

Mindfulness-based Neurofeedback to augment DBT for Borderline Personality Disorder

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Introduction

Borderline personality disorder (BPD) is a mental health condition characterized by affective instability, impulsivity, and difficulties in interpersonal relationships. Pharmacological treatments have shown limited and inconsistent benefit, and no medication is specifically approved for BPD; the most widely disseminated evidence-based treatment is Dialectical Behavior Therapy (DBT) ¹. A core component of DBT is mindfulness training, and individuals with BPD have been shown to exhibit deficits in mindfulness-related capacities ². Neuroimaging studies have shown that mindfulness practice is associated with reduced activity and connectivity within the default mode network (DMN), particularly reduced coupling between the medial prefrontal cortex (mPFC) and the posterior cingulate cortex (PCC) ³. Increased coupling between these regions has been linked to maladaptive self-referential processing and fixation on distressing emotional states ⁴ supporting the idea that these regions may be relevant mechanistic targets in BPD. Mindfulness-based real-time fMRI neurofeedback (mbNF) has been repeatedly shown to reduce internal DMN connectivity and strengthen anticorrelated dynamics between the DMN and the frontoparietal control network (FPCN/CEN) ^{5,6}. This study tests whether the mbNF could help BPD patients get better outcomes with DBT by improving their mindfulness.

Methods

This is a randomized, controlled, double blind clinical trial funded by an R61/33. This form of funding has a two year R61 phase. If data are promising enough in the R61 phase to meet pre-specified “Go criteria”, an additional three years of funding (the R33 component) will be provided for another trial. 52 participants aged 18-60 who meet the criteria for BPD are recruited during the R61 phase; comorbidities that could impair learning or unwillingness to keep the medication / treatment stable are exclusionary. Participants are randomized to experimental or yoked-sham control groups. Both groups receive Dialectical Behavior Therapy (DBT) and 1 session of mbNF training. An initial resting-state scan is acquired to derive individualized DMN and CEN networks using independent component analysis (ICA). Participants then receive instruction for mindful describing practice outside the scanner while network maps are generated. A second resting-state scan is obtained immediately prior to neurofeedback. Neurofeedback consists of five 2.5-minute feedback runs in which real-time DMN and CEN activity is visualized through a graphical interface. A post-training resting-state scan is acquired to quantify changes in within-network connectivity and DMN–FPCN

anticorrelation. The R61 Go criterion is a medium effect size (Cohen's $d \geq 0.5$) for change in target engagement in the mbNF group relative to the yoked-sham group. Target engagement is operationalized as either (i) a reduction in within-DMN functional connectivity or (ii) an increase in DMN–FPCN anticorrelation following neurofeedback training.

Concluding remark

This is a registered clinical trial (NCT06446765) and recruitment is currently ongoing, but expected to be completed before the meeting. The findings of the trial will be shared at the meeting.

References

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