

Physical Exercise as a Reinforcer to Promote Calmness of an ADHD Child

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Age-appropriate reinforcers have been found to be effective in promoting attentiveness and calmness with children with attention deficit hyperactivity disorder (ADHD). The present study with a 4-year-old ADHD boy found attentive calmness was substantially increased from a mean of about 3 seconds per trial to the maximum scheduled duration of 60 seconds by using a scheduled period of physical activity as the reinforcer for the attentive-calmness. These results suggest the possible use of this type of reinforcer as an addition or substitution for the usual reinforcers in contingency management with ADHD children.

Keywords: *ADHD; hyperactivity; contingent activity; reinforcement; treatment*

Contingency management has been found to be an effective treatment of hyperactive children (Barkley, Guevremont, & Anastopoulos, 1992; Reitman, Hupp, O'Callaghan, Gulley, & Northup, 2001). The reinforcement procedure used is typically the token economy method initially developed by Ayllon and Azrin (1965, 1968) and used initially with children with attention deficit hyperactivity disorder (ADHD) by Ayllon, Layman, and Kandel (1975). The types of reinforcers included in the token or point system have been the same as those used for other problems and include a wide range of reinforcers including edibles, toys, candy, lunch in the teacher's room, and school supplies (Ayllon et al., 1975; O'Leary, Pelham, Rosenbaum, & Price,

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1976; Reitman et al., 2001). One general guideline for identifying a reinforcer is the Premack Principle (Premack, 1962), which states that high-frequency behavior will serve as a reinforcer for low-frequency behavior. This principle was used in the original token economy of Ayllon and Azrin (1965, 1968) and suggests that for hyperactive children the opportunity for vigorous scheduled activity paradoxically might be effective as a reinforcer for calmness. Such a finding would provide an additional reinforcer or a substitute for the usual reinforcers and would possibly increase the effectiveness of treatment.

The present study systematically evaluates a young hyperactive boy to determine whether scheduled vigorous activity could serve as a reinforcer for calmness and to provide control measures evaluating whether any increase of calmness might be attributable to the effect of the exercise (even if noncontingent) or to the effect of the descriptive praise that normally accompanies reinforcement or whether the contingent aspect was necessary.

METHOD

PARTICIPANTS

The participant was a 4-year-old boy diagnosed as ADHD comorbid with autism. He was enrolled in a day school for autistic children attending a small class of eight pupils seated in a circle with one senior teacher. Two assistants were assigned fairly exclusively to manage the participant's constant restlessness. At the direction of the parent, the child received no medication for the ADHD symptoms. His classroom instructors described him as disruptive and said that he never stops moving. Records indicated that this condition also existed at home for most of the boy's life.

RECORDING

A baseline recording was taken of the child's attentive sitting during his normal 17-minute classroom circle-time setting. A response was defined as nonattentive if he jumped out of his seat or positioned

his head and body substantially away from the teacher to engage in a non-task-relevant behavior. The 17-minute period was divided into 1-minute intervals. Two dependent observers recorded whether or not an inattentive response occurred in each of the intervals.

PROCEDURE

In the procedure phase of the study, the child was observed in a separate room. Each procedure was implemented by a graduate student and was observed by a second graduate student who provided independent measures of attentive calmness as defined above. The child was seated in a chair facing the study assistant who provided the instructions and protocol. Each of the five conditions listed below were given on a separate day, 1 to 5 days apart. The intended reinforcer was a 1-minute opportunity to play in the adjacent outside playground containing typical gymnastic equipment (slides, ladders, swings, rotary wheels, climbing structures, etc.). Upon entering the play area, the child immediately and continuously engaged in vigorous activity with this equipment with no prompting.

Shaping. This procedure attempted to shape the child into sitting calmly and attentively, looking at the study assistant. The initial criterion response for reinforcement was set at approximately 1 second and increased by approximately 50% after each duration was achieved and therefore reinforced 1 or often 2 trials in succession. The successive durations were approximately 1, 2, 3, 5, 8, 12, 18, 27, 42, and 60 seconds. Descriptive praise (e.g., "You're sitting so still, you're looking right at me, you're hands and arms are so relaxed.") was given continuously. At the end of the scheduled duration, the assistant informed the child, "You can go out and play now since you have been relaxed and attentive," and gave him access to the playground area. The assistant did not interact with the child during the play to avoid the confounding of social attention.

Descriptive praise. In the second procedure, the child was given only the descriptive praise as described above. No opportunity to use the playground was given. When the child left the chair, he was

reminded to sit and guided back to the chair, whereupon the next trial would begin for recording purposes.

Noncontingent reinforcement. In this procedure, the child was given the playground activity every 60 seconds independent of his calmness or lack thereof. No descriptive praise was given. Again, no social interaction occurred during the playground exercise.

Reconditioning. In this procedure, the reinforcement was given throughout the session at the same duration achieved (60 seconds) at the first reinforcement session. The boy was given the playground activity for 60 seconds upon achieving 60 seconds of attentive sitting without the shaping supplied previously. Descriptive praise was again included.

Baseline. In this procedure, the child was seated in the chair by the study assistant. However, no intervention, no contingent or non-contingent playground activity, and no descriptive praise for being calm was given. For recording purposes, when the child arose from the seat, he was returned to it, and the next trial would begin.

RESULTS

The classroom recordings showed the child to be inattentive for 100% (17 of 17) of the 1-minute observation intervals. The child would arise almost instantaneously after being seated and would engage in gross movements of his arms, legs, and body as reported previously by his teachers. This would require the assistant teacher to be assigned exclusively to restrain and return him to his seat. Recording reliability was 100% between the two observers.

Figure 1 shows the mean number of seconds per trial that the boy remained calm and attentively seated during each of the five procedures. In the shaping reinforcement procedure given first, it can be seen that the child attained the maximum possible duration of 60 seconds of attentiveness in the latter part of the session, which lasted for approximately 50 minutes. Figure 1 also shows that the use of descrip-

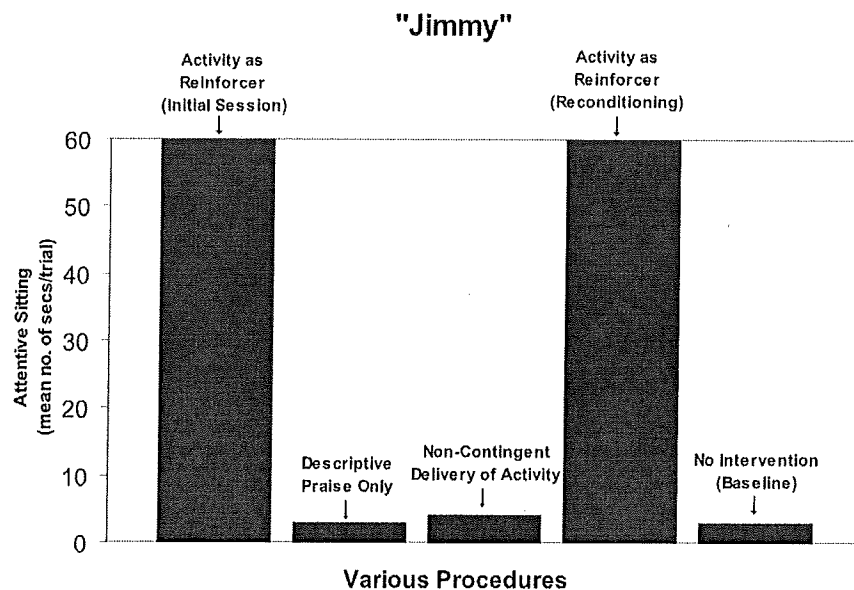


Figure 1. Mean number of seconds per trial.

NOTE: Figure 1 shows the mean number of seconds per trial that a child with attention deficit hyperactivity disorder (ADHD) showed while attentively sitting during conditions of no-intervention baseline, descriptive praise only, noncontingent availability of activity, reinforcement by that activity, or reconditioning by reinstated reinforcement by the activity. The data for the initial reinforcement session are only for the last 2 trials of that shaping session. The data for the reconditioning reinforcement trial are for the last 14 of the 17 trials in that session.

tive praise (the second procedure) or noncontingent reinforcement (the third procedure) produced an average of about 3 to 5 seconds of calmness. The contingent reinforcement reconditioning (the fourth procedure) resulted in a return to the maximum scheduled duration of 60 seconds of calmness. The last procedure of no intervention (baseline) also resulted in brief calmness for approximately 3 seconds.

Qualitatively, the boy's overall manner appeared greatly improved during the reinforcement condition. Several teachers and school personnel who incidentally observed him at that time commented that his face, gaze, mouth, and body were notably relaxed and normative.

DISCUSSION

Descriptively, the present results indicate that engaging in vigorous physical activity was a reinforcer for this ADHD child. Other features

of the reinforcement process, such as the concurrent praise or even possibly the noncontingent exercise that plausibly could have been expected to produce calmness by discharging a physical need for exercise, might very well have accounted for the increase in reinforced behavior. Neither of these procedures, when used alone, was effective in increasing the response to the level attained by the contingent exercise. Paradoxically, the structured opportunity to engage in the major symptom of the disorder, vigorous activity, served as a reinforcer to increase the absence of that same symptom.

A direct implication of the results is the possible utility of using the scheduled availability of exercise as a reinforcer for ADHD children. Such an application could be therapeutically beneficial as an addition to or substitute for the usual reinforcers used in contingency management with ADHD children.

The possible limitations of this study are numerous (one participant, comorbidity with autism, nonclassroom application, unusual setting, follow-up, generality, etc.). Notwithstanding these possible limitations, the present results do suggest a method for increasing the effectiveness of contingency management treatment for hyperactive children.

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