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ORIGINAL ARTICLE

# Intensive Behavioral Treatment for Severe Feeding Problems: A Cost-effective Alternative to Tube Feeding?

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**Abstract** Forty-six children with severe feeding problems received intensive behavioral therapy in a day treatment program. All of the children were dependent on supplemental tube feedings. The outcomes of the day treatment program were reported at discharge, 12, and 24 month follow-up. The program was found to be cost-effective when compared to the cost of long-term supplemental feeding.

**Keywords** Pediatric feeding disorders · Behavioral feeding therapy

Behavioral treatment has been recommended as an effective form of treatment for a variety of feeding problems (Rudolph 1994). For more severe feeding problems, behavioral treatment has often been delivered in inpatient settings (Babbitt *et al.* 1994; Blackman and Nelson 1987; Foy *et al.* 1997; Handen *et al.* 1986). While efficacy of these inpatient programs has been demonstrated, the method of service delivery is still being debated. The children described in these studies are largely described as having either total food refusal or food selectivity to the extent they are nutritionally compromised. Most of these children are also described as being dependent on supplemental feedings, having little or no experience with oral feeding, and having failed outpatient therapy.

Unfortunately, there are few data on cost effectiveness of the treatment of feeding problems, regardless of setting. One study reported the average cost of treatment for their sample, including evaluation, inpatient treatment, and outpatient follow-up, was $130,380 (Shore *et al.* 1999). These authors calculated the cost of maintaining a child on gastrostomy tube feedings through the age of majority would be over $800,000. While data from this project demonstrate inpatient treatment can be more

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cost effective than long-term tube feeding, this form of treatment is still costly, especially in light of rapidly rising hospitalization costs.

While there have been numerous studies that have demonstrated effectiveness of specific interventions targeting a range of childhood feeding programs, there has been little examination of the settings in which the interventions have been provided. To date, there have been no evaluations of feeding programs conducted in settings other than inpatient. Our current study describes a day treatment program that was developed as a more cost-effective alternative to inpatient treatment of severe feeding problems.

## Materials and Methods

### Program Overview

Developed as an alternative to inpatient treatment, the day treatment program provides intensive treatment in which the children spend the entire day at the program. It is a component of a multidisciplinary feeding program that provides a continuum of care for a wide range of childhood feeding problems. The day treatment program is a self-contained unit located at a tertiary-care medical center. It contains four treatment rooms with adjacent observation rooms, a food preparation area, a play area, a nap room, and staff offices. It is staffed by two feeding therapists with Master's degrees in Psychology or Applied Behavior Analysis and a doctoral-level licensed psychologist, with each therapist working with a single patient per day. The psychologist spends approximately one hour per day supervising each day treatment patient. A pediatric nutritionist consults for one hour per week and as needed. A pediatric gastroenterologist, a speech pathologist, and an occupational therapist are available for consultation as needed. Graduate-level behavior analysis interns participate by assisting the therapists to collect primary, reliability, and treatment integrity data. The caregiver training includes provision of a written plan and demonstration of the feeding procedures. Training is competency-based, with the program staff providing feedback and training to caregivers until competence in implementation of the feeding plan is demonstrated.

### Participants

Every child dependent on gastrostomy tube feedings enrolled in the day treatment program between November 1997 and December 2002 was included in this study. Participants included 46 children (23 male) who ranged in age from 16 to 133 months with a median age of 37 months. All had been evaluated by our multidisciplinary feeding clinic prior to enrollment and failed at least six months of typical outpatient therapy. While intensity of the outpatient therapy varied, in most cases the children were seen at least weekly by a community-based therapist.

### Interventions

Many of the children's treatment plans included similar interventions. All of the interventions have been used previously in empirical research. Interventions were

selected on the basis of a behavioral assessment, which included: a caregiver screening form designed to elicit information about antecedents and consequences, a caregiver interview with the behavioral psychologist, direct observation of the parent feeding the child a meal in the clinic, videotapes of home meals, and baseline sessions conducted by therapists. A brief description of each intervention is provided below. The references cited described the procedure we replicated in our interventions.

1. Contingency contacting—a procedure that combines positive reinforcement and escape prevention by holding a bite or drink to the child's mouth until it is accepted then immediately providing reinforcement (Hoch *et al.* 1994).
2. Re-presentation—an escape prevention procedure used to reduce or eliminate the expulsion of food by immediately re-presenting the expelled food (Coe *et al.* 1997).
3. Swallow induction—a procedure used to establish eating in children who do not swallow either solids or liquids. The treatment consists of an eliciting stimulus to facilitate swallowing. (Lamb and Greer 1988).
4. Thermal stimulation—a procedure in which cold is used as an eliciting stimulus to facilitate swallowing (Wolf and Glass 1992).
5. Exit criterion—a procedure in which the child is allowed to exit the feeding environment contingent on completing a specified food portion. In our procedure, this was paired with a "beat the clock" or positive reinforcement for completing the food portion within a predetermined time (Babbitt et al. 1992).
6. Texture fading—a fading procedure in which food textures are systematically increased (Shore *et al.* 1998).
7. Response cost for refusal—preferred activities were removed contingent on the occurrence of inappropriate feeding behaviors (Kahang *et al.* 2001).
8. Differencial reinforcement of other behavior (DRO) targeting vomiting—reinforcement was provided for the absence of vomiting (Dahlquist 1990).
9. Token economy—a token economy was used to improve feeding and mealtime behaviors (Sisson and Dixon 1986).
10. Graduated guidance for self feeding—graduated guidance is applied to self feeding (Stimbert *et al.* 1977).
11. Least to most prompts for self-feeding—this procedure consisted of using a least to most prompting procedure to teach self feeding (Piazza *et al.* 1993).

The children's ages, medical history, number of treatment days, number of treatment sessions and a listing of interventions used for each child are shown in Table 1.

## Measures

### *Treatment Effectiveness*

The goal of treatment was to increase oral intake to 100% of age-appropriate portions and eliminate the need for supplemental tube feedings. Either a pediatric gastroenterologist or a pediatric nutritionist determined the children's caloric needs. Effectiveness of treatment was categorized as either successful (complete elimination of all tube

**Table 1** Participant demographics

| | Age (months) | Medical diagnoses and significant history | Number of treatment days | Treatment components |
|---|---|---|---|---|
| 1 | 123 | Failure to Thrive (FTT), unknown growth disorder, autism, dysphagia | 20 | 1,2,3 |
| 2 | 20 | FTT, GER, food allergies | 18 | 1,2 |
| 3 | 18 | FTT, food allergies, | 42 | 1,2,4 |
| 4 | 63 | FTT, GER, cardio-velo-facial syndrome, developmental disabilities (DD) | 20 | 1,2,3,5 |
| 5 | 62 | GER, pulmonary disease, autism | 11 | 1,6 |
| 6 | 36 | GER, VATER association | 45 | 1.2 |
| 7 | 16 | GER, Treacher Collins Syndrome, dysphagia | 19 | 1,,6 |
| 8 | 35 | GER, dysphagia, esophageal dysmotility, microgastria, DD | 30 | 1,9 |
| 9 | 38 | FTT, GER, constipation, dysphagia, cerebral palsy, DD | 41 | 1,2,8 |
| 10 | 27 | FTT, GER | 29 | 1,2,6 |
| 11 | 27 | FTT, GER, delayed gastric emptying | 25 | 1,2,12 |
| 12 | 27 | FTT, GER, Down Syndrome, dysphagia, cardiac disease | 39 | 1,2 |
| 13 | 17 | FTT, GER, dysphagia, cardiac disease | 34 | 1,2,4 |
| 14 | 38 | FTT, DiGeorge Syndrome, dysphagia | 28 | 1,2 |
| 15 | 40 | GER, Hirshsprung's disease, DD | 25 | 1,2 |
| 16 | 18 | GER, autism, pulmonary disease, dysphagia | 25 | 1,2 |
| 17 | 61 | FTT, GER, autism, dysphagia | 40 | 1,2,3 |
| 18 | 39 | GER | 22 | 5 |
| 19 | 16 | FTT GER, food allergies, delayed gastric emptying | 28 | 1 |
| 20 | 30 | FTT, GER, DD, hypotonia, dysphagia, | 25 | 1,2,3,4 |
| 21 | 24 | FTT, GER | 21 | 1,2,8 |
| 22 | 70 | GER, CHARGE association, food allergies | 30 | 1,2,3 |
| 23 | 39 | GER, Down syndrome, cardiac disease | 31 | 1,5 |
| 24 | 35 | GER, motility disorder, food allergies, Allagile syndrome | 39 | 1,2 |
| 25 | 28 | GER, pulmonary disease, prematurity, DD | 29 | 1,2 |
| 26 | 46 | GER, carbohydrate-deficient glycoprotein disorder, DD | 18 | 1,2,12 |
| 27 | 25 | GER, DD | 26 | 1,2,3 |
| 28 | 72 | S/P chemotherapy for medullablastoma, autism | 30 | 1,2,3 |
| 29 | 24 | GER, food allergies, VATER association | 20 | 1,2,12 |
| 30 | 66 | GER, motility disorder, dysphagia, s/p trachostomy | 24 | 1,2,5 |
| 31 | 168 | GER, deaf, asthma, lung hypoplasia, motility disorder | 10 | 5,10 |
| 32 | 29 | GER, pulmonary disease | 24 | 1,2, |
| 33 | 26 | GER cardiac disease, constipation | 21 | 1,2,11 |
| 34 | 29 | GER | 10 | 5 |
| 35 | 42 | GER, Down syndrome | 20 | 1,2 |
| 36 | 71 | GER, prematurity | 26 | 1,2,3 |
| 37 | 24 | FTT, prematurity | 16 | 1,2 |
| 38 | 31 | GER, FTT, BPD, prematurity | 21 | 1,2 |
| 39 | 37 | GER, FTT FG syndrome | 23 | 1,2 |
| 40 | 36 | GER, FTT | 17 | 1 |
| 41 | 63 | GER, prematurity, CP, asthma | 20 | 1,2,10 |
| 42 | 44 | GER, Hydrocephaly, VP shunt, Seizures | 21 | 1,2,5 |
| 43 | 64 | Delayed gastric emptying, autism, >40 food allergies | 19 | 1,2,5 |
| 44 | 66 | GER, prematurity, CP | 18 | 1,2,5 |
| 45 | 41 | GER, cyclic vomiting | 14 | 1,2,5 |
| 46 | 126 | FTT, autism | 8 | 1,2,5 |

feedings), partially successful (dependence on tube feedings for 50% or less of caloric needs) or unsuccessful (dependence on tube feedings for more than 50% of caloric needs). Treatment effectiveness was evaluated by the program director at discharge from day treatment, 1 year after discharge, and 2 years after discharge.

### *Cost Effectiveness*

There were two goals in examining cost information. The first goal was to determine if there was a cost savings for day treatment when compared to inpatient treatment. This goal was met by examining the charges for day treatment and inpatient treatment. The second goal was determine if day treatment would be an effective alternative to supplemental tube feedings. To meet this goal, the day treatment charges were compared to the cost of supplemental tube feedings as reported by insurance companies.

## Results

### Treatment Effectiveness

Of the 46 children treated, 31 (67%) were successfully weaned from their feeding tube during the course of treatment. Another 14 (30%) were partially successful and their tube feedings were reduced by 50% or more by the end of treatment. One child was not successful and received more than 50% of her nutritional needs from tube feedings.

At 1 year follow-up, 29 (63%) of the participants remained weaned from their tube feedings. Thirteen children (28%) received 50% or less of their caloric needs from tube feedings. Four children (9%) received more than 50% of their caloric needs from tube feedings.

At 2 year follow-up, 34 (74%) of the participants were not receiving tube feedings. Eight children (17%) received 50% or less of their caloric needs from tube feedings and four children (9%) were still not successful and received 50% or more of their caloric needs from tube feedings. The outcomes at discharge and follow-up for each child displayed in Fig. 1.

### Cost Effectiveness

While actual cost of day treatment was dependent on the contractual agreement with the payor, the daily charge was $575 per day. A daily charge included all feeding therapy, caregiver training for other behavioral issues, nutritional consultation and all food and supplies required for feeding therapy. The total charges for the children enrolled in day treatment ranged from $6,325 (11 days) to $25,875 (45 days). The mean length of treatment was 24 days ($13,800). In comparison to day treatment, charges of our inpatient program for the same services were $1,175 per day. In the last 5 years, 12 children were treated as inpatients. Three of these children had commercial insurance and were treated prior to the development of our day treatment option. Nine children had Pennsylvania Medical Assistance and were treated prior to our wavier from the Department of Welfare to provide day treatment as an alternative to inpatient

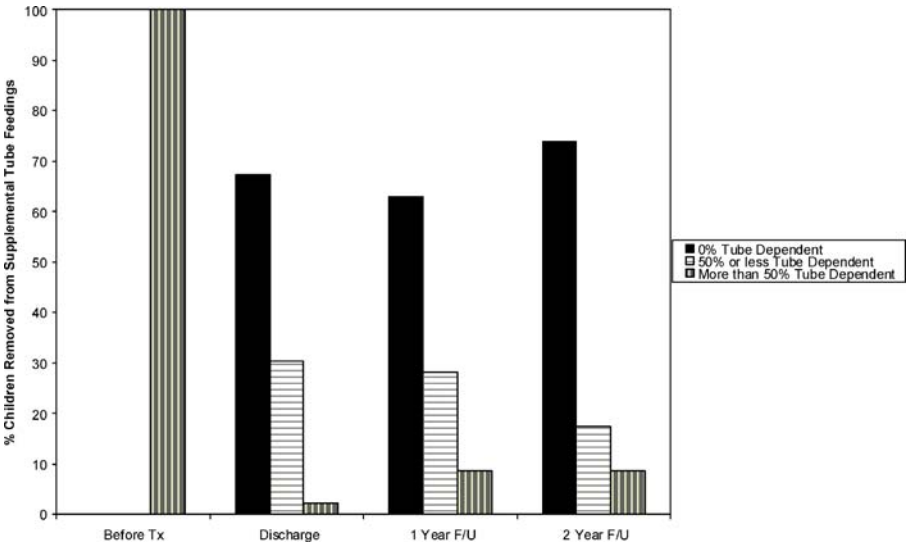


**Fig. 1** Treatment effectiveness measured by tube dependency

treatment. All 12 children were treated as inpatients not because of medical necessity, but because of the unavailability of day treatment. Charges for the inpatient admissions ranged from $17,625 (15 days) to $51,700 (44 days). Children receiving treatment as inpatients received treatment from the same staff, using the same behavioral interventions, and in the same setting as the day treatment patients.

Cost information for supplemental tube feedings was obtained directly from insurance companies' case managers for three of the children included in this study. Costs of tube feeding for these children are summarized below:

Case 1 The cost of the feeding pump, formula bags, tube supplies, and formula was $3,750 per month. The cost of home nursing was $94.50 per visit × 8 visits ($756) per month. The total cost of tube dependency was $4,506 per month or $54,072 per year.

Case 2 The cost of the feeding pump, formula bags, tube supplies, and formula was $1,485 per month. The annual cost was $17,820. This child also had a home health aide for 40 h/week. Although this cost was incurred by a state medical assistance wavier and not the insurance company, home nursing costs are often paid by the third party payor. At $11.00 per hour for the home health aide, this increases the monthly cost of maintaining the child on tube feedings by $1,760. The total cost of the tube feeding and home health aide was $3,245 per month or $38, 940 annually.

Case 3 The cost of the feeding pump, formula bags, tube supplies, and formula was $1,360 per month. The annual cost was $16,320. These case managers reported these costs as being fairly typical, although one also noted that costs are sometimes higher when children received elemental formulas. Based on costs provided by formula sales representatives, the cost of elemental formulas is approximately twice the cost of a typical milk-based pediatric formula.

In these three cases, costs of replacing gastrostomy tubes and other medical needs related to the tube feedings were not calculated. The frequency at which gastrostomy tubes need to be replaced probably ranges greatly, but it is nonetheless another expense that needs to be considered.

Four children in our study had nasogastrostomy tubes. In all cases, treatment was successful and precluded the placement of gastrostomy tubes. The surgical and hospital costs for the placement of a gastrostomy tube exceeds $6,000 with laproscopic surgery and can be significantly more with traditional open surgery. The cost of gastrostomy tube placement combined with even the lowest annual cost estimate for tube feeding exceeds the cost of all but one of the day treatment cases.

## Discussion

Previous studies have shown that intensive behavioral treatment of severe feeding problems is effective (Blackman and Nelson, 1987; Foy *et al.* 1997; Handen *et al.* 1986; Shore *et al.* 1999). The treatment effectiveness of our day treatment program was comparable to the results of the inpatient programs reported in the literature. At the end of their day treatment stays, 67% of children had eliminated their dependence on tube feedings. At 1-year follow-up, 63% of children met all of their nutritional needs with oral feedings. At 2-year follow-up, 74% of children were meeting all their nutritional needs from oral feeding.

While behavioral treatment was effective in eliminating tube feedings for most of the children in this sample, 15 (33%) children were unable to completely eliminate their need for tube feedings during treatment. These children were either not able to tolerate enough volume during oral feedings to meet their caloric needs or were unable to drink enough to meet their hydration needs. All but one of these children had on-going medical issues, such as GERD or motility problems that interfered with their oral feeding. Based upon our experience with the children in this sample, we have developed four guidelines to help determine which children will benefit from intensive behavioral treatment and when intensive behavioral treatment should be started. These guidelines are as follows:

1. *Gastroesophageal reflux must be adequately treated prior to initiating therapy.* While gastroesophageal reflux may still be present, if it is not controlled either medically or surgically, treatment may be more difficult, longer in duration, and less successful. Eight children continued to vomit during and after meals secondary to gastroesophageal reflux, which precluded increasing oral feedings to necessary volumes.
2. *The child must be able to tolerate sufficient volume*. Children who cannot tolerate a bolus feeding of 4–6 oz during a typical meal duration of 20–30 min without retching or vomiting may have problems tolerating a sufficient volume of oral intake. Seven children were not able to tolerate sufficient volumes of food or liquid at a single meal and while they were doing well with oral feeding, they required supplemental feedings overnight to meet their nutritional needs.
3. *The child must have sufficient oral motor skills.* Children with significant neurological deficits and/or developmental delays may not have the ability to

develop the oral motor skills required to maintain oral intake. While it is difficult to determine if a particular child has appropriate oral motor skills, we did find that all of the children who failed to make any progress had significant overall motor delays and none were ambulatory.

4. *Identify and resolve significant medical issues prior to treatment prior to treatment*. Children requiring surgery, hospitalization, or any intensive medical treatment, especially those requiring no oral intake for an extended period, should have these treatments prior to feeding therapy. One child who was weaned from his tube completely was returned to tube feedings after multiple cardiac surgeries. Another child who was successfully weaned from his gastrostomy tube during intensive treatment developed a seizure disorder several months after discharge, which resulted in multiple lengthy hospitalizations that interfered with oral feeding and necessitated reinstituting tube feedings.

We provided three examples of the cost of supplemental tube feedings. A single year of tube feedings for even the least expensive case ($16,329) exceeded the cost of day treatment for the majority of the children in this study. Given the costs of tube feedings, intensive treatment can produce large cost savings when these feedings are eliminated during the course of treatment or shortly afterwards. The cost savings for children successfully treated before a gastrostomy tube is placed can be even greater. In our program, day treatment offered many of the same benefits of inpatient treatment. The therapy is conducted by the same staff in the same treatment space and monitored by the same physician and nutritionist. Despite these similarities, the cost of day treatment is less than half the cost of inpatient treatment.

This study was limited to examining the efficacy of intensive therapy and comparing the direct costs of feeding therapy and tube feedings. Unfortunately, many possible benefits of weaning children from tube feedings were not examined. We did not compare the utilization of medical services for children who were tube fed, but did not receive intensive therapy with children who received intensive therapy and were successfully weaned from their tube feedings. Based on our experience with this population, children on tube feedings typically require more physician and clinic visits to monitor tube feedings. Neither did we measure psychosocial nor other benefits of oral feeding for either the children or their families. Benefits we have seen are varied and include one school aged girl who now eats in the cafeteria with her friends rather than going to the nurse's office for a tube feeding, and caregivers who miss less work due to reduced physician visits. Future research on these benefits would provide additional rationale for the use of intensive treatment of severe feeding problems.

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