MEMORY ENHANCEMENT IN AGING - THE ROLE OF COGNITIVE TRAINING COMBINED WITH TDCS: BEHAVIORAL AND NEUROIMAGING DATA

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Background: In recent years, numerous strategies have been developed in an attempt to maintain or enhance cognitive functions in the elderly. Cognitive training (CT) has been widely implemented and is currently accepted as the most promising method to alleviate cognitive decline. Several techniques have been combined with CT to explore the synergetic effects and, recently, a beneficial effect has been shown after the combination with transcranial direct current stimulation (tDCS).

Aims: Here we combined multiple sessions CT with tDCS to assess verbal episodic memory improvement in healthy elderly subjects, compared with sham and a wait list group.

Method: We used an innovative design to further explore the synergetic effects of CT combined with tDCS. Specifically, we tested whether CT and excitatory tDCS over the left dorsolateral prefrontal cortex (IDLPFC) or right cerebellar cortex (rCC) facilitates verbal episodic memory, compared with sham stimulation and a wait list control group. CT was applied daily for 1 hour, after 20 minutes of tDCS, over 12 sessions. Performance on memory and other cognitive tasks was evaluated at baseline and post-intervention, using behavioral and neuroimaging tools. Participants were healthy elderly, ≥ 60 years, right handed, without history of neuropsychiatric disease.

Results: 53 healthy elderly completed the study (mean age=68.4, SD=4.8) (ongoing recruitment). Participants received either CT and sham (n=13) or excitatory tDCS over the IDLPFC (n=14) or rCC (n=14), or a wait list control group (n=12). Data suggest an improvement in verbal episodic memory tasks in the groups receiving CT + tDCS. Interestingly, there is a greater improvement and consistency in the group receiving CT + tDCS in the rCC. Neuroimaging data supports the results from the neuropsychological assessment. Specifically, tDCS over the right cerebellum + CT increased the functional connectivity in the left hippocampus.

Conclusions: These data suggest that CT and neuromodulation hold promise as a means to enhance cognitive functions in healthy elderly. Greater light is also shed on the role of the cerebellar cortex in cognitive processing.

Keywords: Aging, Cognitive enhancement, tDCS, fMRI, Cerebellum
Publications:

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