The Chinese University of Hong Kong
Department of Biomedical Engineering

Graduate Seminar – PhD Oral Defence

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Date	***:***	16 August 2024
Time	***:***	4:00 pm
Venue	***:***	Room 1122, William M W Mong Engineering Building, CUHK

Title: Motor Restoration after EMG-driven Robotic Hand Training and Personalized High Definition tDCS, from Neuroimagings to Clinical Outcomes

The EMG-driven robotic hand (EMG-RH) training has reported to brought significant motor recovery for stroke survivors, with better motor function, motor control, and improved performance in activities of daily life after training. Transcranial direct current stimulation could modulate intracortical neuronal activity and promote motor recovery for stroke survivors. While several factors remain limited explored: 1) The neural mechanisms underneath the motor recovery were unknown, understanding how brain network is regulated by EMG-RH would inform more effective training strategies; 2) Not all (less than 50%) subjects were observed to acquire meaningful improvement after EMG-RH therapy, while current prediction models could not accurately predicted motor improvement for EMG-RH; 3) How can we further improve motor recovery in addition to EMG-RH? Will high definition tDCS (HD-tDCS) targeting individual motor hotspot primes additional effect?

This study utilized multimodal neuroimaging to explore the brain reorganization after EMG-RH and HD-tDCS intervention, investigating neural plasticity for motor recovery. The evidence of clinical application was also investigated, informing a more effective decision-making for EMG-RH therapy. The first part utilized Dynamic Causal Modeling to analysis task-based fMRI data, we found EMG-RH could enhance ipsilesional brain activation and reduce inhibition of ipsilesional motor regions from contralesional hemisphere, which demonstrated that reduced interhemispheric inhibition and facilitation of ipsilesional motor networks were important for motor recovery. In the second part we proposed a decision tree model with integrating motor-intention to predict improvement after EMG-RH, we found when adding EMG-measured motor-intention variables, the prediction accuracy significantly improved from 70% to 89%. We identified survivors in two conditions showed high percentage of clinical motor-improvement: moderate-to-high motor-intention and low-to-moderate function; as well as high-intention and high-function. In last part, understanding the ipsilesional hemisphere plays important part in motor recovery, we designed personalized HD-tDCS targeting individual ipsilesional motor hotspot, and found this stimulation strategy further enhance motor function with higher brain activation and better motor control.

***** ALL ARE WELCOME *****

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