EEG Analyses of Source Localization and Functional Connectivity of Kinesthetic Illusion Elicited by Tendon Vibration

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Purpose: The purpose of this study was to examine the influence of vibratory stimulation-induced kinesthetic illusion on brain function, which compared it with brain function during actual muscle contractile movement by using the EEG analysis.

Subjects: Twenty healthy people aged 21.5 ± 1.5 years were recruited. No subjects were observed to exhibit motor and sensory paralysis.

Methods: Brain waves in vibratory stimulation were measured in the resting condition and presence of vibratory stimulation, active muscle contraction (active movement), and sensory stimulation without vibratory stimulation to tendon or movement. For the neurophysiological index to evaluate brain function, the μ rhythm (10-13 Hz high α cortical Oscillations), which is expressed mainly in the kinesthetic cortex and attenuates with movement, was employed. Calculated data were compared employing analyses of Source Localization and Functional Connectivity by eLORETA method.

Results: In vibratory stimulation condition, compared to brain waves in the resting condition or sensory stimulation condition, the kinesthetic cortical μ rhythm decreased under the other conditions. Furthermore, intra- and inter-hemispheric brain functional connectivity in sensorimotor cortex were significantly stronger than it under the other conditions. When brain waves were compared between those in the presence of vibratory stimulation and active movement, no significant difference was noted in both the kinesthetic cortical μ rhythm and functional connectivity in sensorimotor cortex.

Conclusions: These findings suggested that sensorimotor information processing induced by vibratory stimulation is based on neural functional networks in sensorimotor cortex.