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The Application of Repetitive Transcranial Magnetic Stimulation (rTMS) as an Adjunct Therapy in Reduction of Craving and Consumption of Illicit Drugs (Ref.: BDF190052; Beat Drugs Fund)

重覆性跨顱磁刺激(rTMS)對吸毒者減少服用違禁藥品的渴望和使用的輔助療法

Professor Kenneth, N. K. Fong (Principal Investigator)
Department of Rehabilitation Sciences, The Hong Kong Polytechnic University

Introduction

- **Transcranial magnetic stimulation (TMS)** is a technique for non-invasive brain stimulation based on the principle of electromagnetic induction.
- Our review (Zhang, Fong, et al., 2019) showed that excitatory repetitive TMS of the left **dorsolateral prefrontal cortex (DLPFC)** significantly reduced craving (Hedges' g = -0.62; 95% CI, -0.89 to -0.35; P < 0.0001), compared with sham stimulation.

Research questions:

Primary question:

- Can rTMS reduce craving and consumption of the mostly used illicit drugs, such as amphetamine & cocaine, among people in Hong Kong?

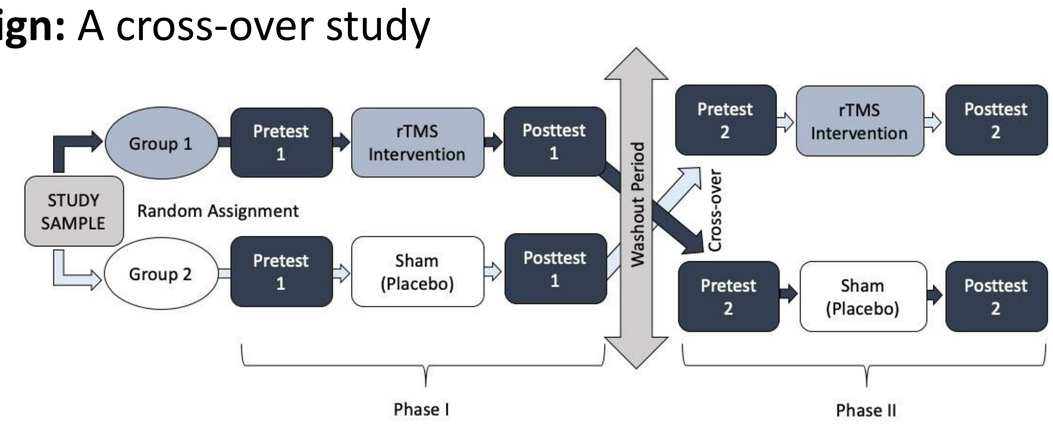
Secondary questions:

- Is there any association between rTMS protocol and drugs craving/consumption?
- Can rTMS provide reduction in depressive and anxiety symptoms?
- Can rTMS provide any gains in executive functioning?

Methods

Participants: Illicit drug users; currently using or have used either methamphetamine (ice), cocaine, or both, frequently for at least 3 times per week.

Design: A cross-over study



Intervention:

- High-frequency rTMS over the left dorsal lateral pre-frontal cortex (DLPFC).

Outcome measures:

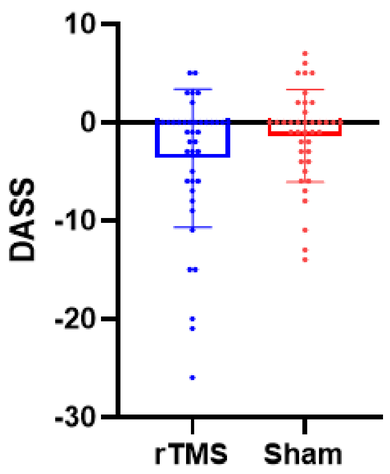
Primary

- Craving Experience Questionnaire
- Contemplation Ladder: a brief measure of motivation or readiness to change

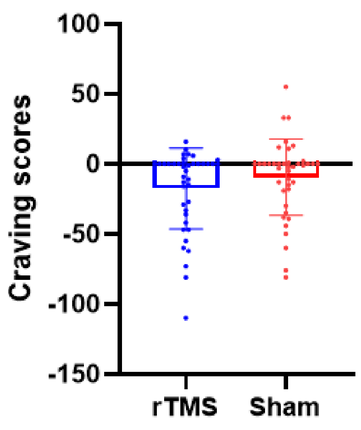
Secondary

- Depression Anxiety Stress Scales (DASS)
- Executive functioning: MATRICS Consensus Cognitive Battery (MCCB)'s subtests for attention (CPT-IP), processing speed (TMT), reasoning and problem-solving (NAB Mazes)

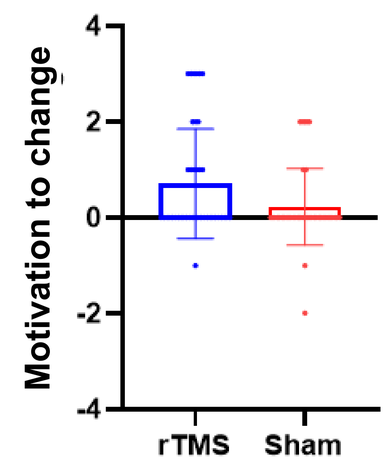
Results



- rTMS, but not sham rTMS, significantly improved **mood** in illicit drug users (within-group difference: p=0.020 vs. p=0.072).



- Both real and sham rTMS significantly reduced **craving** in illicit drug users (within-group difference: p<0.001 vs. p=0.035)



- rTMS demonstrated a higher level of effectiveness compared to sham rTMS in **enhancing motivation to quit addictive behaviors** among illicit drug users (between-group difference, p = 0.031).

Conclusion

- High-frequency left DLPFC rTMS, but not sham stimulation, appears to improve mood of people with illicit drugs abuse, which is in line with the research findings in depression population.
- High-frequency left DLPFC rTMS reduces craving but the actual drug consumption is unclear in Illicit drug users.
- Placebo effect of rTMS on craving and in drug abusers is significant.
- Future studies are required to investigate the underlying neural mechanism underlying the therapeutic effect in substance abuse in association with rTMS.

Reference:
Zhang, J. J. Q, **Fong, K. N. K**., Ouyang, R. G., Siu, A. M. H, & Kranz, G. S. (2019). Effects of repetitive transcranial magnetic stimulation (rTMS) on craving and substance consumption in patients with substance dependence: A systematic review and meta-analysis. *Addiction*. 114(12):2137-2149