This study proposes a verbally-based cognitive task for elderlies and measurement of cerebral blood flow (CBF) activation during the task. During the task, an elderly firstly talks four topics about season, travel, gourmet, and daily life, and then he/she does three cognitive tasks of reminiscence, recall, and working memory. With the use of functional near-infrared spectroscopy (fNIRS), we collected 42 channels of fNIRS signals from the frontal, right, and left temporal areas from 42 elderly participants (14 males and 28 females between the ages of 64 to 93) at National Hospital for Geriatric Medicine, NCGG. The elderly participants were classified into three clinical groups: 11 patients with mild Alzheimer’s disease (AD) and 19 participants with mild cognitive impairment (MCI) and 12 cognitively normal persons (CN). Moreover, MCI group is divided into two subtypes of Amnestic-MCI (A-MCI) composed of nine participants and Nonamnestic-MCI (N-MCI) composed of ten participants. We will present a comparative analysis of CBF activation between CN, N-MCI, A-MCI, and AD, by statistical tests of between-group significant differences using fNIRS signals of oxy-Hb during the cognitive task.

Aging brain and cognitive Intervention - The role of neuroimaging and neuroengineering in geriatrics and gerontology

In this review, we focus on the role of functional magnetic resonance imaging (fMRI) to seek solutions for cognitive problems in the aging brain. fMRI enables not only visualization of the brain activities but also evaluation of neural integrity status under various physiological and pathological conditions. It is assumed that age-related hyperactivation represents potential cognitive decline leading to neural compensation. The observation that this hyperactivity was decreased after cognitive rehabilitation in older adults is compatible with this hypothesis, suggesting recovery of neural efficiency. fMRI is also applied to evaluate the risk of falls, which is a serious problem for older adults. Significant associations between brain activation with change in the risk for falls have been pointed out. Advances in fMRI, especially real-time fMRI for biofeedback and brain-computer interface, will further reveal neurophysiological basis of behavioral changes in older adults and contribute to their risk assessment. Neuroimaging is nowadays an important tool of neuroengineering not only for diagnosis but also for cognitive intervention in geriatrics and gerontology.

Aging in place and extension of healthy life-span

In this context, it is necessary to consider the concept of residential care, which is an important factor in determining the quality of life of elderly people. It is observed that elderly people who live in a supportive environment with access to healthcare services have better physical and mental health outcomes than those who live in an institutionalized setting. Therefore, it is essential to develop policies and programs that promote aging in place and support the extension of healthy life-span for elderly individuals.