A COMPONENT ANALYSIS OF A PARENT-CONDUCTED MULTI-COMPONENT TREATMENT FOR FOOD SELECTIVITY

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Treatment packages including differential reinforcement of alternative (DRA) behavior and escape prevention in the form of a non-removal of the spoon procedure have been shown to successfully increase food consumption. However, when these treatment components are introduced simultaneously, the treatment component(s) responsible for behavior change cannot be determined. The purpose of this study was to conduct a sequential component analysis of the following treatment components: Bite fading, manipulation of reinforcer magnitude, and escape prevention. For two participants, food consumption did not increase until after escape prevention was introduced. For one participant, increased food consumption was observed after the magnitude of reinforcement was increased; therefore, escape prevention was not necessary. Results were maintained at a 12-week follow-up for all participants.

In a review of empirically supported treatments for severe pediatric feeding problems, most studies reported in medical or psychological journals from 1970 to 1997 employed treatment packages consisting of multiple treatment components (Kerwin, 1999). Hence, empirically supported interventions were classified according to the most salient aspect of each treatment package; these interventions included differential reinforcement, physical guidance of the appropriate response (i.e., eating), and escape prevention (i.e., non-removal of the spoon). Treatments classified as well established or promising had several components in common, including the delivery of positive reinforcement (e.g., praise) for appropriate eating, consequence procedures for inappropriate eating (e.g., representation of expelled bites), and
methods used to decrease negative side effects associated with escape prevention, such as demand fading (i.e., systematically increasing the difficulty of the task or, in this case, systematically increasing the number of requests to take a bite). The effectiveness of these treatment components in isolation is not known; however, previous research has demonstrated the effectiveness of the combined use of such components (e.g., Kerwin, Ahearn, Eicher, & Burd, 1995; Shore, Babbitt, Williams, Coe, & Snyder, 1998).

Although results of former studies are promising, the independent effects of various treatment components cannot be determined, given that these studies employed treatment packages in which a range of components were evaluated simultaneously. Cooper et al. (1995) conducted one of the first studies to address this limitation. They described a method for conducting post-treatment analyses of treatment packages used to address food refusal. Specifically, following implementation of multi-component treatment packages, independent contributions of specific variables were evaluated by removing them from the treatment package. Results demonstrated that escape prevention was an active variable when evaluated; however, for two participants, positive reinforcement and non-contingent play were also identified as active variables.

Although the methods described by Cooper et al. (1995) enable one to identify those variables responsible for the maintenance of food consumption, the variables responsible for the acquisition of food consumption cannot be determined because treatment components were not introduced sequentially. Hence, while food consumption may be maintained when certain variables are removed from treatment, acquisition of food consumption may not have occurred had these variables never been introduced. Cooper et al. note that one advantage associated with a sequential introduction of treatment components is that the need to utilize more intrusive variables may be eliminated (assuming that the treatment components are introduced starting with the least intrusive component).

In more recent studies, sequential component analyses have been utilized in an effort to determine the relative effectiveness of differential reinforcement and escape prevention. Patel, Piazza, Martinez, Volkert, and Santana (2002), Dawson, Piazza, Sevin, Gulotta, Lerman, and Kelley (2003), and Piazza, Patel, Gulotta, Sevin, and Layer (2003) are all examples of component analyses that attempted to isolate the effects of differential reinforcement from escape prevention. All three studies found that differential positive reinforcement, when implemented alone, is not effective. However, one possibility for these findings may have been that the reinforcers used (i.e., leisure items and praise) were simply not potent enough to compete with escape.

Moreover, with respect to the studies conducted by Patel et al. (2002) and Piazza et al. (2003), positive reinforcement may not have been effective, given that
the participants in these studies exhibited total food refusal. Consequently, participants may have had few opportunities to contact the reinforcement contingencies. In earlier studies conducted by Riordan, Iwata, Wohl, and Finney (1980) and Riordan, Iwata, Finney, Wohl, and Stanley (1984), participants were observed to engage in accepting and swallowing during baseline conditions. This suggests that interventions relying solely on positive reinforcement contingencies may be more effective for children who engage in food selectivity versus total food refusal, in that reinforcement can only work if the individual comes into contact with the contingency.

Najdowski, Wallace, Reagon, Penrod, Higbee, and Tarbox (2010) addressed some of the limitations described in the aforementioned studies. Specifically, the magnitude of reinforcement was greater; participants received an entire plate of high-preferred foods contingent on initially accepting only one bite of non-preferred food, and participants in this study exhibited food selectivity versus total food refusal. Moreover, in the beginning stages, reinforcement was contingent on food acceptance only, thus increasing the likelihood that participants would come into contact with the reinforcement contingency.

Following a differential reinforcement of alternative (DRA) behavior procedure combined with escape baseline, escape prevention was evaluated in combination with DRA. During this condition, a bite fading protocol was employed, starting with a one-bite requirement; the magnitude of reinforcement was increased to an entire plate of high-preferred foods; and escape prevention was implemented in the form of a non-removal of the spoon procedure. Bite requirements were increased by 150% and the magnitude of reinforcement was systematically decreased as bite requirements increased. Results indicated that food consumption of non-preferred foods increased. In addition, generalization of accepting and swallowing was observed across all participants. Although the treatment package employed in this study was demonstrated to be effective, it is not possible to determine which treatment component was responsible for behavior change in that treatment components were introduced simultaneously. Specifically, bite fading, changes in the magnitude of reinforcement, and escape prevention were all implemented at the same time.

Few studies have evaluated the isolated effects of treatment components commonly included in treatment packages for food selectivity. Therefore, the purpose of this study was to replicate and extend previous research by conducting a sequential component analysis of the abovementioned treatment components. A sequential component analysis was conducted in an effort to determine the treatment component most necessary for behavior change. Furthermore, by conducting a sequential component analysis, it was possible to determine whether a less intrusive treatment for food selectivity would result in increased food consumption.
METHOD

Participants and Setting

Three child–parent dyads participated. Participants were recruited from those individuals seeking services from the Nevada Center for Severe Behavior Problems (NCSBP). Criteria for selection included the following: (a) Children had to be between the ages of 2 and 6, (b) they had to engage in inappropriate mealtime behaviors when asked to eat non-preferred or novel foods, (c) they had to be eating less than five foods (not including snacks or sweets) and refusing foods from at least one of the food groups of fruit, starch, protein, and vegetable, (d) children had to be weaned from the bottle or breast milk; (e) there could be no signs of an immediate family history of maladaptive eating patterns or eating disorders that may have affected parents’ perceptions regarding their child’s eating patterns, and (f) one parent had to be willing to serve as a therapist throughout the entirety of the study. A behavioral feeding assessment developed by Budd (1992/1998), as well as a pre-treatment nutritional assessment developed by the investigators (available upon request), was used to determine whether or not participants met these criteria. The three child–parent dyads who participated in this study included Matt and his mother Mandy, Jack and his mother Leslie, and Patrick and his mother Barbara.

Matt was a 4-year-old boy diagnosed with Pervasive Developmental Disorder (PDD). At intake, Matt consistently ate four foods, including waffles, grilled cheese sandwich, chicken nuggets, and grapes. Snacks and sweets that Matt regularly consumed included goldfish, pretzels, fruit snacks, and ice cream. When asked to try new foods, Matt was reported to engage in inappropriate mealtime behaviors such as pushing the food away and leaving the table. Matt’s mother, Mandy, was a 30-year-old Caucasian woman who was a married homemaker with 16 years of formal education.

Jack was a 4-year-old boy diagnosed with autism. At intake, Jack consistently ate three foods, including pancakes, chicken, and refried beans. Snacks and sweets Jack regularly consumed included potato chips and maple syrup on his pancakes. When asked to try new foods, Jack was reported to engage in inappropriate mealtime behaviors such as pushing the food away, crying/tantrums, turning away from the food, and leaving the table. Jack’s mother, Leslie, was a 36-year-old Caucasian woman who was also a married homemaker with 16 years of formal education.

Patrick was a 3-year-old boy diagnosed with autism. At intake, Patrick consistently ate four foods, including garlic bread, pizza, corndogs, and peanut butter and jelly sandwich. Snacks and sweets Patrick regularly consumed, included cheese puffs, brownies, cake, and ice cream. When asked to try new foods, Patrick was reported to engage in inappropriate mealtime behaviors such as turning away from the food and
throwing the food. Patrick’s mother, Barbara, was a 35-year-old Caucasian woman who was a married homemaker with 12 years of formal education.

Each child’s mother conducted feeding sessions at the kitchen table. Feeding sessions were conducted during one meal per day, as many days of the week as possible. Meals were terminated after the child consumed their bite requirement or after 30 min elapsed (whichever occurred first). For all three participants, dinner was selected as the target meal. To control for possible establishing operation effects, such as deprivation and satiation, parents were asked to restrict the children’s food intake and allow no food or snacks for at least 2 h prior to the target meal. For two participants (Matt and Patrick), a therapist was present during two meals per week, one meal was videotaped, and the remainder of meals were conducted by parents, unsupervised. For one participant (Jack), a therapist was present during one meal per week, two meals were videotaped, and the remainder of meals were conducted by Jack’s mother (Leslie), unsupervised.

**Parent Interview**

During an initial interview, parents were asked to identify six foods that their child preferred and six foods that they wanted their child to start eating. Preference for these 12 foods was tested in a paired choice preference assessment (described below). Parents were also asked to identify seven to eight non-preferred foods that were included in a second preference assessment. The foods included in the second preference assessment were used during generalization probes. Parents were encouraged to pick foods from the food groups of vegetable, fruit, protein, and starch.

**Preference Assessment**

Prior to treatment, preference assessments were conducted following procedures described by Fisher, Piazza, Bowman, Hagopian, Owens, and Slevin (1992). Preference assessments resulted in the identification of non-preferred foods that could be targeted during intervention and generalization probes, as well as high-preferred foods that could be used as potential reinforcers. Preference assessments were conducted at least 2 h before or after meals. Data were collected on the number of times each food was selected and consumed (defined as a clean mouth following food acceptance), which was then converted into a percentage by dividing the number of times each food was selected and consumed by the total number of times each food was presented. Non-preferred foods were defined as those foods selected and consumed less than 10% of trials, and high-preferred foods were defined as those foods selected and consumed more than 50% of trials.
Interobserver agreement (IOA) was calculated by dividing the number of agreements by the number of agreements plus disagreements and converting this ratio to a percentage. An agreement was defined as both observers circling the same food item during the same trial. A disagreement was scored if, for each trial, the food item circled differed across observers. Two trained independent observers collected data during 67% of the preference assessments. Mean IOA for child selection and consumption was 99%.

For Matt, three foods never chosen (chicken, cheese, and pasta) were targeted during baseline and intervention sessions. Eight foods never chosen (cookie, carrot, turkey, milk, string bean, ham, tomato, and pickle) were targeted during generalization probes. Three foods, chosen between 82 and 100% of opportunities (fruit snacks, Goldfish®, and pretzels), were identified as high-preferred foods and included in meal sessions.

For Jack, three foods never chosen (broccoli, pear, and pasta) were targeted during baseline and intervention sessions. Nine foods never chosen (carrot, black bean, avocado, egg, lettuce, apple, hot dog, peas, and corn) were targeted during generalization probes. Three foods, chosen between 73 and 100% of opportunities (Ruffles® potato chips, corn chips, and plain chips), were identified as high-preferred foods and included in meal sessions.

For Patrick, three foods never chosen (corn, turkey, and cheese) were targeted during baseline and intervention sessions. Ten foods chosen between 0 and 9% of opportunities (spaghetti, rice, applesauce, egg, apple, ham, carrot, peas, grape, and potato) were targeted during generalization probes. Three foods chosen between 55 and 91% of opportunities (cheese puffs, garlic bread, and peanut butter and jelly sandwich) were identified as high-preferred foods and included in meal sessions.

**Response Measurement and Data Collection**

**Baseline and Intervention**

Following the completion of the preference assessments, baseline and then intervention were initiated. Data were collected on frequency measures of child behaviors, including accepts, defined as the food passing the plane of the child’s lips, including instances in which the food was subsequently expelled; and mouth cleans, defined as no food remaining in the child’s mouth upon inspection, following food acceptance. Data were collected on the number of grams consumed, which was determined by recording the before-meal and after-meal weight of food, as well as the before-meal and after-meal weight of napkins or paper towels used during meals to wipe up expelled or vomited food and subtracting the latter from the prior weight. Finally, data were collected on the number of trials with inappropriate mealtime
behavior, defined as pushing food away, throwing food, negative vocalizations related to the food, expelling food, gagging, and vomiting.

Data were also collected on parent behaviors, including correct and incorrect implementation of antecedents and consequences associated with each experimental phase. During baseline, generalization probes, and Phases 1 and 2 of treatment, data were recorded on whether parents implemented the 3-step prompting sequence correctly (i.e., provided prompts in the correct sequence: verbal, model, physical); whether parents allowed their child to escape for 30 s contingent on inappropriate mealtime behavior (i.e., removed the food and turned away from the child for 30 s); and whether parents delivered high-preferred foods within 5 s of food being accepted or swallowed.

During Phase 3 of treatment, data were collected on correct implementation of the non-removal of the spoon procedure (whether the parent held the spoon within one inch from the child’s lips until the child accepted the bite or 30 min elapsed); whether parents ignored inappropriate mealtime behaviors (i.e., did not comment on the child’s behaviors or make eye contact with the child); whether parents prevented their child from escaping until 30 min had elapsed without food being accepted or swallowed; and whether parents delivered high-preferred foods following consumption of the bite requirement. During follow-up, data were collected on whether parents correctly implemented the antecedents and consequences associated with the last experimental phase their child had been exposed to.

Data on parent behaviors were converted into a percentage of procedural integrity by dividing correct implementation of antecedents and consequences by correct plus incorrect implementation of antecedents and consequences and multiplying by 100%.

Interobserver Agreement

During baseline, mothers were trained to collect data until achieving a minimum of 90% agreement with an investigator, across two consecutive feeding sessions. Once this criterion was met, mothers and investigators independently collected data on child behaviors (accepts, swallows, and inappropriate mealtime behavior) and grams consumed. Beginning with each experimental phase following baseline, mothers were considered trained following one feeding session during which a minimum of 90% agreement was achieved between mothers and investigators (one session with 90% agreement was considered sufficient since data collection on child behaviors during experimental phases did not differ from baseline). IOA for accepts, swallows, and inappropriate mealtime behavior was calculated on a trial by trial basis by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. IOA for grams consumed was calculated by dividing the
smaller value by the larger value and multiplying by 100%. When measuring grams, both observers looked at weight at the same time and then independently recorded the number of grams. For accepts, agreements were defined as both observers marking a plus (+) or minus (−) during the same trial; for swallows, an agreement was defined as both observers marking (+), (−), or not applicable (NA) during the same trial; for inappropriate mealtime behaviors, an agreement was defined as both observers marking (+) or (−) during the same trial. A disagreement was scored if the symbol marked by the two observers differed. Mothers and investigators independently collected data on child behaviors during 54% of sessions. Mean IOA for the number of accepts, swallows, grams consumed, and percentage of trials with inappropriate mealtime behavior was 99, 100, 100, and 97%, respectively.

Two independent observers collected IOA for procedural integrity measures during 40% of sessions during which procedural integrity data were collected. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Mean IOA for the 3-step prompting procedure, providing access to escape, the non-removal of the spoon procedure, ignoring inappropriate behavior, and providing reinforcement was 98, 100, 100, 99, and 100%, respectively.

**Intervention Training**

Parents were trained to conduct baseline, treatment, generalization probes, and follow-up sessions according to procedures described by Najdowski et al. (2010). As mentioned previously, training criteria consisted of two consecutive sessions of baseline performed with at least 90% accuracy. Beginning with each experimental phase following baseline, mothers were considered trained following one feeding session performed with at least 90% accuracy. Once these training criteria were met, parents were asked to conduct meals unsupervised and videotape either one or two meals per week. Investigators viewed videotaped sessions on a weekly basis, such that feedback on incorrectly implemented procedures could be provided.

**Experimental Design**

Effects of treatment components (described below) were evaluated in a multiple baseline across participants design. Generalization probes were conducted during each phase to assess the extent to which accepting and swallowing generalized to other non-preferred foods not targeted during treatment.
DRA + Escape Baseline

During baseline, mothers presented three non-preferred foods to each child. Non-preferred foods were rotated across trials. The number of trials was based on the mean number of bites the child was observed to consume across three meals consisting of preferred foods. Each child’s terminal bite requirement was based on this average. Parents used a 3-step prompting procedure (verbal, model, physical) when instructing their child to take a bite of food. If the child accepted or swallowed the bite of food, parents praised the child for doing so and delivered one bite of high-preferred food; this occurred within 5 s of food acceptance or swallowing. After the child was accepting bites of non-preferred food for three meals in a row, he was then required to swallow in order to receive a bite of high-preferred food. A fixed-ratio (FR)-1 schedule of reinforcement was employed throughout baseline. If, at any time during the 3-step prompting procedure, the child engaged in an inappropriate mealtime behavior or failed to accept the bite of non-preferred food within 5 s of the physical prompt, the child was allowed to escape from the non-preferred food for 30 s.

Phase 1: DRA + Escape + Bite Fading

During Phase 1, the bite requirement was decreased from baseline to a 1-bite requirement. As in baseline, parents used a 3-step prompting procedure when instructing the child to take a bite. If the child accepted or swallowed the non-preferred bite of food, parents praised their child for doing so and provided one bite of high-preferred food, and this marked the termination of the meal. If the child engaged in an inappropriate mealtime behavior at any time during the 3-step prompting procedure, the child was allowed to escape from the non-preferred bite of food for 30 s; this marked the termination of the meal. Non-preferred foods were rotated across meals.

Following three consecutive meals, during which the child accepted the bite of non-preferred food, the child was then required to swallow the bite of non-preferred food. One bite of high-preferred food was provided following swallows. Following three consecutive meals, during which the child swallowed the bite of non-preferred food without any expulsions, the number of bites presented increased by approximately 150% of the previous bite requirement. Bite requirements of non-preferred food increased according to the following sequence: 1-bite, 3-bites, 9-bites, 21-bites, and 51-bites, respectively (Najdowski et al., 2010). As bite requirements increased, high-preferred food continued to be delivered according to a FR-1 schedule. During the 3-bite requirement and all subsequent bite requirements, an equal number of each of the non-preferred foods was presented. If the child did not accept or swallow a bite
within at least three meals of the initiation of Phase 1, then Phase 2 (described below) was implemented.

**Phase 2: DRA + Escape + Bite Fading + Reinforcer Manipulation**

During Phase 2, the magnitude of reinforcement was manipulated. As mentioned above, the parent used a 3-step prompting procedure when instructing the child to take a bite. Initially, a plate of high-preferred foods (consisting of the terminal number of bites minus one) was provided contingent on the child accepting one bite of non-preferred food; this marked the termination of the meal. If the child engaged in an inappropriate mealtime behavior during the 3-step prompting procedure, the child was allowed to escape from the non-preferred food for 30 s, and this marked the termination of the meal. Following three consecutive sessions of the child accepting one bite of non-preferred food, the child was required to swallow the bite of non-preferred food in order to receive the plate of high-preferred food. Again, non-preferred foods were rotated across meals.

Following three consecutive meals of the child swallowing one bite of non-preferred food without any expulsions, the bite requirement was increased according to the bite fading procedure described above (Patrick only). In addition, the schedule of reinforcement was thinned according to the following sequence: FR 1, FR 3, FR 9, FR 21, and FR 51. Finally, the magnitude of high-preferred foods provided contingent upon swallowing non-preferred foods was decreased systematically. That is, the number of high-preferred bites of food delivered always equaled the difference between the terminal bite requirement and the current bite requirement. The magnitude of reinforcement continued to be thinned until the child reached his terminal bite requirement. When the child reached his terminal bite requirement, high-preferred foods (previously delivered contingent on swallowing non-preferred foods) were replaced with a dessert of the child’s choice. During the 3-bite requirement and all subsequent bite requirements, an equal number of each of the three non-preferred foods was presented. If the child did not accept or swallow a bite within at least three meals of the initiation of Phase 2 then Phase 3 (described below) was implemented.

**Phase 3: DRA + Bite Fading + Reinforcer Manipulation + Escape Prevention**

During this Phase, the non-removal of the spoon procedure was added, whereby the parent instructed the child to take a bite while holding a spoonful of food within 1 inch of the child’s lips. After the initial instruction to take a bite was presented, the parent did not interact with the child until the child had accepted or swallowed the bite of
food. As soon as the child opened his mouth, the bite of food was inserted. If the child expelled the food, the same bite was represented until the child accepted and swallowed the bite (once the requirement to swallow was introduced). If the bite was accepted or swallowed, praise was provided. The parent was instructed to provide no programmed consequences following inappropriate mealtime behaviors. Food acceptance, and subsequently swallowing, was reinforced under a progressive ratio schedule (i.e., FR 1, FR 3, FR 9, FR 21, and FR 51). Bite requirements were increased according to the bite fading procedure described above. Again, the magnitude of high-preferred foods was decreased systematically.

Initially, the child was provided with a plate of high-preferred food contingent on acceptance of one bite of non-preferred food. Following three consecutive meals of the child accepting one bite of non-preferred food, the child was provided with the plate of high-preferred food contingent on swallowing the non-preferred food. Following three consecutive meals of the child swallowing the bite of non-preferred food without any expulsions, bite fading, schedule thinning, and systematic decreases in the magnitude of reinforcement were introduced into the meals. These components were introduced as described previously.

**Generalization Probes**

Generalization probes were conducted prior to the start of each experimental phase to determine if the child would accept and/or swallow non-preferred foods identified during the paired stimulus preference assessment. Within experimental phases, generalization probes were conducted prior to increasing the bite requirement. During generalization probes, the same procedures employed during baseline were used; however, only swallows were reinforced. Generalization probes consisted of foods not targeted during the intervention and chosen 0% of opportunities during the preference assessment. Three different foods were presented three times each for a total of nine trials.

**Follow-up**

Once each child had met his terminal bite requirement for at least three consecutive sessions, without expulsions, follow-up sessions began, in which the parent was instructed to prepare a meal that consisted of one portion of a novel food and one to three portions of foods that were familiar to the child. The child was required to either eat the novel food first or eat one bite of the novel food followed by one bite of one of the more familiar foods, alternating until the entire meal had been consumed. Follow-up procedures approximated those procedures employed in the last treatment phase for each child. During follow-up, the child was offered dessert contingent on
consumption of the entire meal on an intermittent schedule. Praise, however, was always provided contingent on consumption of the entire meal. Follow-up data were collected 2, 4, 6, and 12 weeks following completion of the intervention.

**Satisfaction Questionnaire**

Following the last session of treatment, a satisfaction questionnaire was given to the parent. The questionnaire was a brief version of that developed by Hoch, Babbitt, Coe, Krell, and Hackbert (1994), in that only five of the original 20 questions were included. Parents were instructed to fill out the questionnaire and then put it in a sealed envelope (provided by the investigators) with their signature on the seal. Parents were told that the envelope would be given to the director of NCSBP without the seal being broken.

The full-length version of the parent satisfaction questionnaire developed by Hoch et al. (1994) was given to parents at the end of the last follow-up visit. Parents were instructed to complete the questionnaire in the same manner described above.

Both versions of the questionnaire consisted of questions that were rated using a 1–5 Likert scale, with a score of 1 indicating dissatisfaction and a score of 5 indicating complete satisfaction. A measure of satisfaction was obtained by dividing the sum of the scores for each question by the highest possible score.

**RESULTS**

**Child Behaviors**

Figure 1 depicts the number of accepts and swallows during baseline, treatment components, generalization probes, and follow-up for Matt in the top panel, Jack in the middle panel, and Patrick in the bottom panel.

**Matt:** During the DRA combined with escape baseline, Matt accepted all three non-preferred foods (chicken, cheese, and pasta); however, once he was required to swallow the number of accepts quickly decreased to zero. Matt never swallowed any bites of non-preferred food during baseline.

During Phase 1 of treatment (DRA + escape + bite fading), when the bite requirement was decreased from baseline to a 1-bite requirement, there was a temporary increase in accepts; however, once Matt was required to swallow in order to obtain reinforcement, accepts decreased to zero. No bites were ever swallowed during Phase 1 of treatment. Consequently, Phase 2 of treatment (DRA + escape + bite fading + reinforcer manipulation) was implemented, during which the magnitude of reinforcement was increased to an entire plate of high-preferred...
Figure 1. Number of accepts and swallows for Matt (top panel), Jack (middle panel), and Patrick (bottom panel) during baseline, treatment components, generalization probes, and follow-up sessions. The black triangles depict the number of accepts, the gray circles depict the number of swallows, and the disconnected black triangles and open circles depict the number of accepts and swallows during generalization probes. The numbers along the top of each graph indicate the bite requirements.
foods (the number of high-preferred bites of food equaled the difference between the terminal bite requirement and the current bite requirement). In Phase 2 of treatment, there was a temporary increase in accepts following four sessions with no accepts or swallows; however, when Matt was required to swallow, accepts decreased back to zero. No bites of non-preferred food were ever swallowed during this phase. As a result, Phase 3 of treatment (DRA + bite fading + reinforcer manipulation + escape prevention) was implemented. During Phase 3, Matt began accepting non-preferred foods immediately, and he began swallowing beginning with the fourth meal. There were a number of sessions during this phase with a high number of accepts, indicating that high levels of expulsions were observed, before Matt consistently began accepting and swallowing non-preferred foods. Matt eventually reached his terminal goal of 51 bites without expulsions. Other than a few expulsions during the 2-week and 4-week follow-up sessions, these results were maintained.

With respect to generalization, Matt began accepting and swallowing some of the bites of non-preferred food presented subsequent to baseline. Subsequent to Phase 1 of treatment, Matt accepted two out of the nine bites of non-preferred foods that were presented but did not swallow any of the bites. Subsequent to Phase 2 of treatment and the 1-bite requirement of Phase 3, Matt did not accept or swallow any of the bites of non-preferred foods that were presented during generalization probes. Subsequent to the 3-bite requirement of Phase 3, Matt again began accepting and swallowing some of the bites of non-preferred foods that were presented.

Jack: During the DRA combined with escape baseline, Jack accepted all three non-preferred foods (broccoli, pasta, and pear). When the requirement to swallow was introduced, Jack stopped accepting the pasta and the pear, but continued accepting the broccoli; however, no bites were ever swallowed during baseline.

During Phase 1 of treatment (DRA + escape + bite fading), when the bite requirement was decreased from baseline to a 1-bite requirement, Jack never accepted or swallowed any bites of non-preferred food. Consequently, Phase 2 of treatment (DRA + escape + bite fading + reinforcer manipulation) was implemented, during which the magnitude of reinforcement was increased to an entire plate of high-preferred foods. During Phase 2, Jack accepted the broccoli but not the pasta or the pear; when the requirement to swallow was introduced, Jack continued to accept the broccoli; however, no bites were ever swallowed. Therefore, Phase 3 of treatment (DRA + bite fading + reinforcer manipulation + escape prevention) was implemented, consisting of the non-removal of the spoon procedure. During Phase 3, Jack began accepting all three non-preferred foods and began swallowing beginning with the fourth meal. There were a few sessions during the 9-bite and 21-bite requirements with a high number of accepts, indicating that, similar to Matt, high levels of expulsions were observed before Jack consistently began accepting and swallowing...
non-preferred foods. Jack eventually reached his terminal goal of 51 bites without expulsion. These results were maintained during follow-up sessions.

With respect to generalization, Jack began accepting and swallowing some bites of non-preferred food presented subsequent to the 1-bite requirement of Phase 3, and he began accepting and swallowing all bites of non-preferred food presented subsequent to the 9-bite requirement of Phase 3.

**Patrick:** During the DRA combined with escape baseline, Patrick never accepted or swallowed any bites of the three non-preferred foods (turkey, corn, and cheese).

During Phase 1 of treatment (DRA + escape + bite fading), when the bite requirement was decreased from baseline to a 1-bite requirement, there was one session during which Patrick swallowed a bite of cheese (Session 2) and one session during which Patrick accepted a bite of corn (Session 6). With the exception of the one bite of cheese being swallowed during Session 2, no other bites of non-preferred food were swallowed during this phase. Consequently, Phase 2 of treatment (DRA + escape + bite fading + reinforcer manipulation) was implemented. During Phase 2, when the magnitude of reinforcement was increased to an entire plate of high-preferred foods, Patrick began consistently accepting and swallowing non-preferred foods beginning with the seventh session. As a result, Phase 3 of treatment (DRA + bite fading + reinforcer manipulation + escape prevention), consisting of the non-removal of the spoon procedure, was not necessary. Patrick quickly reached his terminal goal of 21 bites without expulsion. These results were maintained during follow-up sessions.

With respect to generalization, Patrick began accepting and swallowing some bites of non-preferred food presented during the generalization probe subsequent to baseline, but then did not accept or swallow any bites of non-preferred foods presented during the generalization probe subsequent to Phase 1 of treatment. Subsequent to the 1-bite requirement of Phase 2, Patrick again began accepting and swallowing either all or some of the bites of non-preferred food that were presented.

Figure 2 depicts the mean percentage of trials with inappropriate mealtime behaviors during baseline, treatment components, and follow-up sessions for Matt in the top panel, Jack in the middle panel, and Patrick in the bottom panel.

**Matt:** The mean percentage of trials during which Matt engaged in inappropriate mealtime behaviors during baseline and Phases 1 and 2 of treatment was 100%. The mean percentage of trials during which Matt engaged in inappropriate mealtime behaviors during the 1-bite requirement of Phase 3 was 94%. Inappropriate mealtime behaviors began to decrease beginning with the 3-bite requirement of Phase 3 ($M = 26\%$) and continued to decrease with each subsequent increase in bite requirements. The mean percentage of trials during which Matt engaged in inappropriate mealtime behaviors during follow-up was 2%.
Jack: The mean percentage of trials during which Jack engaged in inappropriate mealtime behaviors during baseline and Phases 1 and 2 of treatment was 100%. Inappropriate mealtime behaviors began to decrease beginning with the 1-bite requirement of Phase 3 ($M = 63\%$) and continued to decrease with each subsequent
increase in bite requirements. The mean percentage of trials during which Jack engaged in inappropriate mealtime behaviors during follow-up was 1%.

**Patrick:** The mean percentage of trials during which Patrick engaged in inappropriate mealtime behaviors during baseline and Phase 1 of treatment was 100 and 83%, respectively. Inappropriate mealtime behaviors began to decrease beginning with the 1-bite requirement of Phase 2 ($M = 44\%$). Following the 1-bite requirement of Phase 2, the mean percentage of trials during which Patrick engaged in inappropriate mealtime behaviors decreased to zero (during the 3-bite, 9-bite, and 21-bite requirements). The mean percentage of trials during which Patrick engaged in inappropriate mealtime behaviors remained at zero during follow-up.

Figure 3 depicts the mean number of grams consumed during follow-up for Matt, Jack, and Patrick. Although data are not depicted in the graph, all three children consumed zero grams during baseline. The number of grams consumed increased starting with the 1-bite requirement of Phase 2 for Patrick and the 1-bite requirement of Phase 3 for Matt and Jack. Number of grams consumed continued to increase with each subsequent increase in bite requirements for all three children. The mean number of grams consumed ranged from 56 to 100 during follow-up. It should be noted that the large difference in number of grams consumed by Patrick versus by Matt and Jack is directly related to the number of bites of food that were presented to each of the children during follow-up. While Patrick’s mother continued to present him with
exactly 21 bites of food, Matt and Jack were provided with amounts of food that were well beyond their terminal bite requirements used during treatment.

**Parent Behaviors**

Mandy demonstrated a mean of 100% procedural integrity with a range of 98 to 100% across experimental phases; Leslie demonstrated an overall mean of 99% procedural integrity, with a range of 93 to 100% across experimental phases; and Barbara demonstrated an overall mean of 96% procedural integrity, with a range of 88 to 100% across experimental phases.

**Satisfaction Questionnaires**

For all three mothers, the satisfaction scores post-treatment were 100%. The satisfaction scores post-follow-up were 95% for Mandy, 98% for Leslie, and 100% for Barbara. On a 1–5 Likert scale, with 1 meaning quite dissatisfied and 5 meaning extremely satisfied, Mandy marked 5 for all but three questions, two of which were scored 3 and one of which was scored 4. Leslie marked 5 for all but two questions which were both scored 4. Both Mandy and Leslie indicated that the implementation of the treatment program did not entirely reduce other behavior problems and their child’s problems with respect to eating were not entirely absent at the time of discharge. In addition, Mandy scored a 3 in response to observed improvements in her child’s health.

**DISCUSSION**

Results of this study indicated that for one participant (Patrick), food consumption increased during Phase 2 of treatment, when the magnitude of reinforcement was increased without an escape prevention component; these results suggest that for some children, a less intrusive intervention may be effective in increasing food consumption of non-preferred foods. In contrast, food consumption for Matt and Jack did not increase until after escape prevention, in the form of a non-removal of the spoon procedure, was introduced. Previous research has suggested that escape prevention is a necessary component in the treatment of food refusal (e.g., Patel et al., 2002; Piazza et al., 2003). Although food consumption did not increase until after escape prevention was introduced for Matt and Jack, it is possible that an increase in food consumption would have been observed without the use of escape prevention had food intake been limited to treatment meals. In comparison to children with food refusal who often have inadequate intake to sustain growth and may not display
hunger even after extended periods of time without food, children with food selectivity often have adequate intake to maintain growth in spite of the limited number of foods they will consume. As such, treatment components such as bite fading and DRA may be effective in increasing food consumption when combined with appetite manipulation (i.e., restricting intake of food to treatment meals).

Discrepancies between results for Patrick and results for Matt and Jack may be attributed to differences in participant characteristics. Specifically, both Matt and Jack were enrolled in public schools, whereas Patrick was receiving early intervention services that utilized discrete trial instruction. Because feeding sessions in some ways resembled discrete trial instruction, it is possible that Patrick did not require escape prevention due to his history of exposure to this type of instruction and the use of escape prevention during academic work.

Another possibility is that the high-preferred foods that were used during treatment did not function as reinforcers for Matt and Jack. High-preferred foods were selected based on the percentage of trials they were chosen and consumed during preference assessments. However, preference for a particular item does not necessarily mean the item will function as a reinforcer, especially when the individual is being instructed to engage in a high-effort response (Roane, Lerman, & Vorndran, 2001). Vollmer and Iwata (1992) suggested that in order for an arbitrary reinforcer to be effective, it has to be more powerful than the reinforcer that controls problem behavior (i.e., the functional reinforcer). For Matt and Jack, high-preferred foods may not have been very potent relative to escape as a reinforcer. It is possible that another form of positive reinforcement (e.g., leisure items or activities) would have been effective in increasing food consumption without the use of escape prevention. Future investigators should conduct reinforcer assessments comparing edible items and leisure items prior to selecting a particular modality of reinforcement to use during the treatment of a feeding disorder. Investigators should also consider conducting reinforcer assessments comparing positive and negative reinforcers in an effort to identify positive reinforcers that will effectively compete with escape (Piazza et al., 2003). Identification of the most potent reinforcers may prevent clinicians from having to implement more intrusive procedures such as escape prevention.

Food consumption did not increase under baseline conditions consisting of DRA combined with escape; however, an increase in food acceptance was observed. A DRA procedure in which only one bite of high-preferred food is delivered may be effective in increasing responses that do not require much effort (food acceptance) but may not be effective for responses that are more effortful (chewing and swallowing food).

In a study conducted by Kerwin et al. (1995), food acceptance decreased as the volume of food was increased. In other words, as the response requirement was increased, the reinforcer lost its potency. Based on these findings, it may be the case
that providing one bite of high-preferred food following acceptance is reinforcing, whereas providing one bite of high-preferred food after the child swallows the non-preferred food is not reinforcing. This conclusion is supported by the fact that increased food consumption did not occur when the demand requirement (in Phase 1) was decreased from baseline to a 1-bite requirement; while participants were only presented with one bite of non-preferred food during this phase, access to one bite of high-preferred food was contingent upon swallowing the bite. For Patrick, food consumption was observed when the magnitude of reinforcement was increased in Phase 2. This suggests that while swallowing a bite of non-preferred food may not be worth receiving one bite of high-preferred food, it may be worth receiving an entire plate of high-preferred foods.

If treatment success can be achieved without the use of intrusive procedures, such as escape prevention, then negative side effects associated with such procedures can be reduced or eliminated. The reduction of negative side effects, including extinction bursts, extinction-induced aggression, and other forms of emotional responding (Lerman, Iwata, & Wallace, 1999), may prevent families from forgoing treatment due to the amount of response effort involved. Although research has demonstrated that negative side effects associated with escape prevention are less severe when escape prevention is combined with a reinforcement procedure (e.g., Piazza et al., 2003), there is no guarantee that side effects associated with escape prevention will be eliminated completely. Hence, for milder forms of feeding disorders, such as food selectivity, consideration should be given to the least intrusive intervention.

Nevertheless, because escape prevention is commonly used in the treatment of feeding disorders, future investigators should continue to evaluate techniques that can be used to reduce side effects associated with extinction. In the current study, escape prevention was implemented in conjunction with positive reinforcement and bite fading, both of which are procedures that have been suggested to decrease negative side effects associated with escape prevention (Kerwin, 1999). In spite of using these techniques, however, high levels of expulsions were observed for both Matt and Jack during Phase 3 of treatment, when the non-removal of the spoon procedure was in effect.

It should be noted that Figure 2, depicting the mean percentage of trials with inappropriate mealtime behaviors, does not provide an accurate representation of the extinction bursts that occurred when the non-removal of the spoon procedure was implemented. Figure 2 indicates that the mean percentage of trials with inappropriate mealtime behaviors during baseline and Phases 1 and 2 of treatment (when escape was provided contingent on inappropriate mealtime behaviors) was 100% for both Matt and Jack; the mean percentage of trials with inappropriate mealtime behaviors decreased when Phase 3 was implemented (non-removal of the spoon procedure), and
continued to decrease with each subsequent increase in bite requirements. Hence, it appears as though less problem behavior was observed during the non-removal of the spoon procedure, relative to the problem behavior observed during the initial phases of treatment.

While the actual percentage of trials with inappropriate mealtime behaviors was higher during baseline and Phases 1 and 2 of treatment, anecdotal information suggests that the intensity of problem behavior was much greater during Phase 3 of treatment. Furthermore, the topography of inappropriate mealtime behaviors observed during baseline and Phases 1 and 2 of treatment differed from the topography of inappropriate mealtime behavior observed during Phase 3 of treatment. For example, during the initial stages of treatment, Matt and Jack would engage in inappropriate mealtime behaviors such as pushing the food away and negative vocalizations related to the food (e.g., ‘No, it’s yucky’), whereas, in Phase 3 of treatment, the topography of inappropriate mealtime behaviors observed, included expelling food, gagging, vomiting, aggression, and food-related screaming and crying. Because the investigators did not take data on varying topographies of inappropriate mealtime behaviors across experimental phases, this difference is not evident when examining data on inappropriate mealtime behaviors. Future researchers should examine changes in the topography and intensity of inappropriate mealtime behavior across various treatment components.

In summary, the current study describes a method for sequentially introducing treatment components based on how participants respond to the intervention. Few studies have demonstrated the implementation of feeding interventions in home settings. While escape prevention has been demonstrated to be effective in increasing food consumption, parents may be averse to using this procedure given the negative side effects that can result. The present study provides a model that would allow parents to implement a feeding intervention in which they attempt less intrusive components before employing more restrictive components such as escape prevention or before seeking the help of a professional. Future researchers may consider evaluating the efficacy of providing parents with decision rules detailing when additional components should be added to an intervention.

REFERENCES


