



Pediatric Feeding and Dysphagia Newsletter

Dear Fellow Feeders:

Welcome to issue 3 of this subscription year! Our issue is once again full, focusing on research on breathing and swallowing coordination, feeding services in the schools, and hypotonia. Also included is a new book, The Reflux Book which I highly recommend, research, my editorial, and a current job opening. Enjoy!

Enjoy, Krisi Brackett (Write me: feedingnews@earthlink.net)

The Pediatric Feeding & Dysphagia Newsletter

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Healthy Infant Breathing-Swallowing Coordination

by Bronwen Kelly, BSc (Hons), MSLT, PhD

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Special Points of Interest:

- ☉ Current information
- ☉ New products
- ☉ Research and publications
- ☉ Education

Editorial assistance provided by Elizabeth Crais Ph.D. CCC SLP, Division of Speech and Hearing Sciences, UNC-Chapel Hill

This article discusses some of the recently published findings of a research group at the Van der Veer Institute for Parkinson's and Brain Research, Christchurch, New Zealand. The data were obtained during a longitudinal study involving healthy infants investigated from soon after birth (at term) until they reached one-year of age.

What is breathing-swallowing coordination (BSC)?

BSC refers to the respiratory phases (inspiration/expiration) associated with swallowing (i.e. the phase of respiration before and after each swallow). For instance, a swallow can occur before expiration but after inspiration. This is referred to as an 'inspiratory-expiratory' swallow ('IE', see Figure 1 below). Note that the description of the patterns of BSC may vary, to some degree, between research groups. It is generally accepted that the patterns of BSC are primarily controlled by the brainstem.

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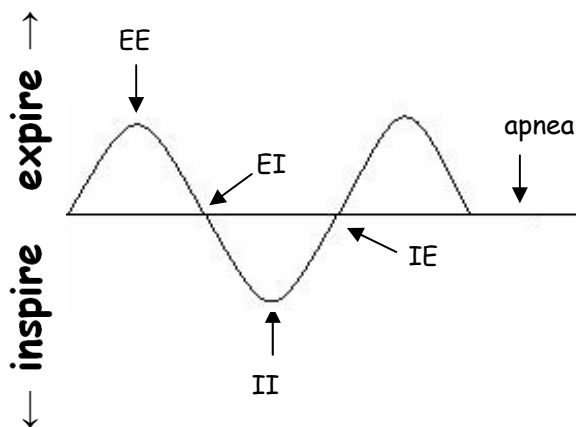


Figure 1. Schematic representation of possible points in the respiratory cycle where infant swallows occur:

- EE = expiratory-expiratory,
- EI = expiratory-inspiratory,
- II = inspiratory-inspiratory,
- IE = inspiratory-expiratory,
- apnea = respiratory cessation

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What is 'normal' BSC?

Our research showed that throughout the first year of life, healthy infants will typically expire after every swallow during feeding [6] which is very similar to the patterns observed in adults during serial swallowing [5]. More specifically, our research showed that the older the infant the more likely the infant will swallow at the 'inspiratory-expiratory' cusp; the BSC pattern mentioned above. This trend towards a predominantly IE pattern of BSC possibly indicates a growing preference to expire after a swallow at maximal lung volume [8] and may serve to increase ventilation during feeding and/or to maximize the expulsion of ingested milk that may threaten the airway (discussed in greater detail below). Furthermore, these patterns were observed irrespective of whether the infants were feeding from the breast or bottle, however, future research confirming this finding with a larger cohort is encouraged.

Our results also showed two key changes in these BSC patterns; one occurring within the first week, and the second occurring at approximately 6 months; a time when feeding is thought to become more voluntary in nature. The first change occurred not long after birth and, hence, is most likely to represent the effect of feeding experience. In fact, the pattern of BSC was altered by only a few days of feeding experience. The latter change, which occurred several months later, is more likely to represent anatomical and/or neurological development. We discuss this in greater details in the *Dysphagia* publication, but in summary, it is well known that during infancy, there are substantial changes in the anatomy of the oro-pharynx as well as concurrent nervous system development. Further to this, whilst brainstem mediation of BSC is undoubtedly substantial, the development and subsequent likely contribution of the suprabulbar structures (sites above the brainstem, including the cerebral cortex) in the control of feeding may also have played a role in the change in the pattern of BSC in late infancy. Consider one of my favourite quotes: "Oral feeding for the newborn is entirely reflexive. Rooting, nipple latching, sucking, and swallowing do not appear to require suprabulbar activity. Immediately after birth, however, the learning process begins with its dependence on experiential opportunities, sensory inputs, and suprabulbar neurologic maturation... in this way, feeding and swallowing gradually changes from a reflexive to a volitional process" [12, p. 1449]. In our second publication [7], we presented the results of the comparison between nutritive and non-nutritive BSC. BSC during feeding differed to that of non-nutritive BSC, irrespective of infant age. Indeed, the sensory stimulation offered by ingesting liquid altered BSC. Even more interesting though, is the finding that there appeared to be a particularly strong influence of feeding on BSC between 2 weeks and 2 months of age. The importance of this finding is that this may represent "a possible 'critical period' in normal infant neural development during which immature sensorimotor integration can result in an exaggerated efferent [motor] response to feeding-related oropharyngeal stimulation" [7, p. 152]. More research is required to determine whether this has clinical implications for infants with neurological impairment.

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Abnormal' BSC and clinical implications: a brief visit

Whilst 'healthy' BSC is the main focus of this article, clinicians may be interested in several studies that describe the BSC in the pediatric patient population (e.g. cerebral palsy [9], acute bronchiolitis [11], bronchopulmonary dysplasia [2] and premature infants [1, 4, 8, 10]). The general consensus is that disease or prematurity is associated with 'abnormal' patterns of BSC, such as a higher incidence of post-swallow inspiration (e.g. in cerebral palsy), the performance of multiple consecutive swallows before a breath is taken and/or swallowing during periods of apnea. The latter 2 patterns, key features of preterm BSC during feeding [4, 8, respectively], are rarely observed in term infants who, even from birth typically alternate between swallowing and breathing [6]. Some consider post-swallow inspiration to be one of the mechanisms that leads to aspiration in the pediatric and adult patient population (i.e. bolus residue inhaled after a swallow). However, in the absence of research that proves a cause-effect relationship, it may be more prudent to consider aberrant patterns of BSC (specifically post-swallow inspiration) merely indicative of respiratory impairment and/or dysphagia [3].

Summary

Post-swallow expiration is a key feature of 'healthy' BSC during feeding in term infants and adults. However, changes in the specific patterns of BSC after breast and bottle-feeding, that occur during the first year of life may be attributed to a combination of post-natal experience and normal anatomical and neurological development. Finally, feeding appears to have a more marked impact on BSC in early infancy, which may indicate a 'window' of exaggerated physiologic response to oral intake.

Further recent publications of interest

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Healthy Infant Breathing-Swallowing Coordination

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Want to learn more about reflux? Check out this great resource!



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A 'Tried and True' Collaborative School-Based Feeding Team Model

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The management of feeding and swallowing disorders has become an emerging issue for school-based speech-language pathologists (SLPs). The American Speech Language and Hearing Association addressed this issue in their Technical Report Executive Summary (2002a) stating, "The area of pediatric swallowing and feeding disorders is one of the most rapidly evolving patient care areas for medically based SLPs and other professionals serving children. In addition, as an increasing number of high-risk infants survive and enter educational programs, SLPs must acquire medical knowledge and skills to manage swallowing and feeding disorders" (p. 76). It has been suggested that "no single activity is as critical to the health, education, and happiness of children with disabilities as feeding" (Lowman & Murphy, 1999, p. 1). Safe and efficient eating and swallowing promotes students' overall health and well-being, which is necessary so that students can obtain full access to the academic curriculum. The educational relevance and critical importance of providing dysphagia services in the schools has been provided elsewhere, and professionals seeking this information are encouraged to consult ASHA's practice documents (ASHA, 2001; ASHA, 2007).

Students with feeding and swallowing problems present a unique management puzzle for school based professionals. In many schools, multiple students have been identified as having feeding and swallowing problems. Yet, often students are located in different rooms and/or school buildings. To complicate matters, school lunches are typically served at roughly the same time for all students, leaving little flexibility in scheduling. Since it is impossible to be in more than one place at a time, SLPs must be extremely creative in crafting a team approach to provision of therapeutic feeding services.

At first glance, it may seem appropriate to adjust the students' mealtimes to before, during, and after their peers' lunches. This adjustment may be appropriate in cases of students with severe feeding and swallowing impairments where the distractions of a group mealtime may inhibit a safe feeding environment. However, for students for whom it is feasible, the benefits of the social aspect of the school mealtime may outweigh the advantages of increased scheduling flexibility for the feeding specialist. For most people, mealtimes are more than just a time to ingest food; they are also social events. In school settings, mealtimes may be an excellent time for students with disabilities to interact with peers with and without disabilities and, as such, can be optimal times for professionals to facilitate inclusion opportunities.

The following proposal for a collaborative school-based feeding improvement

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program model emphasizes the roles and responsibilities of service providers. It was based on and supported by research (Bailey & Angell, 2005). It should be noted that this model may be expanded for larger caseloads (i.e., more than one person may fill each role) and decreased for smaller caseloads (i.e., one person may fill multiple roles). Additionally, all persons providing therapeutic services to students with feeding impairments require specialized knowledge and skills (ASHA, 2002b) and may require extensive training/staff development programs.

Collaborative Feeding Team Model - Roles and Responsibilities

Feeding Specialist.

The role of the feeding specialist requires advanced knowledge and training in pediatric dysphagia. The specific knowledge and skills required for competent service provision have been described elsewhere (ASHA, 2002b; 2007). The feeding specialist is responsible for conducting initial feeding and swallowing evaluations and developing comprehensive therapeutic plans. In this proposed model, s/he also conducts staff development workshops to train school staff in the administration of oral-sensory stimulation techniques, oral-motor exercise, therapeutic feeding strategies, and other individualized feeding techniques. The feeding specialist consistently monitors the feeding program and consults with the trained staff. S/he serves as feeder when possible. In this way, the feeding specialist is accessible to the feeding program staff, is able to interact repeatedly with students with dysphagia, and can individually monitor students' progress and adjust their feeding program activities as needed.

Feeding Support Staff 1-Dietary Manager.

The dietary manager is primarily responsible for making the diet modifications that have been recommended by the feeding specialist. The dietary manager prepares the equipment necessary to modify diets such as food processors, choppers, and grinders in programs where food is not delivered in the consistency needed and for snacks served at school. S/he also assists students in the preparation and modification of their own food (when feasible per each student's abilities). This person may also serve as feeder and/or supervise students in self-feeding situations.

Feeding Support Staff 2-Communication Facilitator.

The communication facilitator works with each student's SLP and teaching staff to prepare alternative/augmentative communication (AAC) devices with common mealtime

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messages (e.g., requests, choices, comments, social exchanges), develop visual strategies, and/or implement any other assistive communication modes appropriate for each student in the feeding program. It is important to consider the social aspect of mealtimes. Mealtimes provide excellent opportunities for meaningful communication (Bailey & Angell, 2007). These opportunities should be maximized within a therapeutic feeding program. The communication facilitator may also serve as feeder and/or supervisor of students in self-feeding situations.

Feeding Support Staff 3-Equipment Manager.

Many students use specific adaptive feeding equipment to facilitate increased independence, safety, and efficiency in feeding and swallowing. This equipment may include such items as specialized bowls, utensils, and cups. Therapeutic equipment is also used daily in a therapeutic feeding program. Items such as Nuk™ brushes, oral exercisers, and commercial liquid thickeners are examples of commonly used therapy materials. Special positioning supports that may not be used during other times of the school day are often required for students during mealtimes. Examples of items used for proper positioning and/or increased stability might include pillows, butterfly straps, or wedges. The equipment manager is responsible for seeing that all students are properly seated and positioned and for preparing therapy and adaptive equipment for each student. The equipment manager may also serve as feeder and/or supervisor of students in self-feeding situations.

Feeding Support Staff 4-Behavior Manager.

It is clear that children with feeding and swallowing problems often develop behavioral problems associated with eating that persist after the underlying problems have resolved or that continue to co-exist with dysphagia (Arvedson, 1997; Burklow, Phelps, Shultz, McConnell, & Rudolph, 1998; Manikam & Perman, 2000). The occurrence of behavioral feeding problems in combination with dysphagia has been well documented (Munk & Repp, 1994; Sisson & Dixon, 1986; Stark, Powers, Jelalian, Rape, & Miller, 1994). Therefore, the behavior manager is an extremely important role within a therapeutic feeding program.

A positive reinforcement behavior management system has been found to be effective in improving mealtime behaviors within a school-based therapeutic feeding program (Bailey & Angell, 2005). Within this system, the behavior manager prepares sticker charts for token exchange systems when feasible per each student's abilities. This requires

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maintaining a supply of token exchange reinforcers and stickers. For students who are not cognitively able to "work" for a sticker, the behavior manager conducts reinforcer preference assessments (Gast et al., 2000) and assembles and maintains sensory reinforcers for a positive reinforcement behavior management system. While all support staff involved in feeding and/or supervision of self-feeding are involved in implementing the behavior intervention programs, the behavior manager is responsible for analyzing the effectiveness of the programs. That is, s/he collects performance data whenever possible for students with mealtime behavior goals. The behavior manager may also serve as feeder and/or supervisor of students in self-feeding situations.

Other Recommended Specialists.

The following specialists are also necessary contributors to the therapeutic feeding program. Depending on their level of training and experience in the evaluation of feeding and swallowing problems, they may function as feeding specialist, in one of the feeding support staff roles, and/or provide additional necessary expertise.

Physical Therapists and Occupational Therapists: Physical and occupational therapists often plan programs for improving feeding independence, hand-to-mouth skills, gross and fine motor movements, positioning, increased independence with the use of adaptive equipment, and other feeding supports.

Nutritionists: Plan programs for improving the diet and nutrition of students with feeding problems. Often serve as great resources for diet modification ideas and suggestions.

Parents/Guardians: Are their children's specialists who often provide critical insights and have excellent ideas and suggestions. Caregivers may provide necessary continuity and carryover of therapeutic programs in the home.

Medical Personnel/School Nursing Staff: Provide medical information, a general health perspective, and medical support/assistance.

Summary

This proposed framework for a collaborative therapeutic feeding improvement program model is based on necessary roles and responsibilities of school-based service providers. Five roles have been described: that of the feeding specialist, dietary manager, communication facilitator, equipment manager, and behavior manager. In larger programs, multiple

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people may need to serve in each role. In smaller programs, a single person may perform multiple duties. It is hoped that our description of these roles and responsibilities will help establish a framework for the development of comprehensive school-based feeding teams that address and meet the mealtime needs of children with feeding and swallowing difficulties.

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Nutrition & Low Muscle Tone

by Kelly Dorfman, Ms., co-founder DDR

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Low muscle tone, or hypotonia, is one of the physical problems often associated with developmental delays. Children can have generalized hypotonia or it may affect just specific areas such as the hands or upper body. It is clinically significant because in severe cases the muscles are literally too weak to perform important tasks such as holding a pencil or sitting without slumping in a chair. In milder cases, stamina or precision are affected. For example, children with severe hypotonia of the hands are reluctant or sloppy writers whose interest in writing or drawing declines in direct correlation with the severity of the low tone. When the concerns are milder, youngsters may try to overcompensate for difficulties by holding pencils too hard and causing cramps or creating blisters.

Causes

There are two possible causes of hypotonia. Occupational therapists contend that vestibular system imbalances are to blame. The vestibular system is the primitive sensory system that is responsible for gravitational stability. The ability to walk down a flight of stairs while carrying a load of laundry is a tribute to the gravitational stability provided by a well-functioning vestibular system. People described as clumsy or children with difficulty climbing or riding bicycles often have vestibular issues. Good muscle development (or how your body pushes against gravity) is also considered a marker of vestibular development.

From a nutritional perspective, hypotonia represents the poor delivery of nutrients to the muscles. Diet represents what is consumed, but nutrition is what the tissues actually get. When soft muscles are present, there is a big gap between diet and nutrition. The muscles, suffering from nutrient deprivation, remain underdeveloped, or if strong, become fatigued easily. Congenital hypotonia is not the same as being out of shape. Those born with low tone can improve their condition but the tendency will remain. That is, if two people exercise exactly the same amount, the one with hypotonia will have less muscle development as a result.

Strategies

If the delivery of nutrients is inefficient, there are two basic strategies to better manage the situation; increase the amount of nutrients available for transport and try to regulate the naturally sluggish dispatch system.

Those with hypotonia tend to love sweets as they are a quick form of energy for tired muscles, but in the long run, a diet high in empty calories worsens the deficit. Controlling the intake of concentrated sugars (candies, sodas, juice, desserts) is the first step followed by the usage of a comprehensive combination of multiple vitamins and minerals. Because even a perfect diet will not be enough for someone with poor nutrient distribution, extra nutrients will assure that minimum requirements are met. The use of supplemental nutrients is a long term management tactic, not a quick fix. Once there are plenty of general nutrients to deliver, one can attempt to strengthen assimilation and usage of nutrients with more sophisticated measures. Digestive enzymes, carnitine, and co-enzyme Q-10 all may help.

Digestive Enzymes

Digestive enzymes aid the breakdown and assimilation of food. If used too aggressively, they cause stomach cramps and loose stools. They are given with meals, preferably lunch and dinner, as the body's strongest capacity for digestion is in the morning and so they are less needed then. Vegetable-based enzymes, such as Prevail Children's Digestion, are gentlest. In addition to low tone, those who do best with enzymes tend to be picky eaters, have digestive complaints such as stomach aches and/or have constipation or diarrhea.

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Carnitine

Carnitine (or L-carnitine, the active form) is critical for regulating fat burning (i.e. energy availability) in muscles. L-carnitine is made by the liver from the amino acids methionine and lysine with the help of vitamins C, B-6 and niacin. Dietary sources are muscle and organ meats. There is no carnitine in vegetables, fruit, or grains. In diseases with muscle deterioration, carnitine almost always helps and low carnitine is often a marker. Those with low tone may likewise benefit from carnitine even though their situation is not as profound. L-carnitine is non-toxic and 500-1000mg is a typical dose range.

CoQ10

The body cannot use food directly for energy but must convert it to an energy holding compound called ATP. There is only enough ATP stored in the body to provide energy for about 5-8 seconds of non-stop strenuous activity, so it must be constantly re-generated using co-enzyme Q-10 (or ubiquinone). Co-enzyme Q-10 nutritional supplementation would, therefore, be important for muscle performance and stamina. One preliminary study found co-enzyme Q-10 improved muscle work capacity in normal volunteers. Studies also show that co-enzyme Q-10, appears to improve immune function. The beginning dose range for co-enzyme Q-10 (like L-carnitine, a nontoxic substance) is usually 30-60 mg. L-carnitine and co-enzyme Q-10 can be taken safely together with a multiple vitamin to aid in their utilization. For specific information on supplements for your child, always confer with a health care professional.

If you need help in finding nutritional supplements contact DDR. Email Kelly at Kelly@kellydorfman.com

Editorial: Gut Comfort by Krisi Brackett MS SLP/CCC



I just have room for a quick comment here but what comes to mind is “gut comfort” when approaching our feeding clients. Research clearly links food refusal with the GI system, yet how many of us take a thorough history of stooling patterns (frequency, amount, ease of passage), gastroesophageal reflux, stomach pain, and motility. And how many of us connect what we uncover with the child’s feeding pattern and use this information when prioritizing intervention?

Let’s all pay attention, the next time we experience a stomach flu or reflux or constipation– how eager are we to eat? Do we want comfort foods? Do we avoid foods? How do we change our feeding habits? What if we were tube fed despite how we feel? Do we make associations? When I was pregnant with my second, I had terrible nausea and morning sickness. My then 3 year old watched a lot of Monsters Inc.. To this day, I feel nauseous when I here the opening theme song of Monsters Inc. and it is a cute movie!

Remember, eating is a learned behavior– not an automatic one. We need to help prepare our clients to learn to eat. The first step in preparation is gut comfort. As therapists, we have a role in working with the family and medical specialist to achieve comfort.



**Job
Opening!!**

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- Pediatrics -

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On the Research Front:

Fischer, E & Silverman A. Behavioral conceptualization, assessment, and treatment of pediatric feeding disorders. *Semin Speech Lang.* 2007 Aug;28(3):223-31.

In this article, the authors review a biobehavioral approach for the assessment and treatment of feeding disorders. First, factors that affect the development of feeding behaviors are described including sensitive developmental periods for acquiring feeding skills and the effects of interpersonal relationships on feeding. Second, behavioral assessment and conceptualization strategies are discussed. Third, behavioral treatment strategies are described including the uses of feeding structure, manipulation of hunger, contingency management, shaping, and parent training. Finally, consideration of various behavioral treatment options are considered including the integration of psychology as part of an interdisciplinary team and the use of intensive behavioral treatment protocols that include inpatient behavioral programs.

Lefton-Greif MA & McGrath-Morrow SA. Deglutition and respiration: development, coordination, and practical implications. *Semin Speech Lang.* 2007 Aug;28(3):166-79.

This article focuses on the coordination between swallowing and breathing in infants and children, aspiration during periods of postnatal lung development and airway protective mechanisms. Identification of infants and children at increased risk for oropharyngeal dysphagia and respiratory disease is critical for optimal intervention. Assessment and management considerations are described.

*Seminars in Speech and Language can be purchased by volume from Theime Publishers.

Norman V, Louw B, & Kritzinger A. Incidence and description of dysphagia in infants and toddlers with tracheostomies: a retrospective review. *Int J Pediatr Otorhinolaryngol.* 2007 Jul;71(7):1087-92. Epub 2007 May 4.

The purpose of this study was therefore to report the incidence and describe the dysphagia in infants and toddlers with tracheostomies at a large pediatric referral hospital in South Africa. Results indicated that 80% (64/80) of the participants presented with dysphagic symptoms. Oral phase dysphagia was reported in 81.25% (52/64), pharyngeal phase dysphagia in 60.9% (39/64) and esophageal phase dysphagia in 79.7% of the dysphagic participants. Infants and toddlers with tracheostomies are at increased risk for dysphagia. Multiple risk factors for dysphagia associated with tracheostomies are included, underlying medical conditions and the context of a developing country were identified in the study population.