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DIFFICULTIES

Functional Assessment and Behavioural Intervention for Eating Difficulties in Children  
with Autism: A study Conducted in the Natural Environment using Parents and ABA Tutors  
as Therapists

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### Abstract

Two functional assessments (interview and direct observation) were used with three children with autism to identify the functions maintaining mealtime behaviour including acceptance, mouth clean, refusal, and other disruptive behaviours such as crying and pushing the spoon. Based on results of the functional assessments it was hypothesized that appropriate and disruptive mealtime behaviour was maintained by different contingencies. A non-concurrent multiple baseline design across participants was utilized to validate the effectiveness of the intervention. Intervention for all participants included presentation of food on a spoon for 30 seconds unless acceptance occurred. Acceptance resulted in putative reinforcement. The meal ended after 20 presentations. For all participants, acceptance and mouth cleans increased while disruptive behaviour decreased, and effects were maintained at follow-up.

Key words: Eating, functional assessment, reinforcement, escape extinction, autism.

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Inadequate development of eating can have serious short and long-term implications for children. Children who are unable to consume sufficient calories may suffer malnutrition, growth retardation, lethargy, weight loss, and aspiration (Howard & Cronk, 1983; Martin, 1973; Rogers, Stratton, Msall, & Andres, 1994; Rosso & Winick, 1973). Complications from feeding problems can range from mild (e.g., missed meals) to severe (e.g., malnourishment or failure to thrive) (Polan et al., 1991). Eating disorders during mid-childhood have been categorized into three groups. The first group is eating disorders that begin during infancy or early childhood and continue to present with serious problems for children during school age, including infantile anorexia and sensory food aversions. The second group is posttraumatic eating disorder, which can occur at any age from infancy to adulthood, and the third group is early onset of the classic eating disorders anorexia nervosa and bulimia nervosa (Chatoor & Surles, 2004).

Approximately 80% of people with a severe and profound learning disability and one third of the total population with a developmental disability have some feeding problems (Palmer, Thompson, & Linscheid, 1975; Perske, Clifton, McClean, & Stein, 1977). Williams, Dalrymple, and Neal (2000) reported 67% of 100 parents of children with autism described their child as a poor eater. However, 73% reported that their child had a good appetite for preferred foods. Texture, appearance, taste, smell, and temperature were factors that parents reported as influencing food selection. The most frequently reported problem behaviours were refusal to try new food, taking medicines, food selectivity, mouthing objects, and rituals surrounding eating. In addition, a wide array of problem behaviour was reported. Other studies have reported similar findings and also other feeding problems, such as lack of

independent feeding skills, rumination, vomiting, pica, and food stealing (Sisson & Van Hasselt, 1989; Matson & Kuhn, 2001).

Eating difficulties rarely have one identifiable cause, but may be attributable to organic impairments, such as physiological abnormalities, such as anatomical defect, neurological dysfunction and metabolic imbalance (Brown, Davis, & Flemming, 1979) or environmental factors (Iwata, Riordan, Wohl, & Finney, 1982). Reinforcement of behaviour incompatible with eating can become a maintaining factor for those behaviours that may initially have had a physical etiology (Iwata et al., 1982). Negative reinforcement in the form of escape from eating has been hypothesized to be a major maintaining factor of feeding problems (Cooper et al., 1995; Iwata, 1987; Patel et al., 2002; Piazza et al., 2003).

Few studies address the etiology of feeding disorders, with most focusing on treatment (Piazza, Fisher et al., 2003). Piazza, Fisher et al. applied the functional analysis described by Iwata, et al. (1982/1994) to the inappropriate meal time behaviours of 15 children in an intensive program for assessment and treatment of severe feeding disorders. A descriptive assessment of the children and their parents during meals was conducted. Following that, an analogue functional analysis using a reversal design was carried out, implementing consequences identified in the descriptive assessment. Piazza, Fisher et al. concluded that parents used a variety of consequences for inappropriate behaviour but without functional analysis it would have been virtually impossible to evaluate which combination of consequences affected behaviour. The results are suggested as partial support for the hypothesis proposed by other investigators that feeding problems are maintained by negative reinforcement. However, Piazza, Fisher et al. also found that positive reinforcement contributed to maintenance of inappropriate behaviours in over half the cases and tangible items for 13% of the children.

Assessment of feeding disorders in the natural environment has not been widely researched to date. Some studies have utilised interview and direct observation to facilitate the identification of variables associated with the onset and maintenance of food refusal (e.g. Sprague, Flannery and Szidon, 1998). Hypotheses derived from observations have been used to develop interventions that consisted of modifying the reinforcement contingencies that were present in the child's mealtime environment. Sprague, Flannery and Szidon (1998) conducted a functional analysis of problem behaviours (spitting and whining) in a 13 year old girl with severe mental retardation and cerebral palsy. A functional assessment was conducted by interviewing the family and classroom staff regarding eating problems at home and school (O'Neill et al., 1997). The student was then observed in the regular lunchroom setting. Based on the interview and observation, two separate functional assessments were conducted in the school classroom; an analysis of trainer attention and control of eating pace. Analysis of food presented with attention and without attention identified attention was not a maintaining factor. Analysis of presentation of the food by a teacher versus student paced eating identified problem behaviour was highest when access to food was contingent on problem behaviour and lowest when contingent on the student grasping the spoon. Intervention of reinforcement for spoon grasping and a 10 second removal of food following problem behaviour resulted in reduction of spitting and whining during meals. Sprague, Flannery and Szidon (1998) demonstrated results of a functional assessment can be used to first determine the components of a meal that contribute to the performance of problem behaviour and then to address those variables in the development of an intervention procedure.

Girolami and Scotti (2001) utilised an analogue experimental functional analysis of behaviour to assess the interaction between three children and their parents to assess food refusal and related mealtime behaviour problems. The children had a variety of disorders,

exhibited significant speech and motor delays, and two had complicated medical histories. The analogue functional analysis was conducted directly in the home utilizing experimental conditions that resembled the contingent relationships associated with the maintenance of problem mealtime behaviour. The analogue functional analysis was supported by indirect methods of assessment; the Functional Assessment Interview Form (FAIF; O'Neill, et al. 1997), a descriptive (ABC) analysis, and the Motivation Assessment Scale (MAS; Durand and Crimmins, 1988). Girolami and Scotti identified the FAIF, MAS and clinical observations as having a high level of agreement with the analogue functional analysis. This is identified as indicating that full analogue functional assessment is not necessary, although it is acknowledged that analogue functional assessment may have advantages in avoiding certain biases, such as caregivers not being accurate reporters of behaviour and contingencies or demonstrating different behaviour due to being observed. Girolami and Scotti suggested interviews, questionnaires and direct observations can provide important information about the potential antecedents, setting events and consequences for feeding difficulties. Furthermore, they suggested these methods can be viewed as a sufficient and reliable step in the identification of function and subsequent development of an intervention plan. If an intervention is then not successful it is suggested that the use of analogue functional analysis may then be utilised.

A “wait and see” approach is often recommended by professionals with the idea that the child will outgrow feeding problems. However, if food selectivity results in the child failing to eat a sufficient variety of foods, the child will not maintain nutritional status required to grow; in these cases food selectivity may present a more serious health risk (Piazza et al., 2002). Research on feeding problems has focused on increasing acceptance and reducing inappropriate behaviour during meal times, demonstrating that behavioural interventions are effective in increasing food consumption in children who demonstrate

selectivity or eat too little (e.g., Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Coe et al., 1997; Patel, Piazza, Martinez, Volkert, & Santana, 2002; Riordan, Iwata, Finney, Wohl, & Stanley, 1984; Werle, Murphy, & Budd, 1993).

Studies have utilized positive reinforcement to increase acceptance and mouth clean in children with eating difficulties (e.g. Coe et al., 1997; Riordan et al., 1984). Various elements of the delivery and type of positive reinforcement used to increase eating have been employed, including simultaneous or delayed reinforcement and primary or secondary reinforcement. Piazza et al. (2002) utilized differential reinforcement and identified simultaneous reinforcement (delivery of a preferred food with a non-preferred food) as being more effective than delayed reinforcement (delivery of a preferred food following acceptance of a non-preferred food) for three children with food selectivity. Various studies have utilized secondary reinforcement (e.g. toys) in increasing acceptance behaviour (e.g. Kahng, Tarbox and Wilke, 2001) while others have found secondary reinforcement less successful than primary reinforcement (e.g. Riordan et al., 1984).

Negative reinforcement is a potentially maintaining factor for inappropriate mealtime behaviour. Escape extinction (defined as either non-removal of the spoon until acceptance occurs, or physical guidance of the food into the child's mouth) has been used in the treatment of eating difficulties maintained by negative reinforcement (e.g. Piazza, Patel et al., 2003; Patel et al., 2002; Reed et al., 2004; Ahearn et al., 1996). Piazza, Patel et al. (2003) demonstrated that positive reinforcement alone was not effective in increasing consumption of food, but food consumption increased when escape extinction was introduced whether reinforcement was present or not. There was a smaller extinction burst of inappropriate behaviour when reinforcement was used, for some participants. This is similar to the findings of Patel et al. (2002) and in contrast to Riordan et al. (1980, 1984) where reinforcement alone increased acceptance. Piazza, Patel et al. suggested a possible explanation for this could be

that all participants in their study exhibited total food refusal which resulted in few opportunities to contact the reinforcement contingencies where as the participants in Riordan et al. exhibited food selectivity, therefore resulting in increased opportunities to contact reinforcement. In addition, Piazza, Patel et al. suggested the reinforcement based treatments may have been ineffective due to the method by which preferred stimuli were selected. In contrast, Kahng, Tarbox, and Wilke (2001) did not utilize escape extinction or a consequence for expulsion and increases in acceptance and decreases in expulsion were demonstrated. Response cost was used as a less intrusive alternative to escape extinction or physical guidance. This would suggest that positive reinforcement for mouth clean was sufficient to decrease expulsion.

Since children typically eat mainly at home and at school, and are provided with food or fed by their parents, it is important to consider these variables when evaluating eating difficulties. Some studies have examined the use of treatment in the natural setting, giving the advantage of allowing these variables to be assessed directly. Gutentag and Hammer (2000) conducted treatment of a three year old girl with food aversion, receiving all nutrition via a gastronomy tube, in the child's home and school; treatment was conducted by parents and teachers. Social praise and access to preferred toy play were provided for food acceptance and food refusal and disruptive behaviours were ignored. Increases in oral acceptance of food were seen, demonstrating the effectiveness of parent and teacher led intervention in the natural setting. Werle, Murphy and Budd (1993) utilised a non-concurrent multiple baseline design to investigate the effects of parent training on parent and child feeding related problem behaviours during meal times in three boys with developmental delay and their mothers. Following training on food type and texture, providing attention to appropriate behaviour, ignoring disruptive behaviours and saying no to expulsions and attempts to leave, increases were seen in acceptance in all three children. Training parents as primary treatment agents,



documenting mealtime interactions in the home and providing home based treatments were all identified as effective within this study.

Few studies include parental involvement in assessment and treatment of eating difficulties. Najdowski, Wallace, Doney, and Ghezzi (2003) evaluated the effects of a parent-conducted functional analysis and treatment on food selectivity in a child with autism. Treatment consisted of differential reinforcement of an alternative behaviour (DRA), escape extinction, and demand fading. Najdowski et al. (2003) demonstrated the effectiveness of functional analysis in identification of treatment of food selectivity. The resulting treatment packages were implemented by parents with little supervision. The results showed increases in food consumption and generalization and maintenance were demonstrated.

Mueller et al. (2003) utilized parent training packages to implement pediatric feeding protocols. Treatment integrity was investigated after a multi-component method was used to train parents. The effectiveness of the multi-component treatment package was evaluated to determine if fewer components could produce similar levels of procedural integrity. The components evaluated included verbal instructions plus modeling, verbal instructions plus rehearsal, and verbal instructions alone. Results indicated parents could be trained to implement intervention procedures for their children's feeding difficulties, and that training packages for parents may require only two components. Mueller et al. suggested that one variable in the success of the training procedures may have been that the parents were highly motivated as their children had severe eating difficulties and had received other treatments in the past without success. Therefore, parents in this situation may be more likely to follow professionals' instructions.

In the present study, functional assessments (O'Neill et al., 1997) were used to analyze mealtime behaviour in three children with autism and an intervention was developed for each child based on the outcome of the functional assessment. Treatment was designed to be

implemented by the parents and tutors and carried out in the child's home as part of regular therapy sessions.

Phase 1 was designed to conduct an assessment of mealtime behaviour in three children with autism. The assessment consisted of two components: Functional Assessment Interview (FAI) and Functional Assessment Direct Observation (FAO; O'Neill et al, 1997). During the FAI the experimenter interviewed the parents to gather information on the problem behaviour, using the FAI form. Following information gathering, observation is essential before hypotheses regarding maintaining factors and possible effective interventions are developed; these should be data driven. In an attempt to achieve this, the FAO was utilized, in which a typical feeding session was videotaped and the child's behaviour was scored using the FAO form. In Phase 2 the results from the FAI and FAO were used to develop hypotheses regarding effective intervention programs to address behavioural excesses and deficits in eating for each child.

## GENERAL METHOD

### *Participants*

The participants were three pre-school aged children with autism receiving home-based Early Intensive Behaviour Intervention for 40 hours per week (EIBI; Hayward, Eikeseth, Gale, & Morgan, 2009; Hayward, Gale, & Eikeseth, 2009). The participants, John, Robert and Bill were aged 46, 30 and 52 months and had been in treatment for 9, 6 and 17 months respectively. The participants had been diagnosed by independent agencies and met the diagnostic criteria for autism according to the ICD-10 (World Health Organization, 1992) confirmed by the Autism Diagnostic Interview – Revised (ADI-R; Lord et al., 1994). The participants were examined by their local general practitioner to ensure there were no medical reasons for the intervention not to take place.

Participants included in the study were referred by their parents, who requested assistance in improving their child's mealtime behaviours and primarily in increasing acceptance of new textures and flavours. John and Robert only accepted pureed foods and their parents initially asked for help in teaching them to eat more difficult textures and new flavours. Bill displayed limited food intake and demonstrated food refusal for various types of food (e.g. would eat chicken nuggets, but would not accept other types of chicken), and did not eat fruit or vegetables. The types of feeding difficulties demonstrated by the participants in this study were less severe than those demonstrated by participants in the majority of research previously conducted in this area. In order to gather more information on the children's specific eating behaviour the FAI and FAO were conducted; this is described in more detail below.

#### *Setting and Materials*

The study was conducted in each of the participant's homes in the rooms where the child was usually fed. A video camera was used to record the FAI, FAO and the intervention for all participants.

#### *Response Definitions*

Two sets of responses were defined: Eating behaviour and concurrent disruptive behaviour. Eating behaviour included acceptance, refusal, mouth clean and expulsion. Acceptance was defined as food passing the lips and being taken from the spoon into the mouth. Mouth clean was defined as the mouth being cleared of food. Refusal was defined as food not passing the lips and not being taken from the spoon into the mouth. Expulsion was defined as food passing out of the mouth and past the lips.

Disruptive behaviour included crying, shouting, pushing food away, self-injury, aggression, attempting to leave, turning head away. Crying was defined as appearance of tears or wetness of the eyes. Shouting was defined as an angry vocalization (words or no

words), and angry noise. Pushing food away was defined as the child touching the spoon or feeder's hand and moving the spoon away from them. Self-Injury was defined as aggressive actions directed to self, the child's hand making contact with the head or any other part of the body with force. Aggression was defined as aggressive actions directed towards the feeder with the child's hand making contact with any part of the feeder with force e.g. hitting, scratching. Attempts to leave was defined as moving upwards, sideways or forwards to try and leave the seat, attempting to undo the strap on the chair or attempting to push the table away (dependent on type of seating). Turning head away was defined as moving the head away from the spoon in any direction, i.e. down, up, to the side.

#### PHASE 1: FUNCTIONAL ASSESSMENT

The FAI was based on O'Neill et al., 1997, and included questions on eating (e.g., "What foods does your child eat at the present time?"); current eating environment (e.g., "Does s/he refuse regularly accepted foods if they are not presented with particular utensils (spoon, plate, etc)?"); previous food refusal (e.g., "Has s/he ever eaten foods in the past that s/he will not eat now?"); current behaviour when presented with new foods (e.g., "Describe what happens when you present a new food to your child"); setting events (e.g., "Describe the sleep patterns of your child", "In what way do you think this affects his/her eating behaviour?"); antecedent events (e.g., "What time of day, if any, is your child most and least likely to accept or reject new foods?"); consequences (parents were asked to describe specific consequences for eating); and finally, previous strategies (e.g., "What strategies have you found to be effective or ineffective in getting your child to accept new foods?"). The information gained from the FAI was used to identify foods that were then used for the FAO sessions and the subsequent eating intervention.

During the FAO the parents were instructed to carry out the meal as they typically would; including setting, materials, and providing consequences for appropriate and

disruptive behaviours. The parents decided when to end the meal and the FAO ended when the child was allowed to leave. Each occurrence of antecedents, eating, perceived functions and actual consequences (O'Neill et al., 1997) were recorded through observation of the videos of each child.

The first author scored the FAO video tapes for all three participants. A second observer, who was experienced in working with children with autism on behavioural programs and conducting functional assessment, scored two participants FAO video tapes. Interobserver agreement was calculated by totaling the number of agreements and dividing by number of agreements plus disagreements. An agreement was defined as both scorers recording the occurrence of a specific predictor, behaviour, or actual consequence, and both scorers recording the same perceived function. Overall agreement for predictors, behaviours, perceived functions and actual consequences was 83%, 76%, 82% and 77%, respectively.

## Results and Discussion

### *Functional Assessment Interview (FAI)*

John's father reported that John currently ate baby food (7 – 12 month jars), but did not consistently accept this. Although the initial parental request was to teach John to eat new textures and flavours, the FAI identified that it was difficult to feed him due to high incidences of food refusal (food not being accepted into the mouth) and disruptive behaviour (e.g. shouting, pushing food away). In addition he often missed meals (typically one per day) due to food refusal and during the FAI his father reported he was concerned about his overall food intake. This information therefore identified that the target for John was to increase acceptance and decrease disruptive behaviours when current foods were presented. The FAI indicated that John received varied consequences for appropriate eating and disruptive behaviour. His father reported sometimes providing access to a video, removing food, and allowing the child to leave the situation temporarily or permanently contingent on

appropriate eating behaviour, although he did not implement these consequences consistently. However, he also reported often allowing the child to leave the situation temporarily or permanently contingent on refusal and disruptive behaviour (e.g. trying to escape, pushing food away, crying, screaming). In addition, the father reported occasionally keeping the child in the meal situation contingent on refusal and disruptive behaviour. On some occasions the child would then eat, on other occasions the child would continue to refuse and the father would allow him to leave. This information suggested the child's refusal and disruptive behaviour may be negatively reinforced. In addition, access to a video and escape from food or the meal situation were not always presented following appropriate eating.

Robert ate homemade pureed food or 7 month baby food jars, but did not consistently accept those foods. Although the initial parental request was to teach Robert to eat new textures and flavours, the FAI identified that it was difficult to feed him due to high incidences of food refusal (food not being accepted into the mouth) and disruptive behaviour (e.g. shouting, pushing food away). In addition he often missed meals (typically one per day) due to food refusal and during the FAI his mother reported that she was concerned about his overall food intake. This information therefore identified that the target for Robert was to increase acceptance and decrease disruptive behaviours when current foods were presented. The parent report in the FAI indicated Robert received positive consequences for appropriate behaviour, as his mother praised him or gave him a toy; however he also received continuous access to potentially reinforcing items throughout the meal as he had toys on the tray of his high chair. His mother reported pushing the spoon into Robert's mouth and ignoring any disruptive behaviour (e.g. crying, screaming) when he demonstrated refusal; he was unable to escape the situation as he was fed in a high chair. This information suggested he was

receiving potential noncontingent positive reinforcement (access to toys) throughout the meal.

Bill did not eat any fruit or vegetables and had a limited diet that included mainly starchy foods such as fish fingers, chips, pasta, and cereal. The FAI indicated that varied consequences followed appropriate and disruptive behaviour when new foods were presented. His mother reported providing praise and a dessert for accepting new foods although this happened rarely. Bill received attention for refusal (e.g. encouraging him to eat the food, telling him he had to eat it, etc.) and also escaped the situation (i.e. he was allowed to leave the table and the food) when he chose to. This information suggested Bill had been receiving potential positive reinforcement for acceptance and potential positive and negative reinforcement for refusal of new foods.

*Functional Assessment Direct Observation (FAO)*

John's father presented him with 7 month baby food from a jar and fed him in a swing in the garden, sitting on his knee, and also at a child's chair and table in front of a television. The meal lasted for 16 minutes and 26 seconds. During this time there were 42 opportunities for John to eat the food (when the spoon was presented) and he accepted and swallowed with no disruptive behaviour on 26 occasions (62%), the remaining 16 mouthfuls (38%) were refused and disruptive behaviours were demonstrated. The scorer observed that when John refused he either turned his head away, pushed the spoon away or attempted to leave the chair; he also demonstrated crying and shouting. The perceived function, scored immediately following observation of these behaviours, was to escape or avoid the food. The actual consequences he received for refusal and disruptive behaviour included removal of the spoon, attention from his father (e.g. "Good boy") being given a preferred toy, being prevented from leaving, and giving him a break. When he demonstrated acceptance, he received attention from his father, or received a preferred item, such as a toy or access to a

video. The results of the FAO indicated that acceptance, refusal and disruptive behaviour resulted in access to desired toys (a potential positive reinforcer) and the spoon was removed or he was given a break (potentially negative reinforcers).

Robert was fed in a high chair and his mother presented him with 7 month baby food from a jar. The meal lasted for 17 minutes and 18 seconds. During this time there were 112 opportunities for Robert to eat the food. Of the 112 opportunities, 90 were when the food was pushed directly into his mouth and 22 were when the spoon was presented in front of his mouth. Robert accepted the 90 mouthfuls (80%) that were placed directly into his mouth and refused the 22 mouthfuls (20%) presented to him on the spoon. Disruptive behaviours were demonstrated on 30 (27%) occasions, which included mouthfuls he accepted and refused. Robert gagged on four occasions when the food was placed into his mouth. The scorer observed that when food was presented to Robert on the spoon this resulted in refusal through turning his head away, pushing the spoon away and shouting. The perceived function, scored immediately following observation of these behaviours, was to escape or avoid the food. The actual consequences the mother delivered were continued access to a toy, presentation of a preferred toy and brief removal of the food. When the mother placed the food directly into the child's mouth, this resulted in acceptance with the child occasionally pushing the spoon away, turning away, shouting, gagging and coughing. The perceived function of the acceptance, scored immediately following observation, was to either obtain the food, or to escape the demand being placed on him. The actual consequences delivered by the mother were continued access to a toy, with occasional presentation of juice and verbal praise. The results of the FAO suggested that when Robert refused food he received access to a toy (a potential positive reinforcer) and/or the food was removed (a potential negative reinforcer), or the food was placed into his mouth (presenting a potentially aversive stimulus). When he accepted food he received access to a toy or juice and verbal praise



(potentially positive reinforcers) and escape from the demand (a potential negative reinforcer).

Bill was sitting at a table and was self-feeding; he was presented with chicken breast pieces and peas which were non-preferred foods, and rice and bread which were preferred foods. His mother and sister were also sitting at the table. The meal lasted for 10 minutes and 40 seconds and during that time the food was on the plate in front of him. On two occasions his mother picked up a non-preferred food and presented it to his mouth, this was refused and accompanied by disruptive behaviour (shouting and pushing the food away). On eight occasions his mother asked him to eat the non-preferred food, this resulted either in disruptive behaviour or no response. On one occasion his mother modelled eating the non-preferred food from Bill's plate, which resulted in him picking up the food and giving it to her. During the meal, Bill ate 25 mouthfuls of the preferred foods (rice and bread) and no mouthfuls of non-preferred foods (chicken and peas). He demonstrated disruptive behaviour on nine occasions when prompted to eat non-preferred foods. The FAO for Bill identified a variety of antecedents that led to behaviours where the perceived function was to escape or avoid the non-preferred food, e.g. the food was held up to the child by his mother and he pushed it away. The actual consequences for the refusal were a combination of continued access to preferred foods, which were on his plate, removal of the non-preferred food, the mother eating the non-preferred food, or no consequence. The child selected preferred or recently preferred foods from his plate, which resulted in a combination of occasional praise, a verbal instruction to eat the non-preferred food, or no consequence. The results of the FAO demonstrated Bill received potentially positive (access to preferred foods), and negative (removal of the non-preferred food, for example his mother eating it) reinforcement for food refusal. He received positive reinforcement (eating the food, and praise) for eating preferred

and recently preferred foods. Being instructed to eat the non-preferred food when he had eaten a preferred food could also act as punishment for eating preferred food.

The combination of the information gained from the FAI and FAO identified that all three participants typically escaped undesired food during eating situations. In addition participants often received potential positive (e.g. attention or access to preferred toys) or potential negative (e.g. removal of the spoon) reinforcement contingent on refusal and disruptive mealtime behaviour (e.g. pushing the spoon away, shouting). All three participants received intermittent positive reinforcement as a consequence for accepting foods.

Conducting both the FAI and FAO provided different information on the contingencies occurring during meal times. Table 1 shows the contingencies identified from both the FAI and the FAO and the intervention implemented based on this information. For example, John's father reported during the FAI that he provided positive reinforcement for acceptance, but did not report providing positive reinforcement for refusal, which was observed during the FAO. In addition, detailed information on the eating situation was not always gained from the FAI, for example, although the parents of John and Robert reported typical meal times as being very difficult they did not describe the behaviours their children demonstrated accurately. The FAO provided further information on the actual antecedents, behaviours and consequences that occurred during meal times. The FAI with the mother of Bill did not provide detailed information of what happened when the child was sitting at the table with the new food in front of him. The FAO did provide this information. However, the FAO was ended when the child left the table and observation of the food being left on the table for an hour afterwards was not conducted, but this was reported in the FAI. The FAI and the FAO therefore provided information about different time periods of the presentation of new foods.

Although the FAI did not provide detailed information, it was an essential element of the functional assessment. Initially the parents of all the participants requested help with their

child's eating in order to increase their child's acceptance of new food. If the FAI had not been conducted then the FAO would have been conducted with new foods. When the FAI was conducted for John and Robert the parents reported that the current meal times were difficult and therefore an intervention was required for regular meal times before new foods. Without the FAI this would not have been identified.

The FAI can be conducted by any professional, familiar with functional assessment. The FAO can be conducted in the child's home and it is possible that parents could conduct the videotaping themselves with detailed instructions. This method is therefore economic both in terms of the child and professional's time, and is a less intrusive method for the child in comparison to analogue functional analysis, while still providing essential information leading to a data driven intervention.

## PHASE 2: INTERVENTION

### *Setting, Materials and Treatment Personnel*

The intervention occurred in the children's homes; in the living room for John and in the dining room for Robert and Bill. Age appropriate seating and tables were used that did not allow escape from the feeding situation (e.g. high chair, booster seat with straps or table attached). The person feeding the child sat at an appropriate height to feed the child comfortably. A standard sized baby spoon was used for all participants ensuring consistency in amounts. Foods were presented in a bowl or on a plate. A digital timer was used to accurately time bite presentations. Intervention and data collection were carried out by the child's tutors and parents, who were also the child's therapy team for the ABA program.

### *Response Measurement and Data collection*

The dependent variables were identical to those described in Phase 1; acceptance, refusal, expulsion, mouth clean, crying, shouting, pushing food away, self injury, aggression, attempts to leave, and turning head away.

Data were collected via event-recording using a paper and pencil data collection method. Appropriate and disruptive behaviours were recorded for occurrence or non-occurrence during each bite presentation of 30 seconds. Data on each type of disruptive behaviour (crying, shouting, pushing food away, self-injury, aggression, attempts to leave, and turning head away) were collected. At the end of the 30 second trial the feeder immediately recorded the outcome for that trial then presented the next mouthful of food. The parents and tutors were instructed to record any occurrences of vomiting during intervention and to contact the first author immediately following the session.

### *Procedure*

*Baseline.* During baseline, target foods were presented to the child in two daily sessions; at 11:30am and 4:00pm. Each session consisted of 20 trials and lasted approximately 10 minutes. During each trial, bites of food were presented approximately 2.5 cm from the child's mouth for 30 seconds. If the child refused or attempted to push the food away during that 30 second interval, the spoon was removed for the rest of the trial. A new trial was then initiated by presenting a new bite of food. There were no consequences for acceptance and mouth clean. If the child accepted a bite, no food would be presented for the rest of that 30 second trial, and then a new bite of food was presented at the next trial. If the child did not accept the food, then the spoon was held in the same position, the tutor did not move the spoon around to follow the child's mouth. No programmed consequences were in place following disruptive behaviours.

*Treatment.* The FAI and FAO identified that the contingencies during meal times for all three participants were not implemented consistently. For example, although positive reinforcement for acceptance was reported in the FAI, the FAO identified that this was not applied consistently for any of the children. In addition, consequences for refusal and disruptive behaviour were applied intermittently, for example, for John and Robert escape extinction (not letting the child out of the chair for John and forcing the food into the child's mouth for Robert) was applied following refusal or disruptive behaviour, but this was not implemented consistently. In addition, the FAI and FAO identified that refusal and disruptive behaviour intermittently resulted in escape from the food or from the chair for all three children suggesting that refusal and disruptive behaviour were being intermittently negatively reinforced. Therefore, the intervention designed for all three children included negative reinforcement (escape from the spoon and the chair) but provided non-contingently in that the spoon was briefly removed after 30 seconds had elapsed and the meal was ended after 20 presentations. In addition, as positive reinforcement had been identified as effective by the parents and was provided intermittently during the FAI and FAO this also formed part of the intervention. Table 1 shows the intervention implemented for each child based on the information from the FAI and FAO.

During treatment, procedures were as for baseline except that interventions hypothesized as being effective were applied to the target identified. In addition, to increase the intensity of the intervention, target foods were presented during five sessions per day (at 10:45am, 12:00, 2:00pm, 3:15pm, and 4:30pm). Regular meals and snacks were adjusted in discussion with the children's parents to ensure the child did not eat within 30 minutes prior to an intervention session. If they did not eat anything or ate an insufficient amount during treatment sessions they would have preferred foods at lunch and dinner times.

Treatment included presenting a spoon of food at approximately 2.5 cm from the child's mouth for 30 seconds. After the 30 seconds had elapsed, the spoon was removed for 2-3 seconds, and then re-presented for the next 30 second interval. Whenever the child attempted to push the spoon away or to turn his head away from the spoon, the tutor/parent continued to present the spoon at approximately 2.5 cm from the child's mouth for the remainder of the 30 second trial. If necessary, the tutor/parent would place their arm across the child's forearms or place their hand over the child's hands to prevent them from pushing the spoon away. If the child succeeded in knocking the food off the spoon the food item was immediately replaced and the trial continued. The removal of the spoon after 30 seconds and the meal being ended after 20 trials may be conceptualized as noncontingent negative reinforcement because the aversive stimulus (food) was removed contingent on time elapsed rather than food refusal or disruptive behaviour.

Prior to each session, potential positive reinforcers were selected by the tutors and parents based on stimuli found to be effective during therapy sessions on that day. Videos, toys and books were used as potential reinforcers for John, Robert and Bill; Bill also received food. Following acceptance the spoon was removed and the potential reinforcers were presented for 10 seconds. The next trial commenced immediately thereafter.

If the child vomited during the intervention session, the feeder cleaned the child and the table, offered the child a drink of water so that any remaining food was cleared from the mouth, and continued with the session.

The food presented to John was jars of 7 to 12 month baby food of varied flavors. Robert was presented either homemade pureed food or jars of 7 month baby food. Bill was presented with one new food on the spoon per trial but three different new foods (e.g. meat, fruit or vegetables) were presented randomly within a meal (e.g. chicken, broccoli and

potato). The flavors of baby food presented to John and Robert, and the foods presented to Bill, were dependent on those available in the house on each session.

### *Design*

A non-concurrent multiple baseline design (Barlow & Hersen, 1984) across participants was used to assess the effectiveness of the intervention. The non-concurrent multiple baseline design was selected for practical reasons; it was not geographically possible for the researchers to conduct the assessment and implementation of the intervention concurrently. Therefore participants were randomly assigned a baseline of 10, 14 or 18 sessions.

### *Interobserver Agreement*

Interobserver agreement data were collected for 33% of the total meals. This consisted of 46% of sessions for John, 32% of sessions for Robert and 24% of sessions for Bill. Sessions were videotaped and then scored by the first author or by three other trained scorers. All of the other scorers had conducted the eating intervention with children and were familiar with the recording procedures.

Interobserver agreement on occurrence for acceptance or rejection, expulsion or mouth clean, and the presence of any disruptive behaviours was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Interobserver agreement for acceptance or rejection was 99% (range 96% - 100%), for expulsion or mouth clean was 99% (range 97% - 100%), and for presence of disruptive behaviour was 97% (range 94% - 99%).

### *Treatment Integrity*

The extent to which the parents and tutors followed the correct intervention procedures throughout the study was monitored in two ways. The first author viewed videotapes of every fourth session conducted for each participant. A total of 51 sessions were observed during the intervention period (16 for John, 18 for Robert and 17 for Bill). Tutors

and parents were 100% correct in implementing the procedures including correct length of trial, removal of the spoon after 30 seconds elapsed, and delivery of potential reinforcers. In addition, the Consultants for John and Robert observed an eating session on a weekly basis and for Bill on a three-weekly basis. This occurred during team meetings and feedback was provided in the same way as for other interventions that were part of the child's EIBI.

### Results and Discussion

Results for each of the participants are shown in Figure 1. As acceptance for all the participants always led to mouth clean, only acceptance is shown in the figure. For John, zero acceptance occurred during baseline for all sessions (consisting of 20 trials), except for sessions one and eight. During both of these sessions a highly preferred food (coco-pops) was mistakenly presented and was not a food that had been selected for presentation during baseline. As the highly preferred food was presented at session 8, an additional baseline session was conducted to establish three stable data points before the intervention was introduced. Following the introduction of the intervention, acceptance occurred on a mean of 16.5 trials (range 0 – 20) per session.

Data on each type of the disruptive behaviours were analyzed and presented together, being scored as occurring if any one of the behaviours occurred and not occurring if none of the behaviours occurred. During baseline, disruptive behaviours occurred on a mean of 16.3 trials (range 0 – 20) per session. Following the introduction of the intervention, disruptive behaviour occurred on a mean of 2.9 trials (range 0 – 19) per session. John did demonstrate emesis during intervention; this was during sessions 30, 47, 58, 61, 65, 68, 69 and 71. Treatment and data collection continued for a total of 300 sessions and vomiting did not occur after session 71. During these subsequent sessions, the intervention was extended to work on new textures and new flavors, as John's eating improved.



For Robert, acceptance during baseline occurred on a mean of 0.6 trials (range 0 – 2) trials per session. Following the introduction of the intervention, acceptance occurred on a mean of 18.3 trials (range 0 – 20) per session. Disruptive behaviours occurred on a mean of 19.4 trials (range 18 – 20) per session during baseline. Following the introduction of the intervention, disruptive behaviour occurred on a mean of 3.0 trials (range 0 – 20) per session.

For Bill, acceptance did not occur during baseline. Following the introduction of the intervention, acceptance occurred on a mean of 6.2 trials (range 0 – 20) per session (the mean occurrence of acceptance for the last 4 sessions was 14 trials). Disruptive behaviours occurred on all trials during baseline. Following the introduction of the intervention, disruptive behaviour occurred on a mean of 11.8 trials (range 0 – 20) per session (the mean occurrence of disruptive behaviour for the last 4 sessions was 6.25). Robert and Bill did not demonstrate emesis during intervention.

*Follow-up.* The FAI was used to collect follow up data for John and Robert. The follow up FAI for John was conducted five months after the end of treatment for this study. Treatment continued following the conclusion of this study and focused on different textures and flavors. According to the FAI, John ate consistently when presented with meals, did not demonstrate disruptive behaviour, would accept almost any foods, could self feed, and the parents no longer considered eating to be a problem. At the time of the follow up interview, John was working on eating with a fork, biting finger foods (rather than tearing pieces), and reducing reinforcement on mastered foods.

The follow up FAI for Robert was conducted four months after the end of treatment for this study. Treatment continued following the conclusion of this study and focused on increasing texture difficulty and new flavors. According to the FAI, Robert ate consistently when presented with meals and did not demonstrate disruptive behaviour, could feed himself (with some prompting and reinforcement), eat more difficult textures, and would try new

foods (with low levels of refusal). At the time of the follow up interview, Robert was working on chewing foods and further new flavors, for example new foods such as pear and apple.

This study extends the literature on interventions for children with eating difficulties. The interventions were identical for all participants and included delivery of potential positive reinforcers (e.g. toys, access to videos) for appropriate behaviours, such as acceptance and mouth clean. Noncontingent negative reinforcement was provided in that the spoon was removed contingent on time elapsed rather than on any specific behaviour. Extinction of disruptive behaviours, such as head turning, pushing the spoon, and crying occurred as these behaviours did not result in escape from the situation or from the spoon, because the spoon was removed after 30 seconds had elapsed and then re-presented. In addition, the meal was terminated contingent on presentation of 20 spoonfuls of food. In other words, disruptive behaviour had no effect on presentation and removal of the spoon or on the length of the meal. The results for John demonstrate a general increase in acceptance and decrease in disruptive behaviours. Robert showed an increase in acceptance and decrease in disruptive behaviours, with the final eight meal sessions showing zero disruptive behaviours and 100% acceptance. The results for Bill were more variable showing an increase in acceptance over baseline, which was zero throughout.

The participants were not deprived of regular meals and snacks during intervention although these were adjusted in discussion with the child's parents to ensure the child had not eaten directly before a treatment session. If the child did not eat anything or ate an insufficient amount during treatment sessions they were given preferred foods at lunch and dinner times. This may have affected treatment success as the results were variable for John and Bill; less variability may have been seen had regular meal times been adjusted.

#### General Discussion

The functional assessment conducted in the current study provided information on the children's meal time behaviour for John and Robert and during presentation of new foods for Bill. Girolami and Scotti (2001) found that the FAI (O'Neill et al., 1997) had a high level of agreement with the analogue functional analysis they conducted and suggested that interviews, questionnaires and direct observations can provide important information about the potential antecedents, setting events and consequences for feeding difficulties. In the current study, the FAO provided more detailed information than was reported in the FAI. However, the FAI was essential in identifying that there was a problem with eating current foods for two of the children. Therefore, both the FAI and FAO were necessary to identify appropriate target behaviours and intervention procedures.

The functional assessment may not have been as accurate for Bill as the results of the intervention were more variable. A limitation of the functional assessment for Bill may be that only one FAO session was conducted, further FAO sessions may have provided more information. Another possible explanation for the variable results for Bill is that, during intervention, several new foods were presented during each meal and therefore increases in acceptance may only have been for one of those new foods. A more accurate method may have been to present single foods during each meal session. It may be that a more successful intervention would be to present one new food until 100% acceptance was achieved for that food, before progressing to another new food.

The children included in the present study demonstrated less severe eating difficulties than those children included in previous research in this area. Many of the previous studies conducted include children with total food refusal, rather than food selectivity. It may be that this type of functional assessment is most suitable for children with less severe food refusal. It is not possible to identify whether the method of assessment utilized in the current study is

suitable for those children with more severe eating difficulties or total food refusal; this is an area for further research.

The current study included a noncontingent negative reinforcement procedure. The reinforcement schedule was a fixed-time 30 second schedule. As presenting the spoon is an aversive stimulus, removal of the spoon acts as a negative reinforcer. Removal of the spoon was contingent on time elapsed regardless of the behaviour demonstrated by the child. Cooper et al. (1995) and Reed et al. (2004) examined the use of noncontingent positive reinforcement, but found that escape extinction was still required. Many previous studies have included noncontingent negative reinforcement in this way, although it was not identified as a component of treatment (e.g. Riordan et al., 1984; Kern & Marder, 1996; Ahearn, 2003). The results of the current study suggest that escape extinction of refusal may not be necessary to increase acceptance. It is not possible to conclude whether the intervention would have been effective if the children had expelled the food. It could be hypothesized that the intervention may be responsible for the lack of expulsion demonstrated by the children. However, potential reinforcement was provided contingent on acceptance of food, rather than on mouth clean and therefore there was an opportunity to expel food following reinforcement so this may be unlikely; therefore this is an area for further investigation.

Positive reinforcement and escape extinction have been investigated in previous studies and many have found that the use of escape extinction for both refusal and expulsion is necessary to increase acceptance and mouth clean (e.g. Patel et al., 2002; Piazza et al., 2003; Cooper et al., 1995). The current study adds to the literature in that a non-contingent negative reinforcement procedure was included rather than the traditional use of non-removal of the spoon until acceptance occurs. Therefore, escape extinction of refusal (holding the spoon to the child's mouth or using physical prompting contingent on refusal until

acceptance occurs) was not included as part of the intervention, yet increases in acceptance were demonstrated for all three children. John did demonstrate emesis during eight of the 73 meals. In six of these eight cases this occurred when a new flavor of baby food was presented, which may have led to the emesis. These flavors were re-presented in later meals and emesis did not occur. Some studies have demonstrated increases in acceptance and mouth clean without the use of escape extinction, however the majority of these studies utilized simultaneous reinforcement (i.e. the reinforcing food was presented on the spoon with the non-preferred food) (e.g. Piazza et al., 2002; Ahearn, 2003), or an additional component such as response cost or antecedent manipulation (e.g. Kahng, Tarbox & Wilke, 2001).

The termination of the meal after 20 trials (approximately 10 minutes) is another element of the intervention to consider. This is also noncontingent negative reinforcement as the meal ended contingent on number of trials presented, regardless of the behaviour demonstrated by the child. During baseline, presentation of food for each trial was terminated contingent on child behaviour, (e.g. pushing the spoon away, the child turning their head). During intervention, these behaviours were no longer reinforced by escape from the spoon as they were prevented, however, the children did eventually escape the presentation of the food but this was noncontingent i.e. occurred after 30 seconds for each mouthful and 10 minutes for the whole meal). As these behaviours were being prevented, the child did not receive reinforcement for them, therefore the positive reinforcement delivered for acceptance was not in competition with the negative reinforcement delivered for disruptive behaviour. Piazza, Patel, et al. (2003) hypothesized that escape extinction for refusal and expulsion may be necessary for those children demonstrating total food refusal but not for those children already demonstrating some food acceptance; this requires further investigation.

Escape extinction may lead to increases in aggressive or disruptive behaviours (e.g. Reed et al, 2004). The participants in the current study did not demonstrate increases in these types of behaviours, suggesting use of noncontingent negative reinforcement; positive reinforcement and extinction of disruptive behaviour may lead to less disruptive behaviours as the child does not need to demonstrate these behaviours in order for the spoon to be removed.

The comparative effects of negative and positive reinforcement within the current study are not clear. As positive reinforcement was provided for acceptance, it is not possible to identify whether increases in acceptance would have occurred with positive reinforcement alone, or noncontingent negative reinforcement alone. It is possible that response prevention and noncontingent negative reinforcement may lead to a reduction in disruptive behaviour, such as pushing the spoon away, but may not be sufficient to increase acceptance and mouth clean, without the use of positive reinforcement. In addition, the delivery of positive reinforcement following acceptance, led to a delay in the presentation of the next bite, this may have confounded the effects of positive and negative reinforcement (Lalli et al, 1999). Therefore, this is an area for further investigation.

Previous studies have suggested that primary reinforcement (food) may be more effective than secondary reinforcers, such as toys and videos, in increasing acceptance and mouth cleans (e.g. Riordan et al., 1984). In the present study two out of the three participants received access to secondary reinforcers, and the third participant was provided with a combination of primary and secondary reinforcers. This suggests that secondary reinforcement may be effective in increasing food acceptance.

Although some studies have conducted treatment in children's homes and included at least one parent in the therapy team (e.g. Werle, Murphy & Budd, 1993; Najdowski et al., 2003 and Mueller et al., 2003) and reported results of treatment integrity in parent training, in

general, studies have often focused on clinic treatment delivered by therapists. The current study demonstrated functional assessments and treatments can be conducted in the children's homes when parents are included as part of the therapy team. This was done as part of an intensive behavioural program and so future studies may investigate the efficacy of conducting such assessment and intervention when there is not a team already in place, and the treatment is conducted solely by the parents.

The use of a concurrent multiple baseline design would have been more desirable to assess the impact of the intervention on the children's acceptance and disruptive behaviour as baseline could have been continued for Bill until changes had been seen in Robert's behaviour. However, due to geographical and practical constraints this was not possible and therefore the non-concurrent multiple baseline design was employed.

The current study analyzed the assessment and treatment of eating difficulties in three children all diagnosed with autism with a history of oral feeding. The effects of this assessment and treatment with children with other difficulties and no history of oral feeding cannot be determined. In addition, the children in the current study were between two-and-a-half and four-and-a-half years old, and therefore it is not clear whether age and the length of time the child has demonstrated eating difficulties has an effect on the outcome of treatment; this is an area requiring further investigation.

Several limitations of the current study have been identified; further limitations include the number of meal presentations during baseline and intervention. During baseline, only two meals per day were conducted, and five meals per day during intervention. The reason for this was that parents may not have been willing to have fifty minutes of the child's therapy time used for assessment purposes each day over a long period of time. However, this makes it difficult to identify the effects of the increased intensity of presentation of the foods as a variable of the intervention package. An additional limitation is the length of baselines. A

longer baseline period between introductions of the intervention for each participant would have been preferable in order to demonstrate treatment effect more convincingly.

Despite the limitations mentioned above, the current study demonstrates functional assessment can be conducted within the child's natural setting and appropriate treatment can be identified and implemented within this setting, including the parents as team members, and without the use of escape extinction.



References

- Ahearn, W.H., Kerwin M.E., Eicher, P.S., Shantz, J., & Swearingin W. (1996). An alternating treatments comparison of two intensive interventions for food refusal. *Journal of Applied Behaviour Analysis, 29*, 321-332.
- Ahearn, W.H. (2003). Using simultaneous presentation to increase vegetable consumption in a mildly selective child with autism. *Journal of Applied Behaviour Analysis, 36*, 361-365.
- Barlow, D.H. & Hersen, M. (1984). *Single Case Experimental Designs. Strategies for Studying Behaviour Change*. Pergamon Press Inc. New York.
- Brown, J.E., Davis, E. & Flemming, P.L. (1979). Nutritional assessment of children with handicapping conditions. *Mental Retardation, 17*, 129 – 132.
- Coe, D.A., Babbitt, R.L., Williams, K.E., Hajimihalil, C., Snyder, A.M., Ballard, C. & Efron, L.A. (1997). Use of extinction and reinforcement to increase food consumption and reduce expulsion. *Journal of Applied Behaviour Analysis, 30*, 581-583.
- Cooper, L.J., Wacker, D.P., McComas, J.J., Brown, K., Peck, S.M., Richman, D., Drew, J., Frischmeyer, P. & Millard, T. (1995). Use of component analyses to identify active variables in treatment packages for children with feeding disorders. *Journal of Applied Behaviour Analysis, 28*, 139-153.
- Chatoor, I & Surles, J. (2004). Eating Disorders in Mid-Childhood. *Primary Psychiatry, 11*, 34-39.
- Durand, V.M. & Crimmins, D. (1992). *The Motivational Assessment Scale*. Topeka, KS; Monaco & Associates.
- Girolami, P.A. & Scotti, J. R. (2001). Use of analog functional analysis in assessing the function of mealtime behaviour problems. *Education and Training in Mental Retardation and Developmental Disabilities, 36*, 207–223.

- Gutentag, S. & Hammer, D. (2000). Shaping oral feeding in a gastrostomy tube-dependent child in natural settings. *Behaviour Modification, 24*, 395-410.
- Hayward, D.W., Gale, C.M. & Eikeseth, S. (2009). Intensive behavioural intervention for young children with autism: A research-based service model. *Research in Autism Spectrum Disorders, 3*(3), 571-580.
- Hayward, D., Eikeseth, S., Gale, C. & Morgan, S. (2009). Assessing progress during treatment for young children with autism receiving intensive behavioural interventions. *Autism, 13*, 613-633.
- Howard, R.B. & Cronk, C. (1983). Nutrition and development. In M.D. Levine, W.B. Carey, A.C. Crocker & R.T. Gross (Eds.), *Developmental-behavioural pediatrics* (pp. 412-426). Philadelphia: Saunders.
- International Statistical Classification of Diseases and Related Health Problems, 1989 Revision, Geneva, World Health Organization, 1992.
- Iwata, B.A. (1987). Negative reinforcement in applied behaviour analysis: An emerging technology. *Journal of Applied Behaviour Analysis, 20*, 361 – 378.
- Iwata, B.A. Dorsey, M.F. Slifer, K.J., Bauman, K.E. & Richman, G.S. (1994). Toward a functional assessment of self-injury. *Journal of Applied Behaviour Analysis, 27*, 197-209. (Reprinted from *Analysis and Intervention in Developmental Disabilities, 2*, 3 – 20, 1982)
- Iwata, B.A., Riordan, M.M., Wohl, M.K. & Finney, J.W. (1982). Pediatric feeding disorders: Behavioural analysis and treatment. In P.J. Accardo (Ed.). *Failure to thrive in infancy and early childhood: A multidisciplinary team approach* (pp. 297-329). Baltimore: University Park Press.
- Kahng, S.W. Tarbox, J. & Wilke, A.E. (2001). Use of a multicomponent treatment for food refusal. *Journal of Applied Behaviour Analysis, 34*, 93 – 96.

- Kern, L. and Marder, T.J. (1996). A comparison of simultaneous and delayed reinforcement as treatments for food selectivity. *Journal of Applied Behaviour Analysis*, 29, 243-246.
- Lalli, J.S., Vollmer, T.R. Progar, P.R., Wright, C., Borrero, J., Daniel, D., et al. (1999). Competition between positive and negative reinforcement in the treatment of escape behaviour. *Journal of Applied Behaviour Analysis*, 32, 285 – 296.
- Lord, C., Rutter, M., & Le Couteur, A. (1994). Autism Diagnostic Interview-Revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism Developmental Disorders*, 24, 659-685.
- Martin, H.P. (1973). Nutrition: Its relationship to children's physical, mental and emotional development. *American Journal of Clinical Nutrition*, 16, 766 -775.
- Matson, J.L. & Kuhn, D.E. (2001). Identifying feeding problems in mentally retarded persons: development and reliability of the screening tool of feeding problems (STEP). *Research in Developmental Disabilities*, 21, 165-172.
- Mueller, M.M., Piazza, C.C., Moore, J.W., Kelley, M.E., Bethke, S.A., Pruett, A.E., et al. (2003). Training parents to implement pediatric feeding protocols. *Journal of Applied Behaviour Analysis*, 36, 545 – 562.
- Munk, D.D & Repp, A.C. (1994). Behavioural assessment of feeding problems of individuals with severe disabilities. *Journal of Applied Behaviour Analysis*, 27, 241-250.
- Najdowski, A.C., Wallace, M.D., Doney, J.K., & Ghezzi, P.M. (2003). Parental assessment and treatment of food selectivity in natural settings. *Journal of Applied Behaviour Analysis*, 36, 383-386.
- O'Neill, R.E., Horner, R.H., Albin, R.W., Sprague, J.R., Storey, K., Newton, J.S. (1997). Functional assessment and program development for problem behaviour. A practical handbook (second edition). Pacific Grove. Brooks/Cole.

- Palmer, S. Thompson, R.J. & Linscheid, T.R. (1975). Applied behaviour analysis in the treatment of childhood feeding problems. *Developmental Medicine and Child Neurology*, 17, 333 – 339.
- Patel, M.R., Piazza, C.C., Santana, C.M., & Volkert, V.M. (2002). An evaluation of food type and texture in the treatment of a feeding problem. *Journal of Applied Behaviour Analysis*, 35(2), 183-186.
- Patel, M.R., Piazza, C.C., Martinez, C.J., Volkert, V.M., & Santana, C.M. (2002). An evaluation of two differential reinforcement procedures with escape extinction to treat food refusal. *Journal of Applied Behaviour Analysis*, 35, 183 – 186.
- Perske, R., Clifton, A., McClean, B.M., & Stein, J.I. (Eds.) (1977). Mealtimes for severely and profoundly handicapped persons: New concepts and attitudes. *Baltimore: University Park Press*.
- Piazza, C.C., Fisher, W.W., Brown, K.A., Shore, B.A., Patel, M.R., Katz, R.M., Sevin, B.M., Gulotta, C.S., & Blakely-Smith, A. (2003). Functional analysis of inappropriate mealtime behaviours. *Journal of Applied Behaviour Analysis*, 36, 187-204.
- Piazza, C.C., Patel, M.R., Santana, C.M., Goh, H.L., Delia, M.D., & Lancaster, B.M. (2002). An evaluation of simultaneous and sequential presentation of preferred and nonpreferred food to treat food selectivity. *Journal of Applied Behaviour Analysis*, 35(3), 259-270.
- Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. S., & Layer, S. A. (2003). The relative contribution of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behaviour Analysis*, 36, 309–324.
- Polan, H.J., Kaplan, M.D., Kessler, D.B., Shindledecker, R., Newmark, M., Stern, D.N., et al. (1991). Psychopathology in mothers of children with failure to thrive. *Infant Mental Health Journal*, 12, 55-64.

- Reed, G.K., Piazza, C.C., Patel, M.R., Layer, S.A., Bachmeyer, M.H., Bethke, S.D., et al. (2004). On the relative contributions of noncontingent reinforcement and escape extinction in treatment of food refusal. *Journal of Applied Behaviour Analysis*, 37, 27 – 42.
- Riordan, M.M., Iwata, B.A., Finney J.W., Wohl, M.K. & Stanley, A.E. (1984). Behavioural assessment and treatment of chronic food refusal in handicapped children. *Journal of Applied Behaviour Analysis*, 17, 327-341.
- Riordan, M.M., Iwata, B.A., Wohl, M.K., & Finney, J.W. (1980). Behavioural treatment of food refusal and selectivity in developmentally disabled children. *Applied Research in Mental Retardation*, 1, 95-112.
- Rogers, B. Stratton, P. Msall, M. & Andres, M. (1994). Long-term morbidity and management strategies of tracheal aspiration in adults with severe developmental disabilities. *American Journal on Mental Retardation*, 98, 490 – 498.
- Rosso, P. and Winick, M. (1973). Relation of nutrition to physical and mental development. *Pediatric Annals*, 1, 33 – 43.
- Sisson, K.A. & Van Hasselt, V.B. (1989). Feeding disorders. In J.K. Luiselli, *Behavioural medicine and developmental disabilities* (pp. 45 – 73). New York: Springer-Verlag.
- Sprague, J., Flannery, B, & Szidon, K. (1998). Functional analysis and treatment of mealtime problem behaviour for a person with developmental disabilities. *Journal of Behavioural Education*, 8, 381 – 392.
- Watthen-Lovaas, N. and Lovaas, E.E. (1999). *The Reading & Writing Program. An Alternative Form of Communication*. Los Angeles, CA: Lovaas Institute for Early Intervention .

Werle, M.A., Murphy, T.B. & Budd, K.S. (1993). Treating chronic food refusal in young children: home based parent training. *Journal of Applied Behaviour Analysis*, 26, 421-433.

Williams, P.G., Darymple, N., & Neal, J. (2000). Eating habits of children with autism. *Pediatric Nursing* 26(3), 259-264.

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Table 1. Contingencies identified from the FAI and the FAO and the intervention implemented based on this information

	Contingencies Identified		
	FAI	FAO	Intervention
John	<p>SR+ for acceptance</p> <p>SR- for refusal, disruptive behaviour and acceptance</p> <p>Escape Extinction for refusal and disruptive behaviour</p>	<p>SR+ for acceptance and refusal and disruptive behaviour</p> <p>SR- for refusal and disruptive behaviour</p> <p>Escape Extinction for disruptive behaviour</p>	<p>SR+ for acceptance</p> <p>Non contingent negative reinforcement (escape)</p>
Robert	<p>SR+ acceptance</p> <p>Non contingent positive reinforcement</p> <p>Escape extinction for refusal and disruptive behaviour</p>	<p>SR+ acceptance, refusal and disruptive behaviour</p> <p>SR- acceptance and refusal</p> <p>Non contingent positive reinforcement</p> <p>Escape extinction for refusal and disruptive behaviour</p>	<p>SR+ for acceptance</p> <p>Non contingent negative reinforcement (escape)</p>
Bill	<p>SR+ for acceptance, refusal and disruptive behaviour</p> <p>SR- for refusal</p>	<p>SR+ for acceptance, refusal and disruptive behaviour</p> <p>SR- for refusal</p> <p>No consequence for refusal</p>	<p>SR+ for acceptance</p> <p>Non contingent negative reinforcement (escape)</p>



Figure Caption

*Figure 1.* Number of trials of food acceptance and number of trials of disruptive behaviour across all participants. By mistake, preferred food was presented to John during baseline session one and eight.

