONCLUSIONS: These results suggest that exercise training and low-level laser therapy were effective in preventing musculoskeletal alterations related to atrophy caused by the degenerative process induced by knee OA.

Am J Phys Med Rehabil 2014 Oct 8

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# Effects of neuromuscular electrical stimulation and low-level laser therapy on the muscle architecture and functional capacity in elderly patients with knee osteoarthritis: a randomized controlled trial.

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OBJECTIVES: To determine the effects of low-level laser therapy in combination with neuromuscular electrical stimulation on the muscle architecture and functional capacity of elderly patients with knee osteoarthritis. DESIGN: A randomized, evaluator-blinded clinical trial with sequential allocation of patients to three different treatment groups. SETTING: Exercise Research Laboratory. SUBJECTS: A total of 45 elderly females with knee osteoarthritis, 2-4 osteoarthritis degrees, aged 66-75 years. INTERVENTION: Participants were randomized into one of the following three intervention groups: electrical stimulation group (18-32 minutes of pulsed current, stimulation frequency of 80 Hz, pulse duration of 200 mus and stimulation intensity fixed near the maximal tolerated), laser group (low-level laser therapy dose of 4-6 J per point, six points at the knee joint) or combined group (electrical stimulation and low-level laser therapy). All groups underwent a four-week control period (without intervention) followed by an eight-week intervention period. MAIN MEASURES: The muscle thickness, pennation angle and fascicle length were assessed by ultrasonography, and the functional capacity was assessed using the 6-minute walk test and the Timed Up and Go Test. RESULTS: After intervention, only the electrical stimulation and combined groups exhibited significant increases in the muscle thickness (27%-29%) and pennation angle (24%-34%) values. The three groups exhibited increased performance on the walk test (5%-9%). However, no significant differences in terms of functional improvements were observed between the groups. CONCLUSIONS: Neuromuscular electrical stimulation reduced the deleterious effects of osteoarthritis on the quadriceps structure. Low-level laser therapy did not potentiate the effects of electrical stimulation on the evaluated parameters.

Clin Rehabil 2014 Sep 26

http://www.ncbi.nlm.nih.gov/pubmed/?term=25261425

# Synergic effects of ultrasound and laser on the pain relief in women with hand osteoarthritis.

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Patients with pain avoid movements, leading to a gradual impairment of their physical condition and functionality. In this context, the use of ultrasound (US) and low-level laser therapy (LLLT) show promising results for nonpharmacological and noninvasive treatment. The aim of this study was evaluated the synergistic effects of the US and the LLLT (new prototype) with or without therapeutic exercises (TE) on pain and grip strength in women with hand osteoarthritis. Forty-five women with hand osteoarthritis, aged 60 to 80 years, were randomly assigned to one of three groups, but 43 women successfully completed the full study. The three groups were as follows: (i) the placebo group which did not perform TE, but the prototype without emitting electromagnetic or mechanical waves was applied (n = 11); (ii) the US + LLLT group which carried out only the prototype (n = 13); and (iii) the TE + US + LLLT group which performed TE before the prototype is applied (n = 13). The parameters of US were frequency 1 MHz; 1.0 W/cm(2) intensity, pulsed mode 1:1 (duty cycle 50 %). Regarding laser, the output power of the each laser was fixed at 100 mW leading to an energy value of 18 J per laser. Five points were irradiated per hand, during 3 min per point and 15 min per session. The prototype was applied after therapeutic exercises. The treatments are done once a week for 3 months. Grip strength and pressure pain thresholds (PPT) were measured. Grip strength did not differ significantly for any of the groups (p >/= 0.05). The average PPT between baseline and 3 months shows significant decrease of the pain sensitivity for both the US + LLLT group ( = 30 +/- 19 N, p<0.001) and the TE + US + LLLT group ( = 32 +/- 13 N, p < 0.001). However, there were no significant differences in average PPT for placebo group ( = -0.3 +/- 9 N). There was no placebo effect. The new prototype that combines US and LLLT reduced pain in women with hand osteoarthritis.

Lasers Med Sci 2015 Jan 30(1) 279-86

http://www.ncbi.nlm.nih.gov/pubmed/?term=25239030

# Magnetoledtherapy in the treatment of wounds after surgical procedures of the knee joint.

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The intense development of methods of physical medicine has been noted recently. The new methods are treatment methods, which in many cases allow a reduction of treatment time and positively influence the quality of life of patients undergoing treatment. This applies to illnesses and injuries of the locomotor system and diseases affecting soft tissues, as well as chronic wounds. This article discusses the positive results of the treatment of a 63-year-old woman with a persisting chronic wound of her right lower extremity after knee joint endoprosthesis surgery. The physical medicine method applied, in the form of magnetoledtherapy, contributed to complete wound healing and alleviation of pain suffered, as well as improvement of the quality of life of the treated patient.

Ther Clin Risk Manag 2014 10 717-20

http://www.ncbi.nlm.nih.gov/pubmed/?term=25214792

# A Meta-analysis of Clinical Effects of Low-level Laser Therapy on Temporomandibular Joint Pain.

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[Purpose] Temporomandibular joint (TMJ) pain is a symptom of TMJ disease. Low-level laser therapy (LLLT) is often used in the clinical treatment of TMJ pain. The aim of this study was to review the effective parameters of LLLT for TMJ pain. [Methods] This study was a systematic review in which electronic databases were searched for the period of January 2005 to January 2010. We selected reports of randomized controlled trials and calculated the effect size (ES) of the pain relief to evaluate the effect of LLLT. [Results] Seven reports are found to meet the inclusion criteria and discussed. Based on the calculation results, the pooled ES was -0.6, indicating a moderate effect of pain relief. In addition, the dosages and treatments with wavelengths of 780 and 830 nm can cause moderate and large pain relief effects. [Conclusion] Use of LLLT on the masticatory muscle or joint capsule for TMJ pain had a moderate analgesic effect. The optimal parameters for LLLT to treat TMJ pain have not been confirmed. However, our results can be a vital clinical reference for clinical physicians in treatment of patients with TMJ pain.

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# Clinical effectiveness of laser acupuncture in the treatment of temporomandibular joint disorder.

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BACKGROUND/PURPOSE: Temporomandibular joint disorder (TMD) is a general term for diseases of the temporomandibular joint and orofacial muscles. In this study, we tested whether laser acupuncture was effective for the treatment of TMD. METHODS: Twenty patients with TMD were treated with diode K-Laser (wavelength 800 nm, energy density 100.5 J/cm(2)) once a week at four acupuncture points including three standard ipsilateral local points (ST6, ST7, Ashi point) and one contralateral distal point (LI4). A 10-cm visual analogue scale (0 no pain and 10 the most severe pain) was used for measuring the pain intensity before and after the treatment. RESULTS: Seventeen out of 20 patients (85%) showed various degrees of pain relief after laser acupuncture treatment. The average pain score was 6.3 +/- 1.6 before treatment and 2.5 +/- 2.2 after treatment. Significant pain relief after laser acupuncture treatment was achieved ($p = 0.0003$, Wilcoxon signed rank test). The 17 patients showed an average pain relief of 63 +/- 31%. There were six patients who showed no TMD symptoms after an average of four treatments of laser acupuncture. The other 11 patients showed partial relief of TMD symptoms after treatment. Although the pain was still present, it was less and was acceptable. No side effects were reported in any patients during or after laser acupuncture treatments. CONCLUSION: Laser acupuncture may be an alternative treatment modality for TMD because it is non-invasive, results in partial or total relief of pain, and has no side effects.

J Formos Med Assoc 2014 Aug 113(8) 535-9

http://www.ncbi.nlm.nih.gov/pubmed/?term=25037758

# Therapeutic Effect of Irradiation of Magnetic Infrared Laser on Osteoarthritis Rat Model.

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Osteoarthritis (OA) is a degenerative joint disease caused by articular cartilage loss. Many complementary and alternative medicines for OA have been reported so far, but the effectiveness is controversial. Previously, we have shown anti-inflammatory effects of low level laser therapy with static magnetic field, magnetic infrared laser (MIL), in various animal models. Therefore, the beneficial effects were examined in OA rat model. Rats were divided by 6 groups; no treatment controls of sham and OA model, 3 MIL treatment groups of OA model at 6.65, 2.66 and 1.33 J/cm2 , and Diclofenac group of OA model with 2 mg/kg diclofenac sodium. The OA control exhibited typical symptoms of OA, but 4-week MIL treatment improved the functional movement of knee joint with reduced edematous changes. In addition, cartilage GAGs were detected more in all MIL treatment groups than OA control. It suggests 4-week MIL irradiation has dose-dependent anti-inflammatory and chondroprotective effects on OA. Histopathological analyses revealed that MIL treatment inhibit the cartilage degradation and enhance chondrocyte proliferation. The fact that MIL has an additional potential for the cartilage formation and no adverse effects can be regarded as great advantages for OA treatment. These suggest that MIL can be useful for OA treatment. 

Photochem Photobiol 2014 Jun 24

http://www.ncbi.nlm.nih.gov/pubmed/?term=24962501

# Effectiveness of phototherapy incorporated into an exercise program for osteoarthritis of the knee: study protocol for a randomized controlled trial.

Coelho CD, Leal-Junior EC, Biasotto-Gonzalez DA, Bley AS, Carvalho PD, Politti F, Gonzalez TD, de Oliveira AR, Frigero M, Garcia MB, Dibai-Filho AV, Gomes CA

BACKGROUND: Osteoarthritis is a chronic disease with a multifactor etiology involving changes in bone alignment, cartilage, and other structures necessary to joint stability. There is a need to investigate therapeutic resources that combine different wavelengths as well as different light sources (low-level laser therapy and light-emitting diode therapy) in the same apparatus for the treatment of osteoarthritis. The aim of the proposed study is to analyze the effect of the incorporation of phototherapy into a therapeutic exercise program for individuals with osteoarthritis of the knee. METHODS: A double-blind, controlled, randomized clinical trial will be conducted involving patients with osteoarthritis of the knee. Evaluations will be performed using functional questionnaires before and after the treatment protocols, in a reserved room with only the evaluator and participant present, and no time constraints placed on the answers or evaluations. The following functional tests will also be performed: stabilometry (balance assessment), dynamometry (muscle strength of gluteus medius and quadriceps), algometry (pain threshold), fleximeter (range of motion), timed up-and-go test (functional mobility), and the functional reach test. The participants will then be allocated to three groups through a randomization process using opaque envelopes: exercise program, exercise program + phototherapy, or exercise program + placebo phototherapy, all of which will last for eight weeks. DISCUSSION: The purpose of this randomized clinical trial is to analyze the effect of the incorporation of phototherapy into a therapeutic exercise program for osteoarthritis of the knee. The study will support the practice based on evidence to the use of phototherapy in individuals with a diagnosis of osteoarthritis of the knee. Data will be published after the study is completed.Trial registration: The protocol for this study has been submitted to Clinical Trials, registration number NCT02102347, on 29 March 2014.

Trials 2014 Jun 11 15(1) 221

http://www.ncbi.nlm.nih.gov/pubmed/?term=24919587

# Effects of laser treatment on the expression of cytosolic proteins in the synovium of patients with osteoarthritis.

Barabas K, Bakos J, Zeitler Z, Balint G, Nagy E, Lakatos T, Kekesi AK, Gaspar L, Szekanecz Z

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BACKGROUND AND OBJECTIVE: Low level laser therapy (LLLT) has been developed for non-invasive treatment of joint diseases. We have previously shown that LLLT influenced synovial protein expression in rheumatoid arthritis (RA). The aim of this study was to assess the effects of laser irradiation on osteoarthritic (OA) synovial protein expression. STUDY DESIGN/MATERIALS AND METHODS: The synovial membrane samples removed from the knees of 6 OA patients were irradiated ex vivo using near infrared diode laser (807-811 nm; 25 J/cm2 ). An untreated sample taken from the same patient served as control. Synovial protein separation and identification were performed by two-dimensional differential gel electrophoresis and mass spectrometry, respectively. RESULTS: Eleven proteins showing altered expression due to laser irradiation were identified. There were three patients whose tissue samples demonstrated a significant increase ($P < 0.05$) in mitochondrial heat shock 60 kD protein 1 variant 1. The expression of the other proteins (calpain small subunit 1, tubulin alpha-1C and beta 2, vimentin variant 3, annexin A1, annexin A5, cofilin 1, transgelin, and collagen type VI alpha 2 chain precursor) significantly decreased ($P < 0.05$) compared to the control samples. CONCLUSIONS: A single diode laser irradiation of the synovial samples of patients with osteoarthritis can statistically significantly alter the expression of some proteins in vitro. These findings provide some more evidence for biological efficacy of LLLT treatment, used for osteoarthritis. Lasers Surg. Med. (c) 2014 Wiley Periodicals, Inc.

Lasers Surg Med 2014 Jun 7

http://www.ncbi.nlm.nih.gov/pubmed/?term=24909318

# Effects of low-level laser therapy on joint pain, synovitis, anabolic, and catabolic factors in a progressive osteoarthritis rabbit model.

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The aim of this study was to investigate the effect of low-level laser therapy (LLLT) on short-term and long-term joint pain, synovitis, anabolic, and catabolic factors in the cartilage of a rabbit model with progressive osteoarthritis (OA) induced by anterior cruciate ligament transection (ACLT). A total of 160 New Zealand white rabbits were randomly assigned into two groups (ACLT group and LLLT group). All rabbits received ACLT surgery, and 2-, 4-, 6-, and 8-week treatment after the surgery, with 20 rabbits being tested biweekly over every study period. The LLLT group received LLLT with a helium-neon (He-Ne) laser (830 nm) of 1.5 J/cm2 three times per week, and the ACLT group received placebo LLLT with the equipment switched off. Long-term and short-term pain was tested via weight-bearing asymmetry; synovitis was assessed histologically; and knee joint cartilage was evaluated by gross morphology, histology, and gene expression analysis of anabolic and catabolic factors. The histological assessment of pain and synovitis showed that at least 6-week intermittent irradiation of LLLT could relief knee pain and control synovium inflammation. Gross morphologic inspection and histological evaluation showed that 6 weeks of LLLT could decrease cartilage damage of medical femoral condyle and 8 weeks of LLLT could decrease cartilage damage of medical and lateral femoral condyles and medical tibial plateau. Gene expression analysis revealed two results: At least 6 weeks of LLLT could decrease production of catabolic factors, for example, interleukin 1beta (IL-1beta), inducible nitric oxide synthase (iNOS), and MMP-3, and slow down the loss of anabolic factors, mainly TIMP-1. Eight weeks of LLLT treatment could slow down the loss of collagen II, aggrecan, and anabolic factors, mainly transforming growth factor beta (TGF-beta). The study suggests that LLLT plays a protective role against cartilage degradation and synovitis in rabbits with progressive OA by virtue of the regulation of catabolic and anabolic factors in the cartilage.

Lasers Med Sci 2014 Jun 3

http://www.ncbi.nlm.nih.gov/pubmed/?term=24890034

# Comparison of low level laser, ultrasonic therapy and association in joint pain in Wistar rats.

Coradini JG, Mattjie TF, Bernardino GR, Peretti AL, Kakihata CM, Errero TK, Escher AR, Bertolini GR

INTRODUCTION: Both therapeutic ultrasound as a low level laser therapy are used to control musculoskeletal pain, despite controversy about its effects, yet the literature is poor and also presents conflicting results on possible cumulative effects of techniques association. The aim was to compare the antinociceptive effects of low level laser therapy, therapeutic ultrasound and the association. METHODS: 24 Wistar rats were divided into: GPL--induction of hyperesthesia in the right knee, and untreated; GUS--treated with therapeutic ultrasound (1 MHz, 0.4 W/cm2) GL--low intensity laser (830 nm, 8 J/cm2); GL +US--treated with both techniques. To produce the hyperesthesia 100 mul of 5% formalin solution were injected into the tibiofemoral joint space, which was assessed by von Frey filament digital before (EV1), 15 (EV2), 30 (EV3) and 60 (EV4) minutes after induction. RESULTS: In comparison within groups, for the withdrawal threshold when the fi lament was applied to the knee, the back to baseline was observed only for GUS. Comparisons between groups were not different in EV3, and GL was higher than GPL. In EV4 the three groups effectively treated were higher than placebo. On withdrawal threshold on the plantar surface, GL showed return to baseline values already in EV3, and GUS and GL+US returned in EV4. Comparing the groups in EV3 there was a significantly lower threshold to compare GPL with GL and GUS ($p < 0.05$), and there was only EV4 differences when comparing GPL with GUS. CONCLUSION: Both modalities showed antinociceptive effects.

Rev Bras Reumatol 2014 Jan-Feb 54(1) 7-12

http://www.ncbi.nlm.nih.gov/pubmed/?term=24878785

# The effect of low-level laser therapy on knee osteoarthritis: prospective, descriptive study.

Soleimanpour H, Gahramani K, Taheri R, Golzari SE, Safari S, Esfanjani RM, Iranpour A

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BACKGROUND: Osteoarthritis (OA) is one of the most common joint disorders in the elderly which could be associated with considerable physical disability. PATIENTS AND METHODS: In a descriptive, prospective study, 33 patients enrolled in the study from which 15 people were excluded due to incomplete course of treatment, leaving the total number of 18 patients with knee osteoarthritis. Gal-Al-As diode laser device was used as a source of low-power laser. Patients were performed laser therapy with a probe of LO7 with a wavelength of 810 nm and 50 mW output power in pulse radiation mode (F = 3,000, peak power = 80 W, Deltat = 200 ns, density = 0.05 W/cm2, dose = 6 J/cm2, area = 1 cm2) and also a probe of MLO1K with a power output of 30 mW and a wavelength of 890 nm in pulse radiation mode (F = 3,000 Hz, peak power = 50 W, Deltat = 200 ns, density = 0.017 W/cm2, total dose = 10 J/cm2), and were given low-level laser therapy (LLLT) three times a week with a total number of 12 sessions. Data were analyzed using SPSS ver. 15, and the obtained data were reported as mean +/- SD and frequency (%). To analyze the data, repeated measurement and marginal homogeneity approaches were used. RESULTS: In the current study, a significant reduction was observed regarding the nocturnal pain, pain on walking and ascending the steps, knee circumference, distance between the hip and heel, and knee to horizontal hip to heel distance at the end of the treatment course. CONCLUSIONS: In brief, the current study focuses on the fact that LLLT is effective in reducing pain in knee osteoarthritis.

Lasers Med Sci 2014 Apr 15

http://www.ncbi.nlm.nih.gov/pubmed/?term=24733283

# Low-level laser therapy for management of TMJ osteoarthritis.

Madani AS, Ahrari F, Nasiri F, Abtahi M, Tuner J

AIMS: This study investigated the efficacy of low-level laser therapy (LLLT) for the management of temporomandibular joint (TMJ) osteoarthritis. METHODOLOGY: In a double-blind clinical trial, 20 patients with TMJ osteoarthritis were randomly divided into laser and placebo groups. The patients in the laser group received irradiation from an 810 nm low-level laser (Peak power 80 W, average power 50 mW, 1500 Hz, 1 micro s pulse width, 120 seconds, 6 J, 3.4 J/cm(2) per point), which was applied on four points around the TMJs and on painful muscles three times a week for 4 weeks. In the placebo group, the treatment was the same as that in the laser group, but with laser simulation. The patients were evaluated before laser therapy (T1), after 6 (T2) and 12 (T3) laser applications and 1 month after the last application (T4), and the amount of mouth opening and the pain intensity were recorded. RESULTS: No significant differences were found in mouth opening either between the study groups or between the different evaluation times in each group (P>0.05). There was no significant difference in pain symptoms of the masticatory muscles and TMJ between the laser and the placebo groups (P>0.05), but some significant within-group improvements were present for Visual Analogue Scale (VAS) scores of the body of the masseter and TMJ in both groups. CONCLUSIONS: LLLT using the present laser parameters was no more effective than the placebo treatment for reducing pain and improving mouth opening in patients with TMJ osteoarthritis.

Cranio 2014 Jan 32(1) 38-44

http://www.ncbi.nlm.nih.gov/pubmed/?term=24660645

# Comprehensive treatment of temporomandibular joint disorders.

Navratil L, Navratil V, Hajkova S, Hlinakova P, Dostalova T, Vranova J

AIMS: Changing lifestyles, decreasing physical activity, which is increasing the number of degenerative joint diseases of various etiology, and certain dental procedures are increasing the number of patients complaining of pain in their temporomandibular joints. The aim of the study was to assess the benefits of comprehensive physiotherapy sessions in order to decrease the number of temporomandibular joint problems, thereby improving the patient's quality of life. METHODOLOGY: An examination by a dentist determined each patient's treatment plan, which consisted of a medical exam, physical therapy and education. Each form of treatment was applied 10 times at intervals of 7-14 days. The main goal of the therapeutic physical education was to redress the muscle imbalance in the mandibular joint. This was achieved by restoring balance between the masticatory muscles, along with releasing the spastic shrouds found in the masticatory muscles. The aim of education was to teach the patient exercises focused on the temporomandibular joint and masticatory muscles. The intensity of the exercises and their composition were individually adjusted and adapted to their current state. Physical therapy consisted of the application of pulsed magnetic therapy, laser therapy, and non-invasive positive thermotherapy. RESULTS: The above procedure was conducted on a therapeutic group of 24 patients (3 men and 20 women). In the course of therapy, there were no complications, and all patients adhered to the prescribed regime. None reported any side effects. The mean treatment duration was 123 +/- 66 days. The outcome of the therapy was evaluated as described in the methodology, the degree of pain affecting the joint, and the opening ability of the mouth. In both parameters, there was a significant decline in patient pain. CONCLUSIONS: In a study devoted to tactics of rehabilitation treatment for temporomandibular joint disorders, the need for comprehensive long-term therapy, involving education, and learning proper chewing habits was made apparent for recovery and pain reduction. A priority in physical therapy, and combinations of pulsed magnetic therapy and hyperthermia-positive peloids, are also beneficial.

Cranio 2014 Jan 32(1) 24-30

http://www.ncbi.nlm.nih.gov/pubmed/?term=24660643

# High-intensity versus low-level laser therapy in the treatment of patients with knee osteoarthritis: a randomized controlled trial.

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The aim of this randomized controlled study was to compare the effects of low-level laser therapy (LLLT) and high-intensity laser therapy (HILT) on pain relief and functional improvement in patients with knee osteoarthritis (KOA). A total of 53 male patients participated in this study, with a mean (SD) age of 54.6 (8.49) years. Patients were randomly assigned into three groups and treated with HILT and exercise (HILT + EX), LLLT and exercise (LLLT + EX), and placebo laser plus exercise (PL + EX) in groups 1, 2, and 3, respectively. The outcomes measured were pain level measured by visual analog scale (VAS) and knee function measured by Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Statistical analyses were performed to compare the differences between baseline and posttreatment measurements. The level of statistical significance was set as $P < 0.05$. The result showed that HILT and LLLT combined with exercise were effective treatment modalities in decreasing the VAS and WOMAC scores after 6 weeks of treatment. HILT combined with exercises was more effective than LLLT combined with exercises, and both treatment modalities were better than exercises alone in the treatment of patients with KOA.

Lasers Med Sci 2014 Feb 1

http://www.ncbi.nlm.nih.gov/pubmed/?term=24487957

# Efficacy of low-level laser therapy applied at acupuncture points in knee osteoarthritis: a randomised double-blind comparative trial.

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OBJECTIVE: To evaluate the efficacy of low-level laser therapy (LLLT) applied to acupuncture points on the knee joint in combination with exercise and advice in patients with knee osteoarthritis. DESIGN: Randomised, double-blind, comparative clinical trial. PARTICIPANTS: Forty-nine patients with knee osteoarthritis were assigned at random into two groups: active laser group (n=26) and placebo laser group (n=23). INTERVENTION: Using a gallium aluminium arsenide laser device, patients received either active or placebo LLLT at five acupuncture points on the affected knee during nine sessions. OUTCOME MEASURES: Patients were assessed using a visual analogue scale (VAS) and the Saudi Knee Function Scale (SKFS) at baseline, the fifth treatment session, the last treatment session, 6 weeks post intervention and 6 months post intervention. RESULTS: VAS scores showed a significant improvement in the active laser group compared with the placebo laser group at 6 weeks post intervention [mean difference -1.3, 95% confidence interval (CI) of the difference -2.4 to -0.3; P=0.014] and 6 months post intervention (mean difference -1.8, 95% CI of the difference -3.0 to -0.7; P=0.003) using the independent samples test. SKFS scores also showed a significant improvement in the active laser group compared with the placebo laser group at the last treatment session (median difference -15, 95% CI of the difference -27 to -2; P=0.035) and 6 months post intervention (median difference -21, 95% CI of the difference -34 to -7; P=0.006) using the Mann-Whitney U test. CONCLUSIONS: The results demonstrate that short-term application of LLLT to specific acupuncture points in association with exercise and advice is effective in reducing pain and improving quality of life in patients with knee osteoarthritis.

Physiotherapy 2013 Nov 15

http://www.ncbi.nlm.nih.gov/pubmed/?term=24418801

# Effects of phototherapy on cartilage structure and inflammatory markers in an experimental model of osteoarthritis.

Oliveira P, Santos AA, Rodrigues T, Tim CR, Pinto KZ, Magri AM, Fernandes KR, Mattiello SM, Parizotto NA, Anibal FF, Renno AC

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ABSTRACT. The aim of this study was to evaluate the effects of laser phototherapy on the degenerative modifications on the articular cartilage after the anterior cruciate ligament transection (ACLT) in the knee of rats. Eighty male rats (Wistar) were distributed into four groups: intact control group (IG), injured control group (CG), injured laser treated group at 10 J/cm2 (L10), and injured laser treated group at 50 J/cm2 (L50). Animals were distributed into two subgroups, sacrificed in 5 and 8 weeks postsurgery. The ACLT was used to induce knee osteoarthritis in rats. After 2 weeks postsurgery, laser phototherapy initiated and it was performed for 15 and 30 sessions. The histological findings revealed that laser irradiation, especially at 10 J/cm2, modulated the progression of the degenerative process, showing a better cartilage structure and lower number of condrocytes compared to the other groups. Laser phototherapy was not able to decrease the degenerative process measured by Mankin score and prevent the increase of cartilage thickness related to the degenerative process. Moreover, it did not have any effect in the biomodulation of the expression of markers IL1beta, tumor necrosis factor-alpha, and metalloprotein-13. Furthermore, laser irradiated animals, at 50 J/cm2 showed a lower amount of collagen type 1.

J Biomed Opt 2013 Dec 1 18(12) 128004

http://www.ncbi.nlm.nih.gov/pubmed/?term=24343447

# Can osteoarthritis be treated with light?

Hamblin MR

Osteoarthritis is becoming more problematic as the population ages. Recent reports suggest that the benefit of anti-inflammatory drugs is unimpressive and the incidence of side effects is worrying. Low-level laser (light) therapy (LLLT) is an alternative approach with no known side effects and with reports of substantial therapeutic efficacy in osteoarthritis. In this issue of Arthritis Research & Therapy, Alves and colleagues used a rat model of osteoarthritis produced by intra-articular injection of the cartilage-degrading enzyme papain to test 810-nm LLLT. A single application of LLLT produced significant reductions in inflammatory cell infiltration and inflammatory cytokines 24 hours later. A lower laser power was more effective than a higher laser power. However, more work is necessary before the title question can be answered in the affirmative.

Arthritis Res Ther 2013 15(5) 120

http://www.ncbi.nlm.nih.gov/pubmed/?term=24286607

# Evaluation of anti-nociceptive and anti-inflammatory activity of low-level laser therapy on temporomandibular joint inflammation in rodents.

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The aim of this study was to investigate the analgesic and anti-inflammatory activity of low-level laser therapy (LLLT) on the nociceptive behavioral as well as histomorphological aspects induced by injection of formalin and carrageenan into the rat temporomandibular joint. The 2.5% formalin injection (FRG group) induced behavioral responses characterized by rubbing the orofacial region and flinching the head quickly, which were quantified for 45min. The pretreatment with systemic administration of diclofenac sodium-DFN group (10mg/kg i.p.) as well as the irradiation with LLLT infrared (LST group, 780nm, 70mW, 30s, 2.1J, 52.5J/cm(2), GaAlAs) significantly reduced the formalin-induced nociceptive responses. The 1% carrageenan injection (CRG group) induced inflammatory responses over the time-course of the study (24h, and 3 and 7days) characterized by the presence of intense inflammatory infiltrate rich in neutrophils, scanty areas of liquefactive necrosis and intense interstitial edema, extensive hemorrhagic areas, and enlargement of the joint space on the region. The DFN and LST groups showed an intensity of inflammatory response that was significantly lower than in CRG group over the time-course of the study, especially in the LST group, which showed exuberant granulation tissue with intense vascularization, and deposition of newly formed collagen fibers (3 and 7days). It was concluded that the LLLT presented an anti-nociceptive and anti-inflammatory response on the inflammation induced in the temporomandibular joint of rodents.

J Photochem Photobiol B 2013 Dec 5 129 135-42

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# Comparative analysis of two low-level laser doses on the expression of inflammatory mediators and on neutrophils and macrophages in acute joint inflammation.

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Synovial membrane inflammation plays an important role in osteoarthritis (OA) pathophysiology. The synovial tissue of patients with initial OA is characterized by mononuclear cell infiltration and the production of pro-inflammatory cytokines and other mediators of joint injury. The study aims to evaluate the effect of low-level laser therapy (LLLT) at doses of 2 and 4 J on joint inflammation in rats induced by papain through histopathological analysis, differential counts of inflammatory cells; gene expression of IL-1beta, IL-6, and IL-10; and TNF-alpha protein expression. Male Wistar rats (20) were randomly divided (5 animals each) into a negative control group, an inflammation injury positive control group, a 2-J LLLT group subjected to injury and treated with 2 J of LLLT, and a 4-J LLLT group subjected to injury and treated with 4 J of LLLT. The animals were subjected to joint inflammation (4 % papain solution) and treated with LLLT. On the day of euthanasia, articular lavage was collected and centrifuged. The supernatant was analyzed for TNF-alpha protein expression by ELISA and IL-1beta, IL-6, and IL-10 mRNA by RT-PCR. The joint tissue was also examined histologically. ANOVA with Tukey's post hoc test was used for comparisons. All data were expressed as means +/- S.D. ($p < 0.05$). Both laser modalities were efficient in reducing cellular inflammation and decreasing the expression of IL-1beta and IL-6. However, the 2-J treatment led to more reduction in TNF-alpha than the 4-J treatment. A single application of LLLT with 2 J was more efficient in modulating inflammatory mediators and inflammatory cells.

Lasers Med Sci 2013 Oct 31

http://www.ncbi.nlm.nih.gov/pubmed/?term=24173911

# Patterns of traditional chinese medicine diagnosis in thermal laser acupuncture treatment of knee osteoarthritis.

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Knee osteoarthritis (OA) manifests with pain, joint stiffness, and limited function. In traditional Chinese medicine, knee OA is differentiated into three patterns: yang deficiency and cold coagulation, kidney deficiency, and blood stasis. The objective of this study was to determine whether yang deficiency cold coagulation patients respond better to thermal laser acupuncture treatment than do non-yang deficient patients. Fifty-two patients with OA were allocated to group A (yang deficient, n = 26) or B (non-yang deficient, n = 26). All patients received a 20-min thermal laser acupuncture treatment at acupoint Dubi (ST 35) three times a week for two weeks and twice a week for another four weeks. Outcome assessments were performed immediately after the first treatment, and at weeks 2, 6, and 10. Group A function scores were significantly better than those of Group B at weeks 2 (P = 0.049), 6 (P = 0.046), and 10 (P = 0.042), but no significant differences were found between the two groups in pain and stiffness scores at any time point. No significant adverse effect was observed. The combined 10.6 mu m-650 nm laser treatment might be most beneficial to yang deficiency cold coagulation knee OA patients, particularly in improving function.

Evid Based Complement Alternat Med 2013 2013 870305

http://www.ncbi.nlm.nih.gov/pubmed/?term=24069060

# Effect of Low Level Laser Therapy on the expression of inflammatory mediators and on neutrophils and macrophages in acute joint inflammation.

Alves AC, Vieira RP, Leal-Junior EC, Dos Santos SA, Ligeiro AP, Albertini R, Junior JA, de Carvalho PD

INTRODUCTION: Inflammation of the synovial membrane plays an important role in the pathophysiology of osteoarthritis (OA). The synovial tissue of patients with initial OA is characterized by infiltration of mononuclear cells and production of pro-inflammatory cytokines and other mediators of joint injury. Our objective was to evaluate the effect of low level laser therapy (LLLT) operating at 50 mW and 100 mW on joint inflammation in rats induced by papain, through histopathological analysis, differential counts of inflammatory cells (macrophages and neutrophils), as well as gene expression of IL-1SZ and IL-6, and protein expression of Tumor necrosis factor alpha (TNF-alpha). Materials and Methods Male Wistar rats (60) were randomly divided into 4 groups of 15 animals, namely, a negative control group; an inflammation injury positive control group; a 50 mW LLLT group, subjected to injury and treated with 50 mW LLLT; and a 100 mW LLLT group, subjected to injury and treated with 100 mW LLLT. The animals were subject to joint inflammation (papain solution, 4%) and then treated with LLLT. On the day of euthanasia, articular lavage was collected and immediately centrifuged; the supernatant was saved for analysis of expression of TNF-alpha protein by ELISA and expression of IL-1SZ and IL-6 mRNA by RT-PCR. A histologic examination of joint tissue was also performed. For the statistical analysis, analysis of variance (ANOVA) with Tukey's post hoc test was used for comparisons between each group. All data are expressed as mean values and standard deviation, with $p < 0.05$. RESULTS: Both laser treatment modalities were efficient in reducing cellular inflammation, and both decreased the expression of IL-1SZ and IL-6. However, the 100 mW treatment led to a higher reduction of TNF-alpha compared to the 50 mW treatment. CONCLUSION: LLLT at 50 mW was more efficient in modulating inflammatory mediators (IL-1beta, IL-6) and inflammatory cells (macrophages and neutrophils), which correlated with the histology that showed a reduction in the inflammatory process.

Arthritis Res Ther 2013 Sep 12 15(5) R116

http://www.ncbi.nlm.nih.gov/pubmed/?term=24028507

# Effect of low-level laser therapy in patients with chronic knee osteoarthritis: a single-blinded randomized clinical study.

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The aim of this study was to investigate the effect of low-level laser therapy (LLLT) on pain relief and functional performance in patients with chronic knee osteoarthritis (OA). Forty patients with knee OA were randomly assigned into active laser group (n = 20) and placebo laser group (n = 20). The LLLT device used was a Ga-As diode laser with a power output of 50 mW, a wavelength of 850 nm, and a diameter beam of 1 mm. Eight points were irradiated and received dosage of 6 J/point for 60 s, with a total dosage of 48 J/cm2 in each session. The placebo group was identical but treated without emission of energy. LLLT was applied two times per week over the period of 4 weeks. Outcome measurements included pain intensity at rest and at movement on visual analog scale, knee function using Western Ontario McMaster Universities Osteoarthritis Index scale, and ambulation duration. These measurements were collected at baseline and post-intervention. The results showed significant improvements in all assessment parameters in both groups compared to baseline. Active laser group showed significant differences in pain intensity at rest and movement, knee function, and ambulation duration when compared with the placebo group. Therefore, LLLT seemed to be an effective modality for short-term pain relief and function improvement in patients with chronic knee OA.

Lasers Med Sci 2013 Aug 3

http://www.ncbi.nlm.nih.gov/pubmed/?term=23912778

# The use of low level laser therapy in the treatment of temporomandibular joint disorders. Review of the literature.

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Introduction: The temporomandibular disorders (TMDs) have been identified as the most important cause of pain in the facial region. The low level laser therapy (LLLT) has demonstrated to have an analgesic, anti-inflammatory and biostimulating effects. The LLLT is a noninvasive, quick and safe, non-pharmaceutical intervention that may be beneficial for patients with TMDs. However the clinical efficiency of LLLT in the treatment of this kind of disorders is controversial. Objectives: Literature review in reference to the use of LLLT in the treatment of TMDs, considering the scientific evidence level of the published studies. Material and Methods: A MEDLINE and COCHRANE database search was made for articles. The keywords used were "temporomandibular disorders" and "low level laser therapy" or "phototherapy" and by means of the Boolean operator "AND". The search provided a bank of 35 articles, and 16 relevant articles were selected to this review. These articles were critically analyzed and classified according to their level of scientific evidence. This analysis produced 3 literature review articles and 13 are clinical trials. The SORT criteria (Strength of Recommendation Taxonomy) was used to classify the articles. Results: Only one article presented an evidence level 1, twelve presented an evidence level 2, and three presented an evidence level 3. According to the principle of evidence-based dentistry, currently there is a scientific evidence level B in favor of using LLLT for treatment of TMDs. Discussion and conclusions: Publications on the use of LLLT for treatment of TMDs are limited making difficult to compare the different studies due to the great variability of the studied variables and the selected laser parameters. The great majority of the studies concluded that the results should be taken with caution due to the methodological limitations.

Med Oral Patol Oral Cir Bucal 2013 18(4) e603-12

http://www.ncbi.nlm.nih.gov/pubmed/?term=23722130

# Osteoarthritis: physical medicine and rehabilitation-nonpharmacological management.

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Osteoarthritis (OA) is the most common joint disease, mainly affecting middle-aged and elderly persons. People with OA of the knee or hip experience pain and deconditioning that may lead to disability. Treatment goals include pain control, maximizing functional independence, and improving quality of life within the constraints imposed by both OA and comorbidities. Exercise is a core recommendation in all nonpharmacological guidelines for the management of patients with knee or hip OA; it is supposed to ameliorate pain and maybe function as well. Therapeutic ultrasound, neuromuscular as well as transcutaneous electrostimulation, pulsed magnetic field therapy, low-level laser therapy, thermal agents, acupuncture, and assistive devices such as insoles, canes, and braces can be used additionally in a multimodal therapeutic program. They may positively influence pain and function, mobility, and quality of life in patients suffering from OA of the lower limbs.

Wien Med Wochenschr 2013 Mar 22

http://www.ncbi.nlm.nih.gov/pubmed/?term=23519486

# Comparative evaluation of the direct analgesic efficacy of selected physiotherapeutic methods in subjects with knee joint degenerative disease - preliminary report.

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Introduction: The goals of the study were to evaluate the efficacy of two physiotherapeutic procedures: low energy laser therapy and low frequency transcutaneous electric nerve stimulation (TENS) and to compare these modalities with regard to their therapeutic effects. Material and methods: Fifty (50) subjects were enrolled into the study and divided into two groups of 25 subjects. Group A received 10 MLS laser therapy sessions with a synchronised laser beam at doses of 12 J per treated site. Group B received ten sessions of low frequency TENS. The procedures were carried out every day for two weeks (5 times a week). All patients completed a personal data questionnaire and underwent an examination of knee joint motion range and circumference. Subjective pain intensity was assessed using the VAS pain scale and the modified Laitinen questionnaire. Results An analysis of the results of the treatment demonstrated statistically significant pain reduction in both groups. This improvement was significantly higher in the two-phase laser therapy group vs. the LF-TENS group. No statistically significant improvement was noted in either of the groups regarding the knee joint range of motion. Conclusions: Both therapies were associated with statistically significant direct pain intensity reduction. The study revealed higher analgesic efficacy of synchronised 2-phase laser therapy vs. LF-TENS.

Ortop Traumatol Rehabil 2012 Nov-Dec 14(6) 537-44

http://www.ncbi.nlm.nih.gov/pubmed/?term=23382281

# The efficacy of low-level laser therapy for the treatment of myogenous temporomandibular joint disorder.

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Low-level laser therapy (LLLT) has been commonly used for the treatment of painful musculoskeletal conditions, but the results of previous studies on this subject are controversial. The aim of this study was to evaluate the efficacy of LLLT in the management of patients with myogenic temporomandibular joint disorders (TMDs). In this randomized, double-blind clinical trial, 20 patients with myogenic TMD were randomly divided into laser and placebo groups. In the laser group, a pulsed 810-nm low-level laser (average power 50 mW, peak power 80 W, 1,500 Hz, 120 s, 6 J, and 3.4 J/cm(2) per point) was used on painful muscles three times a week for 4 weeks. In the placebo group, the treatment was the same as that in the laser group, but without energy output. The patients were evaluated before laser therapy (T1), after six sessions of laser application (T2), at the end of treatment (T3), and 1 month after the last application (T4), and the level of pain and the amount of mouth opening were measured. There was a significant increase in mouth opening and a significant reduction of pain symptoms in the laser group ($p < 0.05$). A similar improvement was not observed in the placebo group ($p > 0.05$). Between-group comparisons revealed no significant difference in pain intensity and mouth opening measurement at any of the evaluation time points ($p > 0.05$). LLLT can produce a significant improvement in pain level and mouth opening in patients affected with myogenic TMD.

Lasers Med Sci 2013 Jan 15

http://www.ncbi.nlm.nih.gov/pubmed/?term=23318917

# Physical Therapy Management of Knee Osteoarthritis in the Middle-aged Athlete.

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Osteoarthritis (OA) is prevalent in today's population, including the athletic and recreationally active "middle-aged" population. OA is a degenerative condition of the articular/hyaline cartilage of synovial joints and commonly affects the knee joint. In general, athletic participation does not specifically influence a higher incidence of knee OA in this population; however, traumatic injury to the knee joint poses a definitive risk in developing early-onset OA. The purpose of this article is to review evidence-based nonpharmacological interventions for the conservative management of knee OA. Manual therapy, therapeutic exercise, patient education, and weight management are strongly supported in the literature for conservative treatment of knee OA. Modalities [thermal, electrical stimulation (ES), and low-level laser therapy (LLLT)] and orthotic intervention are moderately supported in the literature as indicated management strategies for knee OA. While many strongly supported conservative interventions have been published, additional research is needed to determine the most effective approach in treating knee OA.

Sports Med Arthrosc 2013 Mar 21(1) 2-10

http://www.ncbi.nlm.nih.gov/pubmed/?term=23314262

# A new treatment protocol using photobiomodulation and muscle/bone/joint recovery techniques having a dramatic effect on a stroke patient's recovery: a new weapon for clinicians.

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The subject of this case study is a 29-year-old woman who suffered a brainstem stroke. She remained severely dizzy, had a non-functional left hand secondary to weakness, severe spasticity in the right hand, a right lateral sixth nerve palsy and was unable to ambulate on presentation. The stroke occurred 2 years before presentation. The subject had been treated for 21 months at two different stroke rehabilitation centres before presentation. Our stroke protocol includes photobiomodulation administered with the XR3T-1 device (manufactured by THOR) and 'muscle/bone/joint/soft tissue' recovery techniques. The patient was seen once a week for 8 weeks and treatment sessions lasted approximately 60 mins. The results were dramatic: after 8 weeks of implementation of our protocol, the patient demonstrated positive change in every area of her deficits as determined by improvements in physical examination findings. The gains achieved at 8 weeks have been maintained to this day and she continues to be treated once every 4 weeks.

BMJ Case Rep 2012 2012

http://www.ncbi.nlm.nih.gov/pubmed/?term=22967677

# Therapeutic effects of short-term monochromatic infrared energy therapy on patients with knee osteoarthritis: a double-blind, randomized, placebo-controlled study.

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STUDY DESIGN: Randomized, double-blind, placebo-controlled study. OBJECTIVES: To examine the short-term therapeutic effects of monochromatic infrared energy (MIRE) on participants with knee osteoarthritis (OA). Patients were assessed according to the International Classification of Functioning, Disability and Health. BACKGROUND: MIRE is commonly used in therapy for patients with peripheral neuropathies. However, research has not focused intensively on the therapeutic effects of MIRE in patients with knee OA. METHODS: This study enrolled 73 participants with knee OA. Participants received six 40-minute sessions of active or placebo MIRE treatment (890-nm wavelength; power, 6.24 W; energy density, 2.08 J/cm2/min; total energy, 83.2 J/cm2) over the knee joints for 2 weeks. International Classification of Functioning, Disability and Health-related outcomes were collected weekly over 4 weeks using the Knee injury and Osteoarthritis Outcome Score, Lysholm Knee Scale, Hospital Anxiety and Depression Scale, Multidimensional Fatigue Inventory, Chronic Pain Grade questionnaire, World Health Organization Quality of Life-brief version, and OA Quality of Life Questionnaire. Data were analyzed by repeated-measures analysis of variance. RESULTS: No statistically significant differences were found for the interaction of group by time for Knee injury and Osteoarthritis Outcome Score scores, including pain, other symptoms, function in daily living, function in sport and recreation, and knee-related quality of life. Scores on the Lysholm Knee Scale, Hospital Anxiety and Depression Scale, Multidimensional Fatigue Inventory, Chronic Pain Grade questionnaire, World Health Organization Quality of Life-brief version, and OA Quality of Life Questionnaire also showed no significant differences between the 2 groups at any of the 4 follow-up assessments. CONCLUSION: Short-term MIRE therapy provided no beneficial effects to body functions, activities, participation, and quality of life in patients with knee OA. LEVEL OF EVIDENCE: Therapy, level 1b-.J Orthop Sports Phys Ther 2012;42(11):947-956, Epub 5 September 2012. doi:10.2519/jospt.2012.3881.

J Orthop Sports Phys Ther 2012 42(11) 947-56

http://www.ncbi.nlm.nih.gov/pubmed/?term=22960644

# Effect of laser acupuncture on disuse osteoarthritis: an ultrasound biomicroscopic study of patellar articular cartilage in rats.

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To investigate the effect of laser acupuncture (LA) on disuse changes in articular cartilage using ultrasound biomicroscopy (UBM), Eighteen rats were randomly divided into the control group (C), the tail-suspended group (T), and the tail-suspended with LA treatment group (L). During 28-day suspension period, group L were treated with LA at acupoints on the left hindlimb while group T had a sham treatment. Ultrasound roughness index (URI), integrated reflection coefficient (IRC), integrated backscatter coefficient (IBC), cartilage thickness, and ultrasonographic score (US) of articular cartilage at patella were measured by using an ultrasound biomicroscopy system (UBS). Compared with the group C, URI significantly ($P < 0.01$) increased by 60.9% in group T, increased by 38.1% in group L. In addition, unloading induced a significant cartilage thinning ($P < 0.05$) in group T, whereas cartilage thickness in group L was 140.22 +/- 19.61 mum reaching the level of the control group (147.00 +/- 23.99 mum). There was no significant difference in IRC, IBC, and US among the three groups. LA therapy could help to retain the quality of articular cartilage which was subjected to unloading. LA would be a simple and safe nonpharmacological countermeasure for unloading-induced osteoarthritis. The UBM system has potential to be a sensitive, specific tool for quantitative assessment of articular cartilage.

Evid Based Complement Alternat Med 2012 2012 838420

http://www.ncbi.nlm.nih.gov/pubmed/?term=22888368

# Influence of various laser therapy methods on knee joint pain and function in patients with knee osteoarthritis.

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Summary Background: The aim of the study was to estimate the influence of various laser therapy methods on knee joint pain and function in patients with knee osteoarthritis. Material and Methods: 125 patients were randomly assigned to 4 groups: * group I received one-wave laser irradiation (wave length 810 nm, dose 8 J/point) * group II received two-wave MLS laser irradiation (power 1100 mW, frequency 2000 Hz, dose 12.4 J/point) * group III received a similar regimen of two-wave MLS laser irradiation, but at a dose of 6.6 J per point * group IV was a placebo group where laser therapy procedures were simulated without actual irradiation. The effectiveness of the therapy was evaluated by means of Lequesne's scale, a modified Laitinen questionnaire and a visual analogue scale (VAS). Statistical analysis utilised non-parametric Wilcoxon's and Mann-Whitney's tests. Calculations were carried out with MedCalc v. 11.6.1.0. Results: Statistically significant improvements in knee joint function and pain relief were seen in all groups (I, II and III). When groups I, II and III were compared, the largest improvement was found in group II (MLS laser, dose 12.4 J/point). The degrees of improvement in groups I and III were similar. Conclusions: One-wave laser irradiation at a dose of 8 J per point and two-wave laser irradiation with doses of 12.4 J and 6.6 J per point significantly improved knee joint function and relieved knee pain in patients with osteoarthritis.

Ortop Traumatol Rehabil 2012 Jun 29 14(3) 269-77

http://www.ncbi.nlm.nih.gov/pubmed/?term=22764339

# Meta-Analysis of Pain Relief Effects by Laser Irradiation on Joint Areas.

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Abstract Background: Laser therapy has been proposed as a physical therapy for musculoskeletal disorders and has attained popularity because no side effects have been reported after treatment. However, its true effectiveness is still controversial because several clinical trials have reported the ineffectiveness of lasers in treating pain. Methods: In this systematic review, we investigate the clinical effectiveness of low-level laser therapy (LLLT) on joint pain. Clinical trials on joint pain satisfying the following conditions are included: the laser is irradiated on the joint area, the PEDro scale score is at least 5, and the effectiveness of the trial is measured using a visual analogue scale (VAS). To estimate the overall effectiveness of all included clinical trials, a mean weighted difference in change of pain on VAS was used. Results: MEDLINE is the main source of the literature search. After the literature search, 22 trials related to joint pain were selected. The average methodological quality score of the 22 trials consisting of 1014 patients was 7.96 on the PEDro scale; 11 trials reported positive effects and 11 trials reported negative effects. The mean weighted difference in change of pain on VAS was 13.96 mm (95% CI, 7.24-20.69) in favor of the active LLLT groups. When we only considered the clinical trials in which the energy dose was within the dose range suggested in the review by Bjordal et al. in 2003 and in World Association for Laser Therapy (WALT) dose recommendation, the mean effect sizes were 19.88 and 21.05 mm in favor of the true LLLT groups, respectively. Conclusions: The review shows that laser therapy on the joint reduces pain in patients. Moreover, when we restrict the energy doses of the laser therapy into the dose window suggested in the previous study, we can expect more reliable pain relief treatments.

Photomed Laser Surg 2012 Jun 29

http://www.ncbi.nlm.nih.gov/pubmed/?term=22747309

# Complementary and alternative medicine in osteoarthritis.

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The intent of this focused clinical review is to assess the current literature on a variety of complementary and alternative medicine treatments for osteoarthritis. This review assesses acupuncture techniques, moxibustion, transcutaneous electrical nerve stimulation, low-level laser therapy, and massage. These treatment methods are growing in popularity among the general public. It is important that providers become aware of the existing literature regarding the efficacy of these alternative methods for the treatment of osteoarthritis to adequately respond to the inquiries of our patients.

PM R 2012 May 4(5 Suppl) S122-33

http://www.ncbi.nlm.nih.gov/pubmed/?term=22632691

# Effectiveness of Physiotherapy and GaAlAs Laser in the Management of Temporomandibular Joint Disorders.

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Abstract Objective: Low-level laser therapy (LLLT) is a treatment method commonly used in physiotherapy for musculoskeletal disorders. The aim of this study was to monitor the function of temporomandibular joint (TMJ) and surrounding tissues and compare the objective measurements of the effect of LLLT. Background data: LLLT has been considered effective in reducing pain and muscular tension; thus improving the quality of patients' lives. Materials and Methods: TMJ function was evaluated by cephalometric tracing analysis, orthopantomogram, TMJ tomogram, and computer face-bow record. Interalveolar space between central incisors before and after therapy was measured. Patients evaluated pain on the Visual Analog Scale. LLLT was performed in five treatment sessions (energy density of 15.4 J/cm(2)) by semiconductive GaAlAs laser with an output of 280 mW, emitting radiation wavelength of 830 mm. The laser supplied a spot of approximately 0.2 cm(2). Results: Baseline comparisons between the healthy patients and patients with low-level laser application show that TMJ pain during function is based on anatomical and function changes in TMJ areas. Significant differences were seen in the posterior and anterior face height. The results comparing healthy and impaired TMJ sagittal condyle paths showed that patients with TMJ pain during function had significantly flatter nonanatomical movement during function. After therapy, the unpleasant feeling was reduced from 27.5 to 4.16 on the pain Visual Analog Scale. The pain had reduced the ability to open the mouth from 34 to 42 mm. Conclusions: The laser therapy was effective in the improvement of the range of temporomandibular disorders (TMD) and promoted a significant reduction of pain symptoms.

Photomed Laser Surg 2012 May 30(5) 275-80

http://www.ncbi.nlm.nih.gov/pubmed/?term=22551049

# Physiotherapy in the management of disorders of the temporomandibular joint-perceived effectiveness and access to services: a national United Kingdom survey.

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Up to a quarter of the general population has experienced temporomandibular joint disorder (TMD) at some point in time. Physiotherapy has been used in the management of TMD for many years, but evidence supporting its clinical effectiveness is limited. We investigated the perceived effectiveness of physiotherapy for patients with TMD among consultants in oral and maxillofacial surgery (OMFS) and the accessibility of these services in the United Kingdom (UK). Information was gathered from a postal or electronic questionnaire sent to the 356 OMFS consultants listed on the British Association of Oral and Maxillofacial Surgeons' website. A total of 208 responded (58%) and 72% considered physiotherapy to be effective. Amongst these respondents, jaw exercises (79%), ultrasound (52%), manual therapy (48%), acupuncture (41%) and laser therapy (15%) were considered to be effective. Twenty-eight percent of respondents did not consider physiotherapy to be effective. Reasons for this included lack of knowledge or expertise of the physiotherapist (41%) and lack of awareness of the benefits of physiotherapy (28%). In relation to access to physiotherapy services, 10% of respondents had a designated physiotherapist for patients with TMD, 89% could refer directly to physiotherapy and 7% worked in an environment that provided training for physiotherapists. Patients were prescribed jaw exercises by 69% of respondents. Despite limited evidence to support its effectiveness, approximately three-quarters of OMFS consultants in the UK regard physiotherapy to be beneficial in the management of TMD.

Br J Oral Maxillofac Surg 2012 Apr 26

http://www.ncbi.nlm.nih.gov/pubmed/?term=22541647

# Short-Term Effects of 890-Nanometer Radiation on Pain, Physical Activity, and Postural Stability in Patients With Knee Osteoarthritis: A Double-Blind, Randomized, Placebo-Controlled Study.

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Hsieh R-L, Lo M-T, Liao W-C, Lee W-C. Short-term effects of 890-nanometer radiation on pain, physical activity, and postural stability in patients with knee osteoarthritis: a double-blind, randomized, placebo-controlled study. OBJECTIVE: To investigate the effects of short-term light therapy with 890-nm radiation on pain, physical activity, and postural stability in patients with knee osteoarthritis (OA). DESIGN: A double-blind, randomized, placebo-controlled study. SETTING: Rehabilitation clinic. PARTICIPANTS: Women (n=62) and men (n=10) with a mean age of 61.2 years (range, 40-88y). All patients fulfilled the combined clinical and radiographic criteria for knee OA as established by the American College of Rheumatology, and all had obtained a Kellgren-Lawrence score of 2 or more. INTERVENTIONS: Participants received 6 sessions, lasting 40 minutes each, of active or placebo radiation treatment over the knee joints for 2 weeks (wavelength, 890nm; radiant power output, 6.24W; power density, 34.7mW/cm(2) for 40 minutes; total energy, 41.6J/cm(2) per knee per session). MAIN OUTCOME MEASURES: Participants were assessed weekly over 4 weeks using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for pain, stiffness, and physical function. Physical activity (timed stair climbing, 10-m fast-speed walking, and chair-rising time) and postural stability (using the postural stability evaluation system) were also assessed. The pain score on WOMAC was the primary outcome variable. Data were analyzed by repeated-measures analysis of covariance. RESULTS: Compared with baseline, no significant improvement was observed between groups for pain (P=.546), stiffness (P=.573), or physical function (P=.904). No significant improvement was noted for physical activity including the 10-m fast-speed walking time (P=.284), stair-climbing time (P=.202), stair-descending time (P=.468), chair-rising time (P=.499), or postural stability (P=.986) at the 4 follow-up assessments. Follow-up assessments were conducted after 1 week of treatment (thus, after 3 treatments); after 2 weeks of treatment (thus, after 6 treatments); and 1 and 2 weeks, respectively, after treatment was terminated. Although we found a significant time effect for the 10-m fast-speed walking time (P<.001) in the 2 groups, and a significant group effect in the improvement of stair-climbing time in the treatment group (P=.032), the group x time interaction effects were not significant. CONCLUSIONS: Short-term 890-nm radiation therapy for patients with knee OA provided no beneficial effect in improving pain, physical activity, and postural stability.

Arch Phys Med Rehabil 2012 Mar 27

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# Analgesic effect of high intensity laser therapy in knee osteoarthritis.

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Knee osteoarthritis (KOA), the most common type of osteoarthritis (OA), is associated with pain and inflammation of the joint capsule, impaired muscular stabilization, reduced range of motion and functional disability. High-intensity laser therapy (HILT) involves higher-intensity laser radiation and causes minor and slow light absorption by chromophores. Light stimulation of the deep structures, due to high intensity laser therapy, activates cell metabolism through photochemical effect. The transmissions of pain stimulus are slowed down and result in a quick achievement of pain relief. The aim of our research was to investigate the prompt analgesic effect of HILT on patients with KOA. Knee radiographs were performed on all patients and consequently graded using the Kellgren-Lawrence grading scale (K/L). A group of 96 patients (75 female, 21 male, mean age 59.2) with K/L 2 and 3 were submitted to HILT therapy. Pain intensity was evaluated with visual analogue scale (VAS) before and after the treatment. HILT consisted in one daily application, over a period of ten days, using protocol wavelength, frequency and duration. The results showed statistically significant decrease in VAS after the treatment ($p < 0.001$). Considering these results, HILT enables prompt analgesic effects in KOA treatment. Therefore HILT is a reliable option in KOA physical therapy.

Coll Antropol 2011 Sep 35 Suppl 2 183-5

http://www.ncbi.nlm.nih.gov/pubmed/?term=22220431

# Efficacy of low level laser therapy associated with exercises in knee osteoarthritis: a randomized double-blind study.

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Objectives: To estimate the effects of low level laser therapy in combination with a programme of exercises on pain, functionality, range of motion, muscular strength and quality of life in patients with osteoarthritis of the knee.Design: A randomized double-blind placebo-controlled trial with sequential allocation of patients to different treatment groups.Setting: Special Rehabilitation Services.Subjects: Forty participants with knee osteoarthritis, 2-4 osteoarthritis degree, aged between 50 and 75 years and both genders.Intervention: Participants were randomized into one of two groups: the laser group (low level laser therapy dose of 3 J and exercises) or placebo group (placebo laser and exercises).Main measures: Pain was assessed using a visual analogue scale (VAS), functionality using the Lequesne questionnaire, range of motion with a universal goniometer, muscular strength using a dynamometer, and activity using the Western Ontario and McMaster Universities Osteoarthritis (WOMAC) questionnaire at three time points: (T1) baseline, (T2) after the end of laser therapy (three weeks) and (T3) the end of the exercises (11 weeks).Results: When comparing groups, significant differences in the activity were also found ($P = 0.03$). No other significant differences ($P > 0.05$) were observed in other variables. In intragroup analysis, participants in the laser group had significant improvement, relative to baseline, on pain ($P = 0.001$), range of motion ($P = 0.01$), functionality ($P = 0.001$) and activity ($P < 0.001$). No significant improvement was seen in the placebo group.Conclusion: Our findings suggest that low level laser therapy when associated with exercises is effective in yielding pain relief, function and activity on patients with osteoarthritis of the knees.

Clin Rehabil 2011 Dec 14

http://www.ncbi.nlm.nih.gov/pubmed/?term=22169831

# Physiotherapy in hip and knee osteoarthritis: development of a practice guideline concerning initial assessment, treatment and evaluation.

Peter WF, Jansen MJ, Hurkmans EJ, Bloo H, Dekker J, Dilling RG, Hilberdink W, Kersten-Smit C, de Rooij M, Veenhof C, Vermeulen HM, de Vos RJ, Schoones JW, Vliet Vlieland TP

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Background: An update of a Dutch physiotherapy practice guideline in Hip and Knee Osteoarthritis (HKOA) was made, based on current evidence and best practice. Methods: A guideline steering committee, comprising 10 expert physiotherapists, selected topics concerning the guideline chapters: initial assessment, treatment and evaluation. With respect to treatment a systematic literature search was performed using various databases, and the evidence was graded (1-4). For the initial assessment and evaluation mainly review papers and textbooks were used. Based on evidence and expert opinion, recommendations were formulated. A first draft of the guideline was reviewed by 17 experts from different professional backgrounds. A second draft was field-tested by 45 physiotherapists. Results: In total 11 topics were selected. For the initial assessment, three recommendations were formulated, pertaining to history taking, red flags, and formulating treatment goals. Concerning treatment, 7 recommendations were formulated; (supervised) exercise therapy, education and self ma-na-gement interventions, a combination of exercise and manual therapy, postoperative exercise therapy and taping of the patella were recommended. Balneotherapy and hydrotherapy in HKOA, and thermotherapy, TENS, and Continuous Passive Motion in knee OA were neither recommended nor discouraged. Massage therapy, ultrasound, electrotherapy, electromagnetic field, Low Level Laser Therapy, preoperative physiotherapy and education could not be recommended. For the evaluation of treatment goals the following measurement ins-truments were recommended: Lequesne index, Western Ontario and McMaster Universities osteoarthritis index, Hip disability and Osteoarthritis Outcome Score and Knee injury and Osteoarthritis Outcome Score, 6-minute walktest, Timed Up and Go test, Patient Specific Complaint list, Visual Analoge Scale for pain, Intermittent and Constant OsteoArthritis Pain Questionnaire, goniometry, Medical Research Council for strength, handheld dynamometer. Conclusions: This update of a Dutch physiotherapy practice guideline on HKOA included 11 recommendations on the initial assessment, treatment and evaluation. The implementation of the guideline in clinical practice needs further evaluation.

Acta Reumatol Port 2011 Jul 36(3) 268-281

http://www.ncbi.nlm.nih.gov/pubmed/?term=22113602

# Effects of Low-Level Laser Therapy at Wavelengths of 660 nm and 808 nm in Experimental Model of Osteoarthritis.

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The aim of the present study was to analyze the influence of low-level laser radiation at wavelengths of 660nm and 808nm in an experimental model of osteoarthritis. The sample was composed of 36 male adult Wistar rats divided into three groups (G1, G2 and G3). For the induction of cartilage injury, three injections of 4% papain and 10mul of a cysteine solution were performed at right knee of the hind leg. Two weeks after the last injection, group G1 was treated with InGaAlP (660nm, 100 mW, 3.57 W/cm(2) , 40 sec) and G2 was treated with AsGaAl (808nm, 100 mW, 3.57 W/cm(2) , 40 sec) both with energy of 4J. There were significant differences in the type of squamous epithelium between days 7 and 14 in G2 ($p<0.05$) and on Day 14 between G1 and G2 ($p<0.05$). Moreover, statistically significant differences were found in formation of new blood vessels between G1 and G3 on Days 7 and 21 as well as between G2 and G3 on day 21. The formation of fibrotic tissue was greater in G3 ($p<0.05$). In conclusion, laser therapy, especially at a wavelength of 808nm, stimulated angiogenesis and reduced the formation of fibrosis in an experimental model of osteoarthritis.

Photochem Photobiol 2011 Nov 7

http://www.ncbi.nlm.nih.gov/pubmed/?term=22053992

# Laser Florence 2011. Abstracts of the 25th International Congress Laser Medicine & IALMS Courses, jointly with the Congress of the International Phototherapy Association. November 4-5, 2011. Florence, Italy.

Lasers Med Sci 2011 Nov 26 Suppl 1 S16-43

http://www.ncbi.nlm.nih.gov/pubmed/?term=21964622

# Effects of laser irradiation on arthritic histopathology and heat shock protein 70 expression in C57 black mice with osteoarthritis.

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Objective: To study the effects of three different laser treatments (650 nm alone, 10.6 mum alone and combined laser of 650 nm and 10.6 mum) on experimental osteoarthritis of the knees in C57 black mice. Methods: Sixty C57 black mice were divided randomly into 6 groups. Ten mice were assigned to a normal control group (no intervention) and the other 5 groups were subjected to a forced running regimen to induce osteoarthritis. One group was set as the model control group. The other 4 groups were given 90 s of a 650 nm laser, 90 s of a 10.6mum laser, 90 s of a combined laser, or a sham treatment on acupoint Dubi (ST35) of the rear left leg 3 times per week for 4 weeks. The modified Mankin score was used to evaluate the degree of cartilage degradation. Immunohistochemical staining for heat shock protein (HSP) 70 was conducted. Results: Mankin scores of the model control group and the sham control group were significantly higher than that of the normal control group ($P<0.01$). Mankin score of the combined laser group was significantly lower than that of the model control group ($P<0.01$). Compared with the normal control group, there was a significant induction of HSP70 in the arthritic chondrocytes of the combined laser group. Conclusion: The arthritic cartilage induced in C57 black mice improved significantly after combined laser treatment of 650 nm and 10.6mum lasers. This effect may be related to the induction of HSP70 in the arthritic chondrocytes. The two different lasers appear to have a synergistic effect.

Zhong Xi Yi Jie He Xue Bao 2011 Jul 9(7) 761-7

http://www.ncbi.nlm.nih.gov/pubmed/?term=21749827

# Effect of light-emitting diode (LED) therapy on the development of osteoarthritis (OA) in a rabbit model.

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OBJECTIVE: The objective of this study was to evaluate whether light-emitting diodes (LEDs) could be effective in a noninvasive, therapeutic device for the treatment of osteoarthritic (OA) knee joints. DESIGN: Five weeks following the anterior cruciate ligament transection (ACLT) of mature New Zealand White rabbits, the animal knees were exposed to LED stimulation at intervals of 10 min/day, 5 days/week for 5 weeks in the experimental group (n=7). The device used high intensity red and infrared (IR) LEDs with a total amount of energy delivered to the skin of 2.4 J/cm(2). Animals were sacrificed at 9 weeks postoperatively. Femoral surface gross morphology was evaluated with a modified Outerbridge classification and mRNA expression of catabolic and anabolic markers from femoral condyle cartilage and synovial tissue was assessed using RT-PCR. A control group was harvested 9 weeks following untreated ACLT. RESULTS: Gross morphometry of the control group showed four Grade II, two Grade III and one Grade IV (average 2.6) condyles macroscopically. The experimental group showed two Grade I and five Grade II (average 1.7) (Table 1). mRNA expression of aggrecan in the cartilage showed no difference between the groups, however type II collagen expression increased in the experimental group compared with control. TNF-alpha expression was significantly decreased in the experimental group compared to control. CONCLUSIONS: There was general preservation of the articular surface and decreased levels of inflammation in the osteoarthritic joints with the application of LED therapy. This may provide potential application as a noninvasive treatment.

Biomed Pharmacother 2011 Jun 65(3) 224-9

http://www.ncbi.nlm.nih.gov/pubmed/?term=21658899

# Comparing different physical factors on serum TNF-alpha levels, chondrocyte apoptosis, caspase-3 and caspase-8 expression in osteoarthritis of the knee in rabbits.

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OBJECTIVE: To study the therapeutic effects that different physical factors may have on rabbits with osteoarthritis of the knee. METHODS: A total of 64 rabbits were randomised and organised into eight groups, eight of which were each assigned a different physical factor, in which the rabbits received one type of physical therapy: millimetre waves for 20min, pulsed electromagnetic fields, millimetre waves for 40min, ultrasound, low-level laser therapy or ultrashort wave diathermy. The two remaining groups, the normal group and the model group, served as controls. The efficacy of the different treatments were determined by observing the configuration and structure of the cartilaginous tissue by haematoxylin and Eosin staining, measuring the serum tumour necrosis factor-alpha levels by enzyme immunoassay, evaluating the expression levels of caspases-3 and -8 by immunohistochemistry, and calculating the ratio of chondrocytes apoptosis by TdT-mediated dUTP nick end labelling. The values obtained for each assessment of the eight groups were analysed by a One-way ANOVA. RESULTS: By applying upmentioned physical treatments, the organisational configuration and structure of cartilage cells from the knees of rabbits with osteoarthritis increased. These treatments also decreased serum tumour necrosis factor-alpha levels, reduced the expression of caspase-3 and caspase-8 and reduced chondrocyte apoptosis, resulting in an overall delay in osteoarthritis development. CONCLUSION: The application of pulsed electromagnetic fields, millimetre waves for 40min, ultrasound, or low-level laser therapy had significant effects in improving osteoarthritis; in particular, treatment with pulsed electromagnetic fields or ultrasound yielded the greatest therapeutic effect.

Joint Bone Spine 2011 Mar 10

http://www.ncbi.nlm.nih.gov/pubmed/?term=21397547

# Effects of rehabilitative interventions on pain, function and physical impairments in people with hand osteoarthritis: a systematic review.

Ye L, Kalichman, L, Spittle, A, Dobson F, Bennell K

ABSTRACT: INTRODUCTION: Hand osteoarthritis (OA) is associated with pain, reduced grip strength, loss of range of motion and joint stiffness leading to impaired hand function and difficulty with daily activities. The effectiveness of different rehabilitation interventions on specific treatment goals has not yet been fully explored. The objective of this systematic review is to provide evidence based knowledge on the treatment effects of different rehabilitation interventions for specific treatment goals for hand OA. METHODS: A computerized literature search of Medline, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), ISI Web of Science, the Physiotherapy Evidence Database (PEDro) and SCOPUS was performed. Evidence level 2b or higher studies that compared a rehabilitation intervention with a control group and assessed at least one of the following outcome measures: pain, physical hand function or other measures of hand impairment, were included. The eligibility and methodological quality of trials were systematically assessed by two independent reviewers using the PEDro scale. Treatment effects were calculated using standardized mean difference and 95% confidence intervals. RESULTS: Ten studies were included, of which six were of higher-quality (PEDro score>6). The rehabilitation techniques reviewed included three studies on exercise, two studies each on laser and heat, and one study each on splints, massage and acupuncture. One higher quality trial showed a large positive effect of 12-months use of a night splint on hand pain, function, strength and range of motion. Exercise had no effect on hand pain or function although it may be able to improve hand strength. Low level laser therapy may be useful to improving range of motion. No rehabilitation interventions were found to improve stiffness. CONCLUSIONS: There is emerging high quality evidence to support that rehabilitation interventions can offer significant benefits to individuals with hand OA. A summary of the higher quality evidence is provided to assist with clinical decision making based on current evidence. Further high-quality research is needed concerning the effects of rehabilitation interventions on specific treatment goals for hand OA.

Arthritis Res Ther 2011 Feb 18 13(1) R28

http://www.ncbi.nlm.nih.gov/pubmed/?term=21332991

# [Clinical observation on acupoint irradiation with combined laser or red light on patients with knee osteoarthritis of yang deficiency and cold coagulation type].

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OBJECTIVE: To explore the effects of combined laser on patients with knee osteoarthritis (OA) of yang deficiency and cold coagulation type. METHODS: Forty-one cases with knee OA of yang deficiency and cold coagulation type were randomly divided into a combined laser group (n = 22) and a red light group (n = 19), with combined laser and red light irradiation on Dubi (ST 35) and Neixiyan (EX-LE 4), respectively. They were treated for 6 weeks. The scores of Western Ontario and McMaster Universities' Osteoarthritis Index (WOMAC VA3. 1) were used for assessment of therapeutic effects. RESULTS: After treatment for 2 weeks and 6 weeks, the WOMAC scores significantly decreased in the two groups as compared with those before treatment ($P < 0.05$, $P < 0.01$ and $P < 0.001$). The mean improvement rate of WOMAC scores in the combined laser group was better than those in the red light group. CONCLUSION: Combined laser irradiation can improve the pain, stiffness and functional limitation of patients with knee OA of yang deficiency and cold coagulation type.

Zhongguo Zhen Jiu 2010 Dec 30(12) 977-81

http://www.ncbi.nlm.nih.gov/pubmed/?term=21290832

# The Anti-inflammatory Effect of Low-Level Laser Therapy on Experimentally Induced Inflammation of Rabbit Temporomandibular Joint Retrodiscal Tissues.

Kucuk BB, Oral K, Selcuk NA, Toklu T, Civi OG

Aims: To investigate the effect of low-level laser therapy (LLLT) on experimentally induced inflammation in retrodiscal tissues of the rabbit temporo?mandibular joint (TMJ) using scintigraphic imaging. Methods: Eleven male New Zealand rabbits were included in this study. Six randomly selected rabbits were imaged to provide normal joint images (normal group) before the initiation of the experiment. A 5% formalin solution was locally injected into both right and left TMJs of all rabbits. Subsequently, Ga-Al-As laser (wavelength: 815 nm; energy density: 12 J/cm2; output power: 250 mW) was applied for 48 seconds. The treatment was performed six times for 2 weeks to the left TMJ of all rabbits. The right TMJs of the rabbits were used as the control (nontreated) TMJ group, while left TMJs were used as the treated TMJ group. Static images of TMJ were taken at 24 hours, 7 days, and 14 days after the beginning of the treatment. The images of all TMJs were taken in the posteroanterior direction with the rabbit under sedation and its mouth open. The Mann-Whitney U test was used to compare group differences, and intragroup differences were determined by the Friedman test and Wilcoxon sign test. Results: Significant differences were found between normal and both the control and treated TMJ groups. A reduction of inflammation in both treated and control TMJ groups was obtained, but there was no statistically significant difference between the groups. Conclusion: Under the conditions used in this study, quantitative scintigraphic measurements of TMJ inflammation of the treated TMJ group decreased but did not differ significantly from those of the control TMJ group. J Orofac Pain 2010;24:293-297.

J Orofac Pain 2010 Summer 24(3) 293-7

http://www.ncbi.nlm.nih.gov/pubmed/?term=20664831

# Effects of superpulsed low-level laser therapy on temporomandibular joint pain.

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OBJECTIVES: A randomized double-blind study was conducted to compare the efficacy of superpulsed low-level laser therapy (SLLLT) with nonsteroidal anti-inflammatory drugs in the treatment of pain caused by temporomandibular joint disorders. METHODS: A total of 99 patients with temporomandibular joint disorders, secondary to disc displacement without reduction or osteoarthritis were randomly divided into 3 groups. Thirty-nine patients received SLLLT in 10 sessions over 2 weeks, 30 patients received ibuprofen 800 mg twice a day for 10 days, and 30 patients received sham laser as placebo in 10 sessions over 2 weeks. Pain intensity was measured by visual analog scale at baseline, 2, 5, 10, and 15 days of treatment. Mandibular function was evaluated by monitoring active and passive mouth openings and right and left lateral motions at baseline, 15 days, and 1 month of treatment. Magnetic resonance imaging was performed at baseline and the end of therapy. RESULTS: Mean visual analog scale pain scores in SLLLT group was significantly lower than in nonsteroidal anti-inflammatory drug group and control group (P=0.0001) from fifth day up to the end of the observation period. As for active and passive mouth openings and right and left lateral motions, superiority of SLLLT was evident 1 month after treatment (interaction time treatment, P=0.0001). DISCUSSION: Mandibular function improved in all SLLLT patients proving the effectiveness in the treatment of pain, as demonstrated by a significant improvement in clinical signs and symptoms of temporomandibular joint disc displacement without reduction and osteoarthritis at the end of treatment and stability over a period of 1 month.

Clin J Pain 2010 Sep 26(7) 611-6

http://www.ncbi.nlm.nih.gov/pubmed/?term=20664343

# Choice of treatment modalities was not influenced by pain, severity or co-morbidity in patients with knee osteoarthritis.

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Background and Purpose. Patients with knee osteoarthritis (OA) are commonly treated by physiotherapists in primary care. The physiotherapists use different treatment modalities. In a previous study, we identified variation in the use of transcutaneous electrical nerve stimulation (TENS), low level laser or acupuncture, massage and weight reduction advice for patients with knee OA. The purpose of this study was to examine factors that might explain variation in treatment modalities for patients with knee OA. Methods. Practising physiotherapists prospectively collected data for one patient with knee osteoarthritis each through 12 treatment sessions.We chose to examine factors that might explain variation in the choice of treatment modalities supported by high or moderate quality evidence, and modalities which were frequently used but which were not supported by evidence from systematic reviews. Experienced clinicians proposed factors that they thought might explain the variation in the choice of these specific treatments. We used these factors in explanatory analyses. Results. Using TENS, low level laser or acupuncture was significantly associated with having searched databases to help answer clinical questions in the last six months (odds ratio [OR] = 1.93, 95% confidence interval [CI] = 1.08-3.42). Not having Internet access at work and using more than four treatment modalities were significant determinants for giving massage (OR = 0.36, 95% CI = 0.19-0.68 and OR = 8.92, 95% CI = 4.37-18.21, respectively). Being a female therapist significantly increased the odds for providing weight reduction advice (OR = 3.60, 95% CI = 1.12-11.57). No patient characteristics, such as age, pain or co-morbidity, were significantly associated with variation in practice. Conclusions. Factors related to patient characteristics, such as pain severity and co-morbidity, did not seem to explain variation in treatment modalities for patients with knee OA. Variation was associated with the following factors: physiotherapists having Internet access at work, physiotherapists having searched databases for the last six months and the gender of the therapist. There is a need for more studies of determinants for physiotherapy practice. 

Physiother Res Int 2009 Dec 23

http://www.ncbi.nlm.nih.gov/pubmed/?term=20033888

# Validating a Nonacupoint Sham Control for Laser Treatment of Knee Osteoarthritis.

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Abstract Objective: The goals of the present study were to evaluate the effect and safety of combined 10.6 mum and 650 nm laser acupuncture-moxibustion on patients with knee osteoarthritis (OA) and to validate a nonacupoint sham control for assessing the effect of point specificity on the treatment. Materials and Methods: A randomized, sham-controlled clinical trial was conducted in an outpatient clinical setting on patients with knee OA (n = 40). Laser irradiation was performed on acupoint Dubi (ST35) and a sham point three times a week for 4 wk. Outcome measurements were performed at baseline and at wk 2 and 4 using Western Ontario and McMaster Universities' Osteoarthritis Index (WOMAC). Results: At the 2-wk assessment, i.e., after 6 treatments, improvement in the WOMAC pain score of the acupoint group was significantly greater than that of the control group (49.21% vs. 11.99%, respectively; p = 0.021). However, there were no significant differences between the two groups in the WOMAC physical function score (p = 0.129) or joint stiffness score (p = 0.705). No side effects were found during the trial. Conclusions: Combined 10.6-mum-650-nm laser acupuncture-moxibustion on acupoint ST35 is safe to use and was effective after 2-wk treatment, but not at the 4-wk assessment, in relieving knee OA pain compared to a nonacupoint sham control. A larger clinical trial to verify our findings is warranted.

Photomed Laser Surg 2009 Oct 27

http://www.ncbi.nlm.nih.gov/pubmed/?term=19860569

# Wavelength effect in temporomandibular joint pain: a clinical experience.

Carvalho CM, de Lacerda JA, Dos Santos Neto FP, Cangussu MC, Marques AM, Pinheiro AL

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Temporomandibular disorders (TMDs) are common painful multifactorial conditions affecting the temporomandibular joint (TMJ) and whose treatment depends on the type and symptoms. Initially, it requires pain control, and, for this, drugs, biting plates, occlusal adjustment, physiotherapy or their association are used. Lately, laser phototherapy (LPT) has been used in the treatment of pain of several origins, including TMDs. This study reports the treatment of a selected group of 74 patients treated at the Laser Center of the Federal University of Bahia between 2003 and 2008. Following standard anamneses, clinical and imaging examination and with the diagnosis of any type of TMD, the patients were prepared for LPT. No other intervention was carried out during the treatment. Treatment consisted of three sessions a week for 6 weeks. Prior to irradiation, the patients were asked to score their pain using a visual analog scale (VAS). Lasers of wavelength (lambda)780 nm, lambda790 nm or lambda830 nm and/or lambda660 nm were used at each session (30/40 mW; spot (varphi) approximately 3 mm; mean dose per session 14.2 +/- 6.8 J/cm(2); mean treatment dose of 170 +/- 79.8 J/cm(2)). Of the patients, 80% were female ( approximately 46 years old). At the end of the 12 sessions the patients were again examined, and they scored their pain using the VAS. The results were statistically analyzed and showed that 64% of the patients were asymptomatic or had improved after treatment and that the association of both wavelengths was statistically significant (P = 0.02) in the asymptomatic group. It was concluded that the association of red and infrared (IR) laser light was effective in pain reduction on TMJ disorders of several origins.

Lasers Med Sci 2009 Jun 30

http://www.ncbi.nlm.nih.gov/pubmed/?term=19565312

# The Effect of Low-Level Laser in Knee Osteoarthritis: A Double-Blind, Randomized, Placebo-Controlled Trial.

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Abstract Introduction: Low-level laser therapy (LLLT) is thought to have an analgesic effect as well as a biomodulatory effect on microcirculation. This study was designed to examine the pain-relieving effect of LLLT and possible microcirculatory changes measured by thermography in patients with knee osteoarthritis (KOA). Materials and Methods: Patients with mild or moderate KOA were randomized to receive either LLLT or placebo LLLT. Treatments were delivered twice a week over a period of 4 wk with a diode laser (wavelength 830 nm, continuous wave, power 50 mW) in skin contact at a dose of 6 J/point. The placebo control group was treated with an ineffective probe (power 0.5 mW) of the same appearance. Before examinations and immediately, 2 wk, and 2 mo after completing the therapy, thermography was performed (bilateral comparative thermograph by AGA infrared camera); joint flexion, circumference, and pressure sensitivity were measured; and the visual analogue scale was recorded. Results: In the group treated with active LLLT, a significant improvement was found in pain (before treatment [BT]: 5.75; 2 mo after treatment : 1.18); circumference (BT: 40.45; AT: 39.86); pressure sensitivity (BT: 2.33; AT: 0.77); and flexion (BT: 105.83; AT: 122.94). In the placebo group, changes in joint flexion and pain were not significant. Thermographic measurements showed at least a 0.5 degrees C increase in temperature-and thus an improvement in circulation compared to the initial values. In the placebo group, these changes did not occur. Conclusion: Our results show that LLLT reduces pain in KOA and improves microcirculation in the irradiated area.

Photomed Laser Surg 2009 Jun 16

http://www.ncbi.nlm.nih.gov/pubmed/?term=19530911

# Treatment of neck pain: noninvasive interventions: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders.

Hurwitz EL, Carragee EJ, van der Velde G, Carroll LJ, Nordin M, Guzman J, Peloso PM, Holm LW, Cote P, Hogg-Johnson S, Cassidy JD, Haldeman S

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STUDY DESIGN: Best evidence synthesis. OBJECTIVE: To identify, critically appraise, and synthesize literature from 1980 through 2006 on noninvasive interventions for neck pain and its associated disorders. SUMMARY OF BACKGROUND DATA: No comprehensive systematic literature reviews have been published on interventions for neck pain and its associated disorders in the past decade. METHODS: We systematically searched Medline and screened for relevance literature published from 1980 through 2006 on the use, effectiveness, and safety of noninvasive interventions for neck pain and associated disorders. Consensus decisions were made about the scientific merit of each article; those judged to have adequate internal validity were included in our best evidence synthesis. RESULTS: Of the 359 invasive and noninvasive intervention articles deemed relevant, 170 (47%) were accepted as scientifically admissible, and 139 of these related to noninvasive interventions (including health care utilization, costs, and safety). For whiplash-associated disorders, there is evidence that educational videos, mobilization, and exercises appear more beneficial than usual care or physical modalities. For other neck pain, the evidence suggests that manual and supervised exercise interventions, low-level laser therapy, and perhaps acupuncture are more effective than no treatment, sham, or alternative interventions; however, none of the active treatments was clearly superior to any other in either the short- or long-term. For both whiplash-associated disorders and other neck pain without radicular symptoms, interventions that focused on regaining function as soon as possible are relatively more effective than interventions that do not have such a focus. CONCLUSION: Our best evidence synthesis suggests that therapies involving manual therapy and exercise are more effective than alternative strategies for patients with neck pain; this was also true of therapies which include educational interventions addressing self-efficacy. Future efforts should focus on the study of noninvasive interventions for patients with radicular symptoms and on the design and evaluation of neck pain prevention strategies.

J Manipulative Physiol Ther 2009 Feb 32(2 Suppl) S141-75

http://www.ncbi.nlm.nih.gov/pubmed/?term=19251061

# Measuring physiotherapy performance in patients with osteoarthritis of the knee: a prospective study.

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ABSTRACT: BACKGROUND: Patients with knee osteoarthritis [OA] are commonly treated by physiotherapists in primary care. Measuring physiotherapy performance is important before developing strategies to improve quality of care. The purpose of this study is to measure physiotherapy performance in patient with knee OA by comparing clinical practice to evidence from systematic reviews. . METHODS: We developed a data collection form and invited all private practitioners in Norway [n=2798] to prospectively collect data on the management of one patient with knee OA through 12 treatment session. Actual practice was compared to findings from an overview of systematic reviews summarising the effect of physiotherapy interventions for knee OA. RESULTS: A total of 297 physiotherapists reported their management for patients with knee OA. Exercise was the most common treatment used, provided by 98% of the physiotherapists. There is high-quality evidence that exercise reduces pain and improves function in patients with knee OA. Thirty-five percent of physiotherapists used acupuncture, low-level laser therapy or transcutaneous electrical nerve stimulation which has moderate-quality evidence for reducing pain. Patient education, which has moderate-quality evidence for improving psychological outcomes, was provided by 68%. Physiotherapists used a median of four different treatment modalities for each patient, and offered many treatment modalities with low-quality evidence or no evidence from systematic reviews, e.g., traction and mobilisation, massage, stretching and different types of advice. CONCLUSIONS: Exercise was used in almost all treatment sessions in the management of knee OA. This practice is desirable since it is supported by high quality evidence. Physiotherapists also provide several other treatment modalities based on evidence of moderate or low quality, or no evidence from systematic reviews. Ways to promote high quality evidence into physiotherapy practice should be identified and evaluated.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=18611250

# Blood flow changes of a superficial temporal artery before and after low-level laser irradiation applied to the temporomandibular joint area.

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PURPOSE: The aim of this study was to evaluate the blood flow changes of a superficial temporal artery before and after low-level laser irradiation was applied to the TMJ area of healthy subjects. METHODS: Right TMJ areas of six healthy subjects were irradiated with a CO2 laser. Variation of diameter, blood flow rate, and blood flow volume of the vessel, on both the irradiated side and opposite side, before and after irradiation on the TMJ were evaluated by using a Doppler flowmeter. RESULTS: The diameter and blood flow volume of the vessel after irradiation increased significantly compared to that before irradiation. CONCLUSION: Low-level laser irradiation applied to the right TMJ area caused an expansion of blood vessels and an increase in blood flow volume. The same result on the contralateral side may be caused by the vasodilator reflex via the hypothalamic thermostat.

Nihon Hotetsu Shika Gakkai Zasshi 2008 Apr 52(2) 167-70

http://www.ncbi.nlm.nih.gov/pubmed/?term=18467786

# Low-level laser therapy for treatment of temporomandibular joint pain: a double-blind and placebo-controlled trial.

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OBJECTIVE: The objective of this study was to assess the effectiveness of low-level laser therapy (LLLT) in the management of temporomandibular joint (TMJ) pain in a random and double-blind research design. STUDY DESIGN: TMJ pain patients, randomly assigned, received 2 to 3 treatments per week for 8 weeks of active LLLT (Helium Neon, 632.8 nm, 30 mW) (n = 26) or sham LLLT (n = 26). Measures of TMJ pain during function were evaluated at baseline and weeks 2, 4, and 8 after the first laser therapy. RESULTS: At the 8-week point, within-group improvements were present for TMJ pain during function, for both the active and sham LLLT groups (P = .000). Between-group differences were not highly evident (P > .05). CONCLUSION: The study suggests that LLLT is not better than placebo at reducing TMJ pain during function.

Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008 Apr 105(4) 452-6

http://www.ncbi.nlm.nih.gov/pubmed/?term=18329580

# Clinical practice implications of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders: from concepts and findings to recommendations.

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STUDY DESIGN: Best evidence synthesis. OBJECTIVE: To provide evidence-based guidance to primary care clinicians about how to best assess and treat patients with neck pain. SUMMARY OF BACKGROUND DATA: There is a need to translate the results of clinical and epidemiologic studies into meaningful and practical information for clinicians. METHODS: Based on best evidence syntheses of published studies on the risk, prognosis, assessment, and management of people with neck pain and its associated disorders, plus additional research projects and focused literature reviews reported in this supplement, the 12-member multidisciplinary Scientific Secretariat of the Neck Pain Task Force followed a 4-step approach to develop practical guidance for clinicians. RESULTS: The Neck Pain Task Force recommends that people seeking care for neck pain should be triaged into 4 groups: Grade I neck pain with no signs of major pathology and no or little interference with daily activities; Grade II neck pain with no signs of major pathology, but interference with daily activities; Grade III neck pain with neurologic signs of nerve compression; Grade IV neck pain with signs of major pathology. In the emergency room after blunt trauma to the neck, triage should be based on the NEXUS criteria or the Canadian C-spine rule. Those with a high risk of fracture should be further investigated with plain radiographs and/or CT-scan. In ambulatory primary care, triage should be based on history and physical examination alone, including screening for red flags and neurologic examination for signs of radiculopathy. Exercises and mobilization have been shown to provide some degree of short-term relief of Grade I or Grade II neck pain after a motor vehicle collision. Exercises, mobilization, manipulation, analgesics, acupuncture, and low-level laser have been shown to provide some degree of short-term relief of Grade I or Grade II neck pain without trauma. Those with confirmed Grade III and severe persistent radicular symptoms might benefit from corticosteroid injections or surgery. Those with confirmed Grade IV neck pain require management specific to the diagnosed pathology. CONCLUSION: The best available evidence suggests initial assessment for neck pain should focus on triage into 4 grades, and those with common neck pain (Grade I and Grade II) might be offered the listed noninvasive treatments if short-term relief is desired.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=18204393

# Treatment of neck pain: noninvasive interventions: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders.

Hurwitz EL, Carragee EJ, van der Velde G, Carroll LJ, Nordin M, Guzman J, Peloso PM, Holm LW, Cote P, Hogg-Johnson S, Cassidy JD, Haldeman S

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STUDY DESIGN: Best evidence synthesis. OBJECTIVE: To identify, critically appraise, and synthesize literature from 1980 through 2006 on noninvasive interventions for neck pain and its associated disorders. SUMMARY OF BACKGROUND DATA: No comprehensive systematic literature reviews have been published on interventions for neck pain and its associated disorders in the past decade. METHODS: We systematically searched Medline and screened for relevance literature published from 1980 through 2006 on the use, effectiveness, and safety of noninvasive interventions for neck pain and associated disorders. Consensus decisions were made about the scientific merit of each article; those judged to have adequate internal validity were included in our best evidence synthesis. RESULTS: Of the 359 invasive and noninvasive intervention articles deemed relevant, 170 (47%) were accepted as scientifically admissible, and 139 of these related to noninvasive interventions (including health care utilization, costs, and safety). For whiplash-associated disorders, there is evidence that educational videos, mobilization, and exercises appear more beneficial than usual care or physical modalities. For other neck pain, the evidence suggests that manual and supervised exercise interventions, low-level laser therapy, and perhaps acupuncture are more effective than no treatment, sham, or alternative interventions; however, none of the active treatments was clearly superior to any other in either the short- or long-term. For both whiplash-associated disorders and other neck pain without radicular symptoms, interventions that focused on regaining function as soon as possible are relatively more effective than interventions that do not have such a focus. CONCLUSION: Our best evidence synthesis suggests that therapies involving manual therapy and exercise are more effective than alternative strategies for patients with neck pain; this was also true of therapies which include educational interventions addressing self-efficacy. Future efforts should focus on the study of noninvasive interventions for patients with radicular symptoms and on the design and evaluation of neck pain prevention strategies.

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http://www.ncbi.nlm.nih.gov/pubmed/?term=18204386

# Effect of combined laser acupuncture on knee osteoarthritis: a pilot study.

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ChinaOur objective was to assess the efficacy and safety of combined 10.6 micron and 650 nm laser irradiation on patients with knee osteoarthritis (OA). Forty patients with OA were randomly allocated to an active laser group or to a placebo laser group (20 per group). They either received active or sham laser treatment at acupoint Dubi (ST 35) in a total of 12 sessions. There was significant difference between the two groups in the Western Ontario and McMaster Universities (WOMAC) osteoarthritis index pain score change from baseline after 2 weeks of treatment (P = 0.047). The pain reduction of the active laser treatment group was 49%, whereas that of the placebo control group was only 13%. However, due to the high patient drop-out rate, the 4-week assessment could not be analyzed. Combined laser treatment seems beneficial to patients with knee OA. However, due to the small sample size and the high drop-out rate of patients in the placebo group, a large sample-size clinical trial is warranted to determine further the therapeutic efficacy of the device.

Lasers Med Sci 2008 Jan 5

http://www.ncbi.nlm.nih.gov/pubmed/?term=18180980

# Physical Therapy Interventions for Patients With Osteoarthritis of the Knee: An Overview of Systematic Reviews.

Jamtvedt G, Dahm KT, Christie A, Moe RH, Haavardsholm E, Holm I, Hagen KB

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Patients with osteoarthritis of the knee are commonly treated by physical therapists. Practice should be informed by updated evidence from systematic reviews. The purpose of this article is to summarize the evidence from systematic reviews on the effectiveness of physical therapy for patients with knee osteoarthritis. Systematic reviews published between 2000 and 2007 were identified by a comprehensive literature search. We graded the quality of evidence across reviews for each comparison and outcome. Twenty-three systematic reviews on physical therapy interventions for patients with knee osteoarthritis were included. There is high-quality evidence that exercise and weight reduction reduce pain and improve physical function in patients with osteoarthritis of the knee. There is moderate-quality evidence that acupuncture, transcutaneous electrical nerve stimulation, and low-level laser therapy reduce pain and that psychoeducational interventions improve psychological outcomes. For other interventions and outcomes, the quality of evidence is low or there is no evidence from systematic reviews.

Phys Ther 2007 Nov 6

http://www.ncbi.nlm.nih.gov/pubmed/?term=17986496

# Effectiveness of low-level laser therapy in temporomandibular joint disorders: a placebo-controlled study.

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OBJECTIVE: Low-level laser therapy (LLLT) treatment for pain caused by temporomandibular joint disorders (TMD) was investigated in a controlled study comparing applied energy density, subgroups of TMD, and duration of disorders. BACKGROUND DATA: Although LLLT is a physical therapy used in the treatment of musculoskeletal disorders, there is little evidence for its effectiveness in the treatment of TMD. METHODS: The study group of 61 patients was treated with 10 J/cm(2) or 15 J/cm(2), and the control group of 19 patients was treated with 0.1 J/cm(2). LLLT was performed by a GaAlAs diode laser with output of 400 mW emitting radiation wavelength of 830 nm in 10 sessions. The probe with aperture 0.2 cm(2) was placed over the painful muscle spots in the patients with myofascial pain. In patients with TMD arthralgia the probe was placed behind, in front of, and above the mandibular condyle, and into the meatus acusticus externus. Changes in pain were evaluated by self-administered questionnaire. RESULTS: Application of 10 J/cm(2) or 15 J/cm(2) was significantly more effective in reducing pain compared to placebo, but there were no significant differences between the energy densities used in the study group and between patients with myofascial pain and temporomandibular joint arthralgia. Results were marked in those with chronic pain. CONCLUSION: The results suggest that LLLT (application of 10 J/cm(2) and 15 J/cm(2)) can be considered as a useful method for the treatment of TMD-related pain, especially long lasting pain.

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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.

Tanzan Health Res Bull 2007 May 9(2) 121-5

http://www.ncbi.nlm.nih.gov/pubmed/?term=17722415

# WITHDRAWN: Low level laser therapy (Classes III) for treating osteoarthritis.

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BACKGROUND: Osteoarthritis (OA) affects a large portion of the population. Low Level Laser Therapy (LLLT) is a light source that generates extremely pure light, of a single wavelength. The effect is not thermal, but rather related to photochemical reactions in the cells. LLLT was introduced as an alternative non-invasive treatment for OA about 30 years ago, but its effectiveness has to be examined more closely, especially in the treatment of OA. OBJECTIVES: To assess the effectiveness of class III LLLT for osteoarthritis when irradiation is directed at the osteoarthritic joint capsule. SEARCH STRATEGY: Searches were conducted in the following databases: MEDLINE, EMBASE, the Cochrane Musculoskeletal registry, the Rehabilitation and Related Therapies field registry and the Cochrane Controlled Trials Register up to May, 2005. SELECTION CRITERIA: Following an a prior protocol, only controlled clinical trials of LLLT for the treatment of patients with a clinical diagnosis of OA were eligible. Abstracts lacking data were excluded unless further data could be obtained from the authors. DATA COLLECTION AND ANALYSIS: Two reviewers independently selected trials and extracted data using predetermined forms. A fixed effects model was used throughout for continuous variables, except where heterogeneity existed; in which case, a random effects model was used. Results were analyzed as weighted mean differences (WMD) with 95% confidence intervals (CI), whereas the difference between the treatment and control groups was weighted by the inverse of the variance. Standardized mean differences (SMD) were calculated by dividing the difference between treatment and control by the baseline variance, and were used in the analysis of pain because different scales were used to measure it. Dichotomous outcomes were analyzed with relative risk (RR). MAIN RESULTS: Eight trials were included with 233 patients randomized to laser and 172 patients to placebo laser. Treatment duration ranged from two to six weeks. Pain was assessed in seven trials. When the results were pooled from different pain scales used in these seven trials, a statistically significant difference in favor of laser treatment was found with a SMD of -0.28 (95% CI: -0.48 to -0.09). One of these studies also measured pain during movement and found a statistically significant difference in favor of laser treatment with a WMD of -1.16 (95% CI: -2.02 to -0.30). Two studies found significant results for increased knee range of motion. Two others studies found a statistically significant difference in favor of laser treatment for patient-assessed global disease activity with laser compared to placebo (RR 1.70, 95%CI: 1.1. to 2.63). One trial evaluated the effectiveness of laser treatment in temporomandibular joint OA and found a statistically significant difference (WMD 38.69, 95% CI: 29.25 to 48.13) using the change in VAS score to measure pain. One study found a statistically significant difference in favor of laser treatment at the end of treatment and at 4 and 8 weeks post-treatment for morning stiffness. Other outcome measures of joint tenderness and strength did not yield significant differences. AUTHORS' CONCLUSIONS: Five trials included in this review showed a statistically significant difference favoring laser treatment when compared to placebo for at least one outcome measure. Three trials did not report beneficial effects. The varying results of these trials may be due to the method of laser application and/or other features of LLLT application. Clinicians and researchers should consistently report the characteristics of LLLT devices and application techniques used. New trials on LLLT should make use of standardized, validated outcomes. There is clearly a need to investigate the effects of different dosages on LLLT effectiveness for OA in future randomized, controlled clinical trials. Also, more studies should be done to investigate the anti-inflammatory action of laser as well as the appropriate parameters needed to achieve an anti-inflammatory effect.

# [The influence of laser irradiation of low-power density on an experimental cartilage damage in rabbit knee-joints: an in vivo investigation considering macroscopic, histological and immunohistochemical changes]

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In a total of 45 rabbits, knee-joint arthrosis was induced according to the Hulth & Telhag model. Depending on the post-operative survival time, the cartilage was investigated macroscopically, histologically and immunohistochemically (within a period of 10 days to 8 months). Thereafter, the influence of laser irradiation at a wavelength of 692.6 nm and energy densities of 1 and 4 J/cm2 on the cartilage morphology seven days following the exposure was examined. After joint instability surgery it was found out that the cartilage changes in the main stress area (MSA) and in regions outside the main stress area (ROMSA) progressed differently. Various qualitative and semi-quantitative changes were found for collagens I, II, IV and V, and for the glycoproteins fibronectin and tenascin. Immunohistochemically, there was a growing expression of collagen I in the apical layers, collagen II showed a stronger pericellular expression, and collagen IV showed, after an initial growth of the pericellular expression, a reduced territorial expression and a stronger apical-interterritorial expression in the osteoarthrotic cartilage. For fibronectin, the cellular expression turned out to grow in the ROMSA. In the MSA it decreased, but at the same time the interterritorial expression grew. For Tanascin, there was a decrease of the interterritorial expression in the radial zone while the pericellular and interterritorial expression of the apical layers of the osteoarthrotic cartilage grew. Lasing proved to significantly influence the osteoarthrotically changed cartilage when applied at an energy density of 1 J/cm2, i.e., the morphological changes had not yet progressed to the extent the control group had. Both the chondrocyte density and the glucosaminoglycan content turned out to be higher. When lasing was applied at higher energy densities, no significant difference among the control groups was found. Thus, it could be demonstrated in vivo that an arthrotic process decelerates through the influence of laser light of low-energy densities.

Biomed Tech (Berl) 2006 51(3) 131-8

http://www.ncbi.nlm.nih.gov/pubmed/?term=16961456

# Arthralgia of the temporomandibular joint and low-level laser therapy.

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OBJECTIVE: This case report describes the treatment of a patient with arthralgia of the temporomandibular joint (TMJ) caused by disc displacement. BACKGROUND DATA: The goal of the treatment of TMJ arthralgia is to decrease pain by promotion of the musculoskeletal system's natural healing ability. METHODS: This report describes the complex treatment of TMJ arthralgia. Low-level laser therapy (LLLT) was chosen for its antiinflammatory and analgesic effects. Laser therapy was carried out using the GaAlAs diode laser with an output power of 400 mW, emitting radiation with a wavelength of 830 nm, and having energy density of 15 J/cm2; the laser radiation was applied by contact mode on four targeted spots in 10 sessions. Physiotherapy was recommended to this patient to prevent the injury of intraarticular tissue caused by incorrect movement during opening of the mouth. Splint stabilization and prosthetic treatment were used to reduce overloading of the TMJ, resulting from unstable occlusion and to help repositioning of the dislocated disc. RESULTS: Five applications of LLLT led to decrease of pain in the area of the TMJ on the Visual Analog Scale, from 20 to 5 mm. The anti-inflammatory effect of the laser was confirmed by thermographic examination. Before treatment, the temperature differences between the areas of the normal TMJ and TMJ with arthralgia was higher than 0.5 degrees C. However, at the conclusion of LLLT, temperatures in the areas surrounding the TMJ were equalized. CONCLUSION: This study showed the effectiveness of complex non-invasive treatment in patients with arthralgia of the TMJ. The analgesic and anti-inflammatory effects of LLLT were confirmed by infrared thermography.

Photomed Laser Surg 2006 Aug 24(4) 522-7

http://www.ncbi.nlm.nih.gov/pubmed/?term=16942435

# 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.

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

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

# Can Cochrane Reviews in controversial areas be biased? A sensitivity analysis based on the protocol of a Systematic Cochrane Review on low-level laser therapy in osteoarthritis.

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OBJECTIVE: The aim of this study was to test if a conclusion in a systematic review of low-level laser therapy (LLLT) for osteoarthritis from the Cochrane Library was valid and robust. BACKGROUND DATA: Health policy decisions often rely on conclusions from the Cochrane Database of Systematic Reviews for approval of new therapies, although their validity for controversial non-pharmacological treatment has been questioned. METHODS: Validity was tested against a nine-item checklist for systematic reviews. Review selections were analyzed for possible discrepancies between trial and review reports, and omissions of relevant trials and data. Alternative data from discrepancies and omissions were then imputed in a sensitivity analysis, to test if review conclusions were robust. RESULTS: Only clinicians who had performed LLLT trials with negative results were invited into the review group. Review quality was sound in areas of literature search and methodological assessments, and some of the limitations were mentioned. The statistical analysis held 18 questionable selections such as omissions of trials, data, and subgroup analyses. These selections systematically favored the negative review conclusion. Without altering the review protocol, the sensitivity analysis of combined results changed to significantly positive for continuous and categorical data when data from all included trials were combined. Further sensitivity analyses with inclusion of valid non-included trials, performance of missing follow-up, and subgroup analyses revealed consistent and highly significant results in favor of active LLLT. CONCLUSIONS: In this example, the Cochrane review conclusion was neither robust nor valid. Representation of experts and different views on efficacy in the review group and extensive use of sensitivity analyses could probably improve quality control of reviews in areas of controversy.

Photomed Laser Surg 2005 Oct 23(5) 453-8

http://www.ncbi.nlm.nih.gov/pubmed/?term=16262573

# Randomized controlled trial on low level laser therapy (LLLT) in the treatment of osteoarthritis (OA) of the hand.

Brosseau L, Wells G, Marchand S, Gaboury I, Stokes B, Morin M, Casimiro L, Yonge K, Tugwell P

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BACKGROUND AND OBJECTIVES: Low level laser therapy (LLLT) offers promising symptomatic relief of osteoarthritic (OA) pain. We examined efficacy of active LLLT versus sham LLLT on finger joints and three superficial nerves. STUDY DESIGN/MATERIALS AND METHODS: OA-patients randomly assigned, received three treatments per week for 6 weeks of LLLT (n = 42) or sham LLLT (n = 46). RESULTS: Pain relief, morning stiffness, and functional status did not significantly improve for LLLT versus placebo. No significant differences were found in finger range of motion, except carpometacarpal opposition (P = 0.011), grip strength, and patient global assessment which improved for active LLLT participants (P = 0.041). CONCLUSIONS: LLLT is no better than placebo at reducing pain, morning stiffness, or improving functional status for OA-hand patients.

Lasers Surg Med 2005 Mar 36(3) 210-9

http://www.ncbi.nlm.nih.gov/pubmed/?term=15704096

# Effects of helium-neon laser on levels of stress protein and arthritic histopathology in experimental osteoarthritis.

Lin YS, Huang MH, Chai CY, Yang RC

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OBJECTIVE: To investigate the effect of low-power laser therapy on levels of stress proteins (SPs) in experimental arthritis and their relation to the bioeffects on arthritic cartilage repair. DESIGN: A total of 42 rats with similar degrees of induced arthritis evaluated by means of bone scan were divided randomly into two groups. In the treated group, 21 rats received helium-neon laser treatment; in the control group, 21 rats received sham laser treatment. The changes in chondrocytes of SPs were measured by electrophoresis of proteins extracted from chondrocytes of arthritic cartilage at various time periods. The histopathologic changes and the presence of SP of arthritic cartilage were identified by hematoxylin and eosin stain and by immunostains of SP72 antibody individually from frozen sections of arthritic cartilage. RESULTS: SP density increased markedly in rats after laser treatment and was closely related to the repair of arthritic cartilage. Furthermore, the pathohistology of arthritic cartilage improved significantly with the decline of SP levels in the follow-up period. CONCLUSION: Helium-neon (632 nm) low-power laser can enhance SP production in arthritic chondrocytes. The extragenic production of SP is well correlated with the therapeutic effect of low-power laser in preserving chondrocytes and the repair of arthritic cartilage in rats.

Am J Phys Med Rehabil 2004 Oct 83(10) 758-65

http://www.ncbi.nlm.nih.gov/pubmed/?term=15385784

# Low level laser therapy (Classes I, II and III) for treating osteoarthritis.

Brosseau L, Welch V, Wells G, DeBie R, Gam A, Harman K, Morin M, Shea B, Tugwell P

School of Rehabilitation Sciences, University of Ottawa, 451 Smyth Road, Ottawa, Ontario, Canada, K1H 8M5.

BACKGROUND: Osteoarthritis (OA) affects a large proportion of the population. Low Level Laser Therapy (LLLT) is a light source that generates extremely pure light, of a single wavelength. The effect is not thermal, but rather related to photochemical reactions in the cells. LLLT was introduced as an alternative non-invasive treatment for OA about 20 years ago, but its effectiveness is still controversial. OBJECTIVES: To assess the effectiveness of LLLT in the treatment of OA. SEARCH STRATEGY: We searched MEDLINE, EMBASE, the Cochrane Musculoskeletal registry, the registry of the Rehabilitation and Related Therapies field and the Cochrane Controlled Trials Register up to January 30, 2004. SELECTION CRITERIA: Following an a priori protocol, only controlled clinical trials of LLLT for the treatment of patients with a clinical diagnosis of OA were eligible. Abstracts were excluded unless further data could be obtained from the authors. DATA COLLECTION AND ANALYSIS: Two reviewers independently selected trials and abstracted data using predetermined forms. Heterogeneity was tested with Cochran's Q test. A fixed effects model was used throughout for continuous variables, except where heterogeneity existed, in which case, a random effects model was used. Results were analyzed as weighted mean differences (WMD) with 95% confidence intervals (CI), where the difference between the treated and control groups was weighted by the inverse of the variance. Standardized mean differences (SMD) were calculated by dividing the difference between treated and control by the baseline variance. SMD were used when different scales were used to measure the same concept (e.g. pain). Dichotomous outcomes were analyzed with odds ratios. MAIN RESULTS: Seven trials were included, with 184 patients randomized to laser, 161 patients to placebo laser. Treatment duration ranged from 4 to 12 weeks. Pain was assessed by four trials. The pooled estimate (random effects) of three trials showed no effect on pain measured using a scale (SMD: -0.2, 95% CI: -1.0, +0.6), but there was statistically significant heterogeneity (p>0,05). Three of the trials showed no effect and two demonstrated very beneficial effects with laser. In another trial, with no scale-based pain outcome, significantly more patients reported pain relief (yes/no) with laser with an odds ratio of 0.05, (95% CI: 0.0 to 1.56). Only one study found significant results for increased knee range of motion (WMD: -10.62 degrees, 95% CI: -14.07,-7.17). Other outcomes of joint tenderness and strength were not significant. Lower dosage of LLLT was found as effective than higher dosage for reducing pain and improving knee range of motion. REVIEWERS' CONCLUSIONS: For OA, the results are conflicting in different studies and may depend on the method of application and other features of the LLLT application. Clinicians and researchers should consistently report the characteristics of the LLLT device and the application techniques used. New trials on LLLT should make use of standardized, validated outcomes. Despite some positive findings, this meta-analysis lacked data on how LLLT effectiveness is affected by four important factors: wavelength, treatment duration of LLLT, dosage and site of application over nerves instead of joints. There is clearly a need to investigate the effects of these factors on LLLT effectiveness for OA in randomized controlled clinical trials.

Cochrane Database Syst Rev 2004 -3 CD002046

http://www.ncbi.nlm.nih.gov/pubmed/?term=15266461

# Low-power laser in osteoarthritis of the cervical spine.

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Patients with symptomatic osteoarthritis of the cervical spine were treated with very low-power modulated laser (LPL). Two applications were performed at an interval of 20 days. Changes in pain and ultrasound thickness of the soft connective tissue layer above the right and the left superior trapezium were studied. No worsening of pain was observed. Pain improved after the first application of LPL in 9 out of 14 patients, but the difference was not significant. Pain improvement remained stable between the first assessment and the second assessment, which was performed after 20 days. In comparison with the first application, at the second application the number of patients with improved pain after LPL increased to 12 out of 14 ($p < 0.01$). An appreciable difference in the thickness of the subcutaneous soft tissue layer overlying the two superior trapezia was demonstrated in all patients at the first examination. Comparison of the measurements before and after the application of LPL showed significant differences.

Int J Tissue React 2003 25(4) 131-6

http://www.ncbi.nlm.nih.gov/pubmed/?term=15244318

# Low power laser treatment in patients with knee osteoarthritis.

Tascioglu F, Armagan O, Tabak Y, Corapci I, Oner C

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The aim of this study was to investigate the analgesic efficacy of low power laser therapy in patients with knee osteoarthritis (OA). The study design was randomised, placebo-controlled and single blinded. Sixty patients with knee OA according to the American College of Rheumatology criteria were included and randomly assigned to three treatment groups: active laser with dosage of 3 J/per painful point, active laser with a dosage of 1.5/J per painful point and placebo laser treatment groups. A Gal-Al-As diode laser device was used as a source of low power laser with a power output of 50 mW and a wavelength of 830 nm. The patients were treated 5 times weekly with 10 treatments in all. The clinical assessments included Western Ontario and McMaster Universities osteoarthritis index (WOMAC) pain, stiffness and physical function subscales. In addition, the intensity of pain at rest and on activation was evaluated on a visual analogue scale. Compared to baseline, at week 3 and at month 6, no significant improvement was observed within the groups. Similarly, no significant differences were found among the treatment groups at any time. With the chosen laser type and dose regimen the results that we obtained in this study, suggest that low-level laser therapy has no effect on pain in patients with knee OA.

Swiss Med Wkly 2004 May 1 134(17-18) 254-8

http://www.ncbi.nlm.nih.gov/pubmed/?term=15243853

# [Evaluation of low level laser therapy in temporo-mandibular joint disorders]

Lou SH, Zhang XB, Xu B

Shanghai Kou Qiang Yi Xue 2003 Dec 12(6) 435, 442

http://www.ncbi.nlm.nih.gov/pubmed/?term=14966584

# Efficacy of different therapy regimes of low-power laser in painful osteoarthritis of the knee: a double-blind and randomized-controlled trial.

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Physical Medicine and Rehabilitation, School of Medicine, Dicle University, Diyarbakir, Turkey. alig@dicle.edu.tr

BACKGROUND AND OBJECTIVES: A prospective, double-blind, randomized, and controlled trial was conducted in patients with knee osteoarthritis (OA) to evaluate the efficacy of infrared low-power Gallium-Arsenide (Ga-As) laser therapy (LPLT) and compared two different laser therapy regimes. STUDY DESIGN/MATERIALS AND METHODS: Ninety patients were randomly assigned to three treatment groups by one of the nontreating authors by drawing 1 of 90 envelopes labeled 'A' (Group I: actual LPLT consisted of 5 minutes, 3 J total dose + exercise; 30 patients), 'B' (Group II: actual LPLT consisted of 3 minutes, 2 J total dose + exercise; 30 patients), and 'C' (Group III: placebo laser group + exercise; 30 patients). All patients received a total of 10 treatments, and exercise therapy program was continued during study (14 weeks). Subjects, physician, and data analysts were unaware of the code for active or placebo laser until the data analysis was complete. All patients were evaluated with respect to pain, degree of active knee flexion, duration of morning stiffness, painless walking distance and duration, and the Western Ontario and Mc Master Universities Osteoarthritis Index (WOMAC) at week 0, 6, 10, and 14. RESULTS: Statistically significant improvements were indicated in respect to all parameters such as pain, function, and quality of life (QoL) measures in the post-therapy period compared to pre-therapy in both active laser groups ($P < 0.01$). Improvements in all parameters of the Group I and in parameters, such as pain and WOMAC of the Group II, were more statistically significant when compared with placebo laser group ($P < 0.05$). CONCLUSIONS: Our study demonstrated that applications of LPLT in different dose and duration have not affected results and both therapy regimes were a safe and effective method in treatment of knee OA.

Lasers Surg Med 2003 33(5) 330-8

http://www.ncbi.nlm.nih.gov/pubmed/?term=14677160

# Low level laser therapy (Classes I, II and III) for treating osteoarthritis.

Brosseau L, Welch V, Wells G, deBie R, Gam A, Harman K, Morin M, Shea B, Tugwell P

School of Rehabilitation Sciences, University of Ottawa, 451 Smyth Road, Ottawa, Ontario, Canada, K1H 8M5. lbrosseau@uottawa.ca

BACKGROUND: Osteoarthritis (OA) affects a large proportion of the population. Low Level Laser Therapy (LLLT) is a light source that generates extremely pure light, of a single wavelength. The effect is not thermal, but rather related to photochemical reactions in the cells. LLLT was introduced as an alternative non-invasive treatment for OA about 10 years ago, but its effectiveness is still controversial. OBJECTIVES: To assess the effectiveness of LLLT in the treatment of OA. SEARCH STRATEGY: We searched MEDLINE, EMBASE, the Cochrane Musculoskeletal registry, the registry of the Rehabilitation and Related Therapies field and the Cochrane Controlled Trials Register up to December 31, 2002. SELECTION CRITERIA: Following an a priori protocol, only controlled clinical trials of LLLT for the treatment of patients with a clinical diagnosis of OA were eligible. Abstracts were excluded unless further data could be obtained from the authors. DATA COLLECTION AND ANALYSIS: Two reviewers independently selected trials and abstracted data using predetermined forms. Heterogeneity was tested with Cochran's Q test. A fixed effects model was used throughout for continuous variables, except where heterogeneity existed, in which case, a random effects model was used. Results were analyzed as weighted mean differences (WMD) with 95% confidence intervals (CI), where the difference between the treated and control groups was weighted by the inverse of the variance. Standardized mean differences (SMD) were calculated by dividing the difference between treated and control by the baseline variance. SMD were used when different scales were used to measure the same concept (e.g. pain). Dichotomous outcomes were analyzed with odds ratios. MAIN RESULTS: Five trials were included, with 112 patients randomized to laser, 85 patients to placebo laser. Treatment duration ranged from 4 to 10 weeks. Pain was assessed by four trials. The pooled estimate (random effects) of three trials showed no statistically different effect on pain measured using a scale (SMD: -0.2, 95% CI: -1.0, +0.6), but there was statistically significant heterogeneity (p>0,05). Two of the trials showed no effect and one demonstrated very beneficial effects with laser. In another trial, with no scale-based pain outcome, significantly more patients reported pain relief (yes/no) with laser with an odds ratio of 0.05, (95% CI: 0.0 to 1.56). Other outcomes of joint tenderness, joint mobility and strength were not significant. REVIEWER'S CONCLUSIONS: For OA, the results are conflicting in different studies and may depend on the method of application and other features of the LLLT application. Clinicians and researchers should consistently report the characteristics of the LLLT device and the application techniques used. New trials on LLLT should make use of standardized, validated outcomes. Despite some positive findings, this meta-analysis lacked data on how LLLT effectiveness is affected by four important factors: wavelength, treatment duration of LLLT, dosage and site of application over nerves instead of joints. There is clearly a need to investigate the effects of these factors on LLLT effectiveness for OA in randomized controlled clinical trials.

Cochrane Database Syst Rev 2003 -2 CD002046

http://www.ncbi.nlm.nih.gov/pubmed/?term=12804422

# A systematic review of low level laser therapy with location-specific doses for pain from chronic joint disorders.

Bjordal JM, Couppe C, Chow RT, Tuner J, Ljunggren EA

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We investigated if low level laser therapy (LLLT) of the joint capsule can reduce pain in chronic joint disorders. A literature search identified 88 randomised controlled trials, of which 20 trials included patients with chronic joint disorders. Six trials were excluded for not irradiating the joint capsule. Three trials used doses lower than a dose range nominated a priori for reducing inflammation in the joint capsule. These trials found no significant difference between active and placebo treatments. The remaining 11 trials including 565 patients were of acceptable methodological quality with an average PEDro score of 6.9 (range 5-9). In these trials, LLLT within the suggested dose range was administered to the knee, temporomandibular or zygapophyseal joints. The results showed a mean weighted difference in change of pain on VAS of 29.8 mm (95% CI, 18.9 to 40.7) in favour of the active LLLT groups. Global health status improved for more patients in the active LLLT groups ( relative risk of 0.52; 95% CI 0.36 to 0.76). Low level laser therapy with the suggested dose range significantly reduces pain and improves health status in chronic joint disorders, but the heterogeneity in patient samples, treatment procedures and trial design calls for cautious interpretation of the results.

Aust J Physiother 2003 49(2) 107-16

http://www.ncbi.nlm.nih.gov/pubmed/?term=12775206

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

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

Clin Rheumatol 2001 20(3) 181-4

http://www.ncbi.nlm.nih.gov/pubmed/?term=11434469

# Low level laser therapy for osteoarthritis and rheumatoid arthritis: a metaanalysis.

Brosseau L, Welch V, Wells G, Tugwell P, de Bie R, Gam A, Harman K, Shea B, Morin M

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OBJECTIVE: Osteoarthritis (OA) and rheumatoid arthritis (RA) affect a large proportion of the population. Low level laser therapy (LLLT) was introduced as an alternative noninvasive treatment for RA and OA about 10 years ago, but its effectiveness is still controversial. We assessed the effectiveness of LLLT in the treatment of RA and OA. METHODS: A systematic review was conducted, following an a priori protocol, according to the methods recommended by the Cochrane Collaboration. Trials were identified by a literature search of Medline, Embase, and the Cochrane Controlled Trials Register. Only randomized controlled trials of LLLT for the treatment of patients with a clinical diagnosis of RA or OA were eligible. Thirteen trials were included, with 212 patients randomized to laser and 174 patients to placebo laser, and 68 patients received active laser on one hand and placebo on the opposite hand. Treatment duration ranged from 4 to 10 weeks. Followup was reported by only 2 trials for up to 3 months. RESULTS: In patients with RA, relative to a separate control group, LLLT reduced pain by 70% relative to placebo and reduced morning stiffness by 27.5 min (95% CI -52.0 to -2.9), and increased tip to palm flexibility by 1.3 cm (95% CI -1.7 to -0.8). Other outcomes such as functional assessment, range of motion, and local swelling were not different between groups. There were no significant differences between subgroups based on LLLT dosage, wavelength, site of application, or treatment length. In RA, relative to a control group using the opposite hand, there was no difference between control and treatment hand, but all hands were improved in terms of pain relief and disease activity. For OA, a total of 197 patients were randomized. Pain was assessed by 3 trials. The pooled estimate (random effects) showed no effect on pain (standardized mean difference -0.2, 95% CI -1.0 to +0.6), but there was statistically significant heterogeneity ($p > 0.05$). Other outcomes of joint tenderness, joint mobility, and strength were not significant. CONCLUSION: LLLT should be considered for short term relief of pain and morning stiffness in RA, particularly since it has few side effects. For OA, the results are conflicting in different studies and may depend on the method of application and other features of the LLLT. Clinicians and researchers should consistently report the characteristics of the LLLT device and the application techniques. New trials on LLLT should make use of standardized, validated outcomes. Despite some positive findings, this metaanalysis lacked data on how effectiveness of LLLT is affected by 4 factors: wavelength, treatment duration of LLLT, dosage, and site of application over nerves instead of joints. There is a need to investigate the effects of these factors on effectiveness of LLLT for RA and OA in randomized controlled clinical trials.

J Rheumatol 2000 Aug 27(8) 1961-9

http://www.ncbi.nlm.nih.gov/pubmed/?term=10955339

# Low level laser therapy (classes I, II and III) for the treatment of osteoarthritis.

Brosseau L, Welch V, Wells G, deBie R, Gam A, Harman K, Morin M, Shea B, Tugwell P

School of Rehabilitation Sciences, Faculty of Health Sciences, University of Ottawa, 451 Smyth Road, Ottawa, Ontario, Canada, K1H-8M5. lbrossea@uottawa.ca

BACKGROUND: Osteoarthritis (OA) affects a large proportion of the population. Low Level Laser Therapy (LLLT) is a light source that generates extremely pure light, of a single wavelength. The effect is not thermal, but rather related to photochemical reactions in the cells. LLLT was introduced as an alternative non-invasive treatment for OA about 10 years ago, but its effectiveness is still controversial. OBJECTIVES: To assess the effectiveness of LLLT in the treatment of OA. SEARCH STRATEGY: We searched MEDLINE, EMBASE, the Cochrane Musculoskeletal registry, the registry of the Rehabilitation and Related Thereapies field and the Cochrane Controlled Trials Register up to January 30, 2000. SELECTION CRITERIA: Following an a priori protocol, only controlled clinical trials of LLLT for the treatment of patients with a clinical diagnosis of OA were eligible. Abstracts were excluded unless further data could be obtained from the authors. DATA COLLECTION AND ANALYSIS: Two reviewers independently selected trials and abstracted data using predetermined forms. Heterogeneity was tested with Cochran's Q test. A fixed effects model was used throughout for continuous variables, except where heterogeneity existed, in which case, a random effects model was used. Results were analyzed as weighted mean differences (WMD) with 95% confidence intervals (CI), where the difference between the treated and control groups was weighted by the inverse of the variance. Standardized mean differences (SMD) were calculated by dividing the difference between treated and control by the baseline variance. SMD were used when different scales were used to measure the same concept (e.g. pain). Dichotomous outcomes were analyzed with odds ratios. MAIN RESULTS: Five trials were included, with 112 patients randomized to laser, 85 patients to placebo laser. Treatment duration ranged from 4 to 10 weeks. Pain was assessed by four trials. The pooled estimate (random effects) of three trials showed no effect on pain measured using a scale (SMD: -0.2, 95% CI: -1.0, +0.6), but there was statistically significant heterogeneity (p>0,05). Two of the trials showed no effect and one demonstrated very beneficial effects with laser. In another trial, with no scale-based pain outcome, significantly more patients reported pain relief (yes/no) with laser with an odds ratio of 0.05, (95% CI: 0.0 to 1.56). Other outcomes of joint tenderness, joint mobility and strength were not significant. REVIEWER'S CONCLUSIONS: For OA, the results are conflicting in different studies and may depend on the method of application and other features of the LLLT application. Clinicians and researchers should consistently report the characteristics of the LLLT device and the application techniques used. New trials on LLLT should make use of standardized, validated outcomes. Despite some positive findings, this meta-analysis lacked data on how LLLT effectiveness is affected by four important factors: wavelength, treatment duration of LLLT, dosage and site of application over nerves instead of joints. There is clearly a need to investigate the effects of these factors on LLLT effectiveness for OA in randomized controlled clinical trials.

Cochrane Database Syst Rev 2000 -2 CD002046

http://www.ncbi.nlm.nih.gov/pubmed/?term=10796460

# Clinical efficacy of low power laser therapy in osteoarthritis.

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BACKGROUND AND PURPOSE: Of the various physical interventions used to relieve the symptoms of osteoarthritis (OA), a common degenerative joint disease causing considerable pain and disability, low power laser therapy has been reported to be extremely successful in Russia and Eastern Europe. METHOD: Although the overall number of studies was small, this literature review and analysis highlights the relevant controlled clinical trials and related basic research in English-language publications. This review indicates that, despite their shortcomings, the six studies analysed did report post-treatment improvements in a variety of osteoarthritic problems, including pain, mobility, tenderness and function, with few adverse effects. Possible mechanisms documented for the observed results included peripheral nerve stimulation, resolution of inflammation, enhanced chondrocyte proliferation and increased matrix synthesis. CONCLUSION: Not all studies were affirmative and few detailed how reliable their measurements were. Clearly, much more work is needed in this area.

Physiother Res Int 1999 4(2) 141-57

http://www.ncbi.nlm.nih.gov/pubmed/?term=10444763

# Effect of low-level laser therapy (LLLT) on viscoelasticity of the contracted knee joint: comparison with whirlpool treatment in rats.

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BACKGROUND AND OBJECTIVE: The purpose of this study was to compare the effect of Low-Level Laser Therapy (LLLT) with sham and whirlpool treatment on the contracted knee joint in rat. STUDY DESIGN/MATERIALS AND METHODS: Forty-eight Wistar rats were operated on to immobilize knee joint, and 1 week after operation they were randomly assigned to four treatment groups: laser 40 mW (3.9 W/cm2), laser 60 mW (5.8 W/cm2), whirlpool (42 degrees C), and sham laser. Tunable Ga-Al-As semiconductor (810 nm) laser was used for another 2 weeks of treatment. Removing and preparing bilateral hind legs, degree of knee contracture was assessed by measuring the knee flexion angle, weight of the gastrocnemius muscle, and periarticular connective tissue viscoelasticity measuring phase-lag and stiffness. RESULTS AND CONCLUSION: Laser irradiation showed no significant changes except the phase-lag of laser 60 mW. Under the conditions of this study, LLLT stimulation did not provide a significant effect for minimizing the degree of experimental joint contracture over whirlpool treatment.

Lasers Surg Med 1998 22(2) 81-5

http://www.ncbi.nlm.nih.gov/pubmed/?term=9484700

# Laser's effect on bone and cartilage change induced by joint immobilization: an experiment with animal model.

Akai M, Usuba M, Maeshima T, Shirasaki Y, Yasuoka S

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OBJECTIVE: Influence of low-level (810 nm, Ga-Al-As semiconductor) laser on bone and cartilage during joint immobilization was examined with rats' knee model. MATERIALS AND METHODS: The hind limbs of 42 young Wistar rats were operated on in order to immobilize the knee joint. One week after operation they were assigned to three groups; irradiance 3.9 W/cm2, 5.8 W/cm2, and sham treatment. After 6 times of treatment for another 2 weeks both hind legs were prepared for 1) indentation of the articular surface of the knee (stiffness and loss tangent), and for 2) dual energy X-ray absorptiometry (bone mineral density) of the focused regions. RESULTS AND CONCLUSIONS: The indentation test revealed preservation of articular cartilage stiffness with 3.9 and 5.8 W/cm2 therapy. Soft laser treatment has a possibility for prevention of biomechanical changes by immobilization.

Lasers Surg Med 1997 21(5) 480-4

http://www.ncbi.nlm.nih.gov/pubmed/?term=9365959

# Efficacy of arthroscopic surgery and midlaser treatments for chronic temporomandibular joint articular disc derangement following motor vehicle accident.

McNamara DC, Rosenberg I, Jackson PA, Hogben J

Plastic Surgery and Maxillofacial Unit, Royal Perth Hospital.

As a result of motor vehicle accident soft-tissue injury, temporomandibular joint articular disc derangement may develop and persist despite symptomatic treatment and medication. This study reports the effectiveness of management directed at controlling the TMJ and masticatory neuromuscular pain dysfunction with a TMJ/interocclusal stabilization appliance, specific biofeedback and ultrasound therapy. Following these conservative measures residual articular disc derangement was present in some subjects who were offered arthroscopic surgery and infrared midlaser with TMJ/occlusal stabilization. Twenty subjects with residual disc derangement were randomly selected into two groups with and without arthroscopic surgery, and analyses of variance made before treatment, 12 months after conservative procedures, 3 months following arthroscopic surgery and midlaser therapy and 3 years since commencement of management. Dependent variables compared were pain-discomfort, Clinical Dysfunction Index, articular disc derangement and maximal voluntary jaw opening. Conservative management alone provided significant reduction of pain-discomfort and clinical dysfunction, while arthroscopic surgery resulted in significant reduction in articular disc derangement. The midlaser with TMJ/occlusal stabilization maintained significant improvement in the variables ($p < 0.01$) for both groups. The common articular deviations in form found at arthroscopy were soft tissue alteration with hyperaemia, synovitis, synovial membrane and posterior attachment folding with connective tissue hyperplasia, and disc displacement with fibrous adhesions. The Global Status Score of pain behaviour compared with residual function, confirmed the presence of greater pain before treatment commenced.

Aust Dent J 1996 Dec 41(6) 377-87

http://www.ncbi.nlm.nih.gov/pubmed/?term=9008994

# Clinical comparative study of microcurrent electrical stimulation to mid-laser and placebo treatment in degenerative joint disease of the temporomandibular joint.

Bertolucci LE, Grey T

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Mid-laser and microcurrent stimulation (MENS) have been found to be effective in the reduction of painful temporomandibular joints (TMJ) with internal derangement. There was significant improvement in mobility with the reduction of pain. Mid-laser was superior to MENS in its application and effect, and both were significantly better than the placebo treatment.

Cranio 1995 Apr 13(2) 116-20

http://www.ncbi.nlm.nih.gov/pubmed/?term=8697497

# Physiotherapy in the treatment of temporomandibular joint disorders: a comparative study of four treatment methods.

Gray RJ, Quayle AA, Hall CA, Schofield MA

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Temporomandibular joint pain dysfunction syndrome (TMJPDS) comprises of a constellation of signs and symptoms including joint tenderness and pain on function, restricted jaw movement, clicking, jaw locking and tenderness in the muscles of mastication. Headache may also be a feature. Physiotherapy is commonly employed in the treatment of this condition but there is little published material reporting the relative efficacy of the different types of treatment currently available. Further, no attempt seems to have been made to compare the costs of physiotherapy with other forms of treatment of this disorder such as occlusal splint therapy. This paper reports a comparative evaluation of four different physiotherapy treatments and placebo in the management of TMJPDS and comments on their cost benefit aspects compared with that of splint therapy. The four methods of physiotherapy tested were short-wave diathermy, megapulse, ultrasound and soft laser. There was no statistically significant difference in success rate between any of the four tested (range 70.4-77.7%) although each individually was significantly better than placebo treatment. The time of improvement appeared to vary between the four methods.

Br Dent J 1994 Apr 9 176(7) 257-61

http://www.ncbi.nlm.nih.gov/pubmed/?term=8186034

# Low level laser therapy is ineffective in the management of rheumatoid arthritic finger joints.

Hall J, Clarke AK, Elvins DM, Ring EF

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Low level laser therapy (LLLT) is a relatively new and increasingly popular form of electrotherapy. It is used by physiotherapists in the treatment of a wide variety of conditions including RA despite the lack of scientific evidence to support its efficacy. A randomized, double-blind and placebo-controlled study was conducted to evaluate the efficacy of LLLT. The patient sample consisted of chronic RA patients with active finger joint synovitis. Forty RA patients with involvement of some or all of MCP or PIP joints were recruited. Following random allocation they received either active or placebo laser three times a week for 4 weeks. Measurements were taken prior to entry, after the treatment, 1 month and 3 months at follow-up. The groups were well matched in terms of age, sex, disease duration and severity. Few significant differences were noted in grip strength, duration of morning stiffness, joint tenderness, temperature of inflamed joints, range of movement or pain either within or between groups. Using these irradiation parameters the efficacy of LLLT is ineffective.

Br J Rheumatol 1994 Feb 33(2) 142-7

http://www.ncbi.nlm.nih.gov/pubmed/?term=8162479

# Published trials of nonmedicinal and noninvasive therapies for hip and knee osteoarthritis.

Puett DW, Griffin MR

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PURPOSE: To review the efficacy of nonmedicinal, noninvasive therapies in hip and knee osteoarthritis. DATA SOURCES: Search of English-language literature from 1966 through 1993 using MEDLINE by cross-referencing "osteoarthritis" (therapy subheadings) with "controlled trial," "comparative study," or "trial(s)." STUDY SELECTION: Fifteen controlled trials of diathermy (deep heat), exercise, acupuncture, transcutaneous electrical nerve stimulation, topically applied capsaicin, low-energy laser, and pulsed electromagnetic fields were found. No experimental studies of superficial heat and cold, orthotic devices, vibration, or weight loss were identified. RESULTS: Exercise reduces pain and improves function in patients with osteoarthritis of the knee. No support exists in the literature for pre-exercise ultrasound treatment. Single, well-designed studies suggest that topically applied capsaicin and laser treatment reduce pain associated with knee osteoarthritis. Data on the other three therapies were sparse (transcutaneous electrical nerve stimulation, pulsed electromagnetic fields) or inconsistent (acupuncture). CONCLUSIONS: More data are needed to determine the optimal exercise regimen for treating knee osteoarthritis and to evaluate the role of topical capsaicin, laser therapy, acupuncture, transcutaneous electrical nerve stimulation, and pulsed electromagnetic fields. No data specifically address the role of any of these therapies in hip osteoarthritis.

Ann Intern Med 1994 Jul 15 121(2) 133-40

http://www.ncbi.nlm.nih.gov/pubmed/?term=8017727

# Clinical analysis of mid-laser versus placebo treatment of arthralgic TMJ degenerative joints.

Bertolucci LE, Grey T

Laser therapy has been found effective in the management of pain associated with rheumatoid and degenerative joint arthritis and disease. The efficacy of mid-laser therapy has been tested specifically on patients with degenerative joint disease (DJD) involving the temporomandibular joint (TMJ). The following controlled clinical study was designed to test the efficacy of mid-laser therapy to placebo therapy in the reduction of pain associated with TMJ disorders specific to arthralgic DJD.

Cranio 1995 Jan 13(1) 38620

http://www.ncbi.nlm.nih.gov/pubmed/?term=7585998

# [Treatment of the inflammatory and degenerative-dystrophic diseases of the temporomandibular joint]

Aleksandrov NM, Ivanov AS, Agov BS, Tsykin DB, Makeeva NS

Voen Med Zh 1982 Dec -12 42-5

# [Use of laser therapy in nonspecific inflammatory processes of the temporomandibular joint]

Kats AG, Bakin TV, Belostotskaia IM, Zakharova LM, Kushnir II

Stomatologiia (Mosk) 1983 Sep-Oct 62(5) 42-5

http://www.ncbi.nlm.nih.gov/pubmed/?term=6579755

# [Effect of helium-neon laser radiation on the course of temporomandibular joint arthritis and arthrosis]

Ivanov AS, Sokolovskii VV, Agov BS, Goncharova LL, Dzhangulova NE

Stomatologiia (Mosk) 1985 Jan-Feb 64(1) 81-2

http://www.ncbi.nlm.nih.gov/pubmed/?term=3857757

# [Experience in the laser therapy of arthritis and arthrosis of the temporomandibular joint]

Ivanov, AS

Voen Med Zh 1986 Sep -9 48-50

# Improvement of pain and disability in elderly patients with degenerative osteoarthritis of the knee treated with narrow-band light therapy.

Stelian J, Gil I, Habot B, Rosenthal M, Abramovici I, Kutok N, Khahil A

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OBJECTIVE: To evaluate the effects of low-power light therapy on pain and disability in elderly patients with degenerative osteoarthritis of the knee. DESIGN: Partially double-blinded, fully randomized trial comparing red, infrared, and placebo light emitters. PATIENTS: Fifty patients with degenerative osteoarthritis of both knees were randomly assigned to three treatment groups: red (15 patients), infrared (18 patients), and placebo (17 patients). Infrared and placebo emitters were double-blinded. INTERVENTIONS: Self-applied treatment to both sides of the knee for 15 minutes twice a day for 10 days. MAIN OUTCOME MEASURES: Short-Form McGill Pain Questionnaire, Present Pain Intensity, and Visual Analogue Scale for pain and Disability Index Questionnaire for disability were used. We evaluated pain and disability before and on the tenth day of therapy. The period from the end of the treatment until the patient's request to be retreated was summed up 1 year after the trial. RESULTS: Pain and disability before treatment did not show statistically significant differences between the three groups. Pain reduction in the red and infrared groups after the treatment was more than 50% in all scoring methods (P less than 0.05). There was no significant pain improvement in the placebo group. We observed significant functional improvement in red- and infrared-treated groups (p less than 0.05), but not in the placebo group. The period from the end of treatment until the patients required treatment was longer for red and infrared groups than for the placebo group (4.2 +/- 3.0, 6.1 +/- 3.2, and 0.53 +/- 0.62 months, for red, infrared, and placebo, respectively). CONCLUSIONS: Low-power light therapy is effective in relieving pain and disability in degenerative osteoarthritis of the knee.

J Am Geriatr Soc 1992 Jan 40(1) 38525

http://www.ncbi.nlm.nih.gov/pubmed/?term=1727843

# A report of 22 cases of temporomandibular joint dysfunction syndrome treated with acupuncture and laser radiation.

Wang, K

Department of Acu-physiotherapy, Jiangshan People's Hospital, Zhejiang, China.

J Tradit Chin Med 1992 Jun 12(2) 116-8

http://www.ncbi.nlm.nih.gov/pubmed/?term=1495332

# LOW LEVEL LASER THERAPY IS INEFFECTIVE IN THE MANAGEMENT OF RHEUMATOID ARTHRITIC FINGER JOINTS

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SUMMARY

Low level laser therapy (LLLT) is a relatively new and increasingly popular form of electrotherapy. It is used by physio-therapists in the treatment of a wide variety of conditions including RA despite the lack of scientific evidence to support its efficacy.
A randomized, double-blind and placebo-controlled study was conducted to evaluate the efficacy of LLLT. The patient sample consisted of chronic RA patients with active finger joint synovitis.
Forty RA patients with involvement of some or all of MCP or PIP joints were recruited. Following random allocation they received either active or placebo laser three times a week for 4 weeks. Measurements were taken prior to entry, after the treatment, I month and 3 months at follow-up. The groups were well matched in terms of age, sex, disease duration and severity. Few significant differences were noted in grip strength, duration of morning stiffness, joint tenderness, temperature of inflamed joints, range of movement or pain either within or between groups. Using these irradiation parameters the efficacy of LLLT is ineffective.

KEY WORDS: Low level laser therapy; Rheumatoid arthritis; Physiotherapy.

PHYSIOTHERAPY in RA is generally accepted as a useful adjunct in the overall management and a considerable number of treatments are advocated [1]. One of these, low level laser therapy (LLLT), a term introduced by Ohshiro and Calderhead [2], has recently been introduced into physiotherapy departments.
Reports in the literature suggest that LLLT may be effective for a wide variety of disorders including wound healing [3], soft tissue lesions [4, 5], pain relief [6, 7] and rheumatic complaints including pain and inflammation. The findings from studies conducted on patients with RA are contradictory and the controversy is heightened when differences in machine and treatment specifications and injudicious study design are considered [8-14]. Furthermore it is often difficult to determine the clinical value despite some impressive statistical significance levels.
Despite the increasing popularity and use of LLLT the mechanism of action remains unknown. The low power outputs used in these lasers do not produce appreciable temperature changes in the treated tissue. Thus any benefits must be attributed to a non-thermal process resulting from interaction with, or absorption in specific tissues [15]. It is this photochemical effect, dependent on wavelength and frequency, which is considered to cause biostimulatory modulation. Palmgren et al. [9] speculates that stimulation of macrophages, together with laser induced excitation of inflamed synovial cells may result in removal of immune complexes. Herbert et al. [16] note that swollen joints are

# Low-energy Helium Neon Laser Treatment of Thumb Osteoarthritis

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Eighty-one patients with symptomatic osteoarthritis of the thumb took part in a blinded, controlled study to assess the effectiveness of 0.9mw continuous wave HeNe laser treatment. The subjects were randomly placed in

either a control group or a treatment group. In each group the carpometacarpal (CMC), metacarpophalangeal (MCP), and interphalangeal (IP) joints of the most symptomatic thumb were "treated" with 15 see irradiations at four equally spaced intervals around each joint three times a week for three weeks. The same protocol was used for both groups except that a hidden switch on the laser was placed in the "on" position for the treated group and in the "off" position for the control group. Although the laser-treated group noted slightly lessened tenderness of the treated MCP and IP joints ($p<O.Ol$ and 0.05, respectively, Wilcoxon signed-rank test), and a small increase in three-ringer chuck pinch strength ($p<0.04$, paired 1-test), changes in ROM, pain, joint tenderness, grip and pinch strength, activity level, and medication use, did not significantly differ between the groups. Adverse effects were rare (one in each group), minimal, and subjective. We conclude that HeNe laser irradiation at 0.9mw is safe, but that it is not an effective treatment of osteourthritis of the thumb.

KEY WORDS: Laserv,- Osteoartliritis,, Treatnierit

Low-energy lasers are now widely used to treat a variety of musculoskeletal conditions. Although controlled evaluation of these treatments is limited, quite enthusiastic claims are made for pain, arthritic, and wound healing applications.4.-5.19 Since these devices are safe, easy to use, and relatively inexpensive, we decided to evaluate one of the commonly used lasers in a controlled, blinded study. In particular, we studied osteoar-
thritis of the thumbs because (I) it is a common clinical prob-
lem and (2) these superficial joints are as accessible as any to percutaneous treatment.

## METHOD

After approval of the research protocol by the Institutional Review Board of our institution, adults between the ages of 23 and 75 with symptomatic osteoarthritis of the thumb were recruited via advertisements in local newsletters. Volunteers were invited to participate in the study if a nondegenerative source of their arthritis could not be found in their interview, examination, or medical records. It was also required that each volunteer (1) had been on the same medication schedule for at least two months, (2) had a stable level of activity, (3) was not pregnant, (4) had no history of light sensitivity, and (5) would be available for treatment three times a week for three consecutive weeks. Subjects were assigned with a random numbers table into a treatment group (Group A) or a control group (Group B). Treatment for both groups was identical: 15sec of "irradia-
tion" at four points at approximately 90' intervals around the carpometacarpal (CMC), metacarpophalangeal (MCP). and in-
terph,,tlangeal (IP) joints of their most symptomatic thumb. In Group A, each subject was irradiated with a 0.9niw continuous wave lieliuni-Neon (fiene) (632.8nm) laser 'a via a fiberoptic delivery system.

# Low level laser therapy (LLLT) for patients with sacroiliac joint pain

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Abstract
Background and Aims: Sacroiliac joint pain not associated with a major etiological factor is a common problem seen in the orthopedic clinical setting, but diagnosis is difficult because of the anatomical area and thus it is sometimes difficult to effect a complete cure. Low level laser therapy (LLLT) has been well-reported as having efficacy in difficult pain types, so the following preliminary study was designed to assess the efficacy of LLLT for sacroiliac pain.
Materials and Methods: Nine patients participated, 4 males and 5 females, average age of 50.4 yrs, who attended the outpatient department with sacroiliac pain. The usual major disorders were ruled out. Pain was assessed subjectively pre-and post-LLLT on a visual analog scale, and trunk range of motion was examined with the flexion test to obtain the pre- and post-treatment finger to floor distance (FFD). The LLLT system used was an 830 nm CW diode laser, 1000 mW, 30 sec/point (20 J/cm2) applied on the bilateral tender points twice/week for 5 weeks. Baseline and final assessment values (after the final treatment session) were compared with the Wilcoxon signed rank test (nonparametric score).
Results: All patients completed the study. Eight of the 9 patients showed significant pain improvement and 6 demonstrated significantly increased trunk mobility ($P < 0.05$ for both).
Conclusions: LLLT was effective for sacroiliac pain, and this may be due to improvement of the blood circulation of the strong ligaments which support the sacroiliac joint, activation of the descending inhibitory pathway, and the additional removal of irregularities of the sacroiliac joint articular surfaces. Further larger-scale studies are warranted.

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