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LASER ABLATION OF SOFT TISSUES

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Laser technologies are briefly used in a variety of fields. Certain skin conditions such as skin cancer are lethal. Laser surgery is one of the best methods to conquer this issue. This paper includes a comparative analysis of invasive methods of battling different skin conditions.

Keywords: laser, ablation, laser ablation, soft tissues, ablation of soft tissues, low-invasive surgery, melanoma, methods of ablation, surgical ablation, laser surgery

Laser surgery is a method of performing surgical operations, consisting of the removal or cauterization of small areas of tissue with minimal damage to surrounding tissue. [1] It has the potential to affect different groups of tissues with different results, depending on the parameters of the laser and its mode and the parameters of the tissue itself. This makes laser surgery versatile enough to use. How the patient will recover after the procedure is also important. Numerous clinical studies show that laser surgery can significantly facilitate the subsequent recovery period. Thus, we can safely say that the laser technologies used in medicine and surgery, in particular, are extremely useful, especially when it comes to serious diseases like a type of skin cancer known as melanoma. Melanoma is lethal but it may be curable, if operated in the early stages

The most important question for our consideration is how exactly laser radiation affects soft tissues. The biological effect is caused when radiation of a certain wavelength is absorbed by the photoreceptors of structural components of cells. When a laser beam acts on biological tissues, its intensity decreases due to reflection from the irradiated surface as well as the absorption of radiation energy by acceptors of cell membranes. [2] The penetration depth of laser radiation can reach 40 – 70 mm. It is important that high-intensity laser radiation causes various photothermal reactions in biological tissues that are associated with an increase in tissue temperature. These are reactions such as protein denaturation and coagulation necrosis. All of the above leads us to the concept of ablation. In the physics literature, the term "ablation" (from the Latin. "Ablatio" – removal, elimination) refers to a combination of complex physical and chemical processes, the result of which is the removal of a substance from the surface or from the volume of a solid body. [3] The laser ablation method is cheap and easy to perform. Infrared laser ablation of tissue

is explosive in nature, which is carried out in the form of boiling in a limited volume. This explains the relatively large achievable depth of ablation. The result of the action of high-intensity laser radiation on the tissue is a laser wound, which consists of several zones: a laser crater, a zone of necrotic changes, a zone of products of destroyed biological tissue (carbonization zone). And this is the surgical effect of the laser on the tissue.

Of course, in order to ablate soft tissue, it is not necessary to use a laser. There are other methods. Their comparative analysis is presented in the table below.

Table 1

Comparison of the infrared laser ablation method with its closest analogues

Evaluation parameters	Methods of soft tissue ablation		
	Infrared laser ablation	Radiofrequency ablation	Microwave ablation
Effect on soft tissue	Protein denaturation, dehydration, coagulation necrosis, carbonation of ablation products		
Diameter of pathologies	≤ 3 cm	≤ 2 cm	≥ 2 cm
Resistance to heat dissipation in tissues	Low	Low	High
How well studied is the method	Insufficiently explored	Widely used in practice	Insufficiently explored
Complexity of execution	Easy	There are a number of difficulties	Difficult to control
Cost of using the method	Low	Relatively low	High
Additional injury hazard	None	Burns due to grounding	Burns due to high power point concentration

All three methods act the same on tissues. The main difference is the nature of the radiation. However, the quality rating of the use of these ablation methods varies widely. The laser ablation method is the cheapest of those presented in Table 1. And it is also quite universal in operation. The disadvantages of this method are the most insignificant.

Considering all of the above, we can conclude that the laser ablation method is of interest to a deeper practical study since it has great potential and a competitive advantage over other methods.

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