Recent advances in neuroimaging have resulted in techniques that are capable of recording human brain activity in a wide range of environments. Noninvasive methods now enable the study of cortical activity during mobile activities and therefore offer tremendous potential to improve understanding of human motor control and accelerate new therapies for neurological impairments. The Functional and Applied Biomechanics Section of the National Institutes of Health is developing new ways to harness these imaging modalities to improve motor rehabilitation of individuals with central nervous system injuries, with a particular focus on pediatric populations. This talk will illustrate state-of-the-art mobile neuroimaging as one component of a multi-modal motion capture laboratory for developing innovative neurorehabilitation paradigms. We will discuss recent advances developed in our lab, including application of powered exoskeletons, surface functional electrical stimulation (FES), user-driven treadmills, and other device augmented therapies for gait rehabilitation in adults and children with cerebral palsy. This work will be explored in the context of other relevant advances to discuss future directions for improving functional recovery in individuals with neurological disorders.

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