PHYSICAL EXERCISE IMPROVES LONG-TERM MEMORY NO LESS THAN TRANSCRANIAL DIRECT CURRENT STIMULATION

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Introduction

It has been shown that electrical brain stimulation, particularly transcranial direct current stimulation (tDCS), can improve memory performance[1-2]. Physical exercise has also been shown to be able to improve different aspects of cognition[3-5]. The aim of this study was to investigate which of these methods is more effective in the improvement of long-term memory. The tDCS and physical exercise protocols that were chosen for this study have been shown to be effective in the improvement of long-term memory: tDCS during memorisation (targeting encoding phase) and physical exercise after memorisation (targeting consolidation phase). We expected to see improvement following application of both methods. No prediction was made on which method is more effective.

Methods

Participants (n = 24) took part in three experimental sessions. They were asked to memorise a set of images ('training') for a later old/new recognition task ('testing'). In one of the sessions participants were asked to cycle for 30 minutes on an exercise bike following encoding. In the other two sessions they received either 15 minutes ('active' stimulation) or 16 seconds ('sham' stimulation) of 1.5 mA anodal tDCS, applied over the left dorsolateral prefrontal cortex (left-DLPFC). Performance of the participants in the recognition phase was recorded for analysis (**Figure 1**).

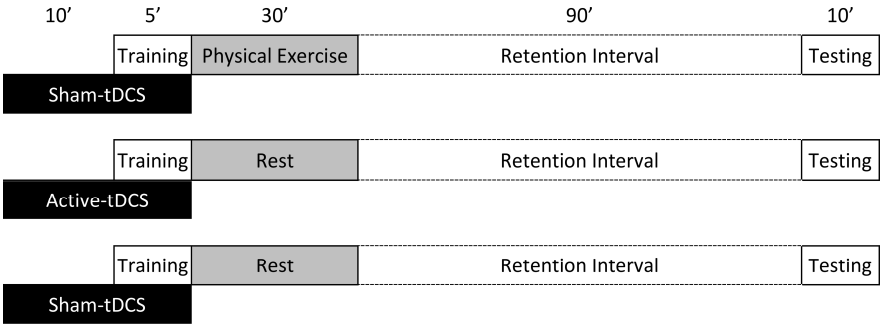

Figure 1. Procedure of the study. All participants (n = 24) took part in three experimental conditions: Physical Exercise, Active-tDCS and Sham-tDCS.

Results

Both physical exercise and active stimulation led to significant improvement of long-term memory performance compared to sham stimulation (paired sample t-test *p*s < 0.05). Physical exercise, however, led to stronger improvement as calculated by Cohen's *d* effect size (**Figure 2**).

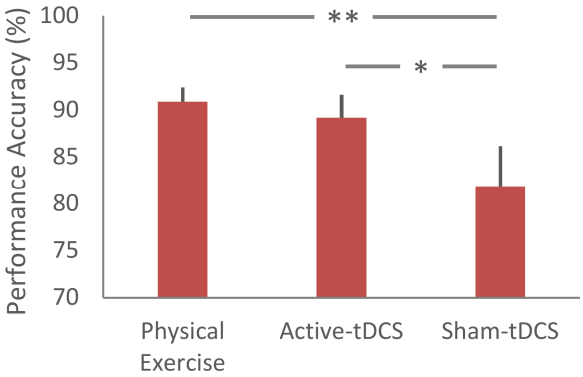

Figure 2. Mean performance accuracy in each condition. ** p = 0.01 Cohen's d = 0.42, * p = 0.02 Cohen's d = 0.21

Conclusions

- Thirty minutes of physical exercise during consolidation was more effective than fifteen minutes of tDCS during encoding.
- Considering that physical exercise tentatively leads to less adverse side effects as compared to electrical brain stimulation, physical exercise can be considered, potentially, as a more effective method of cognitive enhancement.

References

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