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He-Ne laser irradiation accelerates inflammatory phase and epithelization of skin wound healing in rats

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Abstract: The purpose of this study was to evaluate if helium-neon (He-Ne) laser biostimulation can accelerate wound healing. Sprague-Dawley rats (n = 28) were used for experiment and divided into 4 groups of 7 animals. In general anesthesia two 3 cm long parallel skin incisions were performed on the left and right side of each rat spine and immediately sutured. The right wound of each rat was stimulated five times a day, 30 minutes one exposure, total daily dose 3 J · cm^{-2}, by the He-Ne laser radiation, while the parallel control lesion was not irradiated. The specimens of skin wounds were removed for histological evaluation 12 (1st group), 24 (2nd group), 48 (3rd group) and 72 (4th group) hours after surgery. The biological specimens were stained with hematoxylin-eosin and histopathologically evaluated using semi-quantitative analysis. As compared to non-irradiated control tissues, laser stimulation shortened inflammatory phase as well as accelerated reepithelization in laser irradiated wounds. The difference between the control and stimulated wounds was significant after semi-quantitative analysis in the presence of polymorphonuclear leukocytes in the 2nd, 3rd and 4th group and fibroblasts in the 2nd and 3rd group and in the process of reepithelization in the 3rd and 4th group. In conclusion these results suggest a positive effect of the He-Ne laser radiation on skin wound healing in rats.

Key words: He-Ne laser, biostimulation, wound healing, histopathological evaluation, epithelization, inflammatory phase.

Abbreviations: LLLT, low level laser therapy; PMNL, polymorphonuclear leucocytes.

Introduction

Wound healing is defined as a complex process of the replacement of dead tissue by living one, whereas it does not just come to reproduction of lonely cells, but also to recovery of damaged extracellular matrix (RUBIN & FARBER, 1994; KUMAR et al., 2003). Not every tissue is able to repair *ad integrum* – accordingly to the initial state. Therefore, we can divide the healing of various tissues into two basic groups – regeneration and repair (RUBIN & FARBER, 1994). The tissues unable to proliferate are healed by reparation as well as the tissues damaged by surgery or trauma. That kind of healing results in scar formation. The scar never becomes as organized as the non-wounded tissue (STADLER et al., 2001). After the damage of the tissue, the cells of which did not lose the ability to proliferate, it comes to multiply mitosis, neosynthesis of extracellular matrix and to creation of the tissue identical or similar to original tissue by process called regeneration (KUMAR et al., 2003). A wound healing runs in three basic phases, inflammatory, proliferative and maturative phase (BARBUL & REGAN, 1993). The phases are not strictly separated from each other, their processes freely blend together.

Low level laser therapy (LLLT) has become popular because of its variety in clinical applications. Low energy laser light (830 nm, 9 J · cm^{-2}) is reported to reduce pain (LAGAN et al., 2000), to accelerate wound healing and to have a positive effect on wound contraction (820 nm, 8 J · cm^{-2}) (HOPKINS et al., 2004). Some clinical studies have shown that LLLT is also a good choice to help healing of surgical, infected, ischemic and chronical wounds (KARU, 2003; HERASCU et al. 2005). *In vitro* and *in vivo* experiments demon-

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