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SPOON-TO-CUP FADING AS TREATMENT FOR CUP DRINKING IN A CHILD WITH INTESTINAL FAILURE

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We treated a child with intestinal failure who consumed solids on a spoon but not liquids from a cup. We used spoon-to-cup fading, which consisted of taping a spoon to a cup and then gradually moving the bowl of the spoon closer to the edge of the cup. Spoon-to-cup fading was effective for increasing consumption of liquids from a cup.

Key words: cup drinking, fading, feeding disorders, intestinal failure, pediatric feeding disorders, short gut syndrome, total parenteral nutrition

Intestinal failure (IF) is defined as reduced absorption of nutrients from the gastrointestinal tract. The conditions that cause IF (e.g., necrotizing entercolitis) often require surgical resection of large portions of the small intestine, which results in short gut syndrome and the need for parenteral nutrition (PN, nutrition delivered through the veins) for survival (Goulet & Ruemmele, 2006). Unfortunately, PN is associated with medical complications (e.g., liver disease). Because about 50% of children on total PN will die within 5 years (Nucci et al., 2008), it is critical for PN to be weaned as soon as possible. Discontinuation of PN is dependent, in part, on adaptation of the small intestine to increase its absorptive capacity. Adaptation is enhanced and PN-associated liver disease may be reversed with the introduction of enteral nutrition (i.e., oral or through a tube), and oral feedings specifically may have added benefits (Goulet & Ruemmele, 2006).

The extent to which nutrition can be delivered orally depends largely on the child's cooperation and ability to feed orally, which may be compromised in children with IF. Their feeding problems may be particularly intractable because of their numerous medical issues. They have significant ongoing gastrointestinal problems (e.g., chronic explosive diarrhea) that contribute to discomfort associated with feeding. Intake of liquids must be limited to frequent, small amounts throughout the day (e.g., every hour) to prevent dehydration, and most would consider the formula they are required to consume unpalatable. Outcome studies suggest that a large percentage of these children fail to transition to oral feeding (e.g., Nucci et al., 2008). With the exception of a study by Linscheid, Tarnowski, Rasnake, and Bramsthere (1987), few studies have shown that behavior analysts can be successful in treating the feeding problems of children with IF. Given the potential challenges of treating these children and the critical need to transition them from PN, it is important for behavior analysts to show that we can be successful in treating their feeding problems.

In the current investigation, we treated a child with IF who refused solids and liquids. Initial treatment increased consumption of solids on a spoon but not liquids from a cup. Fading (e.g., liquid quality, Patel, Piazza, Kelly, Ochsner, & Santana, 2001; drinking utensil, Babbitt, Shore, Smith, Williams, & Coe, 2001) is an effective method of increasing consumption of liquids in children with feeding disorders. Therefore, we used spoon-to-cup fading (Babbitt et al., 2001) to increase consumption of liquids from a cup.

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METHOD

Participant, Setting, and Materials

Jake was a 4-year-old boy who had been admitted to a day-treatment program for solid and liquid refusal (he consumed minimal solids and liquids). He had been diagnosed with short gut syndrome (62 cm of small bowel) as a result of necrotizing entercolitis, gastrostomy (G-) tube and PN dependence, and status post heart transplant. Jake had frequent bouts of high-volume diarrhea and was not toilet trained. He was ambulatory and communicated with gestures and cards. Jake's oral intake goal was to consume 30% to 40% of his caloric needs.

We conducted sessions in a room that was 4 m by 4 m. Materials included a high chair, blue cut-out cup, large Maroon spoon, a spup (large Maroon spoon taped to a blue cut-out cup), and bib that folded at the bottom to form a receptacle.

Operational Definitions and Data Collection

Observers sat 1.5 m from Jake, collected data on laptop computers, and measured acceptance and mouth clean once per presentation (when the therapist placed the utensil [spoon, cup, or spup] at Jake's lips, not including utensil placement after re-presentation). *Acceptance* was defined as Jake actively opening his mouth and allowing any of the drink past the plane of his lips within 5 s of presentation without inappropriate behavior and negative vocalizations. Observers scored *mouth clean* 30 s after acceptance if all of the liquid (except for liquid pea size or larger) had entered Jake's mouth, and there was no liquid (pea size or larger) in his mouth. Observers scored the frequency of inappropriate behavior when the utensil was in arm's reach of Jake if he turned his head 45° from the utensil or touched the utensil or therapist's arm or covered his mouth. Acceptance and mouth clean were converted to percentages after dividing the number of acceptances or mouth clean by the number of presentations (denominator for acceptance) or drinks entering Jake's mouth (denominator for mouth clean). Inappropriate behavior was converted to responses per minute by dividing the number of inappropriate behaviors by the duration in which the utensil was in arm's reach of Jake.

Interobserver agreement was calculated for acceptance and mouth clean by dividing the session into 10-s intervals and dividing the number of intervals with total agreement by the number of intervals in the session. Exact agreement for inappropriate behavior was calculated by dividing the number of agreements (a 10-s interval in which both observers scored the same frequency of inappropriate behavior) by the number of agreements plus disagreements (a 10-s interval in which observers scored a different frequency of inappropriate behavior) and converting the ratio to a percentage. Interobserver agreement was assessed on 11% of sessions and was 96% (range, 91% to 100%) for acceptance, 97% (range, 93% to 100%) for mouth clean, and 93% (range, 81% to 100%) for inappropriate behavior.

Design and Procedure

We used ABB′AB and mutlielement (spoon vs. cup) designs to demonstrate control of the extinction treatment. A was an attention and escape baseline. B was extinction. B′ was a series of spoon-only sessions with extinction to evaluate whether cup sessions negatively affected mouth clean during spoon sessions. We used a multiple-probe design during fading. After each fading step, the therapist presented liquids in a cup (probe), which was the terminal goal of fading.

Trained therapists conducted 45-min drinking meal blocks three times per day (9:15 a.m., 12:00 p.m., 3:45 p.m.), 5 days per week. Solids meals were conducted separately. Drinking meals consisted of multiple five-drink sessions separated by brief breaks, totaling 110 sessions across 14 days. During the session, the therapist presented 1/8 oz of raspberry-flavored Elecare with fiber at the midline of Jake's lips approximately once every 30 s. The therapist

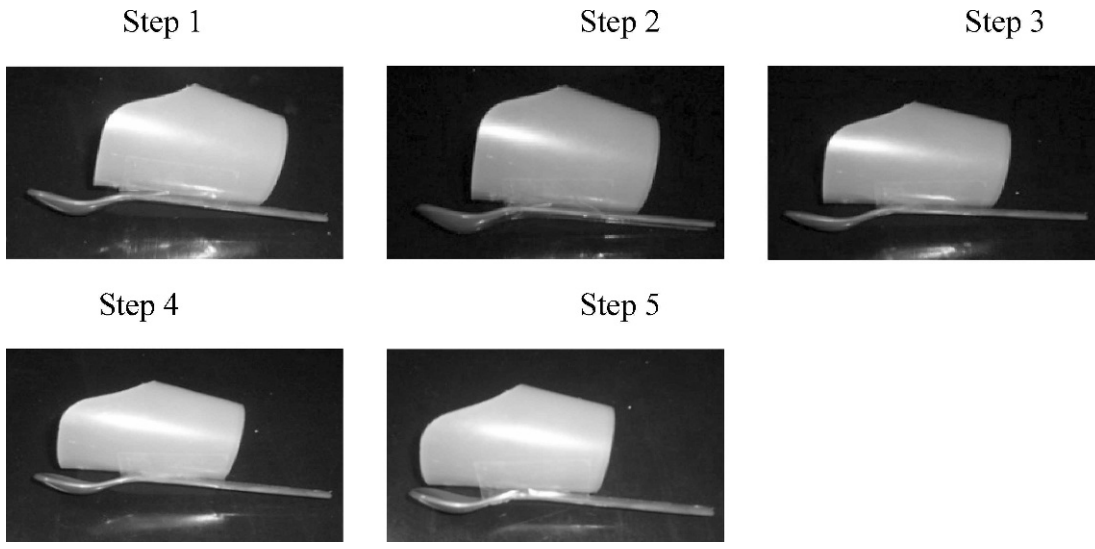

Figure 1. Steps used during fading.

provided praise for acceptance and prompted Jake to "show me" 30 s after the drink entered his mouth. The therapist provided praise if Jake had a mouth clean, prompted Jake to "swallow your drink" if he was packing (liquid pea size or larger in his mouth), and presented the next drink. If Jake packed the fifth drink, the therapist conducted a mouth check every 30 s and prompted Jake to "swallow your drink" until no liquid pea size or larger was in Jake's mouth.

Functional analysis. The therapist followed the general procedures described above with the following additions. The therapist presented drinks in the cup and delivered 30 s of escape (escape condition), 30 s of attention (attention condition), or no differential consequences (control condition) following inappropriate behavior. The functional analysis indicated that Jake's inappropriate behavior was maintained by escape and attention (data available from the second author). Based on the results of the functional analysis, we conducted an attention and escape baseline.

Baseline. The therapist randomly selected a utensil (spoon or cup) to present drinks, counterbalanced across pairs of sessions, and followed the general procedures with the following additions. The therapist removed the cup and delivered attention for 30 s after inappropriate behavior and presented the next drink. The therapist provided no differential consequences for expulsion, vomiting, or gagging.

Extinction. The therapist alternated between spoon and cup and implemented the general procedures with the following additions. The therapist blocked and ignored inappropriate behavior and held the spoon or cup at Jake's lips until she could deposit the drink (attention extinction and escape extinction). The therapist re-presented expelled drinks as soon as the liquid passed the plane of Jake's lips. She used the spoon or cup to scoop the liquid from his face or the bib. She re-presented a fresh drink if she could not recapture the original drink (e.g., after vomiting). Sessions continued until Jake swallowed all of the drinks, which never exceeded 10 min.

Spoon-to-cup fading and cup probes. The therapist implemented extinction as described above during fading with the spup and during cup probes. Fading consisted of altering the spup by retaping the bowl of the spoon 0.6 cm closer to the edge of the cup (Figure 1). If acceptance and mouth clean were above 80% for three consecutive sessions, the therapist conducted a probe. If acceptance or mouth

clean was below 80% for the probe session, the therapist discontinued the probe and returned to the next fading step. She continued cup probes if acceptance and mouth clean were above 80%. We trained the caregivers to provide the treatment and conducted a follow-up session with the caregivers 1 year later.

RESULTS AND DISCUSSION

During baseline, Jake did not accept any drinks (Figure 2, top). Consequently, there was no opportunity for mouth clean (Figure 2, bottom). Inappropriate behavior was high with the spoon (M = 45 responses per minute) and cup (M = 38 responses per minute). During extinction, acceptance increased (M = 60%), mouth clean was variable (M = 57%), and inappropriate behavior was low (M = 2.3 responses per minute) with the spoon. Acceptance was high (M = 88%), and mouth clean (M = 7%) and inappropriate behavior (M = 0.64 responses per minute) were low with the cup. During spoon-only sessions, acceptance (M = 98%) and mouth clean (M = 94%) were high, and inappropriate behavior (M = 2.3 responses per minute) was low. Acceptance was zero during the reversal to baseline with both spoon and cup; therefore, there was no opportunity for mouth clean; inappropriate behavior increased during spoon (M = 56 responses per minute) and cup (M = 58 responses per minute) conditions. During the return to extinction, acceptance (M = 85%) and mouth clean (M = 93%) were high, and inappropriate behavior (M = 0.65 responses per minute) was low with the spoon. Acceptance (M = 80%) was high, and mouth clean (M = 17%) and inappropriate behavior (M = 0.94 responses per minute) were low with the cup.

Acceptance (M = 99%) and mouth clean (M = 100%) were high, and inappropriate behavior (M = 0.76 responses per minute) was low during the first five fading steps. Acceptance was variable (M = 75%), and mouth clean was low (M = 20%) during the first four cup probes. After the fifth fading step (spoon protruding 0.6 cm from the lip of the cup), acceptance and mouth clean were high (Ms = 100% and 80%, respectively) during the cup probe. Consequently, we discontinued fading and continued cup probes. Acceptance (M = 99%) and mouth clean (M = 98%) remained high, and inappropriate behavior remained low (M = 0.38 responses per minute). At this point, Jake was consuming about 3 oz of formula from the cup at each meal, which was his dietitian-prescribed volume limit. Acceptance and mouth clean were 100% at follow-up, and inappropriate behavior was zero.

Because behavior analysts have been successful in treating feeding problems of children with medical diagnoses (e.g., Bachmeyer et al., 2009), we may not appreciate the significance of these findings. Nevertheless, these results are important because feeding problems of children with IF are notoriously difficult to treat, and many children with IF do not transition to oral feeding (e.g., Nucci et al., 2008). These results are also important because Jake was receiving PN, which causes liver damage and increased his risk of death. Therefore, PN weaning was imperative to prevent a liver transplant and to reduce the morbidity and mortality associated with PN. The increase in oral intake accomplished with spoon-to-cup fading contributed to the discontinuation of PN. We were able to increase Jake's oral intake of fluids to the maximum volume allowed at that time.

These results replicate those of Babbitt et al. (2001), in that spoon-to-cup fading was effective in increasing cup drinking. Initially, Jake did not swallow drinks in a cup, but he swallowed liquids from a spoon. Therefore, we presented drinks on a spoon and then altered the characteristics of the spoon gradually such that Jake continued to swallow liquids from the altered utensil and ultimately from the cup. These results suggest that identification of a response that is in the child's repertoire (in this case swallowing liquids on a spoon) might be one method for choosing

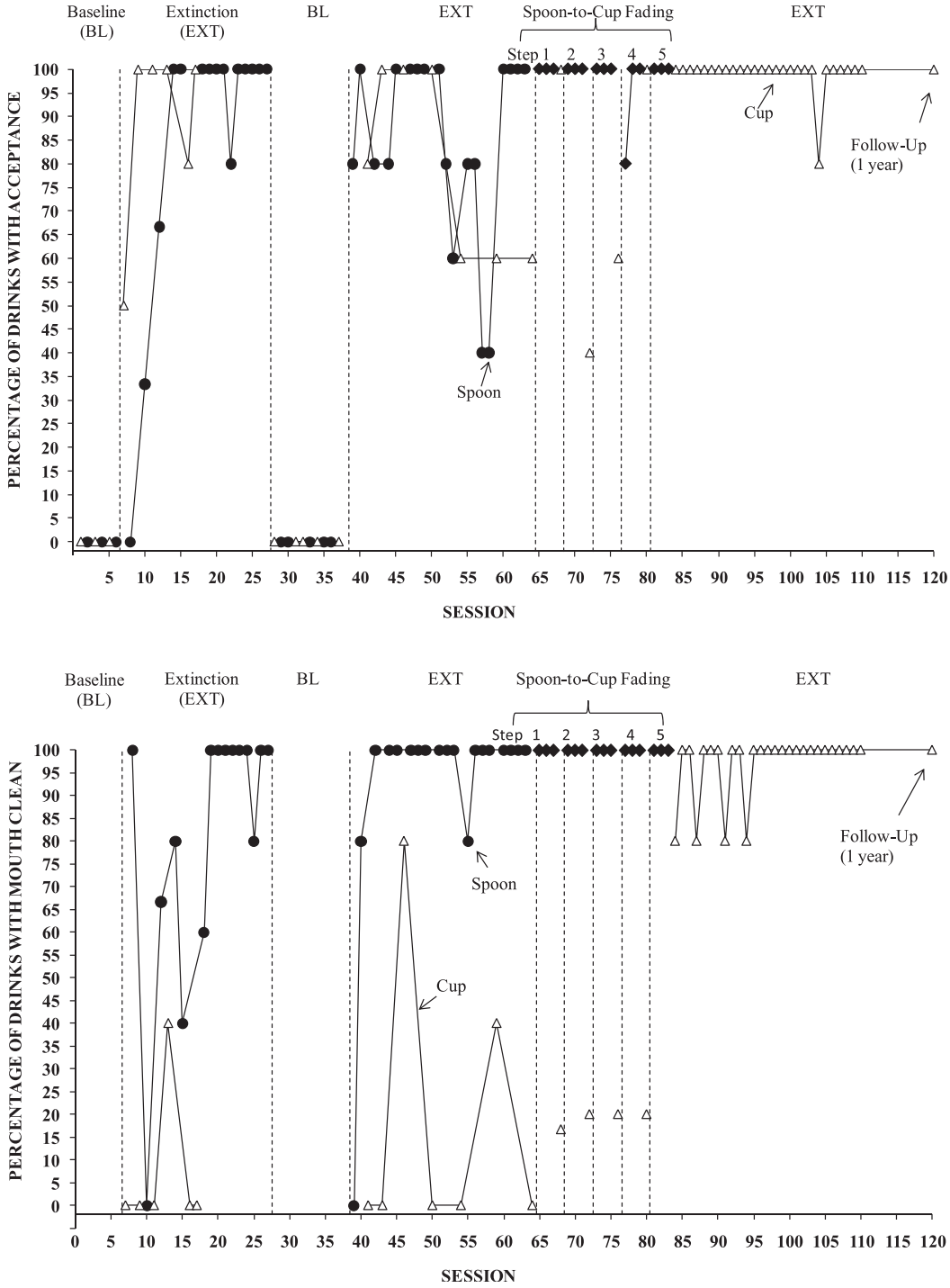

Figure 2. Acceptance (top) and mouth clean (bottom) during baseline, extinction, spoon-to-cup fading, and extinction (cup only).

initial starting points for fading. For example, Patel et al. (2001) used fading to gradually alter the characteristics of water (an accepted beverage) such that the child was consuming a previously refused beverage after fading.

One limitation is that this assessment was conducted with one participant. In addition, we didn't identify which quality of the cup contributed to refusal. Also, we did not evaluate spoon-to-cup fading without a function-based extinction treatment. Future studies should evaluate the effects of spoon-to-cup fading in the presence and absence of additional treatment components and with additional participants (e.g., with different diagnoses and refusal behavior).

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