

**Conclusions:** These results suggest that the HD-tDCS sham method is an effective blind and double-blind for HD-tDCS in clinical trials, even at total amplitudes as high as 6mA.

**Categories:** Neurostimulation/Neuromodulation

**Keyword 1:** neurostimulation

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## 68 Preliminary Evidence of a Therapeutic Effect of Electrical Neuromodulation on Cognitive Deficits in Patients with Mild Cognitive Impairment

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**Objective:** Episodic memory functioning is distributed across two brain circuits, one of which courses through the dorsal anterior cingulate cortex (dACC). Thus, delivering non-invasive neuromodulation technology to the dACC may improve episodic memory functioning in patients with memory problems such as in amnesic mild cognitive impairment (aMCI). This preliminary study is a randomized, double-blinded, sham-controlled clinical trial to examine if high definition transcranial direct current stimulation (HD-tDCS) can be a viable treatment in aMCI.

**Participants and Methods:** Participants and Methods: Eleven aMCI participants, of whom 9 had multidomain deficits, were randomized to receive 1 mA HD-tDCS (N=7) or sham (N=4) stimulation. HD-tDCS was applied over ten 20-minute sessions targeting the dACC. Neuropsychological measures of episodic memory, verbal fluency, and executive function were completed at baseline and after the last HD-tDCS session. Changes in composite scores

for memory and language/executive function tests were compared between groups (one-tailed t-tests with  $\alpha = 0.10$  for significance). Clinically significant change, defined as  $> 1$  SD improvement on at least one test in the memory and non-memory domains, was compared between active and sham stimulation based on the frequency of participants in each.

**Results:** No statistical or clinically significant change ( $N-1 \chi^2$ ;  $p = 0.62$ ) was seen in episodic memory for the active HD-tDCS ( $M_{Diff} = 4.4$ ;  $SD = 17.1$ ) or sham groups ( $M_{Diff} = -0.5$ ;  $SD = 9.7$ ). However, the language and executive function composite showed statistically significant improvement ( $p = 0.04$ ;  $M_{Diff} = -15.3$ ;  $SD = 18.4$ ) for the active HD-tDCS group only (Sham  $M_{Diff} = -5.8$ ;  $SD = 10.7$ ). Multiple participants (N=4) in the active group had clinically significant enhancement in language and executive functioning tests, while nobody in the sham group did ( $p = 0.04$ ).

**Conclusions:** HD-tDCS targeting the dACC had no direct benefit for episodic memory deficits in aMCI based on preliminary findings for this ongoing clinical trial. However, significant improvement in language and executive function skills occurred in response to HD-tDCS, suggesting HD-tDCS in this configuration has promising potential as an intervention for language and executive function deficits in MCI.

**Categories:** Neurostimulation/Neuromodulation

**Keyword 1:** treatment outcome

**Keyword 2:** technology

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## 69 Transcranial Random Noise Stimulation Facilitates Phonemic Verbal Fluency and Convergent Thinking in Multilingual Healthy Adults.

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**Objective:** The aim of the present study was to analyse the effects of the transcranial random noise stimulation (tRNS) technique when placed

on the left dorsolateral prefrontal cortex (L-DPFC) and left inferior frontal gyrus (L-IFG), for the improvement of verbal fluency performance and creativity skills in a group of multilingual healthy adults.

**Participants and Methods:** Fifty healthy adults, aged 18-47 years, participated in the study. All of them were native Spanish speakers of which three were bilingual (Spanish and English) and 47 were multilingual (Spanish, Basque and English). The study had a randomized, counterbalanced, double-blind, sham-controlled design. The participants were randomly allocated to either a tRNS active group or a placebo-control group. All participants were tested individually in one session divided into three parts: (1) baseline, (2) online, and (3) offline assessment. In the active condition, a 1.5mA current (100–500 Hz) was delivered for 20 minutes (online phase). Participants' verbal fluency was assessed through semantic and phonemic verbal fluency tasks in three different languages (Spanish, Basque and English), while creativity was assessed in their native language with the Remote Associations Test (RAT, pre and post forms) for convergent thinking, and with the Unusual Uses subtest (UU, pre and post forms) for divergent thinking. In addition, the linguistic profile of the participants was evaluated with the Language Experience and Proficiency Questionnaire (LEAP-Q), and their processing speed and cognitive flexibility were assessed with the Stroop Color and Word Test (SCWT).

**Results:** The results showed significant differences in phonemic fluency between the groups during the online assessment in Spanish ( $F=5.31$ ,  $p=0.026$ ), and in the offline assessments in Spanish ( $F=6.44$ ,  $p=0.015$ ) and English ( $F=10.80$ ,  $p=0.002$ ), with participants in the active condition performing better. While no differences were observed in the performance of the groups in verbal fluency in Basque, neither in the online ( $F=1.06$ ,  $p=0.31$ ), nor in the offline assessment ( $F=2.62$ ,  $p=0.11$ ). Furthermore, no significant differences were observed between groups in semantic verbal fluency tasks in any of the languages, neither during stimulation nor offline. However, there were no differences between conditions in the online (Spanish,  $F=0.86$ ,  $p=0.35$ ; English,  $F=2.95$ ,  $p=0.09$ ; and Basque,  $F=0.01$ ,  $p=0.94$ ) and offline (Spanish,  $F=2.53$ ,  $p=0.11$ ; English,  $F=0.74$ ,  $p=0.39$ ; and Basque,  $F=1.39$ ,  $p=0.24$ ) semantic tasks. In creativity, significant differences were observed between groups on the RAT ( $F=9.58$ ,  $p=0.003$ ),

while no differences were observed in the performance of any of the three dimensions of the UU (Originality,  $F=0.44$ ,  $p=0.51$ ; Flexibility,  $F=0.42$ ,  $p=0.51$ ; Fluency,  $F=0.69$ ,  $p=0.41$ ). In the SCWT, statistically significant differences were only observed in the colour-word part ( $F=7.60$ ,  $p=0.008$ ) during the online assessment, showing a better performance of the participants under the tRNS condition compare to the sham condition.

**Conclusions:** The results obtained in this study suggest that the excitatory effects of tRNS over the L-DLPFC L-IFG could contribute to the improvement of phonemic verbal fluency and verbal convergent thinking, in healthy individuals.

**Categories:** Neurostimulation/Neuromodulation

**Keyword 1:** neurostimulation

**Keyword 2:** learning

**Keyword 3:** language: second/foreign

## 71 Treatment with TMS Improves Aspects of Attention in Depression: A Pilot Study

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