Treatment of Selective and Inadequate Food Intake in Children: A Review and Practical Guide

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ABSTRACT

Treatment of highly selective or low overall eating by children may prevent the development of more complicated feeding difficulties, which can result in compromised health status and developmental concerns as well as the need for more intensive interventions. Caregiver-friendly intervention strategies that can be implemented with children in their community environments (e.g., in the child's home or school) may reduce the need for tertiary care. A small but growing number of studies have found that certain behavioral procedures can be effective in the absence of escape extinction with children who have established eating patterns (i.e., inadequate intake, selectivity by food type). This article reviews these procedural variations within the behavioral pediatric feeding literature and provides a practical guide for individuals who develop behavioral interventions for children in community settings.
Descriptors: antecedent manipulations, escape extinction, food refusal, food selectivity, pediatric feeding disorders, positive reinforcement

The reported prevalence of feeding problems varies between 2% and 35% in typically developing children and is more frequent (estimated between 33% to 80%) among children with developmental delays (Babbitt, Hoch, & Coe, 1994; Burklow, Phelps, Schultz, McConnell, & Rudolph, 1998; Munk & Repp, 1994; Palmer & Horn, 1978). The variability in prevalence estimates may be attributed to the wide range of complications associated with feeding problems, from consuming an inadequate amount of food or drink to a total refusal to eat and dependence on supplemental feedings (e.g., gastrostomy-tube or nasogastrostomy-tube feeds).

Children who display difficulty with selective eating or inadequate oral intake are often described as "picky or finicky eaters" or as having a "poor appetite" (Kedesdy & Budd, 1998). These children may eat during mealtimes but frequently consume only small amounts of food, which may impair their nutritional status or growth. Other children may not have a healthy or balanced diet because they only eat a few or certain kinds of foods. For example, they may have strong preferences within food groups (e.g., chicken nuggets but no other proteins), refuse all members of a single food group (e.g., vegetables), or have strong flavor preferences (e.g., sweet foods). Children with such feeding difficulties may also display inappropriate mealtime behaviors (e.g., tantrums) that cause meals to be stressful for caregivers.

Children who consistently do not eat enough or who do not eat the right types of food may be at risk for a number of health, developmental, and social concerns. Persistent inadequate intake or substantially unbalanced diets can result in weight loss, malnutrition, lethargy, and even impaired mental or physical development (Christopherson & Hall, 1978). Furthermore, families of children with feeding problems are at high risk for stress and mental health issues (Singer, Song, Hill, & Jaffe, 1990). Thus, the successful treatment of feeding problems has a number of important implications, such as improved health in children, improved quality of life for children and families, decreased mental health problems in families, and reduced risk of long-term eating problems (Piazza & Carroll-Hernandez, 2004).

Several researchers have suggested that behavioral mismanagement (i.e., inadvertent reinforcement of inappropriate eating patterns) frequently contributes to the onset and maintenance of feeding problems (e.g., Babbitt et al., 1994; Palmer, Thompson, & Linscheid, 1975; Piazza et al., 2003). For example, if a caregiver typically removes undesired food items or terminates meals when a child refuses to eat or to consume age-appropriate quantities of food, the child may be more likely to display inappropriate behavior during meals to escape or avoid less preferred food items or larger quantities of food. That is, the child's inappropriate mealtime behavior may be shaped and maintained by negative reinforcement (i.e., contingent removal of food presentation). If the child's caregiver provides preferred foods when the child rejects novel or non-preferred foods, the child's inappropriate mealtime behavior may be shaped and maintained by positive reinforcement (i.e., contingent access to preferred foods).

Piazza et al. (2003), for example, conducted functional analyses of the inappropriate mealtime behavior of 12 children. Results suggested that negative reinforcement (escape from bites of food) served as the most frequently identified maintaining variable, with 90% of the children who displayed differential responding showing sensitivity to negative reinforcement. However, multiple functions were identified for

80% of the children who showed differential responding. These results suggest that negative reinforcement may play a primary role in the maintenance of feeding problems, but the behavior of many children with feeding disorders also may be sensitive to positive reinforcement (i.e., access to adult attention, preferred foods, or toys).

Behavioral interventions have been demonstrated to be effective for treating feeding problems in children. A multi-component treatment package consisting of positive reinforcement and escape extinction is the most commonly used intervention for this problem (e.g., Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Babbitt et al., 1994; Cooper et al., 1995; Kerwin, Ahearn, Eicher, & Burd, 1995; Piazza, Patel, Gulotta, Sevin, & Layer, 2003). The *positive reinforcement* component typically involves providing the child with access to preferred stimuli (e.g., food, toys, praise, tokens) for desired eating behavior (i.e., accepting or swallowing bites). *Escape extinction (EE),* which is implemented when a child's feeding problem is presumed to be maintained by negative reinforcement, is a procedure in which escape from or avoidance of the demand of eating is no longer permitted. *Nonremoval of the spoon (NRS)* is an example of an EE procedure that involves positioning the spoon in front of the child's mouth until the bite is accepted, thus preventing escape from or avoidance of the bite presentation (Ahearn et al.; Babbitt et al.; Cooper et al.; Kerwin et al.). An alternative EE procedure, *physical guidance (PG)*, consists of exerting gentle pressure on the child's mandibular joint or chin so that the mouth is guided open and the food is placed in the child's mouth (Ahearn et al.; Kerwin et al.).

Although a common component of interventions for childhood feeding problems, EE has been associated with a number of undesirable side effects, including response bursts (i.e., initial increases in problem behavior), extinction-induced aggression, and emotional responding (e.g., crying; Lerman, Iwata, & Wallace, 1999). Treatment fidelity when implementing EE also may be compromised as a result of the child's size or strength. Moreover, meals may become aversive for caregivers if they must physically prevent escape from or avoidance of eating while managing the side effects of extinction, particularly if increases in desired behaviors (e.g., bite acceptance) do not occur immediately. This may also compromise treatment fidelity. Thus, EE procedures may not be ideal for treatment programs conducted in natural settings (e.g., in the child's home or school) or by inexperienced behavior change agents (e.g., parents, teachers, paraprofessionals).

A number of studies have shown that some behavioral procedures can be effective without EE for children who have established eating patterns, but who consume an inadequate quantity of foods and/or are highly selective about the types of food consumed. These research findings suggest that these caregiver-friendly interventions could be implemented with some children in their community environments, thus reducing the need for tertiary care. The purpose of this article is to review procedures that have been utilized in the absence of EE for treating highly selective or low overall intake in children and to provide a practical guide for individuals who develop behavioral interventions in community settings.

A systematic search of articles published in peer-reviewed journals targeting the treatment of oral feeding in children was conducted via PsychINFO and ERIC using the keywords "feeding disorders," "feeding problems," "food refusal," and "food selectivity." The references within selected articles were searched for additional relevant sources. Finally, each article was reviewed to determine if it met the inclusionary criteria for this review. Studies were included if they described the use of behavioral procedures in the absence of EE to treat the feeding problems of participant(s) who accepted food orally but exhibited highly selective (by food type) intake and/or did not consume enough to meet daily caloric intake requirements. In addition, the goal of treatment was to increase the quantity and/or variety of foods or liquids consumed. Studies examining procedures to treat selectivity of foods by texture were not included in this review, as treatment with these children may be complicated by delayed oral motor skills and thus require additional considerations that are beyond the focus of this article. Studies with children who had previously received treatment with EE also were not included due to the atypical feeding histories of these participants. Twelve studies met the inclusion criteria (see Table 1). Two studies utilized EE with some or all of the participants (Cooper et al., 1999; Piazza et al., 2002). These studies were included in the review because the experimenters also examined the effects of alternative procedures in the absence of EE with one or more of the participants.

What Types of Procedures Have Been Shown to be Effective Without Escape Extinction?

Seven of the 12 studies used positive reinforcement procedures in the form of either differential reinforcement of alternative behavior (DRA; i.e., contingent access to preferred stimuli for accepting or swallowing bites) or noncontingent reinforcement (NCR; i.e., continuous access to preferred stimuli throughout the meal) in the absence of EE (i.e., there was an ongoing escape-contingency for food refusal). It is likely that positive reinforcement was in direct competition with negative reinforcement (the ongoing escape-contingency for food refusal) because negative reinforcement plays a major role in the maintenance of food refusal (Piazza et al., 2003). However, the extent to which treatments were matched to the functions maintaining food refusal is unclear because functional analyses were not conducted in these studies. Antecedent-based procedures, used in 6 of the 12 studies, involved modifying variables that may increase or decrease the aversive properties of the mealtime or food/drink presentations. Thus, antecedent-based procedures were used to decrease the value of escape. These procedures included simultaneous presentation of preferred and non-

Table 1. Summary of Studies Included in Review

Study	Goals	Procedures	Results
Riordan et al. (1980)	Increase variety and quantity of foods consumed	DRA + demand fading	Contingent access to preferred foods (without EE) resulted in an increase in bite acceptance of non-preferred foods, and demand fading resulted in an increase in the total volume of oral intake
Riordan et al. (1984)	Increase variety of foods consumed	DRA	Contingent access to preferred foods and ignoring disruptive mealtime behavior (without EE) resulted in increased acceptance of non-preferred foods for the participants who exhibited food selectivity
Cooper et al. (1999)	Increase variety and quantity of foods consumed	DRA with/without EE (NRS)	Increasing the quantity of contingent access to preferred foods (without EE) resulted in increased acceptance for the participant who exhibited food selectivity
Levin & Carr (2001)	Increase variety of foods consumed	DRA, MO analysis (i.e., satiation/deprivation of reinforcers)	Availability of preferred foods prior to treatment meals influenced the effectiveness of contingent access to preferred foods for acceptance of non-preferred foods
Brown et al. (2002)	Increase variety of foods consumed	DRA	Contingent access to preferred foods in a preferred format/flavor was effective in increasing acceptance of the same foods in a non-preferred format/flavor
Piazza et al. (2002)	Increase variety of foods consumed	simultaneous vs. sequential presentation with/without EE	Simultaneous presentation of preferred and non-preferred foods (without EE) resulted in immediate increases in acceptance of non-preferred foods for 2 participants; for the third participant increases in consumption occurred with the simultaneous presentation when EE was added
Ahearn (2003)	Increase variety of foods consumed	simultaneous presentation	Simultaneous presentation of preferred (condiments) and non-preferred foods (vegetables) resulted in increased acceptance of non-preferred foods (without EE)
Buckley & Newchok (2005)	Increase variety of foods consumed	simultaneous presentation with/without DRA + RC	Simultaneous presentation alone was effective in reducing packing of non-preferred foods and thus increasing the variety of foods consumed
Luiselli et al. (2005)	Increase variety of liquids consumed	stimulus fading (liquid concentration)	Fading the concentration of a milk/formula concentration resulted in increased consumption of 100% milk (without EE)
Wilder et al. (2005)	Increase quantity of foods consumed	NCR	NCR resulted in a decrease in self-injury and an increase in bite acceptance
Tiger & Hanley (2006)	Increase variety of liquids consumed	stimulus fading (liquid concentration)	Results suggested that gradually decreasing the amount of chocolate mixed with milk resulted in increased milk drinking
Patel et al. (2007)	Increase variety and quantity of foods consumed	High-p	Results suggested that bite acceptance increased in the presence of and not the absence of the high-p instructional sequence (i.e., three presentations of an empty spoon)

DRA = differential positive reinforcement of alternative behavior; EE = escape extinction; High-p = high-probability instructional sequence; MO = motivating operations; NCR = noncontingent reinforcement; NRS = nonremoval of the spoon; RC = response cost

preferred foods, stimulus fading (i.e., gradually altering the concentration of paired preferred and non-preferred foods), and high-probability instructional sequences (i.e., a series of instructions for which compliance is highly likely followed by a request for which compliance is unlikely).

Reinforcement Procedures

Differential (Positive) Reinforcement of Alternative Behaviors (DRA)

DRA involves providing the child with access to preferred stimuli contingent on desired behaviors, such as accepting or swallowing bites of food. In the studies on DRA included in this review, preferred foods or drinks were always used as positive reinforcers, either alone or in combination with social praise (Brown, Spencer, & Swift, 2002; Cooper et al., 1999; Levin & Carr, 2001; Riordan, Iwata, Wohl, & Finney, 1980; Riordan, Iwata, Finney, Wohl, & Stanley, 1984). Thus, the effectiveness of stimuli other than preferred foods or drink remains unclear. For example, in Riordan et al., preferred foods were delivered contingent on acceptance of non-preferred foods to treat the feeding problems of 4 children with developmental disabilities who exhibited either low overall or highly selective food intake.

Some children are also highly selective with their preferred foods based on the brand, presentation, or flavor of the food. For example, a child may only eat chicken nuggets that are from McDonald's™, a sandwich that is cut into quartered-square pieces, or key lime-flavored yogurt. This selectivity with preferred foods makes preparing meals cumbersome and in some cases impossible. Brown et al. (2002) examined the use of providing preferred foods in a preferred format or flavor contingent on acceptance of the same foods presented in a non-preferred format or flavor (e.g., crinkle-cut chips instead of straight-cut chips, a bread roll instead of sliced bread, different flavored yogurt). The participant was a child with moderate learning difficulties who exhibited selectivity by food type. The positive reinforcement procedure alone (i.e., providing contingent access to the preferred foods in the preferred format and/or flavor in the absence of EE) resulted in an increase in the child's acceptance of foods in the non-preferred formats and/or flavors.

Thus, it may be possible to increase the quantity or variety of foods that children consume without having to use EE if highly preferred foods or drinks can be identified for the children. It is important to note, however, that in the study conducted by Riordan et al. (1980), food refusal and inappropriate mealtime behaviors were ignored throughout treatment. Therefore, it may be important to ignore problem behavior in order to obtain treatment effects with some children (i.e., those whose problem behavior is maintained by attention).

As discussed in the following sections, a number of factors may influence whether positive reinforcement will compete with an ongoing escape contingency for food refusal, including the dimensions of the positive reinforcement (e.g., reinforcer quantity) and motivating operations (i.e., reinforcer satiation and deprivation). It is important to understand how these factors may influence the effectiveness of reinforcement procedures and the implications of procedural variations that may address these factors (e.g., restricting access to foods), as they could potentially worsen the child's nutritional status.

Dimensions of the reinforcement. A study conducted by Cooper et al. (1999) demonstrated that certain parameters of reinforcement, such as the quantity of reinforcers provided, may influence the effectiveness of the stimuli as reinforcers for some children. Cooper and colleagues manipulated the quantity and/or quality of preferred food or drink that was provided contingent on acceptance of bites of non-preferred foods when treating low overall or highly selective food intake of 4 children. Increasing the quantity of reinforcers provided (i.e., number of sips of Pepsi™ or bites of potato chips) resulted in an overall increase in food acceptance (in the absence of EE) for one of the participants, a typically developing child. These results suggest that practitioners should consider the number of bites of preferred foods or drinks provided contingently for each bite of non-preferred food consumed. It may be necessary to increase the number of reinforcers offered for each bite of non-preferred food consumed if treatment effects are not achieved with the initial quantity of reinforcers selected.

Once consumption of non-preferred foods increases, the proportion of bites of preferred and non-preferred foods may be altered by gradually increasing the requirement to access reinforcement. In Riordan et al. (1980), for example, 2 children were required to accept one bite of a non-preferred food to gain access to a preferred food item and social praise at the beginning of treatment. Subsequently, the experimenters increased the number of bites required to obtain the preferred food item. However, social praise continued to be delivered after each bite. For 1 participant, a decreasing trend was observed in the number of bites accepted when the requirement was increased to four bites. Therefore, the terminal requirement was two bites for this participant and six bites for the second participant.

Motivating operations. Another factor that may influence the effectiveness of potential reinforcers, particularly preferred foods or drinks, is the relative states of satiation and deprivation (motivating operations) associated with the preferred stimuli. Restricting access to preferred foods or drinks prior to meals has been shown to increase the effectiveness of reinforcement procedures. Levin and Carr (2001) examined the differential effects of having or not having access to preferred food items prior to meals during which positive reinforcement was provided for acceptance of bites of non-preferred food. Four children with developmental disabilities who exhibited food selectivity by type participated. All children consumed non-preferred foods under the positive reinforcement treatment only when access to the preferred foods was restricted prior to the meals. These results suggest that consideration

should be given to the child's access to preferred foods or drinks that will be used as potential reinforcers during meals.

Noncontingent (Positive) Reinforcement (NCR)

An alternative to providing preferred foods or liquids contingently is to provide other types of preferred stimuli continuously throughout the meal. Preferred toys or activities are the most common stimuli used when NCR is utilized in the treatment of feeding problems (Reed et al., 2004; Wilder, Normand, & Atwell, 2005). Wilder et al., for example, examined the use of NCR to decrease self-injury and increase food acceptance in a child who exhibited inadequate and selective food intake and who had been diagnosed with developmental disabilities. Treatment involved continuous access to a video during meals (without the use of EE), which resulted in a decrease in self-injury and an increase in food acceptance. However, treatment was only demonstrated for the select foods that the child consumed prior to the intervention.

Antecedent-Based Procedures

Simultaneous Presentation

Simultaneous presentation involves presenting a less preferred food at the same time as a more preferred food. The foods may be presented together on the spoon or blended together, or the non-preferred food may be inside or covered by the preferred food. This strategy has been shown to be effective in increasing consumption of non-preferred foods in the absence of EE. For example, Ahearn (2003) increased acceptance of non-preferred foods (vegetables) with a child diagnosed with autism by adding preferred condiments to the non-preferred foods in the absence of any programmed consequences (i.e., neither EE for refusal behaviors or positive reinforcement for food acceptance). Similarly, Buckley and Newchok (2005) evaluated the effects of presenting a non-preferred food and a ground chocolate cookie together on a spoon for a child diagnosed with autism who exhibited food selectivity. Initially, treatment included the simultaneous presentation procedure, differential reinforcement (praise for swallowing bites), and response cost (removal of access to a video following packing [i.e., holding food in the mouth]). However, simultaneous presentation was also evaluated alone and found to reduce packing and increase consumption of non-preferred foods. Thus, differential reinforcement with response cost was not necessary to maintain the treatment effects.

One study provided evidence that simultaneous presentation of a more preferred food with a less preferred may be more effective than the differential reinforcement procedures previously described. Piazza and colleagues (2003) compared two methods of food presentation with 3 children who exhibited highly selective eating patterns and had been diagnosed with developmental disabilities. In one condition, a preferred food was presented at the same time as a non-preferred food (e.g., a piece of broccoli on a chip, salad dressing on a piece of broccoli). In the other condition, a preferred food was presented contingent on acceptance of a non-preferred food. Acceptance of non-preferred foods increased for 2 of the 3 participants with the simultaneous presentation procedure (in the absence of EE).

Results of these studies suggest that, when preferred foods can be identified, an effective strategy may be to provide them simultaneously with non-preferred foods. This strategy may momentarily alter the aversive properties of the non-preferred food and thus the child's motivation to refuse the food (abolishing escape as reinforcement). An alternative explanation is that flavor-flavor conditioning may occur. That is, a preference for the non-preferred food may be acquired as a result of pairing the non-preferred flavor with a preferred flavor (see Piazza et al. 2003, for a discussion of flavor-flavor conditioning).

Nonetheless, some researchers have cautioned against simultaneously presenting or blending more preferred foods or drinks with less preferred foods, especially when a child is an extremely picky eater, because some children's preference for the more preferred foods may be altered as a result of this pairing with less preferred foods (Kerwin & Eicher, 2004).

Stimulus Fading

Gradually changing the ratio or concentration of paired preferred and non-preferred foods or liquids (stimulus fading) may reduce the risk associated with pairing non-preferred and preferred foods. A few studies have demonstrated the effectiveness of stimulus fading in the absence of EE. For example, Luiselli, Ricciardi, and Gilligan (2005) established milk consumption in a child with autism by gradually increasing the concentration of milk in a beverage that the child consumed consistently (Pediasure®, a supplemental nutritional beverage). The child drank Pediasure® at full strength and at a blend of 50% Pediasure®/50% whole milk, but refused whole milk at full strength or when it was blended with Pediasure® at a concentration of less than 50% Pediasure®. The fading protocol was initiated at the 50% Pediasure®/50% whole milk concentration, and the milk-to-Pediasure® ratio was gradually increased by one tablespoon across successive sessions. Similarly, Tiger and Hanley (2006) used stimulus fading to increase milk drinking with a typically developing child. The treatment involved mixing a preferred flavor (chocolate) into a non-preferred liquid (milk) and then gradually decreasing the amount of chocolate syrup (by 0.2 ml every two meals) until only plain milk was offered.

Results of these studies suggest that gradually changing the ratio or concentration of preferred and non-preferred foods or liquids may increase acceptance of non-preferred foods or liquids without the use of EE. An advantage of this procedure is that it involves initially presenting a small amount of the non-preferred food with the preferred food, which may decrease the likelihood that the preferred food will acquire the aversive properties of the non-preferred food. A limitation of this procedure is the length of time required for fading. However, periodic

probes (of the full strength substance) can be conducted to determine whether continuing to fade the concentration is necessary, thus potentially shortening the length of the fading protocol.

High-probability Instructional Sequence

High-probability (high-p) instructional sequence involves presenting a series of instructions for which compliance is highly likely followed by a request for which compliance is unlikely (i.e., a low-probability [low-p] instruction). Patel et al. (2007) evaluated the effects of a high-p instructional sequence on food acceptance with a child who had been diagnosed with developmental delays, and who inconsistently consumed a limited variety of foods. The high-p sequence consisted of three presentations of an empty spoon; the low-p instruction was the presentation of a spoon with food. EE was not utilized. Acceptance of a variety of novel foods increased in the presence and not the absence of the high-p instructional sequence. Results of this study suggest that a high-p instructional sequence may be effective in increasing compliance (acceptance) with food in the absence of EE if a child demonstrates high levels of compliance with a similar request such as acceptance of an empty spoon.

Recommendations for Practice

Feeding problems, including those exhibited by children who have established patterns of eating, are not homogenous. Thus, treatment strategies should be selected individually based on existing eating patterns and potential maintaining variables. When practitioners are selecting treatment strategies to implement in community settings with children who exhibit highly selective or low overall food intake, they may want to consider the following general guidelines, based on the empirical evidence reviewed.

Children who have existing eating patterns may exhibit refusal behaviors to escape or avoid less preferred food or larger quantities of food (negative reinforcement). The purpose of this article was to discuss strategies that might compete with a potential ongoing escape contingency. However, it should be noted that some children may demonstrate refusal behaviors to gain access to foods that are relatively more preferred (Piazza et al., 2003). In these cases and/or when preferred foods can be identified, practitioners should consider providing preferred foods contingent on consumption of less preferred foods (e.g., Brown et al., 2002; Riordan et al., 1990) or simultaneously presenting (or blending) more preferred with less preferred foods (e.g., Piazza et al., 2002; Luiselli et al., 2005).

One limitation of this strategy is that highly preferred foods may have poor nutritional value (e.g., chips, soda). Nonetheless, these items may be critical for obtaining treatment effects, and the quantity may be reduced over time by thinning the reinforcement schedule or increasing the number of bites required for reinforcement (Riordan et al., 1980). Gradual schedule thinning also is important for maintaining treatment effects. If treatment effects do not maintain throughout fading, it may be possible to recapture treatment effects by returning to a previous successful step.

When using preferred foods as reinforcers for consumption of less preferred foods, practitioners should consider the quantity (e.g., number of bites offered for each target behavior; Cooper et al., 1999) and availability of these foods at times other than when they are being used as potential reinforcers (Levin & Carr, 2001). These factors may influence the effectiveness of these food items as reinforcers. However, completely restricting access to preferred foods could result in a decrease in overall food intake for some children. Therefore, it may be beneficial to restrict access to preferred foods for only a certain length of time prior to meals. An alternative strategy is to determine a hierarchy of relative preference for foods or drinks that the child consumes consistently via a preference assessment (e.g., Fisher et al., 1992) and to use only the most highly preferred items as reinforcers during meals. This would allow the child to consume moderately preferred foods at other times to maintain his or her current level of caloric intake.

Simultaneously presenting or blending more preferred foods or drinks with less preferred foods should be done with caution. Some children's preference for the more preferred foods may be altered as a result of this pairing with less preferred foods (Kerwin & Eicher, 2004). Consider a situation in which a child's pre-treatment diet is extremely limited or is only comprised of foods or drinks that are vital to maintaining his or her caloric intake. A decrease in consumption of these foods may put the child's nutritional status at greater risk. It should be noted that the preferred foods used for simultaneous presentation in Ahearn (2003), Buckley and Newchok (2005), and Piazza et al. (2003) were condiments, chips, and cookies. These foods do not provide substantial nutritional value when consumed alone and, in these cases, were not the only foods the participants consumed. The risks associated with pairing substances may be reduced by blending a much larger proportion of the preferred food relative to the less preferred food, at least initially. An additional caveat about the simultaneous presentation procedure is that research findings support the use of simultaneous presentation only with solid foods and the use of blending or stimulus fading only with liquids.

If highly preferred food(s) cannot be identified or do not function as reinforcers, practitioners should consider introducing a preferred activity noncontingently into the mealtime (Wilder et al., 2005). It should be noted, however, that research has shown this strategy to be effective in the absence of EE with only 1 participant and with access to a preferred activity as the noncontingent reinforcer. A high-p instructional sequence may be an alternative strategy if the child demonstrates high levels of compliance with a request that is similar to food consumption (e.g., acceptance of an empty spoon; Patel et al., 2007). Evidence for the effectiveness of this strategy in the absence of EE, however, is also limited to 1 participant.

Summary

Although the most common interventions for pediatric feeding problems include EE because of the major role that negative reinforcement (escape from eating) plays in the maintenance of feeding problems, an emerging body of research has shown that some procedures can be effective in the absence of EE with some children who already have established patterns of eating (i.e., inadequate intake, overselectivity). It should be noted, however, that several of the strategies reviewed in this paper have also been shown to be ineffective in the absence of EE (e.g., Najdowski, Wallace, Doney, & Ghezzi, 2003; Patel, Reed, Piazza, Bachmeyer, & Layer, 2005; Piazza, Patel et al., 2003; Reed et al., 2004). It is hoped, however, that these guidelines will assist practitioners in selecting caregiver-friendly treatments that can be implemented in community settings as first line treatments, thus reducing the need for tertiary care for some children.

Findings from this review suggest several implications for future research. First, the majority of the participants in the studies were children diagnosed with developmental disabilities. Thus, additional research with typically developing children is needed. Second, the treatment effects of some strategies (e.g., noncontingent access to a preferred activity, the high-probability instructional sequence) were demonstrated with just 1 participant and thus need to be replicated. Third, adult attention has been shown to play a role in the maintenance of inappropriate mealtime behavior (Piazza et al., 2003) and has been used as a treatment component (in the form of social praise; e.g., Cooper et al., 1999; Riordan et al., 1980), but the individual treatment effects of adult attention (in the absence of EE) remain unclear. Fourth, a shortcoming of the extant literature and thus an area for future research is the absence of an assessment methodology to select treatments that will be effective in the absence of EE based on relative preference for foods, toys/activities, or adult attention. Finally, research is needed on the relative effectiveness of different schedules of reinforcement (DRA versus NCR) with different types of reinforcers (preferred toys/activities, preferred foods, or adult attention) in the absence of EE.

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