WOUND HEALING RESEARCH ABSTRACTS

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Wound Healing

The Effects of Laser Therapy on Tissue Repair and Pain Control: A Meta-analysis of the Literature

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Statement of the Problem:
Low intensity laser therapy devices were first used as a form of therapy more than thiry years ago. However, their efficacies in reducing pain and/or promoting tissue repair remain questionable.

Purpose:
We conducted a meta-analysis of the literature in order to determine the overall treatment effects of laser therapy on pain control and tissue repair.

Method:
Following a literature search, studies meeting our inclusion criteria were identified, coded, and then subjected to statistical meta-analysis procedures as detailed by Cohen. The effect size of laser therapy treatment, i.e. Cohen's d was then calculated from each study.

Results:
A total of 36 peer reviewed papers on tissue repair were coded. Thirty-four of the papers met our inclusion criteria and were used to calculate a total of 46 treatment effect sizes. Fifteen peer-reviewed papers on pain control were coded, nine met the inclusion criteria and were used to calculate nine effect sizes. Meta-analysis revealed a positive effect of laser therapy on tissue repair (d= +1.81; n=46) and pain control (d=+1.11; n=9). The positive effect of laser therapy on specific indices of tissue repair is evident in the treatment effect sizes determined as follows: collagen formation (d=+2.78), rate of healing (d=+1.57), tensile strength (d=+2.13), wound closure (d=+0.76), tensile stress (d=+2.65), mast cell numbers (d=+1.87), and flap survival (d=+2.13). Furthermore, meta-analysis revealed a positive effect of various wavelengths of laser therapy on tissue repair, including: 632.8nm (+2.11), 904nm (+1.09), 514nm (+1.89), 820nm (+1.00), 830nm (+0.61), 780nm (+0.60), and cluster diode (+1.95). The overall treatment effect for pain control was positive as well (d=+1.11). Further analysis revealed a Fail safe N (Na) of 370 for tissue repair and 41 for pain control; indicating that of 370 and 41 peer-reviewed publications with negative or no effect of laser therapy would be needed to negate the positive effect sizes calculated for tissue repair and pain control respectively.

Conclusion:
Our findings indicate that laser therapy has a positive treatment effect on tissue repair processes and also, on pain control.

The Efficacy of Laser Therapy in Wound Repair: A Meta-Analysis of the Literature

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Objective:
We determined the overall effects of laser therapy on tissue healing by aggregating the literature and subjecting studies meeting the inclusion and exclusion criteria to statistical meta-analysis.

Background Data:
Low-level laser therapy (LLLT) devices have been in use since the mid sixties, but their therapeutic value remains doubtful, as the literature seems replete with conflicting findings.

Materials and Methods:
Pertinent original research papers were gathered from library sources, online databases and secondary sources. The papers were screened and coded; those meeting every inclusion and exclusion criterion were subjected to meta-analysis, using Cohen's d. statistic to determine the treatment effect size of each study. Results: Twenty-four studies with 31 effect sizes met the stringent inclusion and exclusion criteria. The overall mean effect of laser therapy on wound healing was highly significant (d = +2.22). Sub-analyses of the data revealed significant positive effects on wound healing in animal experiments (d = +1.97) as well as human clinical studies (d = +0.54). The analysis further revealed significant positive effects on specific indices of healing, for example, acceleration of inflammation (d = +4.45); augmentation of collagen synthesis (d = +1.80); increased tensile strength (d = +2.37), reduced healing time (d = +3.24); and diminution of wound size (d = +0.55). The Fail-Safe number associated with the overall effect of laser therapy was 509; a high number representing the number of additional studies—in which laser therapy has negative or no effect on wound healing—required to negate the overall large effect size of +2.22. The corresponding Fail-Safe number for clinical studies was 22.

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

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

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Objective:
Low-level laser therapy (LLLT) has been promoted for its beneficial effects on tissue healing and pain relief. However, according to the results of in vivo studies, the effectiveness of this modality varies. Our purpose was to assess the putative effects of LLLT on healing using an experimental wound model.

Design and Setting:
We used a randomized, triple-blind, placebo-controlled design with 2 within-subjects factors (wound and time) and 1 between-subjects factor (group). Data were collected in the laboratory setting.

Subjects:
Twenty-two healthy subjects (age = 21 +/- 1 years, height = 175.6 +/- 9.8 cm, mass = 76.2 +/- 14.2 kg).

Measurements:
Two standardized 1.27-cm^2 abrasions were induced on the anterior forearm. After wound cleaning, standardized digital photos were recorded. Each subject then received LLLT (8 J/cm^2; treatment time = 2 minutes, 5 seconds; pulse rate = 700 Hz) to 1 of the 2 randomly chosen wounds from either a laser or a sham 46-diode cluster head. Subjects reported back to the laboratory on days 2 to 10 to be photographed and receive LLLT and on day 20 to be photographed. Data were analyzed for wound contraction (area), color changes (chromatic red), and luminance.

Results:
A group X wound X time interaction was detected for area measurements. At days 6, 8, and 10, follow-up testing revealed that the laser group had smaller wounds than the sham group for both the treated and the untreated wounds ($P < .05$). No group X wound X time differences were detected for chromatic red or luminance.

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.

Key Words:
modalities, experimental wound model

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.

Simunovic Z, Ivankovich AD, Depolo A.

Journal of Clinical Laser Medicine and Surgery (2000) Apr; 18(2):67-73.

Background and Objective:
The main objective of current animal and clinical studies was to assess the efficacy of low level laser therapy (LLLT) on wound healing in rabbits and humans.

Study Design / Materials and Methods:
In the initial part of our research we conducted a randomized controlled animal study, where we evaluated the effects of laser irradiation on the healing of surgical wounds on rabbits. The manner of the application of LLLT on the human body are analogous to those of similar physiologic structure in animal tissue, therefore, this study was continued on humans.

Clinical study was performed on 74 patients with injuries to the following anatomic locations: ankle and knee, bilaterally, Achilles tendon; epicondylitis; shoulder; wrist; interphalangeal joints of hands, unilaterally. All patients had had surgical procedure prior to LLLT. Two types of laser devices were used: infrared diode laser (GaAlAs) 830 nm continuous wave for treatment of trigger points (TPs) and HeNe 632.8 nm combined with diode laser 904-nm pulsed wave for scanning procedure. Both were applied as monotherapy during current clinical study. The results were observed and measured according to the following clinical parameters: redness, heat, pain, swelling and loss of function, and finally submitted to statistical analysis via chi2 test.

Results:
After comparing the healing process between two groups of patients, we obtained the following results: wound healing was significantly accelerated (25%-35%) in the group of patients treated with LLLT. Pain relief and functional recovery of patients treated with LLLT were significantly improved comparing to untreated patients.

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.

Laser Therapy - Positive Double Blind Studies

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