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Non-invasive spinal cord stimulation for improving motor function recovery

NEUROSCIENCE GRAND ROUNDS

SPEAKER

Katinka Stecina , PhD

Associate Professor, Department of Physiology & Pathophysiology, University of Manitoba

DATE

Friday, September 29th, 2023

9:00 AM - 10:00 AM

LOCATION

Psychiatry Bldg. 2nd Floor Rm PX236/238

BIO

Dr. Stecina received a BSc in chemistry and biology from the University of North Carolina at Charlotte, USA, and a Ph.D. in physiology from the University of Manitoba. Before returning as faculty, she worked at Goteborg University in Sweden as a postdoctoral fellow. Then she held a Marie Curie Fellowship from the EU while working at the University of Copenhagen in Denmark. Since 2014, she has been working in the Division of the Neuroscience and Spinal Cord Injury section of the Department of Physiology. Her research is centered around spinal neural networks. Mapping of spinal neural circuits and understanding the role of different neuron populations in movement and sensory-motor integration is what she studies. Dr. Stecina's research combines the application of basic neurophysiology findings with studies regarding the neural control of movement in humans. She has developed novel experimental methods for testing brainstem and spinal neural network interactions in rodents. Understanding the wiring and function of spinal neural networks comprised of different pools of neurons is in the focus of her basic research. Her long-term goals are to generate knowledge to inform the development of novel therapeutic interventions. She helped to establish a new laboratory for health, balance and motor control with colleagues in the Spinal Cord Research Centre of the University of Manitoba where studies focus on using cutting-edge methods for eliciting brain and spinal cord plasticity in humans with paralysis following spinal cord injury. Improving movement and exercise capacity after injury while examining neural networks in humans will support the development of targeted neurorehabilitation in people with spinal cord or other injury to the nervous system. She has published work on motor control in high-impact, peer-reviewed journals, including Journal of Neuroscience; Journal of Physiology; and Journal of Neurophysiology. She is active in the neuroscience community as an invited reviewer for several journals and as a local workshop organizer for neuroscience-focused outreach activities. She has also played NCAA Division I and semi-pro basketball and is currently coaching.

ABSTRACT

Electrical stimulation of the spinal cord has been increasingly recognized as a method to facilitate motor function after spinal cord injury (SCI). Two of the main types of non-invasive stimulation are transcutaneous electrical pulsed stimulation (EPS) and direct current stimulation (DCS). A review of the DCS application in spinal cord injury will be presented to describe the common methodology and efficacy. Although both DCS and EPS are known to increase the excitability of spinal motorneurons, these types of stimulation methods have never been directly compared in terms of effects when applied in the same person. Moreover, the effects of EPS and DCS on spinal networks were mainly assessed near the stimulation site and it is unknown if there are effects at different levels of the neuraxis. Therefore, we sought to compare effects of EPS and DCS when applied in the same person; and to determine effects of lumbar stimulation on the excitability of motorneurons further away, such as those innervating forearm muscles. Preliminary results from these studies will be presented. The utilization of EPS in combination with stance and step training together with functional electrical muscle stimulation as a potential movement rehabilitation program adjunct to traditional physical and occupational therapy after spinal cord injury will be also addressed and preliminary data will be presented. Understanding methodological limitations of non-invasive spinal cord stimulation will improve future research and interventions to be developed for rehabilitation medicine addressing motor function recovery.

OBJECTIVES

- Provide a brief overview of mainstream non-invasive spinal cord stimulation methods.
- Describe current selected experimental protocols for facilitating motor recovery after spinal cord injury.
- Discuss new directions in protocol development for spinal cord stimulation.

Social Media: Facebook, X : kstecina

Website: www.scrc.umanitoba.ca

For more information
T: 204-235-3939
E: info@manitobaneuroscience.ca

Zoom Meeting ID: 836 0700 7450

Passcode: 525419

https://us06web.zoom.us/j/83607007450

Hôpital St-Boniface Hospital
RECHERCHE • RESEARCH
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Health Sciences Centre Winnipeg

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