Spinal direct current stimulation enhances vertical jump power in healthy adults.

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Introduction

Transcutaneous spinal direct current stimulation (tsDCS) is a simple, minimally-invasive tool that affects sensory, motor pathways and segmental reflex activity.

Effects of tsDCS stimulation in a dosedependent manner and these effects depend on polarity: anodal DCS increases the excitability of the underlying neural structures, whereas cathodal DCS decreases it. tsDCS is considered safe, with no adverse events or tissue damage reported in the literature (1).

To date, tsDCS research has focused on neurophysiological outcomes including spinal reflex mechanisms, pain, motor learning and plasticity (4).

The spinal cord is the final common pathway for all motor behaviours, which has been utilized in assessing ascending and descending CNS inputs to modulate and produce appropriate motor behavior: i.e. standing, running, walking or jumping (6).

This bi-directional activity also determines the long term neuromotor adaptations associated with motor skill acquisition, sport and athletic training and the impact of physical activity, in particular in the absence of any physical activity may have potential for rehabilitation where mobility is limited or absent, for example, after sporting or combat injury, or for neuromodulation in patients with brain or spinal cord injury.

Vertical countermovement jump (VCJ)

Changes in PRM reflex RMS moderately correlated to changes in power variables after tsDCS

No return to baseline values at any time post tsDCS

Changes in hamstring (H) and quadriceps (Q) PRM reflexes were moderately correlated with changes in peak GRF (shown above) and amortisation GRF ($r = 0.421$, $p = 0.013$ and $r = 0.340$, $P = 0.044$ respectively).

Changes in PRM RMS were also correlated with changes in CM velocity and power ($r = 0.355$, $P = 0.041$ and $r = 0.386$, $P = 0.023$ respectively).

Changes appear to be due to alterations in fiber recruitment patterns, which have been demonstrated by activity changes in reflex circuitry after sham and active tsDCS.

Posterior root-muscle (PRM) reflexes

The significant difference between sham tsDCS fatigue and the tsDCS powerwork enhancement persisted without decrement over the 3 hours.

The difference in countermovement (CM) power changes from 0 to 180 min.

The duration of tsDCS effect beyond the three hour test point is not known.

Conclusions

We have shown for the first time that anodal tsDCS counters the fatigue normally associated with repeated maximal VCJ performance.

We have shown for the first time that tsDCS increases peak eccentric (braking) power and VCJ power.

The effects of tsDCS last for at least 3 hours without decrement.

The magnitude of response to tsDCS varies from person to person.

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References