Laser Doppler flowmetry and tissue oxygenation monitoring in assessing of the survival rate of an elongated skin flap under the biomaterials application

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Abstract Necrosis of the distal part of the flap, especially in elongated flaps, is one of the complications of vascularized skin grafting due to insufficient blood supply. A promising approach aimed at improving the survival of skin flaps is the development and use of biomaterials. At the same time the range of methods approved for use in the clinic and allowing non-invasive assessment of the effectiveness of biomaterials is limited. The aim of the work is to substantiate the possibility of using the laser Doppler flowmetry method and monitoring tissue oxygenation with the moorVMS-PC software (Windows ™) to assess the survival rate of an elongated skin flap under the action of biomaterials. A modified model of an elongated dorsal (width to length ratio 1 : 4) skin flap is proposed. A decrease in the area of flap necrotization with the

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use of the Zn-dopped matrix by 3.3 times compared with the control group and the absence of necrotization with the use of the non-dopped matrix was found. It has been shown that microcirculation in the caudal part of the flap without the use of matrices decreases in the caudal part of the flap and increases in the cranial part; tissue oxygenation increases in the cranial direction. There were no differences in blood flow rates when using a non-dopped matrix, which indirectly indicates the creation of favorable conditions for flap vascularization. For the first time, using the laser Doppler flowmetry method and monitoring tissue oxygenation with the moorVMS-PC software for Windows ™, it was indirectly shown that the studied matrices have an effect on microcirculation, tissue oxygenation and skin graft survival in a modified model of an elongated skin flap with a width to length ratio of 1: 4. The LDF method is sensitive to the action of biomaterials and can be used in preclinical studies for the initial assessment of the potential bioactivity of new biomaterials and in clinical studies to assess the effect of biomaterials on the survival of a skin flap.

Keywords Laser Doppler flowmetry • Tissue oxygenation • Microcirculation • Skin flap • Tissue necrotization • Matrix