

Behavioral Intervention and Prevention of Feeding Difficulties in Infants and Toddlers

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Abstract

Although eating is considered an automatic physiologic process, many children experience feeding difficulties. The purpose of this paper is to provide a framework for assessment, treatment and prevention of feeding difficulties in children. Identification and treatment of any factors actively interfering with feeding success is a critical cornerstone for effective behavioral interventions for feeding. Using variables that comprise the structure of a meal, this paper discusses how these variables might be manipulated in behavioral interventions for feeding problems. Recommendations for prevention of feeding problems are also presented.

Keywords: Behavioral assessment, Feeding Problems, Behavioral Interventions, pediatric

Behavioral Intervention and Prevention of Feeding Difficulties in Infants and Toddlers

The term “feeding” traditionally refers to the ingestion of food that occurs in the context of a relationship between a child and adult, usually mother; whereas the term “eating” refers to an individual ingesting food. Feeding issues and problems are relatively common among infants and toddlers. Parents of infants often report colic around meals, spitting up, vomiting, and lack of weight gain (Mathieson, Worrall, Masel, Wall, & Shepherd, 1999). In contrast, parents of toddlers are more likely to report picky eating; eating only a few foods while rejecting the majority of other foods and/or eating only a little bit at each meal. Estimates suggest as many as half of parents of toddlers report feeding issues at some time during the early years, with children with special needs (medical, developmental, and physical) being even more at risk for developing feeding problems that require intervention. This paper provides brief background on the factors underlying feeding problems in infants and toddlers, describes how behavioral interventions can be used to treat feeding issues, and provides some guidelines for preventing feeding issues from becoming feeding problems.

Background

Eating is a complex process involving neurologic control of refined and coordinated muscle movements operating in structures next to and part of the respiratory and gastrointestinal tracts. As a result, a multitude of factors may impact the eating process. First, the child must have an intact swallowing reflex and adequate neurological function to successfully manage food and liquid boluses (bites or sips) orally. Second, muscle tone, control, and coordination are necessary components of successful feeding. Children who are feeding themselves need to be able to grip the utensil or cup and move it to their mouth successfully. Appropriate positioning and tone are also important for feeding success.

A third factor is oral-motor skill and function. Oral-motor development follows a stepwise progression from suckling, the most primitive oral motor pattern, to the more complex

oral-motor milestones of suck, munch, and chew (Bosma, 1986). Infants are born with a suckling reflex that works involuntarily whenever something enters the child's mouth. As the infant matures, the reflex fades and is replaced with the voluntary act of sucking in which the tongue moves up and down within the mouth. This increased control in tongue movement enables successful spoon feeding; food placed on the tongue will no longer ride out of the mouth with tongue movement as it did when the baby used the suckling reflex. The next skill in the oral motor developmental sequence is munching. Munching is the rhythmical bite-and-release pattern that allows small pieces of food to be broken off, flattened and then collected by the tongue in preparation for swallowing. Chewing, or shredding food into smaller pieces does not occur until the child acquires a rotary component to jaw movement. This can be seen as early as 9 months but is modified gradually until an adult pattern is attained, typically around 3 years of age. Movement through these oral-motor skill milestones is dependent upon successful and appropriate practice.

Finally, eating must be associated with pleasure. Through the process of classical conditioning, food becomes desired or pleasurable when eating food is paired with feelings of comfort and pleasantness. Conversely, if eating food is paired with feelings of respiratory distress, gastrointestinal discomfort, or nausea, the probability that this food will be avoided is increased.

This presentation of factors that might negatively influence feeding was designed to be brief. For more detailed information about the factors that impact feeding, see Hyman (1993), Kerwin (2003), Rudolph and Link (2002), and Stevenson and Allaire (1991).

Approach to Treatment

Because the feeding process involves many factors, the best approach for assessment and treatment planning is through an interdisciplinary team. The team ideally would consist of a developmental pediatrician, speech-language pathologist, physical therapist or a neurodevelopmentally trained occupational therapist, nutritionist, and behavior analyst. The pediatrician would assess the presence of active medical factors (especially from the respiratory and gastrointestinal systems) through history and physical examination. The speech-language pathologist would assess oral-motor skill and function, especially facial muscle tone, lateralization, and oral transport. The physical or occupational therapist would assess gross motor tone and function and help insure appropriate position during feeding as well as maximizing trunk rotation. The nutritionist would assess the child's nutrition and help establish a plan. The behavior analyst's primary role on the team is to design effective behavioral interventions to accomplish the goals identified and prioritized by the team.

Any active impediments to feeding should be addressed prior to implementation of any intensive behavioral interventions. The most common active impediments to successful feeding include gastrointestinal issues, such as nausea, vomiting, and constipation. Because the focus of this paper is on behavioral interventions, the identification and assessment of possible active impediments will not be presented here (for more detailed information, see Shepherd, Wren, Evans, Lander, & Ong (1987) and Vandenplas (2000)).

Feeding Session Structure

Before presenting specific behavioral interventions for feeding problems, it is important to review the context for the interventions (Kerwin, 2003). Meals are times when the child ingests food for nutrition while feeding sessions are structured times to facilitate the acquisition of new feeding behaviors. For some children with feeding issues, meals and feeding sessions may be synonymous. However, for children whose weight is problematic (they have or are at risk for growth deficiency) or for children who eat only a few foods as their entire diet, we have found that meals should remain “untouched” (i.e., no intervention occurs during the meal and parents feed the child in their usual manner). Our rationale is that these children cannot afford to lose any nutrition if the intervention is not successful immediately.

Table 1 (*Page 139*) presents the main components of a feeding session. Many people may look at these components and wonder why we are making feeding so complex and perhaps even unnatural. These individuals assume that eating is a natural, physiological process. Our response is that this natural process has gone awry with the child or s/he would not be experiencing feeding issues. As a result, we need to change the process so that the child experiences success and practices appropriate oral-motor skill.

The first component to consider when structuring a feeding session is the general environment. For many children with feeding issues, eating is no longer a natural process and it may not be pleasurable. Just as adults need to concentrate when learning and practicing a new skill, so do children with feeding problems. Therefore, feeding sessions often are implemented initially in a minimally distracting environment. This allows the child to focus on the different aspects of the behavioral intervention.

The second component, which is often overlooked, is appropriate positioning of the trunk, shoulders, head and neck. Eating is a flexor activity, meaning that the head should be in a neutral or flexed position to allow the child full oral-motor control. Many children with feeding issues tend to slouch in a chair. As a result, their upper back rounds, their shoulders fall forward, and the child’s head is forward with a hyperextended position of the neck. This extension position of the head and neck does not allow the child full control of food or liquid in the mouth, translating into an increased risk of aspiration of the food or liquid into the lungs. To avoid poor positioning, it is important that the child be seated with their feet flat, their hips flexed at a 90-degree angle, with full support of their trunk so they are not collapsing forward on their lungs and stomach. Once these objectives for seating are achieved, the child’s head will be in an appropriate position for eating.

The third component in structuring feeding sessions concerns decisions about the food, liquid, and utensils. The goal in treating feeding problems is to maximize appropriate oral-motor practice and minimize practice of oral-motor patterns that might impede advancement. To clarify this distinction, consider an example. José is a 3-year-old boy who eats only yogurt and macaroni and cheese as his diet. His chronologic age would indicate that he should be chewing foods, and he has no known developmental problems. His parents have been working with school staff and therapists to increase the texture of food José accepts. After 6 months, José is now “eating” a quarter of a peanut butter or cheese sandwich. However, when eating the sandwich, he pulls the

bread apart and stuffs it into his mouth. He then uses his tongue to put the bread on the roof of his mouth and then begins pumping his tongue against the bread knocking off small pieces that he can swallow. When he swallows, he makes a gulping sound and winces. Although the food is eventually swallowed, the oral-motor pattern that José is practicing and integrating as a learned habit will not allow him to advance to other textured foods. This example illustrates how important it is to facilitate practice of appropriate oral-motor skills even if it may mean starting afresh with less varied and more easily chewed foods or even with pureed food. When implementing feeding interventions, it is critical to ensure that the child is always practicing an oral-motor pattern that is both appropriate within the context of the child's oral-motor development and allows advancement to the next oral-motor milestone/skill.

The fourth consideration in structuring feeding sessions is food presentation. This component refers to whether the child feeds him/herself; the type of verbal instruction (if verbal instruction is required); the order in which foods and liquids are presented during the session; how food is placed into the mouth and anything that is done inside or outside the mouth to facilitate oral-motor function. In general, we recommend that behavioral interventions begin with an adult feeding the child. Our rationale for this decision is twofold: 1) adults have more control over the process, thereby minimizing the potential for coaxing, begging, pleading, and negotiation with the child who is feeding him- or herself, and 2) sometimes the adult will need to manipulate how the food is placed in the oral cavity (e.g., food is deposited on the molars to facilitate tongue lateralization versus being deposited in the center of the tongue).

We also recommend that the adult use a consistent verbal instruction prior to each bite. Examples of typical verbal instructions are "Take a bite" or "Open". The rationale for using a verbal instruction is that this cues the child to possible consequences that might occur if the bite is accepted or rejected. There are several caveats to using a specific verbal instruction. The first caveat is that the verbal instruction should only be used in the feeding sessions; in other words, these specific verbal instructions should not be used during meals if meals are separate from feeding sessions. In this way, the verbal instruction is maximally effective in signaling possible consequences. If the verbal instruction is used during meals when there are no prearranged consequences, the consequences will be less powerful and the child may become confused. A second caveat with a verbal instruction is that it will not have to be used forever. It is used at the beginning of intervention to help the child develop new feeding patterns and it can then be faded.

The order of presentation of food and drink may not matter typically; however, this is an important consideration when the child has oral-motor skill difficulties and/or has strong preferences for a limited number of foods. When the child has oral-motor involvement in eating, you may want to facilitate swallowing by following food that requires chewing with pureed food to build in a natural "break". The reason for this specific order is that chewing is a new, difficult activity for this child. Eating a pureed food entails a less challenging, more familiar and easier oral motor pattern for this child. When the child exhibits food selectivity, you may want to arrange for a relatively preferred food to follow a relatively non-preferred food. Recent research has demonstrated that skill acquisition is faster when the child is initially presented with only a single food within a feeding session (Ahearn, 2002).

The final consideration in determining food presentation is any manipulation to facilitate oral-motor functioning. For example, for children who don't close their lips around the spoon and whose tongue is bunched up in the mouth, the adult may provide deep, even pressure down onto the tongue, pulling the spoon straight out of the mouth to facilitate lip closure and oral transport of the food bolus. For children who appear to have an intact swallowing reflex, but who are not swallowing food, swallow induction training has been demonstrated to increase food acceptance and swallowing of food (Lamm & Greer, 1988). This technique relies on backward chaining in which the last step in the eating process, swallowing, is practiced and reinforced either by delivering food to the back of the mouth (Kerwin & West, 1991) or by physically stimulating the gag and swallow reflexes (Hoch, Babbitt, Coe, Ducan, & Trusty, 1995). Although this technique appears promising, its use should be considered carefully because of the potential for aspiration.

For the purposes of intervention, oral-motor facilitation techniques should be distinguished from other techniques traditionally implemented by speech pathologists and occupational therapists. Often, the aim of these other techniques is to increase food acceptance not improve specific oral-motor function. For example, children with feeding issues are often exposed to a variety of textures and encouraged to manipulate them with their hands. Although these might operate to desensitize the children to different textures, we are unaware of any empirical studies that document its efficacy as a feeding treatment. Similarly, oral sensitization in which a Nuk brush or other utensil is used to stroke different parts of the mouth in an attempt to "desensitize" the child to eating have also not been empirically demonstrated to be effective feeding treatments (Kerwin, Jefferson, & Beecher, 1992). Because the purpose of this paper is a review of behavioral interventions for feeding problems, these possible oral-motor manipulations will not be reviewed in depth (please refer to Alper & Manno, 1996; Arvedson, 1993; Morris & Klein, 2000).

The final two components in structuring feeding sessions are decisions about when to offer or prompt the next bite/sip and when to end the feeding session. When to offer the next bite of food or the next sip of liquid can be dependent on the behavior of the child (i.e., swallows previous bite/sip; spits out previous bite/sip) or can be determined by how much time has elapsed. Initially, a time based criterion (20-30 seconds) is typically used in behavioral intervention because it maximizes the amount of time the child has to experience consequences. Once the child is accepting the majority of bites of food, bites can be offered after the previous bite is swallowed; however, this determination should be individually tailored to each child based on an assessment of progress.

When to end the feeding session is usually determined by: 1) the amount of food consumed, 2) the number of bites presented or 3) the amount of time elapsed. At the start of the intervention, the criterion for ending the sessions is usually the number of bites presented (20 for younger children and 30-40 for older children). Once the child is reliably consuming a specified amount of food, the criterion can be changed to amount of food consumed. Ending the feeding session by specifying an amount of food to be consumed allows a gradual and systematic increase in the amount of food consumed. We typically increase by 0.5 ounce every 3-4 sessions. Meal duration should rarely exceed 30 minutes and the ideal session time is no more than 20 minutes.

Behavioral Interventions

Behavioral treatments have been demonstrated to be efficacious and effective for treating feeding difficulties in infants and toddlers (Kerwin, 1999). There are two main types of behavioral interventions for feeding problems: antecedent manipulations and consequences. Each type of intervention is embedded within a structured feeding session as outlined above. A third type of intervention involves modeling in which appropriate, successful eating is modeled by a peer (Greer, Dorow, Williams, McCorkle, & Asnes, 1991).

Antecedent Manipulations.

Antecedent manipulation interventions involve modifying how the food/liquid is presented to the child. The majority of antecedent manipulations involve what is known as stimulus fading, which is gradually and systematically changing the stimulus (in this case, the food and/or utensil) from combinations that are readily accepted by the child to those that have been refused in the past. The most common stimulus fading procedure is beginning with an empty spoon (Kerwin, Ahearn, Eicher, & Burd, 1995). Once the empty spoon is accepted, the spoon is then dipped in a pureed food. Once the dipped spoon is accepted, a dollop of food is placed on the spoon. The amount of food on the spoon is then gradually increased to half a spoonful and then a full spoonful dependent on the child accepting consistently (usually defined as 80% or more of the bites for 3-4 consecutive sessions) at each level. The rationale for beginning with an empty spoon is to establish feeding as a positive experience and to shape and reinforce the requisite behavior for eventually accepting food. For many of these children, the sight of a spoon can result in a variety of refusal behaviors including crying. Using an empty spoon allows the child to contact the positive consequences (or rewards) for acceptance.

Another example of stimulus fading is taking a liquid that the child refuses by cup and presenting it by spoon. As the child accepts the liquid by spoon, the utensil can be gradually changed to a cup (Babbitt, Shore, Smith, Williams, & Coe, 2001). In addition, stimulus fading can include changing the concentration of a liquid. For example, when a child refuses to drink anything but water, the intervention may begin with presenting water and then gradually changing the concentration of water/juice from 100%/0% to 90%/10% linearly until the desired consistency of juice is accepted. One final example of an antecedent manipulation is the simultaneous presentation of a preferred and non-preferred food together as a single bite. The rationale is that the child will associate the pleasure of ingesting the preferred food with the non-preferred food and begin accepting the non-preferred food without any other manipulation. Preliminary evidence suggests this strategy works for some children but not for others (Piazza, Patel, Santana, Goh, Delia, & Lancaster, 2002). In addition, the non-preferred food should be hidden from the child. While this strategy has the potential to be quite effective when implemented correctly, there is also the chance that the child will begin to refuse the preferred food because they have been “tricked” into accepting an altered version of their preferred food. Because of this potential problem and the relatively limited research on this manipulation, we recommend that this strategy not be used when the child is an extremely picky eater.

Consequence Procedures.

The hallmark of operant conditioning is the effect of consequences on increasing or decreasing the probability of a behavior in the future. As a result, most behavioral interventions involve the manipulation of consequences for a behavior. In the area of feeding, the primary target behavior (the behavior to be changed) is food acceptance. Although there are different operational definitions of food acceptance, they all have in common that the child's mouth is opened wide enough that the **whole** utensil can be or is placed within the mouth. It is important that the definition of acceptance be the placement of the entire spoon; otherwise, the child begins to close down on the spoon while it is entering the mouth thereby pushing the food towards the back of the spoon so the food does not enter the mouth.

There are two different consequential procedures used for feeding problems: differential reinforcement/attention and escape extinction (Kerwin, 1999). Both procedures are implemented within the context of structured feeding sessions in which the child is given an instruction while the utensil is presented to their lower lip. Figure 1 (*Page 140*) depicts the differential reinforcement procedure. In differential reinforcement, if the child accepts the entire spoon into his/her mouth, positive stimuli and events are presented for a specified period of time (usually 20-30 seconds). Such positive events include toys, music, games, praise, points, stars or anything else the child prefers. If the child does not accept the entire spoon within his/her mouth, the spoon is removed and nothing is presented for the same specified period of time (usually 20-30 seconds). At the end of this time period, the next bite trial begins with the presentation of the spoon to the lower lip and the verbal instruction. When the adult feeder is not providing a consequence, it is important that s/he not speak to the child or make eye contact; otherwise, the child is getting attention after having refused the bite.

The other consequential procedure is escape extinction. Escape extinction is a consequence for food refusal in which the child is ultimately not allowed to refuse the bite. It is much more difficult to implement and should not be implemented without training and supervision. As a result, we will not provide the details for implementation (refer to Ahearn, Kerwin, Eicher, Shantz, & Swearingin (1996) for details).

Research suggests that differential attention procedures can be effective for some children's feeding problems; however, the treatment of serious feeding problems often requires the use of an escape extinction procedure (Cooper et al., 1995; Dawson et al., 2003; Patel, Piazza, Martinez, Volkert, & Santana, 2002). Differential attention procedures combined with antecedent manipulations may maximize opportunities to provide positive stimuli and events for food acceptance; therefore, these combined procedures are often quite successful. The key is to begin by using food type, textures, and utensils that the child willingly accepts 80% or more of the time. Each small change can be considered a step in the program. Each time the percentage of bites accepted is 80% or more for 3-4 sessions, then the next step can be introduced. Examples of possible steps in the program include introducing new feeders, transitioning a food from structured feeding sessions into meals, and thinning the schedule of reinforcement so that the child gets the opportunity to play with a toy after 5 accepted bites instead of after every bite.

Limitations to Success

Although these procedures sound easy and simple, success is often dependent upon continuous assessment and adjustment. We have noticed that children often regress prior to becoming ill. If a child has more than two sessions with behavioral responses considerable different than the other sessions, it may be prudent to revert to the previous step in the program to facilitate maximizing appropriate practice and minimizing inappropriate practice.

Another obstacle to implementation is lack of progress. At the first sign of lack of progress, try to drop back to the previous step and then advance more gradually (make the next step less effortful or smaller) or more slowly (make a change after 5-6 sessions of 80% or greater acceptance instead of 3-4 sessions). If you cannot drop back a step and reestablish a high and stable level of acceptance, it may be time to consider possible active impediments to feeding success, such as a physiological problem. Because the act of eating is an exquisite example of integrated process involving multiple systems, it is also important to consult your colleagues regarding the assessment of any factors that might be hindering the child's progress with the behavioral treatment.

Prevention

Because the treatment of feeding difficulties is so labor intensive and complex, prevention may be a more viable tactic. Prevention begins with direct observation and assessment. Suppose an infant/toddler is refusing to eat a lot of foods or eats a few bites and then stops, and these feeding issues persist over time. There are two possible approaches: 1) wait and see, and 2) try to understand more about why the child is refusing. Although some children's difficulties may resolve over time, there is also a possibility that these difficulties will persist and become more troublesome. Using the factors delineated earlier in this paper, it may be more sensible to begin to assess possible impediments to successful feeding earlier rather than later.

Research has consistently demonstrated that exposure and experience with foods result in increased acceptance. Some simple preventative steps may include requiring the child to take a small bite of a non-preferred food to end the meal. Although it is only a small bite, it keeps the taste of the food in the child's repertoire. As a result, the food will become a familiar food. When the child outgrows the typical "picky" eating pattern of toddlerhood, research suggests that the child will eat more of this food. The use of many of the strategies previously discussed in this paper may successfully prevent some feeding issues from becoming feeding problems.

Conclusion

Feeding issues are common among infants and toddlers, especially those with developmental and/or medical problems. The factors that influence feeding include medical, developmental, oral-motor, gross and fine motor, and environmental. Because eating is a complex process, the best strategy for assessment and treatment is interdisciplinary. Identification and treatment of any impediments that are actively interfering with feeding success is critical. Therefore, in our experience, the most important factor in successful intervention with

feeding problems is constant and continuous monitoring and assessment of progress. By individually tailoring interventions to the behavioral response of the child, you maximize chances for positive change. Behavior analysis provides effective and efficacious interventions for feeding difficulties through both antecedent and consequence manipulations. An important cornerstone of behavioral interventions is clear decisions about each component that structures each feeding session. In addition, behavioral approaches to feeding also provide guidance about possible methods for prevention of feeding problems.

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Components of Mealtime Structure

Component	Considerations
General environment	Level of distraction available from other people, auditory stimulation, visual stimulation, and multisensory stimulation
Seating	Child's feet are flat, hips are flexed at 90 degree angle, trunk is supported, and head is in neutral or slightly flexed position
Antecedents	Type and texture of food presented, size and type of feeding utensil(s), cup, bowls, and plates; type and viscosity of liquids
Food Presentation	Non-self-feeder or self-feeder; specific instruction, global instruction or no instruction; verbal statements or no verbal statements; order in which different foods and drink are presented; how does utensil enter mouth and is anything done inside or outside mouth to facilitate oral-motor skill development
Next Bite or Drink	What determines when the next bite or drink is offered
Criteria to Terminate Meal	What determines how the meal ends: amount of time elapsed. Amount of food/liquid consumed; specific child behaviors; unknown

Figure one on next page!

Differential Reinforcement Procedure

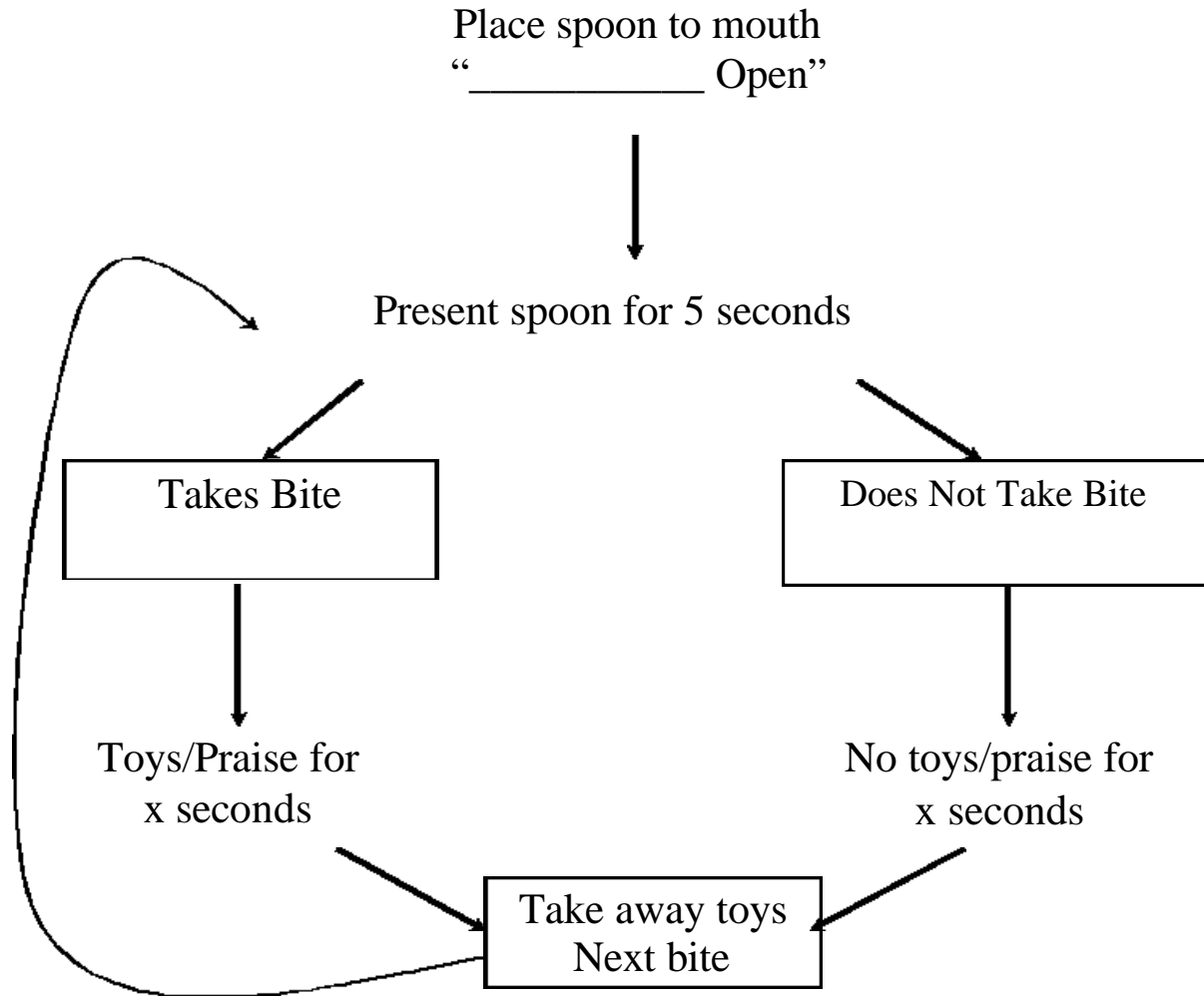


Figure 1. Diagram of a trial in a prototypical behavioral feeding intervention.

Author Note

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