DART
DRUG ABUSE RESEARCH TRAINING

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Combining Transcutaneous Auricular Vagus Nerve Stimulation (taVNS) with Transcranial Magnetic Stimulation (TMS) to Enhance Cortical Excitability

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Background: Neuromodulation techniques, such as transcranial magnetic stimulation (rTMS), are becoming widely used tools to augment motor training to facilitate motor function post-stroke. Primarily, rTMS is used to enhance cortical excitability. However, its effects are transient and behavioral benefits are mild in rehabilitation paradigms. There is a need for noninvasive neuromodulatory techniques that can induce robust changes in cortical excitability to facilitate motor recovery post-stroke and to enhance and accelerate neuroplastic changes induced by rTMS. Transcutaneous auricular vagus nerve stimulation (taVNS) has emerged as a promising facilitator of neuroplasticity, and in this trial, we explore combining two forms of brain stimulation (taVNS and rTMS) to boost cortical excitability. **Methods:** We will prescreen 40 healthy individuals with a single 20Hz rTMS session applied to the motor cortex flanked by pre- and post-MEP evaluations. From this prescreen cohort, we plan to enroll a total of 24 healthy participants (of whom had increases in motor excitability) into a 4-visit, randomized, sham-controlled trial exploring various forms of neuromodulation on cortical excitability. At the visits, we will conduct baseline measures of cortical excitability, using a validated motor evoked potential (MEP) paradigm, followed by 20 minutes of one of four different stimulation conditions (active TMS/sham taVNS, active taVNS/sham TMS, paired taVNS+TMS, or unpaired taVNS+TMS). MEPs will be recorded immediately after stimulation, and every 10 minutes for 30 minutes to analyze changes in excitability. **Results**: Although the study is still underway, we have one of subject who has completed all sessions for data analysis. In this subject, Active TMS/Sham taVNS condition induced a +114.9% increase in MEP amplitude compared to the baseline. Similarly, Active taVNS/Sham TMS condition induced a +82.4% increase in MEP amplitude compared to baseline (20 minutes post-stim). Both combinatory methods resulted in reductions in MEP amplitude compared to baseline at the 20 minute timepoint (Paired taVNS+TMS: -73.4%, Unpaired taVNS+TMS: -70.7%). **Conclusions:** These preliminary results suggest that combining two forms of brain stimulation is safe,

feasible, and likely impacts cortical excitability. These data suggest there may be an interaction between the two administered simultaneous, rather than independently. Further completion of the trial, along with increased sample size, and more rigorous statistical analysis is warranted to determine whether combinatory taVNS/TMS may be used as a cortical excitability tool.