Assessment of Interlimb Coordination in Adults with Hemiplegia

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Brief Description: This pilot study will examine the utility of a novel measure of upper extremity (UE) interlimb coordination, a motor behavior critical to the performance of activities of daily living (ADL). The purpose of this cross-sectional research study is to determine the feasibility and validity of using five inertial sensors to assess UE interlimb coordination in adults with hemiparesis. The completion of this project will result in a new quantifiable measure that will allow clinicians and researchers to assess motor behavior in the home environment using an objective and highly sensitive measure of UE coordination. This proposal meets the requirements for the ASNR Clinical Research seed funding; in particular, it is focused on a system that given further study may be implemented at low cost in multiple settings, utilizes an evidence-based approach, and will serve as the initiation of a novel collaboration between the Investigators and consultants.

Specific AIM #1: To determine the feasibility of using the time (ms) and frequency (Hz) domain features
extracted from acceleration data gathered with wearable inertial sensors to identify distinct features of UE interlimb coordination during unimanual, bimanual asymmetric or bimanual symmetric tasks in adults with hemiparesis.

Specific AIM #2: To validate the summary data obtained from inertial sensors13-15 with the sum score (ability measure) from the Adult Assisting Hand Stroke (Ad-AHA Stroke)8 measure in adults with hemiparesis.

Relevance to Neurorehabilitation: Adults with hemiparesis stemming from stroke often have impaired UE interlimb motor control. This is problematic because without sufficient capacity to use both limbs cooperatively, these individuals often have difficulty performing ADLs. To date, clinical tools have been unsuccessful in objectively quantifying these impairments. We propose that interlimb coordination can now be assessed using wearable inertial sensors. If successful, this project will lead to the development of novel methods to quantitatively assess interlimb coordination in real-world settings, thus allowing close examination of natural recovery and response to intervention in persons with neurological conditions. Future projects could expand this assessment strategy to lower extremity interlimb coordination.

Methods: Twenty adults with hemiparesis stemming from stroke will be enrolled in this single-session study. Five wearable inertial sensors will be placed on the arms and chest: one on each forearm and upper arm and one on the sternum using adjustable straps. We will collect acceleration data while the adults perform (1) 12 ADL tasks, and (2) as they complete a bimanual assessment; the Ad-AHA Stroke. We will analyze results from the acceleration data during the 12 tasks to determine the coherence (left right) in the time and frequency domains. We will also compare findings from the spectral analysis (Hz) of the sensor data to scores on the Ad-AHA Stroke using a Spearman correlation analysis.

Timetable:
This study will require one, one ½ hour session to obtain written consent and collect data from each participant. The data will be securely uploaded and analyzed off-site. We anticipate that we.