

THE IMMEDIATE EFFECTS OF ELECTRICALLY STIMULATED AND VOLUNTARY MUSCLE CONTRACTION ON CORTICOSPINAL EXCITABILITY USING TRANSCRANIAL MAGNETIC STIMULATION (TMS)

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This project was completed in part fulfilment for BSc (Hons) Physiotherapy at University of East London.

Background: Voluntary and electrically stimulated strength training have been successfully used to promote gains in muscle strength post-stroke (Levin, 1992). However, the neural mechanisms promoting these gains remain unclear. The purpose of this study was to identify whether a single bout of both forms of muscle training induced immediate changes in corticospinal excitability, assessed using Transcranial Magnetic Stimulation (TMS).

Method: A convenience sample of 20 healthy adults mean age 27 ± 6.94 years were recruited to this ethically approved study. Using TMS, motor evoked potentials (MEPs) were recorded from the *tibialis anterior* before, during and after a single bout of voluntary and electrically stimulated muscle training. Voluntary exercise involved subjects completing 3 x 10 repetitions of ankle dorsiflexion at 50-70% of their maximum voluntary contraction. During electrically stimulated exercise, a portable electrical muscle stimulator (Elpha 2000) was used to induce repeated ankle dorsiflexion at the same training intensity and duration as voluntary training. The order of exercise was randomised and all measurements were taken during one single session.

Results: Repeated measures analysis of variance showed that there was a significant change in amplitude of MEPs before, during and after exercises ($F= 3.85$, $P < 0.05$). Mean increases of $44.25 \pm 51\%$ and $26.68 \pm 59\%$ were recorded during voluntary and electrically stimulated exercise respectively. However, no significant differences were observed between the effects of voluntary and electrically stimulated muscle contractions.

Conclusion: MEPs are a measure of corticospinal excitability. These results, therefore, demonstrate that both voluntary and electrically stimulated ankle dorsiflexion caused an immediate increase in corticospinal excitability measured for the *tibialis anterior* muscle. Further research is required to discover if these short-term excitability changes translate into longer-term changes with repeated exercise.

References

Levin, M (1992) Relief of hemiparetic by TENS is associated with improvement in voluntary and motor functions. *Electroencephalography and Clinical Neurophysiology*, 85 131-142.

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