AUGMENTATIVE TRANSCRANIAL MAGNETIC STIMULATION FOR VIRTUAL REALITY EXPOSURE THERAPY IN ACROPHOBIA

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INTRODUCTION

- **Anxiety disorders** (and especially specific phobias) are among the most prevalent mental health disorders worldwide (Dattani et al., 2021)
- The **gold standard treatment** for specific phobias is in-vivo or virtual reality (VR) exposure therapy (Bandelow et al., 2021), but not all patients benefit from these treatment approaches (e.g., van Dis et al., 2018)
- Recent laboratory study showed promising results of transcranial magnetic stimulation (**TMS**) enhancing extinction learning processes (Raij et al., 2018), which are **underlying learning processes** in exposure therapy (Craske et al., 2014)

OBJECTIVE

- Transfer laboratory results (Raij et al., 2018) into a clinical trial and examine whether TMS enhances therapeutic effects

METHODS

- N = 76 participants with acrophobia (according to DSM-5), randomized, double-blind in active or placebo conditions
- Study design:

Screening

Pre-Treatment: Diagnostic/MRI session
- Questionnaires
- Behavioral Approach Tasks (BAT) in-vivo and VR (HMD)
- Structural MRI

Fig 1. BAT in VR (Picture: VT Plus GmbH)

Treatment
- 2 therapist-guided height-specific exposure exercises in a 5-sided 3D multisensory PsyCAVE (4x3x2.95m)
- Active or placebo repetitive TMS over the left frontal prefrontal cortex (PFC; functionally connected to the ventromedial PFC), before each exposure exercise

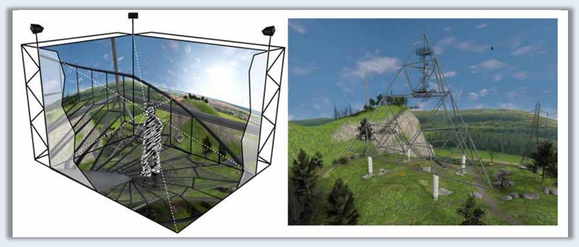

Fig 2. VR exposure therapy environment (Picture: Gromer et al., 2018)

Post-Treatment: Diagnostic session
- Questionnaires
- BAT in-vivo and VR

Follow-Up: Diagnostic session after 6 months
- Questionnaires
- BAT in-vivo and VR

- Statistical analyses: Linear mixed models for continuous primary (AQ) and secondary outcomes (e.g., maximal anxiety in BATs), and mixed logistic regression models for binary outcomes, with time, group, time x group interaction as fixed factors, and subject as a random factor

RESULTS

- No group differences regarding age, gender, and other baseline measurements
- **Primary Outcome**: Significant time main effect (anxiety: $F(1,76) = 85.8$, $p < .001$; avoidance: $F(1,75) = 118.1$, $p < .001$), but no significant group main effect or time x group interaction (*p*s >.050)

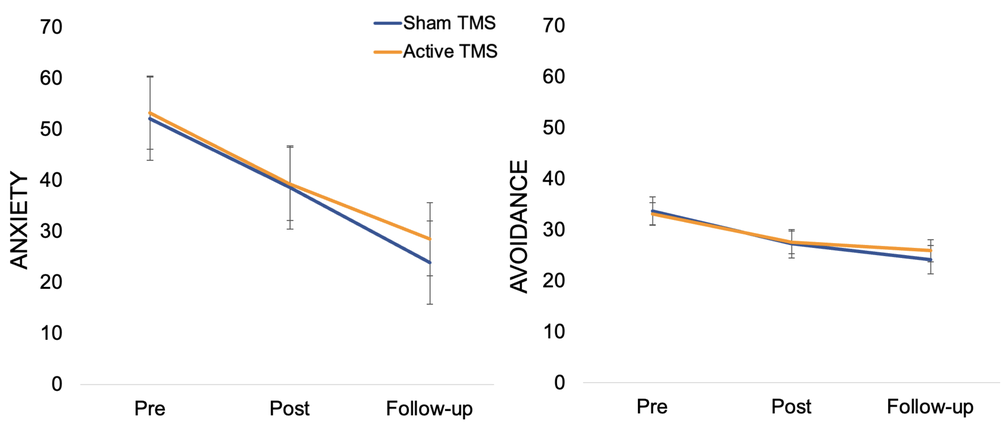

Fig 3. Trajectories of mean anxiety and avoidance scores (Acrophobia Questionnaire) pre, post-treatment, and at 6-month follow-up. Error bars represent +/- 1 standard error.

- **Secondary Outcomes**: Significant time main effect for all secondary outcomes (*p*s >.001), but no significant group main effect or time x group interaction (*p*s >.050), except for response rates:

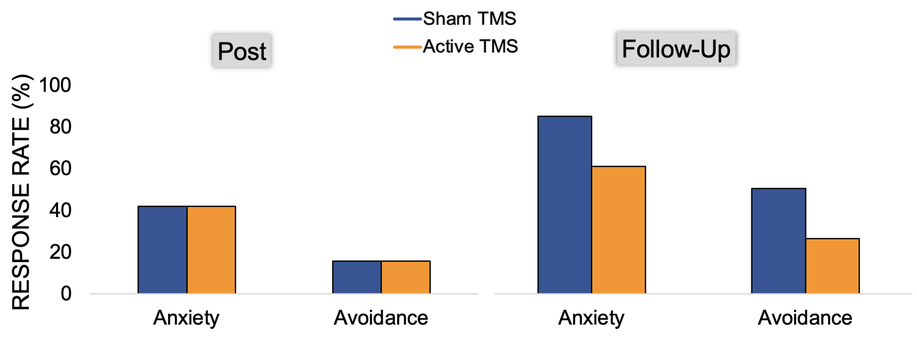

Fig 4. Responder rates for anxiety and avoidance in percent. Response is defined as a 30% score reduction from pre- to post-treatment, or follow-up.

- No significant group effect for post-treatment (*p*s >.050), but for follow-up (anxiety: $F(1,72) = 5.2$, $p = .025$; avoidance: $F(1,71) = 4.0$, $p = .049$)
- No significant group effect for exposure session variables (e.g., maximal anxiety, maximal height, etc.), TMS side effects, estimation of group affiliation, frequency of exercises during the 6 months, etc.

CONCLUSION

- As expected, both groups showed significant symptom reduction after two VR exposure sessions at post-treatment and follow-up
- No additional rTMS effect was found (in contrast to Herrmann et al., 2017, a study of TMS over the medial PFC)
- Optimal rTMS localization and stimulation parameters are still not fully understood and require further research

LITERATURE

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