High-definite transcranial direct current stimulation over lesioned motor cortices reduces the expression of the flexion synergy in hemiparetic stroke

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Introduction

➢ Flexion synergy indicates loss of independent joint control in the paretic arm post-stroke resulting in abnormal co-activation of shoulder abductors and arm/hand/finger flexors.

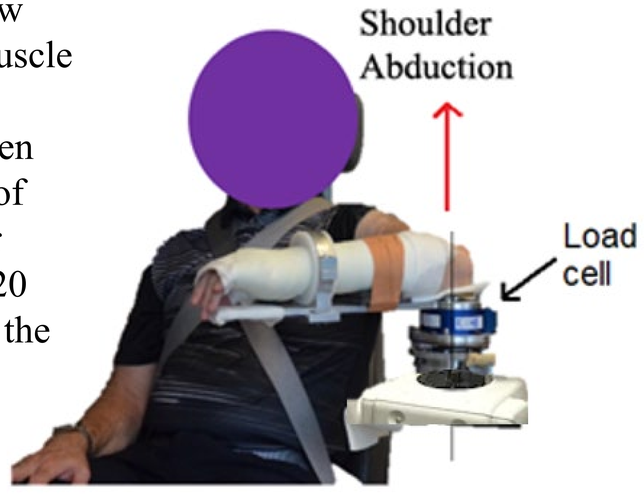
➢ Flexion synergy is likely caused by an increased abnormal reliance on the non-lesioned cortico-reticulospinal tracts (CRST) after a stroke-induced loss of direct corticofugal projections.

➢ Our recent work demonstrated that the expression of the flexion synergy is associated with an enhanced nonlinear connectivity between the brain and muscles from the contralesional hemisphere.

➢ We hypothesize that anodal tDCS over lesioned motor cortices improve the arm function via facilitation of residual corticospinal projections and therefore reducing reliance on the CRST.

Method

➢ In this preliminary study, we measured the flexion synergy elbow torques, brain signal (EEG) and muscle activity (EMG) in 3 chronic hemiparetic stroke participants when lifting their paretic arm with 30% of their maximum voluntary shoulder abduction torque before and after 20 min anodal tDCS stimulation over the motor region in the lesioned hemisphere.

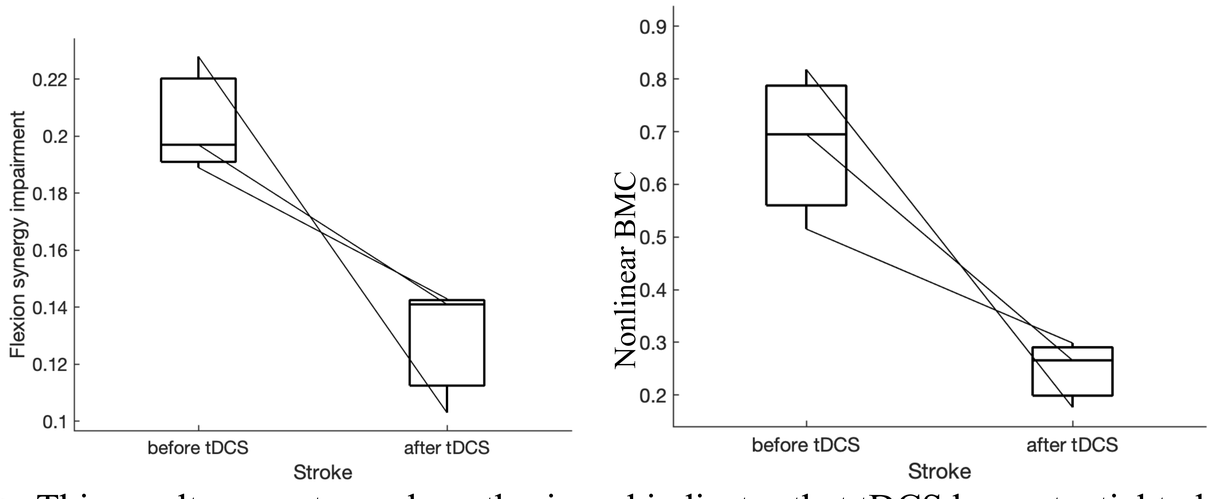


➢ The high-definite tDCS and subject-specific MRI was used to target the motor cortex and its underlying corticospinal tract at the lesioned hemisphere.

➢ The nonlinear connectivity between EEG and EMG (i.e., nonlinear BMC) was estimated by using a novel signal processing method that is a nonlinear extension of cortico-muscular coherence method based on high-order spectra.

Results

➢ We found that the flexion synergy elbow torque and nonlinear BMC decreased after the tDCS.



➢ This result supports our hypothesis and indicates that tDCS has potential to be combined with physiotherapeutic interventions that aim at reducing the maladaptive usage of the CRST and associated motor impairments post hemiparetic stroke.

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