INRS 2017
International Neurorehabilitation Symposium

The Effects of Transcutaneous Spinal Cord Stimulation on Corticospinal Excitability

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Spinal cord stimulation (SCS) is currently used to control neurological pain and spasticity in patients with spinal cord injury (SCI). Continuous SCS has been shown to generate stepping-like activity [1], as well as to enable intentional lower limb movements, in patients with motor complete SCI [2]. It has been hypothesised that residual pathways are responsible for this, and repetitive stimulation may have driven neural plasticity; however, the underlying mechanisms are not fully understood. This investigation compared the effects of transcutaneous SCS with those of functional electrical stimulation (FES) on corticospinal excitability.

Trains of pulses of SCS or FES were applied over the thoracic spine or tibial nerve, respectively, in 11 subjects. Subsequent motor evoked potentials, elicited by transcranial magnetic stimulation at 5 different interstimulus intervals (ISI's), were measured from electromyography of the tibialis anterior and soleus muscles. This was repeated with single pulse SCS.

Single pulses showed inhibition at an ISI of 15-20 ms, followed by facilitation at 50 ms, and a return to baseline value at 200 ms. Both SCS and FES trains did not induce inhibition from baseline values, however, SCS trains gave greater facilitation than both FES and single pulse SCS; FES showed no evidence of facilitation. For SCS trains, facilitation continued until 200 ms after the train was given.

The instantaneous facilitation noted with SCS may allow intentional lower limb movements in people with complete SCI via residual pathways. This study indicates that SCS may be more effective than FES in helping SCI patients recover movement.

Referenzes:
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[2] C. Angeli, V. Edgerton, Y. Gerasimenko and S. Harkema, "Altering spinal cord excitability enables voluntary movements after chronic complete paralysis in humans", *Brain*, vol. 137, no. 5, pp. 1394-1409, 2014.

Supported by:
Completed as part of degree programme BSc Physics with Medical Physics, University College London