

Corticospinal plasticity and motor performance in older adults following alternate tDCS electrode arrangements

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Background: Neurodegeneration accompanies natural ageing, reducing the ability to perform daily activities. Transcranial direct current stimulation (tDCS) can alter neuronal excitability and motor performance, but little is known whether alternate electrode arrangements differentially modulate motor performance and plasticity in the primary motor cortex (M1) of older adults.

Methods: In a double-blinded, cross-over trial, we compared the effects of unilateral, bilateral and sham tDCS (1 mA) combined with visuomotor tracking of the wrist, on M1 plasticity and motor performance of the non-dominant upper limb in 11 older adults. Transcranial magnetic stimulation (TMS) and tracking error assessed indices of plasticity and motor performance at baseline, immediately after and 30 minutes following stimulation.

Results: Both unilateral and bilateral tDCS significantly improved tracking error by 13% and 21% immediately post stimulation. At 30 minutes, sham, unilateral and bilateral conditions all improved tracking error by 10%, 12% and 21% respectively. In the non-dominant M1, motor evoked potentials (MEPs) were significantly facilitated by 38% and 53% for both unilateral and bilateral conditions immediately post and 49% and 54% at 30 minutes, with no significant change in the sham condition at either time point. Short-interval intracortical inhibition (SICI) was reduced by 29% and 36% for unilateral and bilateral conditions immediately post and by 21% and 30% at 30 minutes, with no significant change in the sham. For tracking error, MEPs and SICI, there were no differences between unilateral and bilateral conditions. Changes in MEPs correlated with improved motor performance, however SICI did not. In the dominant M1, bilateral tDCS suppressed MEPs but had no effect on SICI at both time points.

Conclusions: These findings suggest that tDCS induced elements of M1 plasticity, which improved motor performance irrespective of the electrode arrangement. These results provide preliminary evidence indicating that tDCS is a safe non-invasive tool to preserve or improve motor control in older adults.