

# Abstracts from the Medical Literature for ADD/ADHD and eeg/biofeedback/neurofeedback

(Some of the abstracts have been shortened and/ or lightly edited by David Dubin, MD to make this medical literature more accessible to the general public. Only 1 published study has shown no improvement. The rest had significant results.)

1) [Appl Psychophysiol Biofeedback](#). 2005 Jun;30 (2):95-114.

**Review: Electroencephalographic biofeedback in the treatment of ADHD.**

[Monastra VJ](#), [Lynn S](#), [Linden M](#), [Lubar JF](#), [Gruzelier J](#), [LaVaque TJ](#).

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[Meta-Analysis, Review](#)

Historically, pharmacological treatments for attention-deficit/hyperactivity disorder (ADHD) have been considered to be the only effective intervention. However, during the past three decades, a series of case and controlled group studies examining the effects of EEG biofeedback have reported improved attention and behavioral control, increased cortical activation on quantitative electroencephalographic examination, and gains on tests of intelligence and academic achievement in response to this type of treatment.

This review paper critically examines the empirical evidence. **Significant clinical improvement was reported in approximately 75% of the patients in each of the published research studies.**

2) [Expert Rev Neurother](#). 2006 Apr;6 (4):533-40.

**Review: Electroencephalographic biofeedback for the treatment of attention-deficit hyperactivity disorder in childhood and adolescence.**

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[Review](#)

**Introduction:** Considerable scientific effort has been directed at developing effective treatments for attention-deficit hyperactivity disorder (ADHD). (EEG) biofeedback has gained promising empirical support in recent years.

**Results/Conclusions:** Short-term effects were shown to be **comparable to those of**

**stimulant medication leading to significant decreases of inattention, hyperactivity and impulsivity.** In addition, EEG biofeedback results in concomitant improvement of neurophysiological patterns. EEG biofeedback may already be used within a multimodal setting, providing affected children and adolescents with a means of learning to counterbalance their ADHD symptoms without side effects.

3) [Appl Psychophysiol Biofeedback](#). 2002 Dec;27 (4):231-49.

**The effects of stimulant therapy and EEG biofeedback on attention-deficit/hyperactivity disorder.**

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**Methodology:** **One hundred children**, ages 6-19, who were diagnosed with attention-deficit/hyperactivity disorder (ADHD), either inattentive or combined types, participated in a study examining the effects of Ritalin, and EEG biofeedback. All of the patients participated in a 1-year program that included Ritalin, parent counseling, and academic support at school. **Fifty-one of the participants also received EEG biofeedback.** Post-treatment assessments were conducted both with and without stimulant therapy.

**Results/Conclusions:** **Significant improvement was noted** on the Test of Variables of Attention TOVA and the Attention Deficit Disorders Evaluation Scale when participants were tested while using Ritalin. **However, only those who had received EEG biofeedback sustained these gains when tested without Ritalin.**

**EEG biofeedback training, if applied comprehensively, can be highly effective.**

4) [Biofeedback Self Regul](#). 1995 Mar. 20 (1):83-99.

**Evaluation of EEG neurofeedback training for ADHD in a clinical setting.**

[Lubar JF](#), [Swartwood MO](#), [Swartwood JN](#), [O'Donnell PH](#).

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[Randomized Controlled Trial](#)

A study with component parts was performed to assess the effectiveness of neurofeedback treatment for Attention Deficit/Hyperactivity Disorder (ADHD).

**Methodology:** The subject pool consisted of **23 children** and adolescents ranging in age from 8 to 19 years participated in a 2- to 3-month summer program of intensive neurofeedback training.

### **Results/Conclusions:**

Part I indicated that subjects who successfully decreased theta activity showed significant improvement in T.O.V.A. performance;

Part II revealed significant improvement in parent ratings following neurofeedback training.

This study is significant in that it examines the effects of neurofeedback training on both objective and subjective measures under relatively controlled conditions. **Our findings corroborate previous research, indicating that neurofeedback training can be an appropriate and effective treatment for children with ADHD.**

5) [Appl Psychophysiol Biofeedback](#). 2003 Mar;28(1):1-12.

**Neurofeedback treatment for attention-deficit/hyperactivity disorder in children: a comparison with methylphenidate.**

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### **Controlled Clinical Trial**

We compared the effects of a 3-month eeg feedback program. Participants were **34 children** aged 8-12 years, 22 of whom were assigned to the neurofeedback group and 12 to the methylphenidate group based on their parents' preference.

**Both neurofeedback and methylphenidate had improvements** on all subscales of the Test of Variables of Attention, and on the speed and accuracy measures of the d2 Attention Endurance Test. Furthermore, behaviors related to the disorder were rated as significantly reduced in both groups by both teachers and parents.

**These findings suggest that neurofeedback was efficient in improving behavioral concomitants of ADHD in children whose parents favored a non-pharmacological treatment.**

6) [Prilozi](#). 2005 Aug;26(1):71-80.

**Neurofeedback treatment of children with attention deficit hyperactivity disorder.**

**Pop-Jordanova N, Markovska-Simoska S, Zorcec T.**

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**Methodology:** The study comprised **12 children** diagnosed as ADHD. The mean age

was 9.5 years (7 to 13). Each of them participated in a five-month program of neurofeedback training, performed two times weekly.

**Results:** Post-treatment results showed an improved EEG pattern expressed in increased 16-20 Hz (beta) activity and decreased 4-8 Hz (theta) activity. In parallel, higher scores on WISC-R, better school notes and improved social adaptability and self-esteem were obtained.

**Conclusions: EEG biofeedback is a good choice for treatment of ADHD children.**

The method is non-invasive and has high cost-benefit. Optimal results are obtained in children of higher age. Cooperation with family members and teachers is crucial.

7) [Biofeedback Self Regul.](#) 1996 Mar;21(1):35-49.

**A controlled study of the effects of EEG biofeedback on cognition and behavior of children with attention deficit disorder and learning disabilities.**

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**Methodology:** Eighteen children with ADD/ADHD, some of whom were also LD, ranging in ages from 5 through 15 were randomly assigned two groups. The experimental group consisted of 40 45-minute sessions of training in enhancing beta activity and suppressing theta activity, spaced over 6 months. The control condition received no EEG biofeedback. All subjects were measured at pretreatment and at post-treatment on an IQ test and parent behavior rating scales for inattention, hyperactivity, and aggressive/defiant (oppositional) behaviors.

**Conclusions:** At post-treatment the eeg biofeedback group demonstrated a significant increase (mean of 9 points) on the K-Bit IQ Composite as compared to the control group ( $p < .05$ ). The experimental group also significantly reduced inattentive behaviors as rated by parents ( $p < .05$ ).

**The significant improvements in intellectual functioning and attentive behaviors might be explained as a result of the attentional enhancement affected by EEG biofeedback training.**

8) [Appl Psychophysiol Biofeedback.](#) 1998 Dec;23(4):243-63.

**Neurofeedback combined with training in metacognitive strategies: effectiveness in students with ADD.**

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A review of records was carried out to examine the results obtained when people with Attention Deficit Disorder (ADD) received 40 sessions of training that combined neurofeedback with the teaching of metacognitive strategies. The results, including pre- and post-measures, are consistent with previously published research demonstrating the efficacy of neurofeedback.

**Methodology:** **The 111 subjects**, 98 children (age 5 to 17) and 13 adults (ages 18 to 63), attended forty 50-min sessions, usually twice a week. Metacognitive strategies related to academic tasks were taught when the feedback indicated the client was focused.

**Results:** Initially, 30 percent of the children were taking stimulant medications (Ritalin), whereas 6 percent were on stimulant medications after 40 sessions. **Significant improvements ( $p < .001$ ) were found in ADD symptoms (inattention, impulsivity, and variability of response times on the TOVA), in both the ACID pattern and the full-scale scores of the Wechsler Intelligence Scales.**

**The average gain for the full-scale IQ equivalent scores was 12 points.**

**Conclusions:** The positive outcomes of decreased ADD symptoms plus improved academic and intellectual functioning suggest that the use of neurofeedback plus training in meta-cognitive strategies is a useful combined intervention for students with ADD.

9) [Biofeedback Self Regul.](#) 1984 Mar;9 (1):1-23.

**Electroencephalographic biofeedback of SMR and beta for treatment of attention deficit disorders in a clinical setting.**

[Lubar JO, Lubar JF](#)

**Methodology:** **Six children** were provided with long-term biofeedback and academic treatment for attention deficit disorders. Their symptoms were primarily specific learning disabilities, and, in some cases, there were varying degrees of hyper-kinesis. The training consisted of two sessions per week for 10 to 27 months, with a gradual phase-out.

**Results/Conclusions:** All six children demonstrated considerable improvement in their schoolwork in terms of grades or achievement test scores. None of the children are currently on any medications for hyperkinetic behavior. **The results indicate that EEG is an appropriate and efficacious treatment for children with ADHD.**

10) [J Huazhong Univ Sci Technolog Med Sci.](#) 2005;25 (3):368-70.

**A controlled study of the effectiveness of EEG biofeedback training on-children with attention deficit hyperactivity disorder.**

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**Sixty children** with attention deficit hyperactivity disorder (ADHD) were studied to evaluate the effectiveness of electroencephalogram (EEG) biofeedback training.

**Results/Conclusions: Of all the 60 children with ADHD aged more than 6 years, the effective rate of EEG biofeedback training was 91.6%** after 40 sessions of EEG biofeedback training. Before and after treatment by EEG biofeedback training, the overall indexes of IVA were significantly improved among predominately inattentive, hyperactive, and combined subtype of children with ADHD ( $P < 0.001$ ). **EEG biofeedback training is an effective and vital treatment on children with ADHD.**