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PILOT STUDIES OF THE SYNCHRONIZATION IN SKIN BLOOD FLOW OSCILLATIONS IN CONTRALATERAL LIMBS

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ABSTRACT

The study of blood microcirculation provides valuable diagnostic information and can be of particular interest in the evaluation of the severity and nature of different diseases. In modern diagnostics, there are several commonly used optical non-invasive methods to diagnose the functional state of skin microcirculation. One of these methods is the laser Doppler flowmetry. This technique is based on the registration of laser radiation, backscattered and reflected from moving red blood cells, and following processing of the received signal. Recent emerge of new wearable implementation of the laser Doppler flowmetry monitors in compact form factor inspires a renewed interest in the method.

Currently, there is a shortage of studies about the simultaneous detection of the blood perfusion signal from symmetrical areas of upper limbs. The purpose of this work was to investigate the synchronization of blood perfusion signal from contralateral limbs.

Experimental studies were carried out using four experimental prototypes of the wearable laser Doppler flowmetry devices (LAZMA PF, SPE LAZMA, Moscow) for blood microcirculation analysis, implementing identical channels for blood perfusion registration. The study involved 36 healthy volunteers, divided into 2 groups according to their age: 18 volunteers younger than 20 years (19±0.8 years) and 18 people older than 40 years (54±9 years). Studies were conducted in the sitting position; hands were placed on the table at the heart level. The blood perfusion was registered for 10 minutes with the location of sensors on the palmar surface of the 3rd finger distal phalanx of the hand.

In order to study the synchronization of blood perfusion in the contralateral limbs, a wavelet coherence analysis was used. Morlet wavelet was chosen as the kernel function. The box-and-whiskers diagram was built for the demonstration of differences in coherence parameters between healthy volunteers of selected age groups.

A statistical difference in the synchronization of myogenic oscillations was found between the two age groups. Myogenic oscillations of blood perfusion in the younger group had a higher wavelet coherence parameter than in the older group, according to Wilcoxon signed-rank test. The results of this experiment may be useful in determining the age specificity of blood microcirculation.

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