AN EVALUATION OF STIMULANT MEDICATION ON THE REINFORCING EFFECTS OF PLAY

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Although a vast literature has indicated that stimulant medications are effective for reducing inappropriate behavior in children with attention deficit hyperactivity disorder (ADHD), the effects of stimulant medication on ancillary behaviors (e.g., play) have yet to be investigated with the same rigor. We used a reinforcer assessment procedure to evaluate the effects of medication on the play and social behavior of 5 preschool children who had been diagnosed with ADHD. Conditions included (a) social reinforcement (i.e., playing with friends), (b) alone play, and (c) quiet time (i.e., resting). Results indicated that 1 of the 5 participants selected fewer social reinforcers and more nonsocial reinforcers (alone play or quiet time) while on medication. The findings indicate that the reinforcer assessment procedure may be a viable way to evaluate medication effects on an ongoing basis and to inform treatment decisions.

DESCRIPTORS: attention deficit hyperactivity disorder, behavioral pharmacology, reinforcer assessment, stimulant medication

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Attention deficit hyperactivity disorder (ADHD) is among the most commonly diagnosed childhood behavior disorders during the elementary school years. Current estimates indicate that ADHD affects approximately 2% to 18% of school-aged children (Rowland, Lesesne, & Abramowitz, 2002). Approximately 90% of children with a diagnosis of ADHD are treated with stimulant medication (e.g., methylphenidate, amphetamine) at some point in their lives (Pelham, 1993). Although there has been a considerable amount of literature documenting the effects of stimulant medication on the core symptoms of ADHD (Neef et al., 2005), the efficacy of these drugs for the treatment of ancillary features of ADHD is not as clear. Specifically, stimulant medication has not been shown to be effective for improving social interaction in children with ADHD. In fact, social play rarely is measured in the context of medication evaluations, and few objective methods for monitoring these effects have been described.

The purpose of the current investigation was to evaluate a clinic-based assessment for determining the reinforcing value of social play for preschool children with a diagnosis of ADHD and to determine if the procedures could be useful for the further evaluation of medication effects on these behaviors. The procedures are a modification of the concurrent-operants reinforcer assessments described by Northup, George, Jones, and Broussard (1996) that were used to evaluate stimulant medication as a potential establishing operation. The current investigation extends these procedures to the assessment of social behavior and play.

METHOD

Participants and Setting

Five children between the ages of 4 and 6 years participated in the current investigation.

All participants were enrolled in the Summer Treatment and Research (STAR) Program at Louisiana State University. Enrollment in the program required a prior diagnosis of ADHD based on the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2000).

Procedure, Response Measurement, and Interobserver Agreement

Criterion establishment (CE). During this establishment phase, children were presented with an arbitrary task (i.e., placing blocks in a bucket) similar to the general procedures described by Northup, Fusilier, Swanson, Roane, and Borrero (1997). The experimenter instructed the participants to place as many or few blocks in the bucket as they would like. Enough blocks were available to ensure that students never ran out during the assessment. The participants were allowed to place only one block in the bucket at a time and were prompted to count aloud during the task. CE conditions were conducted until blocks were no longer placed in the bucket for three consecutive sessions, which allowed experimenters to ensure that placing blocks in a bucket would not persist in the absence of programmed consequences. The mean number of blocks placed in the bucket during the CE condition was used as the criterion level to earn token coupons in the reinforcer assessment. Children were not taking medication during CE observations.

Reinforcer assessment. During the reinforcer assessment, the participants had to place the criterion number of blocks in the bucket to earn one of three coupons for a preferred item. These coupons included an "alone play" coupon, a "play with friends" coupon and a "quiet time" coupon. The coupons were colored laminated cards (10 cm by 10 cm) with pictures of children engaging in various activities representative of each coupon (i.e., pictures of children playing with toys alone, playing with other children, or sitting alone with no toys). The

children had the opportunity to earn as few or as many coupons as they would like within a 5-min period. Each alone play coupon could be exchanged for the opportunity to play with a number of toys in a room alone for 2 min. Each play with friends coupon could be exchanged for the opportunity to play with a friend in a room for 2 min (the same toys were available to the student as in the alone play condition). Each quiet time coupon could be exchanged for the opportunity to sit in a chair quietly or rest quietly on a couch for 2 min. Neither toys nor peers were available to the participant in this condition. Immediately following each session, children could redeem their coupons by handing the cards to the experimenter. The number of blocks placed in the bucket and the type of coupon selected were recorded.

Interobserver agreement for the number of blocks was collected for 34% of sessions (25% of CE sessions and 37% of reinforcer assessment sessions) by having a second observer count the number of blocks placed in the bucket by each student and by comparing the result with the primary data collector's record. Agreement was calculated by dividing the smaller total by the larger total and multiplying by 100%. Agreement for type of coupon selected was calculated for 37% of assessment sessions. Agreement was calculated by having a second observer mark both the type of coupon and the order in which the child selected it and by comparing the result with the primary data collector's record on a point-by-point basis (number of agreements divided by total possible agreements multiplied by 100%). Interobserver agreement was 100% for both measures for all sessions.

Medication Status

Participants received one of three stimulant medications that had been prescribed to address deficits related to inattentiveness and impulsivity. A consulting child psychiatrist prescribed an alternating course of placebo and one dose of stimulant medication for each participant. There

were two or three possible dose conditions for each participant (one or two medication dose levels and a placebo dose) during the experiment. The director of the summer program contacted the parents daily to confirm that the assigned doses had been given at the appropriate time. Assessments were conducted approximately 1.5 to 2 hr following administration of the assigned medication dose to ensure that testing occurred at the time of peak medication effects. Eric received 20 mg (0.8 mg/kg) of amphetamine mixed salts (Adderall). Brad received 20 mg (0.8 mg/kg) of *d*-amphetamine (Dexedrine). Jack received 36 mg (1.6 mg/kg) of methylphenidate (Concerta). Randy received 54 mg (2.4 mg/kg) of methylphenidate (Concerta). Rick received 36 mg (1.6 mg/kg) and 54 mg (2.4 mg/kg) of methylphenidate (Concerta); the consulting psychiatrist increased the dose for reasons unrelated to the current assessment. All observers were blind to the medication dose with the exception of the director of the program. Medication status was alternated daily in a multielement single-case design.

RESULTS AND DISCUSSION

The results from the reinforcer assessment for all participants are shown in Figure 1. The procedure was useful for evaluating medication effects in at least 2 of the 5 students. Jack displayed no obvious medication effect and always selected play with friends coupons. Randy and Brad demonstrated a gradual increasing trend in play with friends coupon selection regardless of medication dose and rarely selected quiet time or alone play coupons. Eric displayed a gradual increase in the selection of play with friends coupons while taking stimulant medication. By contrast, he demonstrated a gradual decrease in the selection of play with friends coupons and a corresponding increase in the selection of alone play coupons at the placebo dose. The procedure showed relatively clear medication effects for Rick. Rick selected fewer play with friends coupons during

the 54-mg dose condition compared to placebo and 36-mg dose conditions. Furthermore, he demonstrated a corresponding increase in alone play coupon selection at the 54-mg dose. He selected play with friends coupons at the highest frequency and alone play coupons at the lowest frequency while taking the 36-mg dose.

The findings from the current investigation indicate that stimulant medication altered the reinforcing value of specific types of play for some of the participants. The high dose of stimulant medication (54 mg of methylphenidate) decreased the reinforcing value of social play while it increased the value of alone play for Rick. The opposite effect was observed for Rick at the 36-mg methylphenidate dose and for Eric at the 20-mg amphetamine dose. Social play appeared to increase in value while these participants were taking stimulant medication at these doses.

These results illustrate that stimulants may influence the motivation to engage in particular activities, including social play. Stimulant medication may decrease the value of social activity for some children and with some doses, which may be contraindicated for children who exhibit social deficits prior to medication treatment. However, stimulant medication may increase the value of social play for some children and with some doses. This increase in the value of social activities may have implications for social skills intervention (e.g., increased motivation to interact may make social skills training easier). In addition, the procedure showed variability of medication effects both across and within children. This variability suggests that individualized assessment may be necessary to identify idiosyncratic responses to stimulant medication across children and medication doses.

Medication evaluations frequently are limited to anecdotal report and rating scales. Therefore, the results of the current investigation are important in that they demonstrate a method for more objective evaluation of medication effects. More specifically, the current procedure
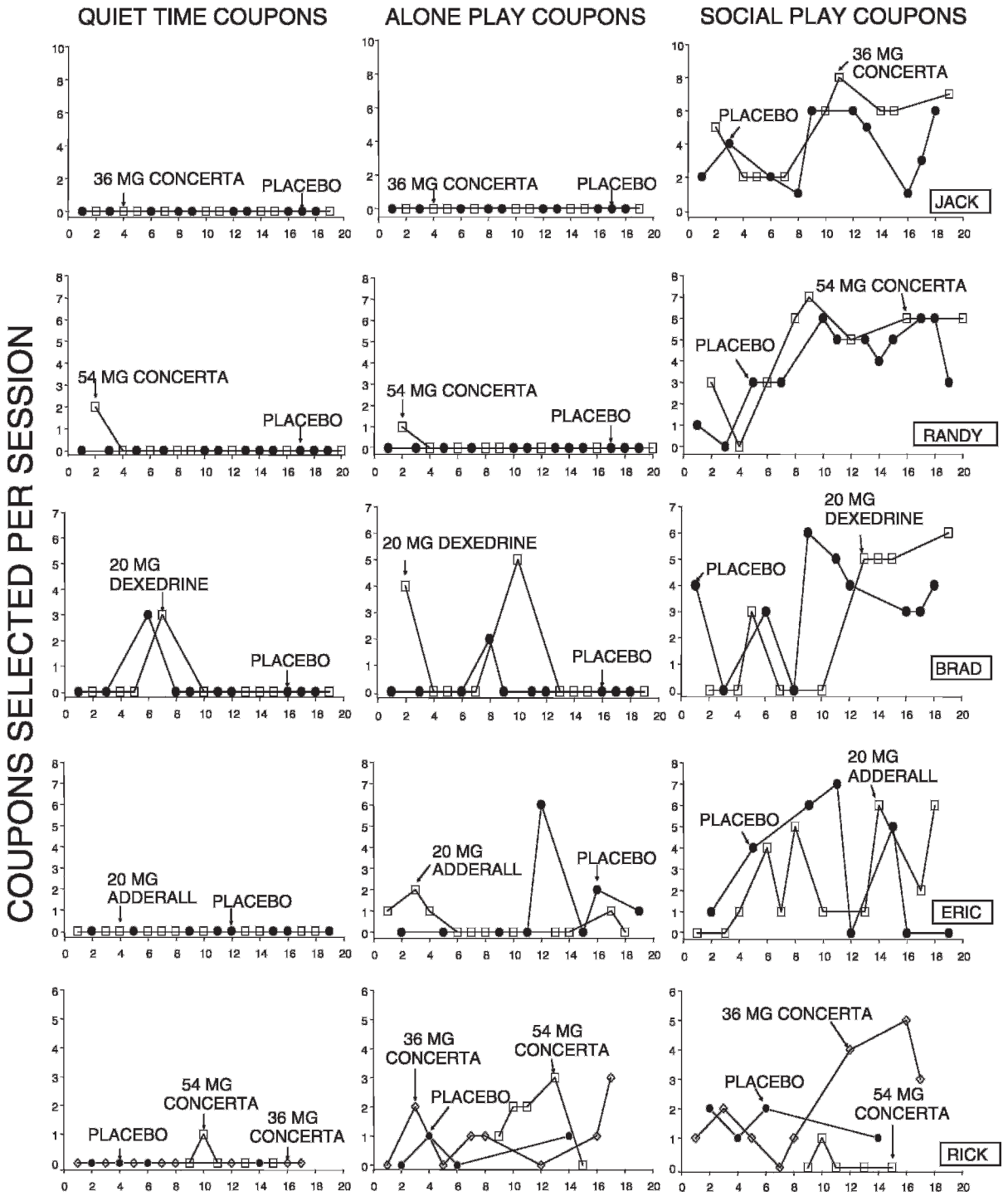
Figure 1.   The number of quiet time (left), alone play (middle), and play with friends (right) coupons selected per session.

represents a unique and relatively efficient way to evaluate the effects of psychotropic medication on preferences among social and nonsocial reinforcers. These procedures could be extended easily to other populations (i.e., autism) or to other classes of psychotropic medications (e.g., antipsychotics, antidepressants).

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