ABSTRACT
IDENTIFICATION OF NEURAL DEFICITS ASSOCIATED WITH UPPER EXTREMITY DYSFUNCTION IN PERSONS WITH MULTIPLE SCLEROSIS

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Multiple Sclerosis is a demyelinating neurodegenerative disease prevalent in approximately 2.8 million people worldwide. The heterogeneous presentation of symptoms arising from demyelination and lesions within the central nervous system creates challenges in understand how underlying pathophysiology is related to disabilities common in persons with Multiple Sclerosis (PwMS). Upper extremity dysfunction, present in up to 80% of PwMS, makes it difficult to achieve daily life activities such as brushing teeth or working on a computer. Currently there is little consensus as to how the underlying functional neural interactions manifest as upper extremity dysfunction in PwMS. This dissertation aims to better understand the disruption in neural pathways which mediate sensorimotor control during visually guided reach to identify common deficits across levels of upper extremity impairment in PwMS. To do this, PwMS and unimpaired adults completed a visually guided reach task with electroencephalography collected simultaneously. The specific aims of this study were to: 1) Determine how sensorimotor control is altered during goal-directed movement in people with Multiple Sclerosis; 2) Identify how increased visual feedback processing delays in people with Multiple Sclerosis are related to cortical-cerebellar functional connectivity; 3) Characterize how Multiple Sclerosis impacts the brain networks that mediate visually guided reach. We show that increased visual response delays differentially impact the neural response in PwMS with more and less impairment via decreased amplitude and latency respectfully. During movement phases more reliant on visual feedback processing, increased functional connectivity of sensory processing regions is common across PwMS but those with greater motor impairment also have motor processing correlates to behavioral measures of dysfunction. Finally increased demand on sensory processing regions throughout movement help mitigate motor deficits for less impaired PwMS while those with more impairment require additional recruitment from sensory, motor, and frontal regions to complete a visually guided movement. These results can be used to facilitate future rehabilitative efforts in reducing motor impairments in PwMS.