Neurocognitive effects of neurofeedback in adolescents with ADHD: a randomized controlled trial.

Bink M, van Nieuwenhuizen C, Popma A, Bongers IL, van Boxtel GJ.


OBJECTIVE:
Neurofeedback aims to reduce symptoms of attention-deficit/hyperactivity disorder (ADHD), mainly attention problems. However, the additional influence of neurofeedback over treatment as usual (TAU) on neurocognitive functioning for adolescents with ADHD remains unclear.

METHOD:
By using a multicenter parallel randomized controlled trial (RCT) design, male adolescents with a DSM-IV-TR diagnosis of ADHD (mean age = 16.1 years; range, 12-24) were randomized to receive either a combination of TAU and neurofeedback (n = 45) or TAU (n = 26). Randomization was computer generated and stratified by age group (ages 12 through 15, 16 through 20, and 21 through 24 years). The neurofeedback intervention consisted of approximately 37 sessions over a period of 25 weeks of theta/sensorimotor rhythm training on the vertex (Cz). Primary neurocognitive outcomes included performance parameters derived from the D2 Test of Attention, the Digit Span backward, the Stroop Color-Word Test and the Tower of London, all assessed preintervention and postintervention. Data were collected between December 2009 and July 2012.

RESULTS:
At postintervention, outcomes of attention and/or motor speed were improved, with faster processing times for both intervention conditions and with medium to large effect sizes (range, $\eta^2 = .08-.54$; P values < .023). In both groups, no improvements for higher executive functions were observed. Results might partly resemble practice effects.

CONCLUSIONS:
Although neurocognitive outcomes improved in all adolescents receiving treatment for ADHD, no additional value for neurofeedback over TAU was observed. Hence, this study does not provide evidence for using theta/sensorimotor rhythm neurofeedback to enhance neurocognitive performance as additional intervention to TAU for adolescents with ADHD symptoms.

TRIAL REGISTRATION:
Trialregister.nl identifier: 1759.