Spring 5-5-2018

A Comparison of Function- and Nonfunction-Based Extinction for Inappropriate Mealtime Behavior

Caitlin Kirkwood
University of Nebraska Medical Center

A COMPARISON OF FUNCTION- AND NONFUNCTION-BASED EXTINCTION FOR INAPPROPRAITE MEALTIME BEHAVIOR

By

CAITLIN ANNE KIRKWOOD

A DISSERTATION

Presented to the Faculty of

the University of Nebraska Medical Center

in Partial Fulfillment of the Requirements

for the Degree of Doctor of Philosophy

Medical Sciences Interdepartmental Area Graduate Program

(Applied Behavior Analysis)

Under the Supervision of Professor Cathleen C. Piazza

University of Nebraska Medical Center

Omaha, Nebraska

May 2018

Supervisory Committee:

Kathryn M. Peterson, Ph.D. Wayne W. Fisher, Ph.D.

Amanda N. Zangrillo, Ph.D.

ACKNOWLEDGEMENTS

My parents, Cindy and Craig, who work tirelessly to provide my siblings and me with the love and support needed to accomplish our professional and personal goals. From letters to texts to phone calls, they have been with me through every step of the dissertation process, and every accomplishment is a reminder of their unconditional love. I am forever grateful for their guidance and assistance from day one of my doctoral program.

My siblings, Nicole and Eric, who have been there for me every step of the way. Their advice, support, humor, and love lifted my spirits and kept me motivated to finish any task I started. Love truly knows no distance. My aunts and uncles, who were always available for a quick call or funny story. My cousins, who continuously remind me of the importance of my work with children. My grandparents, Judy and Frank, whose faith in my passion to help others has served an instrumental role in my accomplishments. I dedicate this project to my grandmother, Judy Kristoff. She was truly the center of our family and a source of unconditional love.

Dr. Piazza, my mentor, who will forever hold a very dear place in my life. Her passion for and dedication to the children and families we serve is remarkable. Her contributions to the field of applied behavior analysis is unmatched and has forever changed the lives of people all around the world, including mine. I am incredibly fortunate that she took me under her wing and shaped my behavior to grow as a scientist-practitioner and as a person. She expanded my ability to help children with feeding disorders and encouraged me to view everything as a learning opportunity.

Dr. Peterson, who supported me from the beginning. Her intelligence, guidance, and kindness were essential to my time in the program, both professionally and personally. She has truly been a second mentor to me, and will be with me in all my future endeavors.

My feeding family at the University of Nebraska Medical Center's Munroe-Meyer Institute's Pediatric Feeding Disorders Program, who assisted me with this study. I am especially thankful for my fellow doctoral students, Jaime Crowley, Sarah Haney, and Vivian Ibañez, who became some of my best friends and colleagues. Thanks to all of the families who allowed me to work with their children and celebrate their feeding milestones.

A COMPARISON OF FUNCTION- AND NONFUNCTION-BASED EXTINCTION FOR INAPPROPRAITE MEALTIME BEHAVIOR

Caitlin A. Kirkwood, Ph.D.

University of Nebraska Medical Center, 2017

Supervisor: Cathleen C. Piazza, Ph.D.

Previous literature supports the use of a functional analysis to prescribe treatment for children with feeding disorders (Bachmeyer et al., 2009; Piazza, Fisher, et al., 2003). Nevertheless, clinicians often train caregivers to use healthy contingencies, independent of whether those contingencies are function based. We do not know, however, whether including nonfunction-based contingencies differentially affects inappropriate mealtime behavior. In the current study, we observed that caregivers of 3 children with feeding disorders provided escape from bites and drinks and attention following inappropriate mealtime behavior. Results of a functional analysis showed escape from bites or drinks, but not attention, reinforced inappropriate mealtime behavior. We then tested the effects of escape extinction when the feeder either delivered or withheld attention following inappropriate mealtime behavior. Inappropriate mealtime behavior decreased and acceptance increased when the feeder implemented escape extinction independent of whether he or she delivered or withheld attention. We discuss implications of including nonfunction-based components in treatment for pediatric feeding disorders.

keywords: attention, escape extinction, function-based treatment, negative reinforcement, pediatric feeding disorders

TABLE OF CONTENTS

LIST OF FIGURES

Effects of Environmental Events on Inappropriate Mealtime Behavior

Understanding the effects of environmental events on inappropriate mealtime behavior may be helpful in the development of effective, efficient, and specific interventions for children with feeding disorders (Bachmeyer et al., 2009; Iwata, Dorsey, Slifer, Bauman & Richman, 1982/1994; Piazza, Fisher, et al., 2003). To this end, functional analyses are useful for identifying the reinforcers maintaining inappropriate mealtime behavior (e.g., Bachmeyer et al., 2009; Borrero, England, Sarcia, & Woods, 2016; Girolami & Scotti, 2001; Nadjowski, Wallace, Doney, & Ghezzi, 2003; Piazza, Fisher, et al., 2003), and researchers have used functional-analysis results to develop function-based extinction procedures to treat pediatric feeding disorders (e.g., Allison et al., 2012; Bachmeyer et al., 2009; Bachmeyer, Kirkwood, Criscito, Mauzy, & Berth, in press, LaRue et al., 2011; Najdowski, Wallace, Doney, & Ghezzi, 2003). Bachmeyer et al. (2009) used a functional analysis to determine that the inappropriate mealtime behavior of four children with a feeding disorder was maintained by escape from bites or drinks and adult attention. Bachmeyer et al. then evaluated the effects of variations of extinction that matched one or both functional reinforcers for inappropriate mealtime behavior. The feeder implemented (a) escape extinction, but provided attention following inappropriate mealtime behavior in one condition; (b) attention extinction, but provided escape following inappropriate mealtime behavior in another condition; and (c) escape extinction and attention extinction in a third condition. Results showed that variations of extinction that discontinued delivery of the reinforcers for inappropriate mealtime behavior identified by the functional analysis, escape and attention, were necessary to reduce inappropriate mealtime behavior to clinically acceptable rates and to increase acceptance to high stable levels.

We wondered whether outcomes would be similar if inappropriate mealtime behavior was maintained by a single reinforcement contingency because outcomes from functional-analysis studies have shown that negative reinforcement in the form of escape from bites or drinks is identified often as a reinforcer for inappropriate mealtime behavior. For example, Piazza, Ibañez, Ney, Kirkwood, and Crowley (2017) analyzed data from 38 functional analyses of inappropriate mealtime behavior and found that escape from bites or drinks, but not attention, functioned as reinforcement for inappropriate mealtime behavior for 35% of children. Escape and attention functioned as reinforcement for inappropriate mealtime behavior for over 50% of children. Attention never functioned as the only

reinforcer for inappropriate mealtime behavior. Thus, the variation of extinction that targets negative reinforcement in the form of escape from bites or drinks is the indicated treatment for about one-third of children with feeding disorders. Would delivering or withholding attention following inappropriate mealtime behavior differentially affect treatment outcomes for these children?

Function-Based Treatments for Inappropriate Mealtime Behavior

The answer to this question is important because clinicians often recommend so-called "healthy contingencies" for children with problem behavior, which potentially include contingencies that are not function based (St. Peter & Marsteller, 2017). For example, a clinician might train a caregiver to "ignore" problem behavior even though results of a functional analysis show that attention did not function as reinforcement. This practice is potentially problematic for several reasons. First, adding nonfunction-based contingencies increases the complexity of treatment (Fisher, Greer, Romani, Zangrillo, & Owen, 2016). Training a caregiver to implement a contingency that is not function-based may waste time and energy that the clinician could allocate to training a function-based treatment and may undermine the credibility of the clinician if the nonfunction-based contingency has no effect on behavior. Second, researchers have shown that caregivers have difficulty withholding reinforcement for problem behavior. For example, Addison and Lerman (2009) taught teachers to withhold reinforcement following problem behavior during a 5-day training program. Nevertheless, teachers provided reinforcement following problem behavior after training. Similarly, Miller, Lerman, and Fritz (2010) showed that attention delivery following problem behavior was resistant to extinction for some participants in an analog study. That is, participants continued to provide attention following problem behavior even though attention had no effect.

No studies to our knowledge have examined the effects of variations of extinction[1] for inappropriate mealtime behavior that are not function based. Iwata, Pace, Cowdery, and Miltenberger (1994) showed that the self-injurious behavior (SIB) of three participants decreased only when the therapist implemented the variation of extinction that discontinued delivery of the reinforcer for SIB identified by the functional analysis. For example, sensory extinction, but not escape or attention

[1] Like Iwata, Pace, et al. (1994), we used the term attention extinction to reduce confusion, even though in this case, withholding attention following inappropriate mealtime behavior did not function as extinction.

extinction, reduced SIB for the participant whose functional analysis showed that SIB was automatically reinforced. Self-injurious behavior decreased to low levels when the therapist implemented sensory extinction even though he or she continued to deliver escape and attention following SIB.

In the current investigation, we evaluated a variation of the Iwata, Pace, et al. (1994) procedure with children diagnosed with a feeding disorder. We identified children whose functional analyses showed that inappropriate mealtime behavior was maintained by escape from bites or drinks but not by attention. The feeder provided escape and attention following inappropriate mealtime behavior in the baseline of the treatment evaluation. The feeder then implemented escape extinction in the form of nonremoval of the spoon or cup and either provided or withheld attention following inappropriate mealtime behavior. We assessed caregiver preference for escape extinction with or without attention following inappropriate mealtime behavior after we completed the treatment evaluation.

Method

Participant Recruitment

We recruited children from the Pediatric Feeding Disorders Program at the University of Nebraska Medical Center's Munroe-Meyer Institute. We asked clinicians who identified children in any clinic in the program who fit the inclusion criteria to describe the investigation to the caregiver(s). The clinician explained that the caregiver's decision regarding his or her child's participation would not impact the child's clinical status in the program. The clinician informed interested caregivers that the primary investigator would contact him or her.

A member of the research team met with the caregiver, verified the child met the inclusion criteria, and reviewed the assessment and treatment protocols. We reiterated that the caregiver's decision about investigation participation would not affect the child's clinical status in the program. We reviewed the consent form, asked the caregiver to read and sign it, and kept a copy and gave a copy to the caregiver if the caregiver(s) consented for his or her child to participate. We thanked the caregiver for his or her time if he or she did not choose for his or her child to participate.

Inclusion and Exclusion Criteria

The inclusion criteria for the investigation were children between the ages of 8 months and 10 years who consumed less than 80% of caloric needs by mouth and consumed less than 20 foods; who were safe oral feeders based on an assessment by an interdisciplinary team, by a speech and language pathologist, or a by physician; and for whom a functional analysis identified only escape as reinforcement for inappropriate mealtime behavior. Exclusion criteria included children for whom expulsion (i.e., food or liquid larger than a pea exiting the child's mouth past the plane of the child's lips) or packing (i.e., holding 80% or more of presentations of food or liquid in the mouth without swallowing) emerged and did not resolve during their clinical course of treatment (i.e., five consecutive sessions with 80% or more expelled or packed bites or drinks); who consumed food in baseline; who did not meet the inclusion criteria; or whose medical problems or other treatments would interfere with investigation participation.

Participants, Setting, Materials, and Session Schedule

Jerry was a 3-year-old male with autism spectrum disorder, bronchopulmonary dysplasia, and a history of prematurity. His feeding history included dysphagia, food refusal, gastrostomy-tube dependence, and vomiting. He received 100% of his calories via gastrostomy-tube feedings of Pediasure 1.5 (180 mL at 1:00 a.m., 5:00 a.m., 10:00 a.m., 4:00 p.m., and 8:00 p.m.). Jerry had received 5 months of services with a speech and language pathologist with minimal improvements in oral feeding. Sara was a 5-year-old female with apnea of prematurity, bronchopulmonary dysplasia, pneumonia, and vocal-cord paralysis. Her feeding history included aspiration, dysphagia, gastrostomy-tube dependence, low oral intake, and vomiting. She received 90% of her calories via gastrostomy-tube feedings of Vanilla Boost Kid Essentials 1.5 (4 oz. at 3:00 p.m. and 12 oz. at 10:00 p.m.) and consumed a bowl of cereal each morning. Sara had received 24 months of early intervention and 7 months of services from a speech and language pathologist with no improvement in oral feeding. Vicky was a 3-year-old female with a history of liver and small bowel transplant and prematurity. Her feeding history included jejunostomy-tube dependence, low oral intake, and milk intolerance. She received 90% of her calories via jejunostomy-tube feedings from a mixture of Nutren Jr. with Fiber and water (990 mL from 8:00 a.m. to 2:00 p.m. and 770 mL from 5:30 p.m. to 10:00 p.m.). Vicky had received 24 months of early intervention with no improvement in oral feeding.

We conducted the investigation at a pediatric feeding disorders clinic. Children attended the day-treatment feeding program Monday through Friday from 9:00 a.m. to 5:00 p.m. We conducted meals in individual 4 m x 4 m rooms equipped with food trays, gloves, hand sanitizer, one-way observation and sound, paper towels, spoons, a scale, timers, and weight-appropriate seating (e.g., high chair) in which the child sat during sessions.

Each child followed an individualized daily meal schedule in which we conducted multiple, consecutive sessions within each meal. Meals for the current investigation were 40 min in length and occurred at 10:40 a.m., 12:00 p.m., and 3:40 p.m. for Jerry; 9:00 a.m., 11:40 a.m., and 3:30 p.m. for Sara's solid meals; 10:20 a.m. and 2:10 p.m. for Sara's liquid meals; and 11:00 a.m., 12:20 p.m., and 4:00 p.m. for Vicky.

We asked caregiver(s) to select 16 target foods the child did not eat currently, four foods from each of the food groups of fruits, grains, proteins, and vegetables, based on the recommendations of a dietician. Sara consumed eight of the 16 caregiver-selected foods during initial assessment. Therefore, we used the eight foods she did not consume in the current study.

Observer Training, Dependent Variables, Reliability, and Procedural Integrity

Observer training. Feeders, observers, and therapist were individuals with bachelor's, master's, or doctoral degrees in behavior analysis, psychology, or related fields. We trained observers before the investigation to collect data with greater than 80% interobserver agreement for three consecutive live sessions. We planned to conduct retraining if interobserver agreement decreased to below 80% for three consecutive sessions; however, no observers met the criterion for retraining.

Dependent variables. Observers sat in the session or observation room. Observers used a checklist to collect data during the home baseline and the DataPal 1.0 program (Bullock, Fisher, & Hagopian, 2017) to collect data on laptop computers during the standard outcome baseline, functional analysis, and treatment evaluation.

The home baseline checklist contained instructions for the observer to record (a) which caregivers were present; (b) presented foods, food texture, and food amount; (c) presented liquid, liquid viscosity, and liquid amount; (d) child appropriate (e.g., acceptance) and inappropriate mealtime (e.g., head turns) behavior; and (e) caregiver responses (e.g., reprimands, statements of concern) that occurred within 3 s of child inappropriate mealtime behavior. Observers checked the boxes on the

checklist that corresponded to their observations. For example, the observer checked the box next to "reprimands" and "loud" under caregiver behavior if he or she observed the caregiver deliver reprimands in a voice above conversational level within 3 s of child inappropriate mealtime behavior.

Observers scored the frequency of incorrect attention and escape during the standard outcome baseline. *Incorrect attention* occurred when the caregiver provided attention in the form of coaxing, reprimands, statements of comfort or concern, or threats within 3 s of inappropriate mealtime behavior (Borrero, Woods, Borrero, Masler, & Lesser, 2010). *Escape* occurred when the caregiver moved the utensil 2.5 cm from the child's lips during nonself-feeding sessions or when the caregiver moved the utensil out of the child's reach in self-feeding sessions. We examined the raw data, which displays the data second by second, and recorded the occurrence or nonoccurrence of incorrect attention, escape, or both following each instance of inappropriate mealtime behavior. We calculated percentage of incorrect attention and percentage of escape separately after dividing the occurrences of incorrect attention and the occurrences of escape, respectively, by the frequency of inappropriate mealtime behavior.

We report the data for inappropriate mealtime behavior for the functional analysis and treatment evaluation. We report the data for acceptance and mouth clean for Jerry and Sara for the treatment evaluation, and we used the number of presentations to calculate percentage of bites or drinks accepted. Observers scored *inappropriate mealtime behavior* only when the bite or drink was within arm's reach of the child. Inappropriate mealtime behavior included head turning and batting at or blocking the utensil. A head turn occurred when the child (a) moved the middle of the mouth 45° in any direction relative to the utensil; (b) changed the direction of the mouth or movement paused for 1 s or more and the middle of the mouth moved another 45° in any direction relative to its previous position; or (c) moved the head back and away from the utensil, defined as moving the head 2.5 cm along a horizontal plane in a direction opposite the utensil. A bat occurred when the child's hand, arm, or anything in the child's hand touched the utensil, food, or liquid or the arm or hand or anything in the hand the feeder was using to implement the procedure. Observers scored additional bats when the child engaged in a bat then moved his or her arm, hand, or anything in his or her hand more than 1 cm away from the utensil, food, or liquid or the arm or hand or anything in the hand the feeder was using to implement the procedure and then met the criterion for bat again. Observers scored a block when

the child's hand, arm, or anything in the child's hand was within 2.5 cm of his or her own mouth. Observers scored additional blocks when the child engaged in a block then moved his or her arm, hand, or anything in his or her hand more than 1 cm away from his or her mouth and then met the criterion for block again.

A presentation occurred when the feeder touched the child's lips at midline with the utensil, not including touching the child's lips during re-presentation. Observers scored *acceptance* when the child (a) opened his or her mouth or leaned forward in the absence of crying, screaming, whining, yelling, or making negative or refusal statements about the food, liquid, or mealtime context *or* (b) opened his or her mouth *and* leaned forward in the presence of crying, screaming, whining, yelling, or making negative or refusal statements, and the entire bite or drink except for a pea-sized amount passed the plane of the wet vermillion within 5 s of the bite or drink presentation, not including bites or drinks that entered the mouth during re-presentation. Observers had one potential opportunity to score mouth clean for Jerry and Sara for each bite or drink that entered the child's mouth. Observers scored *mouth clean* when there was no food or liquid larger than a pea in the child's mouth at the mouth-clean check, which occurred 30 s after the bite or drink entered the mouth initially, not including when the bite or drink entered the mouth during re-presentation. Observers did not score mouth clean if the absence of food or liquid in the mouth was due to expulsion. Observers did not score mouth clean for Vicky because she always swallowed the bites that she accepted during the initial assessments.

We converted the occurrences of acceptance and mouth clean to a percentage after dividing the occurrences of acceptance or mouth clean by the number of bite or drink presentations or bite or drinks that entered the child's mouth, respectively. We converted the frequency of inappropriate mealtime behavior to responses per minute by dividing the number of inappropriate mealtime behaviors during the session by the length of time the utensil was in arm's reach of the child.

Procedural integrity. Observers scored the duration of *correct utensil placement* during escape extinction with and without attention by activating a duration key and leaving the key "on" as long as the feeder (a) presented the utensil by touching it to the child's lips at the designated interval, (b) held the utensil touching the child's lips until the feeder could deposit the bite or drink into the child`s mouth or the time-cap elapsed, (c) re-presented with the utensil within 3 s of an expulsion, and

(d) removed the utensil immediately after the bite or drink entered the child`s mouth and did not present the next bite or drink until the next scheduled presentation interval. Observers turned off the correct utensil placement key if the feeder did not place the utensil or stopped placing the utensil correctly as described above. We converted correct utensil placement to a percentage after dividing the duration of correct utensil placement by the session time. Mean percentage of correct utensil placement was 98% (range, 28% to 100%) for Jerry; 97% (range, 45% to 100%) for purees, 99% (range, 82% to 100%) for table textures, and 99.7% (range, 85% to 100%) for liquids for Sara; and 99.9% (range, 99.6% to 100%) for Vicky.

Observers scored *correct procedure* after the mouth check or when the time elapsed to signal the feeder to present the next bite or drink only if the feeder implemented every component of the protocol correctly. Correct procedural components across conditions included the feeder (a) delivered a vocal prompt to "Take a bite (drink)" while touching the child's lips with the utensil containing the correct bolus size within 5 s of the scheduled bite or drink presentation; (b) delivered vocal praise within 5 s of acceptance and mouth clean; (c) deposited the bite or drink within 5 s of presentation if the child met the criterion for acceptance; (d) removed the utensil after the bite or drink entered the child's mouth; (e) conducted a mouth check as described below approximately 30 s after the bite or drink entered Jerry or Sara's mouth; (f) said, "Swallow your bite (drink)" within 5 s of the mouth-check interval if Jerry or Sara packed the bite or drink; (g) held the utensil to the side of the child's mouth if the child coughed, gagged, or vomited and the protocol specified that the utensil should be touching the lips or continued to implement the protocol and provided no differential consequence for coughing, gagging, or vomiting that occurred when the protocol specified that the utensil should not be touching the lips; and (h) presented the next bite or drink within 5 s of the next scheduled bite- or drink-presentation interval.

Additional correct procedural components during the escape and attention baseline included the feeder (a) delivered escape for 30 s by removing the utensil from the child's lips following inappropriate mealtime behavior and (b) provided 30 s of attention that matched the form we observed the caregiver provide during home baseline and standard outcome baseline following inappropriate mealtime behavior. Additional correct procedural components during escape extinction and attention and escape extinction and attention extinction included the feeder (a) kept the utensil touching the

child's lips and deposited the bite or drink 6 s or more after presentation when the child opened his or her mouth, (b) kept the utensil touching the child's lips if the bite or drink did not remain on or in the utensil and the feeder needed to obtain another bite or drink, (c) re-presented expelled food or drink within 3 s of expulsion; and (d) waited until the child held the expelled bite or drink in his or her mouth for 3 s before presenting the next bite or drink if 30 s had elapsed from the bite or drink entering the child's mouth. Additional correct procedural components during escape extinction and attention included the feeder delivered 30 s of attention following inappropriate mealtime behavior as described above.

We converted correct procedure to a percentage after dividing the number of bites or drinks with correct procedure by the total number of bite or drink presentations. Mean percentage of correct procedure was 90% (range, 97% to 100%) for Jerry; 100% for purees, 83% (range, 60% to 100%) for table textures, and 98% (range, 60% to 100%) for liquids for Sara; and 100% for Vicky.

Reliability. Two observers independently and simultaneously collected data on incorrect attention and escape in the standard outcome baseline during 89%, 9%, and 100% of sessions for Jerry, Sara, and Vicky, respectively; on inappropriate mealtime behavior in the functional analysis during 48%, 48%, and 33% of sessions for Jerry, Sara, and Vicky, respectively; and on inappropriate mealtime behavior, acceptance, and mouth clean in the treatment evaluation during 19%, 31%, and 30% of sessions for Jerry Sara, and Vicky, respectively. Two observers independently and simultaneously collected data on correct utensil placement during 97% (range, 90% to 100%) and on correct procedure during 82% (range, 57% to 100%) of the treatment-evaluation sessions across participants. The DataPal Reli 1.0 software calculated interobserver agreement by partitioning each session into 10-s intervals. DataPal calculated total agreement coefficients for incorrect attention, escape, acceptance, mouth clean, correct utensil placement, and correct procedure by dividing the number of agreements (both observers scored the occurrence or nonoccurrence of the behavior) by the total number of agreements plus disagreements (one observer scored and one observer did not score the occurrence of the behavior) and converting this ratio to a percentage. DataPal calculated exact agreement coefficients for inappropriate mealtime behavior by dividing the number of exact agreements (both observers scored the same frequency of the behavior in the 10-s interval) by the number of exact agreements plus disagreements (observers scored a different frequency of the

behavior in the 10-s interval) and converting this ratio to a percentage.

Mean interobserver agreement across participants was 99% (range, 91% to 100%) for incorrect attention and 86% (range, 52% to 100%) for escape during the standard outcome baseline; 78% (range, 50% to 100%) for inappropriate mealtime behavior during the functional analysis; and 95% (range, 62% to 100%) for inappropriate mealtime behavior, 96% (range, 56% to 100%) for acceptance, and 98% (range, 70% to 100%) for mouth clean during the treatment evaluation.

Experimental Design

We used a pairwise design during the functional analyses (Bachmeyer et al., 2009) to identify the reinforcers for inappropriate mealtime behavior in which we compared each test condition to the control condition. We used a combined multielement and reversal (ABAB) design to compare rates of inappropriate mealtime behavior and levels of acceptance and mouth clean in the presence and absence of attention following inappropriate mealtime behavior for Jerry and Vicky. The A phase was escape and attention following inappropriate mealtime behavior, and the B phase was a multielement comparison of escape extinction in the presence and absence of attention following inappropriate mealtime behavior. We used a combined multiple baseline and multielement design across purees, table textures, and liquids for Sara. We compared escape extinction in the presence and absence of attention following inappropriate mealtime behavior during the multielement phase for Sara.

Initial Observations and Interview

Interview. The therapist conducted a brief interview with the caregivers to fill any gaps that might be missing in the child's initial paperwork and reviewed details or remaining questions regarding the child's feeding and medical history. The caregiver interview provided the therapist with an opportunity to gather additional information on the child's past and current medical diagnoses, prior services (e.g., occupational therapy, nutrition), typical meal format, and past and current food and liquid intake.

Home baseline. We conducted two 5-min observations with each child and caregiver immediately after the child's admission to the program and the caregiver interview to simulate a feeding in the home. The caregiver presented preferred food(s) and liquid(s) during one observation and nonpreferred or novel food(s) and liquid(s) in the other. We provided the caregiver with the seating, utensils, and other materials (e.g., tv) that he or she used at home during meals. We asked the

caregiver to present the food and liquid to the child and respond to child behavior exactly as he or she would at home.

Standard outcome baseline. Next, we conducted sessions (a) to observe child and caregiver behavior when we added structure to the feedings and (b) to establish baselines we could use to assess treatment outcomes in the future. Because our long-term goal was for the child to be an age-typical feeder, we conducted baselines for our current and future feeding goals. That is, we typically initiate treatment with the caregiver feeding the child liquid in a cup and purees on a spoon, but our long-term goal is for the child to self-feed liquid in a cup, purees on a spoon, and table-texture food on a spoon. Thus, the standard outcome baseline included five different conditions in which the caregiver (a) attempted to feed the child liquid in a cut-out cup, (b) attempted to feed the child purees on a spoon, (c) prompted the child to self-feed liquids in a cut-out cup, (d) prompted the child to self-feed purees on a spoon, and (e) prompted the child to self-feed table-texture food on a spoon.

We instructed the caregiver to present a level bolus of pureed food on a rubber-coated baby spoon for Jerry, on a small maroon spoon for Sara, and on a large maroon spoon for Vicky during conditions with pureed food. To level the bolus, the caregiver scooped a bite of pureed food on the spoon, scraped the bowl of the spoon against the side of the dish to level the bolus, and scraped the bottom of the spoon against the side of the dish to remove any remaining food. The caregiver presented 2 cc of Pediasure 1.5 with Fiber in a cut-out cup to Jerry, 2 cc of Vanilla Boost Kids Essential 1.5 in a cut-out cup to Sara, and 2 cc of Nutren Jr. with Fiber in a cut-out cup to Vicky during liquids conditions. The caregiver presented 0.6- x 0.6- x 0.6-cm bites of food on a spoon during the table-texture condition. The caregiver conducted as least three 5-bite or drink sessions in each condition. The caregiver prompted the child to “Take a bite (drink),” depending on the condition, once every 30 s. The therapist cued the caregiver to present a bite or drink by knocking on the observation glass.

The therapist told the caregiver which condition to conduct before each of the five conditions and reviewed the bolus size and presentation rate (e.g., “In this one, I want you to try to feed Jerry a level bolus of pureed food once every 30 s. I will knock on the glass when it is time for you to present a bite.”). The caregiver presented the same four foods, selected from the list of foods he or she had identified before the investigation, in each solid condition, one from each of the food groups of fruits,

grains, proteins, and vegetables, and the same liquid in liquids sessions. Other than specifying whether the condition was solids or liquids, identifying the specific foods and liquid the caregiver presented, the bolus size, the presentation rate, and whether the caregiver tried to feed the child or prompted the child to feed him or herself, we instructed the caregiver to respond to child behavior as he or she would at home.

General Procedure for the Functional Analysis and Treatment Evaluation

Trained feeders conducted multiple, consecutive five-bite or drink sessions in each 40-min meal, with 1- to 2-min breaks between sessions during which feeders and observers prepared for the next session (e.g., reset computer program). The number of sessions per meal depended on the duration of each meal and each session within the meal, which depended on the child's behavior.

The feeder presented the eight or 16 caregiver-selected foods in each phase and every condition to control for potential differences in the child's behavior as a function of food type (Patel, Piazza, Santana, & Volkert, 2002). The feeders conducted the conditions of the pairwise functional analysis and the multielement phases of the treatment evaluation in a randomized but counterbalanced order. The feeders randomly selected four of the caregiver-selected foods, one from each of the food groups, and randomly ordered the presentation of the foods before each set of the two conditions. Thus, the feeder presented the same foods in the same order in each pair of conditions. The feeder presented three foods once and one food twice during each session. The feeder presented purees to Jerry, Sara, and Vicky during puree sessions and presented liquids and table textures to Sara during liquid and table-texture sessions using the same bolus sizes and utensils described for the standard outcome baseline.

The feeder presented bites or drinks approximately every 30 s to Jerry and Sara or 15 s to Vicky by touching the child's lips with the utensil and saying, "Take a bite (drink)." The feeder deposited the bite or drink in the child's mouth within 5 s of the bite or drink presentation if the child (a) opened his or her mouth *or* leaned forward in the absence of crying, screaming, whining, yelling, or making negative or refusal statements or (b) if the child opened his or her mouth *and* leaned forward in the presence of crying, screaming, whining, yelling, or making negative or refusal statements. The feeder delivered vocal praise for acceptance (e.g., "Good job taking your drink") and activated a timer for 30 s for Jerry and Sara or 15 s for Vicky.

We did not conduct a mouth-clean check for Vicky because we observed high levels of mouth clean following bite acceptance during initial assessment. The feeder presented bites to Vicky 15 s after the previous presentation if the bite did not enter her mouth or 15 s after the previous bite entered her mouth, “Show me, Ahh,” while modeling an open mouth. The feeder inserted a rubber-coated baby spoon between the child’s lips and turned it 90° if the child did not open his or her mouth within 3 s of the verbal and model prompt. The feeder delivered vocal praise (e.g., “Good job swallowing your bite”) for mouth clean; said, “Swallow your bite (drink)” if the child had food or liquid larger than a pea in the mouth; and presented the next bite or drink. The feeder immediately delivered praise if the child showed that he or she had no food or liquid larger than a pea in the mouth before 30 s elapsed, but the feeder waited until 30 s elapsed before he or she presented the next bite or drink. The feeder delivered no differential consequence if the child showed before 30 s elapsed but had food or liquid larger than a pea in the mouth. The feeder prompted the child to, “Swallow your bite,” every 30 s if the child was packing after the fifth bite or drink presentation until there was no food or drink larger than a pea in the mouth or 10 min elapsed.

The feeder ended the session (a) in baseline if 30 s for Jerry and Sara and 15 s for Vicky after the fifth bite or drink presentation if no bites or drinks entered the mouth or if bites or drinks entered the mouth, but the child expelled; (b) across conditions if Jerry or Sara were packing bite(s) or drink(s) and 10 min elapsed from session initiation; (c) across conditions if bites or drinks entered Jerry or Sara’s mouth, and the child had no food or liquid larger than a pea in the mouth at the mouth check for the fifth bite or drink presentation; (d) during escape-extinction conditions if Jerry, Sara, or Vicky were expelling bites or drinks and 10 min elapsed from session initiation; or (e) during escape-extinction conditions for Jerry, Sara, and Vicky if the feeder had not deposited five bites or drinks when 10 min elapsed from session initiation. The feeder delivered no differential consequence for coughing, crying, gagging, making negative or refusal statements about the food, screaming, vomiting, whining, and yelling.

Functional Analysis

We selected test conditions for the functional analysis based on the caregiver interview and our observations during the home baseline and standard outcome baseline. We observed caregivers provide escape and attention, but not tangible items, following inappropriate mealtime behavior across

participants. Thus, we conducted escape and attention, but not tangible, test conditions with all children based on this information. We conducted functional analyses with purees for Jerry, Sara, and Vicky, and we also conducted functional analyses with table textures and liquids for Sara. The feeder followed the general procedure described above in addition to the specific procedure described below. The feeder held the utensil for 30 s in the position in space in which he or she initially touched the child's lips if the child did not open his or her mouth such that the feeder could deposit the bite or drink in the attention and control conditions, or if the child did not open his or her mouth such that the feeder could deposit the bite or drink and did not engage in inappropriate mealtime behavior in the escape condition. The feeder presented the next bite or drink after 30 s. The feeder delivered no differential consequence for expelled bites or drinks across conditions.

Control. The feeder presented highly preferred stimuli identified by a paired-choice preference assessment (Fisher et al., 1992) on the tray and interacted with the child by playing, singing, and telling stories throughout the session. The feeder delivered no differential consequence if the child engaged in inappropriate mealtime behavior. The purpose of this condition was to assess the effects of free access to attention and preferred stimuli and no differential consequence for inappropriate mealtime behavior.

Escape. The feeder removed the bite or drink for 30 s if the child engaged in inappropriate mealtime behavior and presented the next bite or drink after the 30-s escape interval. The purpose of this condition was to assess the effects of putative negative reinforcement in the form of escape from bites or drinks following inappropriate mealtime behavior.

Attention. The feeder delivered 30 s of attention following inappropriate mealtime behavior (LaRue et al., 2011) that matched the form we observed the caregiver deliver in the home baseline. The feeder presented the next bite or drink after the 30-s attention interval. The purpose of this condition was to assess the effects of putative positive reinforcement in the form of attention following inappropriate mealtime behavior.

Treatment Evaluation

Escape and attention baseline. This condition combined the contingencies of the escape and attention conditions of the functional analysis. The feeder removed the bite or drink and delivered attention as described above for 30 s following inappropriate mealtime behavior.

Escape extinction and attention following inappropriate mealtime behavior. The feeder followed the general procedure with the following additions. The feeder kept the utensil touching the child's lips until the child opened his or her mouth and allowed the feeder to deposit the bite or drink inside the mouth. The feeder gently scraped the bite on the child's teeth with the spoon if the child failed to close his or her lips around the spoon when the feeder placed the spoon in the mouth. The feeder used the utensil to collect expelled food or liquid as quickly as possible and placed it back in the child's mouth while prompting the child to, "Swallow your bite (drink)," approximately every 30 s until the bite or drink remained in the child's mouth for at least 3 s at which time the feeder presented the next bite or drink if 30 s had elapsed from the bite or drink entering the mouth initially or until 10 min elapsed from session initiation. The feeder delivered 30 s of attention as described above following inappropriate mealtime behavior.

Escape extinction and attention extinction for inappropriate mealtime behavior. This condition was like escape extinction and attention following inappropriate mealtime behavior except the feeder withheld attention following inappropriate mealtime behavior.

Postinvestigation Caregiver Satisfaction Questionnaire

The first author met with each child's caregiver after the treatment evaluation and explained the results of the investigation by describing the level, stability, and trend of the data. For example, the first author stated, "We saw high rates or many instances of inappropriate mealtime behavior and he didn't accept any bites when we removed the bite and gave Jerry attention following inappropriate mealtime behavior. We saw inappropriate mealtime behavior decrease and acceptance increase when we kept the spoon at Jerry's lips and provided attention or told Jerry not to turn his head following inappropriate mealtime behavior. We saw inappropriate mealtime behavior decrease and acceptance increase when we kept the spoon at Jerry's lips and did not provide any attention or did not say anything following inappropriate mealtime behavior." The first author gave each caregiver a brief satisfaction questionnaire after reviewing the data to determine which procedure the caregiver preferred and trained the caregiver to implement that procedure.

Results

We observed Jerry's caregiver move the food or liquid away from Jerry, remove Jerry from

his chair, and provide attention in the form of statements of concern following inappropriate mealtime behavior during the home baseline. We observed Sara's caregiver move the food or liquid away from Sara and provide attention in the form of statements of concern, singing, and talking about the food or liquid following inappropriate mealtime behavior during the home baseline. We observed Vicky's caregiver move the food or liquid away from Vicky and provide attention in the form of reprimands following inappropriate mealtime behavior during the home baseline. Jerry, Sara, and Vicky's caregivers provided incorrect attention after 21% (range, 2% to 40%), 26% (range, 6% to 50%), and 11% (range, 0% to 33%), respectively, and escape after 83% (range, 49% to 100%), 76% (range, 52% to 98%), and 99%, respectively, of occurrences of inappropriate mealtime behavior across conditions of the standard outcome baseline.

Figure 1 depicts data for inappropriate mealtime behavior per minute in the functional analysis for Jerry (top left); for Sara's purees (top right), table textures (middle left), and liquids (middle right); and for Vicky (bottom left), respectively. Mean inappropriate mealtime behavior per minute was higher in the escape relative to the control conditions across participants. Mean inappropriate mealtime behavior per minute in the escape condition was 12.4 (range, 3.5 to 17.4) for Jerry; 49.5 (range, 31.6 to 64.3) for purees, 68.1 (range, 55 to 86.7) for table textures, and 14 (range, 0 to 43.5) for liquids for Sara; and 35.7 (range, 12.7 to 54) for Vicky. Mean inappropriate mealtime behavior per minute in the control condition was 3.3 (range, 1.8 to 5.6) for Jerry; 4.4 (range, 2.6 to 6) for purees, 5.3 (range, 3.6 to 8.5) for table textures, and 3.2 (range, 0 to 8.4) for liquids for Sara; and 5.2 (range, 3 to 9) for Vicky.

Mean inappropriate mealtime behavior per minute was equivalent in the attention and control conditions. Mean inappropriate mealtime behavior per minute in the attention condition was 8.6 (range, 4.4 to 17.3) for Jerry; 4.2 (range, 3.7 to 5.3) for purees, 4.5 (range, 3.6 to 7.4) for table textures, and 2.2 (range, 0 to 5) for liquids for Sara; and 7.7 (range, 5.4 to 10.2) for Vicky. Mean inappropriate mealtime behavior per minute in the control condition was 4.6 (range, 0.8 to 6) for Jerry; 4.2 (range, 3.7 to 5.3) for purees, 4.7 (range, 3 to 7.4) for table textures, and 4.8 (range, 1.4 to 14) for liquids for Sara; and 6 (range, 3.4 to 7.6) for Vicky. Results suggested that escape from bites or drinks, but not attention, functioned as reinforcement for each child's inappropriate mealtime behavior.

Figure 2 displays inappropriate mealtime behavior per minute (top), percentage of acceptance

(middle), and percentage of mouth clean (bottom) for Jerry's treatment evaluation. Mean inappropriate mealtime behavior per minute was 48.8 (range, 0 to 105.3), mean percentage of acceptance was 4% (range, 0% to 60%), and mean percentage of mouth clean was 90% (range, 0% to 100%) during the escape and attention baseline. During the multielement comparison, mean inappropriate mealtime behavior per minute was 5.8 (range, 0 to 28), mean percentage of acceptance was 72% (range, 0% to 100%), and mean percentage of mouth clean was 98% (range, 67% to 100%) during escape extinction and attention following inappropriate mealtime behavior. Mean inappropriate mealtime behavior per minute was 5.8 (range, 0 to 41), mean percentage of acceptance was 79% (range, 0% to 100%), and mean percentage of mouth clean was 97% (range, 0% to 100%) during escape extinction and attention extinction.

Figure 3 displays inappropriate mealtime behavior per minute for purees (top), table textures (second), and liquids (third); percentage of acceptance for purees (fourth), table textures (fifth), and liquids (sixth); and percentage of mouth clean for purees (seventh), table textures (eighth), and liquids (ninth) for Sara's treatment evaluation. Mean inappropriate mealtime behavior per minute during the escape and attention baseline was 50 (range, 34 to 71) for purees, 37 (range, 7 to 58) for table textures, and 22 (range, 0 to 47) for liquids. Mean inappropriate mealtime per minute during escape extinction and attention following inappropriate mealtime behavior was 6 (range, 0 to 44) for purees, 4 (range, 0 to 38) for table textures, and 1 (range, 0 to 11) for liquids. Mean inappropriate mealtime behavior per minute during escape extinction and attention extinction was 6 (range, 0 to 40) for purees, 4 (range, 0 to 40) for table textures, and 1 (range, 0 to 5) for liquids.

Mean percentage of acceptance during the escape and attention baseline was 2% (range, 0% to 20%) for purees, 13% (range, 0% to 40%) for table textures, and 25% (range, 0% to 100%) for liquids. Mean percentage of acceptance during escape extinction and attention following inappropriate mealtime behavior was 76% (range, 0% to 100%) for purees, 87% (range, 0% to 100%) for table textures, and 81% (range, 20% to 100%) for liquids. Mean percentage of acceptance during escape extinction and attention extinction was 80% (range, 0% to 100%) for purees, 92% (range, 50% to 100%) for table textures, and 83% (range, 20% to 100%) for liquids.

Mean percentage of mouth clean during the escape and attention baseline was 100% for purees and table textures and 98% (range, 67% to 100%) for liquids. Mean percentage of mouth clean

during escape extinction and attention following inappropriate mealtime behavior was 100% for purees and table textures and 99% (range, 80% to 100%) for liquids. Mean percentage of mouth clean during escape extinction and attention extinction was 92% (range, 0% to 100%) for purees, 95% (range, 75% to 100%) during table textures, and 99% (range, 80% to 100%) for liquids.

Figure 4 displays inappropriate mealtime behavior per minute (top) and percentage of acceptance (bottom) for Vicky's treatment evaluation. Mean inappropriate mealtime behavior per minute was 49.5 (range, 6.7 to 78.3), and mean percentage of acceptance was 3% (range, 0% to 20%) during the escape and attention baseline. During the multielement comparison, mean inappropriate mealtime behavior per minute was 2.2 (range, 0 to 13.3), and mean percentage of acceptance was 90% (range, 40% to 100%) during escape extinction and attention following inappropriate mealtime behavior. Mean inappropriate mealtime behavior per minute was 1.6 (range, 0 to 13.8), and mean percentage of acceptance was 84% (range, 20% to 100%) during escape extinction and attention extinction.

Postinvestigation Caregiver Satisfaction Questionnaire

When the first author reviewed the results of the investigation with the caregivers, caregivers preferred escape extinction and attention extinction relative to escape extinction and attention following inappropriate mealtime behavior. Thus, we trained caregivers to implement escape extinction and attention extinction.

Discussion

In the current investigation, we evaluated the effects of delivering or withholding attention when attention did not function as reinforcement for inappropriate mealtime behavior. Clinicians often recommend that caregivers implement "healthy contingencies," such as withholding attention following inappropriate mealtime behavior, even when results of a functional analysis do not show that attention functions as reinforcement. Iwata, Pace, et al. (1994) examined the effects of variations of extinction that matched or did not match the results of a functional analysis. Results showed that reductions in SIB occurred only when the extinction variation matched the reinforcement for SIB identified previously during the functional analysis. Iwata, Pace, et al. developed a consequence matrix to describe the predicted outcomes of variations of extinction based on reinforcement that matched or did not match the results of a functional analysis. Relevant to the current investigation, the

matrix predicted that delivering or withholding attention would be irrelevant or have no effect when escape functioned as negative reinforcement for inappropriate mealtime behavior, but attention did not. Inappropriate mealtime behavior decreased and acceptance and mouth clean increased when the feeder implemented function-based escape extinction, independent of whether he or she delivered or withheld attention following inappropriate mealtime behavior.

We observed that caregivers of the children in the current investigation provided removed the spoon or cup and attention when the child engaged in inappropriate mealtime behavior during the home baseline and standard outcome baseline. The functional analyses showed that escape from bites or drinks functioned as negative reinforcement for inappropriate mealtime behavior, but adult attention did not. Results replicate those of Thompson and Iwata (2007), who found poor correspondence between descriptive and functional analyses. Thompson and Iwata found that attention delivery following problem behavior was relatively ubiquitous; nevertheless, attention functioned as reinforcement for only 25% of the participants in the study.

Results of the current investigation did not resolve the issue of whether to teach caregivers to withhold attention when results of a functional analysis suggest that attention does not function as reinforcement for inappropriate mealtime behavior. We first had to establish the effects of delivering and withholding attention when attention did not function as reinforcement for inappropriate mealtime behavior. A reasonable next step is to determine the conditions under which clinicians should teach caregivers to withhold attention following inappropriate mealtime behavior when attention does not function as reinforcement.

There are several factors that might impact the answer to this question. Logically, a treatment with more components, like escape extinction and attention extinction, is more difficult to implement than a treatment with fewer components (Fisher et al., 2016). No one to our knowledge has measured treatment integrity when caregivers implement escape extinction and deliver or withhold attention following inappropriate mealtime behavior. We might speculate that withholding attention following inappropriate mealtime behavior may impact the caregiver's implementation of escape extinction negatively because the caregiver must do two things, keep the utensil at the lips and remember to withhold attention. It is possible, however, that attention delivery following inappropriate mealtime behavior might distract the caregiver from implementing escape extinction correctly. For example, the

caregiver may be so busy delivering reprimands, that he or she forgets to hold the utensil at the lips.

Similarly, research has shown that caregivers have difficulty withholding reinforcement following problem behavior (Addison & Lerman, 2009; Miller et al., 2010), and future research should evaluate whether this finding applies to caregivers of children with feeding disorders. Interestingly, caregivers in the current investigation chose to implement escape extinction and withhold attention following inappropriate mealtime behavior even though withholding attention had no effect on child behavior. One caregiver stated, "I don't want to provide my child with attention for naughty behavior." We do not know, however, how their choice to implement escape extinction and withhold attention following inappropriate mealtime affected their short- or long-term adherence to treatment.

Third, results from Nock and Ferriter (2005) suggest that caregiver nonadherence to treatment is more likely if the caregiver believes that the treatment is irrelevant or not related to the child's problem behavior. We did not evaluate caregivers' beliefs about the cause of the child's feeding disorder or the relevance of treatment, and this could be a direction for future research.

Results of the current investigation may have implications for reinforcement-based treatment of inappropriate mealtime behavior. Piazza, Patel, Gulotta, Sevin, and Layer (2003) showed that delivery of adult attention and preferred stimuli did not decrease inappropriate mealtime behavior or increase acceptance or mouth clean when inappropriate mealtime behavior continued to produce escape from bites or drinks. By contrast, inappropriate mealtime behavior decreased and acceptance and mouth clean increased when the feeder implemented nonremoval of the spoon, a putative escape-extinction procedure. Unfortunately, the authors did not conduct a pretreatment functional analysis. One possible explanation of the results of Piazza et al. is that preferred stimuli and attention did not function as reinforcement for inappropriate mealtime behavior. Results from the current investigation suggest that nonfunctional reinforcement in the form of attention would have no effect on inappropriate mealtime behavior and may explain why "positive reinforcement" does not increase acceptance, mouth clean, or both during feeding-disorders treatment for some children (Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Patel, Piazza, Martinez, Volkert, & Santana, 2002; Piazza, Patel, et al., 2003).

Results from the current investigation replicate those of numerous studies showing that escape extinction and putative escape extinction in the form of nonremoval of the spoon or cup is effective as

treatment (Addison et al., 2012; Ahearn et al., 1996; Bachmeyer et al., 2009; Cooper et al., 1995; Hoch, Babbitt, Coe, Krell, & Hackbert, 1994; Kerwin, Ahearn, Eicher, & Burd, 1995; Najdowski et al., 2003; Patel, Piazza, Martinez, et al., 2002; Penrod, Wallace, Reagon, Betz, & Higbee, 2010; Piazza, Patel, et al., 2003). Our results also show that implementation of escape extinction resulted in relatively rapid decreases in inappropriate mealtime behavior and increases in acceptance and mouth clean. We implemented escape extinction for a mean of 0.6 hr (range, 0.07 to 1.1 hr), which is equivalent to 16 bite or drink presentations, across participants before acceptance increased to 80% or above. Peterson, Piazza, and Volkert (2016) conducted a randomized clinical trial in which they compared an applied-behavior-analytic treatment that included nonremoval of the spoon with a modified sequential oral sensory treatment (M-SOS). Participants were young children diagnosed with autism spectrum disorder and had food selectivity. Acceptance and mouth clean increased to above 80% in 0.3, 0.8, and 3.8 hr for the three participants assigned randomly to the applied-behavior-analytic intervention. By contrast, acceptance and mouth clean remained at 0 even after 17, 17, and 21.5 hr of M-SOS for the three participants assigned randomly to M-SOS.

Van Houten et al. (1988) proposed that behavior analysts have a professional obligation to provide individuals with behavior disorders access to the least restrictive but effective treatment. Van Houten et al. stated, “A procedure's overall level of restrictiveness is a combined function of its absolute level of restrictiveness, the amount of time required to produce a clinically acceptable outcome, and the consequences associated with delayed intervention” (pp. 383-384). As indicated above, extinction-based treatments produce rapid improvements for some children with feeding disorders. By contrast, Jerry, Sara, and Vicky received 5, 31 and 24 months, respectively, of therapy before the current investigation, with minimal or no progress in their feeding behavior.

Feeding disorders may represent a problem for which rapid improvement is important, as the consequences of a feeding disorder can include dehydration, growth retardation, severe malnourishment, and substantial weight loss (Babbitt, Shore, Smity, Williams, & Coe, 2001; Palmer & Horn, 1978; Piazza & Carroll-Hernandez, 2004). Deficits in calories, nutrition, or both are associated with long-term behavior, health, and learning problems (Freedman, Dietz, Srinivasan, & Berenson, 1999). Young children like those in the current investigation may be at greatest risk for the negative impact of a feeding disorder as the most damaging effects of inadequate caloric intake, poor

nutrition, or both occur before age 5, which is a period of critical brain development (Winick, 1969).

A second consideration is that a child with a feeding disorder may miss important social opportunities because of his or her inability or unwillingness to eat. Most major cultural, religious, and social events (e.g., birthdays, holidays, weddings) involve food consumption, and these events often provide opportunities for families and friends to come together and interact. When a child doesn't eat like same-age peers or family members, the child misses opportunities to practice social skills and form friendships.

Third, feeding disorders are associated with caregiver stress and depression (Franklin & Rodger, 2003; Singer, Sing, Hill & Jaffe, 1990), and treatment of a feeding disorder reduces caregiver stress (Greer, Gulotta, Masler, & Laud, 2008). Fourth, although studies have shown that extinction can be associated with negative side effects, such as extinction bursts and an increase in aggression (Lerman & Iwata, 1995; Lerman, Iwata, & Wallace, 1999), we do not know whether the prevalence of negative side effects is the same for extinction-based treatment of feeding disorders as that for other problem behavior.

A fifth factor relative to the restrictive versus effective issue is that feeding disorders are financially costly. Williams et al. (2007) examined data for children with a gastrostomy tube who were enrolled in a day-treatment program from November 1997 to December 2002. Data analysis showed that a single year of tube feedings often exceeded the cost of intensive treatment of a feeding disorder. The cost of tube feedings for the children in Williams et al. ranged from $16,320 to $54,072 annually, and the mean cost of an intensive day-treatment admission was $34,662. A study by the fiscal analyst of the state of Nebraska in 2009 showed that the state would save over $1 million over 3 years by paying for intensive treatment for children with feeding disorders relative to gastrostomy-tube placement (Legis., N.E., 2009).

Although escape extinction has rapid effects and poor diet and nutrition have negative consequences, only behavior analysts with appropriate training and supervised experience should use extinction-based treatments for children with feeding disorders. The etiology of most feeding disorders is multiply controlled and complex (Rommel, DeMeyer, Feenstra, & Veerman-Wauters, 2003). Treatment of a feeding disorder requires knowledge that extends far beyond applied behavior analysis about topics in nutrition, medicine, and oral-motor anatomy and physiology for example.

Behavior analysts should recognize when to consult with other professionals, such as an allergist, pediatric gastroenterologist, or speech and language pathologist. Inadequate training can lead to mistakes in therapy that can have serious consequences, such as anaphylaxis due to cross contamination, aspiration when the child is not a safe oral feeder for the presented food or liquid, or choking because the presented texture is inappropriate for the child's chewing skills. "Knowing what you don't know" is an essential skill for behavior analysts working with children diagnosed with feeding disorders.

Although the results of the current investigation showed no differences when the feeder delivered or withheld attention following inappropriate mealtime behavior, trained therapists served as feeders. The possibility exists that including caregivers as feeders would produce a different result. Another limitation of the current investigation was that we did not conduct attention extinction and escape following inappropriate mealtime behavior. Bachmeyer et al. (2009) showed that attention extinction was ineffective when inappropriate mealtime behavior produced escape even when attention functioned as reinforcement for inappropriate mealtime behavior. We were concerned that caregivers would be reluctant to participate if a component of the investigation was implementation of a potentially ineffective treatment.

In conclusion, results of the current investigation are like those on the function-based treatment of other problem behavior (Iwata, Pace, et al., 1994; Smith, Iwata, Vollmer, & Zarcone, 1993) in that a nonfunction-based treatment component (i.e., withholding attention following inappropriate mealtime behavior) did not have any effect on child behavior. Nevertheless, caregivers chose to implement escape extinction and withhold attention following inappropriate mealtime behavior. Results indicated that escape extinction decreased inappropriate mealtime behavior and increased acceptance and mouth clean rapidly, but behavior analysts should implement extinction-based procedures with children with feeding disorders only with proper training and supervision.

Bibliography

Addison, L., & Lerman, D. C. (2009). Descriptive analysis of teachers' responses to problem behavior following training. *Journal of Applied Behavior Analysis, 42,* 485-490. doi:10.1901/jaba.2009.42-485

Addison, L. R., Piazza, C. C., Patel, M. E., Bachmeyer, M. H., Rivas, K. M., Milnes, S. M., & Oddo, J. (2012). A comparison of sensory integrative and behavioral therapies as treatment for pediatric feeding disorders. *Journal of Applied Behavior Analysis, 45,* 455-471. doi:10.1901/jaba.2012.45-455

Ahearn, W., Kerwin, M. E., Eicher, P. S, Shantz, J., & Swearingin, W. (1996). An alternating treatments comparison of two intensive interventions for food refusal. *Journal of Applied Behavior Analysis, 29,* 321-332. doi:10.1901/jaba.1996.29-231

Allison, J., Wilder, D. A., Chong, I., Lugo, A., Pike, J., & Rudy, N. (2012). A comparison of differential reinforcement and noncontingent reinforcement to treat food selectivity in a child with autism. *Journal of Applied Behavior Analysis, 45,* 613-617. doi:10.1901/jaba.2012.45-613

Babbitt, R. L., Shore, B. A., Smith, M., Williams, K. E., & Coe, D. A. (2001). Stimulus fading in the treatment of adipsia. *Behavioral Interventions, 16,* 197-207. doi:10.1002/bin.94

Bachmeyer, M. H., Piazza, C. C., Frederick, L. D., Reed, G. K., Rivas, K. D., & Kadey, H. J. (2009). Functional analysis and treatment of multiply controlled inappropriate mealtime behavior. *Journal of Applied Behavior Analysis, 42,* 641- 658. doi:10.1901/jaba.2009.42-641

Bachmeyer, M. H., Kirkwood, C. A., Criscito, A. B., Mauzy, C. R., & Berth, D. P. (*in press*). A comparison of functional analysis methods of inappropriate mealtime behavior. *Journal of Applied Behavior Analysis*.

Borrero, C. S. W., England, J. D., Sarcia, B., & Woods, J. N. (2016). A comparison of descriptive and functional analyses of inappropriate mealtime behavior. *Behavior Analysis in Practice, 9,* 364-379. doi:10.1007/s40617-016-0149-5

Borrero, C. S. W., Woods, J. N., Borrero, J. C., Masler, E. A., & Lesser, A. D. (2010). Descriptive analysis of pediatric food refusal and acceptance. *Journal of Applied Behavior Analysis, 43,* 71-88. doi:10.1901/jaba.2010.43-71

Bullock, C. E., Fisher, W. W., & Hagopian, L. P. (2017). Description and validation of computerized behavioral data program: "BDataPro." *The Behavior Analyst*. Advanced online publication. doi:10.1007/s40614-016-0079-0

Cooper, L. J., Wacker, D. P., McComas, J. J., Brown, K., Peck, S. M., Richman, D.,… Millard, T. (1995). Use of component analysis to identify active variables in treatment packages for children with feeding disorders. *Journal of Applied Behavior Analysis, 28,* 139- 153. doi:10.1901/jaba.28-139

Fisher, W. W., Greer, B. D., Romani, P. W., Zangrillo, A. N., & Owen. T. M. (2016). Comparisons of synthesized and individual reinforcement contingencies during functional analysis. *Journal of Applied Behavior Analysis, 49,* 596- 616. doi:10.1002/jaba.314

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25,* 491-498. doi:10/1901/jaba.1992.25-491

Franklin, L., & Rodger, S. (2003). Parents' perspectives on feeding medically compromised children: Implications for occupational therapy. *Australian Occupational Therapy Journal, 50,* 137-147. doi:10.1046/j.1440-1620

Freedman, D. S., Dietz, W. H., Srinivasan, S. R., & Berenson, G. S. (1999). The relation of overweight to cardiovascular risk factors among children and adolescents: The Bogalusa heart study. *Pediatrics, 103,* 1175-1182. doi:10.1542/peds.103.6.1175

Girolami, P. A., & Scotti, J. R. (2001). Use of analog functional analysis in assessing the function of mealtime problem behavior. *Education and Training in Mental Retardation and Developmental Disabilities, 36,* 207-223.

Greer, A. J., Gulotta, C. S., Masler, E. A., & Laud, R. B. (2008). Caregiver stress and outcomes

of children with pediatric feeding disorders treated in an intensive interdisciplinary program. *Journal of Pediatric Psychology, 33,* 612-620. doi:10.1093/jpepsy/jsm16

Hoch, T. A., Babbitt, R. L., Coe, D. A., Krell, D. M., & Hackbert, L. (1994). Contingency contacting: Combining positive reinforcement and escape extinction procedures to treat persistent food refusal. *Behavior Modification, 18,* 106- 128. doi:10.1177/01454455940181007

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis, 27*, 197-209. (Reprinted from *Analysis and Intervention in Developmental Disabilities, 2,* 3-20, 1982). doi:10.1901/jaba.1994.27-197

Iwata, B. A., Pace, G. M., Cowdery, G. E., & Miltenberger, R. G. (1994). What makes extinction work: An analysis of procedural form and function. *Journal of Applied Behavior Analysis, 27,* 131-144. doi:10.1901/jaba.1994.27-131

Kerwin, M. E., Ahearn, W. H., Eicher, P. S., & Burd, D. M. (1995). The costs of eating: A behavioral economic analysis of food refusal. *Journal of Applied Behavior Analysis, 28,* 245-260. doi:10.1901/jaba.28-245

LaRue, R. H., Stewart, V., Piazza, C. C., Volkert, V. M., Patel, M. R., & Zeleny, J. R (2011). Escape as reinforcement and escape extinction in the treatment of feeding problems. *Journal of Applied Behavior Analysis, 44,* 719-735. doi:10.1901/jaba.2011.44-719

Legis., N. E. (2009). *Fiscal note: Legislative fiscal analyst estimate*. LB 243, Revision 01.

Lerman, D. C., & Iwata, B. A. (1995). Prevalence of the extinction burst and its attenuation during treatment. *Journal of Applied Behavior Analysis, 28,* 93-94. doi:10.1901/jaba.1995.28-93

Lerman, D. C., Iwata, B. A., & Wallace, M. D. (1999). Side effects of extinction: Prevalence of bursting and aggression during the treatment of self-injurious behavior. *Journal of Applied Behavior Analysis, 32,* 1-8. doi:10.1901/jaba.1999.32-1

Miller, J. R., Lerman, D. C., & Fritz, J. N. (2010). An experimental analysis of negative

reinforcement contingencies for adult-delivered reprimands. *Journal of Applied Behavior Analysis, 43,* 769-773. doi:10.1901/jaba.2010.43-769

Najdowski, A. C., Wallace, M. D., Doney, J. K., & Ghezzi, P. M. (2003). Parental assessment and treatment of food selectivity in natural settings. *Journal of Applied Behavior Analysis, 36,* 383-386. doi:10.1901/jaba.2003.36-383

Nock, M. K., & Ferriter, C. (2005). Parent management of attendance and adherence in child and adolescent therapy: A conceptual and empirical review. *Clinical Child and Family Psychology Review, 8,* 149-166. doi:10.1007/s10567-005-4753-0

Palmer, S., & Horn, S. (1978). Feeding problems in children. In S. Palmer & S. Ekvall (Eds.), *Pediatric nutrition in developmental disorders* (pp. 107- 129). Springfield, IL: Thomas.

Patel, M. R., Piazza, C. C., Martinez, C. J., Volkert, V. M., & Santana, C. M. (2002). An evaluation of two differential reinforcement procedures with escape extinction to treat food refusal. *Journal of Applied Behavior Analysis, 35*, 363-374. doi:10.1901/jaba.2002.35-363.

Patel, M. R., Piazza, C. C., Santana, C. M., & Volkert, V. M. (2002). An evaluation of food type and texture in the treatment of a feeding problem. *Journal of Applied Behavior Analysis, 35,* 183-186. doi:10.1901/jaba.2002.35-183

Peterson, K. M., Piazza, C. C., & Volkert, V. M. (2016). A comparison of a modified sequential oral sensory approach to an applied behavior-analytic approach in the treatment of food selectivity in children with autism spectrum disorder. *Journal of Applied Behavior Analysis, 49*, 485-511. doi:10.1002/jaba.332

Piazza, C. C., & Carroll-Hernandez, T. A. (2004) Assessment and treatment of pediatric feeding disorders. In R. E. Tremblay, B. G. Barr, & R. Peters (Eds.), *Encyclopedia on Early Childhood Development [online]*. Montreal, Quebec: Centre of Excellence for Early Childhood Development; 2004: 1-7. Available at: http://www.excellence earlychildhood.ca/documents/Piazza-Carroll-HernandezANGxp.pdf. Accessed March 9, 2018.

Piazza, C. C., Fisher, W. W., Brown, K. A., Shore, B. A., Patel, M. R., Katz, R. M., … Gulotta C. S. (2003). Functional analysis of inappropriate mealtime behaviors. *Journal of Applied Behavior Analysis, 36,* 187-204. doi:10.1901/jaba.2003.36-187

Piazza, C. C., Ibañez, V. F., Ney, H. M., Kirkwood, C. A., & Crowley, J. G. (2017). Assessment and treatment of pediatric feeding disorders. Archives of Practitioner Resources for Applied Behavior Analysts. Western Michigan University, Kalamazoo, MI. Retrieved from https://wmich.edu/autism/resources.

Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. M., & Layer, S. A. (2003). On the relative contributions of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis, 36,* 309-324. doi:10.1901/jaba.2003.36-309

Rommel, N., DeMeyer, A. M., Feenstra, L., & Veerman-Wauters, G. (2003). The complexity of feeding problems in 700 infants and young children presenting to a tertiary care institution. *Journal of Pediatric Gastroenterology and Nutrition, 37,* 75-84. doi:10.1371/journal.pone.0013656

Singer, L. T., Sing, L., Hill, B. P., & Jaffe, A. C. (1990). Stress and depression in mothers of failure-to-thrive children. *Journal of Pediatric Psychology, 15,* 711-720.

Smith, R. G., Iwata, B. A., Vollmer, T. R., & Zarcone, J. R. (1993). Experimental analysis and treatment of multiply controlled self-injury. *Journal of Applied Behavior Analysis, 26,* 183-196. doi:10.1901/jaba.26-183

St. Peter, C. C., & Marsteller, T. M. (2017). A "healthy-contingencies" behavioral intervention. *Journal of Behavioral Education, 26,* 250-263. doi:10.1007/s10864-017-9267-6

Van Houten, R., Axelrod, S., Bailey, J. S., Favell, J. E., Foxx, R. M., Iwata, B. A. … Lovaas, O. A. (1988). The right to effective behavioral treatment. *Journal of Applied Behavior Analysis, 21,* 381-384. doi:10.1901/jaba.1988.21-381

Williams, K. E., Riegel, K., Gibbons, B., & Field, D. G. (2007). Intensive behavioral treatment for severe feeding problems: A cost-effective alternative to a feeding tube? *Journal of Developmental and Physical Disabilities, 19,* 227-235.

doi:10.1007/s10882-007-9051-y

Winick, M. (1969). Malnutrition and brain development. *The Journal of Pediatrics,74*, 667-679. doi:10.1016/s0022-3476(69)80129-0

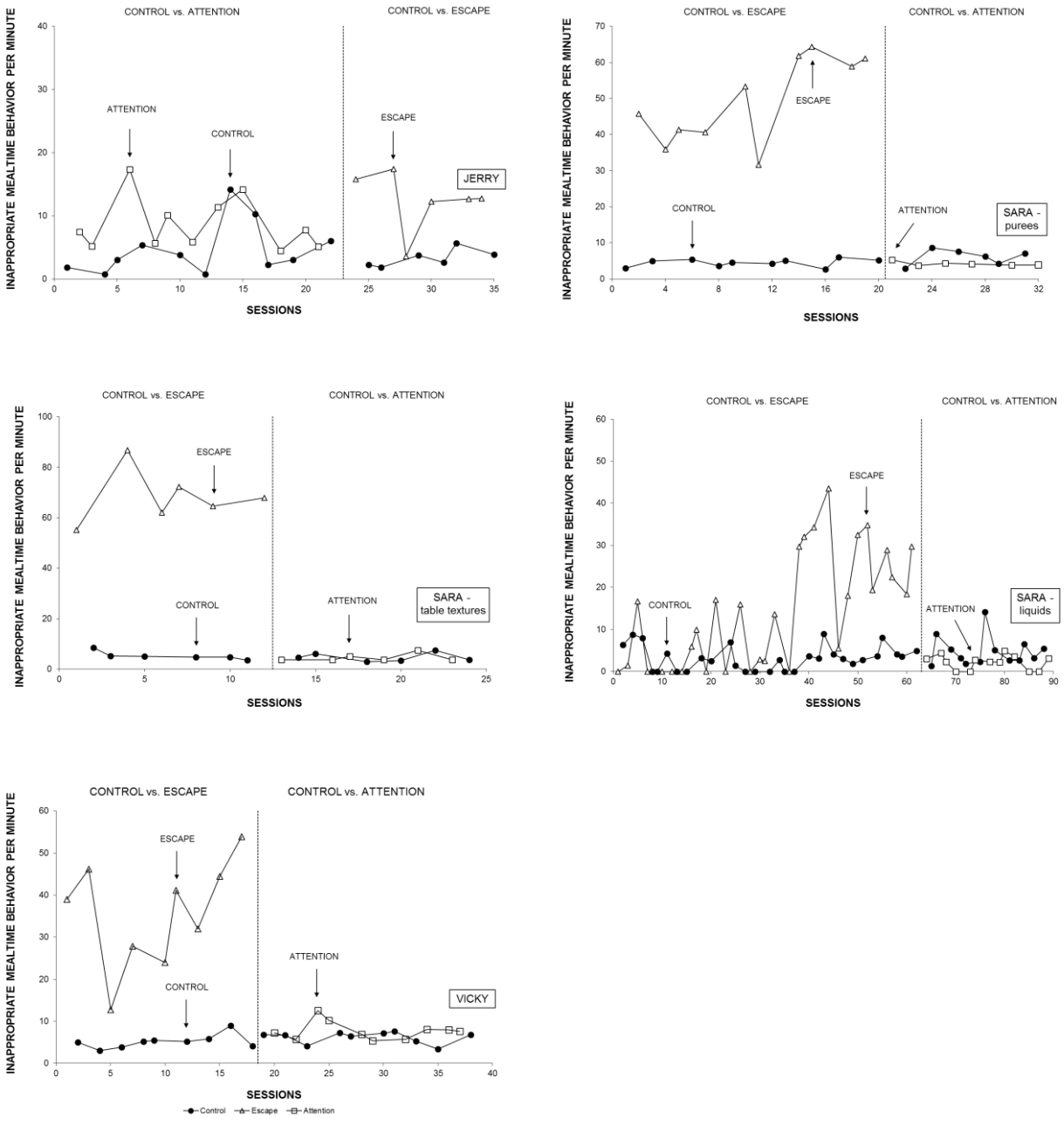

Figure 1. Inappropriate mealtime behavior per minute for Jerry (top left), Sara's purees (top right), Sara's table-textures (middle left), Sara's liquids (middle right), and Vicky (bottom left) during the functional analysis.

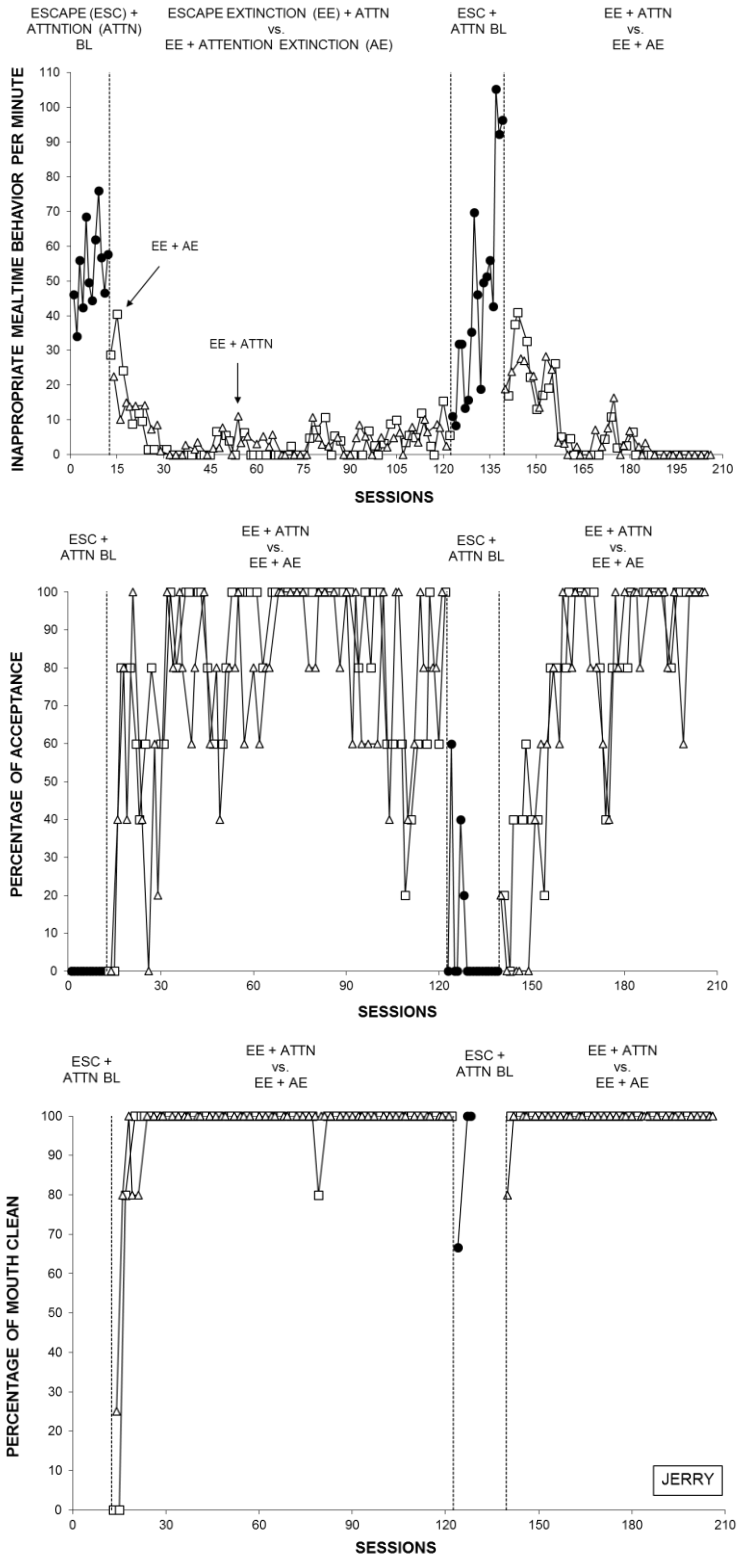

Figure 2. Inappropriate mealtime behavior per minute (top), percentage of acceptance (middle), and percentage of mouth clean (bottom) during Jerry's treatment evaluation.

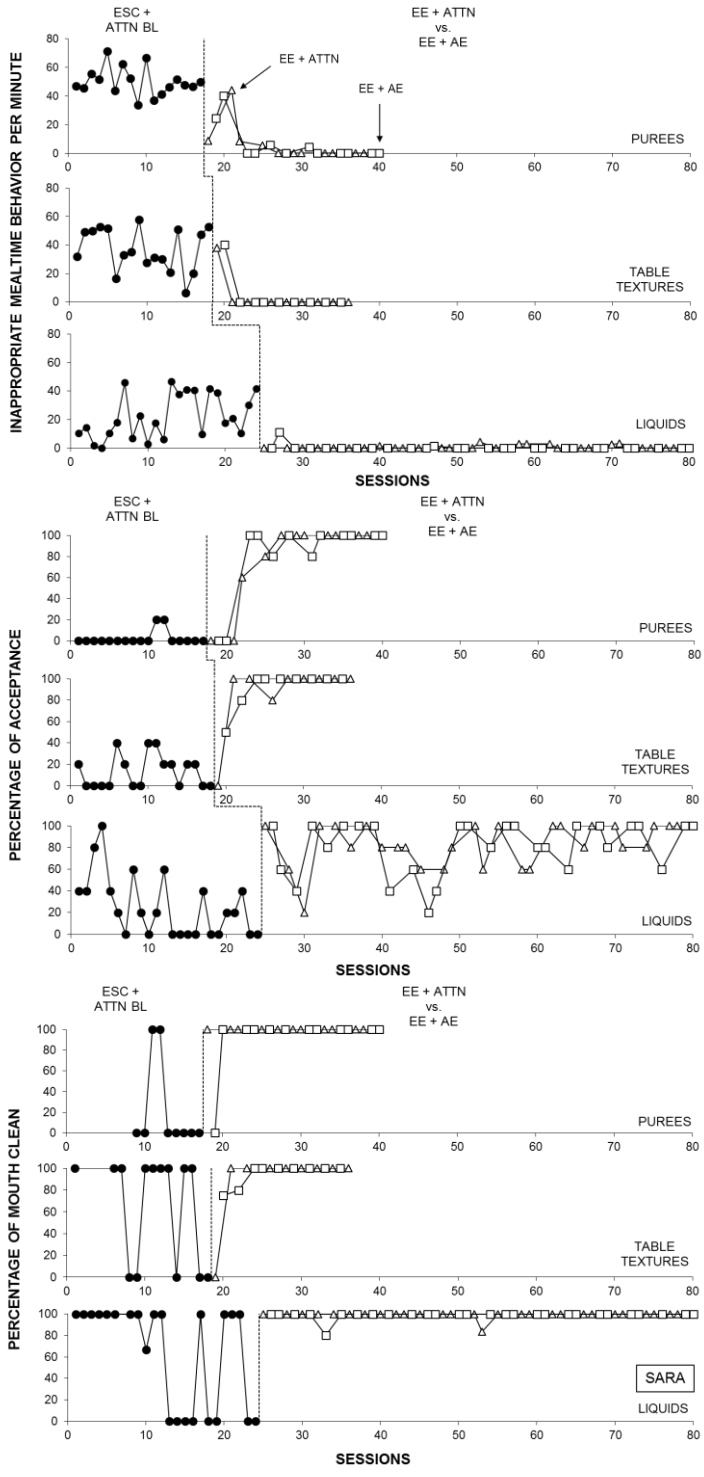

Figure 3. Inappropriate mealtime behavior per minute (top), percentage of acceptance (middle), and percentage of mouth clean (bottom) for purees, table textures, and liquids during Sara's treatment evaluation.

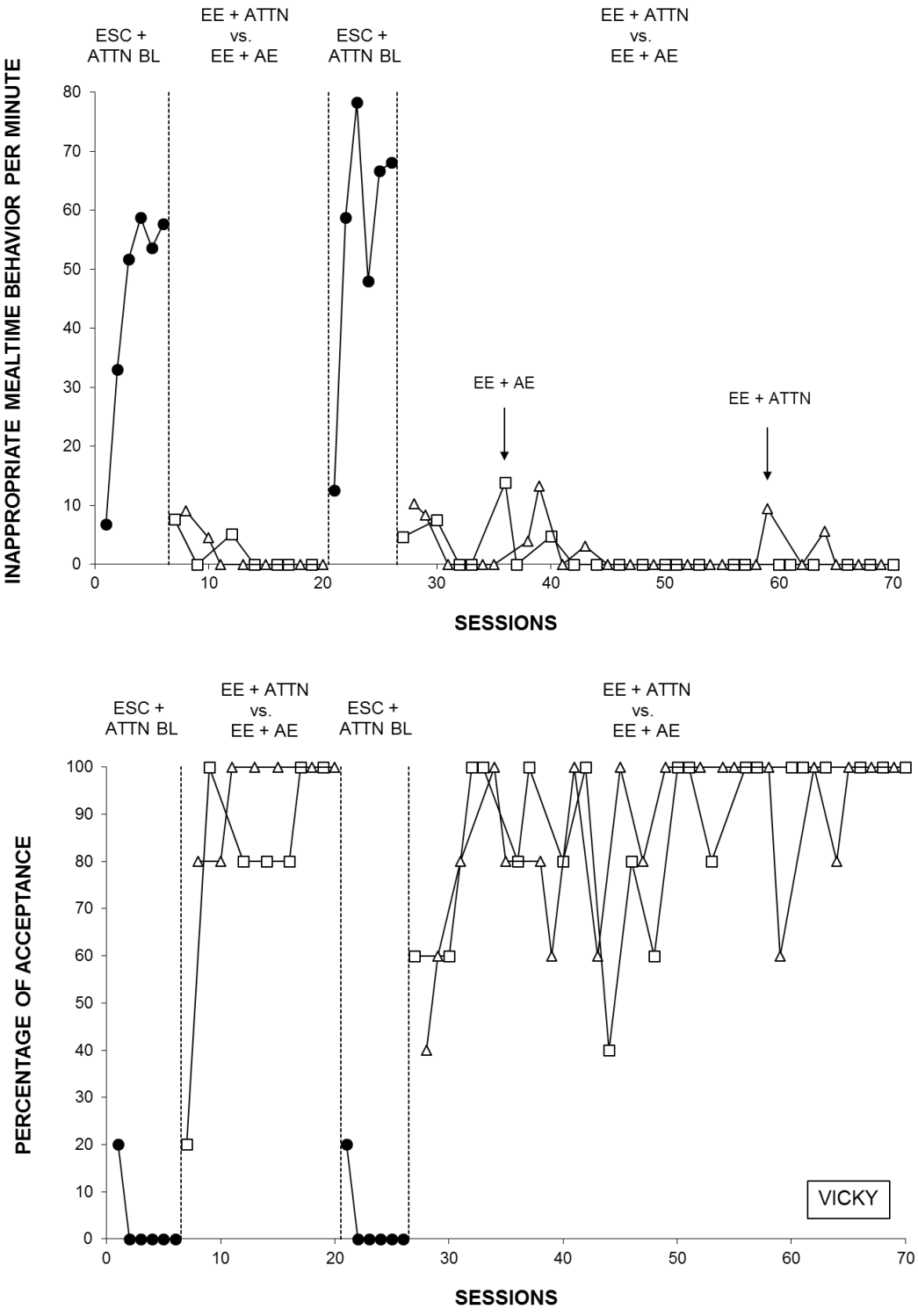

Figure 4. Inappropriate mealtime behavior per minute (top) and percentage of acceptance (bottom) during Vicky's treatment evaluation.