

THE RESEARCH OF POSSIBILITY OF THE EVALUATING LASER EXPOSURE BY METHODS OF OPTICAL SPECTROSCOPY DURING MINIMALLY INVASIVE ENDOSCOPIC OPERATIONS

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The scientific paper is concerned with the research of the possibility of the application of optical spectroscopy methods for real-time dynamic estimations of the level of the laser radiation exposure on the surface of a biological object in the conduct of minimally invasive endoscopic operations.

From the 1990s has been started the development of minimally invasive operations, which allowed to minimize the area of intervention in the body and level of tissue injury. The impact on biological tissues becomes more targeted by using endoscopy methods in the field of minimally invasive operations. Commonly radiofrequency or laser radiations are used for exposure. Nowadays the number of medical fields which are using such methods of operational interventions is increasing. For example, this type of operation is used in cardiology, oncology, and phlebology [1-3]. Despite this, methods of estimating the impact results in real-time remain very deficient. This study provides a dynamic method for estimating the laser impact on the biological tissue. The method is based on the dynamic estimation of changes in tissue's spectral characteristics. The proposing method permits controlling the level of ablation's impact on the tissues in real-time and can improve the efficacy and safety of the operation. The realization of the proposed method is based on continuous registration of broadband back-reflected radiation from the field of impact by the spectrometer. The broadband radiation is delivered to the field of impact by the same optical fiber as laser radiation. An optical system of the spectral division was developed for the effective work of the method. Additionally, there is developed a program for spectrometer, which permits to visualization and record spectral characteristics during a required time interval, allowing to reproduce of the recorded data and visualize the spectral characteristics in form of three-dimensional function. During this research were made several experiments. The results of the experiments have confirmed the potential of using the method for continuous control of laser impact to biological tissues and also they showed significant changes in the spectral characteristics of laser exposed biological tissues.

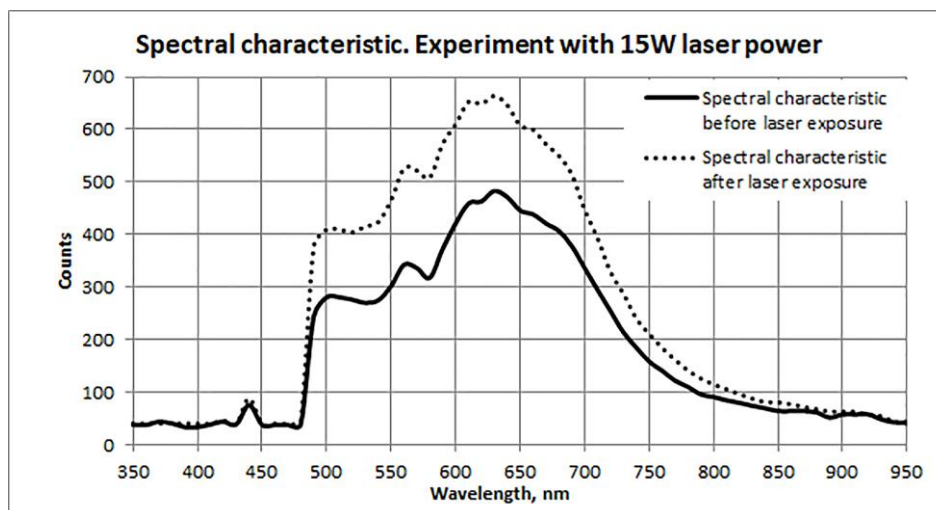


Рис. 1. Spectral characteristic from one of experiments

All achieved results reveal that the proposed method has sufficient sensibility and operating speed. At present we are working on new experiments of determination laser power which is needed for necessary impact.

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