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# Efficacy of neurofeedback treatment in ADHD: the effects on inattention, impulsivity and hyperactivity: a meta-analysis

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## Abstract

Since the first reports of neurofeedback treatment in Attention Deficit Hyperactivity Disorder (ADHD) in 1976, many studies have investigated the effects of neurofeedback on different symptoms of ADHD such as inattention, impulsivity and hyperactivity. This technique is also used by many practitioners, but the question as to the evidence-based level of this treatment is still unclear. In this study selected research on neurofeedback treatment for ADHD was collected and a meta-analysis was performed. Both prospective controlled studies and studies employing a pre- and post-design found large effect sizes (ES) for neurofeedback on impulsivity and inattention and a medium ES for hyperactivity. Randomized studies demonstrated a lower ES for hyperactivity suggesting that hyperactivity is probably most sensitive to nonspecific treatment factors. Due to the inclusion of some very recent and sound methodological studies in this meta-analysis, potential confounding factors such as small studies, lack of randomization in previous studies and a lack of adequate control groups have been addressed, and the clinical effects of neurofeedback in the treatment of ADHD can be regarded as clinically meaningful. Three randomized studies have employed a semi-active control group which can be regarded as a credible sham control providing an equal level of cognitive training and client-therapist interaction. Therefore, in line with the AAPB and ISNR guidelines for rating clinical efficacy, we conclude that neurofeedback treatment for ADHD can be considered "Efficacious and Specific" (Level 5) with a large ES for inattention and impulsivity and a medium ES for hyperactivity.

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