

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

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### **Abstract**

In this review, seven studies using photoradiation to treat carpal tunnel syndrome (CTS) are discussed: two controlled studies that observed real laser to have a better effect than sham laser, to treat CTS; three openprotocol studies that observed real laser to have a beneficial effect to treat CTS; and two studies that did not observe real laser to have a better effect than a control condition, to treat CTS. In the five studies that observed beneficial effect from real laser, higher laser dosages (9 Joules, 12-30 Joules, 32 J/cm<sup>2</sup>, 225 J/cm<sup>2</sup>) were used at the primary treatment sites (median nerve at the wrist, or cervical neck area), than dosages in the two studies where real laser was not observed to have a better effect than a control condition (1.8 Joules or 6 J/cm<sup>2</sup>). The average success rate across the first five studies was 84% (SD, 8.9; total hands = 171). The average pain duration prior to successful photoradiation was 2 years. 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.

## Placebo-controlled investigation of low-level laser therapy to treat carpal tunnel syndrome.

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### **Abstract**

#### **OBJECTIVE:**

This study investigated the short-term efficacy of low-level laser therapy (LLLT) in patients with mild to moderate carpal tunnel syndrome (CTS), lasting for <1 year.

#### **METHODS:**

Seventy-nine patients with CTS were included in this double-blind, placebo-controlled study, and randomly divided in two treatment groups: Experimental group (EG), active laser group (40 patients); and control group (CG), placebo (sham) laser group (39 patients). A GaAlAs diode laser [780 nm, 30 mW continuous wave (CW), 0.785 cm(2), 38.2 mW/cm(2)] was applied in contact with four points perpendicularly to the skin over the carpal tunnel area for 90 sec per point (2.7 J, 3.4 J/cm(2)/point). Both groups were treated five times per week, once a day over 2 weeks, followed by 10 treatments every other day for 3 weeks, that is, for a total of 20 treatments. Clinical assessment, including visual analogue scale (VAS) pain rating, Tinel's sign, and median nerve conduction studies (NCSs) were evaluated before, and 3 weeks after, the last LLLT treatment.

#### **RESULTS:**

Significant reduction in pain, reduction in the percentage of patients with a positive Tinel's sign, and shortening of sensory and motor latency time in the NCS examination was observed in the experimental LLLT group (but not in the control group).

#### **CONCLUSIONS:**

This study has observed and documented the statistically significant short-term effects of LLLT on CTS patients in comparison with a placebo group. The results support this conclusion, especially if the LLLT is applied in the earlier stages of CTS, and with mild to moderate cases.

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## **Carpal tunnel syndrome treated with a diode laser: a controlled treatment of the transverse carpal ligament.**

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### **Abstract**

#### **OBJECTIVE:**

The purpose of this placebo-controlled study was to investigate the therapeutic effects of the 830-nm diode laser on carpal tunnel syndrome (CTS).

#### **BACKGROUND DATA:**

Many articles in the literature have demonstrated that low-level laser therapy (LLLT) may help to alleviate various types of nerve pain, especially for CTS treatment. We placed an 830-nm laser directly above the transverse carpal ligament, which is between the pisiform and navicular bones of the tested patients, to determine the therapeutic effect of LLLT.

#### **MATERIALS AND METHODS:**

Thirty-six patients with mild to moderate degree of CTS were randomly divided into two groups. The laser group received laser treatment (10 Hz, 50% duty cycle, 60 mW, 9.7 J/cm<sup>2</sup>, at 830 nm), and the placebo group received sham laser treatment. Both groups received treatment for 2 wk consisting of a 10-min laser irradiation session each day, 5 d a week. The therapeutic effects were assessed on symptoms and functional changes, and with nerve conduction studies (NCS), grip strength assessment, and with a visual analogue scale (VAS), soon after treatment and at 2-wk follow-up.

#### **RESULTS:**

Before treatment, there were no significant differences between the two groups for all assessments ( $p > 0.05$ ). The VAS scores were significantly lower in the laser group than the placebo group after treatment and at follow-up ( $p < 0.05$ ). After 2 wk of treatment, no significant differences were found in grip strengths or for symptoms and functional assessments ( $p > 0.05$ ). However, there were statistically significant differences in these variables at 2-wk follow-up ( $p < 0.05$ ). Regarding the findings of NCS, there was no statistically significant difference between groups after treatment and at 2-wk follow-up.

#### **CONCLUSIONS:**

LLLT was effective in alleviating pain and symptoms, and in improving functional ability and finger and hand strength for mild and moderate CTS patients with no side effects.

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

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### **Abstract**

#### **OBJECTIVES:**

Carpal tunnel syndrome (CTS) is the most common neuropathy that can be diagnosed with confidence by the nerve conduction study (NCS). One of the recent treatments of CTS is the application of low power laser (LPL) therapy. The present study evaluates the effects of LPL irradiation through NCS and clinical signs and symptoms.

#### **METHODS:**

A total of 80 patients were included in this study. Diagnosis of CTS was based on both clinical examination and electromyographic (EMG) findings. Patients were randomly assigned into two groups. Test group (group A) underwent laser therapy (9-11 joules/cm<sup>2</sup>) over the carpal tunnel area. Control group (group B) received sham laser therapy. Pain, hand grip strength, median proximal sensory and motor latencies, transcarpal median sensory nerve conduction (SNCV) were recorded. After fifteen sessions of irradiation (five times per week), parameters were recorded again and clinical symptoms were measured in both groups. Pain was evaluated by Visual Analog Scale (VAS; day-night). Hand grip was measured by Jamar dynamometer. Paired t-test and independent sample t-test were used for statistical analysis.

#### **RESULTS:**

There was a significant improvement in clinical symptoms and hand grip in group A ( $p < 0.001$ ). Proximal median sensory latency, distal median motor latency and median sensory latencies were significantly decreased ( $p < 0.001$ ). Transcarpal median SNCV increased significantly after laser irradiation ( $p < 0.001$ ). There were no significant changes in group B except changes in clinical symptoms ( $p < 0.001$ ).

#### **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.

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## **The effectiveness of conservative treatments of carpal tunnel syndrome: splinting, ultrasound, and low-level laser therapies.**

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### **Abstract**

#### **OBJECTIVE:**

The objective of this study was to investigate the effectiveness of splinting, ultrasound (US), and low-level laser (LLL) in the management of carpal tunnel syndrome (CTS).

#### **BACKGROUND DATA:**

CTS is the entrapment mononeuropathy most frequently seen in clinical practice, caused by compression of the median nerve at the wrist. Although several treatment modalities are routinely in use, there is no consensus about the best way to manage CTS.

#### **MATERIALS AND METHODS:**

In our study, patients were randomly allocated to three groups that received the following treatment protocols: splinting only, splinting plus US, and splinting plus LLL therapy. Patients were assessed with the Boston Questionnaire, patient satisfaction inquiry, visual analogue scale for pain, and electroneuromyography.

#### **RESULTS AND CONCLUSION:**

The study was completed with a total of 100 hands of 50 women patients with bilateral CTS at 3 mo after treatment. At the end of the follow-up period, each of the groups had improvements to varying degrees. It appeared that the combinations of US or LLL therapy with splinting were more effective than splinting alone in treating CTS. However, LLL therapy plus splinting was more advantageous than US therapy plus splinting, especially for the outcomes of lessening of symptom severity, pain alleviation, and increased patient satisfaction.

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## **Treatment of carpal tunnel syndrome by low-level laser versus open carpal tunnel release.**

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### **Abstract**

Carpal tunnel syndrome (CTS) is an entrapment neuropathy of the median nerve at the wrist. It is one of the most common peripheral nerve disorders. The cause of idiopathic CTS remains unclear. The diagnosis of CTS is still mainly clinical. Open carpal tunnel release is the standard treatment. The present study was conducted to evaluate the effectiveness of low level laser treatment (LLLT) for CTS in comparison to the standard open carpal tunnel release surgery. Out of 54 patients, 60 symptomatic hands complaining of CTS were divided into two equal groups. Group A, was subjected to LLLT by Helium Neon (He-Ne) laser (632.8 nm), whereas group B was treated by the open approach for carpal tunnel release. The patients were evaluated clinically and by nerve conduction studies (NCSs) about 6 months after the treatment. LLLT showed overall significant results but at a lower level in relation to surgery. LLLT showed significant outcomes in all parameters of subjective complaints ( $p < \text{or} = 0.01$ ) except for muscle weakness. Moreover, LLLT showed significant results in all parameters of objective findings ( $p < \text{or} = 0.01$ ) except for thenar atrophy. However, NCSs expressed the same statistical significance ( $p < \text{or} = 0.01$ ) after the treatment by both modalities. 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.

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## The effects of low intensity laser on clinical and electrophysiological parameters of carpal tunnel syndrome.

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### **Abstract**

#### **INTRODUCTION:**

Carpal Tunnel Syndrome (CTS) is the most common type of entrapment neuropathy. Conservative therapy is usually considered as the first step in the management of CTS. Low Level Laser Therapy (LLLTT) is among the new physical modalities, which has shown therapeutic effects in CTS. The aim of the present study was to compare the effects of applying LASER and splinting together with splinting alone in patients with CTS.

#### **METHODS:**

Fifty patients with mild and moderate CTS who met inclusion criteria were included in this study. The disease was confirmed by electrodiagnostic study (EDx) and clinical findings. Patients were randomly divided into 3 groups. Group A received LLLTT and splinting. Group B received sham LLLTT+ splinting and group C received only splints. Group A received LLLTT (50 mw and 880nm with total dose of 6 joule/cm<sup>2</sup>). Clinical and EDx parameters were evaluated before and after treatment (3 weeks and 2 months later).

#### **RESULTS:**

Electrophysiologic parameters and clinical findings including CTS provocative tests, Symptoms severity score (SSS), Functional Severity Score (FSS) and Visual Analogue Score (VAS) were improved in all three groups at 3 weeks and 2 months after treatment. No significant changes were noticed between the three groups regarding clinical and EDX parameters.

#### **CONCLUSION:**

We found no superiority in applying Low Intensity Laser accompanying splinting to traditional treatment which means splinting alone in patients with CTS. However, future studies investigating LLLTT with parameters other than the one used in this study may reveal different results in favor of LLLTT.

#### **KEYWORDS:**

CTS; electrodiagnoses; laser therapy; low level

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

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### **Abstract**

#### **OBJECTIVE:**

To investigate whether real or sham low-level laser therapy (LLLT) plus microamperes transcutaneous electric nerve stimulation (TENS) applied to acupuncture points significantly reduces pain in carpal tunnel syndrome (CTS).

#### **DESIGN:**

Randomized, double-blind, placebo-control, crossover trial. Patients and staff administered outcome measures blinded.

#### **SETTING:**

Outpatient, university-affiliated Department of Veterans Affairs medical center.

#### **PARTICIPANTS:**

Eleven mild to moderate CTS cases (nerve conduction study, clinical examination) who failed standard medical or surgical treatment for 3 to 30 months.

#### **INTERVENTION:**

Patients received real and sham treatment series (each for 3-4wk), in a randomized order. Real treatments used red-beam laser (continuous wave, 15mW, 632.8nm) on shallow acupuncture points on the affected hand, infrared laser (pulsed, 9.4W, 904nm) on deeper points on upper extremity and cervical paraspinal areas, and microamps TENS on the affected wrist. Devices were painless, noninvasive, and produced no sensation whether they were real or sham. The hand was treated behind a hanging black curtain without the patient knowing if devices were on (real) or off (sham).

#### **MAIN OUTCOME MEASURES:**

McGill Pain Questionnaire (MPQ) score, sensory and motor latencies, and Phalen and Tinel signs.

#### **RESULTS:**

Significant decreases in MPQ score, median nerve sensory latency, and Phalen and Tinel signs after the real treatment series but not after the sham treatment series. Patients could perform their previous work (computer typist, handyman) and were stable for 1 to 3 years.

**CONCLUSIONS:**

This new, conservative treatment was effective in treating CTS pain; larger studies are recommended.

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