

Temporal gamma tACS and auditory stimulation affect verbal memory in healthy adults

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Abstract

Research suggests a potential of gamma oscillation entrainment for enhancing memory in Alzheimer's disease and healthy subjects. Gamma entrainment can be accomplished with oscillatory electrical, but also sensory stimulation. However, comparative studies between sensory stimulation and transcranial alternating current stimulation (tACS) effects on memory processes are lacking. This study examined the effects of rhythmic gamma auditory stimulation (rAS) and temporal gamma-tACS on verbal long-term memory (LTM) and working memory (WM) in 74 healthy individuals. Participants were assigned to two groups according to the stimulation techniques (rAS or tACS). Memory was assessed in three experimental blocks, in which each participant was administered with control, 40 Hz, and 60 Hz stimulation in counterbalanced order. All interventions were well-tolerated, and participants reported mostly comparable side effects between real stimulation (40 Hz and 60 Hz) and the control condition. LTM immediate and delayed recall remained unaffected by stimulations, while immediate recall intrusions decreased during 60 Hz stimulation. Notably, 40 Hz interventions improved WM compared to control stimulations. These results highlight the potential of 60 Hz and 40 Hz temporal cortex stimulation for reducing immediate LTM recall intrusions and improving WM performance, respectively, probably due to the entrainment of specific gamma oscillations in the auditory cortex. The results also shed light on the comparative effects of these neuromodulation tools on memory functions, and their potential applications for cognitive enhancement and in clinical trials.

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