

A study of illumination spectra to improve contrast imaging of biological tissues

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More than 250 thousand open operations are carried out in Russia throughout the year in the view of World Health Organization. The quality of illumination of the operating field is important parameter for surgical. The leading manufacturing companies have produced a number of surgical lamps based on phosphor conversion white LEDs, that provide high-quality illumination with a color rendering index (CRI) reaching 95. Our approach suggests use of polychrome LED RGB emitters - the only light sources that allow dynamic control of the spectral-color composition of illumination during operation. Each biological tissues have the own reflectance spectrum. It allow highlight features or objects of interest amid the surrounding by change spectrum characteristics of light.

Thus, the purpose of this work is to obtain and study the spectral composition of radiation of a multicolor LED controlled source light for better visualization of biological structures in the operating field. For this work a radiation source developed in Submicron Heterostructures for Microelectronics, Research & Engineering Center (Russian Academy of Sciences) was used. This device contains 6 light-emitting diodes of different colors: blue, green, lime, turquoise, red, orange. The presence of 6 diodes with a complex spectral composition of radiation provides the ability to adjust and select the spectral composition of the illumination of the working field.

Selection of optimal lighting parameters of the operating field was carried out with the help of an experienced surgeon. The proposed initial parameters of illumination of the operating field were determined based on previously recorded reflection spectra of various organs and tissues. The studies were conducted on a rat of the Wistar line. Narcosis and anesthesia were carried out with Xylazine-Zoletil mixture. The surgical illuminator was mounted above the operating table in a specially designed 3D-printed holder. To obtain spectral characteristics of illumination, temperature, and coordinates in color spaces CIE1939, CIE1976 and other parameters, UPRtek MK350N portable spectrometer were used. The following biological tissues *in vivo* were examined in the experiment: liver, arterial vessels, intestines, bladder, nerve fibers, kidney, and spleen.

As a result of the work, the modes of operation of the light source for better visualization of biological structures on the background of biological objects were selected and investigated. The hypotheses of the modes of operation of the light source were confirmed and tested.