

Carpal Tunnel Syndrome

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Comparison of splinting and splinting plus low-level laser therapy in idiopathic carpal tunnel syndrome.

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This study aimed to compare the short-term efficacy of splinting (S) and splinting plus low-level laser therapy (SLLLT) in mild or moderate idiopathic carpal tunnel syndrome (CTS) with a prospective, randomized controlled study. The patients with unilateral, mild, or moderate idiopathic CTS who experienced symptoms over 3 months were included in the study. The SLLLT group received ten sessions of laser therapy and splinting while S group was given only splints. The patients were evaluated at the baseline and after 3 months of the treatment. Follow-up parameters were nerve conduction study (NCS), Boston Questionnaire (BQ), grip strength, and clinical response criteria. Forty-five patients with CTS completed the study. Twenty-four patients were in S and 21 patients were in SLLLT group. In the third-month control, SLLLT group had significant improvements on both clinical and NCS parameters (median motor nerve distal latency, median sensory nerve conduction velocities, BQ symptom severity scale, and BQ functional capacity scale) while S group had only symptomatic healing (BQ symptom severity scale). The grip strength of splinting group was decreased significantly. According to clinical response criteria, in SLLLT group, five (23.8%) patients had full and 12 (57.1%) had partial recovery; four (19%) patients had no change or worsened. In S group, one patient (4.2%) had full and 17 (70.8%) partial recovery; six (25%) patients had no change or worsened. Additionally, applied laser therapy provided better outcomes on NCS but not in clinical parameters in patients with CTS.

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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/cm², 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.

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

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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/cm²) 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 dynameter. 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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Effect of low level laser therapy in rheumatoid arthritis patients with carpal tunnel syndrome.

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OBJECTIVE: the aim of the present study was to evaluate the efficacy of low level laser therapy (LLLT) in patients with rheumatoid arthritis (RA) with carpal tunnel syndrome (CTS). **MATERIAL AND METHODS:** a total of 19 patients with the diagnosis of CTS in 19 hands were included and randomly assigned to two treatment groups; LLLT (Group 1) (10 hands) with dosage 1.5 J/ per point and placebo laser therapy group (Group 2) (9 hands). A Gallium-Aluminum-Arsenide diode laser device was used as a source of low power laser with a power output of 50 mW and wavelength of 780 nm. All treatments were applied once a day on week days for a total period of 10 days. Clinical assessments were performed at baseline, at the end of the treatment and at month 3. Tinel and Phalen signs were tested in all patients. Patients were evaluated for such clinical parameters as functional status scale (FSS), visual analogue scale (VAS), symptom severity scale (SSS) and grip-strength. However, electrophysiological examination was performed on all hands. Results were given with descriptive statistics and confidence intervals between group means at 3 months adjusted for outcome at baseline and for the difference between unadjusted group proportions. **RESULTS:** clinical and electrophysiological parameters were similar at baseline in both groups. Improvements were significantly more pronounced in the LLLT group than placebo group. A comparison between groups showed significant improvements in pain score and functional status scale score. Group mean differences at 3 months adjusted at baseline were found to be statistically significant for pain score and functional status scale score. The 95% significant confidence intervals were [-15 - (-5)] and [-5 - (-2)] respectively. There were no statistically significant differences in other clinical and electrophysiological parameters between groups at 3 months. **CONCLUSIONS:** our study results indicate that LLLT and placebo laser therapy seems to be effective for pain and hand function in CTS. We, therefore, suggest that LLLT may be used as a good alternative treatment method in CTS patients with RA.

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

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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 ($p \leq 0.01$) except for muscle weakness. Moreover, LLLT showed significant results in all parameters of objective findings ($p \leq 0.01$) except for thenar atrophy. However, NCSs expressed the same statistical significance ($p \leq 0.01$) 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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Laser therapy in the treatment of carpal tunnel syndrome: a randomized controlled trial.

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OBJECTIVE: This prospective, randomized, placebo-controlled trial aimed to investigate the efficacy of laser therapy in the treatment of carpal tunnel syndrome (CTS).

BACKGROUND DATA: Low-level laser therapy (LLLT) has been found to have positive effects in the treatment of CTS and various musculoskeletal conditions. **METHODS:** A total of 81 patients were included in this study. Diagnosis of CTS was based on both clinical examination and electromyographic (EMG) study. Patients were randomly assigned into two groups. Group 1 (n = 41) underwent laser therapy (7 joules/2 min) over the carpal tunnel area. Group 2 (n = 40) received placebo laser therapy. All patients received therapy five times per week, for a total of 10 sessions. Patients also used a wrist splint each night. Patients were assessed according to pain, hand-pinch grip strength, and functional capacity. Pain was evaluated by Visual Analog Scale (VAS; day-night). Hand grip was measured by Jamar dynamometer, and pinch grip was measured by pinchmeter. Functional capacity was assessed by a self-administered questionnaire for severity of symptoms. **RESULTS:** The mean age of the patients (70 women, 11 Men) was 49.3 +/- 11.0 (range, 26-78). After therapy there were statistically significant improvements in VAS, pinch grip, and functional capacity measurement in both groups (p < 0.001). Hand grip was found to have been improved in the laser group. In EMG, there were statistically improvements in sensory nerve velocity, and sensory and motor distal latencies in the laser group (p < 0.001). Only sensory nerve velocity was meaningful in the placebo group. **CONCLUSION:** In using LLLT, (1) there was no difference relative to pain relief and functional capacity during the follow-up in CTS patients; (2) there were positive effects on hand and pinch grip strengths.

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

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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/cm², 225 J/cm²) 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/cm²). 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.

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Carpal Tunnel Syndrome Pain Treated with Low-Level Laser and Microamps TENS, A Controlled Study.

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Objective: To investigate whether real or sham, low-level lasertherapy (LLLT) plus microamps TENS applied to acupuncture points significantly reduces pain in carpal tunnel syndrome (CTS).

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

Setting: Outpatient, V.A. hospital, university-affiliated.

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

Intervention: Patients received real and sham treatment series (each for 3-4 weeks), order randomized. Real treatments used red-beam laser (continuous wave, 15 mW, 632.8 nm) on shallow acupuncture points on affected hand; infrared laser (pulsed, 9.4W, 904 nm) on deeper points on UE and cervical paraspinal areas; and microamps TENS on affected wrist. Devices were painless, non-invasive and produced no sensation whether real or sham. Hand treated behind hanging black curtain without patient knowing if devices were turned on (real) or off (sham).

Main Outcome Measures: Melzack pain score, sensory and motor latencies, Phalen and Tinel signs.

Results: Significant decreases in Melzack pain score, median nerve sensory latency, Phalen sign and Tinel sign, Post-real treatment series but not Post-sham. Patients able to perform prior work (computer typist, handyman) and stable for 1-3 years.

Conclusions: This new, conservative treatment was effective to treat CTS pain in this study, larger studies are recommended.

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Carpal tunnel syndrome: clinical outcome after LLLT-acupuncture, microamps TENS, and other alternative therapies: an open protocol study.

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They measured outcome for carpal tunnel syndrome (CTS) patients (who previously failed standard medical/surgical treatments) treated primarily with a red-beam, LLLT-AP and microamps TENS on the affected hand; secondarily, with other alternative therapies.

DESIGN: Open treatment protocol, patients diagnosed with CTS by their physicians. Treatment was given by licensed acupuncturist in a private practice office. 36 hands were treated (from 22 women, 9 men), ages 24-84 yr, median pain duration, 24 mo. 14 hands had failed 1-2 surgical release procedures. Primary treatment: red-beam, 670 nm, continuous wave, 5 mW, diode LLLT pointer (1-7 J per point), and microamps TENS (<900 uA) on affected hands. Secondary treatment: infrared LLLT (904 nm, pulsed, 10 W) and/or needle AP on deeper acupoints; Chinese herbal medicine and supplements, on a case-by-case basis (3 treatments/wk for 4-5 wk). Pre- and posttreatment Melzack pain scores and profession and

employment status were recorded. Posttreatment, pain significantly reduced ($p < .0001$), and 33/36 hands (91.6%) no pain, or pain reduced by $>50\%$. 14 hands that failed surgical release were successfully treated. Patients remained employed, if not retired. Follow-up after 1-2 yr with cases aged <60 , only 2/23 hands (8.3%) had return of pain, but were successfully re-treated within a few weeks. Possible mechanisms for effectiveness include increased adenosine triphosphate (ATP) on cellular level, decreased inflammation, temporary increase in serotonin. *Combined treatment with LLLT-AP + microamp TENS + Chinese herbs has potential cost-savings (current estimated cost per case, \$12,000; this treatment, \$1,000). It is safe when applied by licensed acupuncturist trained in laser-AP; supplemental home treatments may be performed by patient under supervision of acupuncturist.* Publication Types: Clinical trial PMID: 10100028, UI: 99199801

Carpal Tunnel Syndrome Laser Acupuncture Research The Purpose of this Research Project

The purpose of this research project is to investigate whether red-beam low-energy laser and microamps TENS (painless transcutaneous electric nerve stimulation) can be used to stimulate acupuncture points on the hand, to treat the painful symptoms of CTS, under controlled research conditions. This research project uses a painless, non-invasive, non-surgical technique, which can also be applied by the patient him/herself, at home.

Method used in this Research Project

In the controlled research at the hospital, the patient's hand is treated behind a black curtain, and the patient does not know whether the laser beam and TENS devices are "on or off," because each device produces no feeling. The research at the hospital is a randomized, double-blind, placebo-controlled, cross-over design. There, patients receive 3 treatments per week (every other day), with 12 real and 12 sham treatments (each for 4 weeks), order randomized. Pre- and post-testing are performed with objective and subjective tests. These tests include nerve conduction studies; Melzack pain questionnaires; and hand strength and dexterity testing which are performed by hospital staff blind as to the treatment condition (real or sham).

In the controlled research at the hospital, various lasers are used, but limited space here does not permit discussion of all lasers. Some of these larger lasers include a 15 mW red-beam, helium neon laser, Dynatronics Model 1620; or a 50 mW infrared-beam, diode laser, 830 nm wavelength, Dynatronics Model 1650.

The laser used in the Home Treatment program is described later, under "The Naeser Laser Home Treatment Program for the Hand ©."

Results from this Research Project

As of November, 1996, seven patients had completed the treatment under controlled research conditions at the hospital. These seven patients had significant reduction in pain scores after the series of real treatments, but no significant reduction in pain scores after the series of sham treatments. Following the real treatment condition, the Melzack pain scores were significantly reduced ($p < .02$). For example, before the real treatments were started, the average pain score was 17.3 points (S.D., 10.3). After the real treatments were finished, the average pain score was only 5.4 points (S.D., 6.9). Following the sham treatment condition where the lasers and microamps TENS devices were taped into place on the patient's hand (but not turned on), the Melzack pain scores were not significantly reduced. Before the sham treatments were started, the average pain score was 16.9 points (S.D., 12.2). After the sham treatments were finished, the average pain score was 11.0 (S.D., 11.8).

Also, these seven patients treated under controlled research conditions at the hospital, had significant improvement in their nerve conduction studies after the series of real treatments, but no significant improvement in their nerve conduction studies after the series of sham treatments. Following the real treatment condition, the sensory latency of the median nerve across the wrist was significantly reduced ($p < .05$). In the real condition, five of the seven patients showed improved, shorter latencies following treatment; two patients showed no change. Before the real treatments were started, the average median nerve sensory latency was 4.8 msec (S.D., 1.3). After the real treatments were finished, the average sensory latency was 4.5 msec (S.D., 1.3). Following the sham treatment condition, the sensory latency of the median nerve across the wrist was not significantly reduced. In the sham condition, data were available for only six patients. Following sham treatment, only two of the six patients showed improved, shorter latencies; three patients showed no change and one patient showed an increased, longer latency. Before the sham treatments were started, the average median nerve sensory latency was 4.7 msec (S.D., 1.2). After the sham treatments were finished, the average median nerve sensory latency was 4.4 msec (S.D., 1.1).

All patients were able to resume prior work activities with less, or no pain, including keyboard typing, handyman work (cement laying, electrical wiring), and plumbing. At one year follow-up, one patient (who was diabetic and had had a stroke), had a return of hand pain.

These data indicate that after the series of real treatments, there was a significant reduction in pain, and the function of the sensory aspect of the median nerve became significantly "closer to normal." These significant changes were not observed following the series of sham treatments. Hence, it appears that the treatments with the real laser and microamps TENS devices are promoting a positive change in the patient's condition (not observed with the sham devices), and the placebo effect is being controlled for.

Three other cases were treated in an open protocol with the Naeser Laser Home Treatment Program for the Hand using the 5mW laser pen, and MicroStim 100 TENS device at home. All resumed prior type of work (computer keyboard typing and transcription work) without pain after 4 weeks.

We presented a research paper on the first six patients at the 16th Annual Meeting of the American Society for Laser Medicine and Surgery, Inc., Orlando, FL, April 15, 1996 and the paper was one of 12 papers nominated for "Best Clinical Award." The research will continue.

LOW – LEVEL- LASER THERAPY IN MILD AND MODERATE CTS – A DOUBLE BLIND, RANDOMISED STUDY

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The aim was to evaluate the LLLT in CTS (ENG: $< 6,9$ ms) monitored by EMG and VAS (Visual Analogous Scale) recordings. 72 hands with CTS treated by LLLT (15 sessions/30 min, over a period of 5 weeks) were evaluated by a double blind – randomised study. ENG and VAS (visual analogous scale) were performed prior to and after LLLT.

LLLT (wavelength 830 nm, 400 mW) with an energy of 3J per point focused on the Carpal – tunnel, on trigger and acupuncture – points was performed in 38 cases, in 38 cases (control – group) we used a red light pen. Follow-up ranged from 8 to 12 months. ENG and VAS improved in 66%, didn't change in 8% and got worse in 26% in the LLLT group after a 12 month period. No improvement was recorded in the control group. The

results suggest that LLLT can be recommended in mild or average CTS (ENG < 4,9 ms) especially if a conservative treatment is required.

SUCCESSFUL MANAGEMENT OF FEMALE OFFICE WORKERS WITH "REPETITIVE STRESS INJURY" OR "CARPAL TUNNEL SYNDROME" BY A NEW TREATMENT MODALITY- APPLICATION OF LOW LEVEL LASER

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Abstract. Female office workers with desk jobs who are incapacitated by pain and tingling in the hands and fingers are often diagnosed by physicians as "repetitive stress injury" (RSI) or "carpal tunnel syndrome" (CTS). These patients usually have poor posture with their head and neck stooped forward and shoulders rounded; upon palpation. they have pain and tenderness at the spinous processes C5 - T1 and the medial angle of the scapula. In 35 such patients we focused the treatment primarily at the posterior neck area and not the wrists and hands. A low level laser (100 mW) was used and directed at the tips of the spinous processes C5 - T1. The laser rapidly alleviated the pain and tingling in the arms, hands and fingers. and diminished tenderness at the involved spinous processes. Thereby, it has become apparent that many patients labeled as having RSI or CTS have predominantly cervical radicular dysfunction resulting in pain to the upper extremities which can be managed by low level laser. Successful long-term management involves treating the soft tissue lesions in the neck combined with correcting the abnormal head, neck and shoulder posture by taping. Cervical collars, and clavicle harnesses as well as improved work ergonomics.