Changing the Wettability of Titanium Using the Method of Laser Surface Modification in Liquid

Marshunina, Mariia (School: Samara Regional Centre for Intellectually Gifted Children)

Titanium and titanium alloys are used in modern medicine for making implants. For integration into bone and soft tissues, the surface of the implant has to be the most hydrophilic. If the implant is not for integration, its surface has to be the most hydrophobic. The project proposes a solution to the problem of controlling the degree of engraftment of titanium implants, depending on the wettability of their surface. To solve this problem, the method of laser ablation in a liquid is used. It is based on local melting of the material under a liquid layer using a laser beam. The morphology of the resulting surface is affected by: the wavelength of the laser radiation, the energy density, the duration of the laser pulse, and the environment surrounding the sample. We experimentally found out that different parameters of laser irradiation result into an increase of various quasi-periodic structures on the titanium surface. The morphology and elemental composition of the surface of titanium samples were studied using a scanning electron microscope. Next, we examined how to determine a contact angle of a liquid with a modified surface, since the osseointegration of the sample directly depends on it. To be able to make a specific drop of liquid on the surface of the test sample and to exclude human factor we developed an experimental setup. Based on the experiments, we made a conclusion that the wettability of the surface changes according to the laser energy density. At the moment, we are studying the biocompatibility of samples using a special express method. We are working on a portable device that provides a possibility to change the wettability of the implant using the method of laser ablation in the liquid, depending on surgeon’s requirements.

Awards Won: