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MODULATING THE COGNITIVE AND SUBJECTIVE EFFECTS OF THC IN YOUNG ADULTS WITH CANNABIS USE DISORDER

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Abstract
Young adults are particularly vulnerable to the negative effects of cannabis and the development of cannabis use disorder (CUD). CUD is largely defined by maladaptive decision-making, which often occurs while intoxicated in habitual cannabis users. This is problematic because cannabis and its major psychoactive chemical, THC, alter cognition and subjective experience. Pharmaco-TMS has informed mechanisms of movement; however no published research has examined the ability of TMS to modulate the acute effects of THC on decision-making dynamics, cognitive performance, and subjective effects in individuals with CUD. This ongoing double-blind, placebo and sham controlled study is enrolling young adults with CUD (n=6). On separate days, individuals receive randomized combinations of oral THC (0, 10, 30mg) and intermittent theta-burst stimulation (iTBS: sham, real). Decision-making and cognitive task performance and subjective effects are measured before dosing and directly following iTBS at the estimated THC concentration peak. Left dorsal lateral prefrontal cortex (DLPFC) stimulation targets are neuronavigated from individualized fMRI analyses isolating overlap between correct choice evaluation (decision-making task) and accurate high load working memory performance (N-Back). Primary measures are reinforcement learning modeled parameters from the decision-making task, accuracy from the N-Back task, and subjective drug effects on a visual analog scale. Preliminary analyses reveal trends in the ability of iTBS (real − sham) to modulate the effects of 30mg of THC on several outcomes (average±SEM). A modeled perseveration parameter during dynamic decision-making was lower (−0.48±0.21) and percent correct responding during high load working memory was greater (+7%±3.8), following iTBS. Several subjective measures also decreased following iTBS, including difficulty concentrating (−12%±14.5), feelings of high (−19.2%±17.2), and willingness to pay for drug (−12.5%±5.6). Together, these preliminary findings suggest that iTBS is a useful tool for studying the acute effects of THC on neurobehavioral outcomes relevant to understanding and treating CUD.
Keywords: Cannabis, Learning, Neuronavigation, TMS

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CAN TDCS AFFECT ACQUISITION OF A SIMPLE MOTOR SKILL IN NEUROTYPICAL ADULTS?

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Abstract
Excitatory tDCS (positive current into the brain) enhances skill acquisition and task dependent adaptation (TDA). Little is known about tDCS impact on spinal cord. Spinal reflexes participate in movements, change through life, and can be modified by experience or injury (Ann Rev Neurosci 24: 807-843). People can change spinal reflex size through operant conditioning (J Neurosci 29: 5784-5792). Acquiring this simple motor skill (larger or smaller reflex size) requires supraspinal drive (J Neurophysiol 87: 645-652). This study asks if tDCS affects the magnitude or consistency of H-reflex conditioning.
The MUSC IRB approved the study. Neurotypical participants receive Active (excitatory, 2mA, 0.06mA/cm2, 30m) or Sham tDCS over contralateral leg region of primary motor cortex during soleus H-reflex down-conditioning. Tibial nerve stimulation elicits H-reflexes. Participants stand comfortably and maintain soleus background activity in a defined range. In 4 Baseline (BL) sessions, H-reflexes are simply recorded (control trials, three 75-trial blocks). In 12 subsequent Conditioning sessions (CS), participants practice reducing the H-reflex (conditioning trials, 3 blocks of 75). Visual feedback about reflex size follows each conditioning trial. Every session collects H-reflex recruitment curves (RCs) and control reflexes. TMS MEP RCs are collected periodically. A 1-month follow-up examines retention.
To date, 8 participants (4 women, 5 Active tDCS, Age 22-36) have completed the study. Final conditioned H-reflex sizes (mean of CSs 10-12 as % BL) were 58, 67, 90, 99, 215% for Active and 71,115,125% for Sham participants. MEPmax change was -0.66, -0.28, -0.07, +0.04, +0.30mv and +0.09, +0.11, +1.11mV, Active and Sham respectively. The study is ongoing. The full results may illuminate tDCS impact on skill acquisition and guide its therapeutic applications as a neuromodulator.
Keywords: tDCS, Hoffman reflex, operant conditioning, motor learning

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A NOVEL APPROACH TO CLOSED-LOOP NEUROMODULATION WITH MACHINE LEARNING

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Abstract
Closed-loop neuromodulation enables the utilization of ongoing neural activity to guide neuromodulatory interventions. These neuromodulation interventions can be enhanced with machine learning techniques used to identify periods of maximal stimulation responsiveness. While utilizing the large open source GX dataset, which examined changes in vigilance and attention with tACS and tDCS; we present a theoretical framework for designing closed-loop neuromodulation protocols and integrating them with machine learning and deep learning techniques to create multimodal (tACS, tDCS, TMS) optimized closed-loop neuromodulation approaches. We compare the predictive performance of handcrafted and machine derived features extracted from EEG and physiological data in our open source dataset. Preliminary results indicate that both hand crafted and machine derived features are able to adequately predict stimulation responsiveness.
Keywords: Machine learning, tES, closed-loop, EEG

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THETA BURST STIMULATION (TBS) TO MODULATE CRAVING AND ATTENTIONAL BIAS IN PEOPLE LIVING WITH HIV/AIDS SMOKERS (PLWHA)

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Abstract
Background: Cigarette use is a leading cause of mortality among people living with HIV/AIDS (PLWHA) and currently approved smoking cessation strategies have modest efficacy. Brain stimulation could be a viable option to augment current smoking cessation strategies. There is little work determining the effects of theta burst stimulation (TBS) on predictors of relapse (e.g., craving and bias) and brain connectivity. Cigarette-cue attentional bias (AB) is a robust predictor of cigarette relapse. The present study examined the effects of one TBS session on cigarette craving, cigarette-cue AB, and functional connectivity in PLWHA.
Methods: In an ongoing trial, eight cigarette using PLWHA were recruited and given one session of TBS (1800 pulses delivered at 120 % resting motor threshold). This was delivered to left dorsolateral prefrontal cortex (DLPFC) using MNI coordinates for BA 46 and T1 structural scan targeting via neuronavigation. Craving was measured via the Tobacco Craving Questionnaire (TCQ- SF) before and after the TBS session. Cigarette-cue AB was measured via the eye-tracking before and after the session. In addition, resting state functional connectivity brain scans were obtained pre- and post-session for all participants and processed using conn toolbox v20b.