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Feeding Disorders and Behavior: What Have We Learned?

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Feeding a child can be one of the most satisfying interactions a caregiver can have with a child. Unfortunately, feeding problems are fairly common among children with developmental disabilities [Gouge and Ekvall, 1975; Palmer and Horn, 1978]. In some cases, feeding becomes a source of frustration, rather than satisfaction, for both the caregiver and the child. Caregivers often express feelings of inadequacy when they are unable to nourish their child appropriately. In addition, caregivers of children with complex developmental and medical disorders are frequently faced with difficult decisions when prioritizing the child's medical and developmental needs [Guerriere et al., 2003]. Feeding must sometimes take a back seat to more pressing, life-threatening issues.

WHAT IS A FEEDING DISORDER AND WHAT CAUSES IT?

Feeding disorders are a heterogeneous set of problems that may include inadequate caloric and nutritional intake, growth failure, skill deficits, oral motor deficits, and/or behavioral problems. Recent studies have suggested that feeding disorders may be characterized by medical, oral-motor, and/or behavioral problems [Burklow et al., 2002; Rommel et al., 2003]. In fact, the results of studies by Rommel et al. [2003] and Burklow et al. [2002] suggested that most feeding problems have combined causes (e.g., medical-behavioral). The most commonly identified medical problem is gastroesophageal reflux disease (GERD), but a number of other medical diagnoses probably play a role in the etiology of feeding problems. Sixty-four and seventy-four percent of the children in the Field et al. [2003] and Burklow et al. [2002] studies, respectively, were diagnosed with a developmental disability, indicating a high prevalence of developmental disabilities among children referred for assessment and treatment of feeding problems. Commonly identified topographies of feeding problems described by Field et al. [2003] include *food refusal* (refusal to eat all or most foods, such that the child fails to meet his or her caloric or nutritional needs), *selectivity by type* (eating a narrow range of food that is nutritionally inappropriate), *selectivity by texture* (refusal to eat food textures that are developmentally appropriate), *oral motor problems* (problems with chewing, tongue movement, lip closure or other oral motor areas as determined by a speech and/or occupational therapist), and *dysphagia* (problems with swallowing, documented by a history of aspiration pneumonia and/or barium swallow study).

The high prevalence of medical disorders in children with feeding problems, particularly those that affect the gastrointestinal tract, suggest that biological factors may play an important role in the etiology of feeding disorders. The child who experiences pain, nausea, or fatigue during or following eating may learn to associate eating with unpleasant consequences. The child then may develop refusal behavior (e.g., batting at the spoon, head turning) to avoid eating and its associated aversive consequences. Refusal to eat may result in inadequate opportunities to practice the skills associated with eating (e.g., lateralizing the tongue, chewing, swallowing). In this case, the child may fail to develop the skills, strength, and stamina necessary to be a competent eater. A vicious circle thus develops in which the child associates eating with pain, and then exhibits refusal behavior that interferes with eating. The child's refusal to eat results in inadequate practice and experience as an oral feeder, which reduces the probability that the child can or will eat in the future.

Medical problems may have additional indirect effects on the child's motivation to eat. Children with chronic medical problems often are subjected to invasive diagnostic tests and procedures that may involve manipulation of the face and mouth (e.g., with a laryngoscope). The child may learn to associate the presentation of objects to the face and mouth (e.g., a spoon) with the pain or discomfort caused by invasive

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medical tests or procedures. Parents of chronically hospitalized and medically fragile children often report that their child exhibits avoidance behaviors during activities associated with the face and mouth (e.g., tooth brushing, face washing).

HOW IS A FEEDING DISORDER DIAGNOSED?

The heterogeneous nature of feedings problems has contributed to the difficulties in developing a diagnostic nosology that comprehensively represents all aspects of the disorder and its etiology. *Organic failure to thrive* (OFTT) and *nonorganic failure to thrive* (NOFTT) have been used to characterize feeding problems. The dichotomy between organic and nonorganic refers to feeding problems associated with delays or disturbances in growth that have (organic) or do not have (nonorganic) a medical explanation. The process used to distinguish OFTT from NOFTT is to conduct medical tests to rule out organic explanations, followed by feeding the child with a negative medical workup either by mouth or nasogastric tube (typically during an inpatient hospitalization). A diagnosis of NOFTT would be made if the child gained weight during the hospitalization, with the assumption that psychosocial deprivation (e.g., the parent wasn't feeding the child adequately) was the source of the growth failure [Skuse, 1985].

The limitations of the dichotomy between OFTT and NOFTT are numerous. First, the diagnosis of OFTT or NOFTT does not result in prescription of a method of feeding the child orally that will produce weight gain. Children with OFTT and NOFTT often continue to exhibit refusal behavior during oral feedings even after medical problems have been treated (OFTT) or when enteral feedings produce weight gain (NOFTT). Second, weight gain during an inpatient hospitalization may rule out physiological causes of growth failure (e.g., the child does not have a metabolic disease that negatively affects weight gain), but that demonstration does not identify the variables that contributed to the child's poor weight gain outside of the hospital. And in fact, studies have not shown a consistent association between psychosocial factors (e.g., provision of inadequate calories, dysfunctional family) and nonorganic FTT [Pollitt et al., 1975; Singer et al., 1990; Polan et al., 1991; Ramsay et al., 1993]. Third, not all children with feeding problems have growth failure. The organic/nonorganic dichotomy does not capture the wide variety of problems that characterize a feeding disorder. A child with severe food selectivity (e.g., child eats only junk food) may gain weigh adequately with consumption of enough of a particular food(s), but the child still would be at risk for nutritional deficiency.

More formal classification systems such as the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (*DSM-IV-TR*) [APA, 1994] and the *International Classification of Diseases, 9th Revision* (*ICD-9*) are also limited in their ability to capture the heterogeneity of childhood feeding problems. The diagnosis of Feeding Disorder of Infancy and Childhood (307.59) described in *DSM-IV-TR* specifies that the child must exhibit a growth failure and excludes children (1) with a medical condition severe enough to account for the feeding disturbance, (2) with another mental disorder that may account for the feeding problem, or (3) whose feeding problems result from a lack of available food. The majority of feeding problems are associated with a concomitant medical condition(s) [Burklow et al., 2002; Rommel et al., 2003]. Some children with significant feeding problems do not have growth failure (e.g., a child fed through a gastrostomy tube gains weight adequately, but consumes nothing by mouth). By contrast, the *ICD-9* diagnosis (feeding difficulties and mismanagement; 783.3) excludes children who do not have a medical cause of their feeding problem.

Current classification systems used to diagnose feeding disorders are inadequate in that they do not provide criteria that reflect the heterogeneity of feeding problems, do not account for the complex etiology of feeding problems, lack sufficient specificity in terms of operationally defining the criteria for the diagnosis, and are not prescriptive.

Neither the *DSM* and *ICD* nor the organic/nonorganic classification systems address treatment. Another significant problem is that criteria used to apply a diagnosis are not operationally defined. Much is left to clinical judgment, and some clinicians lack necessary training (e.g., what is "inadequate weight gain," what constitutes a "medical condition severe enough to account for the feeding disorder"?). Current classification systems used to diagnose feeding disorders are inadequate in that they do not provide criteria that reflect the heterogeneity of feeding problems, do not account for the complex etiology of feeding problems, lack sufficient specificity in terms of operationally defining the criteria for the diagnosis, and are not prescriptive.

WHEN IS FEEDING A PROBLEM?

One method of evaluating severity of feeding problems is to compare a child's feeding behavior with typical developmental feeding patterns. Most babies will consume breast milk or formula readily after birth. In fact, the sucking response should strengthen over time (i.e., in the course of a few weeks) as the infant learns to coordinate the suck- swallow-breathe response. Introduction of baby foods usually occurs at about 4 to 6 months. Tongue thrusting is common at this time and may result in the infant expelling the bolus from his or her mouth; replacing the expelled bolus back into the infant's mouth should provide sufficient practice to eliminate the tongue thrusting over time. The transition to mashed table foods occurs around 12 months with the ability to manage small bites of regular textured food improving as teeth erupt. It is quite common for children to demonstrate transient difficulties during feeding.

By contrast, problematic feeders may show poor coordination of the suck-swallow-breathe response which does not improve over time. Of more concern is the child that consistently rejects breast or bottle feedings, particularly if refusal is accompanied by no or slow weight gain. Problematic feeders may reject breast or bottle feedings while awake, but may feed more readily while sleepy. Some children may feed well on the breast or bottle but demon-

strate difficulty transitioning to solid foods (baby, mashed, or table food). The ability to transition from one type of food to another (e.g., baby food to mashed food) is probably important in strengthening the child's oral motor skills in preparation for chewing [Troughton and Hill, 2001].

Food selectivity (strong preferences for a few foods, rejection of many foods, called "food jags") are common beginning at about 18 months. Food preferences may be unpredictable from day to day or week to week. Total caloric intake also may vary dramatically from meal to meal. However, most children will meet their needs for calories and nutrition over longer intervals of time and grow appropriately.

By contrast, selectivity becomes a problem when the child's diet is limited to nutritionally deficient foods (e.g., foods high in fat). In addition, selectivity is problematic when the child's food preferences are accompanied by dramatic, emotional responses to nonpreferred foods (e.g., long-lasting tantrums, self-injurious behavior) [Wilder et al., 2001]. Other problems of selectivity may include consumption of only a certain texture of food (e.g., smooth, creamy foods) or only liquids with refusal of most solid foods.

Weight gain is one of the most objective and easily quantified measures of a feeding problem. Children should gain weight consistently and not lose weight. Consistent weight loss over a 3-month period, a decrease in expected rate of growth based on the child's previously defined growth curve, or crossing more than two major weight percentiles downward are indicative of a problem that should be treated. Other indicators of a recalcitrant feeding problem are dehydration and malnutrition, particularly if they require emergency treatment; the presence of a nasogastric (NG-) or gastrostomy (G-) tube with no increase in the percentage of calories obtained via oral feeding for three consecutive months; chronic lengthy meals consistently lasting more than 30 minutes [Reau et al., 1996; Stark et al., 1997; Powers et al., 2001; Powers et al., 2003]; unusual or inappropriate mealtime conditions (e.g., will only eat food off of the floor); high levels of inappropriate behavior (e.g., tantrums) during meals; feeding habits that differ significantly from that of the family or negatively affect social life (e.g., the child can't go to a birthday party); feeding that is not age appropriate; over-dependence on a single or limited source(s) of nutrition; and high levels of parental or family stress during meals.

Even though children may show a preference for playing over eating, hunger cues eventually will override preferences for other activities and the typical child will eat. By contrast, children with feeding problems appear minimally or unaffected by hunger cues, and parents of problematic feeders report that their child can "go days without eating." There may be a physiological basis for this apparent insensitivity to hunger and satiety cues: Kasese-Hara and colleagues showed that children diagnosed with FTT did not alter their energy intake in response to their energy intake in a previous meal [Kasese-Hara et al., 2002].

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The authors suggested that these results supported the hypothesis that children with FTT lack the normal responses to hunger and satiety cues that would allow them to effectively regulate their energy intake.

Assessment of Feeding Problems

As indicated earlier, most feeding disorders have multiple interacting causes. A thorough, comprehensive interdisciplinary work-up should precede any aggressive attempts to treat the feeding problem and assess whether oral feedings are safe. Aggressive oral feeding in the context of an ongoing medical problem or oral-motor dysfunction may exacerbate the feeding problem. For example, if the child has untreated GERD and eating continues to be paired with pain, it is unlikely that therapeutic attempts to increase intake will be successful, and may well worsen the child's refusal behavior Some children may not be candidates for oral feeding and attempts to feed orally may have serious or life-threatening consequences (e.g., aspiration). Therapeutic interventions can begin only after the causes of the feeding problem have been evaluated.

One therapeutic option for children with developmental disabilities and growth failure is to provide nutrition enterally (e.g., G-tube). Parents report that the decision to place a gastrostomy or jejunostomy (J-) tube is difficult and stressful [Guerriere et al., 2003]. Nevertheless, most studies indicate enteral nutrition is a safe and effective means of facilitating weight gain in children with developmental disabilities [Strauss et al., 1997; Kutiyanawala et al., 1998; Sullivan et al., 2005]. Placement of G-, GJ-, or J-tubes is not without complications, however, and is associated with a high cost relative to oral feeding [Kutiyanawala et al., 1998; Heyman et al., 2004; Sleigh et al., 2004]. Some children have difficulty transitioning to oral feedings once a tube is placed [Blackman et al., 1985; Bazyk, 1990].

The decision to increase oral intake in a child with a feeding problem requires accurate assessments to determine treatment prescription. Munk and Repp [Munk and Repp, 1994] conducted behavioral assessments to identify characteristics of the limited intake of five individuals with developmental disabilities by presenting 10 to 12 foods with one or more textures to each child. Textures included *junior* (blended into a puree), *ground* (blended to a semisolid consistency like ground beef), *chopped fine* (0.25-inch pieces), and *regular* (0.5-inch pieces or larger). Even though all participants presented with limited intake, the specific feedings patterns that contributed to the problem varied: One participant exhibited selectivity by type of food, another by texture of food, and two participants exhibited selectivity by type and texture. One participant exhibited total food refusal. The authors suggested that assessing characteristics of feeding behaviors be used to prescribe treatment stategies for individual participants.

Children with chronic feeding problems may not respond to strategies that are commonly recommended for children with milder or more transient

feeding problems. Many parents face the decision as to whether or not to end a meal if the child refuses to eat. Most professionals argue that a child will eat if hungry, so parents should allow the child to end the meal if he or she does not want to eat. But is this an appropriate strategy for children with feeding problems? Piazza and colleagues [Piazza et al., 2003] assessed the effects of a variety of consequences on the inappropriate mealtime behavior of 15 children diagnosed with a feeding disorder (nine were also diagnosed with developmental disability). In Study 1, a "naturalistic" observation of caregivers feeding their child as they would at home, caregivers used a variety of consequences following their child's inappropriate behavior, including (a) allowing the child to take breaks from or end the meal, (b) providing attention or coaxing, and/or (c) giving the child a tangible item such as a toy or preferred food.

In Study 2, the authors then tested the effects of these consequences on child inappropriate behavior during four analogue conditions. A therapist presented the child with bites of food once every 30 seconds across all conditions. During the *control* condition, the child had access to preferred toys and adult attention, and inappropriate behavior resulted in no differential consequence. During the *escape* condition, inappropriate behavior resulted in escape from the presentation of food for 30 seconds. During the *attention* condition, inappropriate behavior resulted in 30 seconds of attention and the spoon remained at midline for the entire 30 second interval. During the *tangible* condition, the therapist presented the child with a preferred toy or food following inappropriate behavior and the spoon remained at midline for the entire 30 second interval. Of the 15 children, nine had differentiated functional analyses: The inappropriate behavior of 90% of those nine children was higher when inappropriate behavior resulted in escape or breaks from bites of food (i.e., the child engaged in inappropriate behavior to "get out of" eating). The inappropriate behavior of 80% of the children with differentiated functional analyses was higher when inappropriate behavior resulted in adult attention or tangible items (i.e., the child engaged in inappropriate behavior to get attention or to get a preferred toy or food). These results suggest the importance of environmental variables in the maintenance of feeding problems [Piazza et al., 2003].

More recently, we have conducted functional analyses of inappropriate mealtime behavior using a pairwise design [Iwata et al., 1994]. We compare each test condition (escape, attention, tangible) to the control condition. We randomly select the order in which to conduct the comparisons of test and control conditions (e.g., escape versus control, attention versus control). Sessions of test and control are conducted in a counterbalanced order and continued until the data are stable: either a clear function is demonstrated (e.g., rates of inappropriate behavior are higher in the escape relative to the control condition), or rates of behavior are equivalent in test and control conditions [Hagopian et al., 1997]. Data from more than 30 cases of functional analyses conducted in this manner suggest that 98% of the cases showed a function for inappropriate mealtime behavior.

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TREATMENT TO INCREASE ORAL INTAKE

An important first step in the successful treatment of children with feeding problems is to set goals for treatment in measurable terms that are individualized for each child. An example of measurable goals might be to "increase oral intake of solids and liquids to 65% of the child's nutritional needs" for a child who is 100% G-tube dependent when treatment begins.

Another goal might be to increase acceptance of bites of food to greater than 90%. This might be an appropriate goal for a child who refuses bites of food. Children with food refusal have a different history or experience with food than typical children, and their feeding problems often persist and worsen over time [Lindberg et al., 1996]. Techniques or recommendations that work in typical children, such as the consequences parents used in the Piazza et al. study to get their children to eat actually worsened their child's inappropriate mealtime behavior in almost 70% of cases [Piazza et al., 2003]. This suggests the need for some limit setting when treating children with feeding problems. I give parents this analogy, "You wouldn't allow your child to run into the street if a car was coming, no matter what. So why do we allow the child to refuse to eat?" Both behaviors are life-threatening. Why do we prevent one, but not the other? Although parents are told repeatedly not to force feed their child, setting limits at meal times is not the same as force feeding.

A number of investigators have proposed the hypothesis that negative reinforcement in the form of escape from eating plays an important role in the maintenance of feeding problems [Hoch et al., 1994; Cooper et al., 1995; Ahearn et al., 1996]. This hypothesis is supported by the above data and results of treatment studies that showed that procedures based on extinction of negative reinforcement (so-called *escape extinction*) is effective as treatment [Hoch et al., 1994; Cooper et al., 1995; Ahearn et al., 1996]. The idea behind "escape extinction" procedures is that children with feeding disorders engage in inappropriate mealtime behavior such as batting at the spoon and head turning to avoid eating [Piazza et al., 2003]. The child is more likely to continue these inappropriate mealtime behaviors when the result is removal of the food ("the food goes away if I bat at it or I turn my head"). Escape extinction involves teaching the child that inappropriate mealtime behavior no longer makes the food go away.

One limitation of early studies on extinction of negative reinforcement is that escape extinction was combined with other procedures (e.g., differential reinforcement [Hoch et al., 1994]), and the individual effects of the procedures on acceptance and inappropriate behavior were unknown. Piazza and colleagues have examined the effects of positive reinforcement and escape extinction alone and in combination on acceptance and inappropriate behavior [Piazza et al., 2003; Reed et al., 2004]. Neither differential positive reinforcement nor noncontingent reinforcement alone produced increases in acceptance or decreases in inappropriate behavior as long as inappropriate behavior continued to produce escape from eating. Acceptance increased and inappropriate

behavior decreased when escape extinction was implemented, independent of the presence or absence of differential [Piazza et al., 2003] or noncontingent [Reed et al., 2004] reinforcement. However, inappropriate behavior and/or negative vocalizations were lower for some participants when treatment consisted of escape extinction and differential positive or noncontingent reinforcement compared to escape extinction alone. The results of Piazza et al. [2003] and Reed et al. [2004] suggested that escape extinction may be a critical component of treatment for some individuals, but that the addition of a positive reinforcement component (i.e., either differential or noncontingent) may be beneficial for some individuals.

The two procedures that have been evaluated most frequently as escape extinction for feeding problems are nonremoval of the spoon (NRS) [Hoch et al., 1994] and physical guidance (PG) [Ahearn et al., 1996]. During NRS, the feeder presents the spoon or cup to the child's lips and the cup remains at the lips until the child allows the feeder to deposit the bite into the child's mouth. During PG, the feeder applies gentle pressure to the mandibular joint and deposits the solid or liquid into the child's mouth if the child fails to accept the bite within a prespecified time period. Both of the procedures eliminate the child's opportunity to escape from bite presentations via inappropriate mealtime behavior, and produce relatively rapid increases in acceptance and decreases in inappropriate behavior. In addition, Ahearn et al. showed that both NRS and PG were associated with relatively few side effects and rated as acceptable as treatment by caregivers [Ahearn et al., 1996].

Even though a number of investigators have shown that escape extinction is effective as treatment for food refusal, some children may not respond to escape extinction alone. A number of studies have evaluated the effectiveness of treatment packages that combine escape extinction with other procedures. Kern and Marder and Piazza and colleagues showed that simultaneous presentation of prefererred and nonpreferred foods (e.g., placing a piece of nonpreferred broccoli on a preferred potato chip) was more effective than sequential presentation (e.g., giving the child a preferred potato chip following consumption of a nonpreferred piece of broccoli) [Kern and Marder, 1996; Piazza et al., 2002].

Patel et al. [2001] and Mueller et al. [2004] extended this work by demonstrating that blending (mixing) preferred and nonpreferred foods [Mueller et al., 2004] or liquids [Patel et al., 2001] was an effective method of increasing consumption of nonpreferred solids or liquids when combined with escape extinction. The child in the Patel et al. study [2001] drank water, but no other beverages. The goal of treatment was to increase the child's consumption of a calorically dense beverage, milk with Carnation Instant Breakfast (CIB). Initially, the authors blended (mixed) a small amount of CIB into water and then gradually increased the amount of CIB in water. Once the child was consuming 8 oz of water and a full packet of CIB, the authors then gradually added milk to the water/CIB mixture and decreased the amount of water. The child's consumption of 8 oz of milk with a full packet of CIB increased to above 90% following the blending procedure. Similarly, Mueller et al. increased consumption of solid foods by blending nonpreferred and relatively preferred foods and then gradually decreasing the ratio of preferred to nonpreferred foods [Mueller et al., 2004].

Patel et al. [Patel et al., 2006] combined a high-p sequence with escape extinction to increase acceptance of solids and liquids for three children. A high-p sequence is a set of demands or activities with which the child demonstrates a high level of cooperation or compliance. By contrast, the low-p sequence for a child with a feeding problem typically would be a command to consume solids or liquids (e.g., "take a bite"). The high-p sequences used by Patel et al. were similar topographically to the low-p stimulus (i.e., the high-p sequence was presentation of an empty utensil for a child who refused food, liquid on a spoon for a child who refused liquid in a cup, water on a spoon for a child who refused food from a spoon). By contrast, a high-p sequence consisting of simple motor tasks (e.g., touch head) combined with escape extinction did not produce increases in acceptance relative to escape extinction alone for one child [Dawson et al., 2003]. The effectiveness of the high-p sequence in the treatment of feeding problems may be influenced by the similarity of the high-p and low-p responses.

Response effort (altering the difficulty or effort associated with eating) is another variable that has been shown to influence consumption of food [Kerwin et al., 1995]. Kerwin et al. [1995] altered the volume of food on a spoon in the presence and absence of escape extinction. Levels of acceptance increased with decreasing spoon volumes (i.e., higher levels of acceptance when the amount on the spoon was smaller). Manipulations of response effort may thus represent a viable option in treatment of feeding disorders.

Escape extinction procedures either alone or in combination with other procedures may produce increases in consumption (intake of solids and/or liquids) for some children by increasing acceptance and decreasing inappropriate behavior. Other problematic mealtime behaviors, including expulsion (spitting out food) or packing (pocketing or holding accepted food in the mouth), may also interfere with food consumption. A re-presentation procedure [Coe et al., 1997; Sevin et al., 2002], consisting of placing the expelled food back into the child's mouth until the child swallowed the bite, was effective for reducing expulsion in studies by Coe et al. and Sevin et al. Patel et al. [Patel et al., 2002] showed that expulsion for one child occurred with meats but not with other types of food (i.e., fruits, vegetables, starches). Expulsion decreased with the authors reduced the texture of meats, but not other foods.

Packing is a behavior that may emerge simultaneous with the introduction of treatment for acceptance [Gulotta et al., 2005] or subsequent to treatment of other response topographies of problematic feeding behavior [Sevin et al., 2002]. Sevin et al. showed that a re-distribution procedure was effective for reducing levels of packing [Sevin et al., 2002]. The re-distribution procedure consisted of removing the packed food from the child's mouth with a nuk brush, then replacing the packed food back on the tongue with the nuk brush. This finding was replicated by Gulotta et al. who showed that levels of intake could be increased by reducing levels of packing [Gulotta et al., 2005].

Gulotta et al. hypothesized that packing may be an avoidance behavior that allows the child to escape eating by holding food in his or her mouth, or it may occur because the child lacks the prerequisite skills (e.g., tongue lateralization and elevation) necessary to swallow [Gulotta et al., 2005]. Delays or deviations in development may occur in a number of neurodevelopmental conditions (e.g., cerebral palsy (CP)). Therefore, treatment focused on oral motor skill development may play an

important role in the treatment of some types of feeding problems. Gulotta et al. suggested that the re-distribution procedure may facilitate swallowing since the procedure approximates one of the early behaviors in the chain that is necessary for swallowing (i.e., forming the food into a bolus and moving it back on the tongue). Lamm and Greer and Hoch et al. used a slightly different procedure to increase swallowing by placing food on the posterior of the child's tongue, which may have elicited the swallow response [Lamm et al., 1998; Hoch et al., 1995].

Oral motor delays may affect a wide variety of feeding related behavior. For example, some children experience difficulty as the texture of food increases [Troughton and Hill, 2001]. Shore et al. showed that texture fading was effective for increasing one child's acceptance of gradually increasing textures [Shore et al., 1998]. Shore et al. advanced the child's texture from pureed to chopped, while maintaining high levels of acceptance and swallowing and low levels of packing and expulsion. Data from the other three children in the study were less clear with respect to the necessity of the texture fading procedure. We have found that chewing skills often do not emerge as we increase the texture of foods in the absence of training chewing skills. Many children simply swallow the presented bites without chewing, which is not safe. The child should learn how to chew, and demonstrate the ability to masticate a variety of foods to a wet ground or lower texture and swallow those masticated bites in a timely manner before increasing the texture of food presented during meals.

Shore, Leblanc, and Simmons increased the rate of chewing for one individual with a differential reinforcement procedure [Shore et al., 1998]. The therapist delivered social praise and a sip of juice if the participant chewed a prespecified number of times. The authors set the number of chews required for reinforcement based on the mean number of chews in the previous two meals. Mean chews per bite increased steadily across treatment.

Self-feeding can be difficult for children with developmental disabilities. Self-feeding may be affected by a child's underlying motor disabilities (e.g., children with CP), by underlying motivational deficits, or both. Piazza, Anderson, and Fisher taught five girls with Rett syndrome to self-feed using a three-step prompting procedure [Piazza et al., 1993]. This consisted of sequential verbal, modeled, and physical prompts with verbal praise when the girl took the bite following the verbal or modeled prompt.

A key focus for successful outcomes for children with feeding problems is parent training. Several authors have evaluated the effectiveness of parent training procedures for children with feeding problems [Werle et al., 1993; Anderson and McMillan, 2001; Mueller et al., 2003]. Mueller et al. evaluated four different multicomponent training packages to teach parents to implement treatment protocols for children with pediatric feeding disorders. The four training packages consisted of (1) written and verbal instructions, modeling, and rehearsal, (2) written and verbal instructions and modeling, (3) written and verbal instructions and rehearsal, and (4) written and verbal instructions. All packages were effective in increasing parental integrity with the treatment protocol. The training procedure consisting of written and verbal instructions was the most time efficient. The authors suggested that effective training should consist of at least two training components to insure high treatment integrity.

treatments based on theories of operant conditioning appear to be effective for children with feeding problems.

As discussed earlier, treatments based on theories of operant conditioning appear to be effective for children with feeding problems. This is supported by several other studies evaluating the outcomes of behaviorally based treatments. Kerwin's analysis of the literature on the assessment and treatment of feeding problems [Kerwin, 1999] showed that the only treatments that have empirical support were those based on reinforcement of appropriate eating and extinction of refusal [Kerwin, 1999]. Benoit et al. [2000] compared behavioral treatment with nutritional education for children with food refusal who were G-tube dependent. They showed that 47% of the children in the behavioral treatment group had been weaned from their G-tubes after 15 weeks of treatment compared with none in the nutritional education group.

Other reports on behaviorally based treatments of groups of children with feeding disorders have shown positive effects. Byars et al. [2003] showed that a behaviorally based, intensive interdisciplinary feeding program was successful in increasing intake and decreasing G-tube feedings in nine patients. Irwin et al. [2003] showed that children with CP and feeding problems improved in the number of bites accepted, weight, and height following intensive interdisciplinary treatment combining behavioral strategies and oral motor techniques.

One of the biggest challenges that parents and professionals face is not the treatment of feeding problems per se, but the reluctance of third party payors to reimburse professionals for treating children with feeding problems. The following two cases (the names have been changed) illustrate the clinical costs to the patients and the financial costs to the third party payor that result from these refusal to authorize treatment.

Kim was a three-year-old boy whose medical history was notable for projectile vomiting, FTT, and severe food refusal. He was at risk for placement of a G-tube because of the severity of his FTT and food refusal. His insurance company denied authorization for treatment to increase Kim's oral intake, but subsequently paid for G-tube placement and the associated costs of maintaining Kim on the G-tube. Kim has not received treatment for his feeding disorder, and remains 100% G-tube dependent over a year later. The insurance company continues to pay the costs of his care with respect to G-tube feedings, which are estimated to be about $35,000 per year if Kim has uncomplicated care.

Ann was a five-year-old girl whose medical history was significant for liver transplant and treatment with total parenteral nutrition (TPN). She was at risk for reintroduction of her TPN because of food and liquid refusal and weight loss. Her insurance company denied the authorization to treat Kim to increase her oral intake to 100% of her nutritional and hydration needs to avoid re-introduction of TPN. Approximately one week later, Ann was admitted to the hospital for central line placement, and TPN was initiated. In addition to medical costs, TPN alone costs approximately $200/day. Mainte-

nance on TPN is associated with significant morbidity (e.g., central line sepsis) and mortality, raising the costs for care for TPN-dependent children to thousands of dollars per month. TPN may also cause progressive liver disease, which may necessitate another transplant for Ann in the future. This approach to her feeding problem results in substantially higher costs and lower quality of life for the patient.

CONCLUSIONS

Pediatric feeding disorders are common among children with developmental disabilities. Feeding disorders may be characterized by inadequate caloric and nutritional intake, growth failure, skill deficits, oral motor deficits, and/or behavioral problems. The causes of feeding disorders are complex and multifactorial. Appropriate assessment of feeding disorders should include a comprehensive, interdisciplinary evaluation to identify medical, oral-motor, and behavioral causes of feeding problems. Direct observation data collection procedures quantify the nature and extent of the feeding problem. Enteral feedings may be appropriate for some children at risk for growth failure, but may be associated with higher costs than oral feeding and may decrease the probability that the child will feed orally in the future. Treatments with the most empirical support are based on applied behavior analysis. Obtaining reimbursement for treatment services remains a significant challenge for parents and professionals. ■

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