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General Summary

Our main research interests are gravitational physiology and aerospace medicine. We also developed a new method with which human mental concentration and relaxation can be objectively evaluated.

Research Activities

Research on visual stimulus and posture control

The information used to maintain body direction and to produce movements of the body center to maintain posture are determined by visual input factors, equilibrium vestibular input factors, and somatosensory factors from the muscles, tendons, joints, and skin of the entire body. Visual information becomes the main factor in outer space because the vestibular and somatosensory inputs are reduced owing to the lack of gravity. The aim of this research was to analyze the change of posture induced by visual stimulus. This year, we developed the following device: a roll screen 90 cm in diameter and 110 cm high which has vertical black and white 7-cm-wide stripes on its inner surface and can rotate at speeds of 5, 10, and 20 rpm. The center of gravity of the body of each subject was measured with a balance board (a modified Wii Balance Board, Nintendo Co., Ltd., Kyoto) that was placed at the center of the roll screen. The data of the balance board was sent to a computer via a data acquisition system (PowerLab, ADInstruments Japan, Tokyo) on line. First, the subjects stood on the board and then watched the rotating screen (visual stimulus). Next, the subjects stepped on the board with or without visual stimulus.

Changes in the body's center of gravity in the static standing position were observed when the screen was rotated, but there was no significant difference between with and without the visual stimulus. However, a significant rotational change of the body was observed when the subjects stepped on the board. The rotation angle showed individual patterns, but the direction of rotation was the same as that of the screen.

Evaluation of human mental concentration by using the event-related potential

If subjects performed mental concentration, the latency of P300 event-related potentials was reduced.

Evaluation of human strain and relaxation

The power spectral density in a low-frequency component increased after stress loading.

Evaluation of human stress by using platelet aggregation

We studied the fundamental factors that influence platelet aggregation. We observed an increase in platelet aggregation after the subjects smoked cigarettes.

Publications

Toshima H, Kimura N, Kurihara S. Influence of smoking on the human autonomic nervous system. *Autonomic Neuroscience: Basic Clin* 2009; **149**: 72

Toshima H, Tsukui T (Tokai Univ), Kobayashi Y (Daiichi-Sankyo), Kurihara S. New event-related potential (ERP) induced by loading of auditory and visual stimuli. *J Physiol Sci* 2009; **59 Suppl**:

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Ohira T¹, Terada M¹, Kawano F¹, Nakai N¹, Ochiai T (Mitsubishi Heavy Industries), Gyotoku J (Tsurui Chemical Co), Sudoh M, Ohira Y¹ (Osaka Univ). Region-specific responses of adductor longus muscle to unloading and reloading in wistar hannover rats. *J Physiol Sci* 2009; **59 Suppl**: 216.