



## Clinical and Morphological Evaluation of Infrared Lasers of Different Powers

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**Abstract:** One of the mechanisms of low-intensity laser radiation (LILI) of infrared (IR) range effect on the body is the improvement of microcirculation. Exposure to LILI on the damaged tissue helps to shorten the phases of the inflammatory process, mainly exudative and infiltrative. Modern advances in physics allowed to create infrared emitters capable of generating impulse power of 1 to 100 W, in contrast to the series installations of previous generations ("UZOR, MILTA"), the impulse power of which does not exceed 3-6 W. The Republican Center for Laser Medicine and Surgery in collaboration with NPF "Supramed" (Tashkent) on the basis of this radiator was established a device "IMPULS-100", which is a portable semiconductor pulsed IR-laser with a wavelength of 0.89 microns, pulse frequency of 5 to 500 Hz, the duration of the laser pulse of 100 ns.

**Keywords:** clinical and morphological evaluation, exposure to IR radiation of different power on the anterior abdominal wall tissue in the area of herniotomy gate, in patients with postoperative hernias.

**OBJECTIVE OF THE WORK** - to give a clinical and morphological assessment of the effects of IR radiation on the anterior abdominal wall in the area of the herniotomy gate, with postoperative hernias

**MATERIALS AND METHODS OF RESEARCH.** Three sessions of irradiation once a day ("MILTA, UZOR"- 168 patients, "IMPULS-100"- 32 patients), and 7 sessions in the postoperative period: from the second day after surgery were included into the preoperative preparation plan in 200 patients. Results of LILI influence were estimated on the basis of clinical course of the wound process, healing of the postoperative wound and morphological studies by means of light and transmission electron microscopy. To this end, skin, aponeurosis and muscle biopsy specimens were taken.

**RESULTS AND DISCUSSION.** Exposure to 3W IR-radiation ("MILTA, UZOR") did not cause significant changes in the epidermis. The cells of the thorny layer were closely adjacent to each other, without any signs of acantholysis. The stratum corneum is somewhat thickened. The most significant changes are detected in the dermis. The number of fibroblasts increases, cells themselves become larger. The relative volume fraction of microvessels also increases. Most of them have dilated lumen

and contain erythrocytes and other blood elements. In superficial fascia and aponeurosis rather large bundles of collagenous fibers alternate with elastic fibers, there are almost no structured zones. The number of microvessels increases. There is a thickening of muscle fibers in muscles, a relative, volumetric share of microvessels increases. The volume of nerve elements also increases. Electron-microscopic studies showed that in cells of basal and lower rows of the thorny skin layer laser exposure causes increase in the volume of nuclei and nuclei. In the cytoplasm of epidermocytes, the content of polysomes and free ribosomes increases. The number of desmosomes in the areas of plasma membranes contacting with neighboring cells also increases significantly. Desmosomes themselves become larger. The number of tonofibrils approaching each part of the desmosome from the corresponding contacting cells also increases.

In the cells of the granular layer, small keratogialin granules are observed. They are evenly distributed throughout the cytoplasm. In the cytoplasm of keratinocytes there is a significant increase in the number of tonofilaments. This contributes significantly to the increase of epithelial layer strength. In the derma, the increase in the volume fraction of collagen fibers and thickening of their bundles is accompanied by a pronounced activation of fibroblasts. At the electron microscopic level this is manifested by a significant increase in cytoplasmic density, due to an increase in the number of polysomes, volume fraction of granular endoplasmic network and Golgi complex. Among fibroblasts, cells with large nuclei prevail. Significant content in the cytoplasm of both polysomes and structures for heterosynthesis indicates that these are active young fibroblasts. Large collagen fibers are in close contact with plasma membranes of fibroblasts. Individual collagen fibers can be distinguished in vacuoles in the fibroblast cytoplasm. This and close contact of clusters of collagen fibers with plasma membranes of fibroblasts indicate intensive collagen formation processes by these cells. Microvessels of the derma are dilated. Lumen surface of endotheliocytes with numerous microvilli and outgrowths. Numerous vacuoles are detected in the cytoplasm of endotheliocytes. The pericardion area protrudes into the vascular lumen. The basal membrane is thickened. It is in contact with pericytes throughout. Numerous blood-forming elements, mainly erythrocytes, are detected in dilated lumens of microvessels. Around the vessels, as a rule, numerous collagen fibers are determined. The aponeurosis microvessels undergo similar ultra-structural changes. Basal membranes become thickened. Along with young fibroblasts, other co-tissue cells, including neutrophilic polymorphic nuclear leukocytes, are often detected around the vessels. Dark Z lines and light stained I bands, as well as dark A bands with M lines are clearly detected in the muscle. There are few mitochondria in myocytes. The course of the wound process in the first group of patients (168 patients) was attenuated by suppuration in 18 patients, 3 of them had wound infiltrates. The incidence of HBO was 10.7%. When irradiating with the apparatus "IMPULS 100" the action was carried out using a pulse power of 30W with a frequency of 300 Hz. Three laser therapy sessions were carried out. A significant thickening of the epidermis was noted in the skin. This thickening occurs due to an increase in the number of cells of the thorny layer. The thickness of the granular and glossy layers increases. A pronounced thickening of the stratum corneum is noted. Nuclei in cells of basal and horny layers enlarge, nuclei are clearly contoured in them. There is no visible increase in mitotic activity of epidermis. Mitosis is not detected in basal layer as well. Bundles of collagenous fibers in aponeurosis are enlarging, relative volume fraction of microvessels is slightly increasing, but so-called structureless zones are still detected. There is also thickening of muscle fibers in muscles, small edema without infiltration with connective tissue elements is detected between muscle fibers, small accumulation of fat cells and nerve elements is only noted. Electron microscopic study showed that nuclei of cells of basal layer of epidermis become significantly enlarged, they contain large nuclei. The number of desmosomes on plasma membranes of cells of the basal and lower rows of the thorny layer increases considerably. The nuclei of cells of the thorny layer are also large with large nuclei. However, the number of tonofilaments in the cells of the basal and thorny layer is small. Mitochondria of epidermocytes of skin irradiated with IMPULS-100

apparatus were somewhat swollen with enlightened matrix. The content of free polysomes and small vacuoles increased in cytoplasm. Large drops of keratohyaline are found in the upper cell rows of the spiky layer and in the cells of the granular layer. The mitochondria of keratinocytes are swollen. Small vacuoles and free ribosomes were detected in cytoplasm. The patients of the second group (32 patients) who received sessions of irradiation with the apparatus "IMPULM-100" had a more favorable course of the wound process. Inflammation of the postoperative wound was noted in 1 case, which was 3.1%..

**CONCLUSIONS.** Used laser emitters of different pulse power ("IMPULS-100" and widely known "UZOR and MILTA") have unequal effects on the skin and subcutaneous tissue. So, "IMPULS 100" has a greater impact on the epidermis, and "UZOR" and "MILTA" cause positive changes in the dermis. The effect of both devices on aponeurosis and muscles is of the same nature and consists in stimulation of fibroblasts and enhancement of myocytes and stimulation of microcirculation.

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