Cortical activity difference in the young and elderly adult

C-J. CHANG, S-W. YANG. ***Cortical activity difference in the young and elderly adult during a quiet standing task.*** *Gerontechnology 2014;13(2):176;* doi:10.4017/gt.2014.13.02.116.00 **Purpose** Posture control and the associated neurological pathways degenerate with age. Age-related changes result in poor motor coordination, delayed muscle recruitment, and even loss of compensatory strategy while dealing with postural perturbation[1]. In the central nervous system, the sensorimotor cortex has to integrate and coordinate the different sensation inputs and motor outputs to help the neuromuscular and musculoskeletal systems deal with disturbances and maintain stability. Several studies have employed the electroencephalography (EEG) to investigate brain activity during posture control task, and the variable of power spectral density (PSD) indicates that the brain activities increases during an unstable standing task[2]. In this study, we investigate variations in EEG in subjects of different ages while standing on the ground with eyes open or closed. **Method** Two female subjects were recruited into the pilot test, the ages were 23 years (young group) and 66 years (elderly group). Each subject had to complete 3 trials while standing with her eyes open or closed for 30s. We used the NuAmps 40-channel DC amplifier for EEG records (Neuroscan, USA). *Figure 1* depicts brain area Cz, Pz, Fz, T3, and Oz electrode locations that correspond to the sensorimotor, vestibular, and visual cortex areas, at a rate of1000Hz. After filtering and smoothing the data in 0.1-50Hz with AcqKnowledge 3.9.1 analysis software (Biopac Systems, Inc.), we estimated the maximum PSD differences between age and vision factors. **Results & Discussion** The young group had greater maximum PSD in each test condition (*Figure 2*), and the elderly group exhibited lower cortical activity when performing the quiet standing task. During the eyes closed condition, the young group had between 2.7-6 times greater cortical activity than during the eyes open condition; and the elderly group had between 2.5-4 times greater than the eyes open condition (*Figure 2*). This finding suggests that the young subjects have better efficiency than the elderly group in relevant brain areas responsible for coordinating the neuromuscular system. Furthermore, while the task became more difficult (e.g., eyes closed when standing), the greater cortical activities measured in the younger subjects indicate that the brain can regulate the proprioceptive biofeedback changes more quickly than in the elderly group. This was a pilot test of our age-related brain cortex activity with postural control. For rehabilitation engineering, the findings help to establish parameters for age-related neurological degeneration screening and provide preliminary data for developing fall prevention standards and improvement of the daily living quality and safety.

References

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Keywords: aging, postural control, electroencephalography, rehabilitation engineering
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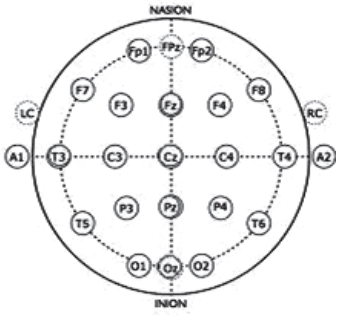

Figure 1. EEG International 10–20 system

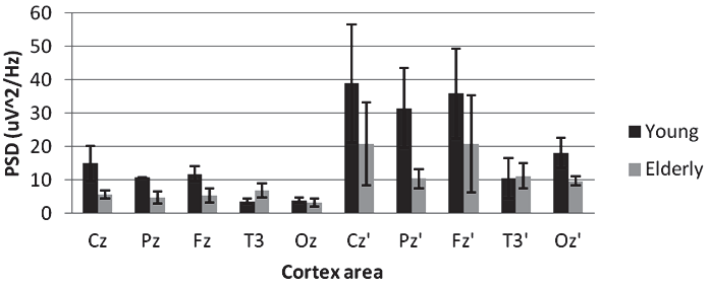

Figure 2. Maximum PSD in standing with eyes open vs. eyes closed (') in each cortex channel