

Histological Changes in Skin During the Process of Aging and Improvements Observed with the Use of Combined Laser Radiation.

Natalia Shanina

Military Medical Academy. S.M. Kirov, Department of Skin and Venereal Diseases, St. Petersburg, Russia

SUMMARY

Nowadays, there are very few scientific works devoted to studying structural changes in the skin following treatment with high-intensity laser radiation. While skin rejuvenation procedures are in high demand in developed countries, it seems relevant to obtain objective data proving the effectiveness of such therapies.

Purpose of the study: to evaluate morphological changes in the skin after combined application of erbium (Er:YAG) and neodymium (Nd:YAG) laser.

Material and methods: the study included an examination of 18 patients (3 men and 15 women), Fitzpatrick phototype from I-III, aged 32 to 66 with signs of aging of the facial and neck skin. The patients did not use other anti-aging procedures and did not take any medications during the study. All patients signed an informed agreement, which was approved by the independent local ethics committee of the Military Medical Academy (No. 189 of May 23, 2017). The work was carried out on a Fotona SP Dynamis laser system using the Fotona4D® technique. Two sessions were held with a one-month interval. The patients were not under anesthesia, but the Zimmer Cryo 6 system was used for local cold-air cooling of the skin.

Human skin samples were obtained from the chin area for histological examination. Biopsies were taken before the procedure as a control and 60 days after. Standard staining of tissue samples 4-5 microns thick with hematoxylin and eosin, as well as picrofuxin according to Van Gieson, was done.

Sections were studied in a light field using a Zeiss Axio Imager A1 microscope. To obtain digital images, the Leica DC 500 camera was used. Digital image post-processing was carried out using a personal computer with installed Adobe Photoshop CS4.

Results: In all cases, before the procedure, there was thinning of the basement membrane of the epidermis, the phenomenon of atrophy, and low cellularity. In cases where the method was applied, there was an increase in the number and activity of fibroblasts and an increase in the density of connective tissue. High eosinophilicity of the main substance of connective tissue was revealed as a manifestation of the chemistry of fibroblasts. In the preparations, after the performed procedures, the appearance of vascular "kidneys" is noted as one of the stages of neoangiogenesis, activated during the alteration of tissues in response to the laser effects. Reactive changes in the epidermis in response to the non-ablative effects of the laser were manifested as an increase in the cellularity of the epithelial layer. On average, the thickness of the epidermis before exposure to the laser was $38.03 \mu\text{m} \pm 0.59$ and after exposure $59.4 \mu\text{m} \pm 0.53$.

While determining the bulk density of the material by the "fields" method, the following results were obtained: in tissue sections before application of laser irradiation, the density was $12.33 \mu\text{m} \pm 1.74$, whereas after it was - $18.83 \mu\text{m} \pm 1.50$. The increase in area indicates the activation of neoangiogenesis in tissues after the procedure. Evaluation of the histochemical method of coloring the tissues by the Van Gieson made it possible to detect an increase in the number of collagen fibers after laser exposure.

Conclusions: combined laser action on the skin leads to a change in its structure (remodeling), which is manifested by an increase in the thickness of the epidermis, increased bulk density of the dermis, increased synthesis of collagen fibers and the formation of new vessels.

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