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**QUESTION**

**Question:** Does neurofeedback training produce greater improvements in attention deficit hyperactivity disorder (ADHD) compared with attention skills training?

**Patients:** 102 children (8–12 years old) with DSM-IV ADHD based on a semi-structured clinical interview (CASCAP-D) and the Diagnostic Checklist for Hyperkinetic Disorders/ADHD.

**Main exclusions:** gross neurological or organic disorders; medication or psychotherapy received within 6 weeks of beginning the intervention. Children with comorbid conduct disorder, emotional disorders, tic disorder and dyslexia were included in study. The majority of participants (87, 85.3%) were drug naïve.

**Setting:** Outpatient clinics in three cities in Germany; May 2005–December 2007.

**Intervention:** Neurofeedback training (NF) or attention skills training (AST). NF involved theta/beta training and slow cortical potential training using the computerised Self-regulation and Attention Management system. AST was based on the computerised program Skillies, which targets visual and auditory perception, vigilance, sustained attention and reactivity. Training was presented in two blocks of nine 50 min double sessions, two or three times a week. Each block lasted 3–4 weeks. Children trained in pairs and the administering psychologist discussed strategies for successful completion of the tasks and provided positive feedback to all participants, irrespective of group allocation. Children were asked to practice strategies learnt in the training sessions for 10 min each day while engaged in a daily task.

**Outcomes:** Primary outcomes: overall ADHD symptoms (parent rated German ADHD rating scale, FBB-HKS) impulsivity/hyperactivity and inattention symptoms (FBB-HKS subscales). Secondary outcomes included teacher rated FBB-HKS; response (≥ 25% reduction on FBB-HKS). Outcomes were assessed pre-training, between training blocks (about 1 week before the first block of sessions) and post-training (about 1 week after the second block of sessions).

**Main results**

Both treatments reduced overall parent rated ADHD symptoms from pre-training to post-training but NF produced greater reductions (change in FBB-HKS mean total score: −0.39 with NF vs −0.14 with AST; Cohen's d effect size 0.60; p<0.005). A similar pattern of results was observed for the inattention and hyperactivity/impulsivity symptoms (inattention: −0.31 with NF vs −0.19 with AST, effect size 0.57; p<0.005; hyperactivity/impulsivity: −0.31 with NF vs −0.12 with AST, effect size 0.45, p<0.05). Compared with AST, NF also improved teacher rated total ADHD symptoms (effect size 0.64; p<0.01) and inattention symptoms (effect size 0.50; p<0.05) but not hyperactivity/impulsivity symptoms (effect size 0.40, p<0.1). NF increased the proportion of participants responding compared with AST (51.7% with NF vs 28.6% with AST; OR 2.68, 95% CI 1.1 to 6.5; p<0.05).

**Conclusions**

Combined neurofeedback (theta/beta training and slow cortical potential) training produces greater improvements in ADHD symptoms than attention skills training.

**Notes**

The study used one sided p tests as the hypothesis was that NF would improve outcomes compared with AST. The study set a level of p<0.05 for significance.

**Abstracted from**


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Gevensleben and colleagues describe a multisite randomised controlled trial comparing the efficacy of neurofeedback with a computerised attention skills training (AST) in a sample of 102 German children aged between 8 and 12 years of age with a well defined diagnosis of ADHD. The study compares the two treatment conditions in a parallel design. In order to control for non-specific effects, the two interventions were designed to be as similar as possible with equal task demands, session length, number and timing of sessions. Two types of neurofeedback were used: training of slow cortical potential and theta/beta training. Each child in the neurofeedback group received both types of training given sequentially with the presentation order counterbalanced.

The key findings were that children in the neurofeedback group made significantly greater improvements in parent and teacher ratings of ADHD symptoms (effect sizes were in the medium range; parents 0.60, teachers 0.64) and oppositionality (effect size 0.38) compared with the AST group. Interestingly, many parents were unsure which treatment group their children had been in and parental attitude did not differ between the two treatments. Comparable effects were found for the two neurofeedback conditions.

This well conducted, well powered and well reported study has the potential to become a pivotal study in the field of non-pharmacological treatment of ADHD. It is superior in design to previous neurofeedback studies, and the use of a comparator that controlled for the training demands and parental expectation makes the results more compelling. It will be important to see the results of the long term follow-up data from this trial to see whether improvements persist over time. While it is probably still too early for neurofeedback to be routinely integrated into everyday practice, it is important that independent research groups conduct similar studies to provide both replication and extension of these important findings. For their part, clinicians should start to develop an understanding of neurofeedback techniques and take note that, although they may not be quite as powerful as stimulant medications, they may have the potential to become a mainstream treatment for ADHD in the not too distant future.

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**Competing interests:** DC has been paid by several companies that make medications for treating ADHD. Janssen Cilag, UCB, Shire, Pfizer, Medice, Flynn Pharma and Lilly for consultancy, research and speaking at and travel to conferences.