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BEHAVIORAL FEEDING INTERVENTIONS FOR PEDIATRICS

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INTRODUCTION

Mealtime is one of the oldest social routines, yet it is forgotten that eating is an essential life activity that is necessary to sustain nutrition and ensure growth. While mealtime is an opportunity to indulge, relax, and socialize for many, it is a common challenge and stress for many children. According to Sharp, Jaquess, Morton, & Herzinger (2010), up to 40% of toddlers and early school-age children experience some mealtime difficulties. Mealtime issues include strong food preference, food refusal, lack of independent feeding skills, consuming less quantity than peers, and/or disruptive behaviors toward non-preferred food items or behaviors aimed to end meals. Research by Kerwin (1999) illustrated that between 3% and 10% of children develop chronic feeding issues exceeding ordinary developmental variation and possibly associated with a number of negative medical and developmental outcomes. These negative outcomes range from mild to severe, and include stunted growth, malnutrition, communication deficits, poor academic achievement, social difficulties, invasive medical procedures, or even death. This is an investigation of the most effective interventions for pediatrics with severe behavioral feeding disorders.

BEHAVIORAL FEEDING DISORDER

As a child's feeding problems progress to becoming a physical and/or emotional distress, it becomes characterized as a "feeding disorder". A feeding disorder is identified when a child is unable or refuses to eat or drink sufficient quantities to maintain nutritional status, regardless of etiology. The psychiatric diagnosis of a feeding disorder during infancy and/or early childhood is "non-specific, encompassing children who fail to eat a sufficient quantity and/or variety of food resulting in chronic malnutrition, poor weight gain and/or weight loss before age 6 years in the

absence of an active organic complaint", (American Psychiatric Association, 2000). The process of assessing and treating feeding disorders is complicated due to a number of interrelated factors.

Behavioral feeding disorders can develop due to various underlying etiologies. Children with either physical handicaps or delays in self-feeding often receive fewer calories than normal children their age (Brown, Davis, & Flemming, 1979). Organic factor (e.g., gastroesophageal reflux, cleft palate, oral motor deficits, cerebral palsy, hypersensitivity to food, etc.) can lead to difficult or painful eating. Although these disabilities have an organic basis, the mealtime problems may be exacerbated by environmental variables. Children with developmental disabilities, such as autism and mental retardation, are at high risk for feeding disorders. At one time, aberrant eating habits were included among the early diagnostic indicators of autism (Ahearn et al., 2001). Although the current diagnostic criteria do not include aberrant eating, there have been numerous reports and studies of feeding problems in children with autism. "Approximately one-third of all children with developmental disabilities experience a clinically significant feeding concern", (Dahl & Sunderlin, 1986). Additionally, the greater level of developmental disability, the more prevalent the problem; for example 80% of severely or profoundly developmentally disabled individuals have mealtime problems (Perske, Clifton, McClean, & Stein, 1977).

There are also children with significant feeding problems with no clear physiological precursor or developmental issues, or feeding problems continue after organic issues have resolved. "There has been very little systematic research on feeding problems in typically developing children, but Bentovim (1970) estimated that such problems may occur in up to 45% of that population," (Ahearn et al., 2001). In these cases there are causal environmental factors such as caregiver mismanagement of mealtimes and maladaptive patterns of reinforcement believed to cause feeding disturbances.

Feeding and growth problems can stem from distorted dynamics around feeding, which can be indicative of mismanaged parent-child interactions. Satter (1990) claims incidence estimates range from 1% to 2% for severe and prolonged problems to 25% to 35% for common difficulties such as food refusal and "overeating", as related to mismanaged parent-child interactions. Mismanagement of mealtimes are believed to be problematic to feeding practices and include unrestrained access to food, irregular mealtimes, exposure to developmentally inappropriate textures, and modeling of inappropriate feeding habits (Babbitt et al., 1994; Blissett & Harrist, 2002). Behavioral mismanagement occurs with the misuse of positive reinforcement (e.g., caregiver attention for disruptive behaviors) and negative reinforcement (e.g., ending mealtime when the child screams) and can inadvertently shape and strengthen problem behaviors (Sharp et al., 2010).

ORAL MOTOR DEVELOPMENT

The diagnostic inclusion and possible etiological pathways for feeding disorders is very extensive, and it is common for children to have more than one causal factor. The newborn infant's eating behaviors are initially elicited as reflexes in part by the physiological sensations of hunger (Linscheid, 1983). An infant is born with the primitive reflexes of root, hand, grasp, bite, suckle, and gag which disappear between 3 and 5 months of age. The progressive development of adaptive mealtime behaviors can, however, be delayed or even prevented by continuance of a primitive reflex (Lewis, 1982). Sometimes primitive reflexes can persist beyond infancy. For example, it is common for children with cerebral palsy to exhibit a tonic bite beyond the first year. An outline of the normal oral-motor development of the child is presented is Figure 1 (O'Brien et al., 1991).

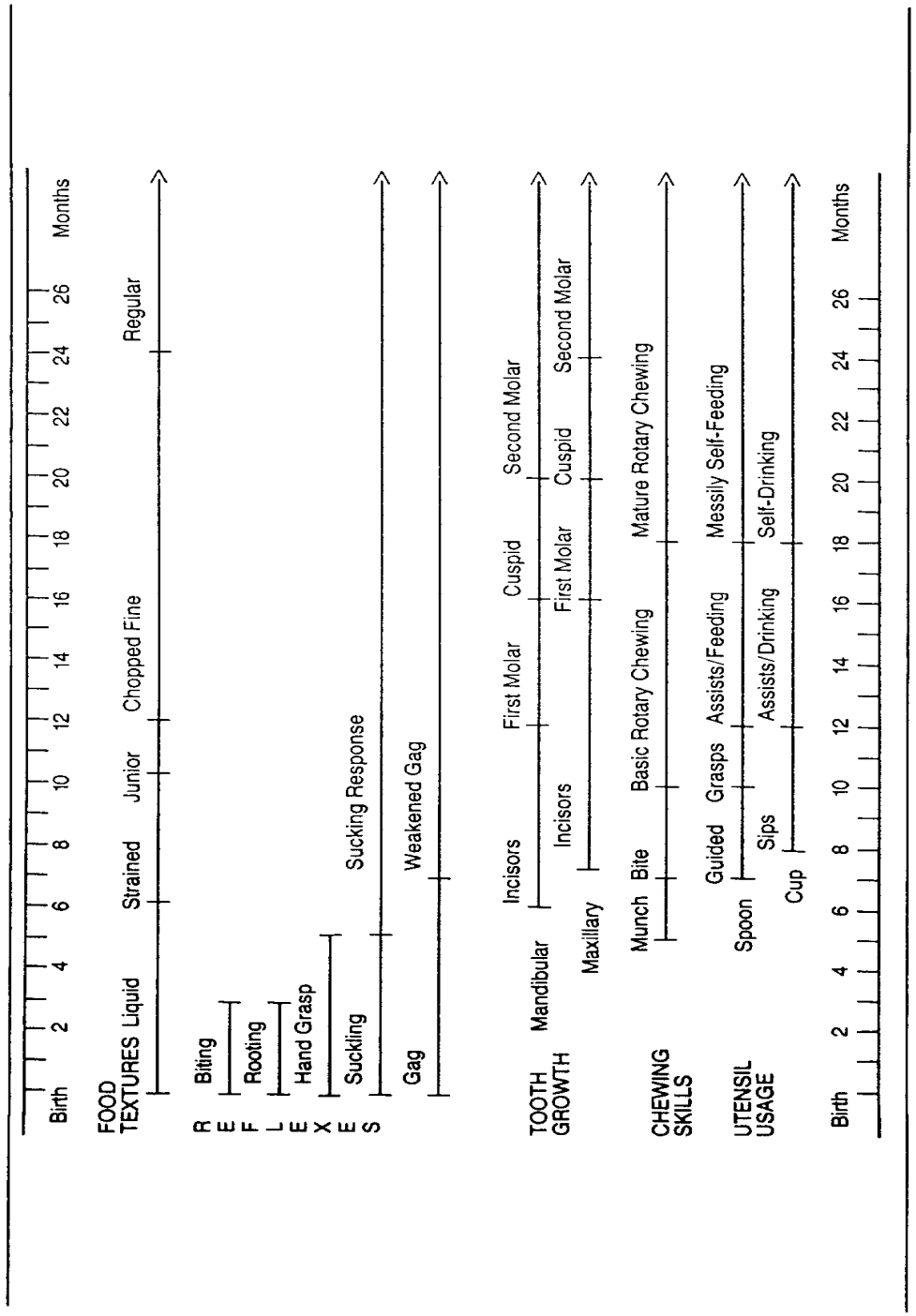

Figure 1: The child's acquisition of mealtime skills and food textures.

"Typical consumption involves a number of successive steps: bringing a bite to the lips, accepting food into the mouth, chewing and forming a bolus, and swallowing," (Gulotta et al.,

2005). The child begins to chew food by learning behaviors in a hierarchical order. The child learns to munch on foods around 5 months of age, develops tongue lateralization at 7 months, begins biting around 7 months of age, and refines tongue and jaw movements into mature chewing skills between 8 and 36 months of age (Howard, 1984). This systematic progression of feeding behaviors dictates appropriate food texture to feed a child. The appropriate food texture cannot be accurately based on a child's chronological age, as it depends on the child's oral-motor, alimentary tract, and kidney development (O'Brien et al., 1991).

For example, some children with developmental disabilities are maintained on junior-texture because of marked oral-motor difficulties. There are problems associated with maintaining a child on a developmentally inappropriate food texture, including (a) continued infantile patterns of sucking and swallowing (Lewis, 1982), (b) delayed development of chewing skills (Lewis, 1982), (c) limited stimulation to the jaw and facial muscles to facilitate their development (Palmer & Horn, 1978), (d) possible damage to the teeth and gums (Coffee, 1977), (e) exacerbation of an existing abnormal tongue thrust (Lewis, 1982), (f) constipation (Laidler, 1976), and (g) delays in articulation and speech (Blockley & Miller, 1971). Therefore, continued feeding of textured foods beyond a developmentally appropriate age should be avoided when possible. When there is an interruption in the process, problems can arise at different steps of consumption, which further complicate the diagnostic and intervention picture (Sharp et al., 2010). It is necessary to address any medical concerns prior to beginning feeding intervention. This may involve consultation with specialists or complete medical workup to ensure that the individual is cleared for feeding treatment (Luiselli, 2011). Assessment should include an interdisciplinary approach: evaluation by a physician, nutritionist, occupational therapist, and a speech-language pathologist. Each of these interdisciplinary approaches should be directed at identifying specific controlling variables, so that a functionally determined treatment program

can be designed. The primary purpose of the physical exam is to rule out organicity. Additionally, a physician should monitor a child's physical status throughout any feeding intervention program.

ASSESSMENT OF FEEDING DISORDER

Once a child has been medically cleared for feeding interventions, it is necessary to assess various aspects of the individual's current eating patterns and mealtime routines. The mealtime assessment should include multiple observations. The time of feeding, the amount of food, the rate of feeding, and the amount of food consumed. To begin, the extent of food selectivity must first be determined. Food selectivity is the limited consumption of foods based on texture, familiarity, and taste (Knox et al., 2012). To illustrate, a child with food selectivity may only eat yogurt, applesauce, and mash potatoes to avoid harder textures. Texture selectivity (i.e., refusing to eat developmentally appropriate food consistencies) is noted in 27% of children with feeding problems (Palmer & Horn, 1978).

The initial step in the assessment process often involves completion of a diet record, commonly referred to as a food diary. A food diary is a record of all foods and drinks consumed during meals across a certain period of time (Luiselli, 2011). Completion of a food diary allows for identification of volume of food, types, textures, and brands of food accepted prior to onset of intervention. Knox et al (2012) reports applied behavior analysis as being an effective way to overcome food selectivity. Applied behavior analysis (ABA) is the use of techniques (i.e., verbal praise, access to a preferred item) and principles (i.e., positive reinforcement, escape extinction) to bring about a meaningful and positive change in behavior.

Munk and Repp (1994) developed procedures for classifying the feeding problems of individuals with physical or developmental disabilities through direct observational assessment. Their assessment involved systematic presentations of multiple items from four food groups and

three textures; acceptance or rejection of each item was recorded. An assessment of a child's food preferences should be conducted to identify items or activities that may function as positive reinforcement during the feeding intervention. According to Knox et al. (2012), consequence-based procedures have been effective in increasing appropriate eating and decreasing problematic mealtime behaviors. Consequence-based procedures use positive reinforcement and access to preferred items for increasing appropriate eating. Consequence-based procedures also implement escape extinction when wanting to decrease mealtime problem behavior.

If food items do not seem like a viable option, then it will be necessary to identify non-food items usable for reinforcement, (Luiselli, 2011). Non-food items for a child include toys, videos, books, or other activities that the child enjoys, as well as a form of social praise from caregivers or instructors. Typically, intervention plans for food selectivity combine behavioral momentum and consequence-based and antecedent-based procedures. Behavioral momentum refers to the rate and type of reinforcement. Consequence-based procedures are used to minimize reinforcement for problem behavior and increase reinforcement for desirable behavior. Antecedent-based procedures focus on promoting engagement and on task behaviors during therapy.

Many behavioral feeding interventions provide a preferred item when the target behavior, such as accepting food into the mouth, has been accomplished. Access to one of the preferred items is contingent on the acceptance of a nonpreferred food item. Initially, no time delay occurs between acceptance of the nonpreferred food item and reinforcement of the preferred item. A delay, however, is developed and increases as the rate of acceptance increases. Pizza el al. (2003) compared the effects of positive reinforcement with escape extinction, positive reinforcement alone, and escape extinction alone on food refusal of 4 children with intellectual disabilities. The

type of escape extinction was non-removal of the spoon and physically guiding mouth opening with light pressure, positive reinforcement used was verbal praise. Pizza et el. (2003) found that escape extinction alone, but not positive reinforcement alone, increased food consumption by all children. Bernal (1972) treated a 4-year-old normal child who refused table foods and would not self-feed the entire meal. Reinforcement included praise, preferred foods, and contingent television viewing. Over a 20-week period, this child began to self-feed, to eat regular table foods, and had eaten 50 new food items.

It is also important to assess various aspects of the child's mealtime routines. Some of the most important aspects to assess include the individual's meal schedule, duration of meals, location of meals, presentation of foods, and materials used during meals, (Luiselli, 2011). It is important to be aware of the child's behavior during mealtime to identify both preferred and non-preferred foods. Assessment for possible inappropriate mealtime behaviors of a child should be conducted to identify behaviors targeted for extinction. Some inappropriate mealtime behaviors recorded are head turning, batting at utensils, throwing food or utensils, out of seat, negative vocalizations, self-injury, or aggression. Inappropriate mealtime behaviors should be assessed through observation of parent-child interaction during mealtime and are best identified in a naturalistic environment (i.e., where the child typically has mealtime).

BEHAVIORAL FEEDING INTERVENTION

Once assessment of the current eating patterns and mealtime routines have been completed and preferences have been identified, a protocol for a specific feeding intervention can be developed. It is common for a treatment plan addressing feeding intervention to target several objectives in a hierarchical order. For example, the objectives of the treatment plan may include elimination of mismanaged mealtime routines, intervening with food selectivity,

decreasing food refusal, and increasing food acceptance. The treatment plan will establish criteria of each objective for feeding intervention implementation. The subsequent paragraphs are going to elaborate on the implementation of the previously mentioned feeding intervention objectives.

First, it is important to eliminate any mismanagement of the mealtime routines that may impede the success of a feeding intervention. The following factors may include the schedule and structure of meals (e.g., duration of meals, location of meals, presentation of meals and materials used for meals), (Luiselli, 2011). For example, if a child is given food throughout the day with no established mealtime and does not sit at the table when he eats, these behaviors of the mealtime would be targeted prior to food selectivity and food refusal. Piazza et al. (2003) found that when parents used coaxing, reprimanding, access to a preferred item, and allowed avoidance from eating following inappropriate child behavior that the inappropriate behaviors worsened 67%.

Sensory-based strategies may be needed to address behavioral responses such as decreasing self-stimulatory behavior, improving attention, and regulating the activity level needed for in-seat behavior that may interfere with the child's ability to engage during mealtime (Twachtman-Reilly, Amaral & Zebrowski, 2008). Twachtman-Reilly et al. (2008) reports that case studies emerging show the effectiveness of sensory-based strategies designed to facilitate the behavioral readiness skills needed for improved functional performance.

When developing a protocol to intervene with food selectivity, it is helpful to identify target behaviors that the child demonstrates when the food is presented. A refusal occurs when a child does not accept the bolus. If the child allows the bolus into his or her mouth it is considered an acceptance, and if he or she subsequently swallows the bolus, it is termed swallow, (Luiselli,

2011). If the child allows the bolus into his mouth but then spits it back out, it is considered an expulsion, (Luiselli, 2011). At any point in the feeding intervention, a child may gag, where it appears that he or she is coughing and is likely to vomit. Differential reinforcement of other behavior (DRO) such as providing reinforcement for the absence of vomiting is a technique used to extinct unwanted behavior (Williams et al., 2007). Simply exposing the child to novel foods does not necessarily lead him or her to accept new foods. Only the tasting of new foods leads to higher acceptance of non-preferred food items. However, for a child with extreme food anxiety, simply exposing him or her to new foods and praising the tolerance of that food being present may be an appropriate place to begin intervention.

Luiselli et al. (1985) decreased food selectivity and oppositional eating in an 11-year-old boy with visual impairment and moderate intellectual impairment. All sessions were conducted in a residential school's cafeteria. Using an ABAB reversal design, these authors assessed the effectiveness of treatment: restricting the meal to 25 minutes, ignoring the boy's inappropriate behaviors, and providing a preferred edible only after the entire meal had been consumed. These procedures increased consumption from the two baseline averages of 33% to 45% to the two treatment averages of 75% and 88%. Follow-up at one month indicated maintenance of food acceptance. A few years later, Luiselli (1989) used prompting and reinforcement procedures to improve self-feeding in children who were deaf and blind.

There are several advantages to using reinforcement when treating behavioral feeding problems. One advantage being that the person implementing the treatment is taught to interact more positively with the child. Another is that reinforcement provides an opportunity to shape the acceptance, chewing, or swallowing response; the feeder may reinforce any behavior within the eating chain. Lastly, it is the least restrictive treatment procedure for training

developmentally appropriate mealtime behaviors. Unfortunately, reinforcement is not always a viable treatment procedure. Children, who do not accept food as a natural reinforce or if food is found be an ineffective reinforce, may require another treatment (Luiselli, J. K., & Gleason, D. J., 1987).

Some researchers, such as Hater (1979), find that using time-out and reinforcement are effective for decreasing disruptive behavior. Hatcher (1979) treated a 26-month-old non-self-feeding child who refused all solid foods. The child was hospitalized for 13 weeks of treatment. Preferred liquids and verbal attention were provided for solid food ingestion; time-out for inappropriate feeding behavior. During the course of treatment, the subject initially lost 28 ounces and then gained 37 ounces. Unfortunately, the weight gain coincided with the child being transferred to a different department in the hospital. Therefore, whether access to the preferred liquids or the environmental change produced the increased weight is unclear.

Once the child tolerates the presence of the new food for longer than 30 seconds without disruptive behaviors, targeting the actual consumption of new foods can begin. The steps to successfully consume a new food, include meeting at designated mealtime area, presenting food, giving verbal command and finally, providing praise. Palmer et al. (1975) implemented similar reinforcement procedures to treat a 6-year-old child with developmental delay and paraplegia who refused solid foods. The child was treated as an outpatient with the therapist feeding one meal per day. Preferred food, praise, and time-out were introduced in an AB design. In addition to access to preferred foods, the child was required to accept a bite of nonpreferred food in order to terminate the session. The dependent variable measured was grams consumed, and acceptance increased from a baseline level of 0 g to 147 g when access was provided to preferred foods.

Food presentation begins where the new food is systematically presented to the child on a routine basis, (Luiselli, 2011). Such feeding sessions should work with the child's natural appetite when the child is hungry and more likely to eat, and therefore, should be conducted at similar times of the day. Conduct feeding sessions 3 to 4 times a day, and keep feeding sessions brief, ranging from 5 to 30 minutes. Bring the child to the feeding area and have him or her sit appropriately. This step is the initial opportunity to provide positive reinforcement for sitting if this is a target problem behavior. Present the novel food to the child and provide a simple verbal directive, such as "take a bite", when the child is calm and disruptive behaviors are absent. Providing a verbal prompt such as "take a bite" when presenting food to the child has been proven effective for delivery and establishing predictability (Knox et al., 2012).

Least to most prompts for self-feeding are used depending on the child's cognitive and physical capabilities. A child requiring maximum prompting may require hand over hand assistance. Hand over hand assistance involves placing one's hands over an individual's hands to help them complete the movement. If the child complies with the directive by accepting and swallowing, provide high behavior-specific praise for the behavior and allow access to the child's assessed preferences, (Luiscelli, 2011).

If the child does not consume the food, do not continue to verbally negotiate, plead, or engage otherwise around the refusal behavior to obtain a successful acceptance. This continued encouragement only allows for the child to obtain continued attention for the undesired behavior of food refusal, or positively reinforces a negative behavior. Instead, remove the food and redirect the child to a neutral activity (Luiscelli, 2011). When removing the food, make sure the child is not currently engaging in disruptive behavior. If the child engages in disruptive behaviors and does not accept the new foods, it is best to withhold preference foods between

feeding sessions. This step will help prevent the reinforcement of food refusal behaviors to the child is allowed preference foods (Luiscelli, 2011). However, contradicting literature states that food removal for disruptive behaviors is negative reinforcement and that it should not be done. Instead of food removal, a common procedure employed called exit criterion is used to treat food refusal. For this procedure, a child is allowed to exit the feeding environment contingent on completing a specified food portion, or within the set amount of time.

Once objectives have been established and feeding sessions have been initiated, criteria to advance or move back to the previous step must be decided on. A common criteria of 80% to 90%, over three consecutive sessions is used for feeding interventions. For example, if the clinician is targeting touching the bolus to the lips, after three successful consecutive sessions the target could move to allowing the bolus into the mouth. A procedure used to increase texture criteria is called fading. Fading is used in which food textures are systematically increased (Williams et al., 2007). Probe meals of varying textures (i.e., pureed, pudding, ground, and chopped) to determine the next texture for fading. The probe meals should not include the last texture successfully consumed. Success with any of the probe textures is defined by acceptance by swallowing and will identify the next target texture. If the child exhibits no acceptance of probe foods then the higher texture of the previously successful texture will be selected. For example, if the child is successfully accepting cheese puff than the next texture consistency to try could be Cheetos. Continue to advance the child by fading until he or she is accepting and swallowing the novel foods presented. Once the child is accepting single bite presentations, increase the quantity of the novel food presented.

Shore et al. (1998) demonstrated the efficacy of texture fading in the treatment of food selectivity displayed by four children with severe feeding problems who had been admitted to the

hospital. The first child had severe food selectivity with mild developmental delays. The second child had bottle dependency and food refusal with a diagnosis of failure to thrive. The third child was being treated for gastrostomy tube dependency, food refusal, and chronic cyclical vomiting but had no cognitive or physical deficits. The fourth child was being treated for food refusal and food selectivity by texture with a diagnosis of craniosynostosis (repaired), severe mental intellectual disability, hypotonia, and oral motor dysfunction. All children received three meals a day at the hospital presented by a trained therapist. During beginning textures, texture-fading, and probe meals, the same treatment components were exhibited. Treatment consisted of praise contingent on accepting bites and drinks, 15s of toy play and praise contingent on swallowing bites or drinks, escape extinction for behaviors incompatible with acceptance (i.e., holding the spoon to his or her lips until an opportunity to deposit the food occurred), and extinction of expelling bites (i.e., placing expelled food back into mouth until swallowed).

When deciding upon novel foods to target next, begin with foods that are highly likely to be accepted based on similarities to the child's current food repertoire. This procedure previously described is referred to as shaping, in which the child is given food close to texture and taste that he or she has been accepting. The previous example of moving from the cheese puff to Cheetos is also an example of shaping because the child appears to like the taste and/or color of that food item. The closer the food targets are to each other, the greater the success rate in the child adding new food. This success initiates behavioral momentum where the child associates trying new foods with positive outcomes and is more likely to try subsequent novel foods (Luiscelli, 2011). Continue advancing feeding therapy long-term goals until there is acceptance of a minimum of five foods across five food groups (e.g., fruits, vegetables, dairy, starch, and protein). It is

important to make adaptations and modifications to each behavioral feeding treatment plan in order to efficiently target the client's specific needs.

DISCUSSION

Feeding problems occur in children with both normal development and developmental delays. Of these children, the feeding disorders develop and are diagnosed as organic, nonorganic, or mixed. The previously identified studies represent an experimentally sound body of literature demonstrating significant improvements in mealtime behaviors among pediatrics. Williams et al. (2007) found behavioral feeding interventions to be effective and cost efficient for treatment of severe feeding problems. The literature reviewed showed progression and improvement of therapy techniques over time. In particular, studies illustrate a progression of behavioral feeding treatment components that show efficacy of increasing acceptance, decreasing food selectivity, food refusal and escape extinction, and fading food texture among populations of children with organic, nonorganic, and mixed deficits (Luiselli et al., 1985; Luiselli, & Gleason, 1987; Luiselli, 1989; and Luiselli, 2011).

Although Luiselli's studies show potential efficacy for effective behavioral feeding treatment, there are limitations worth noting. There may be limited generalizability due to small sample size. Second, the use of subjective criteria across treatment components makes systematic replication of the procedures very difficult. However, a more current study conducted by Shore et al. (2008) demonstrated the efficacy of texture fading with periodic probes at higher textures, combined with reinforcement and extinction procedures, in establishing higher texture food consumption by children who show food selectivity.

Shore et al. (2008) found that by using positive reinforcement after acceptance and swallowing, and escape extinction of food refusal and expulsion, that all participants successfully

advanced to consumption of age-appropriate texture and volume. Whereas, Piazza et al. (2003) indicated that negative reinforcement (e.g., escape from feedings demands) often maintains inappropriate mealtime behaviors. In addition, Piazza et al. (2003) & Kerwin et al. (2010) compared the relative contribution of different treatment elements and have demonstrated the importance of escape extinction in eliminating disruptive behaviors that preclude food acceptance. However, Blissett & Harrist (2002) found that the use of extinction-based procedures for milder degrees of feeding difficulty to be contradicted. Therefore, further studies should focus on understanding the role of escape extinction in the treatment of feeding problems. For example, under what conditions is escape extinction effective in treatment, and do differential reinforcement procedures contribute to treatment effectives?

In summary, the literature provides further support for the use of behavioral intervention in the treatment of feedings disorders, but there are limitations. The goal of a feeding intervention is to achieve the closest approximation of age-appropriate mealtime behaviors, including both proximate behavior change and more distal nutritional and medical goals (Sharp et al., 2010). With this in mind, it is suggested that future studies include documentation of behavioral (e.g., acceptance), medical (e.g., weight, restrictions), physical (e.g., motor mechanism), social (e.g., caregiver stress and satisfaction), and generalization data. Generalization, the transfer of skills to a new environment, must be a systematic component of any feeding intervention. There was a lack of literature reporting generalization outcomes of treatment.

Studies reported the use of behavioral intervention for children with feeding problems with no physical or developmental causal factor to be effective. However, a majority of the literature reported focused specifically on the treatment of behavioral feeding problems with

children with autism spectrum disorder. While this information is helpful to speech-language pathologists and other feeding specialists, it is very limited in respect to how these intervention components benefit other populations. This variability could be due to the high correlation between autism and behavioral feeding problems, and the large amount of children being diagnosed with autism.

Further research should be done targeting behavioral feeding intervention with children with no physical or developmental causal factors. As indicated by the literature on feeding problems taken as a whole, there is a continuum of studies focusing on the most severe of cases. The problems addressed were on the high end, as indicated by the children receiving treatment after hospital admission. Functional analysis would be useful on the lower end of the continuum (i.e., picky eating). In conclusion, the current literature suggests behavioral intervention remains the only treatment for pediatric feeding disorders with well-documented support.

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