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Editor’s Corner

Lori Davis

This issue of Perspectives is focused on pediatric issues and, specifically, treatment of feeding disorders. Four of the articles discuss specific clinical approaches to treating feeding disorders. Lori Overland describes a sensory-motor approach to treating feeding disorders, focusing on the idea that food refusal is an adaptive response to negative feeding experience. William Roche and his team discuss their interdisciplinary model that incorporates oral, motor, medical, and behavioral aspects of the treatment approach for feeding. Cheri Fraker and Laura Walbert detail a systematic method of using Pre-Chaining and Food Chaining therapy to treat dysphagia and aversive feeding disorders. Kay Toomey and Erin Ross present the SOS approach, which is a transdisciplinary program designed to assess and address the reasons why a child struggles to eat successfully. In the final article, Donna Edwards and Sara Marlise Martin review important information related to choking risk and foreign body aspiration in young children.

This issue would not have been possible without the support and reviews from the Editorial Committee: Sheryl Amaral, Krisi Brackett, Elizabeth Callaway, Todd Coleman, James Coyle, Cindy DuBose, Jane Mertz-Garcia, Jo Puntill-Sheltman, Dave Zirlen, and our CE Administrator, Julie Blair.

The final issue of Perspectives for 2011 will be a point-counterpoint discussion on hot topics in dysphagia. Suggestions from affiliates for future topics are always welcome. Please e-mail me at lori-davis@utulsa.edu to share any topic suggestions or other comments.

Following are some notes for your information and Convention planning purposes:

- The ASHA ACE award recognizes ASHA members and/or certificate holders who show their commitment to professional continuing education by earning 7.0 ASHA CEUs in 36 months. The Coordinating Committee congratulates SIG 13 affiliates who recently received the ACE (www.asha.org/sig/13/SIG-13-Affiliates-Who-Earned-an-ACE-in-2011/).
- The SIG 20th Anniversary Celebration is Thursday, November 17, 5:30-7:00 p.m. at the SIG Lounge, located in the Sails Pavilion area of the San Diego Convention Center. You may also visit the SIG Lounge to talk with other affiliates at any time during the Convention hours.
- Our SIG Affiliates’ meeting at Convention will be Friday, November 18, 12:30-1:30 p.m. (after the SIG 13 Short Course), in the San Diego Convention Center, room 25B. Meeting times and locations may change; for the most up-to-date information, please check the schedule at the SIG information kiosk in the ASHA Member Services Center.
A Sensory-Motor Approach to Feeding

Lori Overland

Alphabet Soup Pediatric Oral Motor, Feeding, and Speech and Language Services
Talk Tools
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Abstract

Speech-language pathologists (SLPs) play an increasingly significant role in the treatment of children with feeding disorders (American Speech-Language-Hearing Association, 2009). Physicians often refer children for feeding therapy secondary to what is seemingly a behavioral issue. This assumed diagnosis usually reflects a child’s refusal to eat; a self-limited diet based upon taste, texture, and visual appearance; or difficulty progressing from breast or bottle to pureed or solid foods. However, a child’s case history review may reveal gagging, choking, or vomiting incidents with the introduction of pureed or solid foods, in addition to possible medical and developmental issues. Food refusals can develop secondary to these concerns. Additionally, the child’s motor skills may not be adequate to handle the food, and the resulting sensory reaction can be described as “fright, fight, flight” (Overland, 2010). Interactions between the sensory and motor systems cannot be ignored (Fisher, Murray, & Bundy, 1991). The use of a purely behavioral approach to treat these children negates the impact of sensory-motor issues on the oral phase of feeding. Though behavioral issues may develop secondary to sensory-motor problems in the mouth, we need to consider the child’s refusal as an adaptive, communicative response to a negative experience, rather than as the primary disability to be addressed. Assessment and treatment of the underlying sensory-motor issues should, in many cases, precede behavioral interventions.

When an infant or child is referred to a speech-language pathologist (SLP) for feeding issues, the SLP should conduct a comprehensive feeding assessment, including a review of the child’s medical status; overall gross, fine, and oral-motor development; nutritional status; and sensory processing (Arvedson & Brodsky, 2001). Issues that affect safe, effective, nutritive feeding may be secondary to oral, pharyngeal, or esophageal dysphagia. This article will focus on the oral phase of feeding.

The oral phase of feeding includes intake of food into the oral cavity, preparation of the bolus, and oral transport in preparation for swallowing. Infants are born with hard-wired synergies, or reflexes, that support the oral phase of feeding. These synergies become mature motor skills secondary to the infant’s experiences with the environment and feeding (Morris & Klein, 2000). Medical issues, such as craniofacial anomalies, gastrointestinal disorders, compromised respiration, and allergies, may interfere with feeding. Delays or disorders in gross motor development, such as reduced postural stability or head control, may interfere with the development of integrated oral-motor skills. In addition, sensory processing issues, such as regulation disorders, sensory discrimination, and sensory-based motor delays, may also contribute to feeding disorders.
Children with sensory regulation problems may not be able to organize themselves for feeding. Those with oral sensory issues may not feel the food in their mouths, or they may be overly sensitive to the feeling of the food in their mouths. In addition, they may not feel hunger or satiation. Sensory processing issues can cause feeding disorders, such as food refusal and self-limited diets (Twachtman-Reilly, Amaral, & Zebrowski, 2008).

It is important for the clinician to know the typical development of motor skills that support feeding in order for him/her to complete an oral phase assessment. By 2 years of age, the typically developing child has the ability to eat a wide variety of food textures and usually has been exposed to a variety of food tastes (Bahr, 2010). Assessment of oral-motor skills should include task analysis of the movements typically observed in the wide range of normal skill developments.

We must also consider the impact of the sensory systems on the oral phase of swallowing. Think about the motor skills that a 2-year-old uses for spoon-feeding. The jaw opens just wide enough to accept the spoon. The upper lip comes down and inward to remove the food as the lower lip provides stability (Morris & Klein, 2000). A labial seal is maintained as tongue retraction and cheek contraction support oral transport of the bolus. The taste, texture, temperature, and size of the bolus provide sensory input.

Children with muscle-based issues that affect feeding often use compensatory movements such as wide jaw excursions, tongue protrusion, jaw/lower lip protrusion, biting the spoon, and using head retraction to remove the food from the spoon. Oral transit time may be delayed, and the sensory feedback that facilitates a swallow may be inhibited (Overland, 2010).

To manage solid foods, the 2-year-old child needs a different set of motor skills. In a typically developing child, these skills develop as the child learns to handle liquids and purees and mouths toys. A 2-year-old child has the ability to bite through a texture, such as a hard cookie. The tongue tip and lateral borders of the tongue are used to move the food to the molars for mastication. The bolus is then collected, organized, and swallowed. Jaw strength must be graded and adequate to break down the bolus (Bahr, 2001).

Depending on the size and texture of the bolus, the child may transfer it between right and left molar areas in conjunction with a rotary chew pattern. Lip closure and cheek contraction serve to control the bolus and support mastication. The taste, texture, size, and shape of the bolus provide the sensory input. If the child does not have the motor skills to adequately masticate a solid bolus, he/she may develop compensatory strategies. Compensatory motor skills may include a nondissociated munch chew, suckling the food on the surface of the tongue, or pooling of the bolus on the anterior surface of the tongue or behind the front central incisors. In addition, food may be held intra-orally for an extended period of time, or the bolus may be swallowed prior to being adequately masticated. Both problems can be related to decreased sensory awareness and/or registration.

Any breakdown in oral sensory-motor development can result in gagging, choking, vomiting, and subsequent food refusal (Twachtman-Reilly et al., 2008). The sensory properties of the food affect the ease with which it is masticated. A Cheerio® or Gerber Puff® can be handled with a munch chew or suckle pattern, whereas these early motor skills cannot effectively break down a piece of meat or a raw vegetable (Overland, 2010). For some children, this results in a self-limited diet that may include easy-to-dissolve, meltable solids. Children who accept only small amounts of food that is more difficult to masticate may tire easily or lose interest. The nutritional value of meltable solids is lower than that of meats and vegetables that are more difficult to masticate. This affects a child’s ability to thrive and gain weight (Gisel, 1994). These self-limited diets or self-limited quantities are often viewed as behavioral issues, when they are actually adaptive responses to primary oral phase feeding disorders (Overland, 2010).
Purely behavioral feeding programs use preferred foods, toys, books, or television to reinforce children for eating challenging foods. They do not account for the sensory and motor challenges children may be experiencing. In addition, many children are resistant to doing therapy with food given their past negative experiences. While a behavioral feeding program can encourage children who have compromised motor skills to swallow purees, these children are often at risk for choking with the introduction of solids. Purely sensory-based programs encourage children to explore the smell, feel, and taste of food. However, this approach does not help a child with limited motor skills to develop the ability to safely handle food. It is essential to incorporate behavioral and sensory components into a feeding program; however, they should be implemented in conjunction with a motor-based pre-feeding approach.

The goal of a pre-feeding program is to develop the motor skills for feeding. Following task analysis/evaluation of the sensory and motor systems, the clinician designs a program to help the child develop skills needed to support safe, nutritive feeding (Overland, 2010). The motor planning required for specific feeding tasks, such as spoon feeding and chewing, can be addressed with oral sensory-motor activities and exercises prior to the introduction of solid foods. Appropriate oral massage and motor planning tasks with oral-sensory tools can help facilitate the development of motor movements required for the oral phase of feeding (Beckman et al., 2004).

Oral massage may assist with oral sensory registration and regulation. Carefully selected motor-planning tasks may assist with successive approximations toward the requisite motor skills used in feeding. After the child has improved sensory regulation and some pre-requisite oral-motor skills, a therapeutic feeding program can be designed. This includes choosing adaptive utensils, cups, and therapeutic straws (Rosenfeld-Johnson, 2009). Other decisions the clinician considers when designing a therapeutic feeding program may include the choice of foods, the size and shape of the bolus, and the placement of foods in the oral cavity (Overland, 2010).

The following case study illustrates the use of pre-feeding and therapeutic feeding techniques with a 2-year-old child who has a diagnosis of Down syndrome.

**Case History**

Allison was referred to my office by her physician, secondary to concerns regarding nutritive feeding. In addition to a diagnosis of Down syndrome, Allison had a complicated medical history that included prematurity, bronchiopulmonary dysplasia (BPD), and neutropenia. Allison had feeding challenges from birth. She was initially fed intravenously and then transitioned to oral gastric (OG) tube feeds, which were followed by nasogastric (NG) tube feeds. Finally, a gastrostomy tube (G-tube) was placed prior to Allison’s leaving the neonatal intensive care unit (NICU). Allison’s family worked hard to transition her to bottle feeds and purees. She reportedly “never really enjoyed eating purees” and the majority of her nutrition continued to be provided from formula at age 2 years. Her parents had attempted to introduce solid foods at 1 year of age. Allison gagged and choked numerous times; she eventually refused to open her mouth for anything but rice crackers, Veggie Stix®, and Goldfish® crackers.

Allison’s family had been advised by their SLP to “just keep giving her a variety of foods to explore and she will eventually eat.”

**Assessment Notes**

During the evaluation, Allison was observed exploring a rice cracker. She broke off a small piece using a nondissociated head and jaw movement. She clearly enjoyed the salty flavor on the first trial. The cracker was held on the front third of her tongue, and a suckle-like pattern was used to break it down. Over the next three trials, the following observations were made:

- Allison partially broke down the cracker and used a suckle-like pattern to facilitate oral transport of the poorly masticated bolus followed by a hard swallow.
On the next “bite” the cracker piece was slightly larger, and Allison used a lingual protrusion to expel the bolus.

On the last bite, the cracker was “stuck” at the midline on Allison’s tongue; she subsequently gagged, vomited, and adamantly refused another piece.

A task analysis of Allison’s oral-motor skills revealed she did not have adequate jaw strength or the motor plan for chewing. She was also unable to sweep the bolus to the molar ridge using the lateral margins of the tongue and the tongue tip. Following episodes of gagging, choking, and vomiting, Allison’s sensory system went into “fright, fight, flight.” She self-limited her diet to foods that could be easily broken down with existing motor skills.

**Treatment Plan**

The initial pre-feeding plan was established to address adequate and graded jaw strength and the motor plans for chewing. Because Allison was averse to trying new movements with foods and tolerated firm bouncing on a therapy ball, whole body movement was initially paired with the facilitation of up-down jaw movement. Once she tolerated up-down jaw facilitation, a Chewy Tube® was placed, while she was seated, perpendicular to the lateral molar ridge where her first molar would emerge. A “munch” chew on the tube was facilitated using jaw support. Allison was now ready to move toward therapeutic feeding. The Chewy Tube® was filled with a Veggie Stix® and the entire sequence was repeated. At this point, Allison was able to bite on a Chewy Tube® with imposed support. Allison was able to manipulate the crushed Veggie Stix® and swallow the bolus. Finally, the Chewy Tube® was replaced with a Veggie Stix®. Jaw support to facilitate a chew was imposed as the Veggie Stix® was presented perpendicular to the lateral molar ridge, making sure she could only bite off what she would crush with her gums. Once again, Allison was successful with oral transport of the crushed bolus. The use of carefully selected pre-feeding exercises and activities allowed Allison to develop the motor plan for chewing along with positive sensory feedback and safety. Presentation of the bolus on the molar ridge allowed Allison to break down the bolus, even though she did not have the lingual mobility to move the bolus. Future goals for this client include the development of lingual mobility and the motor plans for tongue lateralization to support a rotary chew.

**Conclusions**

Children such as Allison, who present with delays in the motor skills to support feeding, may have had negative sensory experiences with food. If a child resists the use of food paired with therapeutic feeding techniques, a sensory-motor based pre-feeding program could be implemented with carefully selected oral sensory-motor exercises and activities. This will allow the child to develop the motor plans for safe nutritive feedings. Once prerequisite oral-motor skills have been acquired, sensory exploration techniques and behavioral reinforcements, if needed and appropriate, can be used effectively to expand the diet and increase food quantity.

**References**


Bahr, D. (2010). *Nobody ever told me (or my mother) that! Everything from bottles and breathing to healthy speech development*. Arlington, TX: Sensory World.


An Oral, Motor, Medical, and Behavioral Approach to Pediatric Feeding and Swallowing Disorders: An Interdisciplinary Model

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Abstract

Feeding and swallowing problems are reported in 10-25% of all children, 40-70% in premature infants, and 70-90% in children with medical/developmental delays (Graham, 1985; Rogers & Arvedson, 2005; Sullivan et al., 2000). The etiologies of feeding disorders are as varied as the multiple disciplines, approaches, and interventions available. This paper illustrates, through case presentation, an interdisciplinary feeding team model that incorporates an oral, motor, medical, and behavioral approach to treating children with feeding disorders.

A Team Model

Children with feeding disorders often present with complex multifactorial symptoms. The assessment and intervention model selected by a facility is, in our experience, as important as the interventional strategies themselves. Rommel, DeMeyer, Feenstra, and Veereman-Wauters (2003) found that nearly 50% of the 700 children evaluated with feeding problems had both medical and oral problems and that a multidisciplinary team approach was indispensable in assessment and intervention.

There are essentially two assessment and treatment team models: multidisciplinary and interdisciplinary (Arvedson, 1998; Strauss, 1999; Williams, Witherspoon, Kavsac, & McBlain, 2006). The multidisciplinary model provides an opportunity for individual practitioners from various disciplines (e.g., speech, gastroenterology, physical therapy, pediatrics, behavioral psychology) to independently evaluate and treat the patient and cooperate with other disciplines, but there is little collaboration and shared information. One liability found within
the multidisciplinary model is the lack of integration of findings, impressions, and recommendations (Kummer, 2008). The oral, motor, medical, and behavioral approach chosen to address swallowing and feeding problems at the Center for Pediatric Feeding and Swallowing at St. Joseph’s Medical Center in Paterson, New Jersey, replicates an interdisciplinary model used by the 34 pediatric subspecialists serving the regional craniofacial team at the same medical center. The feeding and swallowing team includes a pediatrician, nurse practitioner, speech-language pathologist (SLP), family counselor, occupational therapist, physical therapist, applied behavior analyst, feeding specialists (six), financial representative, child-care aides (two), and a secretary. Not unlike children with a craniofacial anomaly, children with a feeding disorder require an interdisciplinary collective process that encourages family participation, shared assessments and treatments, and negotiated mutual goals with timelines. The treatment program also should feature a vehicle to ensure timely follow-up appointments and treatment coordination and a forum for face-to-face collaboration.

**Swallowing Versus Feeding**

Requisite for the development of a successful feeding treatment plan is the knowledge that the anatomical and physiological components of the swallow can safely support the recommended feeding goals. Children signal in a variety of behaviors their aversion to and refusal of a bolus (Arvedson, 2001). What initially presents as bolus refusal, avoidance, aversion, or failure to transition may, in part, be attributed to swallowing dysfunction. History, clinical examination, and mealtime observation are critical components to determining if the child can safely transport a bolus. If these noninvasive clinical observations uncover questions concerning structure, safety, and timeliness of the swallow, the clinician may need to use instrumental assessments to obtain more objective information. Therefore, the radiologist, otolaryngologist, and gastroenterologist are indispensable ancillary cohorts to members of the swallowing and feeding team.

For example, the Center for Pediatric Feeding and Swallowing recommends the multiview videofluoroscopic swallow study (VFSS), considered the gold standard evaluation tool for the pharyngeal swallow event, for the 2% of children for whom the clinical evaluation does not clearly elucidate the competency of the swallow. The VFSS is transmitted live from the radiology suite to the interdisciplinary feeding team through efeed™, a telemedicine teaching vehicle. This telepractice connection allows the radiologist, SLP, and caretaker completing the swallow study in the radiology suite to collaborate in real time with the feeding team members who are physically blocks away.

Typically, there are three vignettes to each of the VFSSs completed at the Center. The first vignette is replication. The SLP and caretaker attempt to reproduce feeding variables, such as the representative seating, posture, feeder, utensil, pacing, and bolus composition, that were reported and/or observed during the clinical observation to be easy or difficult. The second vignette is modification. The SLP, caretaker, and team members collaborate in real time by efeed™ and apply, observe, and adjust adaptations to the feeding variables. This vignette is an essential element to the dynamic X-ray procedure when aspiration is suspected or identified (Taniguchi & Moyer, 1994). The third vignette is feedback/documentation. The VFSS images are recorded, creating a visual and acoustic baseline and an opportunity for teaching caretakers, staff, and the referral source. A DVD of the swallow study accompanies each written report requested from the Center. Other instrumental studies can help to further evaluate the feeding problem or provide support for the feeding treatment plan. Flexible endoscopy enables the clinicians to observe saliva and thin liquid swallows, pharyngeal-laryngeal color, symmetry, physiology, and anatomy. An upper gastrointestinal (GI) series, scintigraphy, and impedance pH probe may be recommended to document upper GI structural deficits, gastroesophageal reflux, or motility issues. All of the instrumental studies have the capability of being transmitted via efeed™ to the interdisciplinary feeding team.
Clinical Perspectives

With the safety of the swallow ascertained, the feeding assessment can move forward. Children with feeding problems often present with delays in acquiring feeding skills. Feeding skills are learned and require successful practice at each skill level, analogous to the attainment of gross motor skills. At the Center for Pediatric Feeding and Swallowing, we believe that the acquisition of feeding skills occurs as a natural progression as long as there are no barriers to practice. Impediments to successful feeding practice include GI dysfunction, developmental delays, neurologic impairment, anatomical variations, medical compromises, and motor delays. Behavioral problems typically develop as well, as the child works to avoid eating. We have found that an evaluation that includes a medical and feeding history, growth pattern and developmental history, oral-motor evaluation, motor evaluation, and feeding observation provides the information necessary to identify the inhibiting factors. Recognizing inter-relationships among inhibiting factors enables clinicians to formulate goals and prioritize interventions. The success of the feeding treatment plan depends on the integration of the oral, motor, behavioral, and medical expertise.

Oral-Motor

The initial task of the oral-motor specialist is to identify a child’s present level of oral function during feeding and non-feeding tasks. Often the child will demonstrate greater range and coordination of movement of the lips, cheeks, and tongue when no food is present. Thus, observation during a mealtime is a key element in the evaluation process. Once the clinician has identified and controlled deterrents to advancing feeding (i.e., medications, posture, respiratory), the oral-motor therapist can focus on practicing oral-motor skills needed to improve feeding function. After the child has mastered the new oral-motor skill, he/she is encouraged to practice with a variety of foods at that level of competence. Therapy continues to stimulate the oral-motor movements necessary to advance to the next texture. To correctly swallow pureed food from a spoon or a sip of liquid from a cup, the child needs to use a single anterior to posterior tongue movement with the jaw stabilized. This can be stimulated by putting a press onto the mid-tongue with the spoon and then pulling the spoon out slowly while providing chin support. Once the child is eating pureed foods using a single posterior tongue movement, he/she will find cup-drinking easier because it requires the same oral-motor movement.

To move beyond to higher textured food, the patient needs to acquire lateral tongue movement and increased movement of the jaw to adequately manipulate, crush, and transport the food. Our approach to improving chewing skills is a multidisciplinary one. We believe there are two very important components to chewing: the biting movement of the jaw and, equally important, effective lateral movement of the tongue to push the food between the jaws and then recollect the pieces. To attain chewing, we first try to optimize the child’s respiratory and GI function to make her/him more comfortable. Proper seating is important to ensure correct positioning, which maximizes postural control. Often, we find that improving rotation through the trunk also helps to improve lateral movement of the tongue. Once the child is comfortable, medically stable, and properly positioned, we can focus on oral-motor function. Prerequisite to chewing is the effective use of the tongue to transport the food bolus as described above; the child who uses his or her cheeks to suck the food back or will not accept food onto the tongue is not going to be a successful chewer. If the child uses a central transport pattern, we will take the texture with which he/she is most successful (usually puree) and place it into the cheek using lateral placement of the spoon. The lateral position of the familiar food is intended to encourage lateral movement of the tongue in order to return the food to the center of the tongue to be swallowed. Once the child demonstrates lateral tongue movement with the familiar food, we can advance the texture to either mashed consistency or soft chewable. For some children, pressing a crunchy chewable, like cereal or a cookie piece, over the molar surface will stimulate tongue movement to the side. This is also a useful technique when the
child has weak or absent jaw compression (biting). When crunchy chewables are mastered, we add soft chewables, presenting them over the teeth. The child who has real mastery will move a chewable piece from the center of his or her tongue to the molar surfaces. Each of these steps is accomplished in the chair with proper positioning and supervision. As the child becomes more efficient with chewing, more of the meal is advanced to a chewable texture.

**Medical**

The task of the medical professional is to identify the medical issues interfering with successful feeding practice. The chronology of the child's feeding history helps to pinpoint when feeding difficulties began and, when combined with the medical history, often suggests the underlying contributing medical factors. For example, a 15-month-old child presents with poor weight gain and limited intake of a few soft table foods. The feeding history describes persistent refusal of spoon feedings and premature elimination of bottle feedings. The medical history identifies a change to firm, infrequent stools at 5 months with slowed weight gain since that time. Taken together, they suggest that constipation decreased the child's caloric intake and interest in eating, resulting in delayed oral-motor development and deficient growth parameters. The abdominal distension and palpable stool on physical exam corroborates this hypothesis. Irritation or increased pressure anywhere along the GI tract can cause enough discomfort to reduce the child’s interest in eating, as well as negatively influence the coordination of the patterned muscular contractions of the swallow (Chao et al., 2008; Hassall, 2005; Hyman, 1993). Likewise, a medical issue that interferes with respiratory function can also affect feeding and swallowing. In fact, GI and respiratory problems are the most common medical issues that interfere with successful feeding (Manno, Fox, Eicher, & Kerwin, 2005; Williams, Field, & Seiverling, 2010). Sensory information from the lungs, heart, and GI tracts travels to the sensory area of the swallowing center in the brainstem, where it can directly modify the motor output area (Miller, 1986). Because the pharynx serves both the respiratory and alimentary tracts, the neurologic impulses are gated to enable respiration to supersede swallowing (Lefton-Greif & McGrath-Morrow, 2007). Thus, when respiratory work increases significantly, the time available for swallowing decreases, which makes feeding more difficult (Timms, DeFiore, Martin, & Miller, 1993). For preterm infants with feeding difficulties, abnormalities of the swallow/respiration interface may be more causative than the suck/swallow interaction (Lau, Smith, & Schanler, 2003).

**Motor**

The task of the motor therapist is to address postural alignment and mobility of the head, neck, shoulder girdle, and trunk. The trunk serves as the foundation for the shoulder girdle, which then influences the function of the tongue and swallowing mechanism (Darnell, 1983). The trunk also houses the rib cage and abdominal organs and is the location of respiration, food digestion, and stool evacuation. Postural alignment is an aspect of the feeding and swallowing puzzle. Children who are working hard to breathe or experience discomfort within the gastrointestinal tract will often choose positions that assist their efforts to alleviate pain/pressure on the abdomen. Children with abdominal discomfort tend to assume a hip angle that is more than 90 degrees when sitting; this results in a posterior pelvic tilt (Darnell, 1983). We have found that this compensatory strategy results in a “C” spinal curve, or a kyphotic position, rounding the shoulders forward. This posture increases the work of breathing and changes the line of muscle pull within the tongue, jaw, and swallowing structures due to its forward head posture. This kyphotic posture places pressure on the abdomen, which can increase reflux and make digestion more difficult (Eicher, 2007).

A goal at the Feeding Center is to position the pelvis, trunk, and shoulder girdle in neutral alignment using a high chair, car seat, or therapeutic seating system. These tools provide a strong base of support for the swallowing and oral-motor structures. Postural re-education techniques are taught to caregivers to assist in stimulating extensor patterns outside of mealtime activity. Rib cage mobility and respiratory pattern are equally important considerations for the motor therapist, because “if you can’t breathe, you can’t function”
(Massery, 1991). The team assesses breathing patterns by looking at the rib cage shape, size, mobility, and support from the spine and the abdominal muscles. The ribs encase the lungs and provide the attachment for the diaphragm; therefore, if rib shape is asymmetrical, barreled, or indented, the movement of the diaphragm and the expansion of the lungs can be restricted. Therapeutic strategies employed at the Center to improve shape and movement include manual mobilization to the rib cage and spine, active thoracic extension with scapular retraction, and kinesiotaping. It has been our experience—and Yasukawa, Patel, and Sinsung (2006) reported—that kinesiotaping application is most effective after therapeutic exercises due to its ability to excite the targeted muscles.

It is through movement that children strengthen and gain control of muscles that maintain postural alignment of the swallowing structures to the shoulder and head, assisting with rib cage development and breath support (Massery, 1991). Our experience has shown that a motor treatment program must have a dynamic component, to lengthen and strengthen structures for maximal alignment and control, and a static component of proper seating, to provide alignment and support during meals, so the refined patterns of the mouth and the swallow can be accurately practiced.

**Behavioral**

The role of the behavior analyst is to assess the environmental factors contributing to a child’s feeding difficulties, help in the development and implementation of mealtime contingencies, and systematically evaluate the contributing factors and treatment recommendations using objective data. Oral-motor, medical, and motor impediments can make consumption of food and/or liquid difficult. Even when these deterring factors have been minimized, children with a history of feeding difficulties may persist with a negative association for food or other aspects of eating. Therefore, many of these children need to be taught how to consume higher textured foods and they need to be exposed to a variety of foods (Manikam & Perman, 2000).

When presented with nonpreferred or difficult-textured foods, children with feeding difficulties may engage in a number of undesirable mealtime behaviors (Babbitt et al., 1994). These include refusal to go to the eating area, crying, clenching teeth when food is presented, batting the spoon or food away, turning the head away from food, gagging, spitting food out, holding food in the mouth for extended periods of time, or even vomiting. Research has been conducted to identify the reasons or functions involved in these behaviors (Piazza et al., 2003). The most common function for these behaviors is to escape the consumption of food or a particular food item. This is consistent with the known etiologies of feeding disorders discussed above. The second most common reason children engage in undesirable mealtime behaviors is to obtain additional adult attention or preferred items (e.g., toys). Parents of children with feeding difficulties typically attempt various strategies, such as coaxing, bribing, and punishment, to persuade their children to eat. Unfortunately, these strategies are often not based on the function of the undesirable behavior or the etiologies of the feeding disorder and may maintain or exacerbate the undesirable behaviors.

It has been found throughout the behavioral literature that strategies based on the function of the undesirable behaviors are more effective than those based on other factors (Iwata et al., 1994). Several treatment procedures based on the principles of learning have been examined in the literature and found to be effective in increasing the acceptance and consumption of food in children presenting with feeding disorders. The delivery of preferred objects or activities as a distraction or consequence of completing a targeted task has been shown to be effective in the area of feeding disorders (Riordan, Iwata, Finney, Wohl, & Stanley, 1984). This positive reinforcement procedure is typically one of the first recommendations Center staff make when adding structure to mealtimes.
Family

The task of the Family Counselor is to educate, support, and guide families in the journey to more successful mealtimes. Often, the family counselor is the first person families meet at the Center. The families may reside anywhere, but all share a common theme of a disruptive family life. Parents will go to any extreme to help their child eat, even if it means uprooting the entire family to live in a hotel for 5 weeks. Many families recall extended mealtimes and battling with the child during meals (Craig, Scambler, & Spitz, 2003). Families report they want normalcy at mealtimes, a pleasant experience, no tantrums, and no vomiting; that is, they just want to eat dinner as a family. The transition from chaos at meals to structured family meals is often a difficult journey. Families are more successful with support from a comprehensive interdisciplinary team and families who have faced similar challenges. In our experience, parents are more successful and partner with the team when they feel comfortable asking questions and empowered to actively participate in the daily mealtime learning activities at the Center.

When entering the program, families want to hear about what they should expect and what challenges they will face; they want to be informed consumers. Before a family enters into the 4-5 week intensive day treatment program at the Center, we encourage them to use the Center’s website, phone, e-mail, and/or efeed™ to communicate with other families who have graduated from the program. Research indicates that families appreciate the opportunity to speak with others who empathize with them; speak the same language; and share the same fears, frustrations, and anxieties (Craig, Scambler, & Spitz, 2003).

Another level of support the Center offers is parent training. Parents are often desperate to get their children to eat. This anxiety often leads to “whatever he will eat is what I give him.” The staff recognizes that families require training and guidance during the transition from chaotic to structured mealtimes, where the parents are in control. Families seem to prefer an apprenticeship-style approach to learning practical skills (Hoddinott & Pill, 2000).

It can be difficult to teach parents how to feed their children. The staff often meets resistance because the parent is reluctant to give up the role of “child expert.” Staff can facilitate the learning process by including parents in setting feeding goals, in addition to daily communication and mealtime observation. Parents appreciate knowing why and how decisions are made. The more effective the communication between patient and provider, the more likely parents are to adhere to the program (Nobile & Drotar, 2003). For example, in the Center, daily communication regarding bowel movements and meals at home is maintained via a journal that travels with the child to and from the Center. The idea is for the parent to become the feeding expert for the child; one of our goals is for the family to successfully transition our program to home and the educational setting. Efeed™ has been an asset in promoting this carryover.

Case Presentation

M. was born prematurely at 23 weeks. From birth, his feeding practice was limited and sporadic due to significant prematurity and his medical history. Although he escaped prematurity without significant neurologic deficits, his infancy was complicated by respiratory issues in the form of bronchopulmonary dysplasia (BPD) and GI problems in the form of gastroesophageal reflux and constipation. M.’s primary diagnosis initially was BPD. Dumas, Skaff, Just, Tounian, and Girardet (1997) found that, like M., children with BPD are at risk for nutritional compromise. Reflux; aspiration; and developmental, respiratory, and motor coordination issues are prevalent in children with BPD; therefore, fluoroscopy and endoscopy studies are integral to uncovering some of the underlying reasons for food refusal and aversion. By 28 months, however, M. no longer needed respiratory support to maintain adequate respiratory function at rest and for all normal activities. M. had continued difficulty with
constipation and persistent vomiting, despite medication resulting in gastrostomy tube (G-tube) and then gastrostomy-jejunal tube (G-J tube) placement.

Bottle feeding was attempted once M. was weaned off ventilator support at 3 months of age, but he required tube feedings for adequate nutrition. At 8 months, M. had refused both bottle feedings and the introduction of spoon feedings. From 8 months of age to 24 months, M.’s oral intake was minimal with frequent vomiting. For M., vomiting did not result directly from reflux, given that the majority of his nutrition was given through the jejunal tube (J-tube) portion of the G-J tube. Often, his vomiting during meals was accompanied by gagging that could have resulted from tongue position or increased nausea. M.’s history of constipation suggested continued increased intra-abdominal pressure.

When he was 24 months old, M. was given a laxative to facilitate regular daily bowel movements. M. began to accept 2-3 ounces of four baby foods, but refused all other foods. M.’s parents reported that he only ate when he was attending to a highly preferred video or toy and often required frequent coaxing. M. often retched or gagged throughout the meals.

M. presented to the Center for Pediatric Feeding and Swallowing as a 40-month-old male on G-J tube feedings because he could not advance beyond 4 ounces of a few table food purees, four times a day. Feedings of an amino acid–based formula given over 12 hours through the J-tube portion of the G-J tube provided most of his nutrition. He continued to vomit 1-2 times a day. His medications included small doses of a proton pump inhibitor and laxative.

On feeding observation during the evaluation, M. was reluctant to get into the chair and refused to sit in a booster seat. He asked to play with an iPad during the meal; his mother allowed him access for 1 minute after every three bites. Initially, M. opened well to accept spoons of applesauce. His tongue was humped posteriorly. As his mother lightly scraped the spoon on his upper lip to strip the food off the spoon, he lowered his head pulling his tongue back away from the spoon. He swallowed with a push of his tongue anteriorly, not extending beyond his lips. He then suckled multiple times after he swallowed. After he had consumed about 2 ounces, his mother needed to negotiate with him more. He complained, refused, cried, and asked to be done. She stopped the meal at about 3 ounces of food. M. also sucked on his tongue when playing.

The physical exam was remarkable only for a high-riding rib cage. Motor evaluation demonstrated that he had normal tone and was able to sit independently; however, he demonstrated a posterior pelvic tilt, decreased thoracic extension, bilateral shoulder rounding, and a forward head posture. We found that M.’s rib cage had not descended as expected for a 40-month-old; this condition is associated with decreased abdominal muscle activation.

The team recommended facilitating increased stool output to decrease intra-abdominal pressure. The dosage of proton pump inhibitor was increased to decrease stomach discomfort, in light of the gagging and retching with oral feedings and protective tongue posture. As his GI issues improved, he became more comfortable, more cooperative, and better able to tolerate the oral-motor techniques needed to increase feeding success.

Related to his GI issues, M. assumed a hip angle that was greater than 90 degrees when sitting, which resulted in a posterior pelvic tilt, secondary “C” spinal curve, and rounded shoulders. M.’s posture increased his work of breathing; changed the line of muscle pull within his tongue, jaw, and swallowing structures; and increased pressure on the abdomen and diaphragm. To improve his posture in sitting, we recommended using a car seat with shoulder straps for meals to set the pelvis, trunk, and shoulder girdle in neutral alignment.

Rib cage mobility and respiratory pattern were also important components of M.’s motor evaluation. Examination found M.’s rib cage flared at the lower borders and had limited upper chest expansion secondary to a kyphotic sitting posture, as well as increased posterior intercostal spacing for respiratory support. Therapeutic strategies used during the 4-week
admission to improve shape and movement included manual mobilization to the rib cage and spine, active thoracic extension with scapular retraction, and kinesiotaping.

M. presented with food refusal unless he was attending to a highly preferred video or toy and often required frequent coaxing. M.’s mother tried to provide preferred objects/activities for 15 to 20 seconds contingent upon acceptance of a bite of food and removing preferred objects/activities for 15 to 20 seconds for refusal. However, she had thinned it to every third accepted bite and, when she negotiated with him after 2 ounces, she drifted into continuous attention. M. was observed to use a thrusting, suckle-like pattern, exaggerated by sucking on his tongue outside of mealtimes. Using this oral pattern, he could safely swallow pureed food; however, he gagged frequently, due in part to poor clearance of the bolus as well as his continued GI issues.

The initial goal of oral-motor therapy was to decrease/eliminate the continual sucking pattern by stimulating posterior tongue movement during transport of the pureed food. It was necessary for M. to learn to eat pureed food correctly before the clinician stimulated oral-motor movement for higher textures. To accomplish this, we needed to obtain consistent acceptance in order to position the spoon on mid-tongue. Because we wanted to use the mealtime structure to help him accept food as the meals became more difficult, we modified the structure to preferred toys/videos provided only after each accepted bite. With medical, motor, and behavioral interventions in place, we focused the therapy on strong mid-tongue pressure with the spoon during the feedings, while providing jaw stability to facilitate tongue jaw disassociation. Reinforcement in meals included play after every two bites accepted. Although M. tolerated an increase in volume to 4-4.5 oz./meal four times daily and accepted a wide variety of pureed table foods, he continued to demonstrate poor oral transport with occasional gagging and retching. We evaluated hyoglossal support, a technique intended to strengthen posterior lingual movement. With weeks of practice, M. was able to significantly decrease the suckle pattern and use a single posterior lingual movement before transport. This resulted in an improved swallow, and gagging disappeared.

During his last week of admission, staff provided consistent parent training and adjusted reinforcement, allowing M. to play during the entire meal. At the time of discharge, M. was eating four 4- to 5-oz. meals daily and drinking an amino acid–based formula from an open cup. His tube feeding schedule was decreased to 4 hours overnight.

Summary

An interdisciplinary team model of care for children with swallowing and feeding disorders provides opportunities for early identification of contributing factors and collaborative interventions. Utilizing an oral-motor, behavioral, motor, and medical approach has proven to be a viable, comprehensive diagnostic and therapeutic option when a child presents with a feeding problems.

References


Treatment of Selective Eating and Dysphagia Using Pre-Chaining and Food Chaining© Therapy Programs

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Abstract

Pre-Chaining and Food Chaining© are child-specific intervention programs used to treat pediatric patients with dysphagia and selective eating. Pre-Chaining programs are designed primarily for infants with severe dysphagia. The focus of treatment is rehabilitation of the swallow and pro-active care to keep the infant’s feeding development on track as much as possible through the critical periods of the first year of life. At each stage of development, the infant nervous system is ready to acquire new motor skills. The medically fragile infant may not have adequate feeding exposure during these periods of development. This lack of experience may result in great difficulty mastering the skills later in life. Pre-Chaining helps the infant with dysphagia acquire skills with very minimal amounts of food and liquid. Volume is increased only as swallow function and oral skills improve. Food Chaining© has been developed as a systematic method for the treatment of children with food selectivity and aversive eating behaviors. Food Chaining is an individualized, multidisciplinary, home-based feeding program designed to expand food repertoire by emphasizing similar features between accepted and targeted food items. This paper will discuss Pre-Chaining and Food Chaining therapy as methods to treat dysphagia and aversive feeding disorders.

Pediatric Feeding Disorders

With advances in perinatal care, premature infants are surviving at earlier gestational ages, creating a population of children at high risk for developing feeding and swallowing disorders. Mercado-Deane et al. (2001) reported that 26% of preterm infants have dysphagia, which is double the incidence seen in term infants. Oestreich and Dunbar (1984) found that nasopharyngeal reflux has been associated with apnea, choking, and pneumonia in the infant. Aspiration can result in significant health issues such as bronchiectasis and pneumonia. Inappropriate feeding products, techniques, and positioning can interfere with ventilation and contribute to poor intake and growth patterns. Clinicians must be pro-active and forward-thinking in management these complex patients.

Fraker, Walbert, Cox, and Fishbein’s (2007) Pre-Chaining programs expose infants to minimal therapeutic tastes, following the developmental progression. The clinician uses specifically selected bottles, spoons, and cups to develop a repertoire of flexible oral sensory-motor feeding skills. Volume offered varies, based on each child’s oral-motor and swallowing skill level. Treatment goals are to rehabilitate the swallow, provide consistent taste and texture
stimulation, improve oral-motor function, develop feeding skills, and prevent or reduce the risk of developing feeding aversion. Rudolph and Link (2002) reported feeding aversion in 25-35% of typically developing children. Reilly, Skuse, and Poblete (1996) revealed that dysphagia is reported in up to 90% of patients with neurological disorders. It is our belief that there is a relationship between the immature as well as the disordered oral-motor patterns of infancy and the primitive munching patterns seen in older children with selective eating. An infant with poor oral-motor skills may develop maladaptive feeding patterns that can persist into childhood. An infant fed with a nipple that flows too fast may learn to compensate by lifting the tongue to the palate to reduce flow and protect the airway. As the infant continues to feed with an erroneous pattern, he or she does not master a coordinated suck/swallow/breathe sequence. Poor bottle-feeding skills can lead to difficulty successfully transitioning to cup-drinking. Disordered feeding patterns compromise lip seal, cheek activation, bolus formulation, and control, creating a higher risk for nasopharyngeal reflux, premature spillage, laryngeal penetration, and aspiration. A child may experience aerophagia with significant gastrointestinal discomfort after ingesting food. Undiagnosed food allergies and gastroesophageal reflux may contribute to the negative feeding experience. The child may struggle to consume complex, multitexture, or watery foods. If ingestion of food is associated with uncomfortable or unsafe feeding experiences, over time the child may become increasingly selective in his or her food choices. The child may not possess the skills to successfully consume more challenging textures of food. Food Chaining is used as a method to treat dysphagia and feeding aversion. Food Chaining significantly lowers the risk of food refusal because faulty oral-motor patterns are remediated and foods are offered in a sequence based on the child’s current level of feeding skills (dysphagia chains). The child is likely to accept food items, given that the clinician is specifically targeting the child’s individualized taste, texture, and temperature preferences.

**Use of Pre-Chaining in Treatment**

For the purpose of this paper, we will discuss treatment of the non-oral infant. Pre-Chaining therapy starts with shaping non-nutritive sucking using a Soothie™ brand pacifier. This product is used because the shape closely matches the shape of a standard bottle nipple and facilitates tongue grooving to improve bolus control. The therapist provides firm pressure to the palate or tongue and periodically tractions the pacifier to improve lip seal. The therapist dips the pacifier in breast milk or formula for daily taste stimulation. Once the infant has the ability to hold the pacifier in the mouth and swallow single drops of breast milk or formula, the therapist moves to targeting successive swallows of 2-5cc’s of liquid. Liquid is offered via pacifier/syringe, Hazelbaker finger feeder™, or the Bionix™ bottle, a therapeutic feeding product with a variable flow rate (0 = no flow, 5 = slow flow). The infant is placed in an upright, side-tilt position to accentuate the ability to control the bolus. Wolf and Glass (1992) described external pacing as a method to regulate feeding and improve coordination of the suck/swallow/breathe sequence. Feeding volume is increased in small increments as tolerated. Prone positioning programs are developed and implemented by the physical therapist to improve respiratory function, endurance, and strength. Respiratory skills must be sufficient to support the oral feeding attempts.

At age 5-6 months, the infant starts a pre-cup, pre-spoon, and mouthing program with small tastes of baby food and drops of thin liquid in the soft spout of a cup. Therapeutic utensils (DuoSpoon™, TriChew™) are also used to work on chewing/biting skills and to desensitize the infant to future foods with texture. The textured surface of the utensils reduces intra-oral sensitivity and decreases the risk of gagging and retching with textured food. The infant practices chewing while having to swallow only food-flavored saliva. Some infants tolerate tastes only at the level of “flavored saliva,” while others move on to more substantial portions of baby food and small volume liquid feedings. Intake is increased based on results of video oropharyngeal swallow studies and physician approval. All Pre-Chaining programs are medically supervised.
NNS = Non-nutritive suck. Increase volume of liquids while shaping skills for bottle and cup. Introduce baby food and move to pureed high flavor table foods at age 9-10 months. Increase intake per results of feeding observation, video oropharyngeal swallow study, and physician approval. It is our practice to use cervical auscultation of the swallow purely as a subjective measure of monitoring the quality of intake.

**Food Chaining**

Children refuse to eat for a variety of reasons. Effective treatment involves determining what is behind the aversive response and controlling as many contributing factors as possible. Rudolph and Link (2002) found that pediatric feeding disorders are complex biobehavioral oral sensory-motor disorders, and multidisciplinary care is needed to treat children effectively. The child with feeding aversion must be evaluated sufficiently to determine the cause or multiple causes of food refusal. Food Chaining programs start with the 6-step evaluation process to define the disorder, because understanding the core issues is key to changing eating behaviors.

**Table 1. Evaluation: Defining the Scope of the Feeding disorder (The 6 Steps of Food Chaining)**

<table>
<thead>
<tr>
<th>6 Steps of Feeding Team Evaluation</th>
<th>Red Flags in History</th>
<th>Evaluating Professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Medical evaluation</td>
<td>Constipation, diarrhea, reflux, vomiting, retching, motility issues, allergies, eosinophilic disorders, adenoiditis, laryngeal cleft, vocal cord dysfunction, Chiari malformation</td>
<td>Primary care physician and any of the following subspecialists: pediatric GI, otolaryngologist, neurologist, pulmonologist, developmental pediatrician, radiologist</td>
</tr>
<tr>
<td>2. Nutrition assessment—standard</td>
<td>Poor weight gain, failure to thrive, allergies, inappropriate diet, tube management</td>
<td>Registered dietitian</td>
</tr>
<tr>
<td>3. Oral-motor swallowing evaluation—standard</td>
<td>Wet congested breathing patterns, poor oral reflexes, poor intake patterns, limited liquid intake, lengthy feedings, selective eating or refusals</td>
<td>Speech-language pathologist completes examination and instrumental evaluation of swallowing</td>
</tr>
<tr>
<td>4. Sensory and fine/gross motor evaluations—based on interview and observations</td>
<td>Positioning problems, poor state management, sensitivity to feeding environment, gagging, aversive response to feeding, tactile hypersensitivity, motor delays and tone</td>
<td>Occupational and physical therapist</td>
</tr>
<tr>
<td>5. Behavior Analysis—based on interview and observations</td>
<td>Complex food refusal, anxiety, extreme parent-child stress</td>
<td>Psychologist</td>
</tr>
<tr>
<td>6. Food Chaining assessment</td>
<td>Excludes entire food groups, rigid brand-specific eating patterns</td>
<td>Clinician and dietitian</td>
</tr>
</tbody>
</table>
The clinician analyzes eating behaviors using the Food Chaining Individualized Eating Profile (below). The profile describes the scope of the feeding disorder and helps the clinician prioritize treatment goals. Kedesky and Budd’s (1998) Scales of Selectivity are used to further define the feeding problem in regard to features, texture, volume, and persistence to intervention and health consequences. The disorder is rated in severity from mild to profound. The clinician considers a number of factors:

- Age of onset of selective eating
- Number and type of accepted liquids
- Volume daily liquid intake
- 3-day food log and nutritional evaluation
- Child’s current taste, texture, and temperature preferences
- Accepted and rejected food groups
- Previously accepted foods and food loss
- Number of foods in the core diet
- Five favorite foods
- Five least favorite foods
- Successful eating environments
- Parents’ goal foods

The parent completes the Food Chaining Food Intake Form and a 3-day food log. The parent identifies preferred foods and gives a general assessment of appetite. The parent checks the core foods/liquids the child consumes reliably in all environments and lists foods the child used to eat. Food loss is recorded, and events that led to the food loss are discussed and analyzed. The clinician records the number of foods in the core diet and studies the features of both accepted and rejected food items.

Flavor mapping is used to evaluate the range of flavors in the core diet. The child may have one overwhelming flavor preference. Flavor mapping helps the therapist select new foods and start the process of slowly expanding to other flavor families. The goal is to help the child accept a variety of flavor families. Flavor is altered prior to changing the texture of food. Texture and temperature mapping are used; the clinician studies all textures/temperatures of accepted food and introduces targeted items in a progression the child can safely and comfortably consume.

The pediatric dietitian completes nutritional evaluation. The therapist and the dietitian meet with the family and establish the initial steps of the treatment program. Parents are instructed to follow a schedule of meals and snacks and to offer age-appropriate portions of specific food items. Caloric supplements are used as needed. Food items are modified to match the child’s level of oral-motor swallowing skills. The therapist selects new foods that are similar in taste and texture to foods the child successfully consumes. The therapist rates the child’s response to new foods on the 1-10 Food Chaining scale and creates chains for higher rated foods. Because foods are offered in a progression the child enjoys and tolerates well, the mealtime experience is a positive one. Food education programs are used to teach children about healthy eating. The diet is expanded in a nonthreatening, sensory-friendly manner. Food Chaining is implemented primarily at home in the natural environment. The therapist facilitates successful parent-child interaction at the table and in the community.

Treatment programs focus on not only oral-motor skill development, but also oral-motor flexibility. We believe that many children do not know how to eat complex, mixed, or multitextured foods. The child must be able to shift his or her eating pattern throughout a meal based on the consistencies of food and liquid offered. Children with primitive munching patterns may lack these skills and eat only uniform texture foods, because these are the only
foods they can successfully chew and swallow. Selectivity may be due to poorly developed oral-motor skills and a lack of oral-motor confidence, rather than actual desire for a few processed, uniform-texture foods.

**Treatment Techniques**

Flavor masking is a technique used to improve acceptance of a new food; the clinician pairs the new food with a dip or condiment in a flavor family the child enjoys. Later, the flavor mask is faded to help the child slowly adapt to the true flavor of the new food item. For a child with dysphagia, a masking flavor or condiment may help the child chew and swallow the bolus comfortably. For children who do not tolerate wet dips, the therapist can use *dry masks*, including cinnamon sugar, garlic salt, and other seasonings. *Transitional foods* are used to reduce anxiety and aversive response at meals. A *core food item* is offered as part of the meal to assist with the transition to new foods. *Anchor foods* are used for children with extreme selectivity to reduce risk of refusal at meals and entice the child to the table. Anchor foods are not modified, although the size of the portion of the anchor food may be reduced. As the child’s food repertoire expands, *surprise foods* are used during treatment to help children develop coping strategies when presented with an unfamiliar food. Instead of immediately rejecting a new food item, the child uses food-chaining strategies to explore it with the senses. Biofeedback may be paired with introduction of surprise foods.

Food education activities help children learn about the properties of new foods and develop skills for sensory exploration. The language of mealtime helps the parent know what to say at the table during food exploration. The parent is coached to describe the features of the food, instead of directing the child to take a bite. *Theme-based meals* teach the child societal eating routines (for example, foods eaten at a baseball game or birthday party). Rating scales are used weekly via our 10-point food acceptance scale (1, tolerated poorly with gagging, to 10, pleasant experience, age-appropriate portion). Ratings determine rate and variety of dietary progression. Higher rated foods are chained.

*Figure 2. Food chain for a child with profound food selectivity and one food item in the core diet (animal crackers)*
Therapist expanded the food repertoire and nutritional value of diet was markedly improved. Preferred foods were not eliminated from the diet.

**Conclusion**

Fishbein, Fraker, Cox, and Walbert (2004) described a retrospective chart review performed on children referred to our feeding program for evaluation/treatment of feeding aversion from September 2001 to June 2003. Subjects underwent initial assessment by a multidisciplinary feeding team, including a pediatric gastroenterologist, dietitian, speech language pathologist, and behavioral psychologist. Targeted or goal food items were established by the parent, child, and feeding therapist. During the course of therapy, new food items were introduced.

Clinic visits, telephone calls, videotape, and secure e-mail were used as methods of correspondence between study participants and feeding team members. The investigation commenced at the initiation of the feeding program and was completed 3 months later. Subject demographics included age, gender, diagnoses other than aversive feeding disorder, nutrition status, gastrostomy/jejunostomy tube status (present or absent), and intervention duration per week.

A paired t-test involving the number of new food items accepted from 0 to 3 months was used to determine the outcome of intervention. Ten children (6 m, 4 f) with age median of 3 years (range, 1-14 years) were studied. Eight of 10 subjects had experienced prior feeding interventions without sustained improvement. All subjects were enrolled in the feeding program for at least 3 months. Six of 10 children carried other diagnoses, ranging from renal disease to microgastria. Four of the 10 children required supplemental gastrostomy/jejunostomy feedings. At the onset of feeding intervention, subject #2 was consuming only animal crackers and juice, subject #5 was consuming only water, and subject #9 was consuming only carbonated beverages. The median intervention during the 3-month interval occurred for 1.25 hours/week (range, 0.5-2 hours/week; see Table 1). All children were able to increase their food repertoire over 3 months \((p < .05, \text{paired t-test})\). The median number of accepted foods at onset was 5 (range, 1-10). The median number of new food items at 3 months was 20.5 (range 8-129).

The children were non-uniform with regard to nutritional status or medical condition, but all had extreme food selectivity. A majority of subjects had failed previous feeding therapy. Despite these prior failures, all subjects involved in a Food Chaining feeding program were able to expand their diets successfully in 3 months. Our chart review shows that parents were able to comply with clinician recommendations and progress was closely monitored. Based on our experience, we believe that any children with similar circumstance or medical backgrounds will benefit from Food Chaining. A prospective study would be beneficial to further analyze the benefits of Food Chaining. However, we believe that children with feeding aversion, regardless of medical condition, will benefit from an individualized, multidisciplinary Food Chaining program. If implemented properly, Pre-Chaining and Food Chaining therapy programs can be a useful method in the treatment of infants and children with dysphagia and feeding aversion.

**References**


SOS Approach to Feeding

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Abstract

The Sequential Oral Sensory Approach to Feeding (The SOS Approach) is a transdisciplinary program designed to assess and address the reasons why a child is struggling to eat. Assessment occurs across seven different areas of human function involved in the process of learning to eat: organs, muscles, sensory, learning, development, nutrition, and environment. The SOS Approach uses a whole child perspective, integrating sensory, motor, oral-motor, behavioral/learning, medical, and nutritional factors for both assessment and intervention, resulting in strategies to comprehensively evaluate and manage children with feeding/growth problems. Success is determined by (a) intrinsically motivated and sustained interest in trying new foods, (b) enjoyment in and appropriate skills for eating and drinking a wide range of age-appropriate foods and fluids; (c) consumption of sufficient calories for optimal growth along a child’s own percentile line on a growth curve, and (d) improved family understanding and functioning during mealtimes for the development of healthy relationships with food and each other.

The Sequential Oral Sensory Approach to Feeding (the SOS Approach) is a transdisciplinary program designed to assess and address the reasons why children struggle to eat. The SOS Approach encompasses seven areas of human function involved in the process of learning to eat: organs, muscles, sensory, conditioning/learning, development, nutrition, and environment (Berlin, Davies, Lobato, & Silverman, 2009; Greer, Gulotta, Masler, & Laud, 2008; Medoff-Cooper, 2000; Sharp, Jaquess, Morton, & Herzinger, 2010; Skuse, 1993; Williams, Field, & Seiverling, 2010). The program is theory-driven and focused on evidence-based research to support each of the components with the goal of increasing enjoyment, range, and volume of foods consumed. The complex nature of feeding disorders led to the creation of this transdisciplinary approach, and clinical data supporting its effectiveness is emerging.

Development

The conceptualization of the SOS Approach began in the mid-1980s and continued into the early 1990s in response to the increasing use of gastrostomy (G) and nasogastric (NG) tubes to save children unable to independently eat well enough to grow appropriately (Gauderer, 1991). During this time, a series of articles appeared, which stated that in order to fully assess and address the source of feeding difficulties, professionals needed to join their
expertise together, rather than continue working in isolation within only their respective areas of specialization. For example, one study demonstrated significantly improved rate of growth for the 53 children followed by a team from a multidisciplinary clinic, compared to 107 children seen only in a primary care setting (p < .001; Bithoney et al., 1991).

As more and more children lived longer with G/NG-tubes, it became apparent a plan for tube removal was needed. Professionals needed to (a) better understand how children learned to not eat, (b) identify why an individual child might require supplemental tube feeding, and (c) provide a set of intervention strategies to help the child transition from tube feedings. The SOS Approach was initially developed as a multidisciplinary team approach for assessing the myriad of factors across professions involved in long-term feeding/growth problems. The program expanded to include a multidisciplinary approach to treatment, using the disciplines represented in the assessment phase. Over the past 20 years, the SOS Approach has evolved into a transdisciplinary program, with professionals from various disciplines providing both individual and group therapy in a community clinic setting. The core members of the team include a developmental pediatrician, pediatric psychologist, occupational therapist, speech-language pathologist, and registered dietitian.

The SOS Approach asserts that in order to best understand and treat a child who is not eating, a whole child perspective is required. Crist and Napier-Phillips (2001) described a biopsychosocial model in which physiological, behavioral, and social factors are all viewed as contributing to the development of feeding difficulties and critical for fully understanding the etiology of the problem (p. 279). In the SOS Approach, a whole child viewpoint encompasses the areas of sensory, motor/oral-motor, behavioral/learning, medical/organs, nutrition, and environment. Medical reasons for atypical feeding development are examined and treated first. This includes identifying any nutritional deficits and developing recommendations tailored to each individual child’s growth parameters and needs. Physical skills influencing feeding across all developmental areas are also assessed. Learning capabilities further influence the therapeutic interventions provided within the SOS Approach. Family functioning and the way the environment may be maintaining feeding problems are viewed within the context of alterations precipitated by the feeding problems of the child.

In the SOS Approach, feeding difficulties are understood as being predominantly body-based. A child’s behavior is understood as a communication of his or her immediate physiological experience of food, as well as learned behavior resulting from past experiences with food and feeding. If the child’s feedings have gone well physically and he or she has the skills to appropriately manage the foods presented, the child learns that eating is a pleasurable experience that satisfies hunger. If the feedings have been difficult, the typical positive reinforcement of this experience is lacking and the child learns that eating is to be avoided. What most programs term a behavioral feeding problem is conceptualized in the SOS Approach as a constellation of learned avoidance reactions to an experience that is physically difficult for the child. Learned avoidance behaviors are not viewed as emotional reactions or misbehaviors to be punished or extinguished. Instead, these behaviors are viewed as (a) communication that the child does not have the physical skills to manage the situation or (b) the means to avoid situations that cause physical discomfort. The SOS Approach teaches children how to physically manage foods comfortably so they do not have to avoid the feeding experience and allows the development of the natural reinforcement related to the enjoyment of eating. Since its inception, the approach has been used by Toomey and her teams to evaluate approximately 1,200 children; 789 evaluations have been documented since 1999.

**Tenets of the SOS Approach**

The SOS Approach asserts there are multiple myths about eating that interfere with adults’ understanding why children won’t eat. Rather than assuming eating is automatic and instinctive, the clinician or researcher needs to examine what the child has actually learned
about eating (Drewett, 1993). The developmental transition from when a central pattern generator controls the suckling motions to when the volitional control of eating takes over is seen as creating critical influences on learning about eating (Delaney & Arvedson, 2008). Eating is also conceptualized as a task requiring 25-32 skill-based steps, rather than a two-step process involving sitting down and eating automatically. The skill-based steps include the ability to look at the foods and manipulate and touch the foods, as well as taste and eat the food.

The SOS Approach assumes the normal developmental sequence of eating skill acquisition is the most appropriate physiological path for children, even those with delays (Carruth, Ziegler, Gordon, & Hendricks, 2004; Gisel, Birnbaum, & Schwartz, 1998). The developmental sequence has been incorporated in the SOS Approach Steps to Eating Hierarchy. These steps have been organized so trained professionals can identify where the child is in the process of learning to eat, as well as what skills the child has yet to achieve. It can also be used to track a child’s progress with accepting new foods. There are six major steps in the sequential process of learning to eat: visual tolerance, interaction, smell, touch, taste, and eating. As the child progresses through the steps, he/she develops necessary skills and feelings of success. These, in turn, lead to a desire to explore, interact, and eat foods, thereby sustaining the child’s improvements long-term.

Systematic desensitization is the treatment method used to help children move up the Steps to Eating Hierarchy and build new skills. The traditional definition of systematic desensitization includes the use of competing relaxation responses during exposure to a graduated hierarchy of anxiety-producing stimuli, in order to help a patient learn to overcome his/her fears (Goldfried & Davison, 1994). Systematic desensitization in the SOS Approach uses play and social interactions with the foods as the competing relaxation response. The graduated hierarchy equates to the Steps to Eating Hierarchy. Combining the Steps to Eating Hierarchy with systematic desensitization encourages the child to make small steps, moving toward more complex interactions with the foods. The child is always in charge of what he/she does as part of systematic desensitization, and this theory is applied to feeding therapy. An SOS-trained therapist uses social role modeling and play with the food to help children visually explore and then move up to manipulating, smelling, touching, tasting, and, finally, eating the food. Throughout, the therapist monitors the body reactions of the child to ensure he/she is moving up the hierarchy without becoming overwhelmed. Once the child puts the food in his/her mouth, the therapist works on the oral-motor skills required to eat that particular type of food. In the SOS Approach, if the child becomes distressed by one level of interaction with the food, he/she is allowed to move back to a safer level so his/her body can return to a relaxed state and reorganize, with the support of the therapist and/or family. The child is not required to accept a bite of food or a dry utensil into his/her mouth. Instead, he/she learns how to comfortably bite, chew, and swallow food correctly; the child then becomes internally motivated to explore a wide variety of food textures.

Unlike programs focused on compliance with adult commands, the SOS Approach recognizes that children learn about the world through play. In the SOS Approach, play with a purpose focuses on helping the child move upward on the Steps to Eating Hierarchy. Traditionally, children are discouraged from playing with their food. Children learn that playing with their food during mealtimes distracts the parent from the fact that they are not eating the food. However, in the SOS Approach, play becomes an avenue for learning the building block sensory and oral-motor skills needed to eat any food. The play in the SOS Approach also teaches the children the physics of the foods; therefore, the mechanical requirements needed to eat a food are already partially understood by the time the child places a food in the mouth. Play becomes the motivation for learning about new foods.

The last tenet of the SOS Approach is that the therapeutic goals of the child are best addressed by using foods rather than tools/objects. Different types of foods provide different sensory and oral-motor properties that the therapist can use to progressively build the child’s
age-appropriate skills. The foods used in SOS treatment (a) include a variety of nutrition and texture categories, and (b) are presented in a specific order to keep the child as calm as possible (i.e., a gradual hierarchy of stressful stimuli). The use of a range of foods appropriate for each child’s developmental age and current eating skill level also progressively advances the child’s caloric intake. The SOS Approach focuses on achievement and progression of eating skills as the primary goal; a secondary goal is increasing caloric intake, achieved through the advancement of eating skills. The primary goal of many other feeding programs is increasing caloric intake using liquid and/or pureed diets (Greer et al., 2008; Sharp et al., 2010; Williams et al., 2010). The transition to a variety of age-appropriate foods is seen as the secondary goal for the therapist (Foy et al., 1997).

Support

The SOS Approach to Feeding has been used in a variety of clinical settings for more than 20 years. However, because it was developed as a community-based program rather than a university/inpatient hospital/day treatment program, the focus to date has been primarily on service delivery. The majority of currently available data on other programs has been grounded in a behavioral intervention approach, with a strict reinforcement and extinguishment schedule in place, and has included fewer than six participants (Sharp et al., 2010). In a recent review by Sharp and colleagues (2010), there were no identified studies presented by habilitation specialists. Those authors concluded that there is a clear need for interventions that incorporate the habilitative interventions of therapists, as well as carry over into home environments. The SOS Approach has integrated involvement of pediatric psychologists, speech-language pathologists, and occupational therapists in both program creation and implementation; this community-based approach also incorporates family involvement and education. The focus of this program is beginning to broaden from service delivery to research and publications.

Three formal studies have been completed on the SOS Approach program. A pilot study conducted by Creech (2006) videotaped 10 children, aged 17-31 months, during a structured mealtime using the SOS Approach (Creech, 2006). Each participant was presented with the same seven foods in a pre-test and post-test assessment, conducted 10 weeks apart. A behavioral coding scheme was developed to identify categories of behavior (desired behaviors, non-desired behaviors, and neutral behaviors). Frequency counts of the observed behaviors were used for comparison and analyzed using repeated-measures, one-tailed t-test. The children participating in the SOS Approach program demonstrated a significant increase in positive mealtime behaviors ($p < .006$): smiling, positive vocalizations, and interaction with caregiver. They also had a significant increase in their interactions with food ($p < .002$): touching, stirring, and picking up. There was a significant decrease in (a) negative mealtime behaviors of crying and trying to get out of the chair ($p < .001$); (b) interfering sensory responses such as gagging, vomiting, finger splays, and hand retraction ($p < .003$); and food rejection behaviors such as throwing, pushing away, and turning the head away from the food ($p < .003$).

The second study, by Boyd (2007), looked at the progress children in SOS Feeding Groups made after 12-week segments of treatment. This study of 37 children (7 children with gastrostomy tubes), aged 18-61 months, examined how many new foods each child learned to eat, as reported on 3-day diet histories completed by his/her parents. Group SOS treatment was provided once per week, for 1-1.5 hours per session. After their participation in a first round of a 12-week Group SOS program, the children increased their food repertoire by 41%. After an additional second round of a 12-week Group SOS program, the children increased the number of foods they were eating by an additional 17%. The 7 children with gastrostomy tubes were fully transitioned off their tubes and onto an age-appropriate diet with appropriate growth achieved on full oral feedings within 12-24 months.
Data were also presented at the Society for Developmental and Behavioral Pediatrics Annual Conference on 46 children who participated in a 12-week Group program between 2000 and 2001 (Toomey, 2002). All of these children were orally feeding without the need for supplement, but were not gaining weight or height. Children gained a mean of 1 pound in weight and 1 inch in height across the 12 weeks. Using a 3-day diet history as a pre- and post-measure, children also increased their intake by an average of 200 calories per day. At the conference, Toomey also presented a separate analysis, which had been conducted as part of a process improvement project, using data from 30 children who required G-tube feedings and who were treated at the Rose Pediatric Feeding Clinic using the SOS Approach to Feeding. The treatment was provided through both individual and group therapy sessions, once a week for 1.5 hours per session. Children who began therapy with sufficient skills to eat a portion of their nutrition \((n = 19)\) were transitioned fully off of the G-tubes and to an age-appropriate diet within 1 year. The cost of group therapy was $4,500; individual therapy cost $9,500. For children who began therapy relying totally on the G-tubes who did not have any experiences with food prior to the initiation of therapy \((n = 11)\), the average amount of time to transition fully to an age appropriate diet was 24 months. While the data supporting the effectiveness are limited, the next goal of the program is to publish outcomes across a variety of ages and underlying etiologies. Several randomized controlled studies are currently underway. Given the limited number of research studies currently published that address feeding outcomes in more than single-case studies, the preliminary results presented here are promising (Sharp et al., 2010).

In conclusion, the SOS Approach to Feeding is a transdisciplinary program based on the principles of, and research on, the normal developmental processes involved in learning to eat. The goal of the program is to increase the range and volume of foods the child will eat through a play-based intervention. The program uses systematic desensitization to help children learn how to tolerate, interact with, smell, touch, taste, and eat a wide variety of foods. Sensory, oral-motor, and developmental skills are addressed in a deliberate and conscious manner, with a goal of building skills within a positive learning environment. Teaching children the skills necessary for eating then allows them to improve their growth and weight gain, while they develop an enjoyment of eating. Success is determined by (a) intrinsically motivated and sustained interest in trying new foods; (b) enjoyment in, and appropriate skills for, eating and drinking a wide range of age-appropriate foods and fluids; (c) consumption of sufficient calories for optimal growth along a child’s individual percentile line on a growth curve; and (d) improved family understanding and functioning during mealtimes for the development of healthy relationships among family members and with food.

References


Protecting Children as Feeding Skills Develop

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Abstract

The purpose of this brief review is to increase awareness of choking risk and foreign-body aspiration in children and to highlight important aspects of prevention and caregiver education. Food is one of the frequent culprits resulting in choking, morbidity, and even mortality in the pediatric population. This article examines the scope, intricacy, and complexity of reducing choking risk in the pediatric population and areas for further investigation to enrich evidence-based practice to enhance safety during feeding.

“Eating and swallowing is such a natural subconscious act that many adults forget that eating is a learned skill.” (Stevenson & Allaire, 1991, p. 1446)

Introduction

In today’s fast-paced society, traditional mealtimes of children seated at the family table are often abandoned due to the demands of a busy schedule (Schor, 2003). Besides the intrusion of electronic devices into mealtimes, the availability of “drive-thru” fast foods and packaging for portability contribute to children’s being offered foods above their developmental chewing level, often under circumstances that put them at higher choking risk, such as eating while riding in a vehicle.

According to the American Academy of Pediatrics (AAP), every 5 days a child in the United States dies from a choking episode on food (2010). These preventable, traumatic episodes are most typically noted between the ages of 1 and 4 years (Hayes & Chidekel, 2004). Thousands of children are treated for food-related choking in emergency departments (EDs; Center for Disease Control and Prevention [CDC], 2002). These episodes often result in hospitalization, increased morbidity, infection, anatomical damage, hypoxia, cardiac arrest, and even death. In addition to the physiological and psychological impact on the child and family, hospitalization and removal of a foreign body by laryngoscopy or bronchoscopy results in considerable financial costs (Gregori et al., 2008).

Education

Public education for caregivers is vital in reducing unintentional choking in the pediatric population (Gregori et al., 2008). Regularly scheduled visits with physicians and
dentists provide the easiest venue for parent education. However, target audiences should include school nutrition programs, school personnel, daycare providers, and babysitters (Schor, 2003; Tarrago, 2000). It is important that the messages provided by various agencies attempting to educate parents on choking prevention be consistent. Anticipatory guidance about feeding must be based on the developmental level, rather than age, of the child (Delaney & Arvedson, 2008; Tarrago, 2000). In addition, the language used by various agencies to describe textures needs to be consistent. Solids is used to refer to all non-liquids in some literature (Roper & David, 1987) and table foods may refer to anything from smooth purees, such as applesauce, to tough meats.

Chewing skills begin to emerge around 6 months of age with the development of volitional control over the biting motion, lateral lingual movement, and emerging jaw gradation (Stolovitz & Gisel, 1991). By 9 months of age, most babies demonstrate a loosely coordinated chewing pattern that continues to be refined and increases in efficiency between 12-48 months of age (Steeve, Moore, Green, Reilly, & Ruark McMurtrey, 2008). The emergence of teeth for biting and grinding, the emergence of rotary chewing, and the reduction in immature sucking patterns should guide the introduction of foods requiring grinding (Carruth & Skinner, 2002; Delaney & Arvedson, 2008). By age 4, chewing skills are consistent with mature feeders, but continue to become more efficient with the eruption of teeth and growth of bony structures.

Skills for managing different textures develop at different rates (Gisel, 1988) and may be affected by physiological and behavioral feeding issues. Although different authors and agencies vary in their recommendations for introducing different textures (Carruth & Skinner, 2002; Evans Morris & Dunn Klein, 2000; Stevenson & Allaire, 1991), general guidelines emerge and can be found in the literature. Even when children are able to chew foods, they are often unable to determine appropriate bite size or how many pieces they can safely manage. Parents must actively supervise their children during mealtimes while continuing to follow choking precautions and physician recommendations.

Children will deal with the food presented in the least effortful method available to them. If they are not developmentally ready for the food, they modify their movement, whether sucking on a solid until it can be mashed and swallowed, spitting it out, or swallowing it whole (Gisel, 1988; Stolovitz & Gisel, 1991). While mature feeders can adjust oral movements to accommodate different foods or choose easier foods to eat, children with immature chewing patterns must deal with the foods presented using a limited skill set. Safe management of food is considerably more difficult for the child with an underlying neurological process or disorder, characterized by systemic incoordination or paresis that negatively affects chewing efficiency or slows development of emerging feeding skills.

Role of the Feeding Specialist

Feeding specialists must use clinical experience, the limited normative data that is available, and caregiver input to strive to incorporate choking-prevention as a part of the best evidence-based practice. For example, research has shown that foods in the initial feeding evaluation should be carefully selected for the developmental level of the child and should also be used during re-evaluations (Gisel, Lange, & Niman, 1984). Feeding and swallowing specialists must also take an active role in educating parents and care providers about the relationship between oral feeding skills and other aspects of development (Delaney & Arvedson, 2008).

In addition to education, many of the direct interventions provided by feeding therapists reduce a child’s risk of choking. Addressing oral-motor/sensory deficits by teaching the child to be more aware of the food in his/her mouth and teaching underlying skills to develop more efficient chewing may improve the child’s ability to handle different textures. Making physician-approved diet modifications or changes to food presentation may increase safety while chewing skills develop. Recommending modifications to mealtime routines—such as decreasing
distractions and movement during feeding, increasing caregiver supervision, and optimizing positioning—also reduces the risk of choking. In conjunction with the medical team, the feeding specialist may play a role in reducing choking risk associated with medical conditions such as dysphagia, gastrointestinal, and pulmonary complications, in conjunction with the medical team.

Feeding therapists may also be involved in the recovery following a choking episode. After negative experiences with foods offered prematurely, a child may develop aversions, causing avoidance of similar foods. Once the underlying cause for the difficulty has been addressed, behavioral feeding approaches such as Sequential Oral Sensory (SOS) or Food Chaining can be employed to increase acceptance of these foods.

Other Aspects of Prevention

An effective prevention plan cannot rely solely on education; it must also include changes in product labeling, modification to the products, and emergency preparedness training. Changes in product design to reduce the risk have been shown to be the most effective prevention (Hayes & Chidekel, 2004). The AAP (2010) is advocating for design modifications to high-risk foods such as hot dogs. Those involved in community advocacy and legislative efforts have joined forces with the goal of increasing protection for children from choking during mealtimes. Laws differ among states, and federal mandates are set to strive for higher nutritional standards. Nationally, the Small Parts Regulations (U.S. Consumer Product Safety Commission, 1980) was enacted to protect children from choking on small toy parts, while the 2010 Healthy, Hunger-Free Kids Act (The White House, 2010) was enacted to improve nutritional standards for programs in schools and daycare settings. At the state level, New York combines these concepts to protect children with the Food Choking Prevention Act (Assemblyman Harvey Weisenberg, 2008; Committee for Senator Kemp Hannon, 2008) and the Agriculture and Markets Law Amendment (State of New York, 2011). Though these initiatives address nutritional status and choking hazards, they do not typically take developmental ranges of feeding skills into consideration.

Despite legislative efforts by the federal government and educational efforts via the public health system, pediatric choking continues to be a primary cause of morbidity and death, not only in the United States, but worldwide. Improved reporting, cooperation, and regulation among the Food and Drug Administration (FDA), United States Department of Agriculture (USDA), and Consumer Product Safety Commission (CPSC) would allow for better identification of foods that pose a high choking risk and coordination of a more timely response. Obtaining accurate statistics regarding choking is difficult due to variants in the information provided and failure to report data. Though food is more likely to be put in the mouth than a toy, the FDA currently has no protocol or dedicated resource to track and address emerging trends in food-related injuries. The CPSC uses the National Electronic Injury Surveillance System—All Injury Prevention (NEISS-AIP) to track injuries treated in EDs caused by consumer products. It does not include choking episodes that are resolved, positively or negatively, outside of the ED, which Andazola and Sapien found to be 44% of the episodes for which emergency medical services were dispatched in one metropolitan area (1999). In 2010, the AAP recommended that the NEISS-AIP include the type of food involved in the injury. This would allow the monitoring agencies to respond to emerging trends quickly.

While 41% of choking deaths were food-related in 2001 (CDC, 2002), the warning labels on toys are far more prolific and visible than are those on food packaging. Many small, round, smooth, pliable, or slippery foods present a choking hazard (Hayes & Chidekel, 2004); peanuts are commonly identified as the most frequent choking hazard in children younger than 3 years of age. Choking on hot dogs is more likely to result in a fatality; the shape and compressibility cause them to become easily lodged, and they are nearly impossible to extract, even with the best medical treatment and equipment available. Hence, prevention is vital (Altkorn et al.,
2008). Some companies are taking the initiative to put warning labels on products intended for toddlers and preschoolers, recommending supervised feeding to seated children experienced with chewing solid foods. Similarly, certain brands of nuts, seeds, trail mixes, hard candies, and gummy fruit snacks carry warning labels alerting parents to a choking risk; some labels recommend restricting feeding to children age 6 years and older. A few brands of hot dogs also have warnings informing parents to cut the hot dogs lengthwise and then into small bites.

Emergency Preparedness

Although emergency preparedness should not be seen as a primary measure for prevention, it must continue, given that choking in children cannot be completely prevented through other means. However, even these efforts differ in regard to recommendations and may be confusing to those providing first-aid to choking victims. The American Red Cross (2011) recommends a “five-and-five” combination of back blows and abdominal thrusts for a child with a blocked airway, whereas the authors of Principles of Emergency Medical Dispatch (Clawson, Dernocoeur, & Rose, 2008) recommend the Heimlich maneuver and advise against back blows or pats.

Further Research

Further research is needed in many areas related to feeding skills and choking prevention. Continued efforts to amass refined normative data on oral-motor and feeding skill development with an emphasis on quantitative and objective measures, possibly including functional brain imaging, are needed to provide evaluation and treatment protocols (Delaney & Arvedson, 2008). Ongoing research is needed to determine the most effective prevention strategies (CDC, 2002), including how to best use emerging technologies for public education. Zigon et al. advocate for large-scale studies and additional studies to assess the impact of sociocultural variables on choking (2006). Standardization of terminology among professionals is needed to ensure clinicians can accurately communicate intended diet levels that optimize safe oral intake for best nutrition/hydration.

Conclusions

Management of a choking child often involves collaborative efforts from parents, caregivers, primary care physicians, emergency room physicians, otolaryngologists, pulmonologists, feeding specialists, registered dietitians, and radiologists. Health-care providers must intensify injury prevention programs with respect to choking (AAP, 2010; Gregori et al., 2008). Feeding specialists and other health-care providers can play a critical role in increasing educational efforts during evaluations and therapy sessions through education on normal development and anticipatory guidance about choking risks.

Parents, caregivers, and those responsible for food preparation for young children must be educated to feed children under the age of 4 only while the child is seated, with adult supervision; after removing bones and cutting food into small pieces; and limiting the number of pieces available at one time to avoid overfilling the mouth. Foods that pose an aspiration or choking risk—such as popcorn, hard candy, gum, seeds, raisins, raw fruits or vegetables, spoonfuls of peanut butter, whole grapes, sausages, or hot dogs—should not be given to children under the age of 4 without modifying them to reduce risk. Older children may need to be reminded to take small bites and chew well. In addition, feeders must be aware of warning labels and learn how to administer emergency first-aid to a choking infant or child. Similarly, efforts to implement other strategies used to decrease risks and prevent adverse outcomes—such as alterations in product design, warning labels on packaging, public education campaigns, and legislative efforts—must be continued.
References


