Behavioral Effects of Neurofeedback Compared to Stimulants and Physical Activity in Attention-Deficit/Hyperactivity Disorder: A Randomized Controlled Trial.


Abstract

OBJECTIVE:
The efficacy of neurofeedback as a treatment for attention-deficit/hyperactivity disorder (ADHD), and whether neurofeedback is a viable alternative for stimulant medication, is still an intensely debated subject. The current randomized controlled trial compared neurofeedback to (1) optimally titrated methylphenidate and (2) a semi-active control intervention, physical activity, to account for nonspecific effects.

METHODS:
A multicenter 3-way parallel-group study with balanced randomization was conducted. Children with a DSM-IV-TR diagnosis of ADHD, aged 7-13 years, were randomly allocated to receive neurofeedback (n = 39), methylphenidate (n = 36), or physical activity (n = 37) over a period of 10-12 weeks. Neurofeedback comprised theta/beta training on the vertex (Cz). Physical activity consisted of moderate to vigorous intensity exercises. Neurofeedback and physical activity were balanced in terms of number (~30) and duration of sessions. A double-blind pseudorandomized placebo-controlled crossover titration procedure was used to determine an optimal dose in the methylphenidate intervention. Parent and teacher ratings on the Strengths and Difficulties Questionnaire (SDQ) and Strengths and Weaknesses of ADHD Symptoms and Normal Behavior (SWAN) were used to assess intervention outcomes. Data collection took place between September 2010 and March 2014.

RESULTS:
Intention-to-treat analyses revealed an improvement in parent-reported behavior on the SDQ and the SWAN Hyperactivity/Impulsivity scale, irrespective of received intervention (ηp² = 0.21-0.22, P ≤ .001), whereas the SWAN Inattention scale revealed more improvement in children who received methylphenidate than neurofeedback and physical activity (ηp² = 0.13, P ≤ .001). Teachers reported a decrease of ADHD symptoms on all measures for methylphenidate, but not for neurofeedback or physical activity (range of ηp² = 0.14-0.29, P < .001).

CONCLUSIONS:
The current study found that optimally titrated methylphenidate is superior to neurofeedback and physical activity in decreasing ADHD symptoms in children with ADHD.

TRIAL REGISTRATION:
ClinicalTrials.gov identifier: NCT01363544.