Brain mapping-based interhemispheric brain coordination exercises and gerontechnology for improving cognitive function in the elderly

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Purpose The maintenance and enhancement of cognitive function in the elderly is one of the important topics in modern society. Cognitive function refers to the ability of humans to process, understand, solve problems, and make decisions. Elderly individuals tend to experience a decline in cognitive function due to aging, which can have negative impacts on daily challenges and quality of life. One of the most representative diseases caused by the decline in cognitive function in the elderly is Alzheimer's disease.Currently, there is no definitive treatment for Alzheimer's disease. Therefore, it is crucial to detect the risk of dementia early, even before cognitive impairment symptoms appear, and implement lifestyle adjustments and cognitive stimulation training for dementia prevention in daily life. Brain-mapping-based bilateral brain coordination exercises for cognitive stimulation involve activating specific areas of the brain and promoting coordination between the left and right hemispheres. These exercises are designed to be easily performed by the elderly in their daily lives, focusing on stimulating exercises such as hands, tongue, and feet, which occupy the largest proportion of the brain based on Penfield's Brain Map. The exercises include various movements and patterns, through which seniors can enhance cognitive functions such as attention, memory, and concentration. Meanwhile, these exercises are closely related to Gerontechnology. With the use of mobile applications or wearable devices, cognitive training and exercise can be easily performed anywhere. Through this, the bilateral brain coordination exercises can be monitored, and personalized feedback can be provided to individuals, facilitating effective training. Moreover, participating and communicating together through online communities or social media platforms can also help maintain social relationships.Research on the effectiveness of brain-mapping-based bilateral brain coordination exercises for improving cognitive function in the elderly can play a crucial role in enhancing their health and quality of life. Therefore, in this study, we aim to investigate the effects of brain-mapping-based bilateral brain coordination exercises on the cognitive function of the elderly through changes in brainwave intrinsic rhythm frequencies and power spectrum distributions. We also seek to provide foundational data for the development of related programs. **Method** For this study, 23 seniors aged 65 to 80 who utilize a senior welfare center in City A were recruited. They participated in brain-mapping-based bilateral brain coordination exercises for 8 weeks (16 sessions), with 20 participants included in the final analysis. To assess the program's effectiveness, an 8-channel EEG was conducted. Background EEG recordings were performed with participants comfortably seated in a relaxed and stable state, eyes closed, for 5 minutes. Paired t-tests were performed on the collected data to examine changes in brainwave intrinsic rhythm frequencies through power spectrum analysis. As a neurophysiological measure of cognitive function in the elderly, the power spectrum distribution of background brainwave intrinsic rhythm can indicate peak positions within the 5Hz to 13Hz range (Choi, J. et al, 2019). As cognitive processing speed decreases, the frequency of peak positions in intrinsic rhythms tends to decrease from 10Hz to around 6Hz (Penttilä et al, 1985). **Results and Discussion** In this study, the pre-post effects of brain-mapping-based bilateral brain coordination exercises are presented as shown in Figure 1. The results indicate statistically significant increases in intrinsic rhythms at Fp1 (t=-2.999, p< .01), Fp2 (t=2.2, p< .05), and T4 (t=-2.399, p< .05). These significant changes in intrinsic rhythms in the frontal lobe, responsible for all reasoning and judgment, suggest that brain-mapping-based bilateral brain coordination exercises influence cognitive function in the elderly and help integrate motor activities and cognitive functions, enhancing them simultaneously. This suggests that when seniors perform brain-mapping-based bilateral brain coordination exercises, various cognitive processes such as remembering movements, concentrating, and reacting in time are activated simultaneously, promoting brain health. Therefore, utilizing the findings of this study from the perspective of gerontechnology can support the enhancement of cognitive function and healthy aging among seniors.

References

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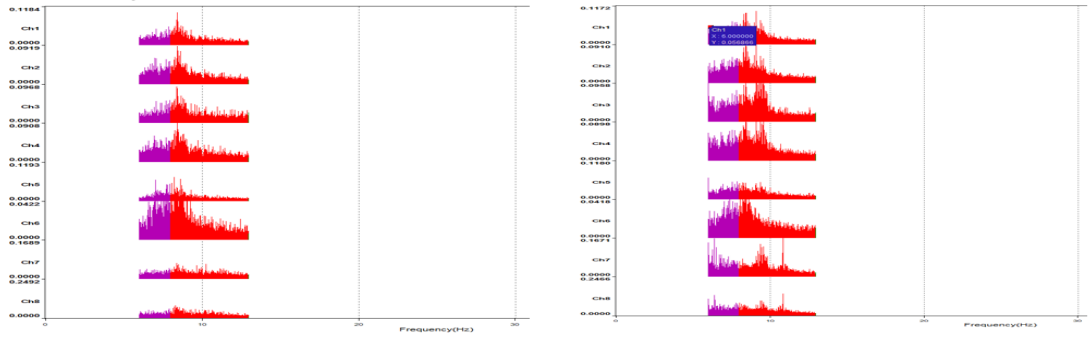

Pre Post

Figure1. Pre- and post-event intrinsic rhythm power spectrum distribution