Behavioral Assessment and Treatment of Pediatric Feeding Problems

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BEHAVIORAL ASSESSMENT AND TREATMENT OF
PEDIATRIC FEEDING PROBLEMS

by

Mary M. Riordan

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

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I would like to thank my previous instructors and fellow graduate students at Western Michigan University for the excellent and enjoyable professional training they have given me.

Mary M. Riordan
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INTRODUCTION

Problems related to feeding occur in approximately one fourth of all children but are especially prevalent in handicapped populations (Palmer & Horn, 1978; Perske, Clifton, McClean & Stein, 1977). It has been estimated that 80 percent or more of severely handicapped persons have some type of feeding problem (Perske et al., 1977). Prior to the use of behavioral interventions with feeding difficulties, passive feeding methods (i.e., food is poured down the person's throat), forced feedings and tube feedings were commonly employed. These practices had aversive health consequences such as the development of aspiration pneumonia in individuals passively fed. There are aversive social consequences as well. One example is that institutional staff may attempt to avoid children who do not appropriately self feed (Perske et al., 1977). In recent years, however, behavioral techniques have been developed and demonstrated to be effective in treating a variety of disorders related to eating.

Anorexia nervosa is a disorder occurring most frequently in females and is characterized by the consumption of insufficient quantities of food, usually with "secondary gain" characteristics, serious loss of body weight, active food refusal and amenorrhea, with no identifiable organic etiology (Minuchin, Rosman & Baker, 1978; Robbins & Palmer, 1978; Stunkard & Mahoney, 1976; Walen, Hauserman & Lavin, 1977). Persons with this disorder may also have several of the following characteristics: overactivity, hypothermia, a history of being overweight,
fear of obesity, above average intelligence and self-induced vomiting (Minuchin et al., 1978; Robbins & Palmer, 1978; Walen et al., 1977). In addition, the families of anorexia individuals have been said to exhibit distinctive maladaptive interaction patterns (Minuchin et al., 1978). The most effective treatments in increasing weight and consumption of food have been systematic desensitization, feedback, family therapy and operant reinforcement (Minuchin et al., 1978; Ollendick, 1979; Stunkard & Mahoney, 1976). Behavioral techniques have also been successful in decreasing the body weight of obese children (Aragona, Cassady & Drabman, 1975), adults (Mann, 1972) and institutionalized individuals (Upper & Newton, 1971). Techniques employed include stimulus control training, self-monitoring, establishing short term weight goals, behavioral contracting, aversion therapy, cognitive restructuring and nutritional or exercise counseling (Stunkard & Mahoney, 1976). The acquisition and maintenance of self-feeding skills represents another problem related to eating and considerable research has been done in this area. Manual guidance, social praise and the consumption of the food item as the reinforcer have been effectively employed to train appropriate utensil usage (O'Brien & Azrin, 1972; O'Brien, Bugle & Azrin, 1972; Stimbert, 1977). Azrin and Armstrong (1973) also found that the use of more frequent, brief meals ("mini-meals") facilitated acquisition of self-feeding skills. Finally, behavioral procedures have been found useful in modifying undesirable mealtime behaviors such as food stealing, throwing food, temper tantrums, aggression and improper feeding responses. The most frequent procedures used have been time-out from the feeding room, removal of food (Barton, Guess, Garcia &

One feeding problem which has received little attention in the behavioral literature is the treatment of children who consume insufficient quantities of food or whose diet is highly imbalanced. This food refusal problem is different from anorexia nervosa in that it occurs in very young children who may have never eaten appropriately, occurs equally in both sexes, occurs more frequently in handicapped children, and does not serve as a means for the child to control the majority of the family interactions (Palmer & Horn, 1978). It is also a different problem than the acquisition of self-feeding in that it may occur in children who already self-feed. Nutritional problems associated with inadequate food intake may pose severe health hazards, and in cases of food refusal, it may not be possible to use the mere consumption of food as a reinforcer for eating appropriately.

Children who eat insufficient amounts of food may receive the medical diagnosis of "failure to thrive". It is a syndrome characterized by inadequate growth in weight and height, malnutrition, retarded motor and social development, all in the absence of a specific medical cause (Gardner, 1978; Glaser, Heagarty, Bullard & Pivchick, 1968; Palmer & Kim, 1978; Riley, 1968). Inappropriate feeding problems are characteristic of children with this diagnosis, although it is not clear that these aberrant patterns are a cause, as opposed to a result of the syndrome. Maternal deprivation, altered mineral metabolism, and central nervous dysfunction have also been suggested as possible causes (Palmer & Kim, 1978). Animal studies have found that hypothalamic
lesions may lead to aphagia in rats (Teitlebaum, 1976). Although similar conditions may exist in children with failure to thrive, their presence is difficult to assess and may not be immediately helpful in determining a reasonable treatment strategy.

Pediatricians often recommend hospitalization for children diagnosed as failure to thrive. There is not, however, a medical procedure available that can be implemented to correct the feeding problem. Thus, the child may be referred to other disciplines such as occupational therapy for treatment. However, the occupational therapy literature deals primarily with appropriate feeding positions, procedures to increase oral-motor function (Finney, 1975) and creating a warm social environment (Perske et al., 1977). The failure to thrive child may also be referred to a nutritionist who will attempt to place the child on a diet balanced in calories, protein, fats and carbohydrates (Palmer & Kim, 1978). Neither of these procedures will be effective if the child will not consume the food. In cases of severe weight loss and malnourishment, tube feedings, intravenous feedings or liquid dietary supplements may be prescribed to prevent the child from starving to death. These measures do not, however, correct the feeding problem. Often no specific treatments are implemented upon hospitalization. It is thought that a separation from the supposed deprived environment may somehow bring about a reversal of this disorder (Stills, 1978). Clearly, current treatment strategies are inadequate since a large proportion of children hospitalized for failure to thrive do not gain weight prior to discharge, continue to have weight and growth problems and are at risk for mental retardation (Glaser et al., 1968).
Another feeding problem which occurs in young children is the selective refusal of one or more food types. Of 500 patients seen by a nutrition department over a four year period, 11.1% had multiple food dislikes (Palmer & Horn, 1978). A highly imbalanced diet may result in vitamin deficiencies, lethargy and caloric imbalances. A variety of suggestions may be given to parents to aid them in dealing with this problem, such as withholding desserts, mixing preferred and nonpreferred foods or giving the child a nutritional supplement. Although from a theoretical standpoint, these procedures appear potentially effective, their utility in eliminating strong food preferences has not been adequately demonstrated (Thompson & Palmer, 1974).

Herbert-Jackson and Risley (1977) assessed the food preferences of 21 preschool children for lunch dishes that had (a) not been supplemented, (b) were supplemented with meat or (c) were supplemented with a textured vegetable protein. These authors found that children ate roughly equivalent amounts of each food regardless of the method of preparation, although the supplemented dishes had higher nutritional content. This study reports the results in terms of an appropriate combination of behavioral and nutritional measures. However, this study does not provide any treatment recommendations for the elimination of food preferences since none were found with these subjects.

The content of 46 Head-Start children's diets was successfully modified by Madsen, Madsen and Thompson (1974). Social praise and sugar-coated cereal were delivered contingent upon eating from the provided meals. However, the subjects in this study were already eating some quantities of the meal prior to intervention. In addition,
data were not presented separately for each food type, so one cannot
determine if treatment procedures eliminated food preferences, or just
increased the quantity of preferred foods that was consumed.

Ireton and Guthrie (1972) report that the vegetable consumption
of 19 preschoolers was increased using a token reinforcement program.
Tokens, redeemable for preferred desserts, were dispensed contingent
on consuming portions of five vegetables. Statistically significant
differences in the number of grams consumed by all 19 children pre-
and post-treatment were reported. Since only group data were reported,
it is unclear if the token reinforcement program was effective in in-
creasing each child’s consumption. Also, some of the children were
eating some of the vegetables before treatment, so it is not clear if
the treatment procedures increased the variety of vegetables eaten or
just increased the consumption of preferred ones.

A similar eating problem is the preference for foods of one texture.
It was reported that prolonged subsistence on pureed foods occurred in
27.3% of patients seen by a nutrition department (Palmer & Horn, 1978).
If this problem persists, it may lead to digestive, dental or oral-
motor disturbances. Several studies have attempted to demonstrate the
effectiveness of behavioral procedures in correcting this problem.

Clancy, Entoch and Rendle-Short (1969) report changing the feeding
preferences of 12 autistic children from primarily pureed foods to courser
texture foods by mixing increasing amounts of nonpreferred (nonpureed)
foods with preferred (pureed) items. It is difficult to assess the
effectiveness of this fading procedure since objective data were not
reported and no experimental evaluation was undertaken. It was noted
that subjects refused all foods for an average of three days at the onset of treatment, leading to weight loss, lethargy and high levels of acetone in the urine. Thus, this procedure might be prohibitively dangerous for use with children who are already severely underweight and malnourished.

Bernal (1972) employed a series of ten interventions to train a four year old child to feed herself table foods. Prior to treatment the child ate only a limited number of strained foods. The mother implemented the program in the home for 32 weeks. The various interventions involved delivery of attention contingent upon self-feeding, the delivery of preferred foods contingent upon consuming nonpreferred foods, extinction of inappropriate behaviors (i.e., crying) and access to television contingent upon eating table foods. During the study the child consumed 50 different foods. A vitamin and mineral supplement was administered and she was allowed to eat whatever she wished at one meal so that weight could be maintained and nutritional requirements met.

Although Bernal's procedures appear to have been effective, no experimental design was employed that allows for a clear demonstration of the functional relationship between the treatment and observed changes in behavior. A variety of procedures was implemented, in a sequential fashion, so that evaluation of each was not possible. A further problem is that the exact food items presented at each meal were not reported. Thus, it cannot be determined if the child would eat the foods during baseline or if consumption of each item continued once the food had first been accepted. The data were also collected.
by the mother with no reliability measures reported.

Thompson and Palmer (1974) successfully treated a 34 month old, developmentally disabled male who drank all liquids from a bottle, ate exclusively strained foods, did not self-feed, held food in his mouth rather than swallowing and exhibiting severe tantrums at mealtimes. The delivery of bites of preferred foods contingent upon accepting bites of nonpreferred foods increased the number of bites eaten from a mean of 28 during baseline to a mean of 60 bites. A brief timeout or extinction procedure decreased the frequency of inappropriate behaviors. An ABCD design was employed, with different persons (i.e., therapist, mother, whole family) conducting each condition. Therefore, a demonstration of functional control was not possible. Data were also not reported on the actual quantities of food consumed, or on any reliability procedures.

Thompson, Palmer and Linshceid (1975) used access to pureed food, social praise and attention contingent upon eating bites of solid food to increase the amount of table food eaten by a six year old male, and the effects of treatment were maintained over a 12 month period. But this study suffers from many of the same methodological problems as the above studies, such as the lack of experimental design, no reliability measures and vague description of independent variables.

Another area in which research is lacking is the initial assessment of children who do not consume adequate quantities or types of food. Food refusal may incorporate a number of separate behaviors. The child may not accept the food when it is presented, may not close his/her mouth, may not swallow it, may expell it or may exhibit such
behaviors as crying, self-injury, aggression, pushing the spoon away, turning the face away, tongue thrust, banging objects, or throwing food or objects. In addition, it is necessary to assess the difference between the child’s current and desirable diet and weight.

The purposes of this study were to design a behavioral assessment procedure to identify specific food refusal problems and to design and implement treatment programs based on the outcomes of such assessments. This study focuses on children who do not currently self-feed although the procedures described could be modified for self-feeding populations. Outcome evaluations were designed so as to correct the serious problems with previous research on food refusal. Measurement procedures enable an assessment of the quantity and type of food consumed, the reliability of observations and maintenance of treatment effects. Within subject designs were employed so that a clearer demonstration of functional control was possible. Continuous monitoring of the subject’s weight and nutritional intake occurred throughout the program. Finally, the procedures are clearly specified and were designed so that sustained periods of fasting did not occur.
STUDY 1: ASSESSMENT OF FEEDING BEHAVIOR

This portion of the research is devoted to a description and evaluation of the assessment instrument. This includes a recommended sequence of events that occurred before the actual behavioral observations, the method employed in conducting the evaluations, calculation of the results obtained from the use of the procedure and discussion of the obtained results.

Method

Subjects

All subjects were inpatients at The John F. Kennedy Institute (JFKI), a hospital which provides interdisciplinary services to developmentally disabled children on either a short term inpatient or outpatient basis. JFKI is primarily a research and training facility. Prior to receiving treatment, the guardians of all patients give signed consent to the implementation of research procedures, professional presentation of data and the use of photographs for professional purposes. The patient's parents are also informed of all treatment programs prior to their implementation.

Six patients were assessed. The first four subjects were children who were reported by nursing, pediatric or occupational therapy staff to exhibit feeding problems, and each was reported to have the ability to take and swallow foods. Each of these four subjects had a note to that effect placed in their permanent medical chart. The next two
subjects were tentatively labeled as children who did not have a feeding problem by the nursing staff. These children were identified upon the request of a member of the Behavioral Psychology staff at an interdisciplinary staff meeting.

Subject 1 was a 16 month old female with cerebral palsy, mild left hemiparesis, gross motor delay, and was functioning at a 12 month level. She was referred to Behavioral Psychology staff by a staff occupational therapist because of excessive crying during meals and refusal to eat any fruit, vegetable or meat items. This refusal of food was not felt to be due to her physical condition or any oral-motor disability.

Subject 2 was a 25 month old female who was functioning at a 12 month level and had a diagnosis of meningomyelocele, arrested hydrocephalus (shunted), cranial nerve damage, failure to thrive, and extrapyramidal cerebral palsy. She received the majority of her caloric intake via gastrostomy tube feedings. The tube had been inserted 11 months earlier as a result of frequent occurrences of aspiration pneumonia that were felt to be due to swallowing difficulties caused by the cranial nerve damage. This subject was referred for evaluation by a staff pediatrician.

Subject 3 was a 23 month old female with a diagnosed chromosomal aberration, questionable visual acuity, possible right hemiparesis and who was functioning at a 8 month level. She was also reported to have limited oral-motor abilities. She was referred for evaluation by an interdisciplinary treatment team due to her refusal to accept sufficient quantities of many foods, failure to chew many foods and excessive crying.
Subject 4 was a 23 year old, mildly retarded female diagnosed as having a rare enzyme deficiency, peripheral neuropathy and a history of seizures. She was referred for evaluation by the nursing staff because of an extremely low caloric intake which was not felt to be due to her physical condition and excessive complaints at mealtimes. At the time of evaluation, she was grossly underweight and malnourished.

Subject 5 was an 18 month old male diagnosed as moderately to severely retarded and having extrapyramidal cerebral palsy. He was referred by a staff nurse as having no significant oral-motor or feeding problems although the child's medical chart indicated that he exhibited tongue thrust.

Subject 6 was a 3 year old female with spastic cerebral palsy, hydrocephalus, and was recovering from hip surgery. Her weight and height were below the third percentile for her age, although her daily caloric intake exceeded normal requirements.

Prior to conducting assessment meals, each child's case was reviewed with the staff member who identified the child as having a feeding problem or not. At this time, preferred and nonpreferred foods, inappropriate mealtime behaviors and any possible medical causes for the problem were identified. Approval for conducting the assessment was also obtained at this time, and any medical precautions necessary when conducting the meal were discussed.

Assessment procedures

Conducting the meal. Each subject was observed during four meals and no more than two of these meals were either breakfast, lunch, or
dinner. The food items presented at each meal were those listed on the standard menu, or those that had been specifically ordered by the pediatrician or nutritionist. The texture of foods presented was determined by the pediatrician or nutritionist. Meals were conducted in one of three locations -- the child's bedroom, the patients' dining room, or in the occupational therapy treatment room. All assessment meals for a given subject were conducted in the same location.

During each meal the following procedures were employed:

1. Bites of food were presented at regular intervals (either 30 or 45 seconds), noncontingent upon the subject's behavior.

2. Bites of food were presented in an arbitrarily determined, rotating manner. Each food item was numbered prior to the meal, the first bite presented was item number 1, the second bite, item number 2, and so on until all foods had been presented. This sequence was repeated as many times as necessary.

3. The subject's face was wiped of any visible food or saliva prior to the presentation of each bite.

4. Inappropriate mealtime behaviors were ignored.

5. For Subjects 2-6, the therapist made comments to the subject approximately once every 2 minutes about topics not related to feeding during two of the assessment meals. During one of these meals, the therapist also intermittently praised the child for accepting bites.

6. The number of bites presented at each meal was constant for a given subject. For Subjects 1 and 3-6, the number of bites presented was 40. For Subject 2, the number of bites presented was reduced to 30 as a result of the concern of the medical staff that consuming
larger amounts might cause aspiration.

7. Each of the following behaviors was scored on every bite (items b-f were scored on an occurrence/nonoccurrence basis):

a) Food item presented (All subjects) - The number assigned to the food item was written on the data sheet. This served as a check on the accuracy with which the therapist presented the appropriate food item, as well as enabling an assessment of the differential performance for various foods.

b) Acceptance of the bite (All subjects) - The subject's mouth was opened so that the spoon or piece of food could be delivered within two seconds after the food item was held within 1 inch of the mouth. This behavior was scored as a means of assessing whether the child would accept foods by mouth.

c) Mouth closure (All subjects) - The subject's lips, teeth or gums touched within 5 seconds of the food being deposited in the mouth. This behavior was not scored if the bite was not accepted. This behavior was scored as a partial assessment of whether appropriate swallowing was occurring.

d) Food expulsion (Subject 1) - Any amount of food was visible outside the lip line prior to presentation of the next bite. This behavior was not scored if the bite was not accepted. This behavior was scored as a partial assessment of whether the food had been swallowed. However, after the assessment and treatment procedures had been completed with Subject 1, it was decided that this measure was too stringent. For subsequent subjects (2-6), food expulsion was scored if food was visible
outside the lip and chin area any time prior to the presentation of the next bite.

e) Mouth clean (All subjects) - No piece(s) of food greater than \( \frac{1}{4} \) inch was visible inside the mouth prior to the food being deposited. This behavior was scored as a partial indication of whether the previous bite had been swallowed. If it had not been expelled and was not visible inside the mouth, it was assumed that it had been swallowed.

f) Inappropriate mealtime behaviors

Crying (All subjects) - The child sobbed or hyperventilated and/or shed tears for at least five seconds.

Aggression (All subjects) - The child hit, pinched, or kicked the therapist or self.

Banging objects (All subjects) - The child banged any part of the body or an object against the tray or table producing a sound audible five feet away.

Face-turning (All subjects) - The subject's face turned at least 45 degrees out of midline and away from the spoon when it was being presented.

Putting hands-up (All subjects) - The subject's hands were raised between his/her face and the food being presented.

Tongue thrust (Subjects 3-6) - The subject's tongue protruded from the mouth enough to touch the middle of the lower lip, after the food had been deposited.

Hands in mouth (Subjects 3-6) - One or both of the subject's hands were placed in the mouth within 10 seconds of the food
being deposited.

8. At two of the assessment meals for each subject, each item on the food tray was weighed to the nearest half gram, both before and after the meal. The bib and wiping cloths were also weighed. These data were collected in order to assess the proportion of accepted food that was expelled and to evaluate the consistency of bite sizes.

**Data calculation.** Each food item presented at an assessment meal was assigned to one of the following food groups: meat, vegetable, fruit, starch, dessert, liquid or other. Using data collected at all assessment meals, the following formulae were employed to obtain separate percentages for the total of all foods presented and for each food type.

1. Acceptance = (number of bites scored accept/ number of bites presented) x 100

2. Mouth clean = (number of bites scored clean/ number of bites accepted) x 100

3. Mouth closure = (number of bites scored mouth closure/ number of bites accepted) x 100

4. Food expulsion = (number of bites scored expulsion/ number of bites accepted) x 100

5. Total inappropriate mealtime behaviors = (number of intervals in which any inappropriate was scored/ total number of intervals) x 100

6. Specific inappropriate mealtime behaviors = (number of intervals the inappropriate was scored/ the number of intervals) x 100

7. Grams consumed = (sum of the differences in pre-post weights of food items) - (the difference in the pre-post weights of the bib
Determination of feeding problems

Based on the calculated data, it was determined if the subject's behavior met the criteria for any of the following feeding problems.

1. Nonacceptance of food
   a) Nonselective/complete - total food acceptance was equal to 0%.
   b) Nonselective/partial - total food acceptance was greater than 0% but less than 50% and was not selective (see below).
   c) Selective by food type - food acceptance for a type was less than 50% for one or more items, but was more than 50% for at least one item.

2. Holding food in the mouth
   a) Nonselective - total percent mouth clean equaled 50% or less and was not selective.
   b) Selective - the percent mouth clean by type was less than 50% for one or more food types, but was more than 50% for at least one item.

3. Mouth closure
   a) Nonselective - the total percent mouth closure was less than 50% and was not selective.
   b) Selective - the percent mouth closure was less than 50% for one or more food types, but was more than 50% for at least one type.

4. Food expulsion
   a) Nonselective - the total percent food expulsion was greater than 50% and was not selective.
b) Selective – the percent expulsion of one or more types was greater than 50% and expulsion of at least one type was less than 50%.

5. Inappropriate mealtime behaviors – the total percent of inappropriate behaviors was greater than 30%, or any one inappropriate behavior was scored in 20% or more of intervals.

Reliability

At one of the four assessment meals for each of Subjects 1, 2, and 4-6 (2 meals for Subject 3), a second observer independently recorded data on all mealtime behaviors and the weights of food before and after the meal. Three percentages of agreement were calculated for each behavior scored. For all three reliability measures, an agreement was scored if both observers recorded the occurrence or non-occurrence of the behavior in the same interval. Occurrence reliabilities were calculated by dividing the number of agreements on the occurrence of the behavior by the number of agreements plus disagreements on the occurrence and multiplying by 100. The percentage reliability on the nonoccurrence of the behavior was computed by dividing the number of agreements on the nonoccurrence of the behavior by the number of agreements on the nonoccurrence of the behavior and multiplying by 100. The percentage agreement on occurrences plus nonoccurrences was computed by dividing the number of agreements on occurrences and nonoccurrences by the number of agreements plus disagreements and multiplying by 100. All reliability data are presented in Table I.
Table I. Occurrence, nonoccurrence and occurrence plus nonoccurrence reliability measures for Study 1.
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<td>a</td>
</tr>
<tr>
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<td>r_n</td>
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<td>75%</td>
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</tr>
<tr>
<td></td>
<td>r_o+n</td>
<td>99%</td>
<td>75%</td>
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<td>97%</td>
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</tr>
<tr>
<td></td>
<td>r_o</td>
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<td>100%</td>
<td>a</td>
<td>100%</td>
<td>a</td>
<td>a</td>
<td>a</td>
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<td>a</td>
</tr>
<tr>
<td>4</td>
<td>r_n</td>
<td>a</td>
<td>a</td>
<td>100%</td>
<td>a</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>r_o+n</td>
<td>100%</td>
<td>100%</td>
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<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Subject</td>
<td>Type</td>
<td>Acceptance</td>
<td>Mouth Closure</td>
<td>Food Expulsion</td>
<td>Mouth Clean</td>
<td>Tot. In Behaviors</td>
<td>Crying</td>
<td>Face-Turning</td>
<td>Hands-up</td>
<td>All Other In Behaviors</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
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<td>----------------</td>
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<td>------------------------</td>
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<td>80%</td>
<td>100%</td>
<td>a</td>
<td>a</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>r_n</td>
<td>a</td>
<td>a</td>
<td>89%</td>
<td>a</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>r_o+n</td>
<td>100%</td>
<td>100%</td>
<td>93%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>r_o</td>
<td>100%</td>
<td>100%</td>
<td>85%</td>
<td>100%</td>
<td>a</td>
<td>a</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>r_n</td>
<td>a</td>
<td>a</td>
<td>93%</td>
<td>a</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>r_o+n</td>
<td>100%</td>
<td>100%</td>
<td>95%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note: $r_o$ = occurrence reliability  
$r_n$ = nonoccurrence reliability  
$r_{o+n}$ = occurrence plus nonoccurrence reliability  
$a$ = this behavior was not scored by either observer
Reliability indices on the pre- and post-weights of food were also calculated by dividing the number of agreements plus disagreements and multiplying by 100. An agreement was scored if the weights recorded by the two observers were not different by more than .5 grams. Percentages of agreement on the pre- and post-weights of foods were 100% for all subjects except Subject 2. A reliability observation was not conducted for Subject 2.

Results and Discussion

Table II shows the percent of bites accepted for all foods and for each food group. These data indicate that Subject 1's behavior during assessment met the criteria for selective nonacceptance of fruit, vegetable, dessert and other food items, since acceptance of these food items was less than 50%, but acceptance of meat and starch items was greater than 50%. Observation of Subject 2's behavior suggests a selective nonacceptance of fruit, vegetable, meat and other items (acceptance was less than 50%). Subject 3's behavior also met the criteria for selective nonacceptance of vegetable and liquid items (acceptance of these items less than 50%, but acceptance of other foods greater than 50%). Data for Subjects 4, 5 and 6 did not indicate a nonacceptance feeding problem since acceptance of all items was greater than 50%.

Table III presents the percentages of accepted bites for which mouth clean was scored. None of the subjects exhibited behaviors that met the criteria for holding food in the mouth since mouth clean was scored on 50% or more of bites for all foods and for each individual.
Table II. Percent of assessment bites scored acceptance for all subjects.
## TABLE II

Percent of Assessment Bites Scored Acceptance for All Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Number of Bites Presented</th>
<th>Total of All Foods</th>
<th>Fruit Items</th>
<th>Vegetable Items</th>
<th>Meat Items</th>
<th>Starch Items</th>
<th>Liquid Items</th>
<th>Dessert Items</th>
<th>Other Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>160</td>
<td>46%</td>
<td>19%</td>
<td>13%</td>
<td>72%</td>
<td>66%</td>
<td>53%</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>2</td>
<td>120</td>
<td>54%</td>
<td>38%</td>
<td>0%</td>
<td>8%</td>
<td>61%</td>
<td>86%</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>3</td>
<td>160</td>
<td>43%</td>
<td>71%</td>
<td>25%</td>
<td>67%</td>
<td>60%</td>
<td>17%</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>4</td>
<td>160</td>
<td>98%</td>
<td>88%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>a</td>
<td>75%</td>
</tr>
<tr>
<td>5</td>
<td>160</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>a</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>160</td>
<td>96%</td>
<td>75%</td>
<td>100%</td>
<td>100%</td>
<td>88%</td>
<td>100%</td>
<td>100%</td>
<td>94%</td>
</tr>
</tbody>
</table>

Note: a = no bites of this item were presented during assessment
Table III. Percent of assessment bites scored mouth clean for all subjects.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Number of Bites Accepted</th>
<th>Total of All Bites</th>
<th>Fruit Items</th>
<th>Vegetable Items</th>
<th>Meat Items</th>
<th>Starch Items</th>
<th>Liquid Items</th>
<th>Dessert Items</th>
<th>Other Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>b</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>66</td>
<td>98%</td>
<td>89%</td>
<td>b</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>4</td>
<td>156</td>
<td>84%</td>
<td>89%</td>
<td>75%</td>
<td>96%</td>
<td>83%</td>
<td>84%</td>
<td>a</td>
<td>84%</td>
</tr>
<tr>
<td>5</td>
<td>160</td>
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<td>94%</td>
<td>100%</td>
<td>100%</td>
<td>88%</td>
<td>100%</td>
<td>a</td>
<td>94%</td>
</tr>
<tr>
<td>6</td>
<td>153</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>94%</td>
<td>100%</td>
<td>100%</td>
<td>94%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note:  

a = No bites of this item were presented during assessment  

b = This behavior not calculated since no bites were accepted
Table IV shows the percent of accepted bites following which the subjects exhibited appropriate mouth closure. Subject 3 was scored as closing her mouth after less than 50% of accepted bites of all solid items and for more than 50% of liquid items and therefore her behavior met the criteria for selective mouth closure. The data recorded for all other subjects did not suggest the problem of lack of mouth closure.

Table V shows the percentage of accepted bites that were expelled for the total of all foods and for each food type. These data indicated that Subject 1's behavior met the criteria for nonselective expulsion of food since expulsion of each item was greater than 50%. The behavior of Subject 2 during assessment indicated the selective expulsion of dessert items since expulsion of these items was greater than 50%, but expulsion of all other items was less than 50%. Data for Subject 3 suggest the selective expulsion of vegetable, meat and liquid items (expulsion of these items was greater than 50%). Subject 5's behavior met the criteria for selective expulsion of liquids (expulsion of only these items was greater than 50%). The data of Subject 6 also suggest the selective expulsion of fruit items. Subject 4's assessment data did not indicate an expulsion problem.

Table VI shows the percentages of bites in which inappropriate behaviors were scored. Subject 1 exhibited crying, face-turning and hands-up greater than 20% of the time and her total percentage of inappropriate behaviors exceeded 30%. Subject 2 also met the criteria for inappropriate mealtime behaviors since she turned her face on 30% of bites. Subject 3's behavior indicated levels of inappropriate mealtime
Table IV. Percent of assessment bites scored mouth closure for all subjects.
TABLE IV

Percent of Assessment Bites Scored Mouth Closure for All Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Number of Bites Accepted</th>
<th>Total of All Foods</th>
<th>Fruit Items</th>
<th>Vegetable Items</th>
<th>Meat Items</th>
<th>Starch Items</th>
<th>Liquid Items</th>
<th>Dessert Items</th>
<th>Other Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>b</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>66</td>
<td>100%</td>
<td>100%</td>
<td>b</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>31%</td>
<td>29%</td>
<td>0%</td>
<td>0%</td>
<td>21%</td>
<td>100%</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>4</td>
<td>156</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>5</td>
<td>160</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>a</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>153</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note:  

a = No bites of this item were presented during assessment  
b = This behavior not calculated since no bites were accepted
Table V. Percent of assessment bites scored food expulsion for all subjects.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Number of Bites Accepted</th>
<th>Total of All Foods</th>
<th>Fruit Items</th>
<th>Vegetable Items</th>
<th>Meat Items</th>
<th>Starch Items</th>
<th>Liquid Items</th>
<th>Dessert Items</th>
<th>Other Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72</td>
<td>66%</td>
<td>67%</td>
<td>100%</td>
<td>57%</td>
<td>62%</td>
<td>81%</td>
<td>b</td>
<td>25%</td>
</tr>
<tr>
<td>2</td>
<td>66</td>
<td>38%</td>
<td>33%</td>
<td>b</td>
<td>0%</td>
<td>33%</td>
<td>42%</td>
<td>75%</td>
<td>33%</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>46%</td>
<td>35%</td>
<td>100%</td>
<td>69%</td>
<td>28%</td>
<td>50%</td>
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<td>a</td>
</tr>
<tr>
<td>4</td>
<td>156</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>2%</td>
<td>3%</td>
<td>a</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>160</td>
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<td>0%</td>
<td>0%</td>
<td>13%</td>
<td>0%</td>
<td>60%</td>
<td>a</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>153</td>
<td>29%</td>
<td>100%</td>
<td>6%</td>
<td>6%</td>
<td>33%</td>
<td>38%</td>
<td>6%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Note:  

- a = No bites of this item were presented during assessment  
- b = This behavior not calculated since no bites were accepted
Table VI. Percent of bites during which inappropriate behaviors were scored for all Study 1 subjects.
TABLE VI

Percent of Bites During Which Inappropriate Behaviors Were Scored for All Study 1 Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Total In. Behaviors</th>
<th>Crying</th>
<th>Face-Turns</th>
<th>Hands-Up</th>
<th>Tongue Thrust</th>
<th>All Other Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54%</td>
<td>36%</td>
<td>42%</td>
<td>48%</td>
<td>a</td>
<td>0%</td>
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<tr>
<td>2</td>
<td>32%</td>
<td>5%</td>
<td>30%</td>
<td>0%</td>
<td>a</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>78%</td>
<td>51%</td>
<td>56%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>13%</td>
<td>0%</td>
<td>3%</td>
<td>0%</td>
<td>10%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: a = This behavior not scored for this subject
behaviors greater than 30% and crying and face-turning greater than 20% each and thus met criteria for inappropriate mealtime behaviors. Subjects 4 and 5 were not scored as emitting any inappropriate behaviors during assessment meals. The percent of intervals in which Subject 6 was scored as exhibiting any inappropriate behavior(s) fell below that required to meet the criteria for inappropriate mealtime behavior problem.

The mean number of grams consumed by Subject 1 during assessment was 47; by Subject 2, 27; by Subject 3, 21; by Subject 4, 336; by Subject 5, 96.5; by Subject 6, 141.

The data obtained from implementation of the assessment procedures with six subjects suggest that these assessment procedures may be useful in objectively identifying several specific feeding problems. Such an objective description of feeding problems is useful in that it enables the therapist to carefully attend to critical aspects of the behavior that might otherwise be overlooked. The selectivity of feeding problems is often overlooked. The present data allow for an analysis of the eating problem in terms of food type and this information is useful as a partial indication of whether the feeding problem is a result of a physiological disability. It would seem unlikely, for example, that a child selectively expelled vegetable items because of a deficit in the swallowing mechanism. Since at least two meals were observed during the assessment process, one can examine the differential feeding behavior exhibited at different meals. It would also be possible to examine differential performance within each meal. In the present study, the behavior of each subject was consistent both across and
within meals. However, marked differences between or within meals might indicate that the child is not hungry during one meal, has not adapted to the hospital feeding schedule, or is reacting to a specific environmental event which occurred prior to or during the meal.

There are several other advantages to an analysis of eating behavior in terms of a variety of social or physical variables prior to treatment. First, the data collected might determine the nature of the treatment procedures. It might identify foods that were consumed appropriately during assessment. These preferred foods can then be used as reinforcers during treatment. Also, where inappropriate mealtime behaviors are identified as the feeding problem, the specific behaviors observed would influence the choice of treatment. For example, one might use an extinction procedure for crying, but another technique for tongue thrust. The data obtained during assessment could also serve as a partial baseline for assessing the effects of subsequent treatments.

Several shortcomings of the assessment procedure should also be noted. Some of the behaviors involved in appropriate feeding are difficult to observe and were not directly scored in this study. Swallowing, for example, cannot be reliably observed and thus was inferred from the mouth clean and food expulsion data. Chewing is also difficult to observe and was not measured. Another problem with the current assessment procedures is that, due to the limited number of meals observed, the number of foods sampled from each group was small. Also, in cases where the subject did not accept any bites of a food, it was not possible to observe the other feeding behaviors.
The criteria that were specified for each of the feeding problems were somewhat arbitrary. However, they do seem to have some validity. The first three children were referred as children exhibiting feeding problems, and the data for each of these children suggested at least two feeding problems. In each case, the feeding problem identified during assessment corresponded to that specified when the child was referred. Subject 4 was also identified as a child with a feeding problem; however, her behavior during assessment did not indicate a feeding problem. This may be due to the nature of the assessment procedures. At all meals, verbal complaints and food refusal were ignored. When other staff were observed feeding this girl, frequent attention to verbal complaints or food refusal and prompts to eat were noted. It is possible that this attention was maintaining food refusal.

The data obtained from the two subjects identified as children not exhibiting feeding problems suggested that each had a selective expulsion problem. Subject 5's behavior met the criteria for the selective expulsion of liquid items. Unfortunately, it is difficult to evaluate this finding further since the expulsion of liquid items is at least partially due to the skill of the therapist in presenting the appropriate amount of liquid from a cup. If too much liquid is presented, some may run around the sides of the cup and down the chin and thus will be scored as expulsion. It is also possible that the referring nurse did not consider the expulsion of liquid items to be abnormal for a child of this age. The data from the second child referred to as not having a feeding problem suggested the selective expulsion of fruit items. However, a fruit item was present at only one
meal and it would be necessary to sample several other fruit items in order to provide stronger evidence that the selective expulsion of fruit is indeed a feeding problem.

The assessment instrument described above could be expanded such that the behavior of the feeder would also be scored. If this was done, one could score the differential performance of the child when he/she is fed by the mother as opposed to the hospital staff. This might also enable a more rapid determination of the feeding problem since presumably the problem of adaption to the hospital situation would be minimized. In addition, it might provide useful information on how the feeding problem developed or is being maintained. It would also be useful in future use of this instrument to incorporate a more detailed nutritional analysis.
STUDY 2: THE TREATMENT OF FEEDING PROBLEMS

Using the assessment procedures described in Study 1, feeding problems have been described as specific, measurable events. The purpose of this study is to examine the effects of treatment procedures designed to eliminate several of these problems, namely the selective nonacceptance, expulsion, and mouth closure of three subjects. Specifically, the treatment procedures involve the pairing of highly preferred food items with those that were consistently refused (i.e., nonpreferred) during assessment. The procedures employed and each of three cases are described separately below.

General Method

Subjects

Subjects 1, 2 and 3 also served, respectively, as Subjects 1, 2 and 3 in the first study. Prior to the onset of this study, each child was seen by a JFKI staff nutritionist who evaluated the child's weight and diet, and indicated that the current diet was inadequate. A pediatrician and an occupational therapist also examined each child and reported that there were no contraindications to implementing a program to increase oral consumption of foods. Procedures for weight maintenance and ensuring appropriate nutritional balance throughout the study were also recommended for each subject.

Throughout the course of this study, each case was presented bi-weekly at an interdisciplinary patient review meeting. Weekly
presentations were also made at a Behavioral Psychology Department staff meeting.

Observation

Sessions. Data were collected five days per week for each subject at breakfast and/or lunch meals. The only exceptions to this were meals missed due to illness or the child's absence from the hospital. All meals were conducted in either the occupational therapy treatment room or in the patient dining room at JFKI. The foods presented at each meal consisted of items from the standard hospital menu and were of the texture ordered by the child's pediatrician. Five items were presented at each meal so as to keep the number of bites presented for each item equal across conditions. When more than five items appeared on the meal tray, duplicate items from a food group were eliminated.

Dependent variables. During each meal, data were collected on each behavior classified as a problem for that subject in Study 1. Identical behavioral definitions and data calculation formulae were used. Each meal was divided into two parts, with data calculated separately for each part. Twenty bites of each meal were considered the primary source of data throughout all treatment conditions so that an equal number of bites were represented in baseline data and probe data during training and maintenance conditions. These 20 probe bites enabled an assessment of the generalization of treatment effects. The remaining bites were used for training trials during the training condition. Periodic measurements of the number of grams consumed of all foods and of...
each food type were taken as described previously. In addition, each child's body weight was measured by the nursing staff and recorded in the child's permanent medical chart at least once during each experimental condition.

Reliability. A second observer was present at 30% or more of meals for each subject and independently recorded each behavior being scored. Occurrence, nonoccurrence and occurrence plus nonoccurrence reliabilities were calculated for each behavior as described in the previous study. Reliability observations on the pre- and post-weight of food were also obtained and calculated as during assessment.

Procedures

Baseline. The procedures for conducting baseline sessions were the same as those employed during the initial assessment (i.e., bites were presented at regular intervals, noncontingent upon the subject's behavior, in an arbitrarily determined, rotating manner), except that no social praise or verbal interactions were delivered. Throughout all conditions of the study, inappropriate behaviors were ignored. Similarly, no contingencies were in effect during any experimental condition for food expulsion or mouth closure. The standard hospital menu was also varied so that the first item to be trained appeared on the meal tray for the last several sessions of baseline.

Training. Two or three specific food items were selected as training items for each subject. These were from food groups that were accepted at low rates or expelled at high rates during baseline. All items chosen for training were approved by the child's nutritionist.
Training procedures were implemented in a multiple baseline across foods fashion. Training occurred during only one part of the meal. The procedures in effect during the remaining probe bites were identical to baseline procedures.

Only bites of the training item(s) were presented during the training portion of the meal. For the first several training meals, a bite of a preferred food (i.e., those accepted on 100% of presentations during the baseline period) and a bite of the training item were held in each of the therapist's hands. Both items were then presented to the subject simultaneously. If the bites were not accepted, nonacceptance was scored and the simultaneous procedure was repeated in the same interval until the items were accepted. Social praise was delivered contingent upon acceptance. After the first several training sessions, a time delay procedure was implemented, so that over a series of sessions, the presentation of the preferred item was contingent upon acceptance of the training item.

**Maintenance.** Maintenance procedures involved the delivery of bites of preferred foods contingent upon acceptance of bites of other items from the tray. The schedule of reinforcement was initially CRF for previously trained items. Acceptance of untrained items was reinforced on 50% of presentations. A gradual transition was then made with two of the subjects so that acceptance of trained items was randomly reinforced. Maintenance procedures were implemented throughout the meal or in only the probe portion of the meal if training was occurring with other food items.

**Follow-up.** Data were collected for each subject at least once.
following the termination of the maintenance condition. The procedures in effect were those employed during baseline, except that in cases where the first two bites of previously trained items were not accepted, or were expelled, acceptance of the next two bites of the food item were reinforced.

Parent training. Prior to each child's discharge from JFKI, the child's parents were trained to implement the simultaneous, ignoring and maintenance procedures. Parents were given written descriptions of procedures, had procedures modeled for them and demonstrated correct use of each procedure under the experimenter's supervision.

Case 1

Subject

Subject 1's behavior during assessment meals suggested the following feeding problems: selective nonacceptance of fruit, vegetable, dessert and other foods; nonselective expulsion; and inappropriate mealtime behaviors (i.e., crying, face-turning and hands-up). The nutritionist's evaluation of the child's diet before treatment estimated caloric consumption at 1100 calories per day and this was reported to be adequate, but the diet was deficient in vitamins and minerals. Evaluations by the child's pediatrician and occupational therapist indicated that the child's weight was appropriate at 18.25 pounds and that she had adequate motor control for oral feeding. Recommended procedures for weight maintenance were that a six ounce bottle be given to her each afternoon and evening and that free access to preferred foods be
allowed at the dinner meal. A daily vitamin supplement was also prescribed.

Following assessment, there was a one and one half month period prior to the onset of Study 2. During this time, several treatment procedures were implemented to test their effectiveness, and the child left the hospital for a three week leave of absence. This study began immediately upon her return.

Observation

Sessions. Data were collected at breakfast and lunch meals, five days per week. All meals were conducted in the occupational therapy treatment room and were 20 minutes (40 bites) in duration.

Dependent variables. Data were collected at each meal on acceptance of the bite, food expulsion, crying, face-turning, putting hands-up and total inappropriate behaviors. The meal was divided into two halves of 20 bites each. The primary data were those obtained from the last 20 bites since these are the bites represented in the probes during training.

The child's weight was measured six times during the course of this study, once in each of the first three experimental conditions and three time during the maintenance condition.

The number of grams consumed per meal was measured four times during baseline, three times during training of the first item, twice during training of the second item and three times during the maintenance condition.

Reliability. Reliability observations were made during 50% of all
sessions. Agreements on occurrences, nonoccurrences and occurrences plus nonoccurrences were, respectively, 98.9%, 96.7% and 99.2% for acceptance of the bite; 85.4%, 81.6% and 91.9% for food expulsion; 88.4%, 94.9% and 98.8% for crying; 78.5%, 95.4% and 96.3% for face-turns; 83.9%, 96.9% and 97.7% for hands-up; and 90.4%, 96.8% and 97.7% for total inappropriate behaviors.

Reliability observations on the pre- and post-weight of food items were obtained on seven occasions, twice during baseline, the first training condition and the maintenance condition and once during training of the second item. The mean percentage agreement was 97.6%.

Procedures

Baseline. The first 11 meals were baseline sessions for all foods.

Training. Items selected for training for Subject 1 were a fruit item (applesauce) and a vegetable item (carrots). During each training meal, the first three bites of the target item were presented as during baseline, training procedures were implemented for the next 17 bites and the last 20 bites of the meal were probe bites.

Training procedures were implemented with the fruit item beginning with Session 12. Simultaneous presentation of the training item and preferred item (graham cracker or dry cereal) occurred in the first two training meals. Beginning with the third meal of training on the fruit item, delivery of the preferred food was contingent upon acceptance of the training item. Over the remaining nine training sessions, the preferred food was delivered on an increasingly more intermittent schedule, such that, on the last day of training of the fruit item, only
five of the 17 training bites were reinforced.

Training of the fruit item was discontinued after meal 23 and training was begun on the vegetable item. The simultaneous presentation procedure was implemented for the first four meals. A transition was then made to a contingent delivery of the preferred food, and the schedule of reinforcement was gradually leaned to an intermittent schedule, so that, on the last day of training of the vegetable item, eight of the 17 bites were reinforced.

**Maintenance procedures.** Beginning in Session 33, immediately after the termination of training on the vegetable item, maintenance procedures were implemented with all food items, throughout the entire meal. The final schedule of reinforcement used in this condition was a VR 2 for all food items. Maintenance procedures were terminated after Session 51.

**Follow-up.** Data were collected two and six weeks after the end of the maintenance condition. During the two-week follow-up, the procedures employed were identical to those of baseline. During the six-week follow-up meal, bites of preferred foods were delivered contingent upon acceptance of two bites of applesauce, and the meal was ended after 30 bites when the child's mother interrupted the meal. All other procedures were as during baseline.

**Parent training.** Prior to Subject 1's discharge from JFKI, her mother was trained to implement all treatment procedures during two dinner meals. The procedures were again demonstrated to her after the six-week follow-up meal.
Results

The percentage of probe bites accepted at each meal of fruit, vegetable, meat and starch items is presented in Figure 1. (Graphic data are not presented for liquid items since acceptance of these items was high throughout all conditions, or for dessert and other items since these items were rarely present on the tray.) The percentage of probe bites accepted of both training fruit items (open circles) and untrained fruit items (closed circles) was zero during all baseline sessions. Acceptance of the specific fruit item trained increased to 100% of the 17 training bites by the second training session and remained at this level for the remainder of the training condition. Implementation of training procedures also increased acceptance of the trained fruit item to 100% of probe bites in the last eight sessions of training on that item. Acceptance of the fruit item decreased to baseline levels when training was discontinued and again increased when maintenance procedures were implemented.

Acceptance of all vegetable items was zero during 11 of the 12 baseline sessions. Acceptance of the vegetable item during the training portion of the meal increased to 100% by the third training meal and remained at this level throughout training of this item. The percent of probe bites of vegetable that were accepted increased substantially during this condition and remained high during the maintenance condition.

The percentage of probe bites accepted of items from untrained groups did not change systematically with changes in treatment conditions.
Figure 1. The percentage of probe bites accepted by Subject 1 for training items (open circles) and untrained items (closed circles) from fruit, vegetable, meat and starch food groups. The breaks in each axis indicate ten day periods during which the child was absent from the hospital.
FIGURE 1

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However, acceptance of untrained fruit and vegetable items (closed circles) increased during the maintenance condition to levels comparable to those of the two trained items. Data collected during the first follow-up meal indicated that bites of all foods were accepted at rates comparable to those obtained during the last meal of the maintenance condition. During the six week follow-up meal, acceptance of the trained fruit item dropped to 50% of bites. All other food items were accepted on 100% of presentations.

Table VII shows the mean percentages of bites accepted of all foods, the mean percentage of accepted bites that were expelled, the mean percentage of crying, face-turning, hands-up and total inappropriate mealtime behaviors, the mean number of grams consumed and the mean number of grams expelled, for each experimental condition. There was an increase in acceptance of all foods during training of the first item, a slight increase during training of the second item, and a marked increase during the maintenance condition and the two follow-up meals.

The percentage of accepted bites that were expelled decreased from baseline levels during training of the first item, but remained high and essentially unchanged during subsequent conditions. The mean number of grams expelled decreased markedly during the first two training conditions and increased again during the maintenance condition and the six-week follow-up meal.

The percentage of total inappropriate mealtime behaviors was variable, but high during baseline and decreased substantially during each subsequent condition. The percentage of each of the three inappropriate behaviors scored decreased during each subsequent condition with one
Table VII. Mean scores per condition for each behavior scored for Subject 1.
TABLE VII

Mean Scores per Condition for Each Behavior Scored for Subject 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Sessions</th>
<th>Mean Percent of Probe Bites</th>
<th>Mean Percent of Probe Bites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Acceptance (All Foods)</td>
<td>Expulsion (All Foods)</td>
</tr>
<tr>
<td>Baseline</td>
<td>11</td>
<td>45.5%</td>
<td>75.6%</td>
</tr>
<tr>
<td>Training Item 1</td>
<td>12</td>
<td>62.9%</td>
<td>55.2%</td>
</tr>
<tr>
<td>Training Item 2</td>
<td>9</td>
<td>64.4%</td>
<td>46.6%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>19</td>
<td>84.5%</td>
<td>54.4%</td>
</tr>
<tr>
<td>2 Week Follow-Up</td>
<td>1</td>
<td>100.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>6 Week Follow-Up</td>
<td>1</td>
<td>90.0%</td>
<td>16.7%</td>
</tr>
</tbody>
</table>
exception. The percentage of face-turns increased slightly during the training of the vegetable item, above the level which occurred during the training of the first item.

The mean number of grams consumed increased during each subsequent condition. However, the number of grams consumed during the six-week follow-up meal was much less than during the maintenance condition. This was apparently due to the fact that only 3/4 of the meal was presented.

Throughout all conditions, the subject's weight as recorded by the nursing staff, did not vary systematically and was never further than one pound from the 18.25 lbs. reported on the first day of baseline. The nutritionist's evaluation of the child's diet at the end of the maintenance phase was that it was well-balanced and that a nutritional supplement was no longer necessary.

Case 2

Subject

Subject 2's behavior during assessment meals suggested the following feeding problems: selective nonacceptance of fruit, meat, vegetable and other items; selective expulsion of dessert items; and inappropriate mealtime behaviors (i.e., face-turning). The nutritional evaluation of the child's diet indicated that her daily caloric intake was inadequate at approximately 500 calories via gastrostomy tube feedings plus from 0 to 200 calories taken orally. The nutritional content of the combined tube and oral feedings was reported to be adequate other than the caloric deficiency. The evaluation conducted by her pediatrician
indicated that she had extensive cranial nerve damage and pharyngeal incoordination which could interfere with oral feedings. It was also questioned whether it was feasible to attempt to increase oral intake to 100% of nutritional needs. However, it was indicated by the pediatrician that implementation of a feeding program aimed at increasing consumption of a balanced diet would be desirable and would not be placing the child at increased risk for medical problems. The child's weight of 13.75 lbs. was reported to be 3 lbs. less than desirable. To ensure appropriate caloric nutritional intake, four daily gastrostomy tube feedings of 200 calories each were recommended.

Observation

**Sessions.** Data were collected during breakfast and lunch meals, five days per week. Meals were conducted in either the patient dining room or the occupational therapy treatment room. Each meal was 22.5 minutes in duration and bites were presented once every 45 seconds.

**Dependent variables.** Data were collected at each meal on acceptance of the bite, food expulsion and face-turning. Each meal was divided into two parts of 10 and 20 bites each. The primary data were those obtained from the 20 bite portion since this is the number of bites represented in the probes during training. Probe and training bites were interspersed randomly throughout the meal during the training condition. But during baseline and maintenance conditions, the probe bites were arbitrarily determined to be the first two of every three bites.

The child's body weight was measured by the nursing staff 17 times.
during the study, at least once every four days.

The number of grams consumed was measured four times during baseline, three times during training of the first item, once during training of the next two items and three times during the maintenance condition.

Reliability. Reliability observations occurred during 33% of all meals. The mean percentage of agreement on occurrences, nonoccurrences and occurrences plus nonoccurrences were, respectively, 100%, 100% and 100% for acceptance; 92%, 91% and 95% for food expulsion; and 74%, 96% and 96% for face-turning.

Reliability observations on the pre- and post-weights of food were made four times during this study, once during each condition, yielding a percentage agreement of 100%.

Procedures

Baseline. The first 17 meals were baseline sessions for all foods.

Training. The first item trained was a vegetable item (green beans) and the second items trained were a meat item (beef) and a fruit item (applesauce). Training procedures were implemented during only the 10 bite portion of the meal.

Training procedures were implemented with the vegetable item beginning in Session 18. Bites of the training item and the preferred food were delivered simultaneously during the first five training meals. Over the remaining ten sessions, a transition was made so that the delivery of the preferred food was contingent upon acceptance of the training item. The schedule of reinforcement was CRF throughout this
Training of the vegetable item was discontinued after Session 31 and training was begun on the meat and fruit items. Five training trials occurred on each of these two items at each meal. The preferred food and the training items were delivered simultaneously for the first two training sessions. A transition was then made so that delivery of the preferred food was contingent upon acceptance of the training items.

**Maintenance.** Maintenance procedures were begun immediately after the termination of training on each of the items, in Session 32 for the vegetable item and in Session 39 for the meat and fruit items. The initial schedule of reinforcement for the vegetable item was a CRF and this was faded so that only 50% of accepted bites were reinforced by the fourth maintenance session. On the first day of the maintenance condition for meat and fruit items, five of the six bites of each were reinforced. The schedule of reinforcement for meat was leaned so that on the last day of this condition, four of the six bites were reinforced. The reinforcement schedule for the fruit item was not leaned.

**Follow-up.** Data were collected at a lunch meal four weeks after the termination of the maintenance condition. Baseline procedures were in effect for all foods except the trained fruit item. The second two bites of this item were reinforced since the child had not accepted the first two fruit bites.

**Parent training.** The child's mother was trained to use all procedures and demonstrated their correct use prior to the child's discharge.
Results

Figure 2 shows the percentage of probe bites that were accepted (circles) and the percentage of accepted bites that were expelled (open squares) of vegetable, meat, fruit and starch items. (Graphic data are not presented for liquid items since acceptance of these items was always high and expulsion relatively low, or for dessert and other items since these items were rarely present on the meal tray.) The percentage of probe bites accepted of both the vegetable training item (open circles) and vegetable items that were never trained (closed circles) was variable during baseline, but zero bites were accepted during the last three baseline meals. Implementation of training procedures increased acceptance of training bites to 100% in 13 of the 14 training meals for vegetables. Probe data during the maintenance condition indicated continued high levels of acceptance. Acceptance of the trained vegetable item occurred in 75% of presentations made during the follow-up meal.

The percent of probe bites accepted of all meat items was variable during the baseline condition. During six of the seven training sessions for this item, 100% of training bites were accepted. Following implementation of training procedures, acceptance of probe bites increased and was more stable than during baseline. Acceptance of the trained meat item occurred on 100% of probe presentations in three out of four maintenance meals and during the follow-up meal.

The percentage of probe bites accepted of all fruit items was highly variable during the baseline condition. When training procedures
Figure 2. The percentage of probe bites accepted by Subject 2 for training items (open circles) and untrained items (closed circles), and the percentage of accepted bites that were expelled (open squares) from vegetable, meat, fruit and starch food groups.
FIGURE 2

- **Acceptance of training items**
- **Acceptance of maintained items**
- **Expulsion of accepted items**

- **Percent of probe bites**
- **Meals**

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were implemented, acceptance of training bites increased to between 60 and 100% of bites (mean, 89%). The percentage of probe fruit bites accepted continued to be variable, although slightly higher than baseline, during the training condition for that item. Acceptance of the trained fruit item increased to 100% during three of the four maintenance meals. Fifty percent of probe fruit bites were accepted during the follow-up meal.

Acceptance of untrained food groups did not change systematically with changes in treatment conditions.

The percentage of accepted probe bites of vegetable items that were expelled was 100% in all but one baseline meal during which bites were accepted. When training procedures were implemented, expulsion dropped to a mean of 29% of training bites. Expulsion of vegetable probe bites remained high throughout the training condition, although not at 100%. Expulsion of the trained vegetable item decreased markedly in the maintenance condition and remained low during the first follow-up meal.

Expulsion of all meat items was variable and high during baseline. During the training condition for this item, the percent of training bites expelled decreased to a mean of 19% of accepted bites. Similarly, the percent of probe bites of meat expelled decreased markedly during the training condition. Expulsion of the trained meat item remained low during the maintenance condition and the follow-up meal.

Food expulsion was scored on the majority of accepted baseline probe bites of fruit. When training procedures were implemented with the fruit item, the percentage of training bites expelled decreased to
a mean of 50% of accepted bites. Expulsion of probe bites of fruit did not decrease during training of that item or during the maintenance condition. However, during the follow-up meal, 0% of accepted bites were expelled.

Expulsion of untrained food groups did not change systematically with changes in treatment conditions. Table VIII shows the mean percentages of bites accepted, accepted bites expelled, and face-turning during the probe portion of the meal in each experimental condition as well as the mean number of grams consumed and expelled per condition. There was a decrease in acceptance of all foods during training of the first item, and an increase during each successive condition. The percent of food expulsion was relatively unchanged throughout all conditions, except for a marked decrease during the follow-up meal. Face-turning decreased with each successive condition and again increased during the follow-up meal. The mean number of grams consumed increased over baseline levels during the two training conditions but decreased again during the maintenance condition. The mean number of grams expelled decreased slightly during training of the first item but increased again, and remained unchanged during subsequent conditions.

The subject's weight as recorded by the nursing staff, did not vary systematically with changes in treatment conditions. At the end of the maintenance condition, she had gained 2 lbs. from her baseline weight. The nutritionist's evaluation of the child's diet during the maintenance condition indicated that there had been some improvement in oral nutrition although the majority of nutritional needs continued to be received via the gastrostomy tube.
Table VIII. Mean percentages per condition for each behavior scored for Subject 2.
### TABLE VIII

Mean Percentages per Condition for Each Behavior Scored for Subject 2

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Sessions</th>
<th>Mean Percent of Probe Bites</th>
<th>Grams Consumed</th>
<th>Grams Expelled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Acceptance (All Foods)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>17</td>
<td>72.9%</td>
<td>46.4%</td>
<td>23.8%</td>
</tr>
<tr>
<td>Training Item 1</td>
<td>14</td>
<td>66.1%</td>
<td>45.6%</td>
<td>21.1%</td>
</tr>
<tr>
<td>Training Items 2 + 3</td>
<td>7</td>
<td>90.1%</td>
<td>32.4%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>4</td>
<td>92.5%</td>
<td>43.3%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Four Week Follow-Up</td>
<td>1</td>
<td>70.0%</td>
<td>7.1%</td>
<td>30.0%</td>
</tr>
</tbody>
</table>
Case 3

Subject

Subject 3's behavior during assessment meals suggested the following feeding problems: selective nonacceptance of vegetable and liquid items; selective absence of mouth closure after accepted bites of fruit, vegetable, meat, starch, other and dessert items; selective expulsion of vegetable, meat and liquid items; and inappropriate mealtime behaviors (i.e., crying and face-turning). The nutritional evaluation indicated that her caloric intake was slightly inadequate and that her intake of coarse textured foods was grossly inadequate. The child's weight prior to the onset of this study was reported to be appropriate at 24 lbs. The evaluation conducted by an occupational therapist indicated that she had oral hypersensitivity, some involuntary tongue movements, poor lip closure, refusal to eat most coarse textured foods although she had the oral-motor ability to eat them, and excessive crying at meals. The occupational therapist recommended that the child be treated by Behavioral Psychology prior to receiving occupational therapy. To ensure weight maintenance, two snacks were to be given daily and free access to preferred foods was to be allowed at the dinner meal.

Observation

Sessions. Data were collected at breakfast and lunch, five days per week for the first two weeks of this study. For the remaining five
weeks, only the breakfast meal was monitored each day. This was done at the request of the occupational therapist so that she could begin work on appropriate cup drinking. All meals were conducted in the occupational therapy treatment room and each was 20 minutes in duration (40 bites).

**Dependent variables.** Data were collected at each meal on acceptance of the bite, mouth closure, food expulsion, crying and face-turning. Each meal was divided into two parts of 20 bites each. One 20 bite portion was considered the probe portion of the meal. During the training conditions, probe and training bites were interspersed with each other, throughout the meal. During baseline and maintenance conditions, the probe bites were arbitrarily determined to be the first of every two bites.

The child's weight was measured once each week by the nursing staff. The number of grams consumed was measured three times during each condition.

**Reliability.** Reliability observations were made during 43% of meals. Agreements on occurrences, nonoccurrences and occurrences plus nonoccurrences were, respectively, 100%, 100% and 100% for acceptance; 94%, 65% and 95% for mouth closure; 89%, 93% and 95% for food expulsion; 98%, 97% and 100% for crying; 96%, 99% and 99% for face-turning; and 98%, 97% and 100% for total inappropriate behavior.

Reliability observations on the pre- and post-weights of food were obtained on four occasions, once during each condition, yielding a mean percentage agreement of 98%.
Procedures

Baseline. The first nine meals were baseline sessions for all foods.

Training. Items selected for training with Subject 3 were first a nonpureed starch item (bread) and later a meat/egg item (scrambled eggs) and a vegetable item (green beans). During each meal, training procedures were implemented during only 20 bites which were randomly interspersed throughout the meal.

Training procedures were implemented with the starch item beginning on Session 10. Simultaneous presentation of the starch item and a preferred item (fruit or ice cream) occurred during the first four meals. Over the remaining nine meals, delivery of the preferred food was made contingent upon acceptance of the training item. The reinforcement schedule was CRF throughout training of this item.

Training of the starch item was discontinued after Session 22 and training was begun on the meat/egg and the vegetable items. Ten training trials of each item were presented at each meal. The preferred item and the training item were delivered simultaneously during the first two training meals. For the remaining eight meals, the delivery of the preferred item was contingent upon acceptance of the training item. The schedule of reinforcement was a CRF during all meals of this condition.

Maintenance. Maintenance procedures were implemented for the starch item on Session 23 (immediately after the termination of training on that item). Maintenance procedures were implemented with all other food items during Session 33 (immediately after the training of
the second two items was discontinued). The initial schedule of reinforcement was a CRF for all trained items and 50% of accepted bites of items that were never trained. The schedule of reinforcement was then leaned so that three of eight accepted bites of trained items were reinforced and one of four accepted bites of untrained items was reinforced.

Follow-up. Follow-up data are not yet available. The child was ill and missed the follow-up meal scheduled for four weeks after the termination of the maintenance condition.

Parent training. The child's mother was trained to implement all procedures and demonstrated their correct use at one meal prior to the child's discharge.

Results

Figure 3 shows the percentage of probe bites that were accepted (circles) and the percentage of accepted bites that were expelled (open squares) of starch, vegetable, meat/egg and other items. (Graphic data are not presented for fruit items since these items were used as reinforcers, for dessert items since these were rarely present on the tray or for liquid items since these items were trained by the occupational therapist.) The percent of probe bites accepted of both training starch items (open circles) and untrained starch items (closed circles) was high throughout the baseline period. When training procedures were implemented, the percent of training bites accepted was very high (mean 95%). There was a slight decrease in acceptance of probe bites of starch items immediately after training of this item began. However, by the end of the condition, acceptance again increased to 100% of
Figure 3. The percentage of probe bites accepted by Subject 3 for training items (open circles) and untrained items (closed circles), and the percentage of accepted bites that were expelled (open squares) from starch, meat/egg, vegetable and other food groups.
FIGURE 3
probe bites. Acceptance remained at 100% during all maintenance sessions.

Acceptance of both trained and untrained vegetable items occurred on 100% of probe presentations during eight of the nine baseline meals. Following implementation of training procedures, 100% of vegetable training bites were accepted. Similarly, 100% of probe presentations of vegetable items were accepted during the training condition for that item and during the maintenance condition.

The percent of probe bites of all meat/egg items accepted was 100% during all but the first two baseline sessions. During the training condition for this item, 100% of both training and probe bites were accepted. All maintenance bites were also accepted.

The percent of accepted starch probe bites that were expelled was high and somewhat variable during baseline. Expulsion of training bites decreased to a mean of 19% of accepted bites during the training of this item. Following implementation of training procedures, the expulsion of starch probe bites also decreased markedly. The expulsion of probe bites during the maintenance condition continued to occur at low rates.

Expulsion of baseline probe bites of vegetable items typically occurred on 50% of accepted bites in the baseline phase. When training procedures were begun, expulsion of training bites dropped only slightly to a mean of 39% of accepted bites. However, during the probe portion of the meal, the percent of accepted bites expelled dropped markedly so that on the last four days of the training of this item, no bites were expelled. Expulsion of vegetable items remained at 0% during
the maintenance condition.

The percent of meat/egg probe bites that were expelled was quite variable during baseline. When treatment procedures were implemented, the percent of training bites expelled decreased to a mean of 20%. Food expulsion occurred on 0% of probe meat/egg bites during nine of the 10 sessions of training with this item. The percent expulsion remained at 0% throughout all maintenance meals.

The percent of bites accepted of untrained food items did not change systematically with changes in treatment conditions. However, with other food items, there was a gradual decrease in expulsion during the training of the first item. The percent of liquid items accepted also increased immediately after the occupational therapist began to work on increasing acceptance of liquids from a cup. The percent of expulsion of liquid items tended to be high for the duration of the study. Acceptance of untrained starch, vegetable and meat/egg items was comparable to levels of trained items from these groups.

Table IX shows the mean percentages for all foods of acceptance, expulsion and mouth closure; the mean percentages of total inappropriate behaviors, crying and face-turns; and the mean number of grams consumed and expelled for each experimental condition. The percent of bites accepted increased during each of these first two training conditions and remained high during the maintenance condition.

The mean percent of accepted bites expelled decreased with each subsequent condition. The percent of bites after which mouth closure was scored increased to near 100% of accepted bites during the training of the starch item and was 100% during the last two conditions. The
Table IX. Mean percentages per condition for all behaviors scored for Subject 3.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Sessions</th>
<th>Mean Percent of Bites</th>
<th>Mean Percent of Bites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Acceptance (All Foods)</td>
<td>Closure (All Foods)</td>
</tr>
<tr>
<td>Baseline</td>
<td>9</td>
<td>74.4%</td>
<td>76.0%</td>
</tr>
<tr>
<td>Training Item 1</td>
<td>13</td>
<td>80.0%</td>
<td>95.7%</td>
</tr>
<tr>
<td>Training Items 2 + 3</td>
<td>10</td>
<td>95.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>8</td>
<td>94.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
percentage of total inappropriate behaviors and face-turning decreased during each of the two training conditions and remained essentially unchanged during the maintenance phase. The mean percentage of crying decreased markedly during training of the first item and was 0% during the last two conditions.

The mean number of grams consumed increased during each successive condition. The mean number of grams expelled, however, remained essentially unchanged.

The child's weight decreased slightly during the baseline period, to one and a half pounds less than her initial weight. Her weight increased during training of the first item, decreased slightly during training of the second items and increased again during the maintenance phase. The variability in her weight appeared to be partially due to the fact that it was not always possible for snacks to be delivered and the variability in the amount of food consumed on weekend home visits. At the end of this study, the child's nutritionist reported that nutritional intake was appropriate, as was her body weight.

Discussion

Results of the multiple baseline analysis demonstrated the effectiveness of behaviorally based treatment procedures in increasing the acceptance of each item trained with Subjects 1 and 2. Acceptance of each trained item was near zero for Subject 1 during baseline sessions and was variable for Subject 2. In both cases, a marked increase in acceptance occurred only when treatment procedures were implemented. Acceptance of items from untrained groups did not change systematically.
with changes in treatment conditions. The effects of training also generalized to untrained items from the same group as training items. The effects of training procedures in increasing acceptance was not demonstrated with Subject 3 since she accepted almost all bites presented during all conditions.

Data obtained during the follow-up meals for Subjects 1 and 2 demonstrated continued high levels of acceptance, although with each of the subjects it was necessary to reinforce acceptance of one of the items trained. Presumably, the maintenance of treatment effects was due to the implementation of training procedures by the child's parents. The fact that two subjects did not accept one item until it was reinforced suggests that the reinforcement schedule should be leaned further than was the case in the present study.

The treatment program resulted in a clear nutritional improvement in two of the three subjects. At the end of treatment, caloric and vitamin supplements were no longer necessary for Subjects 1 and 3. The change in Subject 2's nutritional status was somewhat more questionable since she received the majority of her caloric and nutritional needs via the gastrostomy tube feedings. However, it appears appropriate to increase consumption of a balanced diet as a pre-requisite to removal of the gastrostomy tube.

There was a marked increase in the number of grams consumed in two of the three subjects suggesting that the quantity of food increased as the number of grams did. With Subject 2, however, there was no increase in the number of grams consumed although the number of accepted bites increased. Thus, it is possible that bite sizes were variable
over the course of the study. It is also possible that the recorded weights were lower during the maintenance condition because of limited sampling. Since weights of foods were recorded only occasionally and the weights of different food items varied considerably, the weights may have been recorded at meals where relatively light foods were present.

It is interesting to note that the training procedures were effective in decreasing expulsion although no contingencies were ever placed on this behavior. The one exception to the decrease in expulsion was with one of the three items trained with Subject 2. Unfortunately, the maintenance condition was not of sufficient duration to determine if the percentage of expulsion would decrease. One would expect such a decrease since maintenance conditions were very similar to training procedures which had been effective in decreasing expulsion of training bites. However, the child was discharged from the hospital after the last maintenance session.

In the present study, the same set of independent variables was employed to treat several different feeding problems (i.e., nonacceptance and expulsion). This was done since it was necessary to ensure that acceptance occurred on a high percentage of trials prior to intervening on the next behavior in the chain since acceptance is a pre-requisite to appropriate swallowing (i.e., not expelling). However, reinforcement of acceptance also led to a decrease in expulsion. There are several possible reasons for this decrease. First, the simultaneous presentation of a preferred food and a nonpreferred one may make it more likely that appropriate swallowing will occur, since it is difficult to consume
the preferred item and not the nonpreferred one. Second, it is possible that after a history of reinforcers being delivered contingent upon acceptance of the nonpreferred item, the item becomes a preferred one as a result of the frequent pairings with preferred foods. Finally, using the treatment procedures described above, swallowing (i.e., not expelling) was undoubtedly intermittently followed by the delivery of the preferred food.

The effectiveness of these treatment procedures with other types of feeding problems was not demonstrated in this study. Mouth closure did increase with Subject 3 at the onset of training of the first item. However, mouth closure also occurred after acceptance of items that had not been trained. Thus, a demonstration of functional control was not possible. All three subjects in this study also exhibited selective feeding problems. The extent to which these procedures would be useful in treating nonselective feeding problems (i.e., complete food refusal) cannot be determined from the present data. Certainly, it would not be possible to use a simultaneous presentation of a preferred and a nonpreferred food if the child did not consume any foods by mouth. Other reinforcing events would need to be identified.

The procedures described above may not be appropriate for use with a self-feeding child. Modification of the observation system would be needed to create a more naturalistic (free operant) feeding situation as opposed to a trial by trial one. It would also not be possible to employ a simultaneous presentation procedure since the subject would be presenting all the bites. It would probably be better to use a contingent presentation of the preferred food.
Implementation of the treatment procedures in the present study did not appear to place the children at risk for any medical problems. However, it is still necessary to closely monitor the child's medical status while conducting any feeding program. The present study accomplished this by obtaining frequent body weights, physical examinations and nutritional evaluations. The frequency with which these measures are obtained could be reduced with selective feeding problem children whose health status and weight are normal. Thus, it might be possible to implement treatment procedures on an outpatient basis. However, with children having numerous medical problems such as the subjects in this study, an inpatient program appears to be indicated.
GENERAL DISCUSSION

The assessment and treatment procedures described in these studies were found to be useful in identifying and treating several specific feeding problems. Both studies contributed methodological improvements above previous available research on the treatment of childhood feeding problems.

Herbert-Jackson and Risley (1977) used a similar combination of behavioral and nutritional measures to assess feeding preferences. However, the current study describes procedures which may be more useful with children who do not self-feed and also examines the component responses of appropriate feeding.

Similar treatment procedures were described in several previous studies on food refusal (Bernal, 1972; Clancy et al., 1969; Thompson & Palmer, 1974; Thompson et al., 1975). However, in the present study, controlled data were collected on the specific foods consumed and reliability measures reported. In addition, treatment procedures were clearly specified to enable a successful replication of this study. A further advantage was that the present research provided a clearer demonstration of functional control than was done in the previous studies.

Although the present assessment and treatment procedures were useful with these subjects, there are several improvements and extensions which could be made in future research. Data could be obtained from implementation of the assessment procedures with a larger number of

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developmentally delayed and normal children. These data would aid in the validation of the criteria employed for determination of feeding problems or would suggest changes in these criteria. The assessment instrument could also be expanded so that it would be possible to compare feeding techniques employed by the parents of children who exhibit feeding problems with non-feeding problem children. This might enable a determination of the variables controlling appropriate and inappropriate feeding behavior. Both the assessment and treatment procedures would benefit from a more detailed nutritional analysis of each child's diet. In addition, the assessment and treatment strategies could be implemented with children exhibiting more serious medical problems, such as complete food refusal (i.e., tube fed) children and patients diagnosed as failure to thrive. The effects of treatment procedures similar to those employed in this study might also be investigated in the treatment of various oral-motor problems.

In summary, both the assessment and treatment procedures appear to be useful tools to employ with inpatients identified as having feeding problems. Further validation of the assessment instrument, and replication of treatment effectiveness with other feeding problems is still necessary.
REFERENCES


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