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LIGHT AND LASER RADIATION IN MEDICINE

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Absract: *Light and laser radiation in medicine. Physics of lasers and properties of laser radiation. interaction of laser radiation with biological tissues. Characteristics and parameters of laser radiation. modes of operation of laser radiation. Laser diagnostics, low-intensity and power therapy, surgery. the effect of laser radiation on soft tissues and bone Phototherapy is a method of physiotherapy, which consists in using, for therapeutic and prophylactic purposes, the energy of light from visible, infrared and ultraviolet rays from natural (sun) and artificial sources. At present, laser radiation, which does not exist in nature, can be attributed to phototherapy.*

Only absorbed energy has a biological effect. Visible rays are of hygienic importance, although light sources provide both visible and infrared rays, sometimes all three types of radiation.

Keywords: *Laser diagnostics, Laser dentistry therapy, "microexplosions"*

Laser radiation is a special type of light radiation of an elecomagnetic nature, obtained with the help of optical quantum generators-lasers. Lasers tr emit monochromatic radiation of any wavelength in the optical range: ultraviolet, visible and infrared.[2,8,18,29]

In medicine, laser radiation of various intensities is used. High-energy radiation is used in surgery to cut and destroy tissue. In physiotherapy practice, low-energy lasers are used that generate radiation of the red and infrared spectrum. The intensity of laser radiation is judged by the power flux density in watts per cm (J / cm). In physiotherapy, radiation of the order of 1–6 mW / cm is used.

Laser light is absorbed by a certain structural element that is part of the biological tissue. The absorbing substance is called chromophore. They can be various pigments (melanin), blood, water, etc. Each type of laser is designed for a specific chromophore, its energy is calibrated based on the absorbing properties of the chromophore, as well as taking into account the field of application. In medicine, lasers are used to irradiate tissues with a therapeutic or prophylactic effect, for coagulation and preparation of soft tissues (operating lasers), as well as for bleaching and high-speed preparation of hard tissues of teeth.[7,14]

There are several modes of laser operation: pulsed, continuous and combined. Their power (energy) is selected in accordance with the operating mode.

The mechanism of the therapeutic action. The biological and therapeutic effects of low-energy laser radiation are under study. Some authors believe that the effect of low-energy laser radiation in the optical range is due to its perception and absorption by both specific (porphyrins, carotenes, cytochrome oxidase, catalase) and nonspecific (phospholipids, pigments, blood, plasma, lymph) photoacceptors, which ensures the transformation of energy into biophysical and biochemical processes. [6,13,26]

The biological effect of laser radiation depends on the wavelength, power and time of exposure, continuous or pulsed method of energy supply. The properties and condition of the irradiated tissues are of great importance: pigmentation, vascularization, the nature of the pathological process. [23,24,25]

Under the action of laser radiation in the nuclei of cells of various human tissues, an increase in the synthesis of nucleic acids (DNA, RNA) was revealed, an increase in the activity of enzymes, an increase in oxygen exchange, and activation of redox reactions were noted. The consequence of this is an increase in cell proliferation, a pronounced stimulating and trophic effect. Proven stimulating effect on reparative osteogenesis, anti-inflammatory effect

due to vasodilatation, increasing blood flow rate, opening collaterals, improving microcirculation. [4,20,25]

Laser radiation affects the indicators of humoral and cellular immunity, increases the phagocytic activity of leukocytes. Low-energy laser radiation has a modulating effect on the parameters of the blood coagulation and anticoagulation system. Improvement of the rheological properties of blood is accompanied by hypocholesterolemia and activation of the antioxidant system. [9,19,27]

Healing effects. Laser light has a wide range of therapeutic and prophylactic effects:

- causes a pronounced anti-inflammatory effect;
- normalizes microcirculation;
- reduces the permeability of the vascular walls;
- possesses fibrinothrombolytic properties;
- stimulates metabolism, tissue regeneration;
- increases the oxygen content in them;
- accelerates wound healing;
- prevents the formation of scars after operations and injuries;
- has a neurotropic, analgesic, micro-relaxant, desensitizing, bacteriostatic and bactericidal effect;
- stimulates the immune defense system;
- reduces the pathogenicity of microflora, increases its sensitivity to antibiotics. **Mechanism of action.** Laser dentistry surgery is based on a destructive effect on tissue: thermal, hydrodynamic, photochemical effects from exposure cause tissue destruction.

Laser dentistry therapy is based on photochemical and photophysical effects, in which light absorbed by tissues excites atoms and molecules in them, activating the therapeutic mechanisms of the body: resistance increases, reparative processes are stimulated,

Eight microcirculation improves, immunity normalizes, acute inflammation subsides. [5,16,29]

Diagnostics of laser dentistry in a dental clinic is based on laser exposure that does not cause changes in the properties of biological tissues, the effects of scattering, reflection, penetration. In dentistry, the most commonly used CO2 laser for affecting soft tissues and an erbium laser for preparing hard tissues of teeth.

The mechanism of action on soft tissues of a CO2 laser is based on the absorption of laser light energy by water and heating of tissues, which makes it possible to remove soft tissues layer by layer and coagulate them with a minimum (0, 1 mm) zone of thermal necrosis of nearby tissues and their carbonization. [12,19,28]

The mechanism of action on hard tissues of the erbium laser is based on "microexplosions" of water, which is part of the enamel and dentin, when it is heated by a laser beam. The process of absorption and heating leads to the evaporation of water, micro-destruction of hard tissues and the removal of solid fragments from the affected area by water vapor.

A water-air spray is used to cool the tissues. The effect of exposure is limited to the thinnest (0.003 mm) layer of laser energy release. Due to the minimal absorption of laser energy by hydroxyapatite — the mineral component of the chromophore — the surrounding tissues are not heated by more than 2 ° C.

Scope of use. The universal properties of laser action are used in various branches of practical medicine: surgery, therapy and diagnostics. Depending on the nature of laser action on tissues, including in the oral cavity (parameters of laser radiation: wavelength, power, time and mode of exposure to biological tissues), various effects can be used. [17.22]

Indications for laser use. In therapeutic dentistry, laser therapy is indicated for the treatment of:

- diseases of the hard tissues of the tooth of carious origin (pulpitis, periodontitis);
- non-carious enamel lesions (increased abrasion, hyperesthesia, etc.);
- periodontal diseases (gingivitis, periodontitis, periodontal disease);
- diseases of the oral mucosa (stomatitis of various etiologies, lichen planus, cheilitis);
- stomatoneurological diseases (trigeminal neuralgia, glossalgia, neuritis of the facial nerve). [8,22,33]

In surgical dentistry, quantum therapy is indicated:

- in the treatment of inflammatory processes in the maxillofacial region (periostitis, alveolitis, osteomyelitis, abscesses and phlegmon, lymphadenitis);
- in the postoperative period (after any operations in the maxillofacial area);
- in the complex of measures in the treatment of traumatic injuries of the jaws;
- in the treatment of arthritis and arthrosis of the temporomandibular joint;
- in the treatment of diseases of the salivary glands.

In orthopedic dentistry:

- in the treatment of pressure ulcers (prosthetic) erosions and ulcers;
- with traumatic injuries of the mucous membrane of the gums and oral cavity.

In orthodontics, it is used to speed up the movement of teeth.

The indications for the use of erbium and CO2 lasers include:

- preparation of cavities of all classes, treatment of caries and non-carious lesions; • processing (etching) of the enamel to prepare for bonding;
- sterilization of the root canal, impact on the apical focus of infection;
- pulpotomy, stopping bleeding;
- treatment of periodontal pockets;
- exposure of implants;
- gingivotomy and gingivoplasty;

- frenectomy;
- treatment of mucosal diseases;
- reconstructive and granulomatous lesions;
- operative dentistry.

Soft tissue procedures can be performed using a semiconductor laser. The laser perfectly prepares, disinfects, coagulates and reconstructs soft tissues. In the dental clinic, using a laser, the gums are corrected in the process of preprosthetic preparation, this makes it easier to work with materials. The bloodless field gives direct access to surfaces covered by mucous membranes. Laser dentistry will correct the incorrect position of the frenum of the tongue on the upper and lower jaws Its excision with any soft tissue laser gives immediate results and brings relief to the patient. With laser treatment during the healing process, there is a minimal formation of fibrous tissue, much less than wounds from a scalpel intervention. In the dental clinic, periodontal pockets are processed during initial periodontitis. This gives a quick and good result, which is achieved as a result of irradiation. Tartar after exposure to laser dentistry is easier to remove. [15,31,32]

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