Treatment of Food Selectivity in a Child with Avoidant/Restrictive Food Intake Disorder Through Parent Teleconsultation

Bradley S. Bloomfield¹ · Aaron J. Fischer¹ · Racheal R. Clark¹ · Meredith B. Dove²

Published online: 25 May 2018

© Association for Behavior Analysis International 2018

Abstract

Avoidant/restrictive food intake disorder (ARFID) is a diagnosis for those who display impaired and distressing eating behaviors and symptoms. Behavioral feeding strategies have been shown to be effective at improving food variety and decrease problematic mealtime behaviors in children and adolescents. This study examined the use of teleconsultation for the implementation of a behavioral feeding intervention to increase food variety with a child with avoidant/restrictive food intake disorder. A series of changing criterion designs across foods and food groups was used. Results show that there was an increase in the frequency of bites of nonpreferred foods consumed following successive increases in the criteria. High levels of acceptability of the intervention and technology process were also noted. Additionally, high levels of interobserver agreement, high levels of consultant procedural integrity, and high levels of parent treatment integrity were observed.

Keywords Teleconsultation · Parent training · Food selectivity · Avoidant/restrictive food intake disorder · Reinforcement

Introduction

Avoidant/restrictive food intake disorder (ARFID), a relatively new feeding disorder diagnosis in the *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. (DSM-5; American Psychiatric Association 2013), is provided to patients who struggle with impaired and distressing eating

behaviors and symptoms yet lack the weight and body image-related concerns associated with anorexia nervosa and bulimia nervosa. Among patients with ARFID, the consumption of foods is limited based on the food's appearance, smell, brand, presentation, previous negative experiences with the food, and/or fear of choking or vomiting. Children with ARFID can have different etiologies, including but not limited to delayed oral-motor skills, failure to master self-feeding skills, history of selective (picky) eating, disruptive mealtime behavior, rigid food preferences, and/or fear of vomiting (Fisher et al. 2014; Norris et al. 2014). ARFID is directly linked to a variety of short- and long-term health consequences including growth retardation, malnutrition, developmental and psychological deficits, poor academic achievement, social difficulties, invasive medical procedures (e.g., placement of a feeding tube), or death (Kodak & Piazza 2008; Sharp et al. 2010).

ARFID Treatment

Patients with ARFID have varied presentations, histories, and risk factors, making referrals to the most appropriate healthcare professionals or facilities challenging. Depending on which factors are thought to be driving the eating disturbances, patients' needs differ. Few hospitals or healthcare facilities have specialized clinics to treat ARFID; thus,

Highlights

- Preliminary evidence into the effectiveness of parent teleconsultation in the treatment of ARFID using behavioral intervention
- Highlights practical utility of parent-implemented treatment as a feasible and acceptable modality in the natural environment
- Replication of previous research on the use of behavior interventions as a means to treat ARFID
- Use of a series of changing criterion designs to evaluate effectiveness of interventions across foods
- Highlights important considerations for future research regarding behavioral feeding intervention modalities as clinic services are currently geographically limited

✉ Bradley S. Bloomfield
b.bloomfield@utah.edu

¹ University of Utah, 1721 Campus Center Drive, SAEC 3220, Salt Lake City, UT 84112, USA

² University of Massachusetts, Dartmouth, North Dartmouth, MA 02747, USA

assessment and treatment often requires collaboration among numerous healthcare providers in various locations.

Empirically validated treatments for ARFID have not yet been established (Norris et al. 2016); however, behavioral interventions have well-documented empirical support and a strong evidence base in the scientific literature for the treatment of pediatric feeding disorders (Sharp et al. 2010). For instance, operant procedures, including physical guidance of appropriate feeding responses, differential reinforcement (DRA) contingent upon appropriate eating behaviors, and shaping, have been identified as effective interventions (Hodges et al. 2017), and several studies have demonstrated the effectiveness of a systematic hierarchical sequence using differential reinforcement contingent upon demonstrating desired behaviors to increase food acceptability (Hodges et al. 2017). In the case of feeding interventions, the desired behavior is typically amount/bites/volume consumed, increased variety of foods, and/or appropriate mealtime behavior.

Parent Training for Feeding

The majority of existing literature on feeding disorder treatment involves children with severe feeding disorders in highly structured settings (i.e., inpatient hospital unit, day treatment program). However, treatment options are needed for children with milder forms of ARFID that do not require inpatient interventions and can generalize to home settings (Sharp et al. 2014). Treatments that teach caregivers how to implement behavioral principles may partially solve the obstacles to feeding treatment previously mentioned since caregivers significantly affect the mealtime environment and are able to implement behavioral strategies. Considering previous research that caregivers are either more rigid and forceful or more lenient in setting appropriate boundaries around eating with children with medical or neurodevelopmental issues (Seiverling et al. 2011), caregivers' participation in feeding treatment with a focus on parenting skills may be particularly important. One particular feeding intervention, the MEAL intervention for autism, a parent training curriculum, demonstrated the ability to deliver positive results, including high satisfaction and reductions in parent stress (Sharp et al. 2014).

Telehealth Applications

Feeding treatment often involves numerous office visits. Even to complete the initial intake, several appointments with the dietitian, speech therapist, psychologist, and/or additional feeding clinic member(s) may be required. Although children typically eat in the home setting, feeding assessment and treatment typically occurs in behavioral health clinics and specialty inpatient programs (Milnes & Piazza, 2014) and rarely in the home (Najdowski et al. 2003). To improve generalization to the home environment, telehealth is a desirable mode of

delivery for feeding assessment and therapy to allow for naturalistic observations within the home environment, including parent-child interactions that may contribute to feeding problems (Silverman 2010). Telehealth is defined as the delivery of virtual health-related services from one site to another via information and communication technologies (e.g., video, remote patient monitoring, or mHealth mobile applications). Telehealth is a modality of treatment rather than a specific type of treatment. Guidelines for telehealth treatment delivery exist in the USA and Canada (e.g., APA 2013; American Telemedicine Association 2013; Consortium of Telehealth Resource Centers 2015).

Teleconsultation is a type of telehealth in which synchronous or asynchronous consultation between doctors or between patients and doctors, not physically present at the location where the patient is, is obtained via network or video link (e.g., Facetime, intranet, Internet, Skype, etc.) (Deldar et al. 2016; Teleconsultation [Def. 2], in Segen's Medical Dictionary, <https://medical-dictionary.thefreedictionary.com/teleconsultation>). Its goals are for diagnostics or treatment between two or more geographically separated health providers or health providers and patients. Teleconsultation alleviates the burden of travel to clinic appointments for families, allowing greater access to services including for families living in rural and underserved areas (McGrath et al. 2006).

In regard to feeding treatment, teleconsultation has been considered "probably useful" for the initial clinical interview and "likely to be useful" for behavioral management and parent training sessions (Silverman 2010). Positive outcomes have been demonstrated with the use of videoconferencing to deliver treatment for children and adolescents with chronic illnesses (Van Allen et al. 2011) and depression (Nelson et al. 2006). Additionally, an 8-week parenting intervention using teleconsultation for families of children with ADHD improved children's behavior while decreasing parental distress (Reese et al. 2012). Parents of children who participate in interventions via teleconsultation generally report high levels of treatment satisfaction (Hall & Bierman 2015). While a recent investigation of a family-based treatment for anorexia nervosa delivered via telehealth indicates satisfactory clinical outcomes (Anderson et al. 2017), no known investigations exist on the use of teleconsultation to deliver feeding treatment to children with ARFID.

Purpose and Hypotheses

This study aimed to contribute to the research on parent teleconsultation telehealth applications of parent-implemented behavioral strategies by implementing a step-wise changing contingency for reinforcement procedure for a child with ARFID. The treatment presented in this study was developed to address treatment needs for children with

ARFID and extends the work of Fisher et al. (2014). Research questions and hypotheses were as follows:

1. Is there a functional relationship between an intervention identified by parent teleconsultation (i.e., a stepwise changing contingency for reinforcement) and the increase in the level of bites of nonpreferred foods consumed?
2. To what extent can a parent implement a behavioral feeding intervention taught over teleconsultation with high treatment integrity as measured by 80% or greater fidelity on a treatment integrity checklist? It is hypothesized that a parent will complete intervention procedures with high levels of treatment integrity.
3. To what extent are treatment gains from teleconsultation feeding service maintained at follow-up in the home setting? It is hypothesized that the level of bites consumed will be maintained at both the 1- and 4-month follow-up appointments.
4. To what extent is teleconsultation acceptable to conduct feeding services, as rated by the parent? It is hypothesized that the parent will rate teleconsultation as acceptable.

Method

Participants

Child The participant, Adrian, was an 8-year-old white/non-Hispanic male student with a history of food avoidance and a restricted diet. At the time of the study, Adrian was enrolled in a public elementary school in the second grade. There were no noted social or learning deficits; concerns were solely related to feeding at the time of the assessment.

Adrian had a history of feeding problems that were first identified when he was 3 years old. At that time, he would only eat select foods and expel all others. Adrian has no reported food allergies or dietary restrictions. Although he was treated for reflux as a baby, results of a swallow study indicated no functional abnormalities were evident. The caregivers reported an occupational therapist reported no oral-motor deficits and that the therapist believes feeding concerns were primarily behavioral in nature. A behavioral feeding approach was recommended at that time. No reported history of feeding tube use was reported. Adrian consumed several varieties of starches (e.g., bread, pasta, French fries), proteins (e.g., chicken nuggets, hot dogs, eggs), fruits (e.g., apples, grapes, bananas), and dairy (e.g., milk, yogurt, cheese). Nonpreferred foods included chicken breast, hamburger, steak, all vegetables, berries, oranges, as well as mixed texture foods such as tacos and burritos. As a result of the limited variety of foods, Adrian was underweight and not gaining weight as expected for a child of his age.

At the time of the intake assessment, Adrian displayed significant behavior problems at mealtime. Parents reported that he engaged in tantrum behavior (e.g., whining, crying, gagging) and negotiations with his parents to avoid nonpreferred foods at mealtime. These behaviors typically occur upon sight or smell of nonpreferred foods, yet he can tolerate the foods on his plate. Adrian had a history of expulsion of nonpreferred foods, both upon immediate consumption and with a brief delay. He also frequently gags upon the requested consumption of nonpreferred foods. Additionally, he has engaged in hiding of nonpreferred foods (e.g., packing, holding in hand, expel in garbage) and frequent bathroom requests during meals. Adrian's feeding schedule consisted of three scheduled meals and a scheduled snack where mealtime for Adrian is on average a duration of 60–90 min.

During the pretreatment interview, Adrian's parents disclosed that previously attempted strategies (e.g., mixing preferred and nonpreferred foods, extinction procedures presenting only nonpreferred foods, removing all feeding demands) were met with limited success. The mother expressed she did not feel comfortable persisting with an extinction-based procedure in the home. Based on the report of a significantly limited diet, demonstrated food avoidance behavior, and below average weight, Adrian met the DSM-5 criteria for ARFID (APA 2013).

Consultant The consultant was a Board-Certified Behavior Analyst and graduate student in an APA-accredited doctoral program in school psychology. He received training in pediatric feeding disorders and teleconsultation provided by the second author using a behavior skills training approach to ensure competency in this area. The second author is a licensed psychologist and doctoral designated Board-Certified Behavior Analyst with expertise in teleconsultation and treatment of ARFID. The consultant participated in a didactic training from the second author on the intervention procedures followed by watching models of teleconsultation and behavioral feeding interventions. The consultant then modeled the skills of the feeding intervention (described below in further detail) and teleconsultation. The second author provided performance feedback on the modeled skill to ensure fidelity to intervention procedures.

Setting

This study used teleconsultation; therefore, two locations were a part of the study: the child's home and the consultant's office. All sessions in the child's home were conducted in the home kitchen at a small counter with two chairs side-by-side. A dining table and a sliding glass door was behind the child and caregiver with the kitchen in view. The consultant's office was approximately 12 ft × 8 ft in a secure medical building. There was an undecorated white wall behind the consultant to

eliminate distractions during consultation meetings. The door was closed during all appointments to ensure confidentiality and privacy for meetings. The child's home was located approximately 30 miles from the consultant's office.

Materials

Hardware and Software The consultant used a MacBook Pro (retina display, 13-in., late 2013) with built-in microphone and camera to conduct all teleconsultation sessions. Headphones were used to reduce echo during the sessions. All teleconsultation sessions were conducted using Vidyo (<https://www.vidyo.com>), a Health Insurance Portability and Accountability Act (HIPAA 2007)-compliant telehealth software that has end-to-end encryption. The consultee used a desktop computer with external webcam (model unknown).

Intervention Materials Multiple bowls and an open cup were used to hold the preferred and nonpreferred food items. The bowls were filled with the food items and present in front of Adrian for the duration of the session. A fork and spoon were present along the bowls of food during each session. Paper napkins were also present on the table in front of Adrian.

Other Materials The consultant and consultee used paper and pencil to record data. Data sheets were then emailed to the consultant following sessions. Preferred items for reinforcement were used each session including a tablet to play games.

Pretreatment Assessment

The consultant conducted a semistructured feeding interview, a feeding observation, and a preference assessment for both preferred and nonpreferred foods as well as nonedible reinforcers. The interview was conducted using videoconferencing with Adrian and his mother in the kitchen of their home.

Adrian and his mother participated in a preference assessment of both preferred and nonpreferred foods, as well as nonedible reinforcers. Prior to the preference assessment, Adrian's mother identified six preferred foods, six nonpreferred foods, and six nonedible reinforcers. Due to Adrian's age and language abilities, an interview format for the paired-choice preference assessment provided acceptable information to guide treatment following the probing session. Adrian reported a hierarchy for his preference of nonpreferred foods in the following order (from most to least preferred): strawberries, raspberries, orange juice, lasagna, carrots (raw), and broccoli (cooked). The following foods were identified as preferred foods through a preference assessment interview: apples, grapes, bananas, yellow cheese, pizza, and cinnamon rolls. Adrian additionally identified watching Lego- and superhero-themed videos, video games, board games, Legos, and riding his bike as nonedible reinforcers.

Additionally, a food assessment was conducted during a probing session. During this session, Adrian's mother was instructed to present a bite-size portion (e.g., size of a US quarter) of the six nonpreferred foods noted above and requested Adrian consumed the food. If Adrian engaged in food refusal behavior (e.g., clench teeth, turn head, negative statements ["no"], push the food away), the feeding demand was withdrawn and Adrian was given a 30-s break. The goal of the food assessment was to determine how closely the client would approximate consumption of a nonpreferred food without engaging in food refusal behavior. Results indicate Adrian consumed one bite of strawberry, raspberry, orange juice, and lasagna and half a bite of carrot and broccoli. Adrian refused subsequent bite presentations (i.e., "No thank you.").

Teleconsultation Procedures

Following initial identification of the target foods for treatment, training of the intervention and data collection procedures for the parent was conducted using teleconsultation. Initial training for Adrian's mother adhered to a behavioral skills trainings model (e.g., Seiverling et al. 2011) including didactic instruction, modeling of the required behaviors (e.g., intervention and data collection procedures), and performance feedback on implemented procedures.

Prior to the first meeting over teleconsultation, the consultant sent the caregiver an email with information on how to access the Vidyo teleconsultation meeting, troubleshooting tips, and contact information for the consultant should technical difficulties arise. The preliminary meeting with the caregiver involved didactic instruction where the consultant described the process of teleconsultation, intervention procedures, and data collection procedures. The consultant informed the caregiver how feedback will be delivered (e.g., in the moment and following treatment sessions). Feeding intervention procedures are described in greater detail below. Following the description of requisite steps, the consultant modeled the procedures for the caregiver. The consultant provided multiple examples on behavior-specific praise for the caregiver to use with Adrian. Finally, over teleconsultation, the consultant requested the caregiver to complete a role play of intervention procedures with performance feedback.

During intervention, the consultant met with the parent for weekly sessions over teleconsultation, and the parent was instructed to continue the intervention during the week. The consultant provided performance feedback verbally to the parent on the implementation of the intervention procedures and modeled the provision of praise and feedback to Adrian. Performance feedback was provided both immediately following the observed behavior and in summary at the end of the session. If the caregiver engaged in a desired behavior, the consultant would provide

behavior-specific praise (e.g., “You did a great job praising Adrian immediately after he completed the required demand.”). When corrective feedback was warranted, the consultant would describe the desired behavior in terms of how the caregiver could improve their intervention fidelity. For example, if the caregiver provided the preferred item for reinforcement for greater than 1 min, the consultant would say, “Next time you give Adrian the tablet for eating all of his bites, use a one minute timer to remind yourself when to withdraw the tablet and begin the next bite presentation.”

Feeding Intervention Procedures

Following parent report of discomfort with an extinction-based procedure only presenting nonpreferred foods and Adrian’s performance during the behavior probe, an intervention incorporating a stepwise changing contingency for reinforcement and guided compliance was selected. In the case of this intervention, the target behavior was consumption of 10 bites of a nonpreferred food. Initially, reinforcement was placed on a fixed ratio one (FR1) schedule where Adrian received reinforcement following every successful bite consumed without expelling the food. A bite was defined as food item that is approximately 1 in. $\times$ 1 in. $\times$ 1/4 in. A sip was defined as a liquid drink that is approximately one tablespoon (15 ml). A successful bite was defined as Adrian placing the food into his mouth, chewing the food, and swallowing the food without expulsion. Reinforcement for all trials consisted of one bite of a preferred food item (e.g., apple or grape) and 1 min of tablet use (e.g., watching a video or playing a game).

A trial consisted of the parent presenting the demand in a statement format (e.g., “Eat one bite of strawberry.”). Following a compliant response, the parent was instructed to provide descriptive social praise (e.g., “Good job eating the strawberry!”) and access to reinforcement. Guided compliance (e.g., Wilder & Atwell, 2006) was used in the event that Adrian was noncompliant with the feeding demand. If Adrian did not comply within 10 s of the initial command, the parent reissued the verbal prompt. A modeled prompt was initiated after another 10 s with no response/refusal in which the parent modeled taking a bite (e.g., “Adrian, take a bite of strawberry like me.”). Following an additional 10 s of no response or refusal, a physical prompt will be initiated. The client was physically guided toward the desired behavior (e.g., hand moved to the utensil, hand guided toward the mouth). The parent did not force the food into Adrian’s mouth. A 10-s interprompt interval was used following the procedures outlined by Wilder and Atwell (2006) for guided compliance. The prompting level required for successful consumption of the nonpreferred food was marked on the paper-and-

pencil data sheet. During intervention procedures, the parents provided choices regarding the items used for reinforcement and the presentation order of nonpreferred foods (e.g., “What do you want to work for?”; “Would you like to work with the strawberry or raspberry first?”).

Following a minimum of five successful treatment trials implemented in the home where Adrian met stability criteria (e.g., $\geq 80\%$ consumption), the schedule of reinforcement was thinned beginning with a fixed ratio two (FR2) schedule where Adrian received reinforcement following the successful consumption of two bites of nonpreferred foods. This reinforcement schedule continued to be thinned until Adrian successfully ate a portion of the nonpreferred foods without reinforcement (e.g., 10 bites). Changes in the schedule of reinforcement were determined by the consultant-collected data following a minimum of three consecutive trials meeting the specified criteria.

Response Measurement and Interobserver Agreement

Data were collected on both Adrian’s behavior and procedural fidelity by Adrian’s parent on the implementation of treatment. Trial-by-trial data were collected with paper and pencil by the parent and consultant. A trial consisted of a single opportunity to consume the requisite number of bites to gain access to a preferred reinforcer. The number of bites successfully consumed was marked for each trial. Additionally, data were collected on crying and gagging during each trial. Trial-by-trial interobserver agreement (Hartmann 1977) was collected on 51.9% of treatment sessions. Agreement occurred when the responses for the trial were recorded identically by both the parent and the consultant. Trial-by-trial interobserver agreement was calculated using the occurrence or nonoccurrence of behavior. The number of trials in agreement was divided by the total number of trials to result in an interobserver agreement of 89.7% (range = 75.0–100.0%) across all trials.

Consultant Procedural Integrity and Parent Treatment Integrity

Procedural integrity consisted of a checklist of intervention steps, completed by an independent observer. The consultant procedural integrity checklist consisted of eight steps where the parent treatment integrity checklist consisted of five steps. Interobserver agreement on consultant procedural integrity and parent treatment integrity was calculated for a third (33.33%) of recorded session videos by a secondary observer. Interobserver agreement was 100% for both consultant and parent procedural integrity.

Behavior Questionnaires

Additionally, the Brief Assessment of Mealtime Behavior in Children (BAMBIC; Hendy et al. 2013) and Mealtime Behavior Questionnaire (MBQ; Berlin et al. 2010) were completed by Adrian's parents as pre- and post-treatment measures of mealtime behavior. The BAMBIC is an 11-item measure rated on a 5-point Likert scale from "never/rarely" to "at almost every meal." The BAMBIC measures three types of child feeding problems: limited variety, food refusal, and disruptive behavior, with reported reliability coefficients ranging from .70 to .79 (Hendy et al. 2013).

The MBQ is a 33-item measure rated on a 5-point Likert scale from "never" to "always." The MBQ measures feeding problems using four subscales (food refusal/avoidance, food manipulation, mealtime aggression/distress, and choking/gagging/vomiting) and a total score. Previous research indicates that the internal consistencies of the MBQ total score and subscales are high, on average ($\alpha = .83$, $SD = .06$), and range from fair to excellent ($\alpha = .73-.91$; Berlin et al. 2010). In regard to the total scale score, the clinical cutoff is 1.5 standard deviations above the mean score of the normative sample (total score > 77 ; Silverman et al., 2013).

Acceptability and Social Validity

The Technology Acceptability Model-Fast Form (FF-TAM; Chin et al. 2008) and Behavior Intervention Rating Scale (BIRS; Elliot & Treuting 1991) were administered to the parents using a HIPAA-compliant web-based survey distribution tool. The FF-TAM was used to assess the acceptability of technology on three separate factors: usefulness, ease of use, and predicted usage. The 12-item scale is rated on a semantic differential (range from -3 to $+3$) with higher ratings indicating higher levels of acceptability (maximum total score = 36; maximum average score = 3.0). Previous research indicates adequate internal consistency across all three factors ($\alpha = .93-.97$; Chin et al. 2008).

The BIRS was used to measure Adrian's mother's perceptions of treatment acceptability and perceived effectiveness of the behavioral interventions. This scale is a 24-item measure rated on a 6-point Likert scale from "strongly disagree" to "strongly agree" with higher scores indicating higher levels of treatment acceptability (Elliot & Treuting 1991). The BIRS is a reliable measure, with the total BIRS scale yielding an alpha of .97 and the three factors having adequate internal consistency (i.e., acceptability, effectiveness, and time yielding $\alpha = .97, .92$, and $.87$, respectively).

Experimental Design

A series of changing criterion designs was conducted across foods and food groups to increase the consumption of nonpreferred foods by using a systematic stepwise changing contingency for reinforcement procedure of the count of bites of nonpreferred foods that were consumed.

Results

Stepwise Changing Contingency for Reinforcement Procedure

Figure 1 shows the participant's bites of fruit consumed per trial. Figure 2 shows the participant's bites consumed across carrots, broccoli, and oranges. The participant's behavior was evaluated using visual analysis. Visual analysis is a procedure where the trend, level, and variability of a participant's behavior are compared within and across conditions (Cooper et al. 2006). To further evaluate the intervention effects, a vertical analysis and immediacy of the effect analysis were conducted through visual analysis (Horner et al. 2005). Initially, since one bite of each nonpreferred fruit was consumed during the probing assessment, Adrian was required to successfully consume one bite of nonpreferred food to gain access to the reinforcement (i.e., a FR1 schedule of reinforcement). Nonpreferred fruit consisted of strawberry, raspberry, and orange juice. Adrian was allowed to choose between the three nonpreferred fruits, and a minimum of one serving (e.g., greater than or equal to 10 bites) of all target foods was available on the table. During the initial criterion of one bite, Adrian met or exceeded the criterion during every trial. Following continued inconsistent responding where Adrian was consuming one or two bites of a nonpreferred food, the criterion was increased to two bites. There was stable performance observed with a criterion of two bites to gain access to reinforcement. The following criteria (i.e., 4, 6, 8, and 10 bites) demonstrated stable responding and a clear change in the level following the introduction of the new criteria. No crying or gagging was observed on any trials of fruits. Adrian's behavior was maintained at both the 1- and 4-month follow-up appointment where he consumed 10 bites of all target fruits.

Initially, carrot consumption behavior was placed on a FR1 schedule of reinforcement where Adrian was required to successfully consume one bite of a carrot to gain access to the reinforcement. A minimum of one serving (e.g., > 10 bites of carrot) was available at all times. Across all criteria, Adrian responded with 100% consumption with a clear change in level following the introduction of each new criteria. No crying or gagging was observed on any trials of carrots. At the 1-month follow-

Fig. 1 Bites consumed of fruit across trials

up, Adrian maintained consumption of five bites of carrots, and at the 4-month follow-up, Adrian consumed 10 bites of carrots and verbalized that he liked to eat carrots.

Broccoli and orange were implemented third, and consumption of those foods was reinforced on a FR1 and FR2 schedule of reinforcement, respectively. During intervention, the consumption of broccoli was successful on 5 of the 6 trials at an FR1 schedule. The criterion was increased to two bites, which was also successful for 100% of the trials with a clear change in level from the previous criteria. This was further maintained at the 1- and 4-month follow-up. The consumption of orange was introduced at an FR2 schedule of reinforcement and maintained at that criterion for the duration of the intervention. At the 1-month follow-up, Adrian was consuming four bites of orange and, at the 4-month follow-up, was consuming six bites of orange demonstrating an increase in the level at both follow-up appointments. No crying or gagging was observed on any trials of either broccoli or orange.

At 1-month follow-up, the caregiver was adding new target foods such as hamburger and all target foods maintained at the discharge level; the consumption of previous target foods did not increase (e.g., carrots). At the 4-month follow-up, the client verbalized an interest in carrots and hamburger. Although hamburger was not targeted during intervention, the parent independently targeted this food during follow-up. The mother reported increased compliance with trying new foods and decreased problem behaviors surrounding demands with nonpreferred foods overall.

Parent Treatment Integrity

Overall, the parent implemented intervention procedures with high levels of treatment integrity across all recorded sessions

($M = 94.0\%$, range = 80.0–100.0%). See Fig. 3 for parent treatment integrity by session.

Consultant Procedural Integrity

Consultant procedural integrity was overall acceptable across all recorded sessions for the consultant ($M = 91.7\%$, range = 80.0–100.0%). See Fig. 4 for consultant procedural integrity by session.

Behavior Questionnaires

According to the MBQ at pre- and post-intervention, the parent report resulted in a total score of 71 and 48, respectively. This 23-point decrease on the mealtime behavior questionnaire indicates improvements in mealtime behaviors as perceived by Adrian's parents. A total score of 28 was found at both pre- and post-intervention on the BAMBIC; there was no measured change in reported behavior. The number of items rated as a problem at pre- and post-intervention was both 7 indicating a moderate count of mealtime problem behavior in the home.

Acceptability and Social Validity

According to the FF-TAM, the parent rated the acceptability of technology for this intervention as high with a total sum score of 35 ($M = 2.92$, range = 2.0–3.0). According to the BIRS, Adrian's mother rated the intervention to be highly acceptable overall ($M = 5.96$). The BIRS has three indices of acceptability: overall acceptability, perceived effectiveness, and time to effect. Across all three scales, there were high levels of acceptability ($M = 6.0$, 5.86, and 6.0, respectively). Anecdotally, the parent reported significantly easier family meals following the intervention.

Fig. 2 Bites consumed across trials

Discussion

This report indicates that the use of teleconsultation with a parent of an 8-year-old child with ARFID may be an effective and practical solution to a typically laborious and time-consuming treatment. Results indicate that the client demonstrated increased consumption, while the parent demonstrated high levels of treatment integrity ($M = 95\%$; range = 80–100%). The client enrolled in weekly teleconsultation feeding services for a 12-week parent-facilitated intervention. The parent was trained on the intervention using a behavioral skills training model and was provided with ongoing performance feedback. The parent implemented a systematic stepwise changing contingency for reinforcement intervention; the child accessed a

preferred activity and a bite of preferred food after each bite of nonpreferred food.

Prior to the intervention, the parent reported frequent refusal behaviors in the presence of nonpreferred foods and limited parent success with previously implemented strategies. Adrian engaged in tantrum behavior (e.g., crying, gagging) and negotiations with his parents to avoid nonpreferred foods at mealtime. These behaviors significantly decreased as a result of the intervention; the behaviors were not observed during treatment sessions and the parent reported a decrease in problem behaviors at mealtime. The child consumed a limited variety of preferred foods from most food groups prior to intervention and his diet did not include vegetables.

The consultant determined discharge criteria by examining the stability of client and parent behavior and generalization of

Fig. 3 Parent treatment integrity by session

intervention procedures to novel foods. Stability of client behavior was measured as three or more trials of each target fruit at the terminal criteria. Adrian demonstrated stability at consuming one serving (e.g., 10 bites) of the initial target food group (i.e., fruits). Stability of parent behavior was measured by high fidelity (e.g., > 80%) of parent implementation of the intervention during sessions. Further, the parent demonstrated generalization of intervention procedures to new foods (e.g., broccoli and oranges) while maintaining high fidelity of intervention procedures which supported the decision for discharge.

Overall, the mother's engagement during teleconsultation appointments was high with regard to scheduling of appointments, preparation of target foods, and preparation of all foods into bite-size portions in front of Adrian. Compliance with data collection procedures was limited, as measured by receiving parent-collected data for 51.9% of the sessions with the consultant. The caregiver was also recommended to complete four practice sessions a week outside of the teleconsultation

appointment, yet anecdotally, the parent reported limited follow-through. Although Adrian made significant progress in the current study, Adrian's mother did not practice the skills outside of the sessions with the consultant as intended. Rather, the mother reported utilizing newly acquired feeding skills during family meals with nontarget foods.

Additional forethought is necessary when training parents over teleconsultation. A consideration for training procedures may include a sequential application of the behavior skills training model in order to further ensure consultee and client outcomes. A sequential training model includes the monitoring of implementation fidelity to inform the need for more intensive subsequent training sessions. The critical elements of consultee training using teleconsultation have not yet been evaluated. However, research has shown that the use of a sequential training model produces acceptable levels of integrity and proposes a more efficient use of resources (Mueller et al. 2003; Pangborn et al. 2013). The primary focus of a sequential training model involves utilizing a responsive and

Fig. 4 Consultant procedural integrity by session

individualized approach in order to meet the needs of each consultee and client in relation to pre-intervention performance levels.

Parent teleconsultation is a viable alternative to meet the diverse needs of clients and their families. Thus, an individualized intervention is provided in the home, with a trained consultant. However, teleconsultation may not be applicable for all referral concerns. The medical, behavioral, and dietary needs of the client must be considered prior to being referred to teleconsultation services. An interdisciplinary treatment team may more appropriately manage significant medical complications or nutritional deficits as well as provide an increased intensity of services. Furthermore, parents need to be able to safely and appropriately manage problem behavior in the home. Another challenge with parent teleconsultation utilizing traditional technology forms (i.e., laptop, tablet) is the lack of mobility and stationary viewpoint; the consultant is unable to move with the client if there are concerns with elopement. Future research should explore the use of mobile telepresence robots (see Fischer et al. 2017) in the treatment of pediatric feeding disorders.

Limitations of this study include that the parent did not consistently complete intervention practice sessions outside of meetings with the consultant. Barriers to completing trials outside of sessions may have been related to challenges identifying a consistent time within the family schedule to run sessions. Although the parent noted no challenges with collecting data on paper, sending that data electronically to the consultant was reported to be a challenge. More frequent reminders, such as daily emails or text messages, could help to improve parent compliance with data collection. Ideally, one more food group would have been included in this multiple baseline design, but the changing criterion had sufficient points of change to enhance experimental control. Finally, while the definition of the size of the bite was consistent throughout the intervention, the definition was approximate rather than explicitly measured allowing for greater variability in the bite size presented.

Overall, the current case study elucidates that teleconsultation may be a viable, effective, and possibly more practical modality of treatment for ARFID, especially when symptoms manifest as food selectivity. The client demonstrated success with increasing feeding demands and the parent demonstrated high fidelity to the intervention. Despite parent follow-through and consistency as barriers to treatment, the client demonstrated socially valid progress across the intervention that maintained those gains 4 months following the intervention.

Funding Information This study was supported by a grant from the Autism Council of Utah.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with animals performed by any of the authors; all procedures with human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and comparable ethical standards.

Informed Consent Informed consent was obtained in accordance with the institutional research committee standards.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- American Telemedicine Association, Telemental health practice guidelines work group and the ATA standards and guidelines committee. (2013). Practice Guidelines for Video-based Online Mental Health Services.
- Anderson, K. E., Byrne, C. E., Crosby, R. D., & Le Grange, D. (2017). Utilizing telehealth to deliver family-based treatment for adolescent anorexia nervosa. *International Journal of Eating Disorders*, 50, 1235–1238. <https://doi.org/10.1002/eat.22759>.
- Berlin, K. S., Davies, W. H., Silverman, A. H., Woods, D. W., Fischer, E. A., & Rudolph, C. D. (2010). Assessing children's mealtime problems with the mealtime behavior questionnaire. *Children's Health Care*, 39, 142–156.
- Chin, W. W., Johnson, N., & Schwarz, A. (2008). A fast form approach for measuring technology acceptance and other constructs. *MIS Quarterly*, 32, 687–703.
- Consortium of Telehealth Resource Centers. (2015). Privacy, confidentiality and security. Retrieved from <http://www.telehealthresourcecenter.org/toolbox-module/privacy-confidentiality-and-security#how-does-the-hipaa-rule-apply-to-telemedicine>
- Cooper, J. O., Heron, T. E., & Heward, W. L. (2006). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Deldar, K., Bahaadinbeigy, K., & Tara, S. M. (2016). Teleconsultation and clinical decision making: A systematic review. *Acta Informatica Medica*, 24(4), 286–292. <https://doi.org/10.5455/aim.2016.24.286-292>.
- Elliot, S. N., & Treuting, M. V. B. (1991). The behavior intervention rating scale: Development and validation of a pretreatment acceptability and effectiveness measure. *Journal of School Psychology*, 29, 43–51.
- Fischer, A. J., Clark, R., Askings, D., & Lehman, E. (2017). Technology and telehealth applications. In J. K. Luiselli (Ed.), *Applied behavior analysis advanced guidebook*. New York: Academic/Elsevier.
- Fisher, M. M., Rosen, D. S., Ornstein, R. M., Mammel, K. A., Katzman, D. K., Rome, E. S., et al. (2014). Characteristics of avoidant/restrictive food intake disorder in children and adolescents: A “new disorder” in DSM-5. *Journal of Adolescent Health*, 1–4.
- Hall, C., & Bierman, K. (2015). Technology-assisted interventions for parents of young children: Emerging practices, current research, and future directions. *Early Childhood Research Quarterly*, 33, 21–32.
- Hartmann, D. P. (1977). Considerations in the choice of interobserver reliability estimates. *Journal of Applied Behavior Analysis*, 10(1), 103–116.

- Health Insurance Portability and Accountability Act (HIPAA). (2007). Security standard. Last from <http://www.cms.hhs.gov/SecurityStandard/>.
- Hendy, H. M., Seiverling, L., Lukens, C. T., & Williams, K. E. (2013). Brief assessment of mealtime behavior in children: Psychometrics and association with child characteristics and parent responses. *Children's Health Care*, 42, 1–14.
- Hodges, A., Davis, T., Crandall, M., Phipps, L., & Weston, R. (2017). Using shaping to increase foods consumed by children with autism. *Journal of Autism and Developmental Disorders*, 47(8), 2471–2479. <https://doi.org/10.1007/s10803-017-3160-y>.
- Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children*, 71(2), 165–179. <https://doi.org/10.1177/001440290507100203>.
- Kodak, T., & Piazza, C. C. (2008). Assessment and behavioral treatment of feeding and sleeping disorders in children with autism spectrum disorders. *Child and Adolescent Psychiatric Clinics of North America*, 17, 887–905. <https://doi.org/10.1016/j.chc.2008.06.005>.
- McGrath, P. J., Watters, C., & Moon, E. (2006). Technology in pediatric pain management. In G. A. Finley, P. J. McGrath, & C. T. Chambers (Eds.), *Bringing pain relief to children: treatment approaches* (pp. 159–176). Totowa, NJ: Humana.
- Milnes, S. M., & Piazza, C. C. (2014). Intensive treatment of pediatric feeding disorders. In D. D. Reed, F. D. DiGennaro Reed, & J. K. Luiselli (Eds.), *Handbook of crisis intervention and developmental disabilities* (pp. 393–408). New York, NY: Springer.
- Mueller, M. M., Piazza, C. C., Moore, J. W., Kelley, M. E., Bethke, S. A., Pruett, A. E., et al. (2003). Training parents to implement pediatric feeding protocols. *Journal of Applied Behavior Analysis*, 36(4), 545–562. <https://doi.org/10.1901/jaba.2003.36-545>.
- 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. <https://doi.org/10.1901/jaba.2003.36-383>.
- Nelson, E., Barnard, M., & Cain, S. (2006). Feasibility of telemedicine intervention for childhood depression. *Counselling & Psychotherapy Research*, 6(3), 191–195. <https://doi.org/10.1080/14733140600862303>.
- Norris, M., Robinson, A., Obeid, N., Harrison, M., Spettigue, W., & Henderson, K. (2014). Exploring avoidant/restrictive food intake disorder in eating disordered patients: a descriptive study. *International Journal of Eating Disorders*, 47(5), 495–499.
- Norris, M., Spettigue, W., & Katzman, D. (2016). Update on eating disorders: current perspectives on avoidant/restrictive food intake disorder in children and youth. *Neuropsychiatric Disease and Treatment*, 12, 213–218.
- Pangborn, M. M., Borrero, C. S. W., & Borrero, J. C. (2013). Sequential application of caregiver training to implement pediatric feeding protocols. *Behavior Interventions*, 28, 107–130.
- Reese, R. J., Slone, N. C., Soares, N., & Sprang, R. (2012). Telehealth for underserved families: An evidence-based parenting program. *Psychological Services*, 9(3), 320–322. <https://doi.org/10.1037/a0026193>.
- Seiverling, L. J., Williams, K. E., Ward-Horner, J., & Sturmey, P. (2011). Interventions to treat feeding problems in children with autism spectrum disorders: A comprehensive review. In J. L. Matson, P. Sturmey, J. L. Matson, P. Sturmey, J. L. (Eds.), *International handbook of autism and pervasive developmental disorders* (pp. 491–508). New York, NY: Springer.
- 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(4), 348–365. <https://doi.org/10.1007/s10567-010-0079-7>.
- Sharp, W. G., Burrell, T. L., & Jaquess, D. L. (2014). The Autism MEAL Plan: A parent-training curriculum to manage eating aversions and low intake among children with autism. *Autism*, 18(6), 712–722. <https://doi.org/10.1177/1362361313489190>.
- Silverman, A. H. (2010). Telehealth interventions for feeding problems. In A. Southall & C. Martin (Eds.), *Feeding problems in children: A practical guide for health professionals* (2nd ed., pp. 261–276). Oxon: Radcliffe Medical Press.
- Silverman, A. K., Kirby, M., Clifford, L. M., Fischer, E., Berlin, K. S., Noel, R. J., et al. (2013). Nutritional and psychosocial outcomes of gastrostomy tube-dependent children completing an intensive inpatient behavioral treatment program. *Journal of Pediatric Gastroenterology and Nutrition*, 57, 668–672. <https://doi.org/10.1097/MPG.0b013e3182a027a3>.
- Van Allen, J., Davis, A., & Lassen, S. (2011). The use of telemedicine in pediatric psychology: Research review and current applications. *Child and Adolescent Psychiatric Clinics of North America*, 20(1), 55–66.
- Wilder, D. A., & Atwell, J. (2006). Evaluation of a guided compliance procedure to reduce noncompliance among preschool children. *Behavioral Interventions*, 21, 265–272. <https://doi.org/10.1002/bin.222>.