뇌신경재활

게시일시 및 장소 : 10 월 18 일(금) 13:15-18:00 Room G(3F)

질의응답 일시 및 장소 : 10 월 18 일(금) 15:45-16:30 Room G(3F)

P 2-16

Effect of Dual-site Transcranial Direct Current Stimulation on Hemodynamics in Language Production

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Transcranial direct current stimulation (tDCS) has been known as a non-invasive technique for neuromodulation of corticospinal excitability. Recently, multi-channel approaches have been conducted to improve the effectiveness of tDCS. Through this study, we investigated differences in the cortical activation between dual-site tDCS and conventional tDCS for modulation of language-related areas using functional near-infrared spectroscopy (fNIRS) measurement. Twenty-two right-handed healthy subjects without a history of neurological or psychiatric symptoms (10 males; mean age 29.5 ± 3.9 years) participated in this single-blind, randomized cross-over study. Four conditions were randomly applied to all participants with 24 hours of washout period between each session: sham stimulation on both left inferior frontal gyrus (IFG) and left dorsolateral prefrontal cortex (DLPFC) (Sham condition); anodal tDCS application on left IFG and sham left DLPFC (IFG only condition); simultaneous anodal tDCS on both left IFG and left DLPFC (Dual condition); sham left IFG and anodal tDCS application on left DLPFC (DLPFC only condition). Two battery-driven stimulators (DC Plus stimulator, NeuroConn Ltd., Germany) were used for this experimental design. Each anodal tDCS delivered at 1 mA intensity for 30 minutes. The hemodynamic responses were recorded by an fNIRS system (NIRScout®, NIRx Medical Technologies, Germany) at before and immediately after the stimulation for each condition. Subjects performed overt naming tasks during fNIRS measurements to investigate cerebral activation during producing vocabulary. Through a total of 10 overt naming task blocks, the subject spoke out the name of objects of the pictures selected from the Snodgrass and Vanderwart database. Based on a modified Beer–Lambert Law, the signals were analyzed and transformed resulting in the time course of concentration changes in oxy-hemoglobin (oxyHb) concentration in IFG and DLPFC region. Mean and integrated values of oxyHb concentration were also calculated. In the result of fNIRS measurement, reduction of the oxyHb concentration was observed in the left IFG after Sham condition. Compared to the Sham condition, the average oxyHb concentration and the integrated value of oxyHb in the left IFG region noticeably increased in Dual and IFG only conditions. Furthermore, these changes were 30% greater in the Dual condition than

the IFG only condition. While there were no noticeably changes in the IFG region in DLPFC only condition. While the left IFG region which was associated with language expression was stimulated by anodal tDCS, the cortical activity was increased by measuring with fNIRS. This hemodynamic change was greater when the left DLPFC was simultaneously stimulated by anodal tDCS without significant side effect. Therefore, we can postulate that simultaneous dual-site stimulation over the left IFG and left DLPFC is safe and further enhance cortical activation of language-related region.

Acknowledgment :(This research was supported by a grant from the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health & Welfare, Republic of Korea (HI17C1501) and NRF (NRF-2017R1A2A1A05000730, NRF-2017M3A9G5083690) funded by the Korean government.)