

Compiled by:  
Karl R.O.S. Johnson, D.C.  
Johnson Chiropractic Neurology & Nutrition  
51735 Van Dyke Avenue  
Shelby Township, MI 48316  
(586) 731-8840



## Peer-Reviewed Research Demonstrating the Effectiveness of Low Level Laser Therapy

(Updated March 9, 2014)

### **The efficacy of low-power lasers in tissue repair and pain control: a meta-analysis study.**

CONCLUSION: These findings mandate the conclusion that laser phototherapy is a highly effective therapeutic armamentarium for tissue repair and pain relief.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15345176&query\\_hl=10&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15345176&query_hl=10&itool=pubmed_DocSum)

### **A meta-analysis of the efficacy of laser phototherapy on pain relief.**

CONCLUSION: Laser phototherapy effectively relieves pain of various etiologies; making it a valuable addition to contemporary pain management armamentarium.

<http://www.ncbi.nlm.nih.gov/pubmed/20842007>

### **A meta-analysis of the efficacy of phototherapy in tissue repair.**

CONCLUSION: These findings indicate that phototherapy is a highly effective form of treatment for tissue repair, with stronger supporting evidence resulting from experimental animal studies than human studies

<http://www.ncbi.nlm.nih.gov/pubmed/19698019>

### **Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomized placebo or active-treatment controlled trials**

INTERPRETATION: We show that LLLT reduces pain immediately after treatment in acute neck pain and up to 22 weeks after completion of treatment in patients with chronic neck pain.

<http://www.ncbi.nlm.nih.gov/pubmed/19913903>

**Efficacy of 904 nm gallium arsenide low-level laser therapy in the management of chronic myofascial pain in the neck: a double-blind and randomize-controlled trial.**

CONCLUSION: This study revealed that short-period application of LLLT is effective in pain relief and in the improvement of functional ability and QoL in patients with MPS. Copyright 2004 Wiley-Liss, Inc.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15389743&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15389743&query_hl=18&itool=pubmed_DocSum)

**Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomized placebo or active-treatment controlled trials.**

CONCLUSION: We show that LLLT reduces pain immediately after treatment in acute neck pain and up to 22 weeks after completion of treatment in patients with chronic neck pain.

[http://www.ncbi.nlm.nih.gov/pubmed/19913903?itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel\\_Pubmed\\_RVDocSum&ordinalpos=27](http://www.ncbi.nlm.nih.gov/pubmed/19913903?itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel_Pubmed_RVDocSum&ordinalpos=27)

**Evaluation of low intensity laser therapy in myofascial pain syndrome**

CONCLUSION: Analyzing the analgesic effect of LILT suggests it as a possible treatment of MPS and may help to establish a clinical protocol for this therapeutic modality.

[http://www.ncbi.nlm.nih.gov/pubmed/19891258?itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel\\_Pubmed\\_RVDocSum&ordinalpos=34](http://www.ncbi.nlm.nih.gov/pubmed/19891258?itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel_Pubmed_RVDocSum&ordinalpos=34)

**Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomized placebo or active-treatment controlled trials.**

CONCLUSION: We show that LLLT reduces pain immediately after treatment in acute neck pain and up to 22 weeks after completion of treatment in patients with chronic neck pain.

[http://www.ncbi.nlm.nih.gov/pubmed/19913903?itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel\\_Pubmed\\_RVDocSum&ordinalpos=14](http://www.ncbi.nlm.nih.gov/pubmed/19913903?itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel_Pubmed_RVDocSum&ordinalpos=14)

**Low-level laser therapy for acute neck pain with radiculopathy: a double-blind placebo-controlled randomized study**

**CONCLUSION:** LLLT gave more effective short-term relief of arm pain and increased range of neck extension in patients with acute neck pain with radiculopathy in comparison to the placebo procedure.

<http://www.ncbi.nlm.nih.gov/pubmed/20704667>

**Acute Low Back Pain with Radiculopathy: A Double-Blind, Randomized, Placebo-Controlled Study.**

**CONCLUSION:** The results of this study show better improvement in acute LBP treated with LLLT used as additional therapy.

[http://www.ncbi.nlm.nih.gov/pubmed/20001318?itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=2](http://www.ncbi.nlm.nih.gov/pubmed/20001318?itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=2)

**Efficacy of low power laser therapy and exercise on pain and functions in chronic low back pain.**

**CONCLUSION:** Low power laser therapy seemed to be an effective method in reducing pain and functional disability in the therapy of chronic LBP.

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=12605431&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12605431&query_hl=18&itool=pubmed_DocSum)

**A practice-based study of patients with acute and chronic low back pain attending primary care and chiropractic physicians: two-week to 48-month follow-up.**

**CONCLUSION:** Study findings were consistent with systematic reviews of the efficacy of spinal manipulation for pain and disability in acute and chronic LBP. Patient choice and interdisciplinary referral should be prime considerations by physicians, policymakers, and third-party payers in identifying health services for patients with LBP.

[http://www.ncbi.nlm.nih.gov/pubmed/15129198?ordinalpos=31&itool=EntrezSystem2.PEntrez\\_Pubmed\\_Pubmed\\_ResultsPanel\\_Pubmed\\_DefaultReportPanel\\_Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/15129198?ordinalpos=31&itool=EntrezSystem2.PEntrez_Pubmed_Pubmed_ResultsPanel_Pubmed_DefaultReportPanel_Pubmed_RVDocSum)

**In chronic low back pain, low level laser therapy combined with exercise is more beneficial than exercise alone in the long term: a randomized trial.**

**CONCLUSION:** In chronic low back pain low level laser therapy combined with exercise is more beneficial than exercise alone in the long term.

[http://www.ncbi.nlm.nih.gov/pubmed/17725472?ordinalpos=2&itool=EntrezSystem2.PEntrez\\_Pubmed\\_Pubmed\\_ResultsPanel\\_Pubmed\\_DefaultReportPanel\\_Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17725472?ordinalpos=2&itool=EntrezSystem2.PEntrez_Pubmed_Pubmed_ResultsPanel_Pubmed_DefaultReportPanel_Pubmed_RVDocSum)

## **Comparison of 3 physical therapy modalities for acute pain in lumbar disc herniation measured by clinical evaluation and magnetic resonance imaging.**

**CONCLUSION:** This study showed that traction, ultrasound, and LPL therapies were all effective in the treatment of this group of patients with acute LDH. These results suggest that conservative measures such as traction, laser, and ultrasound treatments might have an important role in the treatment of acute LDH.

[http://www.ncbi.nlm.nih.gov/pubmed/18394495?ordinalpos=36&itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18394495?ordinalpos=36&itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_RVDocSum)

## **The effect of laser irradiation for nucleus pulposus: an experimental study.**

**CONCLUSION:** One of the mechanisms thought to be responsible for PLDD's effectiveness is a decrease in the chemical factors through protein alteration in the intervertebral disc by laser irradiation.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15845216&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15845216&query_hl=18&itool=pubmed_DocSum)

## **The Effect of Low-Level Laser Therapy on Trismus and Facial Swelling Following Surgical Extraction of a Lower Third Molar.**

**CONCLUSION:** Within the limitations of this study it can be concluded that LLLT can be beneficial for the reduction of postoperative trismus and swelling after third molar surgery.

[http://www.ncbi.nlm.nih.gov/pubmed/19196113?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/19196113?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

## **Laser technology in orthopedics: preliminary study on low power laser therapy to improve the bone-biomaterial interface.**

**CONCLUSION:** These preliminary positive results seem to support the hypothesis that LPL treatment can be considered a good tool to enhance the bone-implant interface in orthopedic surgery

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=11831596&query\\_hl=10&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=11831596&query_hl=10&itool=pubmed_DocSum)

## **Effect of laser therapy on attachment, proliferation and differentiation of human osteoblast-like cells cultured on titanium implant material.**

**CONCLUSION:** These results showed that in response to LLLT, HOB cultured on titanium implant material had a tendency towards increased cellular attachment, proliferation, differentiation and production of TGF-

beta(1), indicating that in vitro LLLT can modulate the activity of cells and tissues surrounding implant material.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15621240&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15621240&query_hl=18&itool=pubmed_DocSum)

### **Laser therapy accelerates initial attachment and subsequent behavior of human oral fibroblasts cultured on titanium implant material. A scanning electron microscope and histomorphometric analysis.**

CONCLUSION: It is concluded that in vitro LLLT enhances the attachment and proliferation of human gingival fibroblasts on titanium implant material.

[http://www.ncbi.nlm.nih.gov/pubmed/15777326?ordinalpos=5&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/15777326?ordinalpos=5&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

### **The role of laser biostimulation in early post-surgery rehabilitation and its effect on wound healing.**

Results: Low energy infrared laser radiation had a beneficial effect on the covering of the scar with stratified squamous cornifying epithelium and intensified wound healing.

CONCLUSION: The gross and microscopic findings indicated a beneficial effect of laser stimulation on wound healing. These results underscore the utility of biostimulation lasers in the early post-operative period.

Physicomechanical investigations did not reveal an effect of infrared laser biostimulation on the breaking strength of the cutaneous scar.

<http://www.ncbi.nlm.nih.gov/pubmed/20203347>

### **Effects of Low-Level Laser Therapy on Pain and Scar Formation after Inguinal Herniation Surgery: A Randomized Controlled Single-Blind Study**

CONCLUSION: Infra-red LLLT (830 nm) applied after inguinal-hernia surgery was effective in preventing the formation of keloids. In addition, LLLT resulted in better scar appearance and quality 6 mo post surgery.

[http://www.ncbi.nlm.nih.gov/pubmed/19821701?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=62](http://www.ncbi.nlm.nih.gov/pubmed/19821701?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=62)

### **Low-level laser therapy for implants without initial stability**

CONCLUSION: In this study, low-level laser therapy promoted the osseointegration of implants with poor initial stability, particularly in the initial stages of bone healing.

[http://www.ncbi.nlm.nih.gov/pubmed/19860572?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=48](http://www.ncbi.nlm.nih.gov/pubmed/19860572?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=48)

## **The efficacy of laser therapy in wound repair: a meta-analysis of the literature.**

CONCLUSION: We conclude that laser therapy is an effective tool for promoting wound repair.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15315732&query\\_hl=10&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15315732&query_hl=10&itool=pubmed_DocSum)

## **The effect of low level laser irradiation on implant-tissue interaction. In vivo and in vitro studies.**

CONCLUSION: LLLT can promote bone healing and bone mineralization and thus may be clinically beneficial in promoting bone formation in skeletal defects. It may be also used as additional treatment for accelerating implant healing in bone. LLLT can modulate the primary steps in cellular attachment and growth on titanium surfaces. Multiple doses of LLLT can improve LLLT efficacy, accelerate the initial attachment and alter the behavior of human gingival fibroblasts cultured on titanium surfaces.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15906852&query\\_hl=10&itool=pubmed\\_docsu\\_m](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15906852&query_hl=10&itool=pubmed_docsu_m)

## **Low-level laser therapy (LLLT) efficacy in post-operative wounds.**

CONCLUSION: LLLR with wavelength of 904 nm to stimulate postoperative aseptic wounds (early scar) is efficient in both cases of cutting plaque.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15782037&query\\_hl=10&itool=pubmed\\_docsu\\_m](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15782037&query_hl=10&itool=pubmed_docsu_m)

## **Low Level Laser Therapy (LLLT) as an Effective Therapeutic Modality for Delayed Wound Healing.**

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16387711&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16387711&query_hl=18&itool=pubmed_DocSum)

## **Contribution of phototherapy to the treatment of episiotomies.**

CONCLUSION: The work demonstrated high healing effects with minimum secondary complications in the treatment of episiotomies using a therapeutic laser at an energy density of 2 J/cm<sup>2</sup>. The application of polarized light at an energy density of 5 J/cm<sup>2</sup> also exerted favorable therapeutic effects.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=12614558&query\\_hl=67&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12614558&query_hl=67&itool=pubmed_DocSum)

### **Efficacy of low level laser therapy in reducing postoperative pain after endodontic surgery-- a randomized double blind clinical study.**

CONCLUSION: Low level laser therapy can be beneficial for the reduction of postoperative pain.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=14758818&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=14758818&query_hl=18&itool=pubmed_DocSum)

### **Effect of low-level laser treatment on neurosensory deficits subsequent to sagittal split ramus osteotomy.**

CONCLUSION: In conclusion GaAlAs low-level laser treatment results in both a subjective and objective improvement in mechanical sensory perception in long-standing neurosensory deficit in the inferior alveolar nerve.

[http://www.ncbi.nlm.nih.gov/pubmed/8863301?ordinalpos=5&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/8863301?ordinalpos=5&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

### **Increased fibroblast proliferation induced by light emitting diode and low power laser irradiation.**

CONCLUSION: LED and LLL irradiation resulted in an increased fibroblast proliferation in vitro. This study therefore postulates possible stimulatory effects on wound healing in vivo at the applied dosimetric parameters.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=12928819&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12928819&query_hl=18&itool=pubmed_DocSum)

### **Wound healing of animal and human body sport and traffic accident injuries using low-level laser therapy treatment: a randomized clinical study of seventy-four patients with control group.**

CONCLUSION: In addition to accelerated wound healing, the main advantages of LLLT for postoperative sport- and traffic-related injuries include prevention of side effects of drugs, significantly accelerated functional recovery, earlier return to work, training and sport competition compared to the control group of patients, and cost benefit.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=11800105&query\\_hl=10&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=11800105&query_hl=10&itool=pubmed_DocSum)

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

CONCLUSION: LLLT at a dose of 5.4 J per point can reduce inflammation and pain in activated Achilles tendonitis. LLLT may therefore have potential in the management of diseases with an inflammatory component.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16371497&query\\_hl=29&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16371497&query_hl=29&itool=pubmed_docsum)

**Low Level Laser treatment of tendinopathy: A Systematic Review with Meta-analysis**

Conclusion: LLLT can potentially be effective in treating tendinopathy when recommended dosages are used. The 12 positive studies provide strong evidence that positive outcomes are associated with the use of current dosage recommendations for the treatment of tendinopathy.

[http://www.ncbi.nlm.nih.gov/pubmed/19708800?itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=90](http://www.ncbi.nlm.nih.gov/pubmed/19708800?itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=90)

**Low-Level Laser Therapy Facilitates Superficial Wound Healing in Humans: A Triple-Blind, Sham-Controlled Study.**

CONCLUSIONS: The LLLT resulted in enhanced healing as measured by wound contraction. The untreated wounds in subjects treated with LLLT contracted more than the wounds in the sham group, so LLLT may produce an indirect healing effect on surrounding tissues. These data indicate that LLLT is an effective modality to facilitate wound contraction of partial-thickness wounds.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15496990&query\\_hl=39&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15496990&query_hl=39&itool=pubmed_docsum)

**Effect of NASA light-emitting diode irradiation on wound healing.**

CONCLUSION: We believe that the use of NASA LED for light therapy alone, and in conjunction with hyperbaric oxygen, will greatly enhance the natural wound healing process, and more quickly return the patient to a preinjury/illness level of activity. This work is supported and managed through the NASA Marshall Space Flight Center-SBIR Program.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=11776448&query\\_hl=7&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=11776448&query_hl=7&itool=pubmed_docsum)

## **Carpal tunnel syndrome pain treated with low-level laser and microamperes transcutaneous electric nerve stimulation: A controlled study.**

**CONCLUSIONS:** This new, conservative treatment was effective in treating CTS pain; larger studies are recommended. Copyright 2002 by the American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=12098159&query\\_hl=29&itool=pubmed\\_docsu](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12098159&query_hl=29&itool=pubmed_docsu)  
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## **Treatment of carpal tunnel syndrome by low-level laser versus open carpal tunnel release.**

**CONCLUSION:** LLLT has proven to be an effective and noninvasive treatment modality for CTS especially for early and mild-to-moderate cases when pain is the main presenting symptom. However, surgery could be preserved for advanced and chronic cases. Refinement of laser tools and introduction of other wavelengths could make LLLT for CTS treatment a field for further investigations.

<http://www.ncbi.nlm.nih.gov/pubmed/17334675?ordinalpos=1&itool=Entre>  
zSystem2.PEntrez.Pubmed.Pubmed\_ResultsPanel.Pubmed\_DiscoveryPanel.  
Pubmed\_Discovery\_RA&linkpos=2&log\$=relatedarticles&logdbfrom=pub  
med

## **The effects of low level laser in clinical outcome and neurophysiological results of carpal tunnel syndrome.**

**CONCLUSIONS:** Laser therapy as a new conservative treatment is effective in treating CTS paresthesia and numbness and improves the subjects' power of hand grip and electrophysiological parameters.

<http://www.ncbi.nlm.nih.gov/pubmed/18754533?ordinalpos=8&itool=Entre>  
zSystem2.PEntrez.Pubmed.Pubmed\_ResultsPanel.Pubmed\_DefaultReportPa  
nel.Pubmed\_RVDocSum

## **Photobiomodulation of pain in carpal tunnel syndrome: review of seven laser therapy studies.**

Photoradiation is a promising new, conservative treatment for mild/moderate CTS cases (motor latency < 7 msec; needle EMG, normal). It is cost-effective compared to current treatments.

<http://www.ncbi.nlm.nih.gov/pubmed/16706688?ordinalpos=1&itool=Entre>  
zSystem2.PEntrez.Pubmed.Pubmed\_ResultsPanel.Pubmed\_DiscoveryPanel.  
Pubmed\_Discovery\_RA&linkpos=5&log\$=relatedreviews&logdbfrom=pub  
med

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

**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.

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=14677160&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=14677160&query_hl=18&itool=pubmed_DocSum)

## **The effect of low-level laser in knee osteoarthritis: a double-blind, randomized, placebo-controlled trial**

**CONCLUSION:** Our results show that LLLT reduces pain in KOA and improves microcirculation in the irradiated area.

[http://www.ncbi.nlm.nih.gov/pubmed/19530911?itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=145](http://www.ncbi.nlm.nih.gov/pubmed/19530911?itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=145)

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

**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.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15266461&query\\_hl=62&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15266461&query_hl=62&itool=pubmed_DocSum)

## **The effect of low-level laser in knee osteoarthritis: a double-blind, randomized, placebo-controlled trial**

**CONCLUSION:** Our results show that LLLT reduces pain in KOA and improves microcirculation in the irradiated area

<http://www.ncbi.nlm.nih.gov/pubmed/19530911>

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

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

[http://www.ncbi.nlm.nih.gov/pubmed/18341417?ordinalpos=34&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18341417?ordinalpos=34&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

### **Low-level laser therapy is an important tool to treat disorders of the maxillofacial region.**

**CONCLUSIONS:** These results confirm that LLLT is an effective tool and is beneficial for the treatment of many disorders of the maxillofacial region.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list\\_uids=9796491&query\\_hl=1&itool=pubmed\\_docs um](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=9796491&query_hl=1&itool=pubmed_docs um)

### **Low-level laser therapy in the management of disorders of the maxillofacial region.**

**CONCLUSIONS:** These preliminary results indicate that LLLT is an important tool and brings many benefits for the treatment of many disorders of the maxillofacial region.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list\\_uids=9612167&query\\_hl=1&itool=pubmed\\_docs um](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=9612167&query_hl=1&itool=pubmed_docs um)

### **Laser application effects on the bite strength of the masseter muscle, as an orofacial pain treatment.**

**CONCLUSIONS:** These results suggest that low-level laser application is an effective tool for the treatment of patients with orofacial pain.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16144479&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16144479&query_hl=18&itool=pubmed_DocSum)

### **Effectiveness of low-level laser therapy in temporomandibular disorder.**

**CONCLUSION:** Low-level laser therapy can be considered as an alternative physical modality in the management of temporomandibular disorder.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=12737331&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12737331&query_hl=18&itool=pubmed_DocSum)

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

**CONCLUSION:** The results suggest that LLLT (application of 10 J/cm<sup>2</sup> and 15 J/cm<sup>2</sup>) can be considered as a useful method for the treatment of TMD-related pain, especially long lasting pain.

[http://www.ncbi.nlm.nih.gov/pubmed/17803388?ordinalpos=164&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17803388?ordinalpos=164&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum)

### **Low intensity laser application in temporomandibular disorders: a phase I double-blind study.**

**Conclusion:** Results show that low intensity laser is an effective therapy for the pain control of subjects with TMD.

[http://www.ncbi.nlm.nih.gov/pubmed/17696035?ordinalpos=174&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17696035?ordinalpos=174&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum)

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

**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.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list\\_uids=16942435&query\\_hl=1&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16942435&query_hl=1&itool=pubmed_docsum)

### **Low intensity laser therapy in temporomandibular disorder: a phase II double-blind study.**

**CONCLUSION:** Low intensity laser application is effective in reducing TMD symptoms, and has influence over masticatory efficiency [Ev2 (0.2423) and Ev3 (0.2043), observed in the interaction Evaluations x Probes for effective dosage].

[http://www.ncbi.nlm.nih.gov/pubmed/19004308?ordinalpos=12&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/19004308?ordinalpos=12&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

### **Management of mouth opening in patients with temporomandibular disorders through low-level laser therapy and transcutaneous electrical neural stimulation.**

**RESULTS:** A significant improvement in the range of motion for both therapies was observed immediately after treatment. Comparing the two methods, the values obtained after LLLT were significantly higher than those obtained after TENS ( $p < 0.01$ ). **CONCLUSIONS:** Both methods are effective to improve mouth opening. Comparing the two methods, LLLT was more effective than TENS applications.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list\\_uids=16503788&query\\_hl=1&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=16503788&query_hl=1&itool=pubmed_docsum)

### **Effectiveness of low-level laser therapy in temporomandibular disorder.**

CONCLUSION: Low-level laser therapy can be considered as an alternative physical modality in the management of temporomandibular disorder.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list\\_uids=12737331&query\\_hl=1&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=12737331&query_hl=1&itool=pubmed_docsum)

### **Measurements of jaw movements and temporomandibular joint pain intensity in patients treated with GaAlAs laser**

Conclusion: Laser application can be a supportive therapy in the treatment of TMD, since it resulted in the immediate decrease of painful symptoms and increased range of mandibular movements in the treated group. The same results were not observed in the placebo group.

<http://www.ncbi.nlm.nih.gov/pubmed/20976388>

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

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.

[http://www.ncbi.nlm.nih.gov/pubmed/12775206?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/12775206?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

### **Efficacy of low power laser therapy in fibromyalgia: a single-blind, placebo-controlled trial.**

CONCLUSION: Our study suggests that laser therapy is effective on pain, muscle spasm, morning stiffness, and total tender point number in fibromyalgia and suggests that this therapy method is a safe and effective way of treatment in the cases with fibromyalgia.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=11845369&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=11845369&query_hl=18&itool=pubmed_DocSum)

### **Low level laser therapy in primary Raynaud's phenomenon--results of a placebo controlled, double blind intervention study.**

**CONCLUSION:** Low level laser therapy reduces frequency and severity of Raynaud attacks. The effect is most pronounced in patients with signs of decreased threshold for vasospasm and less effective in patients with delayed hyperemia.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15570642&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15570642&query_hl=18&itool=pubmed_DocSum)

### **Therapeutic Effects of Low-Level Laser on **Lateral Epicondylitis** from Differential Interventions of Chinese-Western Medicine: Systematic Review.**

**Conclusions:** We suggest that using LLLT on tender points or MTrPs of LE could effectively improve therapeutic effects.

[http://www.ncbi.nlm.nih.gov/pubmed/19874256?itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=22](http://www.ncbi.nlm.nih.gov/pubmed/19874256?itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=22)

### **Effects of 904-nm low-level laser therapy in the management of **lateral epicondylitis**: a randomized controlled trial.**

**CONCLUSION:** This study revealed that LLLT in addition to exercise is effective in relieving pain, and in improving the grip strength and subjective rating of physical function of patients with lateral epicondylitis.

[http://www.ncbi.nlm.nih.gov/pubmed/17508839?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17508839?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

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

**CONCLUSIONS:** This clinical study has demonstrated that the best results are obtained using combination treatment (i.e., TPs and scanner technique). Good results are obtained from adequate treatment technique correctly applied, individual energy doses, adequate medical education, clinical experience, and correct approach of laser therapists. We observed that under- and overirradiation dosage can result in the absence of positive therapy effects or even opposite, negative (e.g., inhibitory) effects. The current clinical study provides further evidence of the efficacy of LLLT in the management of lateral and medial epicondylitis.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=9743652&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9743652&query_hl=18&itool=pubmed_DocSum)

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

**CONCLUSION:** LLLT administered with optimal doses of 904 nm and possibly 632 nm wavelengths directly to the lateral elbow tendon insertions, seem to offer short-term pain relief and less disability in LET, both alone and in conjunction with an exercise regimen. This finding contradicts the conclusions of previous reviews which failed to assess treatment procedures, wavelengths and optimal doses.

[http://www.ncbi.nlm.nih.gov/pubmed/18510742?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18510742?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

### **Effects of low-level laser and plyometric exercises in the treatment of lateral epicondylitis.**

**CONCLUSION:** The results suggested that the combination of laser with plyometric exercises was more effective treatment than placebo laser with the same plyometric exercises at the end of the treatment as well as at the follow-up. Future studies are needed to establish the relative and absolute effectiveness of the above protocol.

[http://www.ncbi.nlm.nih.gov/pubmed/17603862?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17603862?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

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

**CONCLUSION:** Results measured according to VAS/VRS/PTM: in acute pain, diminished more than 70%; in chronic pain more than 60%. Clinical effectiveness (success or failure) depends on the correctly applied energy dose--over/underdosage produces opposite, negative effects on cellular metabolism. We did not observe any negative effects on the human body and the use of analgesic drugs could be reduced or completely excluded. LLLT suggests that the laser beam can be used as monotherapy or as a supplementary treatment to other therapeutic procedures for pain treatment.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=9456632&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9456632&query_hl=18&itool=pubmed_DocSum)

### **Efficacy of low level laser therapy in myofascial pain syndrome: an algometric and thermographic evaluation.**

**CONCLUSIONS:** LLLT seemed to be beneficial for pain in MPS by using algometry and thermography.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=14677161&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=14677161&query_hl=18&itool=pubmed_DocSum)

**Laser phototherapy (780 nm), a new modality in treatment of long-term incomplete peripheral nerve injury: a randomized double-blind placebo-controlled study.**

CONCLUSION: This pilot study suggests that in patients with long-term peripheral nerve injury noninvasive 780-nm laser phototherapy can progressively improve nerve function, which leads to significant functional recovery.

[http://www.ncbi.nlm.nih.gov/pubmed/17975958?ordinalpos=44&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17975958?ordinalpos=44&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

**Efficacy of low level laser therapy on neurosensory recovery after injury to the inferior alveolar nerve.**

CONCLUSION: Low level laser therapy seemed to be conducive to the reduction of long-standing sensory nerve impairment following third molar surgery. Further studies are worthwhile regarding the clinical application of this treatment modality.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16480503&query\\_hl=18&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16480503&query_hl=18&itool=pubmed_docsum)

**Pain relief by single low-level laser irradiation in orthodontic patients undergoing fixed appliance therapy.**

CONCLUSIONS: LLLT immediately after multibanding reduced the prevalence of pain perception at 6 and 30 hours. LLLT might have positive effects in orthodontic patients not only immediately after multibanding, but also for preventing pain during treatment.

[http://www.ncbi.nlm.nih.gov/pubmed/16979496?ordinalpos=22&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/16979496?ordinalpos=22&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

**The effect of low-level Nd:YAG laser energy on adult articular cartilage in vitro.**

CONCLUSION: These findings indicate that exposure to low-level noncontact Nd:YAG laser energy promotes a significant stimulation of cartilage matrix synthesis. However, a single exposure may not be sufficient to promote a sustained upregulation of cartilage metabolism.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=1550649&query\\_hl=10&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=1550649&query_hl=10&itool=pubmed_DocSum)

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

**CONCLUSIONS:** LLLT could be considered for short-term treatment for relief of pain and morning stiffness for RA patients, particularly since it has few side-effects. 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 RA in randomized controlled clinical trials.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16235295&query\\_hl=62&itool=pubmed\\_docsu\\_m](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16235295&query_hl=62&itool=pubmed_docsu_m)

## **The role of laser fluence in cell viability, proliferation, and membrane integrity of **wounded human skin fibroblasts following helium-neon laser irradiation.****

**CONCLUSIONS:** Results show that 5 J/cm(2) stimulates mitochondrial activity, which leads to normalization of cell function and ultimately stimulates cell proliferation and migration of wounded fibroblasts to accelerate wound closure. Laser irradiation can modify cellular processes in a dose or fluence (J/cm(2)) dependent manner.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16444694&query\\_hl=18&itool=pubmed\\_docsu\\_m](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16444694&query_hl=18&itool=pubmed_docsu_m)

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

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

[http://www.ncbi.nlm.nih.gov/pubmed/18341417?ordinalpos=44&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18341417?ordinalpos=44&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum)

## **Effects of low-level laser therapy and eccentric exercises in the treatment of recreational athletes **with chronic Achilles tendinopathy.****

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

were similar to the placebo LLLT group results after 12 weeks.

[http://www.ncbi.nlm.nih.gov/pubmed/18272794?ordinalpos=61&itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18272794?ordinalpos=61&itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_RVDocSum)

### **Improved wound healing by low-level laser irradiation after gingivectomy operations: a controlled clinical pilot study.**

**CONCLUSIONS:** Within the limitations of this study, the results indicated that LLLT may enhance epithelization and improve wound healing after gingivectomy and gingivoplasty operations.

[http://www.ncbi.nlm.nih.gov/pubmed/18269665?ordinalpos=63&itool=EntrezSystem2.PEntrez.Pubmed\\_Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18269665?ordinalpos=63&itool=EntrezSystem2.PEntrez.Pubmed_Pubmed_ResultsPanel.Pubmed_RVDocSum)

### **Effect of low-level Er:YAG laser irradiation on cultured human gingival fibroblasts.**

**CONCLUSIONS:** Our results showed that the low-level Er:YAG laser irradiation stimulates the proliferation of cultured gingival fibroblasts. The optimal stimulative energy density was found to be 3.37 J/cm<sup>2</sup>. This result suggests that Er:YAG laser irradiation may be of therapeutic benefit for wound healing.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15974841&query\\_hl=10&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15974841&query_hl=10&itool=pubmed_docsum)

### **Low-level laser irradiation promotes proliferation and differentiation of human osteoblasts in vitro.**

**CONCLUSION:** We conclude that LLLT promotes proliferation and maturation of human osteoblasts in vitro. These results may have clinical implications.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15910179&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15910179&query_hl=18&itool=pubmed_DocSum)

### **Phototherapy promotes healing of chronic diabetic leg ulcers that failed to respond to other therapies.**

**CONCLUSION:** Combined 660 and 890 nm light promotes rapid granulation and healing of diabetic ulcers that failed to respond to other forms of treatment

[http://www.ncbi.nlm.nih.gov/pubmed/19588536?itool=EntrezSystem2.PEntrez\\_Pubmed\\_Pubmed\\_ResultsPanel\\_Pubmed\\_RVDocSum&ordinalpos=83](http://www.ncbi.nlm.nih.gov/pubmed/19588536?itool=EntrezSystem2.PEntrez_Pubmed_Pubmed_ResultsPanel_Pubmed_RVDocSum&ordinalpos=83)

## **A Randomized Clinical Trial on the Effect of Low-Level Laser Therapy on Chronic Diabetic Foot Wound Healing: A Preliminary Report.**

Conclusions: The study provides evidence that LLLT can accelerate the healing process of chronic diabetic foot ulcers, and it can be presumed that LLLT may shorten the time period needed to achieve complete healing.

<http://www.ncbi.nlm.nih.gov/pubmed/21214368>

## **Does the use of low-level laser influence wound healing in chronic venous leg ulcers?**

CONCLUSION: These study results suggest that low-level laser does not stimulate wound healing in venous leg ulcers. Further controlled studies are needed to clarify the efficacy of low-level laser treatment as a wound-healing stimulant.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16178295&query\\_hl=10&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16178295&query_hl=10&itool=pubmed_docsum)

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

CONCLUSION: LLLT is effective in the treatment of denture stomatitis.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15954824&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15954824&query_hl=18&itool=pubmed_DocSum)

## **Low-level laser irradiation promotes proliferation and differentiation of human osteoblasts in vitro.**

CONCLUSION: We conclude that LLLT promotes proliferation and maturation of human osteoblasts in vitro. These results may have clinical implications.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15910179&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15910179&query_hl=18&itool=pubmed_DocSum)

## **Evidence of changes in sural nerve conduction mediated by LED (light emitting diode) irradiation.**

CONCLUSION: LED irradiation, applied to intact skin at the described irradiation parameters, produces an immediate and localized effect upon conduction characteristics in underlying nerves. Therefore, the outcome of this in vivo experiment yields a potential explanation for pain relief induced by LED.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15895289&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15895289&query_hl=18&itool=pubmed_DocSum)

### **Low-level laser for prevention and therapy of **oral mucositis** induced by chemotherapy or radiotherapy.**

CONCLUSION: low-level laser therapy may be useful in decreasing the severity of chemotherapy-associated or radiotherapy-associated mucositis is substantial

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15818167&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15818167&query_hl=18&itool=pubmed_DocSum)

### **Use of laser for **rectal lesions** in poor-risk patients.**

CONCLUSIONS: Outpatient laser therapy is safe, repeatable, and effective in the local control of rectal lesions.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15619488&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15619488&query_hl=18&itool=pubmed_DocSum)

### **Low-level laser irradiation stimulates **mitochondrial membrane potential** and disperses subnuclear promyelocytic leukemia protein.**

CONCLUSIONS: These changes reflect a biostimulative boost that causes a shift of the cell from a quiescent to an activated stage in the cell cycle heralding proliferation and suppression of inflammation. Further characterization of MMP kinetics may provide a quantitative basis for assessment of the effect of LLLI in the clinical setting.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15611960&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15611960&query_hl=18&itool=pubmed_DocSum)

### **Low-level laser treatment can reduce edema in **second-degree ankle sprains**.**

CONCLUSIONS: LLLT combined with RICE can reduce edema in second-degree ankle sprains.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15165387&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15165387&query_hl=18&itool=pubmed_DocSum)

### **Laser biostimulation in the treatment of **pleurisy**.**

CONCLUSION: 1. Patients with pleurisy undergoing laser stimulation presented with faster resorption of effusion and remission of the subjective symptoms, as well as significant decrease of biochemical acute

inflammation parameters in the peripheral blood and therefore with faster recovery. 2. In patients with pleurisy laser treatment increases regenerative mechanisms of the pleural surface, thus decreasing the quantity of formed adhesions and resulting in better mobility of the diaphragm.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15080043&query\\_hl=18&itool=pubmed\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15080043&query_hl=18&itool=pubmed_DocSum)

### **Managing postmastectomy lymphedema with low-level laser therapy**

CONCLUSION: LLLT was effective in the management of PML, and the effects were maintained to the 4 wk follow-up.

[http://www.ncbi.nlm.nih.gov/pubmed/19878027?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=44](http://www.ncbi.nlm.nih.gov/pubmed/19878027?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=44)

### **Laser treatment for toenail fungus**

Conclusion: trial resulted in nail clearing in most subjects

[http://www.patholase.com/sites/all/themes/patholase/downloads/Laser\\_Treatment\\_for>Toenail\\_Fungus\\_SPIE\\_090219.pdf](http://www.patholase.com/sites/all/themes/patholase/downloads/Laser_Treatment_for>Toenail_Fungus_SPIE_090219.pdf)