

### The Use of Lasers in Ophthalmology

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#### ABSTRACT

This article talks about the use of laser in medicine. The first branch of medicine in which lasers were used was ophthalmology. The word "LASER" is an abbreviation of the English "Light Amplification by Stimulated Emission of Radiation" - "light amplification by induced radiation". The term OKG is also used, which is composed of the first letters of the words "optical quantum generator".

**Introduction.** Lasers fundamentally differ from other light sources in the properties of the light flux: coherence, monochromaticity, strict directivity (low divergence). The operation of lasers is based on the principle of stimulated emission in atoms and molecules. Existing laser systems can be divided into two groups:

Powerful neodymium, ruby, carbon dioxide, carbon monoxide, argon, metal vapor, etc. lasers;

Lasers that produce low-energy radiation (helium-neon, helium-cadmium, nitrogen, dye, etc.), which do not have a pronounced thermal effect on tissues.

#### Result

In the treatment of eye diseases are usually used:

excimer laser (with a wavelength of 193 nm);

argon (488 nm and 514 nm);

krypton (568 nm and 647 nm);

diode (810 nm);

Nd:YAG laser with frequency doubling (532 nm), as well as generating at a wavelength of 1.06  $\mu\text{m}$ ;

helium-neon laser (630 nm);

10-CO<sub>2</sub> laser (10.6  $\mu\text{m}$ ).

The wavelength of laser radiation determines the scope of the laser in ophthalmology.

For example, an argon laser emits light in the blue and green ranges, which coincides with the

absorption spectrum of hemoglobin. This makes it possible to effectively use the argon laser in the treatment of vascular pathologies: diabetic retinopathy, retinal vein thrombosis, Hippel-Lindau angiomatosis, Coates' disease, etc.; 70% of blue-green radiation is absorbed by melanin and is mainly used to affect pigmented formations. The krypton laser emits light in the yellow and red ranges, which are maximally absorbed by the pigment epithelium and choroid, without causing damage to the nerve layer of the retina, which is especially important when coagulating the central parts of the retina.

The diode laser is indispensable in the treatment of various types of pathology of the macular area of the retina, since lipofuscin does not absorb its radiation. The radiation of a diode laser (810 nm) penetrates into the vascular membrane of the eye to a greater depth than the radiation of argon and krypton lasers.

A neodymium laser operating in a pulsed mode is used for precise intraocular incisions, dissection of secondary cataracts and pupil formation.

## **Conclusion**

Directions for the use of lasers in ophthalmology:

Laser coagulation. The thermal effect of laser radiation is used, which gives a particularly pronounced therapeutic effect in case of vascular pathology of the eye:

laser coagulation of the corneal vessels of the iris, retina, trabeculoplasty, as well as exposure to the cornea with infrared radiation (1.54-2.9 microns), which is absorbed by the corneal stroma, in order to change refraction.

Photodestruction (photodiscision). Due to the high peak power, tissue is cut under the action of laser radiation. It is based on electro-optical "breakdowns" of the tissue, resulting from the release of a large amount of energy in a limited volume. In this case, a plasma is formed at the point of impact of laser radiation, which leads to the creation of a shock wave and micro-rupture of the tissue. To obtain this effect, an infrared YAG laser is used.

Photoevaporation and photoincision. The effect is a long-term thermal effect with tissue evaporation. For this purpose, an IR CO<sub>2</sub> laser (10.6 μm) is used to remove superficial formations of the conjunctiva and eyelids.

Photoablation (photodecomposition). It consists in the dosed removal of biological tissues. We are talking about excimer lasers operating in the hard UV range (193 nm). Area of use: refractive surgery, treatment of dystrophic changes in the cornea with opacities, inflammatory diseases of the cornea, surgical treatment of pterygium and glaucoma.

Laser stimulation. For this purpose, low-intensity red radiation from He-Ne lasers is used in ophthalmology. It has been established that the interaction of this radiation with various tissues as a result of complex photochemical processes manifests anti-inflammatory, desensitizing, resolving effects, as well as a stimulating effect on the processes of repair and trophism.

Laser stimulation in ophthalmology is used in the complex treatment of uveitis, scleritis, keratitis, exudative processes in the anterior chamber of the eye, hemophthalmos, vitreous opacities, preretinal hemorrhages, amblyopia, after surgical interventions, burns, corneal erosions, and some types of retino-mucoids.

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