Influence of Visual Spatial Positioning Information on Postural Control on People While Standing

- A Comparison between Younger and Elderly Subjects -

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Introduction. Postural control of elderly people while standing is strongly affected by their surrounding environment due to relatively increased dependence on vision. When we consider the prevention of the elderly from falling, it is important to note that the information in their surrounding environment obtained from visual perception affects their postural control while standing. However, previous studies have investigated only two-dimensional visual stimulation and visual effects on younger people. We believe that such experimental conditions are not realistic when studying the postural control of the elderly. When conducting such test on the elderly, three-dimensional visual stimulus (Spatial Positioning Information) must be considered and the study should specifically be conducted using elderly subjects.

Purpose. To examine postural control by investigating the influence of visual spatial position information on younger and elderly subjects.

Subjects. Thirty one younger men/women (mean age, 22.6 ± 2.9 years) ('Younger Group') and 28 elderly men/women (mean age, 75.0 ± 5.1 years) ('Elderly Group'), all healthy and community-dwelling, participated in this study.

Experimental instrument and parameters. A posturography was taken using a G-6100 Anima gravicorder (ANIMA Corporation, Tokyo, Japan), at a sampling frequency of 20Hz. The sampling time was 30 seconds and the parameters were the total length of CoP(1) and the surrounding area(2).

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\text{LNG} = \sum_{i=1}^{600} \sqrt{\Delta x_i^2 + \Delta y_i^2} \quad (i=1,2,3,\cdots,600) \quad (1)
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\[
\text{AREA} = \sum_{i=1}^{120} r_i \cdot r_{i+1} \cdot \sin \theta / 2 \quad (\theta = 3^\circ, i=1,2,3,\cdots,120) \quad (2)
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Experimental environment and conditions. The subjects of both groups were asked to stand on a force-plate in the Romberg position and fix their eyes on a single point placed in front of them. A total of 10 visual information columns were then positioned around the subjects. The point placed immediately in front of the subject was 0°, and other points were placed at 10°, 30°, 50°, 70°. Also as control, the same test was conducted on the subjects without applying any visual information. Except 0° and control, visual information was set radially from left to right of the subjects.

Data analysis. Two trials were performed on the subjects and their mean value was calculated. This data were analysed by two-way ANOVA with repeated measures. Tukey test was also conducted for post-hoc test and a p value less than 0.05 was considered statistically significant.

Results. A significant interaction effect was seen between visual information and age condition (F(9,49)=2.48, p< 0.05) in the total length of CoP. A significant effect in visual information (F(9,49)=4.07, p<0.05) was seen in the surrounding area but there was no significant effect regarding age (F(1,57)=2.86, p=0.09). As for the post-hoc test, the total length of CoP at points left 10°, 0°, right 10° and 30° were significantly lower than control (all p<0.05).

Conclusion. The results of this study suggest that postural control of the elderly while standing is more dependent on visual perception than younger people.