Joint Department of Biomedical Engineering
Marquette University / Medical College of Wisconsin

Announcement of Public Dissertation Defense

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ABSTRACT

"GLOBAL AND LOCAL TASK-BASED CONNECTIVITY OF THE BRAIN IN STROKE"

In this dissertation research project, we demonstrated the ability of task-based functional connectivity to reveal stroke related differences in global and local connectivity not detected during rest. We examined this across a variety of lower limb motor tasks and across a memory and language task. We also found in control patients these task-based functional measurements could be predicted from resting state and structural connectivity. These results will help us more accurately understand stroke-related deficits in global and local connectivity for participants who cannot complete a given task.

This research utilized diffusion and functional magnetic resonance imaging (fMRI) to quantify structural connectivity and functional connectivity of the brain. In the first aim, functional connectivity was used to examine the stroke-related deficits during a foot tapping and pedaling tasks. We found that global network function of the brain was reduced in stroke participants as compared to controls. This effect was detected during pedaling and non-paretic tapping, but not during paretic tapping. Local network function of the brain was elevated in stroke participants during paretic tapping and reduced during pedaling. Our second aim investigated the stroke-related deficits during in discreate pedaling, continuous pedaling, a Sternberg memory task, and an adaptive language mapping task, and how these deficits compared to resting state deficits. We found that the memory and discreate pedaling task allowed for detection of global stroke-related deficits, while the continuous pedaling and language tasks allowed for detection of local stroke-related enhancements that were not detected during resting state. Our final aim sought to predict task-based functional connectivity from resting state and structural connectivity. We used a large dataset of healthy controls from the human connectome project and neural networks to create these predictive models. We found that for both local and global connectivity measurements we were able to create models that were predictive of task-based functional connectivity from resting state and structural connectivity. These models were similarly predictive of behavioral measurements as measured task-based functional connectivity. In conclusion task-based functional connectivity can reveal stroke-related deficit information not detected during resting state, and in control participants these task-based functional connectivity measurements can be predicted from with resting state and structural connectivity information.

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