Journal of Pediatric Psychology, 45(4), 2020, 399–410
doi: 10.1093/jpepsy/jsaa004
Advance Access Publication Date: 25 February 2020
Original Research Article

Side Deposit with Regular Texture Food for Clinical Cases In-Home

Tessa Taylor, PhD, BCBA-D

Paediatric Feeding International, University of Canterbury

All correspondence concerning this article should be addressed to Tessa Taylor, PhD, Paediatric Feeding International, 6 Stafford Street, Double Bay, NSW 2028. E-mail: DrTaylor@PaediatricFeedingIntl.com

Received July 20, 2019; revisions received December 6, 2019; accepted January 22, 2020

Abstract

Objective Research has shown effectiveness of nonremoval of the spoon and physical guidance in increasing consumption and decreasing inappropriate mealtime behavior. The side deposit has been used to treat passive refusal in 2 studies (1 in a highly specialized hospital setting) using lower manipulated-texture foods on an infant gum brush. **Methods** We extended the literature by using regular texture bites of food with a finger prompt and side deposit (placing bites inside the side of the child's mouth via the cheek) in an intensive home-based program setting in Australia, demonstrating that attention and tangible treatments alone were ineffective prior, fading the tangible treatment, showing caregiver training, and following up. 2 male children with autism spectrum disorder (with texture/variety selectivity; one with liquid dependence) participated in their homes. We used a reversal design to replicate effectiveness of the side deposit added to a treatment package. **Results** For both participants, we observed a >98% decrease in latency to acceptance, a 100% decrease in inappropriate mealtime behavior, and a 100% increase in consumption with the side deposit added. Variety was increased to over 85 regular texture foods. 100% of admission goals were met. Caregivers were trained to high procedural integrity and the protocol was generalized to school and the community. Gains maintained to 3 and 1.5 years. **Conclusion** This is important work in adding to the literature and support for the side deposit and expanding to regular texture, as well as replicating and extending empirically supported treatments for feeding internationally to the home setting.

Key words: avoidant/restrictive food intake disorder (ARFID); escape extinction; food refusal; food selectivity; inappropriate mealtime behavior; pediatric feeding disorders; physical guidance; side deposit.

Introduction

Pediatric feeding disorders or avoidant/restrictive food intake disorders are a persistent eating or feeding disturbance where nutritional or energy needs are not met (American Psychiatric Association, 2013; González, Mulderink, & Girolami, 2018). These disorders are common, especially in children with autism spectrum disorders and developmental and intellectual disabilities, and affect the majority of areas of children's lives (e.g., growth, sleep, behavior, toileting, social participation, teeth, and immunity) during critical developmental periods (Kozlowski, Taylor, González, & Girolami, 2015; Manikam & Perman, 2000). Thus, effective treatment should be provided as early as possible. Behavior analytic interventions are the only well-established empirically supported treatments with 40 years of scientific support (Kerwin, 1999; Sharp, Jaquess, Morton, & Herzinger, 2010; Sharp, Volkert, Scahill, McCracken, & McElhanon, 2017; Volkert & Piazza, 2012). However, these treatments are limited in accessibility to a few hospitals in the United States because they require extensive expertise and resources to implement (Piazza, Milnes, & Shalev, 2015), so most children internationally do not receive timely effective help.

Functional analyses have identified that inappropriate mealtime behavior is most often maintained by escape from eating/avoidance (i.e., negative reinforcement; Borrero, England, Sarcia, & Woods, 2016; Girolami & Scotti, 2001; González, Rubio, & Taylor, 2014; Piazza, Fisher, et al., 2003). Treatments targeting escape, that is, escape extinction (e.g., Hoch, Babbitt, Coe, Krell, & Hackbert, 1994; Kerwin, Ahearn, Eicher, & Burd, 1995) has been shown to be necessary and to work on their own (e.g., Bachmeyer et al., 2009; Cooper et al., 1995). As treatment progresses, we may see response covariation of multiple forms of inappropriate mealtime behavior (e.g., active refusal, spitting out bites, not chewing/swallowing; Sevin, Gulotta, Sierp, Rosica, & Miller, 2002), which may require additional specialized intervention components (Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Borrero, Schlereth, Rubio, & Taylor, 2013; Girolami, Boscoe, & Roscoe, 2007; Gulotta, Piazza, Patel, & Layer, 2005; Kadey, Roane, Diaz, & McCarthy, 2013; Kerwin et al., 1995). Even if inappropriate mealtime behavior decreases in treatment, additional procedures may be required to increase consumption because a child can reach the maximum session duration without consuming bites by not opening the mouth for the bite, that is, nonacceptance or passive refusal (Kadey et al., 2013; Rubio, Borrero, & Taylor, 2015; Taylor, 2018). Rubio et al. (2015) defined and evaluated the addition of a side deposit to a treatment package to increase consumption using lower texture foods. They used a finger prompt (inserted index finger along the upper gum line until resistance is met) and a NUK® brush (infant gum brush) to deposit the bolus into the participant's mouth in the cheek or onto the tongue by rolling the brush (Rubio et al., 2015). This was conducted in a highly specialized hospital setting for severe complex cases where admissions are typically 8 weeks.

Treatment evaluation for feeding requires systematically evaluating components to both decrease inappropriate mealtime behavior and increase consumption, as well as targeting the appropriate difficulty and ability level for each child (e.g., food type, amount, and texture; Kozlowski, Taylor, Pichardo, & Girolami, 2016; Kunkel, Kozlowski, Taylor, & González, 2018; Williams, Paul, Pizzo, & Riegel, 2008) and teaching necessary feeding skills (e.g., self-feeding, chewing; Rivas et al., 2014; Volkert, Peterson, Zeleny, & Piazza, 2014). Functional analyses have also shown that inappropriate mealtime behavior may also be multiply maintained by access to attention (e.g., coaxing, comfort, caregiver interaction) and access to tangible items (e.g., preferred foods/liquids, toys, activities; Borrero et al., 2016; Girolami & Scotti, 2001; González et al., 2014; Piazza, Fisher, et al., 2003). However, treatments targeting attention and tangible maintaining factors alone (e.g., giving praise and interaction and preferred items and activities for taking and swallowing bites; not reacting or giving items for inappropriate behavior) may reduce inappropriate mealtime behavior and negative vocalizations, but not increase consumption (Berth et al., 2019; Piazza, Patel, Gulotta, Sevin, & Layer, 2003; Reed et al., 2004); hence the need for components targeting escape and physical guidance.

Taylor (2018) replicated Rubio et al. (2015) addition of a side deposit to a treatment package to the home setting in a 2-week admission. Taylor (2018) also extended by generalizing to family and community meals, showing decreased/absent side deposit use over time, showing maintained gains at 13 months, and showing ineffective tangible and attention treatments alone before escape components and physical guidance were used. Consumption increased only when the side deposit was added to the treatment package and it was no longer used upon discharge and follow-up.

More research is needed on replicating the side deposit procedure as there are only two studies in the literature on it. There are no reports to our knowledge of use of the side deposit with regular texture bites without the use of the infant gum brush (Rubio et al., 2015; Taylor, 2018). This study presents treatment evaluations for clinical cases where progress monitoring and data indicated that additional procedures were needed to increase consumption. The primary purpose was to extend the literature on the side deposit to use with regular texture bites. Additionally, we aimed to replicate use of a side deposit in a home setting (Taylor, 2018), including use of attention and contingent tangible treatments alone prior to escape extinction treatment components and providing follow-up information up to 3 years postdischarge. We also extended the literature further by removing tangible contingent access at the end of the treatment evaluation and showing caregiver training data.

Methods

Participants, Setting, and Materials

This study was conducted in the context of treatment evaluations of clinical cases in an intensive in-home feeding program. Participants' schedules were cleared during the program (no other therapies occurring). Participant names were changed to protect confidentiality. Family socioeconomic statuses (SESs) were high (informally based on income, education, and employment status). Physicians filled out a form to clear and approve participation (e.g., growth, food allergy and exposure history, review of systems, relevant testing results, or specialist referrals needed). This study was performed in accordance with ethical standards laid

out in the 1964 Declaration of Helsinki and its later amendments. Caregivers provided written informed consent. A trained doctoral-level behavior analyst conducted sessions in the family home (dining room for Benoît; therapy room for Emeril) equipped with seating (Bumbo Booster Seat for Benoît; First Class School Chair for Emeril), dining room table and chairs, laptop computers for data collection, webcam, digital scale, timers, preferred tangible items (e.g., toys, games, electronics), and meal-related materials (e.g., adaptive shallow bowl maroon spoons, small plates/bowls, NUK® brush [infant gum brush], Chux® pads, gloves, smocks, infant finger gum brush/guard, cleaning supplies).

Benoît was a 5-year-old Asian and Caucasian male with autism. Benoît did not eat any fruits or vegetables separately at an age-appropriate texture. He only consumed vegemite toast, a specific plain scrambled egg from a certain restaurant, croissants, brand- and container-specific yogurt, and a high ground texture mixture his mother specially prepared for him which included combinations of meat, seafood, egg, and vegetables. He did not consume school lunch foods or eat in the community besides specific foods, so the family could not dine out or travel. Meal duration was long and Benoît would not self-feed the mixture. Benoît had received ~6 months of prior ineffective feeding treatment attempts. Benoît received intensive early intervention. He spoke in sentences, could read and write, and was toilet trained.

Emeril was a 4-year-old Caucasian male with autism, baby bottle/formula dependence, and iron deficiency requiring supplementation. He did not eat any foods from the food groups (protein, starch, vegetable, and fruit). He only ate two specific snack foods (cracker and cookie) and a homemade fruit smoothie as a nonself-feeder on a spoon. He did not feed himself or drink out of an open cup. He refused some liquid medications and would not accept chewable multivitamins. He could not stay a full day at school due to not eating and drinking. The family could not dine out or travel. Emeril had over 2 years of prior ineffective feeding treatment attempts including behavioral and occupational therapy and consultations with a hospital multidisciplinary feeding team. Emeril said a few words, was toilet trained, and received intensive early intervention.

Response Measurement, Interobserver Agreement, and Procedural Integrity

A trained observer recorded participant and feeder behaviors live while seated in the dining room. Observers used Excel for the preference assessments and laptop computers using a specialized real-time data collection program (BDataPro) for the treatment evaluation (Bullock, Fisher, & Hagopian, 2017). We measured variables only while the demand to eat was in place during bite presentation. Frequency keys included: *acceptance* (entire bolus, except an amount smaller than a pea, passed plane of lips into mouth for the first time at any time during each bite presentation (prompted "take a bite," bite placed within arm's reach); m*outh clean* (product measure of swallowing; no food larger than size of pea in mouth at a 30-s check "show me ah" unless absence of food was due to expulsion); *inappropriate mealtime behavior* (45° or further head turn, touch of feeder's arm below elbow, push bite/plate away, or mouth cover during spoon presentation); and *expulsion* (food larger than size of pea passed plane of lips after deposit). We scored duration keys by activating/deactivating a timer to count seconds for *latency to acceptance*, *latency to mouth clean*, and *negative vocalizations* (crying, screaming, whining, negative statements about the food/liquid/meal, 3 s offset [deactivated when ceased for 3 s]).

We calculated percentage mouth clean by dividing frequency of mouth clean by 4 (number of programmed bite presentations for the session) and multiplying by 100 to convert to a percentage to provide an overall measure of consumption of food (i.e., percentage of bites consumed out of total number of bites set for the session; e.g., if the protocol was set for four bites and the participant consumed one, consumption [mouth clean] would be 25% of bites for that session). We divided latency duration by frequency of occurrence to get latency per bite. We divided negative vocalization duration by session duration within demand and converted to a percentage. We converted other frequencies to responses per minute (rpm) by dividing by session duration within demand.

We assessed interobserver agreement for 29% of sessions by having an independent observer collect data using videoed sessions. We calculated partial agreement using BDataPro (Iwata, Pace, Cowdery, & Miltenberger, 1994). For each 10-s interval, we divided the smaller number by the higher number, averaged across intervals, and multiplied by 100. Mean agreement was 97%. We assessed procedural integrity during 100% of sessions. Observers scored *incorrect integrity* if the feeder refrained from implementing each procedure (e.g., praise, physical guidance, tangible delivery) within plus or minus 3 s of when it was programmed to be implemented and implemented procedures when they were not programmed (e.g., incorrect attention, bite removal). Mean incorrect procedural integrity was 0.01 rpm for the behavior analyst and 0.2 rpm for caregivers. Mean interobserver agreement for procedural integrity was 100%.

Experimental Design

We used reversal designs to demonstrate experimental control (Ledford, 2018). We used an ABCDEAE design for Benoît where A was baseline escape, B was

differential attention and contingent access, C was differential attention and contingent access plus nonremoval of the spoon and representation of expulsions, D added the finger prompt, and E added the side deposit. We used an ABCDADE design for Emeril where A, B, and C were the same as Benoît (above), D added the finger prompt and side deposit, and E was with contingent access removed. We calculated effect sizes using percentage reduction (Hagopian & Gregory, 2016).

Procedure

A trained doctoral-level behavior analyst conducted sessions during approximately an 8-hr day. The number of sessions and conditions conducted per day varied based on progress. For Benoît, we did 7 full days. We gradually faded hours as caregiver training progressed. For the next 8 days, we did 0–2 meals per day for caregiver and school therapist training and meals with his sibling (we did feeding treatment with his sibling during this time). For Emeril, we did ~3 weeks: 14.5 days with weekend breaks, then a restaurant meal and school visit. We ran as many sessions per day as possible (with breaks in between to analyze/enter data, do weights and pictures, food preparation and clean-up, setup, talk with/train caregivers, toilet trips, note-taking, protocol writing, etc.). We initially targeted eight regular soft texture foods (two from each food group) that participants did not eat nominated by parents. For Benoît, foods were tuna, boiled egg, potato, Weetbix, cooked carrot, broccoli, blueberry, and banana. For Emeril, foods were yogurt, scrambled egg, peanut butter toast, pasta, cooked carrot, avocado, banana, and grape. We increased variety gradually after consumption was stable at 100% (during the reversal phase starting at session 30). Bolus size was a level small maroon spoon (~1 g) and 1-cm square bites. Sessions were four programmed bites, and no new bite presentations were presented after 10 min. We conducted paired-stimulus edible preference assessment sessions before treatment and posttreatment (Benoît only) using procedures similar to those described by Fisher et al. (1992) and Kunkel, Kozlowski, Taylor, and González (2018). We included some preferred foods that participants already ate in the assessments, but not in the treatment evaluation. Tangibles were a variety of reserved items informed by parents and based on paired-stimulus tangible preference assessments. Upon parental request, for Emeril, we played continuous noncontingent classical music.

Treatment Conditions

Treatment conditions were conducted similar to those described by Taylor (2018); please see Taylor (2018) and Rubio et al. (2015) for more detailed descriptions.

Baseline Escape

We presented bites ~every 30 s, held the spoon stationary 3 cm from the lips after 5 s of presentation, and provided a 30-s break upon inappropriate mealtime behavior or expulsion.

Contingent Access and Differential Attention

If the participant accepted the bite or had a mouth clean at any time, we provided descriptive praise; upon mouth clean, we provided 30-s access to highly preferred toys and activities.

Nonremoval of the Spoon and Re-presentation of Expulsion

We no longer provided escape contingent on inappropriate mealtime behavior and expulsion (e.g., Hoch et al., 1994; Kerwin et al., 1995). We did hand-over-hand (placed our hand over the participant's hand with spoon or bite) at 5 s and kept the bite at the upper lip until acceptance or maximum session duration and re-presented expulsions immediately.

Finger Prompt (Benoît Only)

After 10 s of presentation (5 s after hand-over-hand), we inserted our forefinger between cheek and upper gumline until resistance was met (Borrero et al., 2013).

Finger Prompt and Side Deposit

After 15 s of presentation (5 s after finger prompt), we implemented a side deposit (Rubio et al., 2015). For regular texture bites, we used our fingers to manually insert the bite into the cheek in the space created with the finger prompt. For Benoît, in the last treatment phase, we modified contingent access criteria (to the absence of expels and then the absence of disruptions) and modified to using the NUK® brush to represent subsequent expulsions to the tongue (if needed further smashing the bite onto the brush or fork mashing it onto a plate or with an infant food masher prior; Girolami et al., 2007). At the end of admission, we removed the NUK® brush due to low social acceptability by the mother compared with the manual deposit and decreased frequency/necessity of use (Benoît was opening with the finger prompt alone and repeated expulsions had decreased to near zero).

For Emeril, in the last treatment phase we modified contingent access criteria and made other minor modifications (e.g., prompting, modeling, time frames, pausing/separating out certain food textures and shapes) to address issues with chewing and latency to mouth clean (i.e., packing and early swallows). After the treatment evaluation in the full plate meals (not shown), we made additional modifications to address issues that arose as we increased variety (and therefore different textures), moved to portions instead of cut-

up bites, and did caregiver training and generalization. We added in NUK® brush redistribution (Gulotta et al., 2005) due to packing and long meal duration and also had to make additional modifications[1] to address inappropriate mealtime behavior (mostly arose during caregiver training) and issues with chewing and latency to mouth clean (packing).

Caregiver Training and Generalization

We did intensive caregiver training and generalization (cutlery/crockery, seating, and settings) as described by Taylor (2018). We trained Benoît's mother and school behavior analyst and Emeril's mother, father, nanny, and school shadow. We conducted family meals with siblings and at restaurants. For Emeril, we did a protocol and free access meal at school. With Emeril, we also taught open cup drinking with water and milk, eating pouch foods from pouch, and liquid and chewable medication acceptance.

Follow-Up

For 2 weeks postdischarge, we asked Emeril's caregivers to rotate through his food list and record mealtime data on a shared electronic spreadsheet, take pictures of mealtime plates, and video meals. Benoît's school behavior analyst provided paper/pencil mealtime data on consumption, duration, and rating his independence and writing comments. For Emeril, at 6-month follow-up, we did a caregiver and school shadow meeting and reviewed a general daily food list and his mother provided an email update at 1 year. At 3 years for Benoît and 1.5 years for Emeril, we asked the caregivers which foods from the discharge food list the participants ate and to answer a 5-point Likert type question from 1 (worse than pretreatment) to 5 (resolved) from the satisfaction survey (Hoch et al., 1994) on how their child's appropriate consumption of a variety of foods was compared with before the program.

Results

In the edible preference assessment pretreatment, Benoît consumed vegemite toast only and either avoided or did not respond to novel foods. Posttreatment, vegemite toast was still at the highest preference rank and consumed 100%, but Benoît also consumed potato, tuna, and banana. Emeril avoided all foods in the pretreatment assessment including preferred snacks and the fruit smoothie.

Results of the treatment evaluation are displayed in Figure 1 (Benoît) and Figure 2 (Emeril).

For Benoît, with baseline escape, consumption was 0 and refusal ($M = 4.6$ rpm) and negative vocalizations were moderate ($M = 29.6\%$). With contingent access and differential attention, consumption remained low ($M = 12.5\%$) and refusal was high ($M = 3.9$ rpm). With nonremoval and representation, consumption remained at 0 and he reached all-time caps (high latency to acceptance; $M = 601.40$ s). With the finger prompt, consumption remained low ($M = 8.3\%$) and refusal decreased significantly (i.e., passive refusal/waiting out; Rubio et al., 2015; $M = 0.5$ rpm). With the addition of the side deposit, consumption increased to 100% and was high and stable and latency to acceptance decreased significantly to low and stable rates. During the reversal to baseline escape, consumption decreased to 0 and refusal increased to 1.7 rpm. With the reimplementation of the treatment package including the side deposit, percentage consumption increased to 100% and stayed high and stable at 100% for the remainder of the treatment evaluation. Latency to acceptance decreased and remained low and stable. In the last treatment phase, we had a webcam malfunction and Benoît saw himself on the laptop camera engaging in inappropriate mealtime behavior and started smiling and laughing and repeatedly refusing, expelling, throwing, not chewing, etc. We changed contingent access criteria to include these problem behaviors (rather than mouth clean only). We added brush representation for subsequent expels and expels decreased. We did separate sessions targeting chewing criteria (not shown). Inappropriate mealtime behavior was 0 for the last 8 sessions of the treatment evaluation including during caregiver training, and the side deposit was no longer being used. The side deposit was used only once in the last 20 sessions. We removed the tangible contingent access component during the full plate meals. Benoît increased from eating 4 foods total (no separate vegetables or fruits) to 85 foods (24 proteins, 11 starches, 21 vegetables, 14 fruits, and 15 combination foods) at regular texture including steak and salad and self-feeding. Upon discharge, Benoît was consuming an average of four ounces of solids per meal.

For Emeril, consumption was 0 and refusal was high ($M = 30.2$ rpm) in baseline escape and when differential attention and contingent access were added. When nonremoval and representation were added, consumption remained low ($M = 12.5\%$) and negative

1 Adjusting bite size (and pausing some foods) based on food texture, shape (e.g., strips, thickness, round foods), and consistency; changing time frame, frequency, and attention in prompts; changing contingent access criteria; changing to move-on to next bite rather than wait for mouth clean and decreasing the time frame of move-on with a three-pack rule and changing number of bites; changing re-presentation of subsequent expels to opposite cheek; adding interspersal rotation (requiring rotating through different food textures rather than allowing him to independently choose what bites to take or eat all of a portion/texture); working separately on teaching biting off and judging bite size; interspersing drinks and changing the time frame and amount.

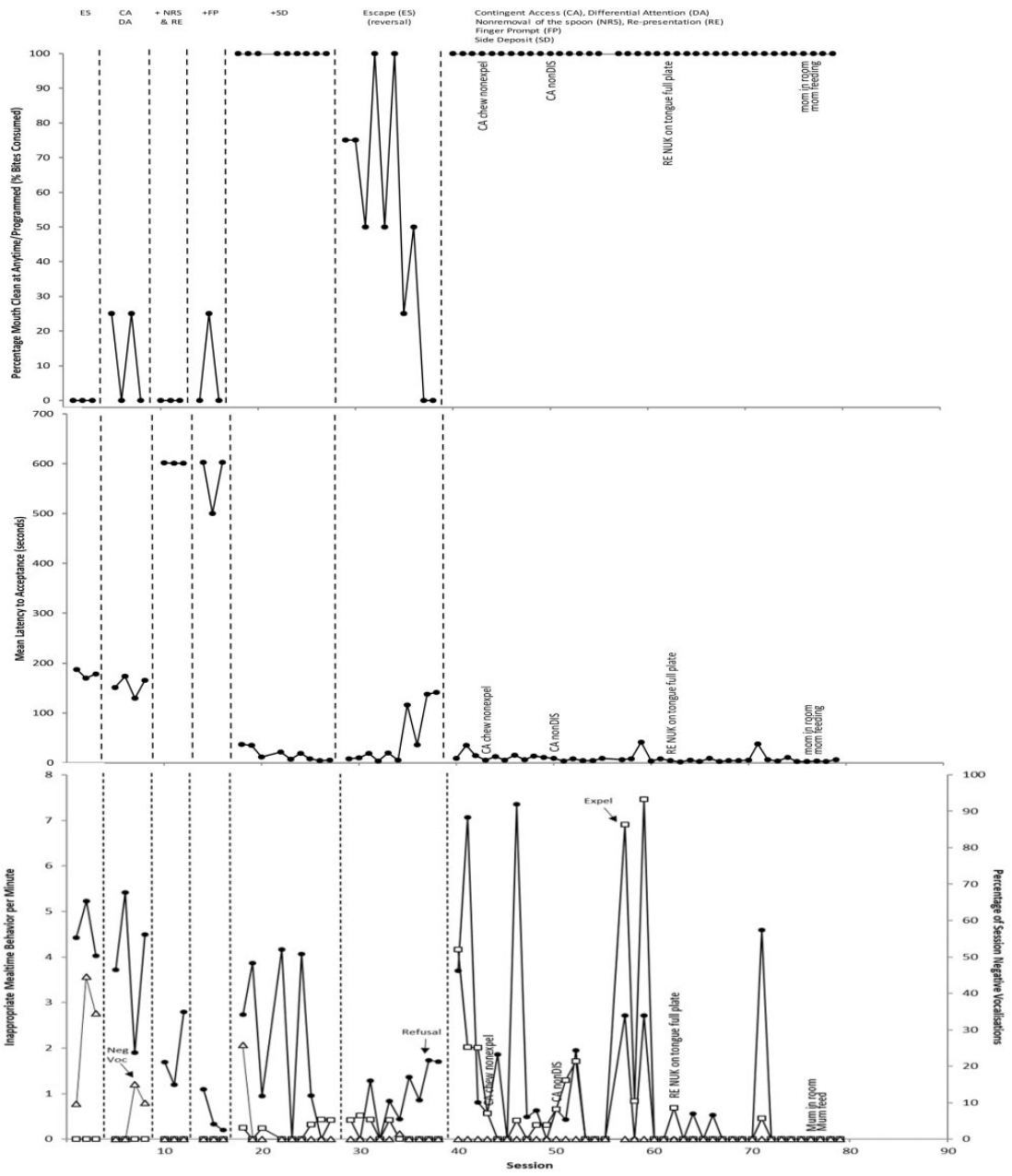

Figure 1. For Benoît, percentage consumption out of programmed bites (top panel), mean latency to acceptance in seconds (middle panel), and responses per minute for inappropriate mealtime behavior and expulsion and percentage of session negative vocalizations (bottom panel).

vocalizations were high ($M = 96.3\%$). He only accepted two bites of lower texture food and there were expels, spoon biting, and periods of passive refusal/waiting out. When the finger prompt and side deposit were added, consumption increased to 100% and inappropriate mealtime behavior decreased to 0. He required prompting for chewing and swallowing and latency to mouth clean (not shown) was too high. We also had to break off and do separate empty spoon sessions to teach self-feeding. During the reversal to baseline escape, consumption decreased to 0 and refusal increased to 32.4 rpm. With the reimplementation of the treatment package, consumption increased to 100% and was high and stable and remained at 100% for the remainder of the treatment evaluation, including during caregiver training and when the tangible contingent access was removed. Inappropriate mealtime behavior was at near 0 levels. The side deposit was not used for the last 34 sessions and was not used more than once per session after the first two sessions. It was also not used for drinks, medications, pouches, etc. (not shown). We only used the redistribution (not shown) twice and did not include it in the final protocol or train caregivers on it. Emeril increased from

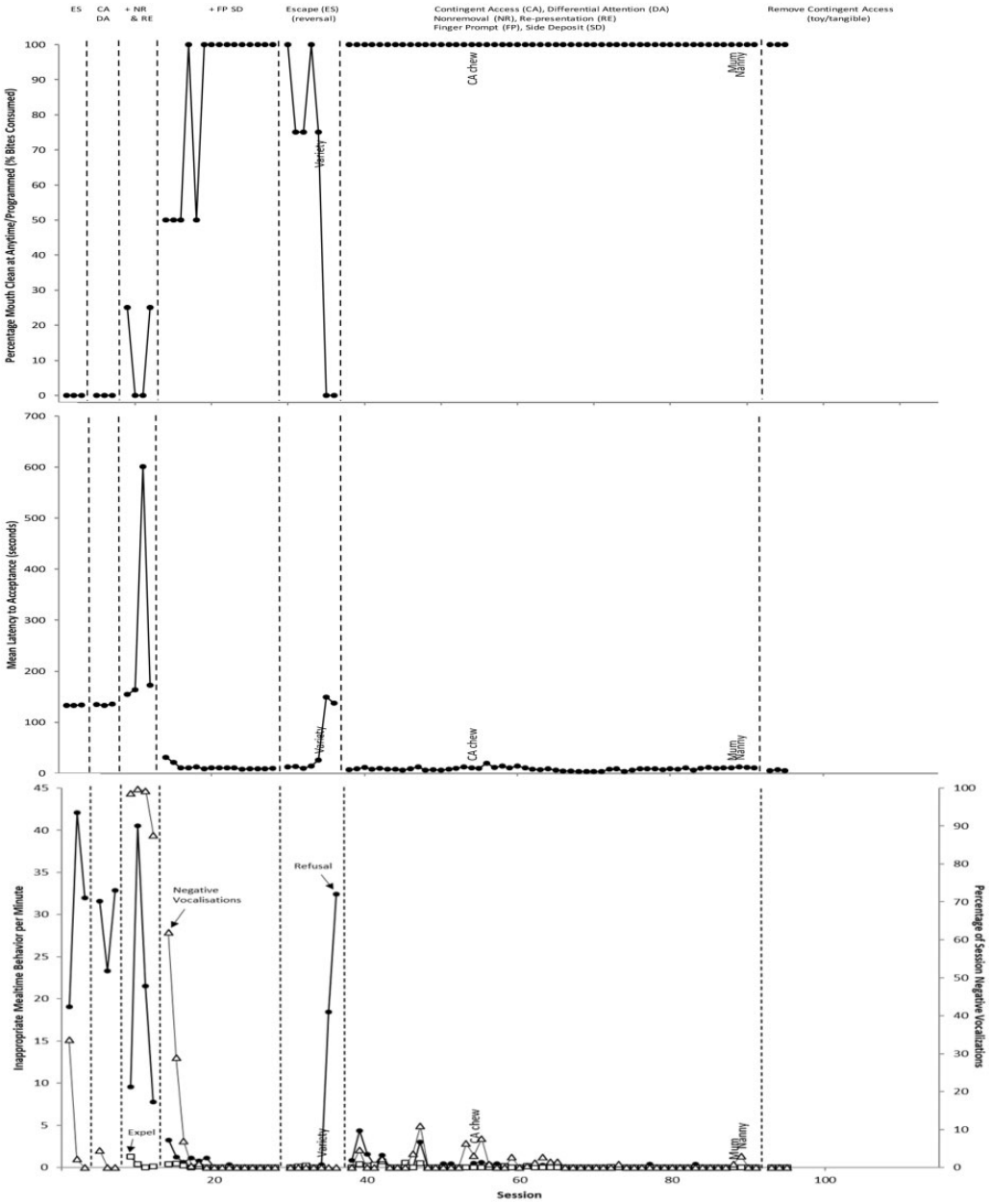

Figure 2. For Emeril, percentage consumption out of programmed bites (top panel), mean latency to acceptance in seconds (middle panel), and responses per minute for inappropriate mealtime behavior and expulsion and percentage of session negative vocalizations (bottom panel).

eating 0 food group foods to 118 foods (24 proteins, 22 starches, 20 vegetables, 16 fruits, and 36 combination foods) at regular texture. Emeril also learned to self-feed, scoop, chew and swallow regular texture like raw veggies and meat, accept medication, drink from a cup, and we eliminated formula and baby bottle dependence. Upon discharge, Emeril was consuming an average of 3.5 ounces of solids per meal.

Participants met 100% of admission goals. For effect sizes of the treatment (Hagopian & Gregory, 2016), from baseline to the end of the treatment evaluation, there was 100% increase in consumption, >98% decrease in latency to acceptance, and 100% decrease in inappropriate mealtime behavior (depicted in Figure 3).

Caregivers did not complete the questionnaires provided, but both reported high satisfaction and social treatment acceptability verbally and via email. Benoît's mother verbally reported low acceptability with the NUK® brush, but higher acceptability of the finger prompt and manual deposit. We were able to discontinue the infant gum brush at the end of the admission as it was no longer needed. Benoît's caregivers reported that they were able to successfully complete

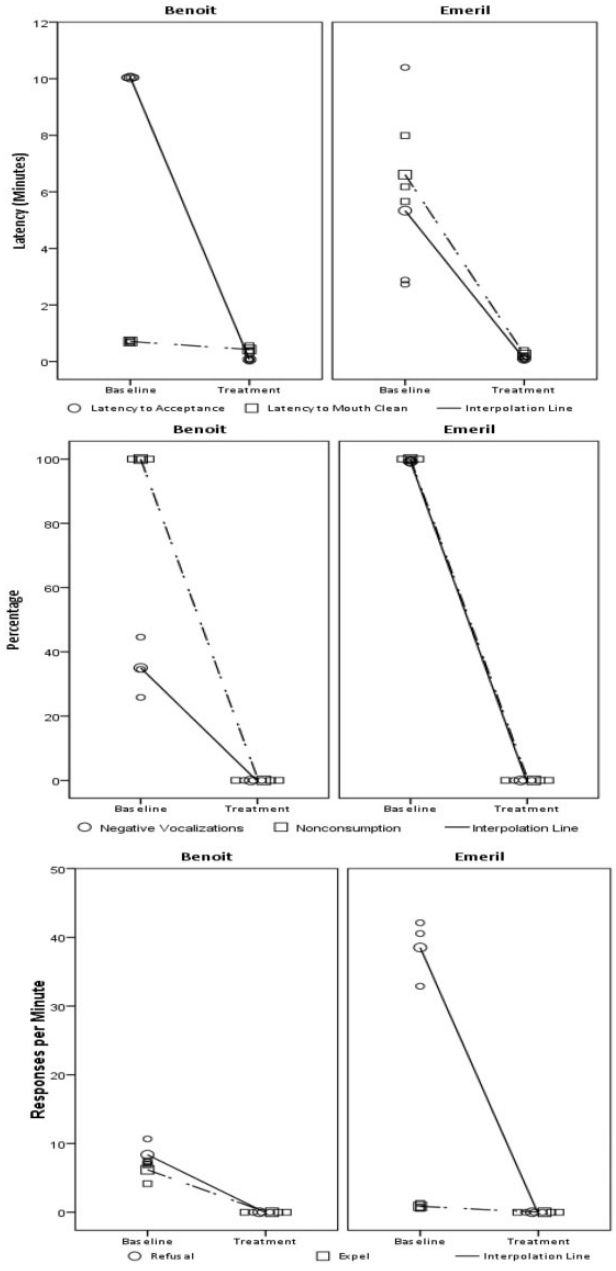

Figure 3. From baseline to end of treatment evaluation, percent reduction for latency to acceptance and latency to mouth clean (top panel), negative vocalizations and nonconsumption (middle panel), and refusal and expels (bottom panel). Each of the three individual data points are shown (to show variability/dispersion) as well as the mean (thicker marker).

meals with the finger prompt and manual side deposit and did not need the infant gum brush. His mother also reported this method was more portable (did not need specialized equipment) and less atypical and stigmatizing in the community as she often did meals in the park and in cafes and restaurants and preferred for the infant gum brush not to be used at school.

At 1-month follow-up, Benoît's mother reported that he was doing perfect in meals and eating everything/anything at home and in the community. At 3-month follow-up, Benoît's school behavior analyst provided paper/pencil data and consumption was 100% and independence was high. He was eating with his peers and the finger prompt and side deposit were no longer being used. At 3-year follow-up, Benoît's mother reported that he still ate all of the foods from his food list and ate different varieties of combination foods. He would try new foods such as sashimi if a friend was eating it. She rated his eating as a 4 (much better than pretreatment) because he still showed some rigidity such as not eating boiled vegetables at a restaurant (wanted them boiled his mother's way).

For the 2 weeks postdischarge, Emeril's consumption was high and stable at 100% and deposits were low ($M = 0.4$; used in 29% of meals). At 6-month follow-up, Emeril's mother reported that he was eating an adequate volume at home and mealtime behavior was better with his father compared with his mother. He was not eating a wide variety of foods free access at school. The family had stopped presenting mixed foods, such as casseroles and spaghetti Bolognese due to inappropriate mealtime behavior. On a daily regular basis at home, he was still eating at least 12 proteins, 6 starches, 7 vegetables, 4 fruits, and 5 combinations. At 1-year follow-up, Emeril's mother reported that he continued to eat at home well, but not free access at school (without a feeder/protocol).

Discussion

We implemented the side deposit procedure with regular texture bites in a home setting for two participants using a reversal design. The side deposit, when added to the treatment package, increased consumption from 0 to 100%. Participants increased to eating a wide variety of foods at regular texture and portions. We trained caregivers and depicted data with caregivers feeding in the treatment evaluation. Treatment duration was quick (1–3 weeks) and all goals were met. Treatment gains maintained over time up to 3 years. This program was healthy and safe as we did not use hunger provocation/deprivation/starvation or preferred edibles, increased to full nutritional variety, and taught mealtime skills needed for age-appropriate independence and texture. Emeril learned to self-feed and chew/swallow regular texture, accept medication, and drink from a cup, and we eliminated baby bottle dependence. Meals were generalized to school and the community.

We evaluated less intrusive interventions systematically before adding the side deposit, and both participants had lengthy failed treatment attempts from various disciplines and approaches. Contingent tangible access and differential attention alone and escape extinction components were ineffective in increasing

consumption. Participants would not eat to get highly preferred toys or praise/interaction with ignoring inappropriate mealtime behavior. We were able to remove the tangible contingent access for both participants. A limitation is that removal of contingent tangible access is not shown for Benoît (was done in full plate meal graph). We also did not conduct a functional analysis. However, in pediatric feeding, escape is most often identified as a function and required in treatment even if multiple functions are identified, and attempted attention and tangible treatments did not work in this study. We hypothesized escape/avoidance (negative reinforcement) to be the maintaining function based on the feeding literature and our intake information, consistent with the hypothesized mechanism of the side deposit. Another limitation is that we did not conduct a component analysis to demonstrate the effectiveness of the side deposit alone versus part of a treatment package.

As previously described in the literature on the side deposit, we observed passive refusal or "waiting out" (Kadey et al., 2013; Rubio et al., 2015). This is particularly evident with Benoît where we evaluated the finger prompt alone first. Across all phases overtime before the side deposit, refusal was on a decreasing trend and negative vocalizations had decreased to 0, particularly with the finger prompt alone. Still, consumption remained low. Limitations were that we did not evaluate the finger prompt alone for Emeril (in the interest of time and he was opening inconsistently, expelling, and spoon biting vs. consistently not opening like Benoît) and session durations were shorter than those conducted in the hospital setting. It did appear that Emeril's refusal was also decreasing except for a burst of negative vocalizations when escape extinction was first implemented. He had a 5-s opportunity to take the bite with the finger prompt alone prior to the side deposit, but still contacted the side deposit particularly in the initial sessions. For Emeril, inappropriate mealtime behavior decreased with the treatment package and remained low (except for an expected increase during the reversal).

Although refusal and negative vocalizations were low for the remainder of the treatment evaluation for Emeril, we had to make modifications for issues with chewing and latency to mouth clean (i.e., packing and early swallows). We also had to make modifications after the treatment evaluation during generalization and caregiver training due to inappropriate mealtime behavior and skill issues. At the end of the program, these issues were resolved and Emeril was chewing and swallowing all regular texture appropriately and independently. Food texture choice and progression are critical aspects in pediatric feeding, as well as assessing the child's skills and knowing how to teach skills as needed. This was accounted for prior to starting the treatment evaluation, and the foods used initially in this study for both participants were soft and most were mashable. For example, due to individualized assessment, Taylor (2018) decreased to lower texture for this participant for the side deposit treatment evaluation and increased to regular texture after. These are illustrations of why pediatric feeding treatment requires expertise, proper evaluation, and resources, particularly with the use of intrusive procedures.

Several limitations are notable. Neither participants' caregivers completed the satisfaction and acceptability surveys; however, they reported them as high and Benoît's mother provided acceptability information on the manual versus brush deposit. Follow-up data were not systematic or formal. We did not present systematic demonstration of fading and removal of the side deposit; however, session data and paper data after the program showed its use had decreased. This was done with high SES families, so it is uncertain whether during training and follow-up results would hold with low SES families.

Future research should evaluate separate data for finger prompt and side deposit and for their use for initial deposit, representation (manual vs. brush), redistribution, and necessity and frequency of use over time. This should be conducted in a proper systematic treatment evaluation using single-subject design with adequate time and resources due to response covariation (e.g., passive refusal, expulsion, packing; Sevin et al., 2002) and with careful consideration of individualized bite size, texture, and chewing skills. Future studies should also evaluate side deposit methods with and without the infant gum brush as well as with other presentation and deposit methods (e.g., flipped spoon; Stubbs, Volkert, Rubio, & Ottinger, 2018) for various textures combined over time with consideration of skill level and compliance (e.g., ability/willingness to open mouth and close lips on upright spoon).

It is imperative to highlight that the side deposit procedure is a relatively intrusive intervention and should only be implemented by highly trained, specialized, experienced professionals in intensive programs with resources for systematic, data-based, individualized evaluation for severe cases when less intrusive procedures have proven ineffective (Brodhead, Quigley, & Wilczynski, 2018; Piazza et al., 2015; Rubio et al., 2015; Taylor, 2018). The behavior analyst who replicated use of the side deposit in the home setting was one of the original study authors and was trained to implement it properly and safely via over 5 years at a specialized hospital pediatric feeding program where the side deposit originated. This behavior analyst had expertise to run a treatment evaluation, individualize procedures, and program components for response covariation, and allotted adequate

resources, necessary precautions/planning, and time for proper treatment evaluation. Pediatric feeding treatments implemented without proper planning, expertise, and intensity can cause harm, risk child safety, and make the problem worse if implemented incorrectly or stopped too soon (González, Mulderink, & Girolami, 2018; Piazza et al., 2015). Prior to treatment, expertise is also needed to conduct a thorough initial assessment and referral for consultation to other experienced disciplines if needed for clearance and testing for medical and physical variables (e.g., food allergies, swallow safety; Yeung et al., 2015; Friman & Piazza, 2011). Participants' parents consented to and approved each procedural change after a thorough description, demonstration, and opportunity to ask questions and have concerns addressed and to watch sessions via video. No injury occurred and no discomfort was reported. Use of the procedure decreased significantly during the program, and we took social acceptability into account.

This study is important in extending the use of a side deposit to regular texture bites (Rubio et al., 2015; Taylor, 2018). We also translated and condensed empirically supported treatment to a home setting overseas that has previously been limited to a handful of multidisciplinary hospital programs in the United States (Sharp et al., 2017).

Funding

Parts of this study were presented at the biannual conference of the Hellenic Community for Behavior Analysis in Athens, Greece in 2017 and at the annual meetings of the Association for Behavior Analysis Australia in Sydney, Australia in 2017. The cases in this study have been included in a group outcome study (Taylor, Blampied, & Roglić, 2020).

Conflicts of interest: None declared.

References

Ahearn, W. H., Kerwin, M. L. 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.1996.29-321

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Arlington, VA: American Psychiatric Publishers.

Bachmeyer, M. H., Piazza, C. C., Fredrick, 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

Berth, D. P., Bachmeyer, M. H., Kirkwood, C. A., Mauzy, C. R. IV, Retzlaff, B. J., & Gibson, A. L. (2019). Noncontingent and differential reinforcement in the treatment of pediatric feeding problems. *Journal of Applied Behavior Analysis*, *52*, 622–641. doi:10.1002/jaba.562

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., Schlereth, G. J., Rubio, E. K., & Taylor, T. (2013). A comparison of two physical guidance procedures in the treatment of pediatric food refusal. *Behavioral Interventions*, *28*, 261–280. doi:10.1002/bin.1373

Brodhead, M. T., Quigley, S. P., & Wilczynski, S. M. (2018). A Call for Discussion About Scope of Competence in Behavior Analysis. Behavior Analysis in Practice, *11*, 424–435. 10.1007/s40617-018-00303-8

Bullock, C. E., Fisher, W. W., & Hagopian, L. P. (2017). Description and validation of a computerized behavioral data program: "BDataPro". *The Behavior Analyst*, *40*, 275–285. 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 analyses to identify active variables in treatment packages for children with feeding disorders. *Journal of Applied Behavior Analysis*, *28*, 139–153. doi:10.1901/jaba.1995.28-139

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

Friman, P. C., & Piazza, C. (2011). Behavioral pediatrics. In W. Fisher, C. *Piazza*, & H. S. Roane (Eds.), *Handbook of Applied Behavior Analysis* (pp. 433–450). New York, NY: The Guilford Press.

Girolami, P. A., Boscoe, J. H., & Roscoe, N. (2007). Decreasing expulsions by a child with a feeding disorder: Using a brush to present and re-present food. *Journal of Applied Behavior Analysis*, *40*, 749–753. doi:10.1901/jaba.2007.749-753

Girolami, P. A., & Scotti, J. R. (2001). Use of analog functional analysis in assessing the function of mealtime behavior problems. *Education and Training in Mental Retardation and Developmental Disabilities*, *36*, 207–223. doi:https://www.jstor.org/stable/23879736

González, M. L., Mulderink, T. D., & Girolami, P. A. (2018). Avoidant restrictive food intake disorder. In A. Maragakis & W. T. O'Donohue (Eds.), *Principle-Based stepped care and brief psychotherapy for integrated care settings* (pp. 53–64). Cham, Switzerland: Springer.

González, M. L., Rubio, E. K., & Taylor, T. (2014). Inappropriate mealtime behavior: The effects of noncontingent access to preferred tangibles on responding in functional analyses. *Research in Developmental Disabilities*, *35*, 3655–3664. doi:10.1016/j.ridd.2014.08.016

Gulotta, C. S., Piazza, C. C., Patel, M. R., & Layer, S. A. (2005). Using food redistribution to reduce packing in

children with severe food refusal. *Journal of Applied Behavior Analysis*, *38*, 39–50. doi:10.1901/jaba.2005.168-03

Hagopian, L. P., & Gregory, M. K. (2016). Behavior analytic approaches to problem behavior in intellectual disabilities. *Current Opinion in Psychiatry*, *29*, 126–132. doi:10.1097/YCO.0000000000000232

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., 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

Kadey, H. J., Roane, H. S., Diaz, J. C., & McCarthy, C. M. (2013). Using a NUK® brush to increase acceptance of solids and liquids for two children diagnosed with autism. *Research in Autism Spectrum Disorders*, *7*, 1461–1480. doi:10.1016/j.rasd.2013.07.017

Kerwin, M. L. E. (1999). Empirically supported treatments in pediatric psychology: Severe feeding problems. *Journal of Pediatric Psychology*, *24*, 193–214. doi:10.1093/jpepsy/24.3.193

Kerwin, M. L. 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.1995.28-245

Kozlowski, A. M., Taylor, T., González, M. L., & Girolami, P. A. (2015). Feeding disorders. In J. L. Matson, & M. L. Matson (Eds.), *Comorbid conditions in individuals with intellectual disabilities* (pp. 109–143). Cham, Switzerland: Springer.

Kozlowski, A. M., Taylor, T., Pichardo, D., & Girolami, P. A. (2016). The impact of emerging liquid preference in the treatment of liquid refusal. *Journal of Developmental and Physical Disabilities*, *28*, 443–460. doi:10.1007/s10882-016-9482-4

Kunkel, K. R., Kozlowski, A. M., Taylor, T., & González, M. L. (2018). Validating a food avoidance assessment for children with food selectivity. *Behavioral Development*, *23*, 89–105. doi:10.1037/bdb0000078

Ledford, J. R. (2018). No Randomization? No Problem. *American Journal of Evaluation*, *39*, 71–90. doi:10.1177/1098214017723110

Manikam, R., & Perman, J. A. (2000). Pediatric feeding disorders. *Journal of Clinical Gastroenterology*, *30*, 34–46. doi:10.1097/00004836-200001000-00007

Piazza, C. C., Fisher, W. W., Brown, K. A., Shore, B. A., Patel, M. R., Katz, R. M., … Blakely-Smith, A. (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., Milnes, S. M., & Shalev, R. A. (2015). A behavior-analytic approach to the assessment and treatment of pediatric feeding disorders. In H. S. Roane, J. E. Ringdahl, & T. S. Falcomata (Eds.), *Clinical and organizational applications of applied behavior analysis* (pp. 69–94). Waltham, MA: Academic Press.

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

Reed, G. K., Piazza, C. C., Patel, M. R., Layer, S. A., Bachmeyer, M. H., Bethke, S. D., & Gutshall, K. A. (2004). On the relative contributions of noncontingent reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, *37*, 27–42. doi:10.1901/jaba.2004.37-27

Rivas, K. M., Piazza, C. C., Roane, H. S., Volkert, V. M., Stewart, V., Kadey, H. J., & Groff, R. A. (2014). Analysis of self-feeding in children with feeding disorders. *Journal of Applied Behavior Analysis*, *47*, 710–722. doi:10.1002/jaba.170

Rubio, E. K., Borrero, C. S. W., & Taylor, T. (2015). Use of a side deposit to increase consumption in children with food refusal. *Behavioral Interventions*, *30*, 231–246. doi:10.1002/bin.1404

Sevin, B. M., Gulotta, C. S., Sierp, B. J., Rosica, L. A., & Miller, L. J. (2002). Analysis of response covariation among multiple topographies of food refusal. *Journal of Applied Behavior Analysis*, *35*, 65–68. doi:10.1901/jaba.2002.35-65

Sharp, W. G., Jaquess, D. L., Morton, J. F., & Herzinger, C. V. (2010). Pediatric feeding disorders: A quantitative synthesis of treatment outcomes. *Clinical Child and Family Psychology Review*, *13*, 348–365. doi:10.1007/s10567-010-0079-7

Sharp, W. G., Volkert, V. M., Scahill, L., McCracken, C. E., & McElhanon, B. (2017). A systematic review and meta-analysis of intensive multidisciplinary intervention for pediatric feeding disorders: How standard is the standard of care? *The Journal of Pediatrics*, *181*, 116–124. doi:10.1016/j.jpeds.2016.10.002

Stubbs, K. H., Volkert, V. M., Rubio, E. K., & Ottinger, E. (2018). A comparison of flipped-spoon presentation and redistribution to decrease packing in children with feeding disorders. *Learning and Motivation*, *62*, 103–111. doi:10.1016/j.lmot.2017.03.007

Taylor, T. (2018). Intensive paediatric feeding treatment and the use of a side deposit for a clinical case within the home setting in Australia. *European Journal of Behavior Analysis*, *19*, 208–227. doi:10.1080/15021149.2018.1472852

Taylor, T., Blampied, N., & Roglić, N. (2020). Effective translation of empirically-supported treatment of paediatric feeding disorders from hospital to home settings: Outcomes of a controlled consecutive case series analysis. *Acta Paediatrica*, Manuscript submitted for publication.

Volkert, V. M., Peterson, K. M., Zeleny, J. R., & Piazza, C. C. (2014). A clinical protocol to increase chewing and assess mastication in children with feeding disorders. *Behavior Modification*, *38*, 705–729. doi:10.1177/0145445514536575

Volkert, V. M., & Piazza, C. C. (2012). Pediatric feeding disorders. In P. Sturmey, & M. Hersen (Eds.), *Handbook of evidence-based practice in clinical psychology* (Vol. *1*, pp. 323–338). Hoboken, NJ: John Wiley & Sons.

Williams, K. E., Paul, C., Pizzo, B., & Riegel, K. (2008). Practice does make perfect. A longitudinal look at repeated taste exposure. *Appetite*, *51*, 739–742.

Yeung, K. A., Taylor, T., Scheimann, A., Carvalho, R., Reinhardt, E., Girolami, P., & Wood, R. (2015). The prevalence of food allergies in children referred to a multidisciplinary feeding program. *Clinical Pediatrics*, *54*, 1081–1086. doi:10.1177/0009922815593499