

Multi-modal Neuroimaging in Children with Hemiplegia to Assess Brain Functional Network Reorganization in Relation to Manual Response Inhibition

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Overview:

This study examines how the brain network involved in inhibiting upper-limb movement responses differs between children with HCP (hemiplegic CP) versus typically developing children. Investigators will use map brain activity using functional neuroimaging, combined with an HD-EEG, while both groups of children engage in an upper extremity response inhibition task, such as reaching for a moving target. This project could impact pediatric clinical practice by providing an increased understanding of the brain's functional network in children with HCP and assist with designing a targeted brain stimulation intervention for these children.

Abstract:

Hemiplegic cerebral palsy (HCP), a type of cerebral palsy affecting the left or right lateral side of the body, can cause permanent impairments in upper limb function that can impact their ability to participate in everyday activities as well as their quality of life. Several factors may contribute to the impaired upper limb function in children with HCP, such as integrity of the motor and somatosensory (e.g., touch, pain, temperature) systems and higher-level sensory and motor information processing. Research on structural and functional reorganization of these motor and sensory pathways reveals alterations of these neural pathways in children with HCP, but the understanding of how the brain re-organizes resulting in abnormal upper limb function continues to be limited. Flexible control of motor behavior, like reaching and grasping a moving object in an ever-changing environment, requires timely suppression of inappropriate actions. Abnormal response inhibition is a potential contributing factor that exacerbates upper limb motor functioning in children with HCP. Brain imaging reveals that the part of the brain that is involved in motor control and movements supports the response inhibition in healthy adults, but we know very little about how the functional network of the brain is altered in children with HCP.

This project aims to assess functional abnormalities in the brain network that supports upper extremity response inhibition in children with HCP. The network will be evaluated using simultaneous magnetoencephalography (MEG) and 256-channels high-density electroencephalography (HD-EEG) recordings while children with HCP and typically developing children will be performing a response inhibition task.

This study will test the hypothesis that children with HCP will show impairments in stopping manual responses, which will be associated with abnormalities in the cerebral functional network that supports response inhibition. The study will pursue the following specific aims: Aim 1: Identify impairments in stopping manual responses in children with HCP. Aim 2: identify abnormalities in cerebral activation and functional connectivity that supports response inhibition in children with HCP. This project may have impacts on pediatric clinical practice by extending

our understanding of brain functional network re-organization in children with HCP and provide insights to the design of targeted brain stimulation interventions for these children.

For more information, visit:

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