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INDIVIDUAL AND COMBINED EFFECTS OF NONCONTINGENT REINFORCEMENT AND RESPONSE BLOCKING ON AUTOMATICALLY REINFORCED PROBLEM BEHAVIOR

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Abstract

Noncontingent reinforcement (NCR) and response blocking are 2 common interventions for problem behavior maintained by automatic reinforcement. We implemented NCR and blocking with 1 boy and found this combined intervention to be effective at decreasing high rates of automatically reinforced pica. With another child, we compared the effects of blocking alone to the combined intervention. With the 3rd child, we compared NCR alone and blocking alone to the combined intervention. Results showed that the combined intervention was effective at reducing automatically reinforced problem behavior while moderate to high levels of item engagement were maintained. When evaluated individually, neither NCR nor blocking was sufficient to reduce problem behavior to clinically significant levels.

Keywords

automatic reinforcement; noncontingent reinforcement; problem behavior; response blocking

Noncontingent reinforcement (NCR) and response blocking are two interventions that have been shown to reduce problem behavior maintained by automatic reinforcement (LeBlanc, Patel, & Carr, 2000). NCR involves the use of a time-based schedule to deliver stimuli that compete with the automatic reinforcer produced by problem behavior (e.g., Hagopian & Toole, 2009), whereas blocking consists of physical intervention to prevent problem behavior. Blocking can prevent access to the automatic reinforcer that maintains the response (i.e., extinction; Smith, Russo, & Le, 1999) or can function as punishment (Lerman & Iwata, 1999).

Several studies have examined the independent and combined effects of NCR and blocking (Carr, Dozier, Patel, Adams, & Martin, 2002; Jennett, Jann, & Hagopian, 2011; Piazza et al., 1998; Piazza, Hanley, & Fisher, 1996; Rapp, Vollmer, St. Peter, Dozier, & Cotnoir, 2004; Rodriguez, Thompson, Schlichenmeyer, & Stocco, 2012; Thompson, Fisher, Piazza, & Kuhn, 1998). For example, Jennett et al. (2011) evaluated NCR when implemented alone, with item representation (i.e., placing the competing item in the subject's hand every 5 s),

and with representation and blocking. NCR with and without re-presentation failed to produce clinically significant reductions in one girl's self-injurious behavior (SIB) until blocking was added. However, blocking was never evaluated in isolation. Carr et al. (2002) found the combination of NCR and blocking to be more effective than either treatment component alone in decreasing levels of one girl's actual and attempted object mouthing. Unfortunately, this combined intervention was never withdrawn after it had been shown to be effective, thereby limiting firm conclusions regarding its overall or relative effectiveness (i.e., compared to baseline or each component implemented alone).

In the current study, we sought to replicate and extend previous findings on the combined effects of NCR and blocking on one individual's automatically reinforced problem behavior and to determine if either treatment component alone would decrease automatically reinforced problem behavior by conducting partial and full component analyses of the combined intervention with two additional individuals.

METHOD

Subjects and Settings

Isaac, a 5-year-old boy, and Callie, a 6-year old girl, had been diagnosed with autism spectrum disorder (ASD), and both engaged in pica. (Additional data for both subjects are presented in Saini, Greer, & Fisher, 2015, and Mitteer, Romani, Greer, & Fisher, 2015.) Malik, a 4-year-old boy who had been diagnosed with ASD, engaged in SIB. All subjects spoke in no more than one-word utterances and required assistance with most self-help tasks. Callie's treatment occurred in a room (3 m by 3 m) equipped with a one-way observation panel. Treatment for Isaac and Malik occurred in rooms that were 6 m by 6 m and 4 m by 4 m, respectively. We placed baited pica items (e.g., dried beans) on sanitized surfaces for Isaac and Callie using procedures similar to those described by Piazza et al. (1998).

Measurement and Interobserver Agreement

All sessions initially lasted 5 min, and we later increased the session duration from 5 min to 90 min with Isaac and from 5 min to 40 min with Callie. Observers used laptop computers to collect data on the frequency of pica (Isaac and Callie) or SIB (Malik) and the duration of item engagement, which was later converted to a percentage by dividing the duration of item engagement by the session duration. We defined *pica* as placing a baited item or any inedible object past the plane of the lips. If a child placed multiple items into his or her mouth, we scored a single instance of pica. We defined *SIB* as self-biting (i.e., closure of the child's teeth on any part of his body). We defined *item engagement* as manipulating a therapist-delivered stimulus in a manner consistent with its intended use. For example, Isaac twirled a tone pipe to produce sound, and Malik built structures by connecting Bristle Blocks. We chose this definition to decrease the likelihood of scoring stereotypic object manipulation as item engagement.

An independent second observer collected data simultaneously with the primary data collector on 59%, 60%, and 55% of Isaac's, Callie's, and Malik's sessions, respectively. We

divided sessions into 10-s intervals and recorded an agreement in each interval for which both observers recorded the same number of responses (or seconds of the response). We summed the number of agreement intervals, divided that number by the total number of intervals, and converted the result to a percentage. Interobserver agreement averaged 85% (range, 73% to 97%) for pica and 97% (range, 93% to 100%) for item engagement for Isaac, 94% (range, 63% to 100%) for pica and 99% (range, 90% to 100%) for item engagement for Callie, and 96% (range, 83% to 100%) for SIB and 90% (range, 79% to 100%) for item engagement for Malik.

Procedure

Pretreatment functional analysis results for all children suggested that problem behavior was maintained by automatic reinforcement (data available from the second author). We conducted a competing stimulus assessment (CSA) with each child to identify stimuli that competed with the automatic reinforcers obtained by engaging in problem behavior (Piazza et al., 1998) by presenting stimuli individually during two 5-min sessions for each stimulus while data collectors measured problem behavior and item engagement. We presented the stimuli in a quasirandom order, with the caveat that each stimulus was presented once before any stimulus was presented a second time. There were no programmed consequences for problem behavior during the CSA (i.e., problem behavior continued to produce automatic reinforcement).

Baseline

Baseline sessions were identical to the ignore condition of the functional analysis for Callie and Malik. For Isaac, a previous treatment (developed for other topographies of problem behavior, i.e., aggression and property destruction) that consisted of preferred items (which differed from the those from his CSA of pica), therapist attention, and punishment was shown to be effective (see Saini et al., 2015). Therefore, these procedures remained in place throughout all of Isaac's sessions in the current evaluation. There were no programmed consequences for pica during baseline.

NCR plus response blocking

Competing stimuli were available throughout the session. If the child stopped engaging with the items, the therapist re-presented the stimuli and said, "You can have this," on a fixed-time (FT) 30-s schedule. The therapist remained in close proximity to the child and physically blocked problem behavior throughout session. Blocking pica consisted of the therapist placing a hand between the subject's hand and mouth to prevent pica. Blocking SIB consisted of the therapist placing his or her arm across Malik's arms to prevent him from raising his hand to his mouth. For all children, blocking ended after the successful interruption of problem behavior, at which point the therapist re-presented the competing stimuli after 5 s.

NCR plus modified response blocking

The blocking procedure for Malik was modified in the context of the combined intervention because the rapidity of his SIB made it difficult for therapists to implement blocking as

designed. During modified blocking, Malik was seated on the floor, and the therapist, positioned behind Malik, placed his or her arms over Malik's shoulders and hands above his arms. Whenever Malik raised his hand to engage in SIB, the therapist's hand blocked the response, regardless of how quickly Malik attempted SIB. He was otherwise able to move freely.

Response blocking

We evaluated the individual effects of blocking with Callie and Malik. These sessions were identical to NCR with response blocking, except that we removed the NCR component, including the re-presentation of competing stimuli.

NCR

We evaluated the individual effects of NCR with Malik. This condition was identical to NCR with response blocking, except that we removed the blocking component. At the start of each session, the therapist delivered Malik's competing stimuli and moved to the opposite side of the session room.

RESULTS AND DISCUSSION

From each child's CSA results, we identified a tone pipe; access to pretzels; and a vibrating teether, teething keys, and Bristle Blocks as competing stimuli for Isaac, Callie, and Malik, respectively (data available from the second author). In both phases in which the combined intervention was used with Isaac (Figure 1, top), we observed immediate suppression of pica to near-zero rates and high levels of item engagement with the competing stimulus compared to the initial baseline. During the return to baseline, in which the tone pipe from his CSA was removed, Isaac began to play with his other preferred items (i.e., those from his previous treatment evaluation) at a high level; however, engagement with these preferred items did not compete with pica.

Because Callie's CSA results indicated that only edible items would compete with pica, we compared NCR plus blocking to blocking alone (Figure 1, middle). Results of the partial and full component analyses with Callie and Malik (Figure 1, bottom) indicated that although the blocking component resulted in moderate reductions in each child's problem behavior, blocking alone was insufficient for both children. Because Callie's treatment did not include an evaluation of NCR alone, we first evaluated the NCR component of the combined intervention with Malik. None of the four phases of NCR alone decreased his high rates of SIB, despite high levels of item engagement. For all subjects, treatment effects were obtained only with the combined intervention, and each time we removed either of the two components with Callie and Malik, problem behavior increased. One limitation of Malik's treatment evaluation is that we did not implement the modified blocking procedure in isolation, which leaves open the possibility that this modification may have been effective without NCR.

We extended the session duration 18-fold for Isaac and 8-fold for Callie and observed near-zero rates of problem behavior with both children. However, we also observed reductions in item engagement with both children at these extended durations, which could be due to

decrements in the reinforcing value of the competing stimuli over time. Despite these decrements, the extension of NCR with blocking to clinically meaningful durations has not been previously reported in the treatment literature, and our results provide some support for the continued effectiveness of this combined intervention across longer session durations. However, one practical limitation of blocking is that it may be unrealistic for caregivers to follow the child closely for long periods of time while attempting to block each instance of problem behavior. Future researchers might consider investigating methods of fading the schedule of blocking while treatment efficacy is maintained.

Carr et al. (2002) suggested that blocking might function as an establishing operation that increases the reinforcing value of the competing stimuli. That is, when the automatic reinforcers obtained from engaging in problem behavior are withheld by blocking, alternative sources of reinforcement (e.g., those obtained from the competing stimuli) may increase in value. With the one subject for whom we evaluated NCR alone and with blocking (Malik), we did not observe an increase in item engagement when blocking was added. However, item engagement for this child was generally high across both conditions, which suggests a possible ceiling effect. By contrast, the subject in Jennett et al. (2011) showed generally higher and more stable levels of item engagement (i.e., stimulus contact) in the conditions that included blocking than in those that did not. Thus, additional research is needed to determine how often and under what conditions blocking increases the reinforcing value of competing stimuli. The current results suggest that combining NCR with blocking is likely to produce better outcomes than either procedure implemented alone. However, additional research is warranted on the independent and combined effects of NCR and blocking on automatically reinforced problem behavior.

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Figure 1.

Results of the treatment evaluation of Isaac's pica (top), Callie's pica (middle), and Malik's self-injurious behavior (bottom).