



Combining NIBS techniques: Is two better than one?

This scoping review demonstrated that combining two neuromodulation techniques is a promising way to boost their individual effectiveness and highlights considerations for future dual stimulation research.



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Introduction

Non-invasive brain stimulation (NIBS) can lead to long lasting improvements in depression and anxiety for some people, but response is variable. Two NIBS techniques with evidence for treating these difficulties are transcranial magnetic stimulation (TMS), which uses magnetic pulses [1], and transcranial electrical stimulation (tES), which uses weak electric currents [2,3]. There is some evidence that combining TMS and tES can amplify their individual effects [4].

Objective

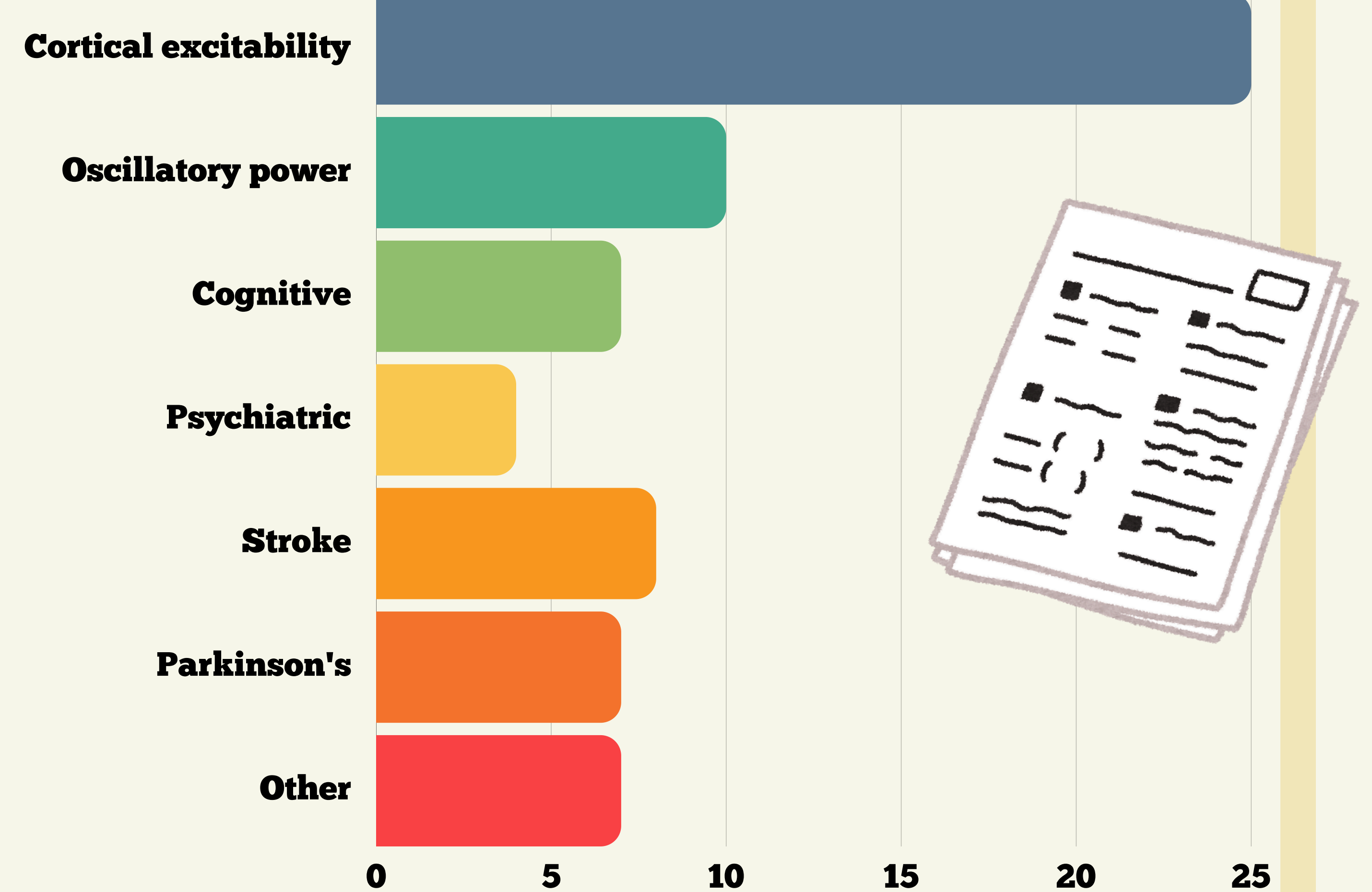
To review how TMS and tES have been combined and identify the most promising approaches to take forward.

Methodology

Three databases, Embase, MEDLINE and APA PsychInfo were searched for studies that compared a technique that combined tES and TMS, with a single method of stimulation. Pre-published protocol here: <https://osf.io/t2vkr/>

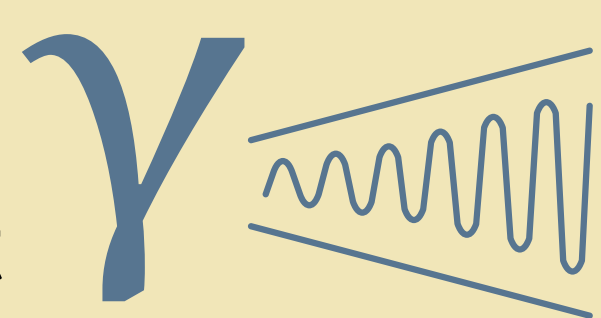
Results

66 studies included



Brain function findings

- Gamma oscillatory power was boosted by combined stimulation, though theta was not consistently boosted.
- Cortical excitability of the motor cortex is increased somewhat by cathodal tDCS priming, and decreased by anodal tDCS priming (regardless of rTMS form). It is also increased by simultaneous gamma tACS-iTBS.
- Short-term memory is not improved by combined stimulation, but long-term memory may be.



Treatment findings

Positive treatment effects in studies:

Psychiatric Disorders - 4/4

Tinnitus - 0/2

Parkinson's - 2/5

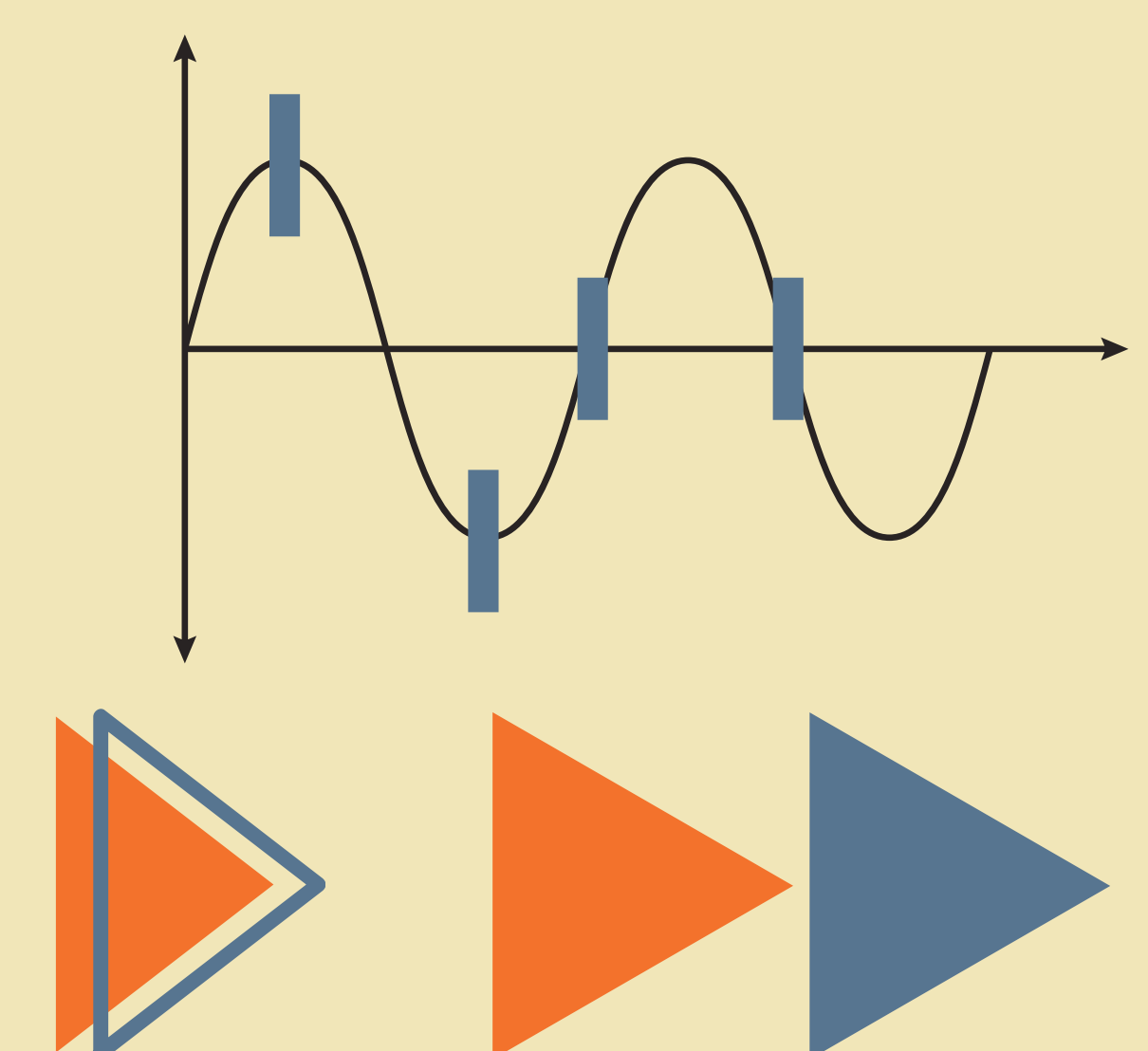
Other - 3/3

Stroke - 5/7

- The form and timing of the tES and TMS appears to have a significant impact on treatment effects.
- Some studies examined differential brain function in participants with some disorders using dual stimulation.

Considerations for future research

- Effect of oscillations
 - Are oscillations important, i.e. should tACS or tDCS be used?
- Effect of phase
 - If an oscillating wave is used, does synchronising the rTMS pulse to a particular point of the wave have a significant impact?
- Effect of stimulation timing
 - Should the protocol simultaneously or consecutively apply tES and rTMS?



References

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