Enhancing Tolerance to a Delayed Reinforce in a Child with Developmental Disabilities: The Comparison between Non-Signaled and Signaled Delayed Reinforcement Procedures

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Abstract

Enhancing tolerance to a delayed reinforce is a significant challenge for young children with developmental disabilities, even for the ones with occasional temper tantrums. Parents, teachers, and mental health professionals seek behavioral management strategies for those children that are effective across settings. This pilot study compared two delayed reinforcement procedures using an alternating treatment design across two settings for teaching a 3-year old child with language delays to wait until a requested reinforce is delivered, without engaging in tangible-maintained problem behavior. Delayed reinforcement was taught by manipulating two conditions: (a) a 50-second time delay with no signal and (b) a 50-second time delay with signals. The result suggested that the 50-second time delay with signals was most effective for increasing tolerance to a delayed reinforce for the participant. Implications for further research are discussed.

Key Words: alternating treatment design, delayed reinforcement, differential reinforcement of alternative behavior (DRA), differential reinforcement of incompatible behavior (DRI), time delay with no signal, time delay with visual signals

1. Introduction

A child's inability to tolerate delays to a preferred reinforce is an important factor that may contribute to a child's temper tantrum. The behavior evokes a wide variety of feelings in caregivers, often making them feel incapable, frustrated, and even angry (Lee, 2015; Lee & Harrington, 2016). Differential reinforcement of alternative behavior (DRA) is widely utilized to increase socially appropriate behavior by teaching a "functionally equivalent" alternative response to reduce problem behavior by the immediate delivery of the reinforce (Austin & Tiger, 2015;Passage, Tincani, & Hantula, 2012; Reichle, Johnson, Monn, & Harris, 2010).

The major drawback of DRA, however, is that caregivers and educational professionals are less likely to maintain the immediate reinforcement in the naturalistic setting due to many environmental constraints (Austin & Tiger, 2015; Reichle, Johnson, Monn, &Harris, 2010). Several studies indicated that delayed reinforcement is a critical factor in the development of maladaptive behavior (Dixon, Rehfeldt, & Randich, 2003; Hagopian, Kuhn, Long, & Rush, 2005; Lee & Harrington, 2016). However, it remains unclear which particular strategy, visual or auditory, for handling reinforcement delays is most effective at increasing tolerance of delayed reinforcement in children with developmental disabilities. Delayer inforcement (or the ability to wait)requires foregoing immediate satisfaction to gain the desired item, which is closely related to differential reinforcement of incompatible behavior (DRI). DRI is utilized to reinforce the child when he or she engages in an identified behavior (e.g., sitting on a chair quietly for the reinforcer) which is positively "incompatible" with problem behavior (e.g., running around the table). Austin and Tiger (2015) mentioned delay fading as a means of teaching tolerance to delay reinforcement after DRA is implemented and found that delays to accessing reinforcement might be enhanced by providing comparable visual stimuli, such as tokens or stickers. Several variations for introducing delays to reinforcement include the use of verbal praise, the use of tokens, and schedule thinning. However, there have been comparatively few experiments with children with developmental disabilities on variables other than the effect of delay fading, prompt delay, and alternating stimuli used in DRI. Few studies have compared different visual and non-visual methods for teaching children to wait until a requested reinforce is delivered without engaging in temper tantrum behavior. This study, therefore, evaluated the child's ability to increase his ability to wait for the reinforce under two prompt conditions that varied the types of delays the child must understand: (a) a 50-second time delay with no signal and (b) a 50-second time delay with visual signals. The authors also examined the effects of two conditions on a preschool-aged child with language delays during his speech therapy in a clinic room and at his home.

2.0 Method

2.1 Participant and Settings

John (a fictitious name), a 48-month-old boy who was diagnosed with language delay, participated. He resided at home with his parents. When he was 38 months old, his pediatrician suspected the child had a language delay, as John had difficulty following the pediatrician's instructions and was selectively mute. In addition, he displayed temper tantrum behavior as a means of primary communication method, which included vocal protest, pinching, and hitting of his parents and other children. His temper tantrum behavior occurred too frequently to be accepted at home or in public, based on the parents' intake interview. The parents also noted that they would like to teach the child how to tolerate delayed reinforcement effectively, but little has been found. Prior to the study, John was assessed by a licensed clinical psychologist according to the criteria set by *the Peabody Picture Vocabulary Test, fourth edition* (PPVT-IV) and scored in the 22-month age equivalent, making his score in language receptive skills more than a year behind his chronological age. His parents reported that the child engaged in temper tantrum behavior when his preferred item (i.e., the reinforce) or activity was not immediately accessible or when a task demand was made by the parent. His parents also mentioned that the child did not tolerate any wait time before he got the reinforce.

The baseline and intervention sessions were conducted in an outpatient clinic and in John's bedroom at his parents' home. A video camera on a tripod was used to record the child and the researchers during all sessions. The child had a regularly scheduled speech therapy program in a clinic, which lasted about 30 minutes and occurred two times per week. During that time, the speech therapist sat in a chair and taught a few words (i.e., "please," "more," "may I?") to John with the researchers and had 5 trials before they ran the baseline sessions. He also had the John's speech therapy program at home, which last about 25 minutes and occurred two times per week. The child was expected to sit quietly, look at the speech therapist or vocabulary cards, listen, and answer simple questions to promote his speech. Prior to the baseline session, a paired-stimulus preference assessment (Fisher et al., 2000) was conducted to identify a hierarchy of preferred reinforcement items across all settings. First, seven different items identified by the primary caregiver (based on the result of the intake interview) were placed on the table. All items were tangible. The items were placed within the participant's view but out of reach. Next, one researcher randomly picked two items, placed them close to the participant, and said, "Pick one." The chosen item was handed to the participant, who was allowed to play with it for 30 seconds. The item was then returned with the other items on the table and the researcher again randomly picked up two items, excluding the first two items, and asked the participant to pick one.

Over the course of the assessment, each item was presented six times in different pairings. The researcher recorded the number of times each item was picked and calculated its selection percentage. The item with the highest selection percentage was used as the reinforce during the three delayed-gratification conditions. Based on the results, the participant's most-preferred item was an iP ad (See Table 1).

2.2 Response Measurement and Inter observer Agreement

Data were collected on John's tolerance to the delayed reinforce. The operational definitions for his tolerance to the delayed reinforce (i.e., DRI) included the following: sitting on a chair without vocal protest (i.e., any vocal statement indicating he would not follow a demand) or hitting (e.g., forceful contact of the participant's hand to the speech therapist from 6 inches or more) and putting a sticker on a whiteboard while sitting on a chair. All observation sessions were conducted in an outpatient clinic and at home. The two trained observers viewed the videotaped clinic sessions and used laptop computers to score John's tolerance to delayed reinforce. Both incompatible behaviors were scored using 10-second partial interval recording. Each session was divided into consecutive 10-second intervals, and the observers recorded the number of responses during each interval. The second observer scored the target responses simultaneously but independently collected data during 90% of the sessions in all phases to assess inter observer agreement. An exact agreement was reached when the observers recorded the John's number of responses in the interval (i.e., both observers scored the presence or absence of various forms of target behavior for the interval). Agreement percentages were calculated by dividing the number of intervals with exact agreement by the total number of intervals in each session. Mean agreement for the dependent variable was 95% (range, 83.3% to 100%).

3.0 Procedure

3.1 Research Design

An alternating-treatments study design was used to make a comparison of the two time delayed reinforcement procedures feasible. The two time-delayed conditions were sequentially introduced and counterbalanced to avoid sequential effects. The design was also used to determine which condition was most effective. A multiple-baseline-across-settings study design was also implemented in order to evaluate the effects of the interventions on teaching delayed reinforcement in two different settings (i.e., in the clinic and at the participant's home).

3.2 Functional Analysis (FA)

The procedure for this phase has been established by Iwata et al. (1982/1994). Four conditions (i.e., tangible, demand, attention, and play) were manipulated for the sessions, and the researcher investigated each during a 5-minute session. Each condition was conducted a minimum of four separate times to ensure the stability of the data. The results of the functional analysis suggested that the problem behavior was maintained by tangible item. Sessions across contexts were randomized and counterbalanced.

3.3 Baseline

All sessions occurred with the speech therapist. John was asked to wait and the two observers recorded how long the child sat on a chair without any problem behavior. Each condition was conducted a minimum of four separate times to ensure the stability of the data. The results of the baseline suggested that measurement of delay tolerance for a reinforce was presented in 5 percent of intervals (see Figure 1).

4.0 The Two Delayed Reinforcement Conditions

The delayed reinforcement phase consisted of manipulating two conditions.

4.1 50-second time delay with no signal

The researcher placed John's iPad (i.e., the reinforce), within view but out of reach. After he verbally requested the item (e.g., "Please."), the researcher gently ignored him by avoiding eye contact. If the child exhibited problem behavior during the 50-second wait time, extinction was placed. He was told to wait, but the session was terminated if the participant's problem behavior worsened. When Johnverbally requested the reinforce within the 50-second period, the psychologist kept ignoring him. Once the participant successfully tolerated the entire wait time, the researcher stated the release cue to the child, saying "OK," and offered access to the reinforce.

4.2 *50-second time delay with visual signals*

John was asked to wait for 50 seconds, but the psychologist displayed a visual schedule board, ten stickers, a time that counts down were placed in front of him. The child earned a sticker to put on a sticker board for every 5 second interval of wait time (i.e., a DRO (50-second) procedure with the addition of another DRO (5-second) in which stickers were provided contingent on 5-second without problem behavior). A timer was used to count each 5-second. When John earned a total of 10 stickers, the researcher gave the release cue and offered access to the reinforce. When the participant exhibited problem behavior within the 50-second wait time, extinction was applied and the participant was told to wait. The time was reset so that John had to wait 50 seconds. If the participant verbally requested the reinforce rafter he received a sticker, the researcher reminded the participant to wait until the end of 50 seconds.

5.0 Results

Figure 1 displays percentage of John's tantrum behavior during all phases of the study. During the baseline, John engaged in relatively low-levels of tolerance on waiting both in clinic (M = 5.67%) and at home (M = 2.14%) in every 10-second interval. His tolerance on delayed reinforcement was near to zero level when the 50-second time delay with no signal was first introduced at both settings. The behavior was gradually decreased when the 50-second time delay was implemented at home. On the other hand, the 50-second time delay with visual signals were more effective in this study (i.e., near to 100% at home). The result of the study indicated that the visual strategy yielded the highest level of the child's tolerance on delayed reinforcement across settings.

6.0 Discussion

Comparing the use of the DROs during delays with and without visual signals is an important question to be answered that will have far-reaching implications for parents and educators of young children with developmental or language delays. This study adds to the specific body of literature in promoting delay tolerance in children with developmental disabilities and extends it by using the baseline results as the basis for evaluating delays to reinforcement. The study demonstrates appropriate experimental control of the independent variables. Finally, the study potentially adds to the body of literature related to schedule thinning and delay fading in the context of function-based interventions (Hagopian, Boelter, & Jarmolowicz, 2011). Two limitations of the study were issued. The first limitation was that the study was conducted with only one participant, which makes generalization of the finding difficult. This, coupled with the fact only two settings were used in the multiple baseline component of the design, made the multiple baseline components difficult to evaluate. The alternating treatments component of the design showed clear differentiation because the 50-second time delay with visual signals consistently produced higher levels of tolerance on the delayed reinforce than the other condition, but it would have brought more efficacy if the researcher had continued the delayed reinforcement phase during the alternating treatments component to provide an extra source of experimental control. The second limitation was that the two time delay conditions might have produced carry-over effects or multiple-treatment interference. In all conditions, the participant was required to wait for 50 second to access the iPad.

It is possible that repeated exposure to one condition improved performance in the other condition. There was the distinct separation between the two conditions, but nevertheless, this could have affected the participant's tolerance on the delayed reinforce. It is also possible that stickers might have provided intermittent reinforcement for the nonoccurrence of John's temper tantrum behavior. However, the 50-second time delay with no signal condition at home treatment evaluation suggest that interference could have occurred, as intervals with tolerance on delayed reinforcement increased to levels comparable to the other condition toward the end of evaluation. The results suggest that the time delay with visual signals is an effective procedure for enhancing tolerance to delayed reinforcement for John. It might be useful for preschool teachers, parents, and related educational professionals to implement the time delay with visual signals for decreasing problem behavior (Lee, 2015). The use of visual cues (i.e., a token economy) may effectively enhance a child's ability to wait if the child with developmental disabilities is sensitive to visual stimulation. This behavioral intervention may also help the child to learn he or she is making progress toward his or her desired goal provided in response for their waiting. The study compared no signal versus visual signals on delay tolerance so that both clinicians and parents see under which delays to reinforcement are tolerated and furthers our understanding by demonstrating that the visual signals during the delay proceeding may produce greater increases in the ability to wait.

Introducing the concept of delayed access to tangible reinforcement may highlight the importance of emotional regulation, thereby preventing future occurrences of problem behaviors and aiding children with developmental disabilities. More research needs to be conducted to substantiate this concept, such as parent training on implementing delayed reinforcement procedures or conducting large scale studies across different settings (e.g., community, daycare, etc.). The study clearly demonstrated that the behaviors of the participant were different between two different places: the clinic and home of the participant. Nevertheless, it is uncertain whether the differences occurred due to the different environment of the sessions of the effect of training throughout the sessions. Due to the reason, it would be more interesting to evaluate whether the different environment of the sessions effect on behaviors of the participant. The experiments could be alternately done at the clinic and home simultaneously in a day. For instance, a session could be done at the clinic in the morning and the next morning session could be done at home. It would be also beneficial to evaluate whether there are any differences in behaviors due to different time periods during a day—i.e., morning, afternoon, evening, and/or night.

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Table 1: Results of theStimulus PreferenceAssessment

Item	Numberofselections	Percentageofselections	Rank
iPad	5	83.33%	1
Lego	4	66.67%	2
Playdoh	4	66.67%	2
Puzzles	3	50%	4
Dolls	2	33.33%	5
Books	2	33.33%	5
Drum	1	16.67%	7

Figure 1: Percentage of John's tolerance on delayed reinforce during baseline and two time-delayed conditions across two settings