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Do Working Memory Differences Exist Dependent Upon Dorsolateral Prefrontal Cortex or Medial Orbitofrontal Cortex Repetitive Transcranial Magnetic Stimulation Treatment for Smoking Cessation?

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Background: In the United States, cigarette smoking yearly claims about one in every five deaths, with mortality rates continuously rising. High-frequency repetitive transcranial magnetic stimulation (HF-rTMS) over the dorsal lateral prefrontal cortex (DLPFC) as well as low-frequency (LF-rTMS) over the medial orbitofrontal cortex (mOFC) has historically demonstrated high efficacy in curbing nicotine cravings and worked as progressive neurostimulation therapy for smoking cessation. While rTMS reports positive findings for smokers and those suffering from tobacco use disorder (TUD), its consequential effects upon working memory are not well known. This study investigated rTMS's use in smoking cessation in DLPFC and mOFC placements to uncover participants' potential cognitive memory impairments, as tested using the N-back working memory task. **Methods:** The Medical University of South Carolina conducted a double-blind, sham-controlled, randomized clinical trial of participants (n=18, 9 female) aged 49.8 [9.7] (mean [SD]) from the Charleston, South Carolina vicinity who voluntarily enrolled for daily rTMS treatment for smoking cessation totaling 15 sessions over a 3 week period. The rTMS was either sham or active MRI-guided to the DLPFC (10 Hz, 3000 pulses each session) for facilitation protocol or to the mOFC (1 Hz, 900 pulses each session) for inhibition protocol. N-back studies occurred once a week, prior to rTMS treatment #1, #6, #11, #15, and 1 month after the 15th rTMS. **Results:** 16 participants started treatment. 9 received DLPFC rTMS treatments, and 7 received mOFC rTMS treatments. 12 participants (7 DLPFC vs. 5 mOFC) were included for the analysis. Mixed model results showed significantly different correct trials between 0-back (5.29±0.31), 1-back (3.27±0.31), and 2-back (2.21±0.31), ($p < 0.01$). A trend difference existed between DLPFC treatment (3.24±0.24) and mOFC treatment (3.93±0.25), ($p=0.054$). No significant change was found between treatment weeks. Response time did not show significant difference between DLPFC and mOFC. **Conclusions:** Initial findings softly suggest that DLPFC rTMS and mOFC rTMS affect working memory, as measured with N-back. Noticeably, both DLPFC and mOFC included sham and active treatments.