Failure to transition from tube to oral feeding with food refusal in children who exhibit medical and developmental readiness for oral feeding is a complex problem. The mandates of the Individuals With Disabilities Education Improvement Act of 2004 prompt consideration of the educational relevance of this issue in school-age children as well as the adequacy of resources and potential effectiveness of the school setting for their treatment. Typically, intervention for food refusal in tube-fed children has occurred in medically based settings on either an inpatient or outpatient basis (Byars et al., 2003; Kerwin, Ahearn, Eicher, & Burd, 1995). There is one reported school-based study in which a peer mediation procedure was used to increase the eating behavior of a 2½-year-old in a school for children with developmental disabilities (Greer, Dorow, Williams, McCorkle, & Asnes, 1991).

Difficulty transitioning from tube to oral feeding with food refusal is best understood within a biopsychosocial context in which physiological, behavioral, and social factors have interacted to result in a pattern of refusal (Arvedson, 1997; Kerwin, 1999; Singer, 1990). Predisposing biological factors for such severe feeding problems include developmental disabilities, gastrointestinal problems, cardiopulmonary problems, neurological issues, renal disease, and anatomical issues (Field, Garland, & Williams, 2003). Gastroesophageal reflux and gastrointestinal motility issues

ABSTRACT: **Purpose:** A school-based treatment program for tube-fed children with medically complex conditions and food refusal was implemented to facilitate the children’s transition to oral feeding and advance their eating skills. **Method:** The program combined educational and therapeutic goals. It was implemented in a regional public school for children with hearing impairments. A team approach was used. Collaboration with the student’s families, medical care providers, personal assistants, and classroom staff was maintained. **Results:** Detailed case reviews are provided for 2 of the children who completed the program at age 8;1 (years;months) and 7;8 after 29 and 26 months of treatment, respectively. At the end of the program, tube feeding was discontinued; the children were feeding themselves and taking medications orally. One child was using mature eating skills to eat an unrestricted diet; the other was eating a modified diet consisting of a full nutrient drink and limited smooth and lightly textured solids. **Conclusion:** Successful transition to oral feeding and advancement of developmental eating skills were accomplished in a school setting for long-term tube-fed children with medically complex conditions. The program included collaboration with family and medical personnel as well as integrated therapeutic and educational goals. **KEY WORDS:** dysphagia, tube feeding, eating skills, school-based program
indications that would compromise the child would be evaluated carefully to ensure that there were no con-

terpretative problems. Behavioral concerns and anatomical abnormalities, neurological conditions, cardiorespira-
tory problems, and metabolic dysfunction (Burklow, Phelps, Schultz, McConnell, & Rudolph, 1998). Behavioral concerns are typically defined with specific reference to the food refusal and include behaviors such as tantrums, turning the head away from the source of food, or batting food away.

The child–caregiver relationship plays a significant role in feeding and in feeding disorders. When caregiver behaviors are not tuned to the child’s needs, they can serve as both etiological and maintaining factors for feeding problems (Arvedson, 1997; Bazyk, 1990; Davies et al., 2006; Kedesky & Budd, 1998; Manikam & Pernan, 2000; Parrish, 1997; Satter, 1990).

Although the biopsychosocial model for the management of feeding disorders is the principal model described in the literature on the management of food refusal (Arvedson, 1997; Kerwin, 1999), controlled studies have focused predominantly on one component of the model—operant and respondent conditioning to increase food acceptance (see Kerwin, 1999, for a review). In this literature, food refusal is viewed as resulting from insufficient positively reinforcing experiences during feeding, in which case positive reinforcement for consumption should be effective in increasing food acceptance. An alternative and complementary hypothesis is that food refusal is maintained by negative reinforcement of food avoidance, whereby refusal results in the termination of the feeding activity. In this case, an escape extinction paradigm should be effective for facilitating acceptance and training needed competencies and skills (Hoch et al., 2001). Flowing from this framework are studies that use a variety of designs to evaluate the efficacy of reinforcement paradigms.

Kerwin (1999) clustered these studies into four main groups: (a) differential attention for which positive attention is offered for an appropriate feeding behavior, (b) physical guidance of the appropriate feeding response, (c) extinction defined as the removal of the reinforcement of a response, and (d) swallowing induction through the elicitation of a swallow with either a finger or a feeding implement. Increases in food acceptance have occurred in studies using each of these paradigms. However, Kerwin cautioned that other than differential attention, the interventions are intrusive and their use needs to be implemented carefully only after other approaches have failed.

Schauster and Dwyer (1996) described an approach to prevent problems when weaning from tube to oral feeding that incorporates the components of the biopsychosocial model. This program includes (a) promoting a positive feeding relationship between the caregiver and child; (b) determining the child’s feeding readiness; (c) normalizing feeding skills with strategies that include oral stimulation, eating-related behaviors, and establishing hunger-satiety cycles; (d) regulating the eating environment; and (e) initiating a behavioral feeding plan.

The complex interactions in the biopsychosocial model indicate that a team approach for intervention for food refusal would be most effective. The team would address primary medical concerns and resolve them insofar as possible. The integrity of the child’s oral motor system and his or her capacity to ingest liquid and food safely would be evaluated carefully to ensure that there were no contraindications that would compromise the child’s respiratory or nutritional status. Parent–child interaction and parental and family functioning would be assessed. Treatment plans would be designed to include all aspects of care.

The treatment approach described in this article was designed initially for school-age children who had established strong patterns of resistance to oral feeding and was tailored for implementation in a public school setting. It took into account the multiple factors inherent in the team model for intervention. Transitioning from tube to oral feeding was one component of overall educational programming for the involved students. The approach was selected with objectives in mind that addressed both general education needs and specific feeding needs.

- Establish instructional control so that the children are able to be educated in a public school setting (Danielson, 2002; Stronge, 2002).
- Establish and expand skills for the development of receptive and expressive language and communication.
- Establish independent oral feeding of a full nutrient food to the extent that is consistent with the children’s oral motor competence, thereby establishing oral feeding and eliminating tube feeding in the school setting.
- Advance the children’s oral motor eating skills and underlying sensory motor competencies for feeding to allow them to manage a full variety of foods insofar as their anatomical and physiological impairments will permit.
- Generalize independent oral feeding to home and community environments.

The program is grounded in educational practice, with its initial emphasis on establishing instructional control, defined as a cooperative working relationship with a guiding adult in a nonfeeding realm, before addressing the feeding issue (Danielson, 2002; Stronge, 2002). It takes into account environmental, psychological, and physiological factors as suggested by Schauster and Dwyer (1996) but adapts them for implementation in a school environment.

Our hypothesis was that it was possible to guide the transition from tube feeding to independent oral feeding within a school setting and that the process and outcomes would be educationally relevant for the child. The network of supports and strategies to accomplish this are discussed, as are the difficulties in meeting these outcomes in a school setting. Detailed description of the program and results are presented in case studies for 2 of the children who completed the program.

**METHOD**

**Participants**

The participants, referred to by the initials EJ and FT, were age 5.9 (years;months) and 5.6, respectively. Both had been enrolled previously in hospital-based oral feeding programs. As part of these programs, both had medical clearance for oral feeding and for participation in swallowing and feeding therapy. Their families were motivated to continue these efforts and advocated for their individualized educational programs (IEPs) to include swallowing and feeding goals and objectives. Both children received all of their nutrition through tube feeding at program initiation.

Both participants had medically complex histories and conditions associated with their dysphagia. EJ had a diagnosis associated with

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Both were most willing to accept small amounts of water. had chronic respiratory conditions and a history of tracheostomy. Both EJ and FT experienced onset of dysphagia at 6 weeks of age as the result of a diabetic coma. She recovered from the coma and was maintained for our program, she had no neuromuscular diagnosis. Both EJ and FT were independent in the activity. Materials were kept out of the child’s reach until they were presented by the adult. This provided appropriate alignment for communication and supported the expectation that the child would be facing the child. This provided appropriate alignment for communication and supported the expectation that the child would be independent in the activity. Materials were kept out of the child’s reach until they were presented by the adult.

### Setting

The program was implemented in a public school district within a regional receiving school that served children with hearing impairments. The students and their families were from culturally and socioeconomically diverse backgrounds, and staff participated in ongoing inservice education to sensitize and familiarize themselves with these issues. School staff was experienced in the use of a team approach for educational planning and implementation for each of its students.

Initial training for the 2 participants was conducted in a quiet room in a 1:1 setting. The room included a chair and table of appropriate size and height so that the child’s feet rested firmly on the floor and her forearms rested on the table. Seating guidelines and equipment recommendations were provided by the child’s occupational therapist. Typically, the guiding adult sat opposite and facing the child. This provided appropriate alignment for communication and supported the expectation that the child would be independent in the activity. Materials were kept out of the child’s reach until they were presented by the adult.

### Personnel

The feeding program was implemented by a school-based team consisting of a speech-language pathologist (SLP), classroom teachers and aides, occupational and physical therapists, the school nurse, the school social worker, the children’s caregivers, and the program administrator. The full-time school-based clinicians provided all related service treatment sessions. The team was supported by the consultative services of a medical speech-language pathologist (CSLP) with extensive expertise in pediatric dysphagia and a clinical psychologist (CCP) with experience in a hospital-based program for medically fragile children and children with feeding disorders. The consultants provided inservice education to team members and onsite consultations on at least a monthly basis. They also attended the IEP meetings. During the monthly visits, the consultants reviewed the documentation of the treatment program to date. This documentation included data regarding the frequency of treatment, notes on participant responses and achievement of treatment objectives, and videotapes of the treatment sessions.

The CSLP conducted the clinical dysphagia evaluations and re-evaluations of the participants and documented this information in written reports. The CSLP conducted onsite consultations monthly or more frequently as needed with the participant, parent, and staff. These consultations were used to re-evaluate participant status, monitor progress, and update, or otherwise modify, treatment objectives and strategies. Using the evaluation findings, the CSLP, in collaboration with the school-based dysphagia team and the parents, selected treatment goals, objectives, and strategies that were congruent with the child’s physiological readiness at that time. In addition, the CSLP was available for staff support by e-mail and phone between consultation sessions.

Each child was accompanied to school by a personal assistant who was provided for in the child’s IEP. Both families were involved in the program to varying degrees, attending consultant visits, maintaining contact with their child’s teachers and clinicians, collaborating on selecting treatment objectives, and carrying over activities to home and community environments.

### Medical Collaboration

Before initiating the school-based dysphagia program, a prescription for therapy was obtained from the children’s primary care physicians. The request for the clearance specified the type of bolus and maximum amount of intake that would be encouraged in the treatment session. The prescriptions were updated as treatment progressed. In addition, the parents solicited physician approval and guidance to modify tube-feeding routines for establishing typical meal and snack time hunger and satiation cycles and physiological tolerances for oral meals.

As intervention progressed, prescriptive recommendations for modified barium swallow studies (MBSSs) were solicited for both of the participants as soon as it was apparent that they were able to cooperate sufficiently to accept a bolus that could be viewed by videofluoroscopy. EJ’s physician agreed that an MBS was warranted, and the study was conducted with the school-based SLP accompanying the child and parent and participating in the test procedure. FT’s physician did not agree that an MBS was warranted. The basis for this conclusion was that FT had had an MBS before her previous oral feeding program that demonstrated competent swallowing for liquid and puree. There had been no change in FT’s medical condition as a result of that feeding program, and no change in her medical condition had occurred since that time that would warrant the MBS. As per the physician’s recommendation and the agreement of the parent, FT’s program continued without benefit of a current MBS. However, as the program advanced, the school-based SLP maintained daily contact with FT’s nurse and parent to ensure her continued tolerance for the interventions. In addition, a designated member of the dysphagia team maintained contact with the health care providers and clinicians who were providing medical or therapeutic care in the community. Ongoing collaborations resulted in timely modifications of the program in response to the participants’ changing medical conditions and behaviors.

### Parental Collaboration

Parental approval for participation was confirmed during the IEP meeting before the program was initiated and was incorporated in each participant’s IEP. The goals and objectives in the IEP were reflective of the steps of the intervention program. In both cases, parents were asked to discontinue any home training program for increasing eating as the school program was initiated in order to eliminate aversive experiences that might be maintaining the patterns of refusal. The children were not to be encouraged to eat orally or to be fed, but if they ate spontaneously within the parameters that had been established by their medical providers, it was allowed.
Parents were encouraged to observe treatment sessions from the outset but participated in the program with their children only during the generalization phase for transitioning to oral feeding to home and community and for ongoing skill development following the transition. Parents met with the CCP and/or team social worker at least monthly. The CCP assisted the parents in managing behaviors that were interfering with the children’s progress in academic and related services and in managing the parents’ own feelings and stressors. The CCP, CSLP, and school staff engaged with and supported the parents when determinations for additional medical consultations were being considered.

Clinical Dysphagia Evaluation

The dysphagia evaluation, which was conducted by the CSLP, included a complete review of each child’s medical and family history as they related to the swallowing and feeding issues; a physical evaluation of each child’s oral and oral–pharyngeal anatomy; a review of each child’s oral motor function and breath control in vocal and swallowing behaviors; and a look at each child’s oral postural control, saliva control, and behavioral and oral motor response to the introduction of small, test boluses of liquid and or/puree. Re-evaluations consisted of updating the history with regard to medical, home, and classroom issues and observing functional swallowing tasks including saliva swallows and ingestion of the food boluses that were being used at that point in the therapeutic program. The clinical signs for adequacy of the oral preparation skills, promptness of initiation of swallowing, and pharyngeal clearance were observed, as were behaviors during eating tasks and activities.

Baseline Intervention for the Children

Physiological tolerance for oral feeding was established at home and school by maintaining daytime tube feeding delivered by bolus on a mealtime schedule. Both children were tolerant of these procedures. When necessary for nutrition, extra feeding boluses, which were smaller than the meal boluses, were delivered at snack times. Parents were encouraged to deliver the bolus feeding over approximately 20 min for the meal and 10 min for the snack in order to simulate oral feeding intake rate as was done at school. At school, the nurse joined the children’s other caregivers at lunch to implement a lunchtime environment that included social–eating tasks and activities.

Dysphagia Therapy

Dysphagia therapy for both participants was incorporated into the speech-language therapy program. That is, the time scheduled for speech-language therapy was allocated in part for work on swallowing and feeding goals and objectives. Speech-language therapy sessions were scheduled for 30 min four times a week. However, the SLP could increase the duration of the session as needed to complete an activity that was in progress. In practice, the length of time allocated for swallowing and feeding activities during the therapy session varied from 5 to 45 min. Swallowing and feeding activities were terminated when the session objectives were accomplished. If the objectives were not met and time for practice increased during the regular classroom eating activities.

PROCEDURE

The Training Program

The training program consisted of five activity levels that were structured to achieve compliant attention and participation during training; to develop the general attitudes and skills needed to participate in challenging learning tasks; to advance the underlying tolerances and competencies for oral feeding; to develop the eating skills needed to transition from tube to oral feeding and to advance skills once the transition was achieved; and to implement the transition to school, community, and home environments (see Figure 1). An essential part of the program was an “information system” that provided clear cues to the child about the number of trials that were required for successful task completion in a training activity. The system consisted of pegs and a modified pegboard. A one-trial pegboard had one peg and one hole, a three-trial pegboard had three pegs and three holes, and so forth. A peg was removed when the child accurately met expectations for the trial. The information system served as an additional discriminative stimulus and visual reinforcer for compliance with the demands of the task.

Step I. Establishing instructional control. The initial activities were designed to establish a working relationship with the children that resulted in consistent compliance with adult requests. The first requirement was the establishment of approximately 1 min of quiet sitting at the table opposite the SLP. Once the child consistently entered the room and sat quietly for 1 min, training moved into the visual and motor realms, including matching objects, pictures, block patterns, and imitations of body movements. The activities used were from “Links to the Language of Learning” (Blank, McKirdy, & Payne, 1994). The specific tasks selected were determined by the child’s sensory, motor, and developmental abilities. The child’s baseline skill for these matching activities was assessed. Tasks at baseline level (the child’s comfort level) were then presented as the requirement for meeting each session’s goal. The number of trials was limited initially and increased as the child’s level of cooperation increased.

At program initiation, successful completion of one to two tasks was sufficient to terminate a session. As the level of cooperation increased, the number of trials increased and on-task working time expanded from 5 to 20 min. A successful trial was rewarded by positive facial expression and removal of a peg paired with positive verbal reinforcement. At this step, session termination after completion of trials was also positively reinforcing. Effusive praise, such as clapping and cheering, was not used for reinforcement because positive contingencies were selected to be typical of those used in the child’s classroom. Work at Step I continued until the child was able to work cooperatively by completing baseline level tasks for 15 min for three consecutive training sessions.

Step II. Maintaining control in challenging tasks. The second phase of the program involved having the children meet cognitively
more complex demands for matching and memory in the non-feeding realm. The children were challenged by tasks that were slightly above their current mastery level. Between 15%–20% of the tasks during a therapy session were at the challenge level; the remaining tasks were at the child’s comfort level to allow for multiple opportunities for positive reinforcement. Successful trials were marked by removal of a peg, the SLP’s positive facial expression, and verbal reinforcement. Once consistency was achieved, work on eating readiness was begun. Consistency was defined as completing three challenge-level tasks correctly on the first attempt for three consecutive training sessions.

**Step III. Initiating eating readiness.** Eating readiness activities were introduced by the same SLP in the same setting and format as the matching and memory tasks, with continued use of the information system, facial expression, and verbal praise for positive reinforcement. The eating readiness tasks involved the child’s active participation in tolerating placement of or placing (a) nonfood “utensils” (e.g., toothbrush, Nuk stimulator) in the mouth and expelling them on cue, (b) eating utensils (e.g., cup, spoon) in the mouth, (c) food at the nose for smelling or at the lips, and (d) finger food in the mouth (e.g., licorice twist, lollipop) and expelling it on cue. The child’s skills for handling spoons and cups, for placing food in the mouth, and for expelling a bolus were developed in these activities. Activities that required the child to swallow an introduced bolus did not begin until the readiness tasks were mastered. Mastery was defined as the child’s imitation of the adult’s model of the task within 2 s while sitting appropriately without gagging, grimacing, or complaining. These activities were intermixed with ongoing presentations of tasks in the visual and motor realms, as well as speech, language, and/or literacy goals from the IEP.

**Step IV. Establishing eating skills.** Typically, feeding activities began using water. One teaspoon of water was set out in a small...
cup, accompanied by a one-trial pegboard. The SLP said, “Drink the water” and modeled the response. Completion of the task by the child resulted in removal of the peg, positive facial expression, and verbal praise. The quantity of liquid in a cup and the number of cups (i.e., task repetition required for completion of the activity) presented were increased systematically. During therapy sessions, feeding tasks were intermixed with a continuation of matching, memory, motor imitations, and speech and language tasks. Training targets for feeding were selected to address the child’s specific physiological impairments and level of disability. The initial goal was to increase the quantity of intake for a small variety of foods, one of which was a full nutrient food (e.g., Ensure), in order to reduce and finally eliminate the tube feeding.

Task difficulty was advanced in a stepwise pattern as the SLP determined that the child’s competency would support the advance, but there was variability so that the consequence of completing a difficult task was not necessarily the introduction of a more difficult task. Mastery was rewarded with positive attention, removal of pegs, and either termination of the session or presentation of a less difficult feeding or nonfeeding task. Progress in mastery of swallowing for a commercial full nutrient drink or pudding and a developmentally based sequence of liquid and or solid food consistencies and textures was tracked systematically. Once the transition to oral feeding was achieved in school, treatment objectives were introduced to train skills for eating a variety of food tastes, textures, and viscosities.

**Step IVa. Generalization of eating skills to the classroom.** In this step, skills were “generalized” to other adult feeding mediators and other eating environments. That is, the behaviors trained during Step IV activities were introduced with other guiding adults regulating the activity and with the activity performed in other than the therapy environment. This transfer was gradual and systematic. The classroom aide was the first new feeding mediator. The aide observed the feeding therapy in the therapy room for two sessions, learning the strategies used by the SLP. For the third session, the aide was seated in the SLP’s chair with the SLP observing. The aide followed the procedures used by the SLP, designating the number of trials to completion with the information system, and so on. In order to ensure success, the quantity to be consumed and the number of trials to completion was reduced with the new mediator and, over time, was increased back to the child’s comfort level established in Step IV. After two successful sessions in the therapy room, the aide and the child moved the feeding session to the classroom at the child’s snack time. The SLP observed in the classroom, intervening as needed to maintain the child’s compliance with the routine that had been established in therapy; gradually, over several days, the SLP faded her presence.

**Step IVb. Generalization of eating skills to the home and community.** After the child consistently complied with the school mediators, parents and other caregivers were included in the training sessions using the generalization procedures described above. The parent initially observed the child eating in school (usually in the therapy room with the SLP) and then exchanged places with the SLP. Once the child was consistently eating with a parent/caregiver serving as the mediator in the therapy room, transition to the home was begun. There was a planning conference with the family regarding where in the home the child would be fed, who would be present, and when feeding would occur. The goal was to eliminate factors that previously had led to avoidance and failure, and to eliminate previous negative associations.

**Common Training Program Elements**

Treatment objectives and strategies incorporated into each step of the intervention program differed for the 2 participants based on their individual needs. Within that variability, there were several program elements that were constants and were considered important to the program’s effectiveness.

- **The information system.** This system of using pegs provided a concrete visual cue of the number of trials required for task completion as well as feedback on the adequacy of the child’s performance in each trial. It was found to be effective as a discriminative stimulus for maintaining the child’s task persistence and effort for achieving acceptable quality performance. To maintain the effectiveness of the system, objectives were selected carefully so as to be within the then current physiological and developmental capabilities of the child.

- **Baselines.** As each new skill was approached, a baseline, or comfort level, was determined at which the child demonstrated a level of competence or ability to engage. The clinician worked with the child at this level to reinforce and make the skill habitual and to bring the behavior under adult guidance.

- **Functional tasks.** The swallowing activities used in this program were functional feeding tasks. The rationale was that tasks that were considered simulations of aspects of eating could not adequately reflect the complexity of an actual feeding/eating task and would, therefore, be less effective in advancing underlying competencies for swallowing and the eating skills themselves (Piek, 2006; Sheppard, 2008). Based on each child’s individual physiological capabilities, tasks were graded for difficulty by varying their difficulty for swallowing and the duration of the activity. For example, the swallowing task might involve a saliva bolus enhanced by the flavor of a drink powder sucked from a toothette; a modified viscosity liquid; or a complex textured, chewable food. The duration of the activity was determined by the number of task repetitions that were required. Self-“feeding” was integrated into these tasks so that the oral–pharyngeal and manual aspects were developed in synchrony.

- **Foods used in treatment.** Two general strategies were consistent across children. These strategies were found to provide the most direct and efficient means for achieving full oral intake in the classroom.

  - Food introduction began with boluses that were judged to be most acceptable to the child.
  - A full nutrient drink or pudding was introduced early in Step IV of the program. The quantity of this full nutrient food that was tolerated in a single sitting was increased in treatment before treatment objectives for increasing the variety of foods was implemented.

- **Stepwise transitions.** The difficulty of the task was increased only after the prior level met criteria and was seen to be stable at that criteria for three consecutive treatment sessions.
The five-step program. Both of the children moved through the five steps at the rate that accommodated their individual needs and capabilities. Step V was initiated soon after the beginning of Step IV training, with generalization of the emerging skills to the child’s personal aide and, subsequently, as tolerated, in the classroom with peers. In spite of the added distractions in the classroom, the presence of peers was a strong motivator for eating. At the same time as generalization outside of the therapy room occurred, generalization to the home—proceeded simultaneously. The aim was to provide as many daily practice repetitions of bolus swallowing as was tolerable for the child. In general, the sequence of Step V goals was first to discontinue tube feeding in school, then in community environments on class trips, and finally at home.

CASE HISTORIES

Two children who completed the dysphagia program, EJ and FT, are presented here to illustrate how the program was implemented. They completed the transition to oral feeding in school and at home in 29 and 26 months at age 8;1 and 7;8, respectively.

Table 1. Case histories for EJ and FT.

<table>
<thead>
<tr>
<th>History</th>
<th>EJ</th>
<th>FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Female</td>
</tr>
<tr>
<td>Age (year;months) at initiation and completion of the program</td>
<td>5;9 to 8;1</td>
<td>5;6 to 7;8</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Gastroesophageal reflex disease, right thoracic scoliosis, hyperopia, posterior indentation of the esophagus (probable aortic compression), subglottic stenosis, laryngomalacia, right cleft lip and palate, right oral/facial paralysis, depression, multiple medications</td>
<td>Diabetic ketoacidosis coma at 6 weeks</td>
</tr>
<tr>
<td>Relevant medical factors</td>
<td>CHARGE</td>
<td>Diabetes mellitus, tracheal stenosis, subaortic stenosis, right diaphragmatic paralysis (one lung functioning), fed by nasogastric tube from 6 weeks old; amblyopia; history of prolonged hospitalization and ventilator dependency</td>
</tr>
<tr>
<td>Surgeries</td>
<td>Tracheostomy (18 mos) and decannulation before initiation of program (5 yrs); cleft lip and palate repair; multiple bilateral pressure- equalization tubes; partial tonsillectomy and adenoidectomy; scoliosis stabilization, nasal repair, percutaneous endoscopic gastrostomy</td>
<td>Tracheostomy (6 weeks) and decannulation (6;6) tolerated speaking valve on admission</td>
</tr>
<tr>
<td>Dysphagia at initiation of treatment: Saliva management</td>
<td>No drooling; congested breath sounds on accumulation of saliva</td>
<td>No drooling or signs of pharyngeal pooling of saliva</td>
</tr>
<tr>
<td>Dysphagia at initiation of treatment: liquid and solid food</td>
<td>Abnormal oral preparation; poorly developed or absent skills for reception of bolus from cup and spoon, containment and oral transport; clinical signs of deficiency for oral initiation, pharyngeal and esophageal phases; capability limited to 1–3 ml low-viscosity bolus</td>
<td>Abnormal oral preparation; poorly developed or absent skills for reception of bolus from cup and spoon, containment and oral transport; clinical signs of deficiency for oral initiation of swallow; capability limited to 1–3 ml low-viscosity bolus</td>
</tr>
<tr>
<td>Ambulatory</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hearing level and communication</td>
<td>Severe bilateral sensorineural hearing loss; total communication with emerging oral communication skills</td>
<td>Profound bilateral sensorineural hearing loss; manual communication with limited voicing for emotional expression</td>
</tr>
</tbody>
</table>

Participant EJ

EJ entered the dysphagia program at age 5;9. Her gastrostomy tube (GT) had been placed when she was 3 weeks old because of difficulty sucking and swallowing. (See Table 1 for additional case information.) EJ had been given medical clearance for dysphagia therapy with the goal of transitioning to oral feeding at 7 months of age and had therapy continuously since then in outpatient and inpatient dysphagia programs. At the time that EJ entered our school program, she accepted being spoon fed 1 to 3 oz of puree daily at home reluctantly and slowly. She accepted sips of liquids from a cup and licks of a few crisp finger foods. Her tracheostoma had been decannulated 9 months before she began the school program. Although decannulation had resulted in increased ease of health care, EJ’s parents reported that EJ continued to be resistant to oral feeding. Tube feeding was by bolus three times daily. Oral feeding was offered at snack times. EJ attended school with her nurse.

On entry into the program, EJ’s parents agreed to discontinue oral feeding at home reluctantly because they were concerned that EJ might lose skills that were important for advancing her oral feeding. However, EJ progressed quickly through the first three program steps, completing them in 7 weeks. Although EJ’s generalized behavioral difficulties continued in the classroom, her relatively rapid progress in the therapy setting was attributed to her extensive prior experience in various structured therapeutic learning situations as compared to her limited classroom experiences.

EJ’s Step IV baseline for bolus acceptance at school was complete refusal. The first selected objective was self-feeding 5mL...
(1 tsp) of water from a small cup. EJ accomplished this after several trials during her first Step IV treatment session. The quantity of water in the cup increased to 1 oz, and EJ’s ability to swallow it without dribbling improved over the next 12 weeks. At that time, the liquid was changed to a full nutrient commercial product, selected as per dietician recommendation. To accommodate EJ’s need to develop tolerance for the change in taste and viscosity, the amount offered was reduced to 0.5 oz. During the next 14 weeks, as EJ’s ability to swallow improved, the quantity of liquid increased to 8 oz in the treatment session.

Generalization of compliance in practice exercises to EJ’s personal assistant and to the classroom began at this time. To accommodate EJ’s need to develop the ability to eat in the complex classroom environment, the amount offered was reduced to 4 oz. Within 16 weeks, EJ consistently consumed 4 oz in the designated 20 min. The quantity was increased during the next week to a total of 8 oz and was stabilized at that amount over the next 3 weeks. The full nutrient drink was provided at snacks and lunch during the schoolday. With the guidance of a dietician, tube feeding at school was discontinued gradually as it was determined that EJ was meeting her nutritional needs.

Once EJ’s tolerance for intake of 4 oz was achieved in the classroom, the school requested and EJ’s physician approved and prescribed an MBS with esophageal follow-through. The school-based SLP accompanied the family to the study and participated as needed for compliance to the procedures. The study confirmed that all phases of swallowing were adequate for the introduction of thicker boluses into the diet, and objectives for ingestion of applesauce, pudding, and applesauce mixed with crushed cracker were introduced in therapy.

With onset of the generalization phase, the amount of time allocated to swallowing and feeding exercises during speech therapy was reduced to 10% to 20% of the session, and practice was implemented daily in the classroom during snack and lunchtimes. Objectives for improving EJ’s drinking efficiency had been introduced sequentially with the transition to the full nutrient liquid. Strategies for accomplishing the objectives were introduced and made habitual in therapy and were incorporated into the daily practice sessions in the classroom. The objectives for underlying competency and functional outcomes were improving lip seal on a cup to eliminate dribbling during drinking, improving lip seal on a spoon for more effective removal of food, and improving the ability to transport the bolus from the lips to the back of the mouth to eliminate head movement as a compensation for transporting the bolus and to enhance control of the bolus for initiation of swallowing. These objectives were accomplished in exercises for drinking the liquid with a straw and taking food from a spoon while keeping the chin down. In addition, systematic exercises were initiated for developing the ability to swallow larger boluses with less time between boluses, thus increasing the rate of intake and reducing the variability in rate for drinking the 8-oz “meal.” These objectives were accomplished over 52 weeks, including 12 weeks of absence during school vacation times.

Transition to home feeding was initiated as tube feeding at school was discontinued. EJ’s mother participated successfully as the primary mediator in the therapy room. Initially, home trials were unsuccessful. However, successful transition was facilitated during two home visits by the SLP. EJ’s parents continued the program for generalization of oral feeding at home with the ongoing support of school staff. Within 2 years of program initiation, EJ was an independent eater: She consumed all liquids and medications orally; she consumed 4 oz of a limited variety of soft, moist, nonchewable solids including applesauce, pudding, and mashed banana with crumbled graham crackers; and she requested favorite foods. All of her nutritional needs were met through self-feeding by mouth. Her food repertoire was limited and preferences continued to be soft, moist, smooth, or mashed food and crisp, soft, finger-fed, chewable food such as graham crackers. She was able to join her family for meals at home and in restaurants, an activity that she was reported to particularly enjoy. The school program continued for 4 more months with objectives to stabilize existing skills and advance eating efficiency for increasing food variety and for chewing. The program ended when EJ was 8;2, at which time the family requested that school therapy focus on expanding EJ’s receptive and expressive language. They sought private therapy after school hours to further advance EJ’s chewing and swallowing skills.

**Participant FT**

FT entered the dysphagia program at age 5;6. She had been fed by nasogastric tube (NGT) since she was 6 weeks old. NGT feeding was initiated because of FT’s inability to be nourished by oral feeding following a diabetic coma. The NGT was maintained as a preference to percutaneous endoscopic gastrostomy (PEG) in the expectation that FT’s transition to oral feeding was imminent. FT had a tracheostomy and tolerated a Passy Muir valve. Decannulation was anticipated in the near future and did occur before the end of the school dysphagia program. (See Table 1 for additional case information.) FT had received medical clearance for dysphagia therapy at 7 months of age, with the goal of transitioning to oral feeding. She was partially nourished by oral feeding during a hospitalization from age 7 months to 20 months. At the time that FT entered our school program, she was accepting intermittently being fed water from a bottle with nipple, spoons of soup, and nibbles of selected crisp finger food. Nourishment and hydration were gravity fed during the day, with 16-oz feeding delivered by NGT over 45 min. FT’s behaviors tended to be aggressive and disruptive. These behaviors, in combination with FT’s tendency to vomit in response to performance requests, had resulted in limited therapy and school experiences. Our program was initiated in close collaboration with FT’s hospital-based dietician and our school CCP and CSLP.

On entry into the program, FT’s parent appeared to be in agreement to eliminate any aversive oral feeding. However, at a later date, it was acknowledged that forced feeding of water by nipple and bottle had continued. FT remained at Step I of the program for 23 weeks before reaching the criteria of cooperative imitation and memory. The first four sessions in Step I were devoted to establishing sitting. FT’s vomiting had been determined by extensive medical evaluations to be under behavioral control (Fleisher, 1994). Therefore, a strategy that was developed in collaboration with the CCP was implemented during Step I to extinguish this behavior. The strategy consisted of interrupting the antecedent behavior—a slightly exaggerated inspiration—by placing a gloved finger on FT’s lips for several seconds without positive or negative comment. This was followed immediately by presentation of the training task. Vomiting as a response to requests was extinguished in 4 weeks. Once extinguished in therapy, it no longer occurred in other school settings.
Initial attempts to advance FT to Step II were unsuccessful and resulted in a resurgence of tantrums and other noncompliant behaviors. FT was withdrawn from school at this time for a family move and returned 5 months later at age 6;4. On readmission, her eating behaviors had not changed. FT resumed the program at Step II. Challenge-level programming continued for the next 18 weeks until she met the criteria for moving to Step III. At this time, FT’s tracheostoma was decannulated. FT progressed through Steps III through V in the next 27 weeks. She achieved Step III criteria within 1 week. The beginning of Step IV, self-feeding of 1 tsp of water in a cup, was achieved in one trial. The quantity of water was increased to 4 oz over the next 4 weeks. Transition to the full nutrient liquid and gradual increase to consumption of 8 oz in 20 min was achieved in all settings over the next 23 weeks. Skills for biting and chewing soft, firm, and complex solids were trained during the next 27 weeks of FT’s program. The continuing use of the information system to indicate the number of required trials was necessary to regulate FT’s task persistence and compliance. FT’s NGT feeding was discontinued when she was 7 years of age. The information system was faded gradually, and at age 7;8, FT was discharged from the dysphagia program because she was self-feeding an unrestricted diet in all settings with oral motor capabilities that were age appropriate for skill and within normal limits for eating efficiency.

See Table 2 for a summary of the treatment objectives and chronology.

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**DISCUSSION**

A program for transitioning from tube to oral feeding for children with long-term food refusal was implemented successfully in a school setting with 2 children and was an integral part of the children’s overall educational program. The program combined many components that have been described by Schauster and Dwyer (1996) as important for making a successful transition from tube to oral feeding, as well as the application of principles of learning theory. Whereas Schauster and Dwyer’s program was designed to prevent problems, the participants with whom we worked exhibited entrenched well-practiced patterns of refusal. Methodology to accomplish desired outcomes was planned accordingly.

The first component of Schauster and Dwyer’s (1996) protocol concerns establishing a positive feeding relationship. Within the school setting, our program began with an antecedent step—the establishment of a cooperative working relationship between a guiding adult and the child in the nonfeeding realm. The cooperative relationship was sustained when tasks increased in difficulty and required new learning. We posit that this relationship was necessary for all instruction, including feeding. The initial relationship between the SLP and the child was then systematically transitioned and generalized to others. Independence in feeding at home was the final step in this process of generalization after the child had experienced many successes at school.

Second, Schauster and Dwyer (1996) described feeding readiness, an area that was addressed through collaboration with parents, physicians, a CSLP, and a CCP. In our program, the collaboration was ongoing to ensure that the participants continued to be physiologically capable of engaging in the program. Third, this collaboration enabled the normalization of feeding skills, including establishing hunger/satiation patterns through modification of the established tube-feeding routines to mirror the quantity and timing of oral feeding. Fourth, the environment in which feeding activities occurred was carefully regulated. Initially, all feeding activities occurred in a quiet therapy room with optimal seating and minimal distractions. The transitions from this setting to the classroom, lunchroom, and home were systematically achieved. Finally, there was a behavioral feeding plan that provided careful management of new objectives. All changes (bolus type or texture, feeding mediator, environment) were accompanied by 50% reductions in bolus quantity to ensure success and were then systematically increased.

Our dysphagia program relied heavily on learning theory, particularly positive reinforcement, a technique that is used to increase oral consumption by others (see Kerwin, 1999, for a review; Luiselli, 2000), which was provided through a variety of modalities: positive facial expression, positive verbal reinforcement, reinforcement through the removal of pegs for successful trials, and session termination after the designated number of successful trials. Escape extinction was also an important component and sessions did not end until the designated number of trials was achieved.

Although principles of learning theory were inherent in our program, we hypothesize that changes in the children’s emotional realm were at work as well. We speculate that for these children, the failure to eat orally was a maladaptive coping strategy that developed as a result of unpleasant and/or traumatic (DiScipio, Kaslon, & Ruben, 1978), and/or unsatisfying and/or insufficient, oral feeding experiences (see Figure 2). By working in the non-feeding realm using carefully graded cognitive challenges, we hypothesize that we were able to evoke stressors that generated similar feelings of anxiety as were provoked by feeding, but anxiety that was not so overwhelming as to precipitate full-blown withdrawal and/or other fear responses. As the children met success in solving these challenges, anxiety diminished, and a sense of control in the face of stress began to grow. Similarly, the children learned that the adult in charge was calm and predictable. These factors may have combined to develop the children’s compliance, trust in the adult, and a sense of competence that carried over into feeding tasks. Once the cooperative relationship was established and the child worked in the face of challenge, we did not experience any difficulty adding eating as another task in which cooperation was expected. Subsequently, we were able to work on improving the physiological competency for swallowing and to advance developmental eating skills and independence.

The subskills in the program were also selected with the goal of building foundation skills for language and swallowing and to advance developmental eating skills and independence. Speech and language learning tasks were included and were intermixed with feeding tasks to maximize valuable therapy time. It is of interest that the 2 children who completed the program advanced in receptive and expressive language at a rate that was commensurate with their overall developmental status and degree of hearing loss.

Although treatment strategies and modalities have varied depending on student and clinician preferences, swallowing skills and self-feeding skills were advanced generally in the context of feeding.
<table>
<thead>
<tr>
<th>Program step/description</th>
<th>Program objectives</th>
<th>Program durations before ending tube feeding</th>
<th>Program durations after ending tube feeding (beginning at Step IV)</th>
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</table>
| **Step I. Establishing instructional control** | - Quiet sitting  
- Compliance in matching activities at the child’s comfort level  
- Understanding of the pegboard information system  
- Extinction of vomiting | | 23 weeks; resumed at Step 2 after 5-mos interruption in program |
| **Step II. Maintaining control in challenging tasks** | - Completion of challenging matching and memory tasks | 7 weeks | 18 weeks |
| **Step III. Initiating eating readiness** | - Daytime tube feeding on a meal/snack schedule  
- Transition to bolus tube feeding at a meal intake rate  
- Increased frequency of saliva swallowing  
- Skills for handling a spoon and cup  
- Placing eating utensils in the mouth | | 1 week |
| **Step IV. Establishing eating skills** | - Ability to swallow and cough voluntarily  
- Drinking small amounts (begin w/1 tsp) of liquid from a cup – advance amount  
- Containing liquid  
- Ability to sip from a straw  
- Ability to strip a spoon and fork  
- Eating small amounts (1–3ml) of semi-solids from a spoon; advance amount  
- Acceptance of full nutrient food (liquid or pudding depending on preference and swallowing ability)  
- Skills for gradually increasing bolus size, viscosity, and texture  
- Compensations for more adequate swallowing, i.e. effortful swallow, double (clean up) swallows, head–neck posture  
- Tolerance for cold and warm food  
- Skills for drinking with sequential sip-swallowing  
- Skills for chewing, advancing from crisp to soft to complex chewable food  
- Increasing quantity of intake  
- Regulate bolus size and rate of intake (faster or slower as needed)  
- Improve awareness of food tastes and preferences | 26 weeks | 4 weeks |
| **Step Va. Generalizing eating skills to the classroom** | - Performance of eating tasks with personal aide, teacher, and parent at school  
- Performance of eating tasks in school eating environments  
- Ability to take medications by mouth | 19 weeks | 18 weeks |
| **Step Vb. Generalizing eating skills to the home and community** | - Eliminate distractions during eating/maintain attentive attitude  
- Performance of eating tasks in home and community environments  
- Performance of eating tasks with a variety of community eating partners | 52 weeks | 23 weeks |
activities. Principles of motor learning were applied, including specificity of training whereby the practice tasks and the environment in which the practice occurs match the carryover target; implicit learning that results from feedback provided during the direct experience with the task to be achieved; and distributed practice so that the skills attained in the therapy room were practiced and reinforced during the school day for naturally occurring events including snack, lunch, and parties (Piek, 2006). See Sheppard (1995, this issue) for the protocol to advance swallowing and self-feeding skills.

We reported in detail on 2 children’s experiences because they represented the differential effects of behavior and physiology on progress in transitioning from tube to oral feeding. In Steps I through III of our treatment program, the child’s behavioral sets were changed to achieve the acceptance of eating tasks. In Steps IV and V, the eating tasks were selected and introduced in a sequence that was carefully considered to address each child’s individual physiological needs for sustaining oral feeding. The treatment program has been effective in advancing the eating behavior of 5 additional tube-fed children who are currently in various stages of the program. This program has been used for students who are nourished orally but are having difficulty achieving their potential for advancing their eating skills and developing satisfactory eating behaviors and full participation in their educational program.

**CONCLUSION**

In summary, we believe that this program demonstrates that the school environment can be an effective setting for the management of dysphagia in children with complex medical conditions including food refusal and failure to transition from tube to oral feeding. Furthermore, we demonstrated that the gains that are made in school can be generalized to home and community environments.

This program illustrates the educational relevance of a dysphagia program in that training for self-feeding, a foundation skill for independence, can be integrated with attaining other goals that support speech and language acquisition and development and enhance the ability of the child to benefit from his or her school program.

Implementing the program required the expertise and collaborative efforts of consulting personnel who supported school staff, and could not have been accomplished without this guidance. Therefore, to appropriately intervene in a school setting, there needs to be recognition of the need for and inclusion of resources from a variety
of disciplines and settings. There cannot be barriers between medical and educational providers. These barriers have been successfully surmounted in the management of children with cochlear implants, where there is collaboration between members of the medical teams providing the surgery and ongoing audiological management and the educational team providing the habilitative services.

Although we have been successful in transitioning students from tube to oral feeding in the school setting, and for the 2 children reported to the home, our experience indicates that transitioning these behaviors to home is particularly challenging. Further discussion and study are needed to clarify the boundaries for intervention that are appropriate for school personnel whose primary responsibility is the education of the child. In addition, we have found these children to be vulnerable to regressions in the feeding program that were associated with surgeries, exacerbation of their medical problems, and family stressors. These regressions were mitigated through intervention by the team. Future study of the factors that might support maintenance of full oral self-feeding once the school-based dysphagia program is terminated is suggested.

This is especially important for children for whom the tube is retained in anticipation of future medical procedures in which tube feeding may be preferred during recovery.

Designing and providing intervention for feeding disorders encourages school personnel to come to a comprehensive understanding of the child and enhances their ability to provide education in all areas as they analyze the variety of factors that influence the child’s capacity to learn new skills and behaviors.

Significant professional growth for school staff was an added benefit of implementing the program. Staff expressed professional pride and satisfaction in working through and overcoming the numerous challenges presented by the students, which ultimately resulted in their functioning independently and participating more fully in the school setting.

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