Cortical excitability and connectivity in the lifespan: A neurophysiological study

ABSTRACT:

Background and Aim
Transcranial electrical stimulation (tES) seems a promising technique to improve learning in young and elderly healthy subjects, but its mechanisms of action are not well understood. Here, we aim to demonstrate how tES in combination with a perceptual learning (PL) paradigm modulates cortical excitability and performance in young healthy subjects. Moreover, we want to explore behavioral and neurophysiological tES effects in PL in healthy aging to investigate modifications in cortical excitability and connectivity in the lifespan. Finally, we aim to highlight correlations between excitability, connectivity and behavioral performance.

Method
Healthy young (N = 45) and elderly (N = 36) subjects performed a PL task, before, during and after tES (1.5 mA over Oz) in three stimulation conditions: transcranial random noise stimulation - tRNS, anodal transcranial direct current stimulation - atDCS, sham. TMS-EEG coregistration preceded and followed the PL+tES.

Results
In young, tRNS abolished the behavioral learning effect observed in the sham condition, while A-tDCS had no effect. In elderly, no effect of stimulation was found. The analysis of TMS evoked potentials (TEPs) showed a pre-post modulation in both the age groups (central cluster, ~90-140ms), regardless of the stimulation condition.

Conclusions
Neurophysiological results (TEPs) suggest that young and elderly have a different baseline visual system connectivity, which may influence tES effects. The presence of neuromodulation effects only in young subjects add evidences about the inadequacy of the young brain as a model to test the effect of tES, when the interest is in developing protocols of stimulation efficacious in aging.

Keywords

Aging, Neuroplasticity, Brain stimulation techniques, Neuromodulation, TMS-EEG

Published Work:

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