Pediatric Feeding and Dysphagia Newsletter

Dear Fellow Feeders,
Happy 2006! In this issue we have covered a variety of topics-from oral motor problems and ASD, the relationship between communication and feeding, the use of pain medication in feeding intervention and the first part of an interview with Mary Schiavoni, the inventor of the chewy tube! Plead read the case carefully, a picky eating adult. I am often asked if children grow out of extreme picky eating-some clearly do not. Lastly, I am hitting the road in 2006, please check out my workshop schedule at http://www.motivationsceu.com/ Cheers! Krisi

Pediatric Feeding and Dysphagia Newsletter
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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 and Cathy Fox MS OTR/L, Private Practice, Frederick , MD

Specific Oral Motor Problems in Children with Autism Spectrum Disorders

Cecilia J. Manno, MS, CCC/SLP, Private Practice, Newtown, PA

Specific oral motor problems in children with PDD and autism can be demonstrated and maintained due to tonal issues, compensatory sensory input due to medical issues, compensatory breathing patterns, pelvic, trunk and shoulder girdle instability limiting practice of more mature oral motor patterns. Due to instability in the proximal areas the head and neck are typically in a more forward position reducing the full range of movement as well as sensory input to the pharyngeal musculature and muscles of the palate, jaw, tongue, lips and cheeks.

When movements are limited they take on the more immature patterns of flexion and extension or midline patterns. This is demonstrated by a suckling or sucking pattern with liquids and soft solids and mashing and munching of soft foods with a sequential swallowing transport pattern.

Gastrointestinal issues can be demonstrated by gagging, an increased feeling of fullness, a decrease in overall volume accepted, difficulty with textures and decreased hunger. These symptoms also affect motor movement patterns increasing extension and more midline patterns. Due to the limited movements the kinds of foods accepted are limited, the ability to stay in a flexed position in a chair are reduced and acceptance of a spoon is reduced due to the patterns required to manipulate and swallow the food.

When gastrointestinal issues continue to be active it impairs the action of the pharyngeal muscles. In particular the cricopharyngeus will not relax totally limiting the amount of food that can pass through. Once the food has passed through contraction of the muscle may also be impaired which prevents reflux of food. The pharyngeal constrictor muscles narrow

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the opening of the pharynx to help squeeze the food downward in a peristaltic action toward the esophagus. The pharyngeal elevator musculature elevates the entire pharynx and widens the superior pharynx to accept the food as it passes through to the esophagus.

If the child is positioned in a posterior pelvic tilt with a forward head posture, his sensation of movement is impaired and the full length of the musculature is reduced limiting the action of the muscles of the swallowing mechanism. The pharynges will not be able to elevate appropriately, open to accept food and then be able to squeeze it through the pharynx. Thus, the kinds of foods accepted and the motor patterns demonstrated are limited.

The muscles of the soft palate serve to raise the palate to close off the nasopharynx so that food will not enter the nose. The palatine muscles also raise the posterior part of the tongue, depress the soft palate and aids in elevating the larynx and pharynx. When there is an imbalance of these synergistic movements due to an imbalance of muscle activity the coordinated efforts of these muscles cannot be achieved. Therefore, foods may be refluxed through the nose or pass through the pharynx before the child is ready with possible gagging or aspiration.

The jaw and hyoid bone provides the structural base for the tongue. An open lax jaw leaves the tongue sitting too far forward in the oral cavity encouraging anterior/posterior movement patterns to transport foods through the oral cavity and pharynx. Wide jaw excursions decrease the ability to manipulate food within the oral cavity with the possibility of food falling out of the mouth or the inability to chew smaller pieces of food due to the inability to grade movement. Stability of the jaw allows the tongue to work and dissociate movement patterns within the mouth.

The tongue demonstrates a variety of patterns as the child develops. As the child grows the swallowing musculature elongates and separates. The child proceeds from liquids to jarred purees to mashed and meltable foods and then to regular table foods. The utensils change from a bottle to spoon to fingers to cup then fork. As the foods change the tongue patterns must also change to accommodate the manipulation of the food. If the utensils do not change the child does not learn to accept them and then manipulate the food with them. If the food does not change or is limited, the child does not learn to accept new foods or to manipulate the food and transport it through the pharynx appropriately and efficiently.

As the child begins to develop the lateral movements of the jaw and tongue, he begins to separate these structures. He is able to move the tongue anterior, posterior, laterally and in elevation as the jaw stays stable. He is able to dissociate each side of the tongue with one side stable as the other is mobile. He also dissociates the front and back of the tongue in elevated positions and then in the process of swallowing.

The lips and cheeks work together providing enough tension within the mouth to contain the food and with the lips together to provide negative pressure to begin the swallowing process. Tonal and muscle imbalance of these structures can leave the lips in an open position loosing food anteriorly or with the inability to contain it while manipulating it. If these muscles are shortened they will not be able to attain full muscle length for closure.

When a child refuses food or utensils he typically extends these muscles into an open mouth posture. It is then difficult to use the upper lip actively to take food off a spoon, to drink from a cup or make full lip closure for a single bolus swallow. As the child opens his mouth to receive the food all of the oral musculature including the tongue is drawn back in a defensive manner. Due to these compensations it is difficult to develop the movements necessary for age appropriate acceptance of a variety of foods.

The Relationship Between Early Feeding and Communication

By Cara S McComish, MA, CCC-SLP mccomish@med.unc.edu

Children with developmental delays are often seen clinically for problems with feeding and swallowing; research shows that an estimated 30-80% of children with developmental delays exhibit some type of feeding or swallowing problem (Schwarz, 2003). Early feeding dysfunction is often considered to be an early indicator of possible neurological problems, which may result in future diagnoses of language or developmental delays (Hawdon, Beauregard, Slattery, & Kennedy, 2000; Selley et al., 2001). Therefore, early feeding struggles could be "red flags", indicative of future developmental problems that would require ongoing supports and services for the child and his or her family.

Severe feeding problems that are persistent over time may result in serious conditions such as malnutrition, nutrient deficiencies, delayed development, failure to thrive, and excessive family stress (Olive, 2004; Sullivan et al., 2000). Infants who are born prematurely, and/or with diagnoses of neurological insults or respiratory disorders, have been found to be at greatest risk for feeding problems (Hawdon et al., 2000). Premature infants born at less than 34 weeks gestation are typically not yet neurologically mature enough to engage in oral feeding (Nobrega, Borion, Henrot, & Saliba, 2004). For these infants and others born with neurological or congenital impairments, feeding often must occur initially via naso-gastric or oro-gastric tubes, also referred to as gavage feedings (Mason et al., 2005). Tube feeding is commonly used in neonatal units due to the immature neurological and digestive systems of premature infants. Although extended tube feeding may be required as a result of multiple medical complications, data suggest that later oral sensitivity and decreased feeding skills may result from the long term use of feeding tubes (Dodrill et al., 2004; Mason et al., 2005).

Breathing is the infant's number one physiological priority; therefore, respiration, as well as heart rate, must be stable for the infant to be physiologically ready and able to engage in feeding interactions. Breathing problems can both cause and contribute to feeding problems. Such issues are prevalent in preterm infants, as they have an increased incidence of chronic lung disease and respiratory distress syndrome (Gewolb et al., 2003). Those infants who have been weaned from oxygen supplementation and are stable on room air may still demonstrate respiratory compromise during feedings. This suggests that the increased physiological demands of feeding may require oxygen supplementation at these times to prevent the loss of oxygen reserves and subsequent hypoxemia (Thoyre & Carlson, 2003). Increased respiratory rates result in decreased time to coordinate swallowing with breathing, which can lead to aspiration; often, aspiration leads to chronic respiratory problems (Sheikh et al., 2001). In addition to the physiological considerations of respiratory rate and compromise, secondary medical diagnoses such as gastro-esophageal reflux or GER (Mercado-Deane et al., 2001), and renal failure (Mason et al., 2005), can also contribute to breathing and swallowing difficulties and further exacerbate feeding problems.

Coordination of swallowing and breathing becomes more effective and efficient with maturation (Nobrega et al., 2004), but for many children, feeding problems appear to persist beyond infancy (Hawdon et al., 2000). Medical complications such as GER contribute to age related changes in food refusal; such age-related changes occur as a result of growth, cognitive and motor development, and increased autonomy. For example, Gisel (1991) reported that the refusal rate of foods increased from 7% at 6 months of age to 41.4% by 24 months of age on specified foods, as reported by parents on feeding history questionnaires. In infants who were tube fed, changes in feeding problems have been documented with increased age (Mason et al., 2005), reflecting a developmental progression and potential sensitive periods. In a survey study of children with CP and dysphagia who were born prematurely, Selley (2001) documented maturational changes in feeding problems based on parent reports. The authors of this study were surprised at the finding that 27% of mothers documented no early suckle feeding problems, but later severe feeding problems in their children (Selley et al., 2001). The authors ask the question "what went wrong after weaning?" for those infants who were reported to initially feed normally during suckle feeding. Interestingly, the authors do not consider the possibility that this subgroup of children may have been unable to make a successful transition beyond a suckle pattern to more mature oral-motor patterns (i.e. rotary chewing) for eating, resulting in struggles with transitions to textured and solid foods. Such inabilities to transition to more mature oral motor patterns could theoretically contribute to later speech and language delays.

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The Relationship Between Early Feeding and Communication

By Cara S McComish, MA, CCC-SLP

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The production of speech sounds is reliant on the control of physical structures as well as physiological stability; therefore any compromise of physiologic stability may impact feeding skills and later speech and language development. Many factors may contribute to such problems; for example, chronic breathing problems could possibly contribute to later difficulties in the ability to coordinate breath support for speech and language (Gewolb et al., 2003). In addition, uncoordinated or dysfunctional early sucking skills may have a negative impact on later feeding and oral motor development. Due to the fact that coordinated oral-motor patterns are needed for speech sound production, dysfunction or disorganization of such patterns that initially impact feeding in infancy could have a negative cascading effect. Such an effect could lead to later speech and language delays or difficulties with regard to the coordinated oral motor movements required to produce speech sounds (Nobrega et al., 2004). For example, before an infant can use speech to communicate, tongue control must be developed for coordinated movements such as tongue lateralization; this skill is initially learned within the context of the development of feeding skills (Skinner et al., 1998).

When considering communication development within the context of early social interactions such as feeding, the co-regulation and engagement required for learning in this context can also be considered with implications for later language learning (Fogel, 1993). An important question remains: if communicative behaviors or cues are overridden by adults during early feeding interactions, what are the possible implications of such caregiver behaviors on future social interactions which will provide the context for infant speech and language development (Skinner et al., 1998). An example of such a scenario can be found in Thoyre's work, where mothers were documented to often resume feeding their premature infant after an oxygen desaturation event, before the infant's oxygen saturation had recovered to the pre-feeding baseline levels (Thoyre & Carlson, 2003). This indicates a breakdown in this earliest communication between caregiver and child, as the caregiver is unaware of or unable to read the physiological and behavioral cues signaled by the infant. Such communicative breakdowns are not solely the result of caregiver ability or lack thereof to read infant cues, as preterm infants also struggle with the ability to maintain engagement and arousal states during feeding. Research has further demonstrated that infant ability to maintain engagement in feeding is determined by characteristics of the dyad, in addition to the dynamic conditions created within the feeding interaction (Thoyre & Brown, 2004). Deficiency of feeding skills on the part of either the parent or the infant has a major impact on these dyadic interactions, as well as on the infant's growth and development of mental and motor skills (Pridham, Limbo, Schroeder, Thoyre, & Van Riper, 1998).

When considering early feeding interactions and their possible contributions to later speech and language development, one must also consider research that documents continued feeding problems in older children with speech and language delays. One such example is a study by Sullivan et al (2000), that documented speech and language delays and disorders in children aged 4 to 13 years who had cerebral palsy and feeding problems. Of the 377 children compared by parent reports on questionnaires in this cross-sectional study, 89% were reported to need help with feeding, while just over half were reported to choke with food. These feeding problems resulted in increased time spent feeding children with disabilities, which subsequently resulted in many of the parents reporting feelings of increased stress and lack of enjoyment when feeding their child. Such results, in combination with caregiver documentation that 64% of these children had never had their feeding or nutrition formally assessed, led the authors to state that feeding problems are a common and under recognized source of increased stress for caregivers and family members (Sullivan et al., 2000). In addition, of the majority of those with motor impairments, 97% were reported by their caregivers to have severe speech problems. These findings contribute to theoretical assumptions that early feeding problems and dysfunctional motor patterns can lead to later speech and language delays.

Contact info: Cara S McComish, MA, CCC-SLP, mccomish@med.unc.edu
PhD Student , UNC Chapel Hill, Division of Speech and Hearing Sciences

Question and Answer: I asked Dr. Paul Hyman, Pediatric Gastrointestinalmotility specialist to explain the use of manometry and pain medicine in feeding intervention

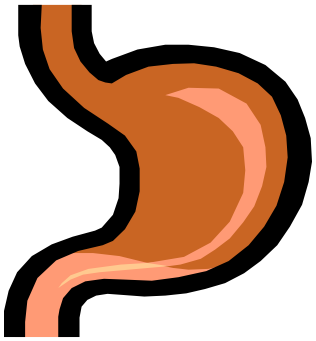
Dyspepsia means that there is upper abdominal discomfort. In lots of folks with dyspepsia it gets worse after eating, or only happens after eating. In adults dyspepsia has been studied carefully. Endoscopy may show an inflammatory or acid-related disease that can be treated with drugs. However, most dyspepsia is functional, meaning that the symptoms are real but there is no easily discovered disease. Functional dyspepsia occurs through one or more of three mechanisms: visceral hyperalgesia, defective receptive relaxation with consequent increases in intra-gastric pressure, and abnormal motility.

Visceral hyperalgesia occurs when sensory nerves in the stomach become over sensitive. Then the pain nerves send messages to the brain that there is pain, even after events that should not cause pain, like normal stomach contractions. Newborn infants, especially ill preemies, may be more susceptible to visceral hyperalgesia for several reasons, including: 1) non-functioning descending pain-inhibitory nerve pathways, 2) no coping mechanisms, 3) repeated pain experiences.

Infants are unable to say when they have dyspepsia. However, infants do not eat if it hurts to eat. Therefore, if an infant refuses to eat, clinicians should always consider why it hurts to eat, or why the infant is afraid it will hurt to eat. Functional dyspepsia is not an accepted diagnosis for children unable to provide an accurate pain history. However, it seems like postprandial dyspepsia may be a common cause for infants and toddlers to refuse to eat. A fundoplication may further complicate dyspepsia by creating more dyspepsia by reducing stomach receptive relaxation and stimulaing more pain nerves in the stomach area.

If a child refuses to eat and there is no anatomic reason to explain the symptom, dyspepsia is high on the list of diagnostic possibilities. If a child refused to eat and has a normal endoscopy, it is reasonable to treat for functional dyspepsia at any age. In everyone except those with seizures or cardiac conduction defects I recommend a tricyclic antidepressant. Tricyclics are used for chronic pain everywhere in the body, and work well to treat visceral hyperalgesia. If the child is irritable and/or has trouble sleeping through the night or diarrhea, amitriptyline is the drug of choice, beginning at 0.2 to 0.3 mg/kg an hour or two before bedtime, and increasing by the same amount once a week until there is a response or stop at 1 mg/kg, whichever comes first. Side effects of amitriptyline are relaxation, ,sedation and constipation. Sometimes the side effects are desirable. Imipramine is midway in side effects between amitriptyline and nortriptyline. Cyproheptidine may be used as well, for its serotonin 1 receptor antagonism probably resulting in improving stomach receptive relaxation. For children with seizures or cardiac conduction defects, I start with gabapentin.

I avoid all unnecessary procedures on children with visceral hyperalgesia, because procedures may cause further hyperalgesia secondary to discomfort and arousal. Therefore I advocate a trial of pain medicine before manometry in most cases. (Sometimes parents or referring docs request manometry before treating, because who wants to use drugs when you are not sure what you are treating? Manometry always shows what works and what does not work.) More than half the time treating pain results in a happy baby and an overjoyed family. If there is no response, and no overt central nervous system reason for food refusal, it is reasonable to find out what works and what does not work in upper GI tract motility. This step can be done only in special centers specializing in pediatric GI motility, because it is time consuming. The top centers for referrals are at Columbus (OHIO) Children's Hospital, Milwaukee Childrens Hospital, Cincinnati Childrens Hospital. We can do esophageal and gastrointestinal manometry at an age, any size. There is a second group of centers that do mostly local patients in Boston at Tufts, Boston Children's Hospital, Riley Children's in Indianapolis, Nemours in Delaware, I think. (If I have forgotten anyone, my apologies.)



This May at Digestive Disease Week there will be a symposium titled Feeding Problems in Infants and Toddlers, chaired by Dr Hayat Mousa and me. Talks include the pharyngeal problems by Natalie Rommel, esophageal motility problems by Sudershan Jadcherla, Dyspepsia and fundoplication problems by Dr Mousa, and Treatment by me! Hope you can make it.

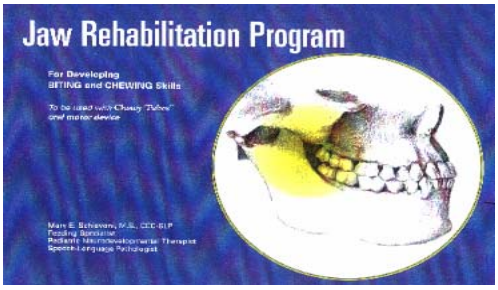
Happy New Year. Dr. Paul Hyman

Professor of Pediatrics and pediatric gastrointestinal motility specialist, The University of Kansas Medical School

PART 1: Interview with Mary E. Schiavoni

By: Mary E. Schiavoni, MS, CCC-SLP, Feeding Consultant Speech-Language Pathologist, Pediatric Neurodevelopmental Therapist

"A little something to chew on."



1. What is your background and what led to the design of the Chewy Tube?

From the earliest days of my professional career I have had an interest in specializing in the pediatric field, working with children having special needs. In addition to my educational preparation as a Speech and Language Pathologist, I also acquired certification as an Elementary Education Teacher, and in the area of Special Education, as a Teacher of the Mentally Impaired in the mild, moderate and severe ranges of impairment. Later in my work experience, I added Teacher of the Emotionally Impaired to my resume. In addition I have an extensive educational and experiential background in Applied Behavior Analysis.

Toward the completion of my undergrad studies, I really wanted to begin working in my field, so I set aside an additional minor in Psychology to graduate with my Bachelors in Speech and Audiology from Western Michigan University in Kalamazoo, MI. After completing my Masters at the University of South Florida in Tampa, FL, I continued my professional training with certification as a Pediatric Neurodevelopmental Therapist under the training of Dr. Christine Nelson in Cuernavaca, Mexico. This training, focusing on the central nervous system, opened up a deeper multidimensional perspective to my treatment as a SLP, on top of which I added training in craniosacral and myofascial treatment.

I also had an interest from the earliest days of my career to focus on the fundamental skills involved in speech production and oral motor function. I began to target function of the tongue and jaw in treatment with my patients and read every book and article I could get my hands on regarding pediatric feeding. At this time I also served a population of children with significant special needs at the Arizona Children's Hospital in Phoenix.

This search led me to Dr. Suzanne Evans Morris a personal friend and colleague to this day. I began to investigate potential treatment to target lingual function, since in the special needs population targeting improved lingual function was a constant treatment issue. I began to address the concept of introducing weight-bearing activities for the lingual musculature in an effort to maximize appropriate function and position within the oral cavity. Realizing that the jaw was key to lingual function as well, I began to target mandibular function. Since that time we have come to understand the mandibular-lingual dissociation that must be established to allow more mature movements of the jaw and tongue and how the function of the jaw and tongue are so incredibly interrelated in the maturation of oral motor function.

I began to work on designing potential tools to target specific oral motor outcomes. My work eventually led me to the design of a series of tubular tools. I consulted with Dr. Suzanne Morris on the prototype. She began to include the initial tools in treatment with her patients. The tubular design offered a unique resiliency factor to encourage additional biting on the tube. The feedback from patient performance was very positive and families began to ask for these tools for home practice. The prototype was refined. A corrugated handle was added in order that visually impaired patients would have tactile boundaries for grasping the tool. Stem diameters were defined to address jaw excursion ranges in the pediatric population. Parameters of color and content were researched to comply with FDA approved materials. Chewy Tubes were born!

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Case by Case:

THIS IS WHAT A TYPICAL PICKY EATING ADULT MIGHT TELL YOU IF THEY DESCRIBED THEIR EATING DISORDER TO YOU. Excerpt from the website: pickyeatingadults.com.

I'm an Adult Picky Eater. I have a big secret that I guard and keep from all but my closest friends and family. I have been this way my entire life and can never remember ever eating like normal people. I was sick a lot as a child. When I was born I could not keep very much down. Every time I was fed it was followed by throwing up. But as time passed I did get better and certain foods would stay down and I was able to grow. My parents have told me that I was a very well behaved child and my picky eating was the only real problem they ever had with me.

Now don't get me wrong I do like the foods I eat. Most of what I eat is very bland. You may find it hard to believe how much taste I get from what I eat. Perhaps I'm a super taster. Texture of the food is very important to me. I like most of the things I eat crisp and crunchy. As an example one of my favorite foods is McDonald's french-fries. In fact I not only love fries I also love Plain Potato Chips and Sticks. Now a mashed Potato is bad because it's mushy. I don't like corn on the cob but I love corn chips and popcorn. I know at least 6 different ways to make pop corn.

I also have issues with things being plain and simple. I love Vanilla and Chocolate Ice Cream. But if you put other things into it I get turned off. No nuts even though I just love Peanuts and Almonds by themselves. Give me plain M & M's but not the kind with nuts. I want what I eat to be plain. Very complex foods generally turn me off. I have trouble sorting out in my mouth what's in the more advanced dishes. That means you probably won't see me at the Olive Garden or most other Restaurants.

I do like to drink plain and chocolate milk, cola's and other soft drinks. R C Cola is a big favorite. I also like the taste of Beer. Now the colder all of these beverages taste the better I like it. It just can't be too cold for me. I even remember where the coldest water fountains are in town. I don't like any beverages that are hot.

Thin is always better than thick. I love American Cheese sliced very thin. If the cheese is in block form it could make me gag. Oh that brings up my problem with swallowing. If I have to chew on something too long it will make me gag and my stomach contents might come up for air. I don't like most other types of cheese. Being able to eat a grilled cheese sandwich has saved my life at many restaurants. But please don't put that darn pickle on top of my grilled cheese sandwich.

The only meat I can eat is thin sliced crisp bacon. I don't like it under cooked and never thick sliced. Other meats are just too hard to chew and I don't like the flavor I get from them.

When I was a child my parents tried to force-feed me a couple of times. That only made things worse. I was forced to eat chicken almost every week for over two years. The only way I could get it down was to cut it into very small pieces that I could wash down with water and avoided having to chew it. You would think that after two years I would have learned to like it.

I eat very few veggies. Raw carrots and celery are ok. A salad with salad dressing is really out of bounds for me. I just hate tomatoes and tomato products. Ranch taste is awful and you can forget about pepper and tobasco sauce. When I'm around someone eating chili I can get sick. I see and smell no difference between chili and dog crap.

Now here is something really strange. Just the name of something can turn me off. Sour dough bread or pretzels. Something about that word sour.

I just hate the holidays especially Thanksgiving. I can remember many terrible things happening to me on that day as a child. While others in my family looked forward to these times I would dread them for weeks even months before they came around.

I'm a success in life. I own a business or work as a professional. I strive very hard to make up for my shortcomings when it comes to eating. I have had several relationships end because of my eating problems.

I think I would like to change the way I eat. But I sometimes worry a part of me would die if I ever did. It's almost a badge of honor to me.

EMAIL: BOB@PICKYEATINGADULTS.COM http://www.pickyeatingadults.com

Pediatric/Adolescent Gastroesophageal Reflux Association, Inc.
PAGER Association
P.O. Box 486
Buckeystown, MD 21717-486
(301) 601-9541 message center
http://www.reflux.org
gergroup@aol.com
501(c)(3) # 52-1800883

The Pediatric Adolescent Gastroesophageal Reflux Association (PAGER Association) recently upgraded its website at www.reflux.org.

The technology upgrade includes a new, uniform look and better organization of the vast amount of information. The discussion board is as busy as ever, allowing parents to chat with each other about common concerns. The Reading Room contains many full length articles about diagnosis, treatment, feeding and more.

Membership is now free and parents as well as professionals are encouraged to log on to the website and register to receive our electronic newsletter and notification of support groups, conferences and research projects.

For information:
Pediatric Adolescent Gastroesophageal Reflux Association
PO Box 486
Buckeystown, Maryland 21717
301-601-9541
www.reflux.org
gergroup@aol.com

PAGER Association is a national non profit patient support organization providing information and support to families of infants to teens with acid reflux. Here is an excerpt from the latest e-newsletter targeting current research-

Reflux Digest (an excerpt of research highlighted in the latest newsletter)

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Low Allergy diet for nursing moms helps with colic
http://pediatrics.aappublications.org/cgi/content/full/116/5/e709
In a recent study, a group of nursing mothers were asked to exclude cow's milk, eggs, peanuts, tree nuts, wheat, soy, fish, preservatives, colors and additives from their diet for seven days. Another group of mothers ate all of these things except preservatives, additives and colors. About two-thirds of the babies whose mothers avoided the allergenic foods responded with a reduction in crying. Overall, the babies reduced their crying by at least 25% from an initial crying time of 600-700 minutes in the 48 hours preceding the test.
Note: Despite a significant drop in actual crying time, the mothers didn't feel the diets were terribly helpful. Most rated their babies as the same after the study. Perhaps they felt a drop in crying from 5.8 to 4.3 hours per day wasn't enough?

Apnea and Acid Reflux: The debate continues with two new studies...
Apnea is not prolonged by acid gastroesophageal reflux in preterm infants. J. Di Fiore, et al Pediatrics 2005, 116: 1059-1063. A group of 119 premature infants were evaluated for apnea and acid reflux events. A total of 6255 episodes of acid reflux were noted. However, only 1% of the reflux episodes were related to apnea. The authors concluded, There is no evidence of a ...relationship between acid based GER and apnea in preterm infants.?

Testing the association between gastroesophageal reflux and apnea in infants. J Pediatr Gastro Nutr 2005, 41: 169-177. In this study of 25 infants with apnea and GERD, test with an intraluminal impedance monitor showed there was no *statistical relationship* However, in two of the infants, there was a clear connection.

PART 1: Interview with Mary E. Schiavoni

By: Mary E. Schiavoni, MS, CCC-SLP, Feeding Consultant
Speech-Language Pathologist, Pediatric Neurodevelopmental Therapist

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2. **Would you explain the development of Chewing Skills?**

The development of biting and chewing skills is a marvelous process of oral motor maturation. There is a gradual refinement of mandibular and lingual motor coordination.

Let's stay with the mandible for the moment. In the initial stage, vertical jaw movement predominates. This is evident in the initial suckling and sucking behavior of the infant. This vertical pattern of jaw excursion and closure continues and is observed in the phasic bite and release movements of the infant's jaw in the munching pattern at about five months of age. This munching pattern has been identified as the earliest form of chewing. During this early oral motor period lingual movement is associated with jaw movement. The anterior-posterior, extension-retraction pattern is predominant in the early feeding pattern of the infant.

In the 6th – 8 month period, vertical jaw movement predominates but a second type of jaw movement is emerging. Diagonal shift of the jaw may be observed in addition to vertical jaw movement in the manipulation of a bolus. Initially this diagonal movement is very slight, but definitely observable to the critical eye of the clinician. When I see this shift occur in the jaw function of my patients it is a moment of joy as I know we are progressing favorably toward our treatment goals. This emerging diagonal jaw pattern is supported by the development of lingual lateralization skill which typically develops during the 7th month. This skill allows the tongue to move a bolus from the center to the side of the mouth, providing bolus placement for more effective mastication.

In the 9-12th month period diagonal jaw movement becomes more frequent. Vertical jaw movement typically becomes less stereotypic. Lingual-mandibular dissociation is developing as tongue movement separates from jaw movement. This is a fun period in treatment. So much is happening and there are many oral motor skills to address in treatment. As this diagonal pattern becomes more consistent in the child's chewing behavior, jaw movement progresses into what is referred to as the diagonal-rotary pattern.

In the 12 to 18 month period the diagonal-rotary pattern becomes more consistent and coordinated with lingual lateralization behavior. Strength of the masseter in jaw closure skill targets mastication of more advanced textures placed laterally within the oral cavity.

Between 24 and 36 months, a third pattern of jaw movement emerges in the child's level of oral motor skill. A circular movement component is added to rotary chewing wherein the bolus is positioned laterally for mastication and then transferred by the tongue to the opposite side of the jaw for continued chewing without interruption at the midline. At this third level of jaw skill development mastication of a bolus may be transferred repeatedly across the child's midline until the chewing process is completed. This third level of skill maturation is referred to as the circular-rotary pattern of jaw movement.

The child's many and varied oral sensorimotor experiences throughout these early months have provided specific skill development of jaw excursion and closure. We see increased precision in the amount of jaw gradation used in biting on various textures. From these early sensorimotor learning experiences and the neurological readiness of the child internal postural stability of the jaw emerges. In feeding treatment, manipulation of the cup on the mandible during drinking experiences assists this process.

During this entire process of oral motor maturation, the jaw along with the tongue is responding to the sensory aspects of the bolus, learning to position, move and masticate food within the oral cavity. Critical aspects of this learning process involve integrating function with characteristics about the bolus such as size, shape, position within the oral cavity, texture, viscosity, firmness, taste and temperature. In addition, the smell of the food itself may impact the child's acceptance or rejection of the bolus.

For practicing Biting and Chewing Skills
Speech Pathology Associates, LLC
1-207-741-2443
www.chewytubes.com

Hiro Publishing
3106 Lincoln Street
Salt Lake City, UT 84106
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phone: 801-599-8250
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On the Research Front:

Finan DS. Smith A. Jaw stretch reflexes in children. Exp Brain Res. 2005 Jul;164(1):58-66. Epub 2005 Mar 15

In adults, the jaw stretch reflex contributes to the functional stability of the jaw. The authors investigated the response properties of the jaw stretch reflex in two groups of young children and a group of young adults. Response latencies increased with development, and all age groups produced stimulus-magnitude-dependent increases in reflex gain and resulting biting force. These data and earlier experiments suggest that oral sensorimotor pathways mature throughout childhood in concert with the continued acquisition of complex motor skills.

Willging JP, Thompson DM. Pediatric FEESST: fiberoptic endoscopic evaluation of swallowing with sensory testing. Curr Gastroenterol Rep. 2005 Jun;7(3):240-3.

Fiberoptic endoscopic evaluation of swallowing (FEES) was developed as an adjunct to the videofluoroscopic swallowing study and clinical examination of swallowing function in the adult. The sensory testing aspect of fiberoptic endoscopic evaluation of swallowing with sensory testing (FEESST) utilizes an air pulse stimulus of mechanoreceptors within the larynx. The study can be performed safely in children as young as premature infants and in adults. Adequate levels of cooperation can be obtained in nearly all children requiring FEESST. No cases of laryngospasm or respiratory compromise have been encountered. FEESST was initially applied to patients with dysphagia. It is now used in the study of the effects of gastroesophageal reflux on the larynx and swallowing function. The extent of pooled secretions in the hypopharynx can be used as a surrogate measure of laryngopharyngeal sensory testing. When patients managed by FEESST were compared with patients managed by videofluoroscopic swallow studies, there were no statistical differences in the rates of pneumonia or pneumonia-free interval. A learning curve is present for the operator, but with basic endoscopic skills, FEESST is a skill within the scope of practice of most pediatric endoscopists.