AOTA Evidence Briefs
Attention Deficit/ Hyperactivity Disorder
Structured Abstracts
A product of the American Occupational Therapy Association's Evidence-Based Literature Review Project

Reinforcement combined with medication improves the academic performance of children with Attention Deficit Disorder

CITATION: Pelham, W. E., Milich, R., & Walker, J. L. (1986). Effects of continuous and partial reinforcement and methylphenidate on learning in children with attention deficit disorder. *Journal of Abnormal Psychology, 95,* 319–325.

LEVEL OF EVIDENCE: IA1a

RESEARCH OBJECTIVE/QUESTION
To examine the interaction between psychostimulant medication and schedules of reinforcement

DESIGN

X	RCT		Single case		Case control
	Cohort		Before–after		Cross-sectional

RCT = randomized control trial
Experimental design (factorial design 2 × 3) with 1 in-group factor (drug and placebo); 1 between-group factor (reinforcement: none, continuous, or partial)

SAMPLING PROCEDURE

	Random		Consecutive
X	Controlled		Convenience

SAMPLE

N = 30	M age = 8.6 years	Male = 24	Ethnicity = NR	Female = 6

NR = Not reported
Children ranged in age from 5 years, 11 months to 11 years, 0 months.

PARTICIPANT CHARACTERISTICS
Inclusion criteria:
- DSM-III criteria
- 25 children met criteria for ADD with hyperactivity
- 4 children met criteria for ADD without hyperactivity
- 1 child fell just short of meeting the criteria for ADD without hyperactivity

MEDICAL DIAGNOSIS/CLINICAL DISORDER
ADD with and without hyperactivity

OT TREATMENT DIAGNOSIS
N/A

OUTCOMES

Measures	Reliability	Validity
Academic learning (spelling task)	NR	NR
Wechsler Intelligence Scale for Children–Revised	Y	Y
(WISC–R IQ)	Y	Y
Abbreviated Conners Rating Scale (Parent, Teacher)		
Iowa Conners Teacher Rating Scale (Inattention/Overactivity, Aggression)	Y	Y
Woodcock–Johnson Achievement Test (Reading, Mathematics, Language)	Y	Y

NR = Not reported

Outcome—OT terminology
Performance components:
- Cognitive Integration and components
- Psychosocial skills and psychological components

Outcome—ICIDH-2 terminology
Impairments

INTERVENTION
- Methylphenidate condition (no reinforcement, partial reinforcement, and continuous reinforcement)
- Placebo condition (no reinforcement, partial reinforcement, and continuous reinforcement)

Description
- Reinforcement conditions: The reinforcement used consisted of points that could be cashed in at a later time for desired objects at the program “store.”
- Continuous reinforcement: Children received points each time they spelled a word correctly (up to 2,000).
- Partial reinforcement (same as above, but up to 1,000 points).

- No reinforcement: verbal praise + 200 points available for following the rules.
- Medication: 0.3 mg/Kg methylphenidate or an identical placebo 3 times a day (order of medication counterbalanced with reinforcement conditions).

Who delivered
Not reported

Setting
Summer camp

Frequency
All children tested at 3:34 pm on 2 successive days

Follow-up
Not reported

RESULTS

- In analysis of variance, significant main effect for drug condition [F (1, 24) = 9.1, p < .01], a trend for a main effect for drug condition [F (2, 24) = 2.25, p < .106 and no significant interaction between drug and reinforcement [F < 1].
- Children made 17% fewer errors in the active medication condition compared to placebo.
- Orthogonal contrasts revealed no significant difference between the continuous and partial conditions, [F < 1], but the 2 rewarded groups combined made significantly fewer errors than did the non-reinforcement group, [t (27) = 2.2, p < .05]. Reinforcement led to a 32% decrease in errors made on the spelling task.
- For incremental effect, combined reward/methylphenidate group made fewer errors than did either the drug alone/nonreward condition or the placebo/reward condition.
- The significant drug X order interaction reflected on the following pattern: Children who received placebo on the 2nd day did not differ significantly from their performance on the methylphenidate (1st day).

CONCLUSIONS
- No support exists for the hypothesis that children with ADD are especially sensitive to and their performance is adversely affected by partial reinforcement schedules.
- Both reward conditions dramatically and equally improved performance relative to no reinforcement. The 32% improvement effected by the point system suggests that it was both highly salient and motivating to the children.
- Results provide information regarding the effects of reinforcement and psychostimulant medication on the academic performance of children with ADD.
- Reward can have dramatic effects on children with ADD’s performance on an academic-like learning task.

LIMITATIONS

Biases

X	Attention		Masking/blinding	X	Drop outs
	Contamination		Co-intervention		

- Terminology used in this document is based on two systems of classification current at the time the evidence-based literature reviews were completed: *Uniform Terminology for Occupational Therapy Practice—Third Edition* (AOTA, 1994) and *International Classification of Functioning, Disability and Health (ICIDH-2)* (World Health Organization [WHO], 1999). More recently, the *Uniform Terminology* document was replaced by *Occupational Therapy Practice Framework: Domain and Process* (AOTA, 2002), and modifications to *ICIDH-2* were finalized in the *International Classification of Functioning, Disability and Health* (WHO, 2001).

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For more information about the Evidence-Based Literature Review Project, contact the Practice Department at the American Occupational Therapy Association, 301-652-6611, x 2040.

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