Promoting Adaptive Neuroplasticity in Mild Cognitive Impairment

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All analyses were completed using STATA 17.0 . While we emphasize reporting effect magnitude (Wasserstein et al., 2019), statistical significance was determined using two-tailed α=0.05. All model assumptions were evaluated prior to interpreting results. There were 321 observations in the dataset comprised of 107 individuals who had taken tests at 3 timepoints (baseline, post-treatment, and 3 month follow-up). All individuals were randomized to one of four groups: Active tDCS + mnemonic strategy training (MST), Sham tDCS + MST, Active tDCS + autobiographical memory recall (ABR), or sham tDCS + ABR. Final sample sizes were n=24 in the ABR+Sham tDCS group, n=29 in ABR+Active tDCS, n=25 in MST+Sham tDCS, and n=29 in MST+Active tDCS. Our primary outcomes were performance on the Cued Recall condition of the Object Location Test Touch (OLTT), the recall score on the Face Name Generalization Test (FNGT), fMRI based BOLD signal change for an object location association task and a face name association task within the left ventrolateral prefrontal cortex region of interest. Note: at the time of reporting, fMRI analyses were preliminary and are undergoing revision. Secondary outcome was Multifactorial Memory Questionnaire (MMQ strategy scale), and Ecological Memory Stimulation (EMS) Route Recall Serial Delay score and Medical Instructions Delay score. Primary MRI outcomes included Preliminary fMRI analyses focused on beta weights during the encoding of novel stimuli (post treatment > baseline) for both the OLTT and FNGT.

Consistent with our longitudinal experimental design, we evaluated the effects of stimulation group over time by mixed-effects regression modeling. Most outcomes met the assumptions for Gaussian based modeling, however the FNGT Free Recall required Poisson link function. All models included a random Y-intercept to accommodate the longitudinal experimental design, and fixed coefficients assessing the effects of time (pre, post, 3m follow-up), strategy (ABR, MST), tDCS (Active, Sham), tDCS duration (20 minutes versus 30 minutes), and the three-way interaction among time, strategy, and stimulus to evaluate the potential dependent effects among these three factors. Our model for the OLTT Cued Recall outcome also included a fixed coefficient adjusting for OLTT Dot Mean Raw scores. A-priori contrasts were set to compare all combinations of active tDCS and MST versus ABR+Sham, baseline versus each subsequent time point, and tDCS duration of 30 minutes versus 20 minutes.

Models revealing a significant three-way interaction (Time x Strategy x tDCS) were followed by simpler models within each strategy group to better elucidate the combined effects of these factors.

Works cited:

Wasserstein, R.L., Schirm, A.L. & Lazer, N.A. (2019). Moving to a World Beyond "p <0.05" The American Statistician, 73:sup1, 1-19, DOI:10.1080/00031305.2019.1583913