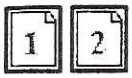

8.1.1.4 Use of Thermal Rhythmography for the Evaluation of Autonomic Nervous Function

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In this study, the changes in skin blood flow and skin temperature with healthy subjects and the difference in the distribution of the rhythms of skin temperature between healthy subjects and patients with Raynaud's syndrome was analyzed using laser doppler flow meters, thermocouples and a thermographic system (thermal rhythmo-graphy) which is capable of displaying topograms of the power spectra of an arbitrary frequency range with respect to changes in skin temperature. The results showed that the periodic fluctuations of skin temperature may provide a useful index for autonomic nervous conditions, and thermal rhythography could become a useful tool for the evaluation of autonomic dysfunction or for the preventive diagnosis of neuro-vascular diseases such as Raynaud's syndrome.

INTRODUCTION

It has been reported that both skin temperature and skin blood flow exhibit several periodic fluctuations, with the period being between several seconds and several minutes. Although details concerning the fluctuations still remain unclear, the mechanism and the physiological basis underlying the periodic rhythms of the blood flow and the skin temperature are not yet well understood, it is thought that the fluctuations originate in the periodic rhythms of the autonomic nervous activity of the central nervous system. This suggests the possibility of using those fluctuations as indices for diagnosing dysfunctions of the autonomic nervous system or for evaluating the individual's psychological state, such as degree of stress or comfort. In this study, the changes in skin blood flow and skin temperature were investigated with healthy subjects using laser doppler blood flow meters, thermocouples or thermistor thermometers. The difference in the distribution of the rhythms of skin temperature between healthy subjects and patients with Raynaud's syndrome was analyzed using a thermographic system which is capable of displaying topograms of the power spectra of an arbitrary frequency range with respect to changes in skin temperature. This permitted investigation of the feasibility of a diagnostic application of the frequency analysis of skin temperature with regard to autonomic nervous dysfunction.

METHOD AND SUBJECTS

The experiments were performed on three healthy males aged 24 to 42 years in a climate-controlled windless room, and then repeated with 0.3 clo of clothing and an activity of 0.8 met. After the subjects had adapted to the thermal environment in the room, the temperature in the room was changed from 10 deg.C to 40 deg.C in intervals of 5 deg.C, and the humidity was maintained at 50%. The skin temperature were measured using thermocouples at the nose and fingertip. The skin blood flow was also measured at the nose and fingertip using laser doppler blood flow meters. The data were recorded and transferred to a microcomputer (Power Macintosh 6100). The frequency analysis was performed by the fast Fourier transform (FFT) method.

2. Thermal rhythmography