Effects of intensive task-specific training in patients with spinal cord injury: from physiology to function

Principal Investigator: Siddhartha Sikdar

Objective: Compelling evidence of neuroplasticity after spinal cord injury (SCI) has led to the development of new approaches to the rehabilitation of walking and other activities of daily living. Intensive task-- - specific training has shown particular promise, but few studies have been conducted to evaluate outcomes and underlying mechanisms. The goal of this project is to develop a new set of measures to characterize the physiological and morphological changes that occur in response to this type of intervention across multiple systems (e.g. neural, cardiovascular, muscular) and at multiple levels (e.g. from physiology to muscle architecture to motor behavior) and how these changes relate to real-- - life function.

Specific Aims and Approach: We will leverage an existing cohort of individuals with incomplete SCI who are participating in a task-- - specific training intervention developed at Mason (IRB 619811-- - 4). We will use 1) ultrasound imaging, elastography, and near - infrared spectroscopy to collect measures of leg muscle morphology and physiology at rest and during walking, 2) transcranial magnetic stimulation to measure the strength of connectivity between the brain and the leg muscles, 3) conventional measures of cardio - respiratory fitness and 4) clinical measures of neurological impairment and functional mobility. Using these novel neurological, cardiorespiratory, and intramuscular measures, we will:
AIM 1: Characterize the differences between individuals with incomplete SCI and a healthy age-matched cohort.
AIM 2: Identify the effects of spinal cord injury that are most strongly related to patients' level of
functional independence.
AIM 3: Identify the effects of intensive task-specific training, and determine which of these
effects are most strongly related to training-induced improvements in overall function.

Impact: This project will leverage an intervention and novel technologies developed at GMU to make unique contributions to the comprehensive understanding of motor recovery following SCI. We will provide an immersive interdisciplinary research environment for trainees in Bioengineering and Rehabilitation Science. SCI is a major emphasis area for federal funding including NICHD (NCMRR), DOD, and VA, with a number of open RFPs. Our competitive edge is an interdisciplinary approach with innovative methods. Furthermore, our protocol has strong potential for commercialization as the only program of its kind in our region.