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# *ON THE RELATIVE CONTRIBUTIONS OF NONCONTINGENT REINFORCEMENT AND ESCAPE EXTINCTION IN THE TREATMENT OF FOOD REFUSAL*

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In the current investigation, we evaluated the relative effects of noncontingent reinforcement (NCR), escape extinction, and a combination of NCR and escape extinction as treatment for the feeding problems exhibited by 4 children. For each participant, consumption increased only when escape extinction was implemented, independent of whether NCR was present or absent. These results were consistent with prior research suggesting that positive reinforcement alone is insufficient for increasing consumption, and that escape extinction often is necessary to increase and maintain food acceptance. However, NCR appeared to decrease inappropriate behavior for some participants.

DESCRIPTORS: escape extinction, food refusal, negative reinforcement, noncontingent reinforcement, pediatric feeding disorders, positive reinforcement

Previous research on food refusal has suggested that procedures based on negative reinforcement (such as nonremoval of the spoon [NRS] or physical guidance) often are effective in the treatment of pediatric feeding disorders (e.g., Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Cooper et al., 1995, 1999; Hoch, Babbitt, Coe, Krell, & Hackbert, 1994; Patel, Piazza, Martinez, Volkert, & Santana, 2002; Piazza, Fisher, et al., 2003; Piazza, Patel, Gulotta, Sevin, & Layer, 2003). The relative role of positive-reinforcement-based procedures, however, remains less clear, because existing research in this area often has produced mixed or unclear findings. For example, some treatment studies have suggested that reinforcement-based procedures alone may be sufficient for increasing and maintaining food consumption (e.g., Riordan, Iwata, Finney, Wohl, & Stanley, 1984; Riordan, Iwata, Wohl, & Finney, 1980) even though others have suggested that escape extinction is necessary not only for initial increases (acquisition) in food consumption (Ahearn et al.; Hoch et al.; Patel et al.; Piazza et al.) but also for maintaining consumption (e.g., Cooper et al., 1995). Evaluation of the role of positive reinforcement in the treatment of feeding

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problems is complicated further because most studies include a package of operant procedures that consist of multiple treatment components implemented simultaneously. As a result, the relative contribution of one treatment component (e.g., positive reinforcement) over another (e.g., extinction) often is difficult to infer.

Most recently, Piazza, Patel, Gulotta, Sevin, and Layer (2003) addressed this issue by examining the individual and combined effects of positive reinforcement and escape extinction during the treatment of 4 children with feeding problems. During the study, researchers compared the effects of positive reinforcement alone (DRA), escape extinction alone, and DRA with escape extinction on each child's food and fluid refusal. Results showed that DRA alone was insufficient for increasing consumption, and that each child's consumption increased only when escape extinction (NRS or physical guidance) was implemented. Of note, however, was that the DRA component appeared to contribute to treatment for some children by reducing extinction bursts, crying, and other inappropriate behavior. Thus, these results provided a clearer picture of the relative contribution of positive reinforcement and escape extinction during feeding treatments, but only in terms of differential reinforcement procedures. The extent to which other reinforcement-based procedures (e.g., noncontingent reinforcement; NCR) contribute to feeding treatments has not been evaluated extensively.

Cooper et al. (1995) reported findings that suggested that positive reinforcement in the form of NCR might play an important role in the maintenance of food consumption for at least some children. Specifically, Cooper et al. increased the food consumption of 1 child by implementing a package of operant procedures, including NCR and NRS. Subsequent removal of the positive reinforcement component (i.e., noncontingent access to toys and attention) was associated with decreases in the number of bites accepted by the participant. Even though the results of Cooper et al. suggested that NCR was needed to maintain appropriate eating, the role of NCR during initial response acquisition (i.e., consumption) was not evaluated.

NCR schedules might not be expected to aid response acquisition because no explicit mechanism for reinforcing alternative behavior (e.g., acceptance) is present. However, the rationale for using NCR during feeding treatment is that NCR may attenuate the aversive properties of the mealtime context, thus reducing disruptive behavior that interferes with or precludes acceptance. If disruptive behavior is decreased, then acceptance may increase correspondingly (i.e., response covariation; e.g., Parrish, Cataldo, Kolko, Neef, & Egel, 1986). Even if NCR is not associated with increased consumption, it may contribute to feeding treatments in other ways. For example, NCR may attenuate the negative effects often associated with extinction (e.g., extinction bursts or negative emotional behavior; Piazza, Patel, Gulotta, Sevin, & Layer, 2003).

In sum, prior research suggests that differential positive reinforcement may have beneficial effects during the treatment of food refusal (Cooper et al., 1995; Piazza, Patel, Gulotta, Sevin, & Layer, 2003). However, a number of questions remain regarding the relative roles of positive and negative reinforcement during feeding treatments. With regard to NCR, it is unclear whether implementing noncontingent positive reinforcement alone (without escape extinction) will result in response acquisition (i.e., increased consumption). It also is unclear whether NCR would contribute to the effects of escape extinction during treatment.

Therefore, a primary purpose of the current investigation was to extend the work of Cooper et al. (1995) on the effects of NCR

in the treatment of feeding problems. A second purpose was to replicate the methods used by Piazza, Patel, Gulotta, Sevin, and Layer (2003) to evaluate the relative effects of escape extinction with and without positive reinforcement for increasing food consumption.

## METHOD

### *Participants and Setting*

Four children who had been admitted to an intensive pediatric feeding disorders day-treatment program participated. Jensen was a 21-month-old boy who had been admitted for poor oral intake and failure to thrive. Nate was a 15-month-old boy who had been admitted for poor oral intake and failure to thrive. His medical problems included allergic colitis and enteritis, gastroesophageal reflux, severe food allergies, constipation, and nasogastric-tube dependence. Jaden was a 3-year-old boy who had been admitted for poor oral intake. His medical history included chronic upper respiratory infections and developmental delays. Abbott was a 4-year-old boy who had been admitted for poor oral intake and gastrostomy-tube dependence. His medical history included Pierre Robin syndrome, posttracheostomy, hearing loss, and nissen fundoplication.

All sessions were conducted in a room with a one-way mirror. A high chair, food or drink, and eating or drinking implements were present during all sessions. Toys were present during reinforcement phases as described below. Oral and supplemental feedings did not occur 1 hr before and 30 min after therapy sessions.

### *Dependent Variables and Data Collection*

The major dependent variables were acceptance, inappropriate behavior, and negative vocalizations. During eating sessions, acceptance was scored if the entire bolus of food was in the child's mouth within 5 s of the presentation. During drinking sessions, acceptance was scored if any portion of the liquid entered the child's mouth within 5 s of the presentation. Data also were collected on inappropriate behavior (i.e., head turns, batting or blocking the spoon or cup) and negative vocalizations (3 s or more of crying or whining). Data on acceptance and inappropriate behavior were collected on laptop computers using an event-recording procedure. Data on negative vocalizations were recorded using a duration measure. The data for acceptance were converted to a percentage by dividing the number of occurrences of acceptance by the number of bite or drink presentations and multiplying by 100%. Data on inappropriate behavior were converted to a rate (responses per minute) by dividing the number of inappropriate behaviors by the duration of the session in minutes. The data on negative vocalizations were converted to a percentage by dividing the duration of negative vocalizations by the total duration of the session and multiplying by 100%.

A second observer independently scored 30.2%, 31.6%, 31%, 58.3%, and 14.3% of sessions for Jensen, Nate, Jaden, Abbott (eating), and Abbott (drinking), respectively. Interobserver agreement for acceptance and inappropriate behaviors was calculated by dividing the smaller frequency by the larger frequency and multiplying by 100%. Interobserver agreement for negative vocalizations was calculated by dividing the smaller duration by the larger duration and multiplying by 100%. Interobserver agreement for acceptance was 93.2% (range, 80.6% to 100%) for Jensen, 94.6% (range, 73.3% to 100%) for Nate, 95.3% (range, 83.3% to 100%) for Jaden, 97.3% (range, 80% to 100%) for Abbott (eating), and 99.2% (range, 93.3% to 100%) for Abbott (drinking). Interobserver agreement for inappropriate behavior was 97.5% (range, 88.3% to 100%) for Jensen, 97.2% (range, 82.3% to

100%) for Nate, 96.9% (range, 85% to 100%) for Jaden, 93.5% (range, 75.7% to 100%) for Abbott (eating), and 96.9% (range, 90.3% to 100%) for Abbott (drinking). Interobserver agreement for negative vocalizations was 100% for Jensen, 95.9% (range, 57.1% to 100%) for Nate, 99.7% (range, 96.7% to 100%) for Jaden, 99.5% (range, 91.1% to 100%) for Abbott (eating), and 100% for Abbott (drinking).

*Experimental Design and Procedure*

A multielement design was used to evaluate acceptance, inappropriate behavior, and negative vocalizations in the escape baseline versus NCR plus escape conditions. A multielement design also was used to examine acceptance, inappropriate behaviors, and negative vocalizations in the escape extinction versus NCR plus escape extinction conditions. A reversal design was used to evaluate responding in the presence and absence of escape extinction (escape baseline/NCR plus escape vs. escape extinction/NCR plus escape extinction).

Table foods were pureed in a blender for Jensen, Jaden, and Abbott. Four foods, one from each food group (fruits, vegetables, starches, and meats), were presented in each session, and the order of food presentation was selected randomly prior to the session. However, the order of food presentation remained the same within a given session. Whole milk combined with Carnation Instant Breakfast® was presented to Jensen, and NeoCate® formula was presented to Nate.

All sessions were scheduled to last 5 min. However, escape extinction sessions sometimes exceeded 5 min because the child was required to swallow the last bite or drink presented before the session was terminated. However, sessions were terminated after 1 hr even if the last bite was not swallowed (the food was removed from the child's mouth by the therapist). The mean session length was 292 s (baseline) and 304 s (escape extinction) for Nate, 301 s (baseline) and 314 s (escape extinction) for Jaden, 288 s (baseline) and 303 s (escape extinction) for Abbott (eating), and 288 s (baseline) and 287 s (escape extinction) for Abbott (drinking). Only 50% of the meal durations were available in the archive for Jaden; therefore, meal duration was calculated from the available data. Meal duration was not archived and therefore not available for Jensen. Approximately five session blocks were conducted each day for Jaden, Jensen, and Abbott, with approximately one to four sessions per block for Jensen and Abbott, and one session at each block for Jaden. Four session blocks with three sessions per block were conducted for Nate. The mean number of sessions conducted per day was 8.7 for Jensen, 9.4 for Nate, 4.7 for Jaden, 16 for Abbott (eating), and 6.2 for Abbott (drinking). Sessions blocks were conducted approximately 1.5 to 2 hr apart (e.g., 9:00 a.m., 10:30 a.m., 12:30 p.m., 2:30 p.m., 4:00 p.m.).

*Escape baseline.* During this condition, the therapist presented a bite or drink approximately every 30 s from the initial acceptance. Brief verbal praise was delivered if the child accepted the bite or drink within 5 s of the presentation or had a clean mouth (no visible food in the child's mouth 30 s after acceptance in the absence of expulsion). No differential consequences were provided for expulsion or vomiting (i.e., bite presentation continued). If the child held the bite or drink in his mouth 30 s after acceptance, the therapist delivered a verbal prompt (i.e., "Finish your bite or drink") every 30 s until the bite or drink was swallowed. If the child engaged in any inappropriate behaviors (e.g., head turns, bats, blocks) during the presentation, the bite or drink was removed for 15 s. If the child did not engage in any inappropriate behavior, the spoon or cup remained at the child's lips for 30 s, at which time a new bite or drink was presented. The

next bite or drink was presented immediately after the escape period or at the next 30-s interval.

*NCR plus escape.* During this condition, reinforcers (preferred toys and attention) were available throughout the session. The toys remained on the child's tray. The therapist talked, sang, and interacted with the child throughout the session. All other procedures were identical to the escape baseline. A paired-choice preference assessment was conducted to identify highly preferred items (Fisher et al., 1992) to use as reinforcement.

*Escape extinction.* During this condition, the therapist presented a bite approximately every 30 s from the initial acceptance. Procedures were similar to the previous phase; however, inappropriate behavior no longer produced escape. If inappropriate behavior occurred or if passive refusal occurred (e.g., nonacceptance without inappropriate behavior), the therapist held the spoon or cup to the child's mouth until he or she took the bite or drink (i.e., NRS; Hoch et al., 1994). If the child expelled the bite or drink, it was scooped up and re-presented until the bite was swallowed. If the child held the bite or drink in his mouth 30 s after acceptance, the therapist delivered a verbal prompt (i.e., "Finish your bite or drink") every 30 s until the bite or drink was swallowed. No differential consequences were provided for vomiting (i.e., bite presentation continued). Sessions were 5 min in duration or ended when the participant finished the last bite or drink presented when time elapsed.

*NCR plus escape extinction.* During this condition, noncontingent positive reinforcement (preferred toys and attention) was delivered throughout the session. The toys remained on the child's tray. The therapist talked, sang, and interacted with the child throughout the session. All other procedures were identical to the escape extinction condition.

## RESULTS

Figure 1 shows the results of Jensen's treatment across three topographies of mealtime behaviors. During baseline, acceptance was low across both conditions (escape and NCR plus escape). When escape extinction was introduced, escape extinction alone and NCR plus escape extinction were equally effective at increasing acceptance. When escape extinction was removed (baseline), acceptance was maintained initially, but eventually decreased to zero across both conditions. Also, acceptance was more variable in NCR than in escape alone during the return to baseline. Finally, high levels of acceptance were reestablished across both conditions when escape extinction was reimplemented. Inappropriate behavior was high during both escape and NCR plus escape but decreased to zero when escape extinction was introduced. Removal of escape extinction (baseline) eventually resulted in increases in inappropriate behavior across both conditions; however, inappropriate behavior was higher in NCR than in escape alone. Inappropriate behavior decreased to zero when escape extinction was reimplemented. Negative vocalizations were zero across both conditions of each baseline phase. However, a burst in negative vocalizations was observed in escape extinction alone, but not in NCR plus escape extinction, during the first phase in which escape extinction was conducted.

Figure 2 shows the results of Nate's treatment across three topographies of mealtime behaviors. During both baseline phases, acceptance was low in both escape and NCR plus escape. The implementation of escape extinction resulted in increased acceptance across both treatment conditions (escape extinction alone and NCR plus escape extinction). However, NCR plus escape extinction initially was associated with higher levels of acceptance than escape extinction alone during both phases in which escape extinction

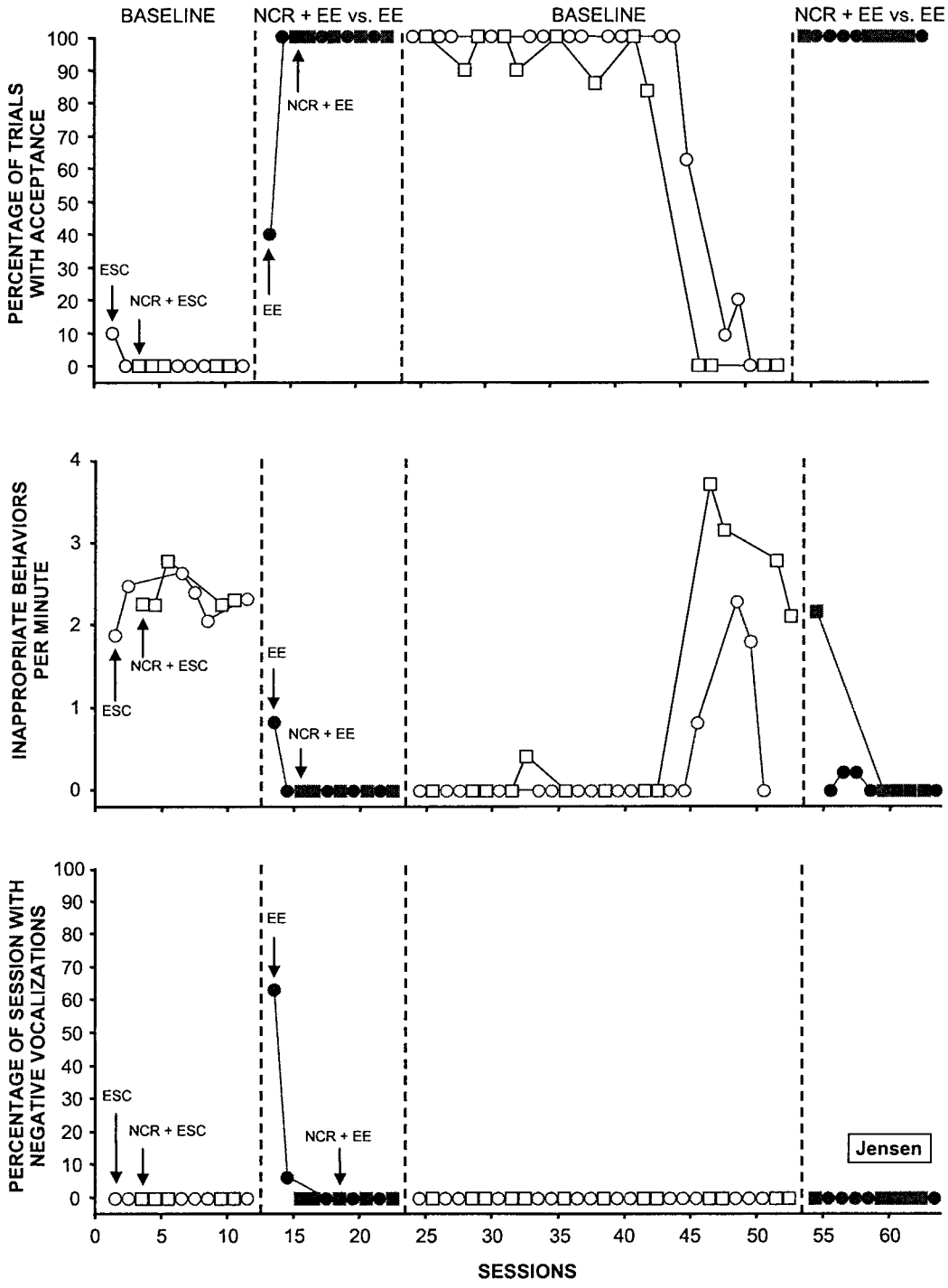


Figure 1. Percentage of trials with acceptance (top panel), inappropriate behaviors per minute (middle panel), and percentage of the session with negative vocalizations (bottom panel) for Jensen during escape baseline, NCR plus escape, NCR plus escape extinction, and escape extinction alone.

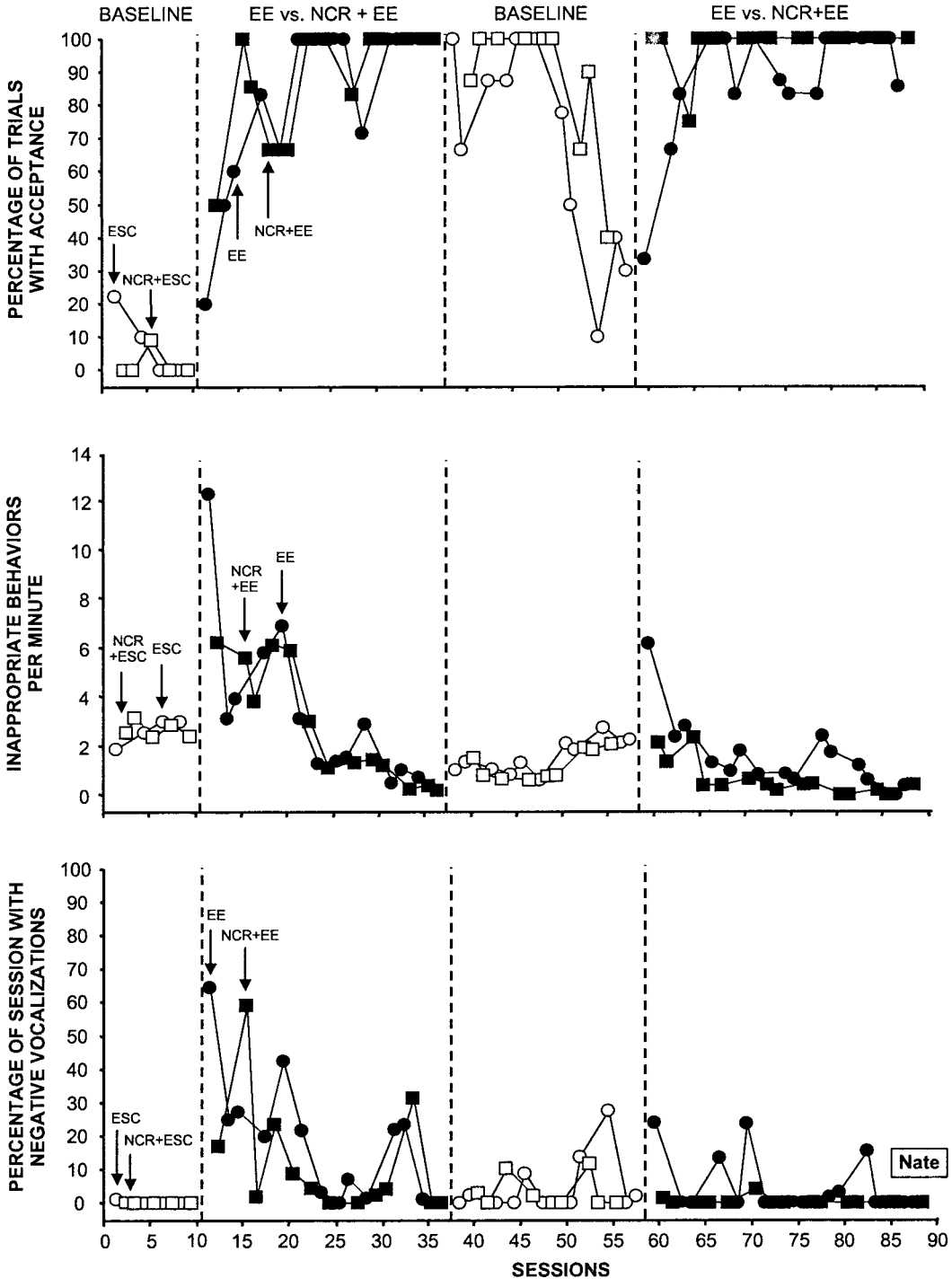


Figure 2. Percentage of trials with acceptance (top panel), inappropriate behaviors per minute (middle panel), and percentage of the session with negative vocalizations (bottom panel) for Nate during escape baseline, NCR plus escape, NCR plus escape extinction, and escape extinction alone.

was conducted. Further, acceptance was more variable in escape extinction alone than in NCR plus escape extinction during the second phase of escape extinction. High rates of inappropriate behavior were observed in both escape and NCR plus escape. When escape extinction was introduced, bursts of inappropriate behavior occurred in both conditions (escape extinction alone and NCR plus escape extinction), but the magnitude of bursting was greater in escape extinction alone. Eventually, however, inappropriate behavior decreased to zero across both conditions. Treatment effects appeared to be maintained briefly when escape extinction was removed (second baseline phase), but increasing trends of inappropriate behavior were observed across both conditions by the end of the phase. When escape extinction was reintroduced, a burst of inappropriate behavior was observed again, but only in the escape extinction alone condition. Escape extinction alone also was associated with increased variability and higher overall rates of inappropriate behavior relative to NCR plus escape extinction. Bursts of negative vocalizations were equally prevalent in escape extinction alone and NCR plus escape extinction conditions during the first implementation of escape extinction. However, when escape extinction was reimplemented, low levels of negative vocalizations were observed in the NCR plus escape extinction condition, whereas higher responding continued to occur variably in escape extinction alone.

Figure 3 shows the results of Jaden's treatment across three topographies of mealtime behaviors. During baseline, acceptance was low in NCR plus escape but variable in the escape condition. The implementation of escape extinction resulted in increases in acceptance across both treatment conditions (escape extinction alone and NCR plus escape extinction), although slower increases in acceptance occurred in NCR plus escape extinction. During subsequent phases, acceptance decreased (across both conditions) when escape extinction was removed, and increased again when escape extinction was reintroduced. Inappropriate behavior was variable and high across both baseline conditions (escape alone and NCR plus escape). When escape extinction was introduced, inappropriate behavior remained high in escape extinction alone for six sessions relative to NCR plus escape extinction, in which it was consistently low. A return to baseline resulted in high rates of inappropriate behavior across both conditions, which again decreased to near zero when escape extinction was reintroduced (although higher rates were observed initially during escape extinction alone). Negative vocalizations were zero in all conditions, across both baseline and escape extinction treatment phases.

Figure 4 shows the results of Abbott's treatment (eating) across three topographies of mealtime behaviors. Although acceptance was low across both baseline conditions, acceptance was consistently at zero in NCR plus escape but was relatively higher in escape only. During subsequent phases, acceptance increased or decreased across both conditions (escape extinction alone and NCR plus escape extinction) as a function of the presence (or absence) of escape extinction. Inappropriate behavior was high across conditions (escape and NCR plus escape) during both baseline phases. By contrast, when escape extinction was implemented, inappropriate behavior decreased to near-zero levels across both conditions; further, bursts of inappropriate behavior occurred in escape extinction alone but not in NCR plus escape extinction. This pattern of responding was observed during both phases in which escape extinction was implemented. Negative vocalizations were at zero in all conditions, across both baseline and escape extinction treatment phases.

Figure 5 shows the results of Abbott's treatment (drinking) across three topogra-

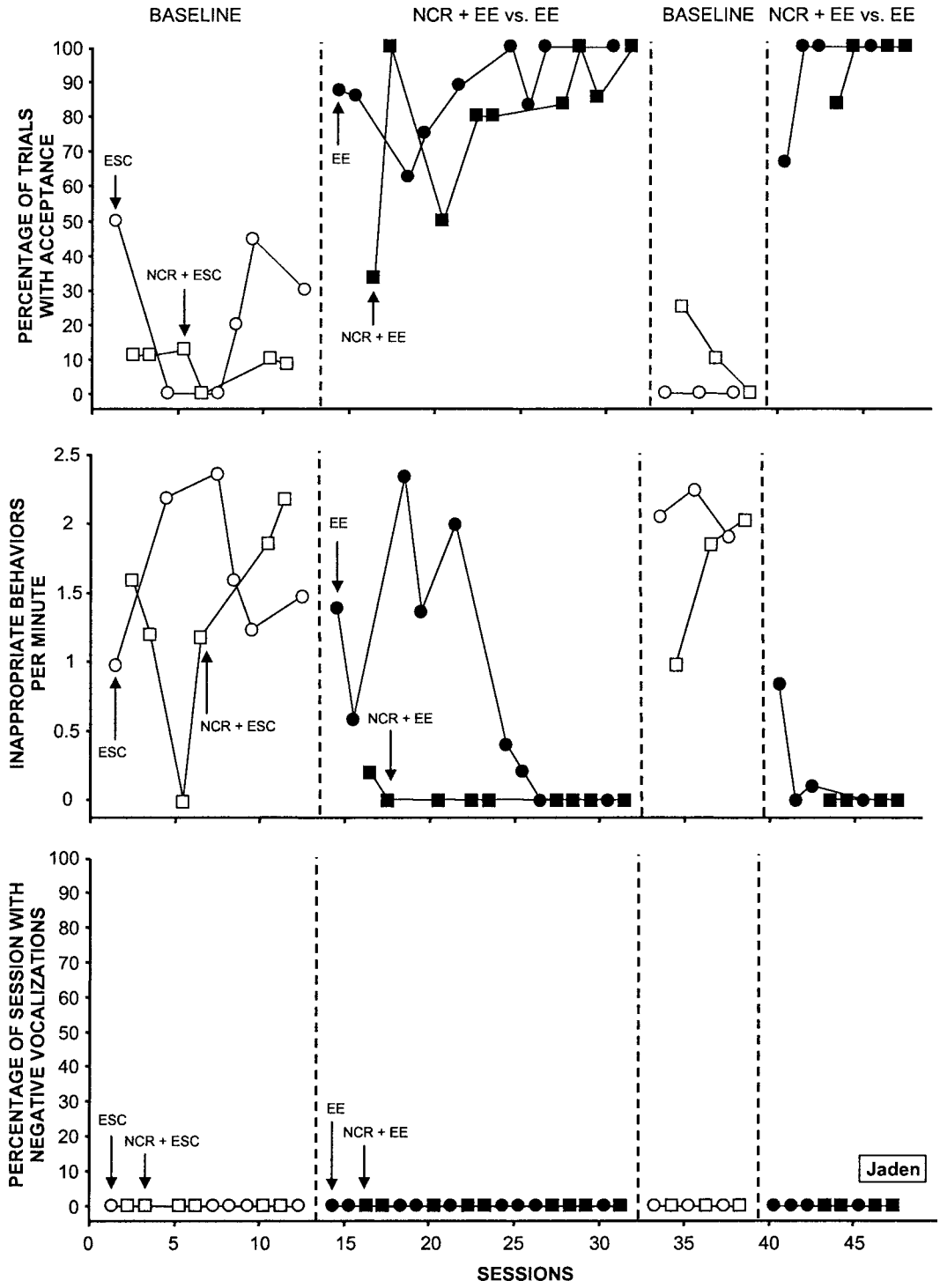


Figure 3. Percentage of trials with acceptance (top panel), inappropriate behaviors per minute (middle panel), and percentage of the session with negative vocalizations (bottom panel) for Jaden during escape baseline, NCR plus escape, NCR plus escape extinction, and escape extinction alone.

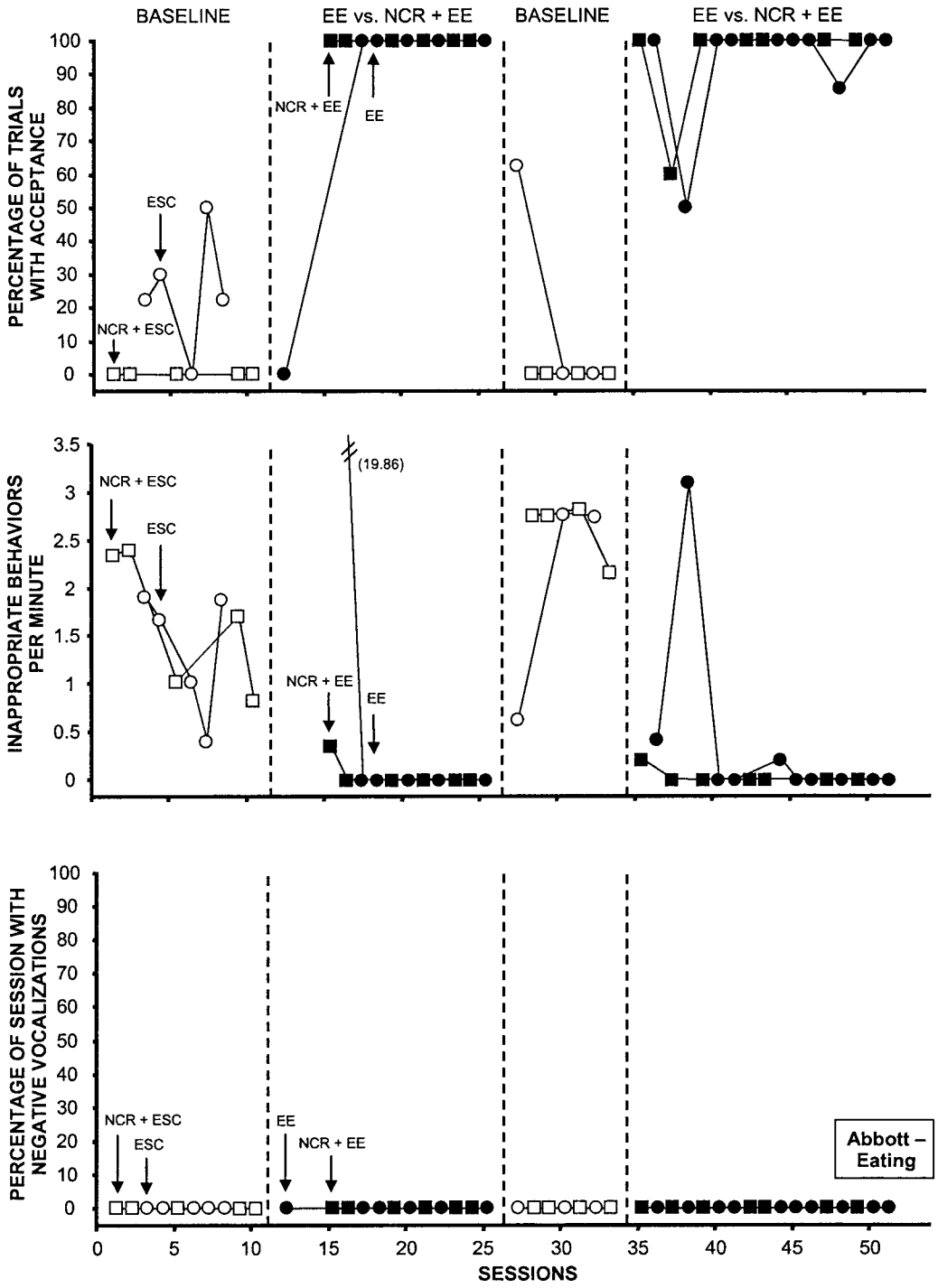


Figure 4. Percentage of trials with acceptance (top panel), inappropriate behaviors per minute (middle panel), and percentage of the session with negative vocalizations (bottom panel) for Abbott (eating) during escape baseline, NCR plus escape, NCR plus escape extinction, and escape extinction alone.

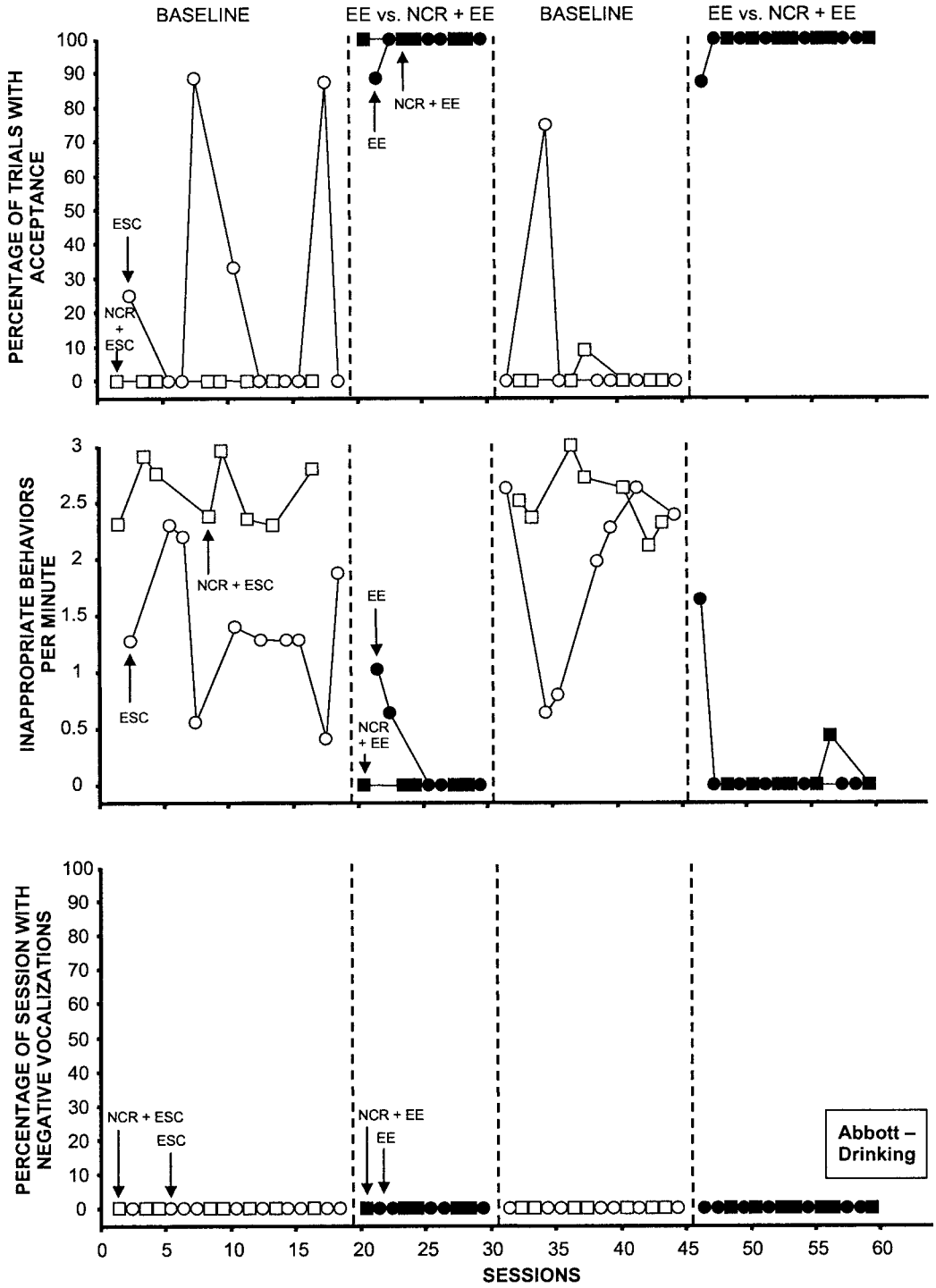


Figure 5. Percentage of trials with acceptance (top panel), inappropriate behaviors per minute (middle panel), and percentage of the session with negative vocalizations (bottom panel) for Abbott (drinking) during escape baseline, NCR plus escape, NCR plus escape extinction, and escape extinction alone.

phies of mealtime behaviors. Acceptance was lower in NCR plus escape than in escape only. Stable and high levels of acceptance were observed across both conditions during phases in which escape extinction was implemented. Inappropriate behavior was higher overall in NCR plus escape than in escape only during both baseline phases. When escape extinction was implemented, inappropriate behavior decreased to zero in both NCR plus escape extinction and escape extinction alone, but more rapid reductions in problem behavior were observed during NCR plus escape extinction. Negative vocalizations were at zero in all conditions, across both baseline and escape extinction treatment phases.

## DISCUSSION

In the current investigation, we evaluated the effects of noncontingent reinforcement, escape extinction, and a combination of noncontingent reinforcement and escape extinction as treatment for the feeding problems of 4 children. In all cases, consumption increased only when escape extinction was implemented, independent of whether noncontingent reinforcement was present or absent. These results are consistent with prior research demonstrating not only that the presentation of positive reinforcers alone is insufficient for increasing consumption (e.g., Patel et al., 2002; Piazza, Patel, Gulotta, Sevin, & Layer, 2003) but also that escape extinction often is necessary to increase and maintain food acceptance (e.g., Ahearn et al., 1996; Cooper et al., 1995; Hoch et al., 1994; Patel et al.; Piazza, Patel, Gulotta, Sevin, & Layer). Such findings, however, have pertained primarily to differential reinforcement procedures. In the current study, similar findings were produced relative to preferred stimuli presented noncontingently. This finding is not surprising in light of the fact that treatments based on noncontingent reinforcement might not be expected to result in increased target behavior because NCR schedules do not contain explicit contingencies to reinforce target behavior (Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). Thus, in the context of feeding, an individual's motivation to accept food is likely to remain unchanged.

Somewhat surprisingly, NCR alone was not associated with decreases in inappropriate behavior, even though the suppressive effect of NCR has been well documented in the literature related to other behavior problems (e.g., Fischer, Iwata, & Mazaleski, 1997; Goh, Iwata, & DeLeon, 2000; Hagopian, Fisher, & Legacy, 1994; Lalli, Casey, & Kates, 1997; Marcus & Vollmer, 1996; Vollmer et al., 1993). This finding may have occurred for a number of reasons. First, extinction is one hypothesized mechanism for the effects of NCR (i.e., reinforcement is response independent). However, in the current study, extinction of the putative maintaining reinforcer for refusal behavior was not in place during NCR alone (i.e., escape continued to be delivered), and highly preferred arbitrary stimuli (toys and attention) were delivered on a noncontingent basis. Although the noncontingent delivery of arbitrary stimuli has been shown to compete with or reduce problem behavior in other studies (e.g., Fischer et al.), the lack of a suppressive NCR effect in the current study may reflect the fact that functional extinction likely was not present. Thus, these results suggest that response suppression associated with NCR schedules during feeding treatments may be related to extinction.

By contrast, previous findings have also suggested that response suppression under dense schedules of NCR may be related to satiation rather than extinction. That is, the motivation to engage in reinforcer-producing responses is decreased because reinforcers are delivered frequently and freely (Vollmer et al., 1998). These studies have shown that

dense NCR schedules can result in response suppression in the absence of extinction when both functional (e.g., Lalli et al., 1997) and arbitrary (Fischer et al., 1997; Fisher, O'Connor, Kurtz, DeLeon, & Gotjen, 2000) reinforcers are delivered. In the current investigation, NCR may have failed to suppress problem behavior because the stimuli used as reinforcers (toys and attention) may not have substituted for (i.e., competed with) the reinforcers maintaining food refusal (e.g., escape from eating). Prior research (e.g., Fisher et al., 2000) has suggested that NCR with arbitrary reinforcers may suppress problem behavior most effectively when the arbitrary reinforcers are of a higher quality than the maintaining reinforcers. Also of note, however, is that most of these studies examined NCR in the context of problem behavior maintained by positive reinforcement (i.e., competing contingent and noncontingent positive reinforcers). By contrast, in the current study, NCR was delivered in the context of problem behavior most likely maintained by negative reinforcement; thus, positive reinforcement (NCR) and negative reinforcement (escape from food) were in direct competition during NCR-alone phases. From this standpoint, the current results are consistent with prior research, given that few studies have shown that positive reinforcement (contingent or noncontingent) effectively competes with negative reinforcement in the absence of extinction (see Lalli et al., 1999, and Harding et al., 1999, for notable exceptions). These interpretations must be offered cautiously because we did not conduct a functional analysis with any of the children in the current study; therefore, the function of their inappropriate mealtime behavior was unknown.

Further, the extent to which highly preferred items used in the current investigation functioned as reinforcers was not evaluated directly. Studies on the assessment of preferences have demonstrated that highly preferred stimuli often function as reinforcers for simple responses (e.g., sitting in a chair; Piazza, Fisher, Hagopian, Bowman, & Toole, 1996), but the extent to which highly preferred stimuli function as reinforcers for more complex behaviors (such as eating) has not been evaluated extensively. Nevertheless, highly preferred stimuli have been used in NCR treatment packages in the absence of demonstrated reinforcer effects (e.g., Piazza, Adelinis, Hanley, Goh, & Delia, 2000; Ringdahl, Vollmer, Marcus, & Roane, 1997).

Even though NCR alone was not associated with beneficial treatment effects, NCR did appear to have beneficial effects with respect to inappropriate behavior and negative vocalizations for some participants when combined with escape extinction. For example, negative vocalizations remained at zero during NCR plus escape extinction for Jensen. By contrast, implementation of escape extinction alone was associated with a burst of negative vocalizations. Implementation of NCR plus escape extinction also was associated with lower levels of inappropriate behavior relative to escape extinction alone for Nate, Jaden, Abbott (eating), and Abbott (drinking). NCR plus escape extinction also appeared to minimize (e.g., Nate) or eliminate (e.g., Jaden and Abbott [eating]) the bursts of inappropriate behavior (Lerman & Iwata, 1995) that occurred during escape extinction alone. These results should be interpreted cautiously, however, given the potential for sequence effects (i.e., escape extinction frequently preceded NCR plus escape extinction within each multielement analysis).

We observed extinction bursts (defined as increases in initial responding during treatment that were greater than baseline levels of responding) for 4 of the 10 behaviors measured (i.e., inappropriate behavior and negative vocalizations across five data sets).

The prevalence of the extinction burst in the current investigation (40%) was consistent with findings from Lerman, Iwata, and Wallace (1999; 39%) but was higher than that reported by Lerman and Iwata (1995; 24%) and Piazza, Patel, Gulotta, Sevin, and Layer (2003; 30%). We also observed increases in agitated or emotional behavior when escape extinction was implemented with 2 of the 4 participants.

We observed that the effects of escape extinction were maintained briefly during subsequent baseline phases for 2 of the 4 participants (Jensen and Nate). Maintenance of acceptance occurred for 22 sessions with Jensen and 15 sessions with Nate. These data are similar to those of Patel et al. (2002) and Piazza, Fisher, et al. (2003), which showed that acceptance was maintained for an extended period (from 13 to 55 sessions) for 2 of 3 and 3 of 5 participants, respectively, following a phase of treatment with escape extinction. However, acceptance declined either eventually or immediately for all participants. Thus, these data are similar to those of Cooper et al. (1995), in that escape extinction appeared to be necessary for the long-term maintenance of treatment.

In conclusion, NCR did not appear to reduce inappropriate behavior when used alone. This finding is different from those of other investigations on NCR to treat severe behavior problems (e.g., Fisher et al., 2000; Vollmer et al., 1993). Nevertheless, NCR did appear to contribute to the effects of escape extinction in the treatment of feeding problems. NCR may have some procedural advantages over DRA (e.g., Marcus & Vollmer, 1996), such as easier implementation and reduced side effects related to extinction. These advantages may be particularly relevant to the treatment of feeding problems because such treatments typically involve a complex array of procedures, including extinction, that can be highly intensive and effortful for care providers to implement. Thus, future research may want to compare these two procedures directly to assess the relative benefits of each during treatment. Future researchers also may want to evaluate the function of inappropriate mealtime behaviors to determine whether differential or noncontingent reinforcement using functional reinforcers would produce different effects than arbitrary reinforcers such as those used in the current investigation.

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## *STUDY QUESTIONS*

1. Based on information contained in the introduction, how might DRA and NCR influence problematic feeding differently?

2. What were the dependent variables, and how were the measures expressed?

3. How did contingencies differ during the escape baseline, NCR plus escape, escape extinction, and NCR plus escape extinction conditions?

4. Summarize the general results of the study in terms of (a) the effects of NCR and (b) the effects of escape extinction.

5. How did the results obtained with NCR alone in this study compare with those reported in previous studies?

6. What explanations were offered for the general effects observed under the NCR alone condition?

7. What is the likely value of combining NCR with escape extinction to treat problematic feeding behavior?

8. Although immediate reversals to baseline levels of acceptance were not observed with 2 participants when extinction was removed, all participants' acceptance declined during the reversal condition. What are the clinical implications of this observed effect?

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