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COMPARISON OF THE EFFECTS OF EXPOSURE TO NANOSECOND PULSED MICROWAVES ON A BURN INJURY DEPENDING ON THE PULSE REPETITION FREQUENCY

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The problem of restoring skin after thermal damaging in humans is an urgent biomedical problem [1]. One of the promising ways to solve this problem is the creation of new recovery methods using high-frequency low-intensity electromagnetic factors. From this point of view, data on the wound healing effect of pulsed radio-frequency radiation [2, 3], as well as nanosecond pulsed electromagnetic radiation (RPMs) are of some interest. RPMs under certain parameters can stimulate the reparative regeneration of a full-layer skin wound in mice. According to some reports, the positive effects of wound healing using extremely high-frequency exposure are explained by a decrease in the intensity of inflammatory processes due to increased microcirculation in the wound site and adjacent tissues [4].

The experiment was performed using 30 mature male rats of the Wistar line (250-280 g). All animals were divided into three groups: control – animals with a burn of the III degree without exposure to electromagnetic radiation; experimental group 1 – animals that, after modeling a III degree burn were exposed to local burn wound effects with exposure to radiation with peak power flux density (pPFD) of 140 W/cm^2, with a pulse repetition rate of 8 Hz; experimental group 2 – animals that, after modeling a III degree burn were exposed to local burn wound effects with exposure to radiation with pPFD of 140 W/cm^2, with a pulse repetition rate of 13 Hz. Thermal burns were modeled according to the standard method. The pulsed laboratory generator based on the MI-505 magnetron was used as a source of nanosecond RPMs. Histological processing of the skin was carried out by standard methods. Statistical processing of the results was carried out according to standard procedures of mathematical statistics using the capabilities of the program Statistica 8.0 for Windows.

In the performed experiments, after thermal exposure in laboratory rats, a burn injury was formed, corresponding to a third-degree burn in humans. In the control group of animals not exposed to nanosecond RPM, a monotonous decrease in the area of burn wounds was recorded. The healing process proceeded gradually from days 1 to 32 of the study. It was accompanied by a long-term preservation of the scab, which completely fell off only on the 16th day of the experiment, and partial epithelialization was observed from the 28th day. In rats of experimental group 1, subjected to 4-fold local irradiation with RPM with an intensity of 140 W/cm^2 at a pulse repetition rate of 8 Hz, starting from the 19th day, a statistically significant decrease in the area of the wound was recorded compared to the control group. At the same time, the discharge of the formed scab began on the 12th day of the experiment, and epithelialization occurred by the 24th day with complete healing of burns in all animals by the 28th day. In rats from experimental group 2, irradiated with nanosecond RPMs with an intensity of 140 W/cm^2 at a pulse repetition rate of 13 Hz, by the 5th day of the study, a statistically significant decrease in the area of the wound was observed relative to both the control group and experimental group 1. However, a further decrease in the area of wounds in experimental group 2 was monotonous and did not differ significantly from that in the control group. The scab was fully formed and began to recede only on the 14th day of the experiment, and on the 28th day of the study, partial epithelization of the wounds was observed. Thus, a comparison of the obtained results allows us to state that nanosecond low-intensity RPMs 140 W/cm^2 accelerates wound healing processes. At the same time, the impact with a pulse repetition rate of 8 Hz turned out to be more effective compared to a pulse repetition frequency of 13 Hz. Histological analysis of rat skin showed an increase in the rate of wound healing due to the accelerated formation of granulation tissue, a decrease in the thickness of the eschar, and scarless healing.

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