

THE PHOTOPLETHYSMOGRAPHY (PPG) APPARATUS FOR DIAGNOSIS OF THE PERIPHERAL BLOOD CIRCULATION

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The modern photoplethysmography (PPG) uses the achievements of quantum electronics. The PPG measures the cardiac induced changes in tissue blood volume by light transmission measurements. The transmission PPG probe consisted of a light emitting diode (LED) and a PIN photodetector which were attached to the palmar and dorsal aspects of the index fingers bilaterally. The light from the LED was modulated at a frequency of 3kHz and the detected transmitted light was filtered through a narrow band around 3kHz to avoid background light. The signal from the detector was then demodulated in order to obtain the PPG signal. The PPG signals were sampled at a rate of 500 samples per sec and digitally stored for further processing.

After the examination, the stored data was digitally analyzed for the detection of the minimum and maximum of each PPG pulse. For each PPG pulse, the baseline BL of the pulse and its amplitude AM were determined. In this study, only the very low frequency (VLF) spontaneous fluctuations were investigated. The low frequency (LF) fluctuations were filtered out by the smoothing method of moving average and were removed (trend removal) by fitting a fifth order polynomial to the data and subtracting it from the original curve.

Another parameter derived from AM and BL was examined: the statistical parameter STD/AVR of ratio AM/BL. The very low frequency (VLF) fluctuations in BL and AM showed high correlation between the right and left hands and feet. Good correlation was also found between the hand and the foot. The right-left coefficient of correlation was little dependent of the subject's age; the coefficient of correlation between AM and BL and STD/AVG(AM/BL) decreased with age.

The high correlation between the VLF fluctuations of the PPG parameters in different body sites show that their origin is central. The similarity in the spontaneous fluctuations of the PPG signal and heart rate indicates that both are mediated by the autonomic nervous system. The VLF fluctuations of the PPG parameters and the correlation coefficients between them enable the understanding and the assessment of the autonomic nervous system function.