Evaluation of Practice Trials to Increase Self-Drinking in a Child with a Feeding Disorder

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Abstract Self-drinking is an important skill for children to acquire as they transition from infancy to early childhood; however, the literature is limited (e.g., Collins, Gast, Wolery, Holcombe, & Leatherby, 1991; Peterson, Volkert, & Zeleny, 2015). We manipulated the consequences associated with self-drinking relative to those associated with being fed along the dimension of response effort. Results demonstrated that self-drinking increased when the child could either choose to self-feed one drink or be fed one drink and 5 practice trials with an empty cup.

Keywords Feeding disorders · Practice trials · Self-drinking

As children acquire complex fine motor skills, it is common for them to transition from bottle feeding to self-drinking with

an open cup (Carruth & Skinner, 2002). Most children self-drink with minimal guidance by 10 months (Pridham, 1990) and begin exclusively self-drinking from an open cup by 36 months (Carruth & Skinner, 2002). Although most children begin self-drinking independently or with some guidance from parents, children with feeding disorders often fail to progress to age-typical eating (e.g., self-drinking) in the absence of treatment (Peterson et al. 2015; Rivas et al. 2014; Vaz, Volkert, & Piazza, 2011). This is frequently true even after successful treatment of liquid refusal in a nonself-drinking context in which a therapist or caregiver feeds the child (Volkert et al. 2016).

Due to a long history of liquid or food refusal, a child with a feeding disorder may not develop the necessary prerequisite fine- or oral-motor skills to self-drink (e.g., hand-eye coordination, lip closure). Alternatively, children with feeding disorders may lack the motivation to take drinks independently. Vaz et al. (2011) and Rivas et al. (2014) described procedures to increase self-feeding for children with feeding disorders who had the skills to self-feed but lacked motivation to do so. In both studies, participants were given the choice to self-feed one bite or be fed multiple bites (up to six).

Volkert et al. (2016) described one challenge that a practitioner may face when implementing the procedures outlined by Vaz et al. and Rivas et al. as overfeeding related to increases in volume of food fed by the therapist. For example, a child may become too full, too fast and motivation to self-feed may decrease rapidly and, in some cases, vomiting may occur when a child consumes over a certain volume of food. To address this possible limitation, Volkert et al. evaluated whether they could increase self-feeding for two participants by allowing him to self-feed one bite (drink) or be fed one bite (drink) and then guiding him to practice self-feeding using an empty spoon (cup) up to 15 times. Practice trials did not lead to consistent increases in self-feeding for either participant.

- It is critical to develop independent eating and drinking skills for children with severe feeding disorders to eventually reduce continuous monitoring from caregivers and sustain adequate nutrition.
- We demonstrated that nonremoval of the cup and hand-over-hand guidance to complete practice trials was effective to increase self-fed acceptance of liquid for a child with a severe feeding disorder, even as we increased the amount of liquid in the cup.
- We were able to teach the treatment procedures to the child's parents who implemented the treatment with high fidelity.
- We also showed that the practice trials described by Volkert, Piazza, and Ray-Price (2016) to address challenges related to volume when implementing procedures outlined by Rivas et al. (2014) was successful.

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In the current study, we used a similar strategy as Volkert et al. (2016) to increase self-drinking and avoid over-feeding. More specific, if the child did not take the drink independently, the child's parent guided her to practice self-feeding one drink and with an empty cup five times.

Method

Participants, Setting, and Materials

Ella was a 6-year-old girl with Down syndrome and a complex medical history, including failure-to-thrive, reflux, and prematurity. We initially admitted Ella into a 16-week day-treatment program (4 h per day, 5 days per week) for food and liquid refusal and nearly 100 % Gastrostomy-tube dependence. Ella was cleared as a safe oral feeder prior to her admission. During day treatment, results of a functional analysis indicated that Ella exhibited inappropriate mealtime behavior (IMB) to escape drinking (data available upon request), and we successfully increased acceptance of Pediasure in a nonself-feeding format using escape extinction and noncontingent reinforcement after approximately 1 week or at total of 75, 5-drink sessions. Following day treatment, we transitioned Ella into an outpatient program. At the time of the study, her volume cap was 240 g per meal and if she exceeded her cap, she often vomited.

We conducted all sessions in a 4-m by 4-m treatment room located inside a pediatric feeding disorders program. Materials in the treatment room included a table and chairs, digital scale, highchair, laptop computers, and timers. Materials for conducting self-drinking included Pediasure, pink flexi-cut cups, a plastic syringe, plastic bib, and a baby spoon (to assist with mouth checks).

Response Measurement and Interobserver Agreement

Trained observers collected data on laptop computers. Observers scored *self-fed acceptance* when Ella grasped the cup, lifted it to her lips, and deposited the entire amount of Pediasure (with the exception of liquid pea-sized or smaller) within 8 s of a drink presentation (i.e., the feeder placed the cup with Pediasure on the tray in front of Ella). We converted data on self-fed acceptance to a percentage by dividing the total number of drinks Ella accepted within 8 s by the total number of drinks the feeder presented. Observers scored IMB each time Ella moved or threw the cup (with liquid) in an opposite direction from the mouth or hit the cup against a surface. We converted IMB to responses per min by dividing the total number of IMB during a session by the total time the cup with Pediasure was within arm's reach of Ella.

Two trained observers independently collected data on self-fed acceptance and IMB during 45 % and 37 % of sessions for

Ella's father and mother, respectively. We calculated interobserver agreement (IOA) for self-fed acceptance by dividing the number of agreements (10-s intervals in which both observers did or did not score an occurrence of self-fed acceptance) by the total number of agreements and disagreements (10-s intervals in which observers scored a different number of self-fed acceptance) and converting to a percentage. Mean IOA for self-fed acceptance was 94 % (range, 58 % to 100 %) and 98 % (range, 87 % to 100 %) for Ella's father and mother, respectively. We used exact agreement to calculate IOA for IMB by dividing the number of agreements (10-s intervals in which both observers scored the same number) by the total number of agreements plus disagreements (10-s intervals in which observers scored a different number) and converting to a percentage. Mean IOA for IMB was 97 % (range, 73 % to 100 %) and 97 % (range, 70 % to 100 %) for Ella's father and mother, respectively.

Treatment Integrity

Ella's parents served as feeders. Observers scored *correct cup presentation* by activating a duration key when the feeder correctly presented the cup according to the criteria for baseline or nonremoval of the cup and practice trials and deactivating the key when the feeder was incorrectly presenting the cup for 3 s or more. Specifically, observers activated the correct cup presentation key at the onset of the session and kept it activated as long as the feeder was implementing the treatment correctly. Feeders implemented the treatment correctly when they guided Ella to take the drink after 8 s elapsed from the presentation, kept at least one of Ella's hands around the cup regardless of IMB, and followed Ella's head if she turned it. We converted correct cup presentation to a percentage by dividing the total duration of correct cup presentation by the session time. Percentages of correct cup presentations were 100 % and 98 % (range, 69 % to 100 %) for Ella's father and mother, respectively.

Observers also scored incorrect praise (whenever the feeder did not provide descriptive praise immediately following self-fed acceptance) and incorrect attention (each time the feeder provided attention within 3 s of inappropriate mealtime behavior). Incorrect praise and incorrect attention were low for both parents (data available upon request).

Two observers independently collected data on the treatment integrity measures during 45 % and 37 % of sessions for Ella's father and mother, respectively. We calculated IOA for treatment integrity by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100 %. Interobserver agreement for correct cup presentation was 98 % (range, 87 % to 100 %) and 87 % (range, 65 % to 96 %), incorrect praise was 99 % (range, 92 % to 100 %) and 96 % (range, 90 % to 100 %), and incorrect attention was 100 % for Ella's father and mother, respectively.

Experimental Design

We used a nonconcurrent multiple baseline across two feeders (father and mother) with an embedded reversal (ABCBC) design in the analysis in which Ella's mother served as the feeder.

Procedure

Ella's weekly appointments lasted 1 h and involved two to five, 5-drink sessions. We coached Ella's parents to implement the procedures using verbal and written instructions and modeling very briefly prior to the initiation of a new condition. We provided in-vivo feedback as necessary. Feeders always stated the session contingencies to the child at the beginning of the appointment and only repeated the contingencies when moving to a new condition.

Baseline The feeder placed a 4-cm³ drink on the tray approximately every 30 s along with the instruction, "Take a drink," for a total of five presentations per session. If Ella did not self-feed

the drink, the cup remained on the tray until 30 s elapsed. If Ella self-fed the drink, the feeder provided praise and removed the cup. Thirty seconds after the drink entered Ella's mouth, the feeder prompted Ella to "show me" (i.e., mouth check). If Ella did not open her mouth within 5 s of the prompt, the feeder touched a baby spoon at the corner of Ella's lips to prompt her to open. The feeder provided praise for mouth clean or reminded Ella to swallow (e.g., "You need to finish swallowing your drink") if Ella had Pediasure pea-sized or greater remaining inside her mouth (pack) and then immediately presented the next drink. If Ella packed Pediasure after the fifth drink, the feeder wiped out any remaining Pediasure with a baby spoon and paper towel. During all sessions, the feeder conversed with Ella regardless of whether Ella engaged in IMB or did not take the drink. If Ella dumped the Pediasure or threw the cup, the feeder did not retrieve or replace it and waited to present a new drink at the next scheduled interval. The feeders provided no differential consequences for negative vocalizations, gagging, or expels.

One Practice Trial (1 Self-Fed:1 Caregiver-Fed) The feeder followed the baseline procedure with the following

Fig. 1 Percentage of trials with self-fed acceptance for Ella with her father as the feeder (*top panel*) and with her mother as the feeder (*bottom panel*). Arrows indicate when we increased the amount of liquid presented to Ella in the cup, starting with 4 cm³ and increasing to

8 cm³ during sessions in which Ella's father served as the feeder. The *horizontal line* displays the mean level of self-fed acceptance for each phase

modifications. If Ella did not self-feed the drink within 8 s, the feeder placed his or her hands over Ella's hands and around the cup, guided the cup to her lips, and followed Ella's lips if she engaged in IMB until the drink could be deposited. If Ella expelled, the feeder scooped up expelled Pediasure or obtained fresh Pediasure (e.g., if it contacted an unclean surface) and re-presented the drink using hand-over-hand guidance within 3 s of the expel. Ella rarely expelled ($M = .08$ per min and $M = .06$ per min during sessions in which her father and mother served as feeders, respectively).

Six Practice Trials (1 Self-Fed: 1 Caregiver-fed + 5 Empty)

We only observed a moderate increase in self-fed acceptance with one caregiver-guided practice trial, so we added five empty-cup practice trials. The feeder used the same procedures as one practice trial; however, if Ella did not self-feed the drink within 8 s, the feeder also conducted five practice trials with an empty cup immediately following hand-over-hand guidance. Specifically, as soon as the feeder deposited the Pediasure inside Ella's mouth, the feeder kept his or her hands around Ella's hands which were placed on the cup and

guided Ella to practice lifting the empty cup from the tray to her lips five times in rapid succession ($1\times/s$) while counting aloud. We increased the volume of Pediasure per drink by 1 cm^3 if Ella's self-fed acceptance was 80 % or greater for seven consecutive sessions.

Results and Discussion

Figure 1 displays the percentage of self-fed acceptance. Self-fed acceptance was low during baseline with Ella's father ($M = 29\%$; range, 0 % to 60 %) and mother ($M = 35\%$; range, 0 % to 60 %). Self-fed acceptance increased to moderate, variable levels with one practice trial with Ella's father ($M = 69\%$; range, 20 % to 100 %) and mother ($M = 67\%$; range, 40 % to 80 %). Self-fed acceptance increased to high, stable levels during six practice trials (one with liquid, 5 empty) with Ella's father ($M = 88\%$; range, 20 % to 100 %) and mother ($M = 92\%$; range, 80 % to 100 %). Self-fed acceptance remained high while we increased the amount from 4 to 8 cm^3 ($M = 91\%$; range, 60 % to 100 %). With Ella's mother, self-

Fig. 2 Inappropriate mealtime behavior per minute for Ella with her father as the feeder (*top panel*) and with her mother as the feeder (*bottom panel*). Arrows indicate when we increased the amount of

liquid presented to Ella in the cup, starting with 4 cm^3 and increasing to 8 cm^3 during sessions in which Ella's father served as the feeder

fed acceptance decreased and became more variable when we withdrew the empty cup practice trials ($M = 72\%$; range, 20 % to 100 %) and increased to high levels when we re-implemented this treatment ($M = 85\%$; range, 40 % to 100 %).

We based our decisions to change phases on visual inspection of self-fed acceptance and not IMB. Inappropriate mealtime behavior per min (Fig. 2) was variable during baseline with Ella's father ($M = 7$ per min; range, 2 to 14) and mother ($M = 8$ per min; range, 3 to 26). During one practice trial, IMB per min decreased with Ella's father ($M = 4$ per min; range, 0 to 16) and mother ($M = 5$ per min; range, 0 to 11). During six practice trials, IMB per min remained low or at zero with Ella's father ($M = 0.1$ per min; range, 0 to 1) and mother ($M = 0.8$ per min; range, 0 to 4). During the return to one practice trial ($M = 2$ per min; range, 0 to 7) and re-implementation of six practice trials ($M = 1$ per min; range, 0 to 4), IMB per min was low and variable with Ella's mother. Mouth clean was consistently high across both feeders ($M = 98\%$; range, 80 % to 100 % and $M = 94\%$; range, 60 % to 100 % for Ella's father and mother, respectively).

When trying to replicate the procedures described by Rivas et al. (2014) and Vaz et al. (2011), we were faced with the challenge of providing repeated drinks, while not exceeding 240 cm³ to avoid emesis. Given that each drink presentation consisted of a 4-cm³ drink, we would have reached Ella's volume cap in two sessions if we implemented all practice trials with liquid. Given that her appointment also involved work with solids, we were limited with how many sessions we could conduct. Although Volkert et al. (2016) found practice trials ineffective to increase self-feeding with two participants, we successfully increased self-drinking from an open cup with one child diagnosed with a severe feeding disorder using practice trials. This treatment may potentially address a serious problem with overfeeding when manipulating the quantity of bites or drinks the therapist or caregiver feeds the child after refusing to self-feed.

Although the treatment we evaluated was effective to increase self-drinking, we cannot say whether some other positive-reinforcement-based or less intensive treatment would have produced similar outcomes. For example, Peterson et al. (2015) used differential reinforcement to increase self-drinking in two children. Results from Peterson et al. suggested that positive reinforcement alone (without nonremoval procedures) may be effective for increasing self-drinking in some children, especially after earlier treatment has addressed initial refusal to liquids in a nonself-feeding context. Practice trials could also be conceptualized as a punishment-based procedure because noncompliance (not self-feeding the drink within 8-s acceptance) and inappropriate mealtime behavior decreased. Future research should compare the aforementioned treatments to determine if there are any advantages (e.g., improved maintenance, efficiency) to positive-reinforcement and punishment-based procedures.

Self-drinking is important for increased independence and for long-term maintenance of treatment gains, nutritional intake, and growth. There are only a few studies that have evaluated effective treatments to increase self-drinking (e.g., Collins et al., 1991; Peterson et al., 2015; Stimbert et al., 1977; Volkert et al., 2016), and our study adds to a small but growing body of literature. One notable feature of the current study was that parents served as the feeders. Future researchers should evaluate the social validity and general preference for these and other interventions, especially when parents implement the procedures.

Compliance with Ethical Standards

Funding This study was not funded by a grant.

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from the parent of the child included in the study.

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