

Non-Invasive Paired Stimulation and Anklebot Robot to Improve Lower Extremity Motor Recovery in Chronic Spinal Cord Injury

Goal

The aim of the study is to use robotic kinematics and neurophysiology as possible outcome markers to predict improvement in motor recovery.

This project has two objectives:

- 1) To investigate the quality of movement in the lower extremity using a robotic device, the Anklebot.
- 2) To strengthen the spared connections between the brain and the muscle after spinal cord injury pairing transcranial magnetic stimulation (TMS) and electrical stimulation. The two stimuli will target the soleus muscle in the lower extremity.

We are expecting to:

- 1) Objectively characterized the motor dysfunction using lower limb robotics.
- 2) Improve the voluntary motor output using the paired stimulation protocol.

Techniques

Anklebot

The Anklebot plays an essential role in walking for forward motion, balance, and gait. Weakness in the muscles caused by neurological conditions can cause foot drop and instability. The Anklebot is an exoskeleton used to assist the ankle in four types of motion: plantar flexion, Dorsiflexion, Inversion and Eversion. As the participant attempts the four types of motion in a goal oriented task the robotic device will sense the amount of force the patient produces and adjusts the amount of assistance accordingly. Through the repetition of the movements weak muscles can be strengthened and neuro-regeneration "healing of nerves" can occur.

Transcranial Magnetic Stimulation (TMS)

TMS is a useful and safe tool that sends brief currents via an insulated coil to painlessly generate currents in the brain tissue beneath the coil. TMS will be placed over the subject's skull over the area of the brain that controls hand movements to assess the brain-muscle connections.

Electrical Stimulator

Surface electrodes will be placed in the back of your knee and a small electrical current will be elicited. This current will send impulses to your spinal cord making your muscles to twitch.

Study Protocol



Participants in the study will attend on two occasions at Burke:

- 1) An evaluation to use the Anklebot (1 hour approx)
- 2) An evaluation for neurophysiological: the paired stimulation protocol (1 hour approx)

Volunteers will need to fill clinical and functional questionnaires as part of the study.

Inclusion Criteria:

- Age: 18 to 80 years.
- Injury Date: Greater than 1 year after the injury.
- Injury type: Incomplete lesion (ASIA B, C, D). Traumatic and Non-Traumatic.
- Presence of some degree of motor function in the ankle flexors and extensors.
- Ability to tolerate sitting upright at for at least one hour.
- Cognitively and behaviorally capable of complying with the regiment.

Exclusion Criteria:

- Motor complete spinal cord injury (ASIA A).
- Presence of other neurological disorders.
- Medically unstable.
- Severely limited range of joint motion or irreversible muscle contractures in the ankle.
- Less than 1 year post-injury.
- Presence of contraindications for transcranial magnetic stimulation (TMS):
 - Implanted metal devices in the head or any part of the body.
 - Presence of cardiac pacemaker.
 - Past medical history of seizures or unexplained spells of loss of consciousness.
 - A history of medication-resistant epilepsy in the family members.

If you are interested, please contact us for more information:

Molly Tessler or Jordan Revis
sciclinicaltrials@burke.org
(914) 597- 2471
(914) 597-2111