Departments of Physical and Occupational Therapy present

Rehabilitation Science Dissertation Defense

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Rehabilitation Science
Final Dissertation Defense

THE EFFECT OF LOWER LIMB NEUROMUSCULAR ELECTRICAL STIMULATION ON THE MUSCLE AND METABOLIC HEALTH AFTER ACUTE SPINAL CORD INJURY

Spinal cord injury (SCI) is a devastating event with long-term consequences for individuals and their families. It causes immediate and significant disruption to neuronal pathways, leading to paralysis and loss of muscle function below the injury level. A few weeks after the injury, a rapid decline in the contractile activity, muscle mass, and cross-sectional area, particularly in muscles below the injury. Such injury leads to muscle fiber degeneration and a shift towards a higher proportion of fast glycolytic fibers, which are more prone to fatigue and less efficient in energy utilization. Severe muscle atrophy in SCI is closely linked to metabolic dysfunction, affecting overall health and rehabilitation recovery. As muscle tissue declines, there is a corresponding drop in the rate at which the body burns calories and absorbs glucose, increasing the risk of insulin resistance, obesity, and type 2 diabetes. The loss of muscle mass and changes in fiber composition disrupt glucose metabolism, impairing glucose and insulin signaling pathways and reducing muscle glycogen storage. Addressing both muscle atrophy and metabolic dysfunction is crucial in SCI rehabilitation, emphasizing the need for therapies targeting muscle and metabolic health simultaneously.

Neuromuscular electrical stimulation (NMES) uses electrical impulses to induce muscle contractions, enhancing strength, circulation and preventing atrophy. While NMES are widely used for chronic SCI, research on acute SCI is limited. We need novel NMES protocols to induce molecular adaptations that maintain muscle mass and a metabolically healthy phenotype early post-injury.

This dissertation project investigated the effects of a 2–5 week Comb-NMES intervention on muscle and systemic parameters, including fasting blood glucose and insulin levels, lipid profiles, muscle signaling for glucose uptake, inflammation, and atrophy. Additionally, we analyzed changes in muscle fiber-type distribution and cross-sectional area in 20 traumatic SCI participants (C4-L1) aged 18-60 years, injured within 14 days, and classified as AISA A-C. The Comb-NMES protocol integrates high-frequency resistance and low-frequency aerobic training targeting the quadriceps. This protocol repetitively stresses muscles with low-frequency stimulation to enhance oxidative metabolism, increase mitochondrial function, and retain type I fibers. Simultaneously, it applies high-load dynamic contractions to prevent atrophy and maintain type IIa fibers.

UAB SCHOOL OF HEALTH PROFESSIONS
The University of Alabama at Birmingham

EVENT DETAILS

Free to UAB students, faculty and clinicians.
***Refreshments will be served to first 20 attendees**

DATE/TIME

Monday, July 8, 2024

10am - 11am

LOCATION

Zoom
https://uab.zoom.us/j/88439052451

CONTACT

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For more information about the Rehabilitation Science Program please checkout our website: https://www.uab.edu/shp/rehabsci/