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SEQUENTIAL EVALUATION OF BEHAVIORAL TREATMENTS AND METHYLPHENIDATE DOSAGE FOR CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER

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We used a sequential approach to evaluate the relative and combined effects of different types of behavioral treatments, as well as dosage of methylphenidate (MPH), on the disruptive behavior of 3 students who had been diagnosed with attention deficit hyperactivity disorder. Results showed that individualized behavioral treatments produced decreases in disruptive behavior equivalent to MPH for all 3 participants and demonstrated the need to evaluate behavioral treatments and medication dosage on an individual basis.

DESCRIPTORS: attention deficit hyperactivity disorder, behavioral pharmacology, behavioral treatment, methylphenidate

The relative and combined effectiveness of stimulant medication and behavioral treatment for the management of behaviors associated with attention deficit hyperactivity disorder (ADHD) has been an enduring social concern (Safer, 2000). The need to identify an optimal dosage of medication on an individual basis is common practice. For example, the recent National Institute of Mental Health Multimodal Treatment Study (MTA Cooperative Group, 1999) conducted systematic monitoring of medication responses by children who had been diagnosed with ADHD through the use of algorithm-guided trials to assess types and dosages of medications on an individual basis. Although the need to identify optimal behavioral treatments on an individual basis has been increasingly recognized in recent years (e.g., DuPaul, Eckert, & McGoey, 1997), systematic methods similar to those used for medication monitoring are rarely used to guide changes to behavioral treatments for children with ADHD. In this study we evaluated the utility of a sequential evaluation method to determine each participant's response to different reinforcement-based behavioral treatments and methylphenidate (MPH).

METHOD

Participants

Participants were 3 students attending a summer research program who had been previously diagnosed with ADHD, prescribed stimulant medication, and were of at least average intellectual functioning based on a prior psychoeducational assessment. Max was a 4-year-old boy, Betty was a 7-year-old girl, and Sally was a 6-year-old girl.

Response Definitions and Measurement

Out-of-seat behavior, inappropriate vocalizations, and playing with objects, as defined by Barkley (1990), were target behaviors for all participants. Aggression, destruction of materials, and throwing objects were additional target behaviors for Max. After re-

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viewing initial results, these behaviors were combined and are subsequently referred to as disruptive behavior.

During classroom observations, all target behaviors were recorded using a 10-s partial-interval recording procedure. All observations lasted 5 min. Participants worked independently on math worksheets or block-stacking activities. Two independent observers simultaneously but independently collected data, and were approximately equally dispersed across all phases of the study. Interobserver agreement was calculated by dividing agreements by the sum of agreements and disagreements for each interval for occurrence and nonoccurrence and multiplying by 100%. Overall, agreement data ranged from 73% to 100% (M = 97%) and were collected for a minimum of 25% of sessions for each treatment condition.

General Procedure

Behavioral treatments. Differential reinforcement of alternative behavior (DRA), DRA plus response cost, and DRA plus time-out were evaluated as behavioral treatments. These three treatments were selected based on their empirical support in the literature and inclusion in the MTA study. Treatments were evaluated, if indicated, in the sequence of DRA alone, DRA plus response cost, and DRA plus time-out. Prior to the treatment analyses, preferred stimuli were determined by a paired-choice preference assessment questionnaire (Northup, George, Jones, Broussard, & Vollmer, 1996). Edible items were identified as most preferred for Max, activities and edible items were most preferred by Sally, and edible items and tangible items were most preferred by Betty. These stimuli were either provided directly to the child (Max) or were available through representative tokens (Betty and Sally).

During DRA, a choice of rewards was provided contingent on appropriate behavior for a specified period of time, which was determined individually for each participant based on baseline levels of target behaviors. Response cost consisted of a loss of 1 min of free time (recess) for each occurrence of disruptive behavior (recess was held in the afternoon, no later than approximately 2 hr after sessions were completed). Time-out consisted of a 30-s nonexclusionary procedure in which the child's chair was turned away from his or her desk, work, and other students.

Medication treatments. Max was initially prescribed 10 mg of MPH (0.6 mg/kg), Betty was prescribed 10 mg of MPH (0.5 mg/kg), and Sally was prescribed 15 mg of MPH (0.6 mg/kg). Medication dosage remained unchanged or was increased based on assessment results, as described below.

Sequential Evaluation

Treatment conditions were implemented in sequential phases, with each phase consisting of either an increase in MPH dosage, a change in behavioral treatment, or both. Initially, the child's currently prescribed dosage of medication, DRA alone, and a combination of medication and DRA alone were evaluated. Two observations were conducted daily in a counterbalanced order; one with a behavioral treatment and one without. A placebo condition was alternated daily with MPH. Parents administered all medication disguised in a serving of food (e.g., chocolate pudding, peanut butter), but provided the same serving of food each morning regardless of whether medication was administered. These procedures provided a practical and economical placebo condition that effectively controls for appearance, taste, and texture. Assessment sessions continued during subsequent phases for either the current or other dosages of MPH or other behavioral treatments based on prior results. Treatment changes were based on the consensus of the parents, the program director (second au-

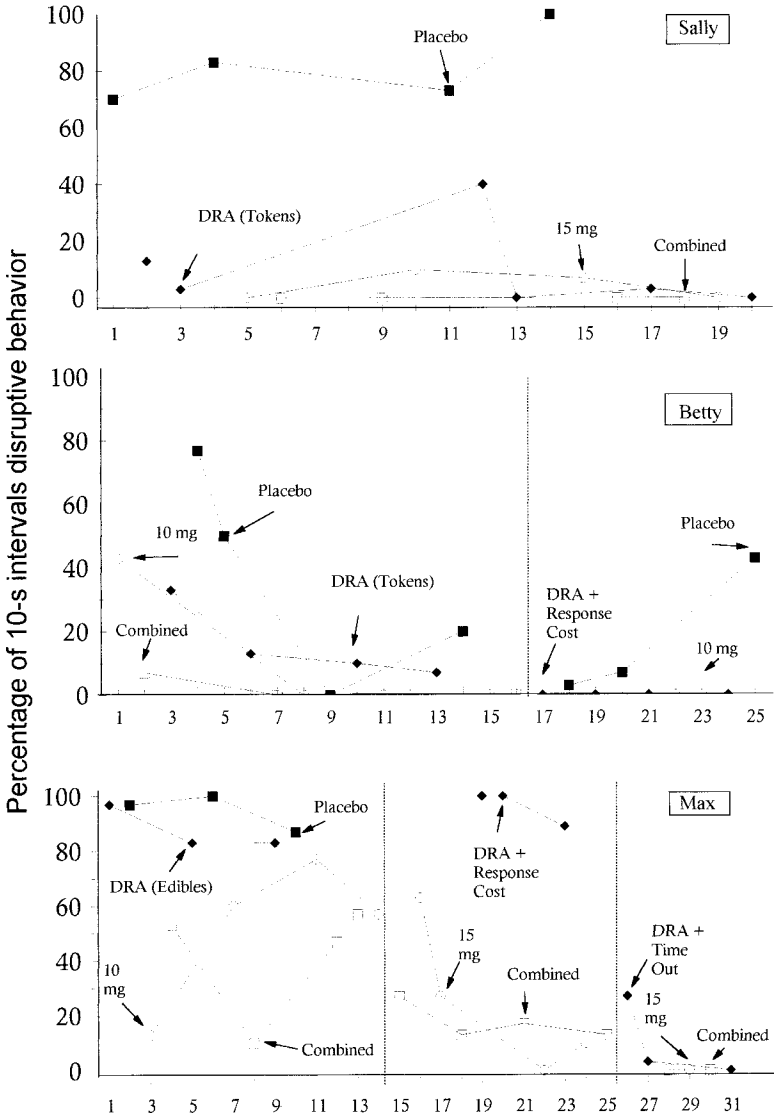

Figure 1. The percentage of intervals with disruptive classroom behavior for Sally, Betty, and Max under placebo and when MPH and behavioral treatments were implemented alone or in combination.

thor), and the consulting psychiatrist. Experimenters, staff, and participants were blind to the participant's medication status. A double-blind, placebo-controlled, multielement design was used.

RESULTS AND DISCUSSION

Results for Sally (Figure 1) show that DRA alone (tokens), MPH alone (i.e., 15 mg), and a combination of behavioral and medication interventions reduced disruptive behavior to low levels. For Betty (Figure 1), results indicated that her prescribed MPH dosage (i.e., 10 mg) and DRA plus response cost reduced disruptive behavior to zero, whereas DRA alone (tokens) was somewhat less effective. For Max (Figure 1), 15 mg of MPH appeared to be more effective than 10 mg, and DRA plus time-out appeared to be more effective than DRA alone (edible items) or DRA plus response cost. Although

initial results were high and stable for placebo, it is a limitation of the study that this condition was not extended for Max.

Overall, results show that either the initial or a subsequent dose of MPH and one of the three behavioral treatments were effective for decreasing disruptive behavior for all 3 participants. The sequential evaluation indicated that a change in the dosage of medication was necessary for 1 child and that a change in the behavioral treatments was necessary for 2 of the 3 children. Results illustrate the need to evaluate systematically different types of behavioral treatments, as well as medication dosage, to develop effective treatments for individual children. The current procedures appeared to provide a practical and relatively efficient method to evaluate the separate, relative, and combined effects of varying dosages of stimulant medication and different types of behavioral treatments simultaneously. Such evaluations may be useful for both clinical applications and future research.

REFERENCES

Barkley, R. (1990). *Attention deficit hyperactivity disorder.* New York: Guilford.

DuPaul, G., Eckert, T., & McGoey, K. (1997). Interventions for students with attention deficit hyperactivity disorder: One size does not fit all. *School Psychology Review, 26,* 369–381.

MTA Cooperative Group. (1999). A 14-month randomized clinical trial of treatment strategies for attention deficit hyperactivity disorder. *Archives of General Psychiatry, 56,* 1073–1086.

Northup, J., George, T., Jones, K., Broussard, C., & Vollmer, T. (1996). A comparison of reinforcer assessment methods: The utility of verbal and pictorial choice procedures. *Journal of Applied Behavior Analysis, 29,* 201–212.

Safer, D. (2000). Are stimulants overprescribed for youths with ADHD? *Annals of Clinical Psychiatry, 12,* 55–62.

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