UNDERGRADUATE RESEARCH IN SCIENCE CONFERENCE OF ALBERTA (URSCA)
PROCEEDINGS VOL.2 | THE KING'S UNIVERSITY, EDMONTON | APRIL 1-2, 2016

The effect of stimulation method and frequency on discomfort during neuromuscular electrical stimulation in the human tibialis anterior muscle

Sarah Rintoul, Raisa Kassam, and Dave Collins* (Human Neurophysiology Laboratory, Faculty of Physical Education and Recreation, University of Alberta)

Poster Presentation Abstract:

Muscular contractions can be generated using neuromuscular electrical stimulation (NMES) delivered over the muscle belly (mNMES) or the nerve trunk (nNMES). NMES is used for rehabilitation to generate contractions of muscles paralyzed by spinal cord injury or stroke. However a major limitation of NMES is discomfort. This may be addressed with interleaved NMES (iNMES) where stimulation pulses are alternated between the muscle site and the nerve site, effectively reducing the firing frequency of muscle fibers. In this way, it may be possible to generate contractions of similar amplitude with lower stimulation intensity and thus lower discomfort. The purpose of this investigation was to determine the effect of NMES method and frequency on stimulation intensity, and determine what parameters resulted in the least discomfort.

Methods: Stimulation intensity (current) was measured during contractions elicited by mNMES, nNMES and iNMES. Stimulation frequencies of 20Hz, 40Hz and 80 Hz were tested, creating 9 experimental conditions. Participants used a visual analogue scale to quantify discomfort during each condition. Tibialis anterior dorsiflexion torque was measured and kept constant between NMES types.

Results: Across NMES methods, discomfort was reduced as current decreased and as frequency increased. mNMES at 20 Hz resulted in the highest average discomfort score, while iNMES at 80 Hz resulted in the lowest average discomfort score.

Conclusion*:* Discomfort depended on both NMES method and stimulation frequency. iNMES may offer an alternative approach to reduce current and subsequently discomfort experienced by users of NMES for rehabilitation, but only when delivered at relatively high frequencies.

* Indicates faculty mentor