Sensorimotor neurophysiology during locomotor learning in infants with and without cerebral palsy

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Abstract: Physical disability in individuals with cerebral palsy (CP) is caused by a failure to learn and/or refine motor control during the first two years of life, during a critical period for neuroplasticity in motor control centers. Despite this, very little is known about how infants at high risk for CP learn (or fail to learn) to move. The long-term goal of our work is to reduce physical disability in individuals with CP by promoting the development of motor control through evidence-based rehabilitation strategies that optimize neuroplasticity to train and shape motor learning during infancy and toddlerhood. Rehabilitation therapies delivered during the early years of life are critical to maximize developmental trajectories and function in individuals with neurodevelopmental disorders. This window of time presumably takes advantage of the prolific neuroplastic capacity in the developing brain. However, there is wide variability in response to rehabilitation intervention, and neither patient characteristics such as age or type of brain injury, nor treatment characteristics such as dose are sufficient to predict an individual's response to therapy. Recent evidence suggests that the pattern of brain re-organization, due to neuroplastic changes and to brain-behavior adaptations in an immature brain, may predict an individual's response to specific types of therapy. Our team has studied the neural organization of somatosensory and motor pathways in children with brain lesions and their reorganization after intervention. The current study will collect preliminary longitudinal data on the development of motor control by measuring sensorimotor activity in the brain at ages 5, 9, and 18 months in infants with CP (N=15) compared to typically developing infants (N=15). The results of this study will provide preliminary data about potential neural biomarkers of motor control and response to rehabilitation, and strategies for sample stratification in larger studies targeting brain-behavior connections and motor skill acquisition.