Announcement of Public Dissertation Defense

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ABSTRACT

“EEG CHARACTERIZATION OF SENSORIMOTOR NETWORKS: IMPLICATIONS IN STROKE”

The purpose of this dissertation was to use electroencephalography (EEG) to characterize sensorimotor networks and examine the effects of stroke on sensorimotor networks. Sensorimotor networks play an essential role in completion of everyday tasks, and when damaged, as in stroke survivors, the successful completion of seemingly simple motor tasks becomes fantasy. When sensorimotor networks are impaired as a result of stroke, varying degrees of sensorimotor deficits emerge, most often including loss of sensation and difficulty generating upper extremity movements. Although sensory therapies, such as the application of tendon vibration, have been shown to reduce the sensorimotor deficits after stroke, the underlying sensorimotor mechanisms associated with such improvements are unknown. While sensorimotor networks have been studied extensively, unanswered questions still surround their role in basic control paradigms and how their role changes after stroke. EEG provides a way to probe the high-speed temporal dynamics of sensorimotor networks that other more common imaging modalities lack. Sensorimotor network function was examined in controls during a task designed to differentiate potential mechanisms of arm stabilization and determine to what degree the sensorimotor network is involved. After sensorimotor network function was characterized in controls, we examined the effect of stroke on the sensorimotor network during rest and described the reorganization that occurs. Lastly, we explored tendon vibration as a sensory therapy for stroke survivors and determined if sensorimotor network mechanisms underlie improvements in arm tracking performance due to wrist tendon vibration. We observed cortical activity and connectivity that suggests sensorimotor networks are involved in the control of arm stability, cortical networks reorganize to more asymmetric, local networks after stroke, and tendon vibration normalizes sensorimotor network activity and connectivity during motor control after stroke. This dissertation was among the first studies using EEG to characterize the high-speed temporal dynamics of sensorimotor networks following stroke. This new knowledge has led to a better understanding of how sensorimotor networks function under ordinary circumstances as well as extreme situations such as stroke and revealed previously unknown mechanisms by which tendon vibration improves motor control in stroke survivors, which will lead to better therapeutic approaches.