fMRI Neurofeedback Training for Increasing Anterior Cingulate Cortex Activation in Adult Attention Deficit Hyperactivity Disorder. An Exploratory Randomised, Single-Blinded Study.

Zilverstand A, Sorger B, Slaats-Willemse D, Kan CC, Goebel R, Buitelaar JK.


Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is characterized by poor cognitive control/attention and hypofunctioning of the dorsal anterior cingulate cortex (dACC). In the current study, we investigated for the first time whether real-time fMRI neurofeedback (rt-fMRI) training targeted at increasing activation levels within dACC in adults with ADHD leads to a reduction of clinical symptoms and improved cognitive functioning. An exploratory randomised controlled treatment study with blinding of the participants was conducted. Participants with ADHD (n = 7 in the neurofeedback group, and n = 6 in the control group) attended four weekly MRI training sessions (60-min training time/session), during which they performed a mental calculation task at varying levels of difficulty, in order to learn how to up-regulate dACC activation. Only neurofeedback participants received continuous feedback information on actual brain activation levels within dACC. Before and after the training, ADHD symptoms and relevant cognitive functioning were assessed. Results showed that both groups achieved a significant increase in dACC activation levels over sessions. While there was no significant difference between the neurofeedback and control group in clinical outcome, neurofeedback participants showed stronger improvement on cognitive functioning. The current study demonstrates the general feasibility of the suggested rt-fMRI neurofeedback training approach as a potential novel treatment option for ADHD patients. Due to the study's small sample size, potential clinical benefits need to be further investigated in future studies.

TRIAL REGISTRATION: ISRCTN12390961.