Photomedicine and Laser Surgery
Volume 22, Number 4, 2004

Pp. 323–329

The Efficacy of Low-Power Lasers in Tissue Repair and Pain Control: A Meta-Analysis Study

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ABSTRACT

Objective: **We used statistical meta-analysis to determine the overall treatment effects of laser phototherapy on tissue repair and pain relief.** ***Background Data:*** **Low-power laser devices were first used as a form of therapy more than 30 years ago. However, their efficacy in reducing pain or promoting tissue repair remains questionable.** ***Methods:*** **Following a literature search, studies meeting our inclusion criteria were identified and coded. Then, the effect size of laser treatment, that is, Cohen's *d*, was calculated from each study using standard meta-analysis procedures.** ***Results:*** **Thirty-four peer-reviewed papers on tissue repair met our inclusion criteria and were used to calculate 46 treatment effect sizes. Nine peer-reviewed papers on pain control met the inclusion criteria and were used to calculate nine effect sizes. Meta-analysis revealed a positive effect of laser phototherapy on tissue repair (d = +1.81; *n* = 46) and pain control (d = +1.11; *n* = 9). The positive effect of treatment on specific indices of tissue repair was 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), time needed for wound closure (d = +0.76), tensile stress (d = +2.65), number and rate of degranulation of mast cells (d = +1.87), and flap survival (d = +1.95). Further, analysis revealed the positive effects of various wavelengths of laser light on tissue repair, with 632.8 nm having the highest treatment effect (d = +2.44) and 780 nm the least (d = 0.60). The overall treatment effect for pain control was positive as well (d = +1.11). The fail-safe number—that is, the number of studies in which laser phototherapy has negative or no effect—needed to nullify the overall outcome of this analysis was 370 for tissue repair and 41 for pain control.** ***Conclusions:*** **These findings mandate the conclusion that laser phototherapy is a highly effective therapeutic armamentarium for tissue repair and pain relief.**

INTRODUCTION

More than 30 years have elapsed since Endre Mester[1–3] first demonstrated that imperceptible amounts of laser light—so innocuous and so low in intensity that some have likened it to weak sunlight—could relieve pain and promote tissue repair. For as many years, the therapeutic value of these low-power lasers, generally, ≤500 mW in average power, has remained controversial, with several studies supporting the original notion that they promote tissue repair processes in experimental animals.[4–32] and human wounds and ulcers,[8,33–38] and other studies[39–46] suggesting the contrary.

A close examination of well-controlled *in vitro* and *in vivo* laboratory experiments suggests that low-intensity lasers enhance wound healing by promoting cell proliferation,[8,28–30,41–44] accelerating the formation of granulation tissue, promoting collagen synthesis,[3–13,47–61] fostering the formation of type I and type III procollagen specific pools of mRNA,[62] increasing ATP synthesis within the mitochondria, activating lymphocytes, and increasing their abilities to bind pathogens.[10,52] This trend is not so clear when clinical reports on tissue repair are examined, as a dichotomy appears between studies demonstrating beneficial effects and those reporting no effects whatsoever.[10,33–46]

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