AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION

Roles of Speech-Language Pathologists in Swallowing and Feeding Disorders: Technical Report

Dysphagia Document Review and Revision Working Group

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About This Document

This technical report and accompanying position statement were updated from existing policy documents by the Dysphagia Document Review and Revision Working Group chaired by Paula A. Sullivan, with members Joan C. Arvedson, Cathy Lazarus, Donna S. Lundy, Gary McCullough, Lisa Newman, and Nancy B. Swigert. Janet Brown served as the National Office liaison and member of the group. Alex Johnson, ASHA vice president for professional practices in speech-language pathology (2000–2002), and Bonnie Martin-Harris, coordinator of the steering committee of Special Interest Division 13, Swallowing and Swallowing Disorders, provided guidance and support.

The position statement defines the role of speech-language pathologists in the evaluation and management of individuals with swallowing and feeding disorders and clarifies the scope and rationale for these services. This technical report updates the Technical Report on Dysphagia (ASHA, 1987) and supports the conclusions of the Roles of Speech-Language Pathologists in Swallowing and Feeding Disorders: Position Statement (ASHA, 2001).

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Background

Although some speech-language pathologists have been involved with the management of oral feeding and swallowing disorders in children with cerebral palsy since the 1930s, the focus on swallowing disorders increased exponentially in the 1970s with published articles on clinical or bedside assessment and management (Larsen, 1972) and, subsequently, on the use of such instrumental assessment procedures as cinefluoroscopy/ videofluoroscopy, followed by sonography, endoscopy, manometry, and scintigraphy (ASHA, 1992; Miller & Groher, 1993).

An Ad Hoc Committee on Dysphagia developed the Technical Report of 1987. It provided a definition of dysphagia, presented guidelines for clinical preparation of speech-language pathologists and for intervention with patients/clients, and identified research needs. The report indicated that speech-language pathologists were providing services according to different models, and in some settings might decide not to become involved in providing services for individuals with dysphagia. In 1985, 35% of speech-language pathologists surveyed reported that they provided dysphagia services. At that time, a speech-language pathologist's ability to assess and treat individuals with swallowing and feeding disorders was limited by at least two factors: speech-language pathologists could not be reimbursed for dysphagia treatment by Medicare unless the dysphagic individual had a concomitant communication disorder; and access to training and education opportunities in dysphagia at the graduate coursework and practicum level was not widely available.

A dramatic increase in demand for swallowing and feeding services in all settings (hospitals, outpatient facilities, long-term care, home health, schools, early intervention programs, and neonatal intensive care units) has resulted in an increasing percentage of speech-language pathologists routinely providing services for individuals with swallowing and feeding problems. In 1999, 46.9% of speech-language pathologists reported that they regularly serve individuals with dysphagia on their caseload; the percentage exceeded 91% for professionals

working in hospitals and residential health care settings (ASHA, 2000). As the inclusive practice model and IDEA (Individuals with Disabilities in Education Act) dictate that intervention for children with complex medical problems be provided in educational settings, the involvement of speech-language pathologists providing services to individuals with swallowing and feeding disorders in those settings will continue to grow.

The following report provides an overview of the current areas of service provision in different clinical populations. It also discusses the preparation of speech-language pathologists to provide services and participate in teams, and the role of speech-language pathologists in evaluation and management of individuals with swallowing and feeding disorders. Finally, the report discusses research issues and needs. A selected literature review resulting from online literature searches provides the scientific base for the position statement and this report.

Overview

Swallowing and feeding disorders occur with multiple medical diagnoses across the age spectrum from premature infants to geriatric adults. Incidence and prevalence vary among diagnostic groups. Morbidity related to dysphagia can be a major concern. For example, dysphagia resulting from stroke is considered to be a major cause of morbidity due to respiratory complications, such as pneumonia and malnutrition (Gordon, Hewer, & Wade, 1987; Gresham, 1990; Veis & Logemann, 1985). The mortality for hospitalized elderly patients with pneumonia is 43% (Gonzalez & Calia, 1975). In addition, the cost of the consequences of feeding and swallowing disorders must be taken into account.

Medical costs can be calculated per episode of pneumonia (Fein, 1999). An average hospitalization cost for treating pneumonia is $13,790 (University of Miami/ Jackson Memorial Medical Center, Miami, FL, 1999). For the typical patient receiving home enteral nutrition, the annual cost of therapy was $18,000, but ranged from $5,000 to $50,000, based on 1996 data (Reddy & Malon, 1998). The cost of lifestyle alterations and caregiver burden is more difficult to determine, but can have enormous impact on individuals and others in their environment.

An overview of populations for which there is evidence of swallowing disorders follows.

Adult Populations

Research has shown that individuals who demonstrate swallowing difficulties commonly have neurologic conditions, treated head and neck cancer, and a variety of medical and surgical conditions. Additionally, individuals demonstrate swallowing disorders of unknown etiology and those that occur during debilitating medical conditions.

Neurologic Conditions

Dysphagia can result from numerous neurologic etiologies, including central nervous system disorders and those associated with cranial nerves and muscles (Kirshner, 1989), including stroke, head injury, and progressive neurologic disease. Both ischemic and hemorrhagic strokes are known to result in dysphagia (Buchholz & Robbins, 1997; Horner, Brazer, & Massey, 1993; Horner, Buoyer, Alberts, & Helms, 1991; Horner, Massey, & Brazer, 1990; Meadows, 1973; Neumann et al., 1994). Dysphagia can result from unilateral cortical and

subcortical lesions as well (Daniels, Foundas, Iglesia, & Sullivan, 1996; Gordon, Hewer, & Wade, 1987; Horner, Massey, Riski, Lathrop, & Chase, 1988; Robbins & Levine, 1988; Robbins, Levine, Maser, Rosenbek, & Kempster, 1993).

Typical swallowing impairments related to stroke may include any combination of the following: oral stage impairments, delay or absence in triggering the pharyngeal swallow, impaired pharyngeal stage function including reduced pharyngeal sensation, prolonged pharyngeal transit times, reduced pharyngeal contraction, reduced tongue base motion, impaired hyolaryngeal excursion, cricopharyngeal dysfunction (Aviv et al., 1998a, 1998b, Horner et al., 1988; Johnson, McKenzie, Rosenquist, Lieberman, & Sievers, 1992; Logemann, 1998; Miller & Chang, 1999; Robbins & Levine, 1988; Veis & Logemann, 1985).

Dysphagia is a common problem in individuals who have had a head injury. Frequently occurring swallowing disorders include delayed pharyngeal swallow, reduced lingual control, delayed trigger of the pharyngeal swallow, and reduced pharyngeal motility (Lazarus, 1991; Lazarus & Logemann, 1987).

Neurologic disorders that are progressive in nature may result in changes in oropharyngeal muscular strength and coordination over time. Individuals with progressive neurologic diseases frequently have reduced pharyngeal muscle contractions that may place them at increased risk of aspiration. In addition, increased secretions may also increase the risk for aspiration, even though saliva production may be reduced in certain populations, such as those with amyotrophic lateral sclerosis (ALS) (Goode & Smith, 1970; Miller et al., 1999). The following are examples of progressive neurologic disorders that are known to cause dysphagia.

Amyotrophic lateral sclerosis is a progressive and degenerative neurologic disorder resulting in upper and lower motor neuron deterioration that results in both spasticity and flaccidity of involved motor units. In the bulbar variety, dysphagia may be the earliest presenting symptom (Carpenter, McDonald, & Howard, 1978). Specifically, bulbar symptoms may result in the lingual atrophy and reduction in strength that are associated with oral stage disorders as well as pharyngeal stage disorders (Mancinelli, 1994; Meyers, 1986).

Parkinson's disease (PD) is a progressive neurologic disorder resulting from degeneration of dopamine-producing neurons in the substantia nigra, locus ceruleus, and the dorsal motor nuclei in the basal ganglia of the central nervous system. The effect on swallowing is progressive and affects both oral and pharyngeal stages of swallowing. Specific oral and pharyngeal stage disorders may include a characteristic lingual rocking pattern, poor lingual control, reduced hyolaryngeal excursion, and laryngeal dismotility (Blonsky, Logemann, Boshes, & Fisher, 1975; Day, 1995; Leopold & Kagel, 1996; Robbins, Logemann, & Kishner, 1986).

Progressive supranuclear palsy (PSP) or Parkinson's plus syndrome is a progressive degenerative extrapyramidal neurologic disorder resulting in multisystem atrophy in the brainstem, basal ganglia, cerebellar nuclei, midbrain, and pontine tegmentum (Leopold & Kagel, 1997a; Yorkston, Beukelman, & Bell, 1988). The most reliable clinical predictors of poor survival have been found to be

falling in the first year after diagnosis, early dysphagia, and incontinence (Litvan et al., 1996). Specific patterns of eating behavior include rapid drinking, decreased chewing, food pocketing in the cheeks, oral residue, and impulsive eating (Leopold & Kagel, 1997b). Videofluoroscopic swallow studies have revealed swallowing disturbances in the oral stage and triggering of the pharyngeal swallow (Johnston et al., 1997; Sonies, 1992).

Postpolio syndrome (PPS) is defined as new onset of progressive muscle weakness, fatigue, and pain in individuals with a prior history of polio (Driscoll et al., 1995). This syndrome typically occurs 30 to 40 years after the original infection. Individuals with PPS frequently present with swallowing difficulties, due in part to oral-motor weakness, and oral and pharyngeal paresis (Driscoll et al., 1995).

Patients with Alzheimer's disease may initially present with an agnosia for food and a swallowing apraxia, resulting in prolonged holding of food in the oral cavity (Logemann, 1998). Other physiologic changes in the swallow may compound to the point that the patient cannot eat or drink enough to maintain adequate nutrition and hydration (Horner, Alberts, Dawson & Cook, 1994; McHorney & Rosenbek, 1998).

Other progressive neurologic diseases that may include dysphagia as one of the signs and symptoms include multiple sclerosis (Daly, Code, & Anderson, 1962; Kilman & Goyal, 1976), myasthenia gravis (Ertekin et al., 1998), and a variety of myopathic conditions, such as inclusion body myositis, polymyositis, dermatomyositis, mixed connective tissue diseases, and muscular dystrophy (Darrow, Hoffman, Barnes & Wiley, 1992; Garrigues et al., 1994; Gibson, Lamey, Zoma & Ballantyne, 1991; Litchy & Engel, 1992; Shapiro, Martin, DeGirolami, & Goyal, 1996; Sonies, 1995, 1997; Sonies & Dalakas, 1991; Willig, Paulus, Guily, Beon, & Navarro, 1994; Young & Durant-Jones, 1997).

Head and Neck Cancer

The treatment for head and neck cancer can result in swallowing disorders, the severity of which can depend on the tumor size, staging and location, and the type of surgical resection and reconstruction (Lazarus, 2000; Logemann, 1998; Logemann & Bytell, 1979; McConnel et al., 1994, 1998). Organ preservation protocols, designed to preserve the anatomy of the organ, can also have a negative impact on swallow functioning (Kendall, McKenzie, Leonard, & Jones, 1998; Kotz, Abraham, Beitler, Wadler, & Smith, 1999; Lazarus et al., 2000).

The types of swallowing problems seen after partial laryngectomy depend on the extent of surgical resection and reconstruction (Lazarus, 2000; Logemann, 1998; McConnel, Cerenko, & Mendelsohn, 1988). Extended partial laryngectomy procedures typically result in delayed resumption of swallow function (Logemann, 1998).

Individuals who have undergone total laryngectomy typically do not demonstrate swallowing disorders. However, swallowing disorders occasionally do occur and can include scar tissue at the tongue base (pseudo-epiglottis) (Davis, Vincent, Shapshay, & Strong, 1982), stricture or narrowing of the esophagus, reduced

tongue base posterior motion, and poor bolus clearance through the pharynx, the latter occurring if a portion of the tongue base is included in the resection (McConnel, Mendelsohn, & Logemann, 1986).

Treatment for oral and pharyngeal cancer may also result in swallowing deficits. For example, after pharyngeal wall resection individuals often demonstrate difficulty with bolus clearance through the pharynx, particularly on the operated side (unilateral pharyngeal dysfunction). The degree of swallowing impairment after oral cancer surgery will depend on the amount of tissue resected and type of reconstruction (Hirano et al., 1992; Logemann & Bytell, 1979; Logemann et al., 1993; McConnel et al., 1994, 1998; Pauloski et al., 1993, 1994; Pauloski, Logemann, Fox, & Colangelo, 1995; Teichgraeber, Bowman, & Goepfert, 1986). Following surgery, individuals frequently experience difficulty in both the oral and pharyngeal stages of swallowing (Pauloski et al., 1993, 1994, 1995). Lip closure problems are often encountered if a mandibulotomy was performed during surgery. Depending on the extent of lingual tissue resected, lingual range of motion, control, and strength may be impaired.

For large, unresectable tumors of the head and neck, organ preservation treatments consisting of chemotherapy and radiotherapy are often used, with comparable cure rates to surgery (Taylor et al., 1997; Vokes et al., 1995). However, these treatments often result in swallowing impairment, with oral and pharyngeal phase dysfunction (Eisele, Koch, Tarazi, & Jones, 1991; Ekberg & Nylander, 1983; Kendall, McKenzie, Leonard, & Jones, 1998; Kotz, Abraham, Beitler, Wadler, & Smith, 1999; Lazarus et al., 1996, 2000). Xerostomia can cause difficulty with bolus manipulation and propulsion and can result in delayed triggering of the pharyngeal swallow (Hamlet et al., 1997; Hughes et al., 1987; Månsson & Sandberg, 1975). The physiologic effects of radiotherapy can often take years to develop and can result in swallowing problems at any time after radiotherapy treatment (Ben-Yosef & Kapp, 1992; Bentzen, Thames, & Overgaard, 1989; Law, 1981; Lazarus, 1993).

Other Conditions

Other conditions in the upper aerodigestive tract that can result in swallowing problems include, but are not limited to, tracheostomy, cervical spine surgery and abnormalities, and vocal fold paresis or paralysis.

Pediatric Populations

The area of pediatric swallowing and feeding disorders is one of the most rapidly evolving patient care areas for medically based speech-language pathologists and other professionals serving children. In addition, as an increasing number of high-risk infants survive and enter educational programs, school-based speech-language pathologists must acquire medical knowledge and skills to manage swallowing and feeding disorders. These children are seen in early intervention and preschool programs, and then transition to school settings where they may be in regular classrooms with some specialized services as needed, or they may be in separate special education groups. In any case, school-based speech-language pathologists often provide services for their swallowing and feeding needs.

The focus of most of the research in dysphagia in the past few decades has been in different areas of adult dysphagia, not in pediatric swallowing and feeding. Evidence-based data are limited; the need for research is substantial. Because

pediatric swallowing has some unique aspects in diagnosis and treatment, research from adult studies cannot always be applied to this population. The pediatric portion of this document is intended to reflect current research in the diagnosis and treatment of this challenging and diverse population.

Considerations for assessment and management of infants and children with swallowing and feeding problems are significantly different in many respects from those for adults. Differences include, but are not limited to:

- There are distinct differences in the relationships of anatomic structures and physiology of the swallowing mechanism among infants, young children, and adults;
- Etiologies of swallowing deficits differ and may not be defined clearly in some pediatric populations;
- Children may have abnormal anatomy and physiology during prenatal or perinatal periods (e.g., esophageal atresia, tracheoesophageal fistulae, intraventricular hemorrhage, bilateral cystic preventricular leukomalacia, and strokes);
- Infants and children cannot describe their symptoms as definitively as most adults, requiring professionals and caregivers to rely on other forms of communication, signs of swallowing and feeding problems, and thorough case histories;
- Infants and children grow and develop even when they have chronic conditions, which means they change over time;
- Infants and young children with swallowing disorders often require intervention techniques that do not require them to follow commands to help improve their swallowing and oral sensorimotor function because their cognitive skill levels are not developed enough for them to follow simple verbal or nonverbal instructions.

Feeding is a developmental process; when interrupted, children may demonstrate oral sensorimotor dysfunction, undernutrition (malnutrition or failure to thrive [FTT]), poor growth, delayed development, poor academic achievement, psychological problems, and loss of overall health and well-being. Oral sensorimotor function, swallowing, and respiration coordination are important processes that relate to development of normal feeding, eating, and speech motor skills. Therefore, the development of functional, safe eating is extremely important.

Pediatric Conditions

Attempts to classify complex pediatric feeding problems are complicated because of the multiple characteristics associated with them (Burklow, Phelps, Schultz, McConnell, & Rudolph, 1998). Burklow and colleagues examined 103 children and found the most frequently coded categories or combinations of categories were: structural-neurological-behavioral (30%), neurological-behavioral (27%), behavioral (12%), structural-behavioral (9%), and structural-neurological (8%). Findings suggest that complex pediatric feeding problems are biobehavioral conditions in which biological and behavioral aspects mutually interact, and both need to be addressed to achieve normal feeding. Although potential overlap of etiologic categories exists, for the purposes of this document, common diagnostic categories associated with pediatric dysphagia are discussed separately.

Prematurity

Medical and technological progress in recent years has resulted in the survival of many infants and children who previously would not have lived. The range and complexity of their problems will continue to challenge the medical profession, as many of these children are now living longer and remaining healthier. Although many children and their families have benefited greatly, the increasing number of children born prematurely at low birth weight (LBW, <2500 gm), very low birth weight (VLBW, <1500 gm), and extremely low birth weight (ELBW, <1000 gm) are confronted with multiple and significant medical problems. A high incidence of immature or abnormal feeding patterns (40%) was found in a prospective study of premature infants. Neonates with prolonged respiratory support and delayed enteral and oral feeding were most affected (Hawdon, Beauregard, Slattery, & Kennedy, 2000).

Premature infants have been shown to demonstrate abnormal tongue movement patterns in the first few days of life (Bu'Lock, Woolridge, & Baum, 1990). Feeding-related apnea, bradycardia, and cyanosis have been reported during swallowing in the preterm infant (Bu'Lock et al., 1990, Hanlon et al., 1997, Koenig, Davies, & Thach, 1990, Menon, Schefft, & Thach, 1994).

Neurologic Conditions

Cerebral palsy is the most common type of neurologic problem associated with swallowing problems. Children with cerebral palsy demonstrate various swallowing disorders, including drooling, impaired sucking, oral stage abnormalities, impaired pharyngeal motility, aspiration, and absent cough in response to aspiration (Lespargot, Langevin, Muller, & Guillemont, 1993; Love, Hagerman, & Taimi, 1980; Mirrett, Riski, Glascott, & Johnson, 1994; Reilly & Skuse, 1992; Reilly, Skuse, & Poblete, 1996; Rogers, Arvedson, Buck, Smart, & Msall, 1994). Although less common, other neurologic disorders (such as ataxiatelangiectasia) in the pediatric population are associated with oropharyngeal dysphagia (Lefton-Greif et al., 2000). Children with neurogenic dysphagia are at high risk for silent aspiration (Arvedson, Rogers, Buck, Smart, & Msall, 1994; Griggs, Jones, & Lee, 1989; Helfrich-Miller, Rector, & Straka, 1986; Mirrett, Riski, Glascott, & Johnson, 1994). Furthermore, children with cerebral palsy may have more restricted diets, feeding difficulty, and poor nutritional intake (Reilly & Skuse, 1992).

Craniofacial Anomalies

Examples of some craniofacial anomalies that commonly have an impact on feeding effectiveness and efficiency include, but are not limited to, cleft palate (Brine et al., 1994; Shaw, Bannister, & Roberts, 1999); Mobius syndrome (D'Cruz, Swisher, Jaradeh, Tang, & Konkol, 1993); hemifacial microsomias, Pierre Robin sequence (Bath & Bull, 1997; Myer, Reed, Cotton, Willging, & Shott, 1998; Prodoehl & Shattuck, 1995): and velocardiofacial (VCF) syndrome (Shprintzen, Goldberg, Young, & Wolford, 1981; Zackai et al., 1996). Other craniofacial and genetic syndromes that may have an impact on feeding and swallowing are beyond the scope of this document.

Complex Medical Conditions

Failure to thrive, or pediatric undernutrition, means inadequate nutrition that impairs growth during the first 2 to 3 years of life. The term failure to thrive implies either a disease process or a mixture of social causes, often not understood completely and implying blame of primary caregivers (Kessler & Dawson, 1999). A failure to thrive organic-nonorganic dichotomy is rigid and fails to account for feeding problems that often result from a combination of physiologic and environmental or emotional causes. It is rare that one reason or cause for feeding disorders can be isolated or identified (Babbitt et al., 1994). The term pediatric undernutrition refers more specifically to growth impairment and is less pejorative, and is therefore the preferred term. In one report when children had no known medical causes for failure to thrive or undernutrition, significant numbers were found to have oral-motor dysfunction that may result in sucking, chewing, or swallowing difficulties (Reilly, Skuse, Wolke, & Stevenson, 1999). The authors suggested that the findings may indicate subtle neurodevelopmental disorders.

Children who had birth trauma, prenatal and perinatal asphyxia, and a multitude of genetic syndromes with accompanying structural and neurologic impairment are also at high risk for swallowing and feeding dysfunction. In addition to specific aspects of oropharyngeal dysphagia, swallowing and feeding problems in infants and young children can result from or be exacerbated by neurologic, airway, respiratory, craniofacial, gastrointestinal, nutritional, and behavioral/interaction factors.

Developmental Disability

Developmental disability (DD) refers to a cluster of lifelong, handicapping conditions with congenital or pediatric onset that are of sufficient severity to warrant extraordinary medical, therapeutic, and/or residential supports. The disability may include cognitive, psychiatric, neurological, gastrointestinal, cardiorespiratory, orthopedic, sensory (e.g., visual and otological) and maxillofacial disorders (Rubin & Crocker, 1989). Etiologies are varied and may result from genetic abnormalities, traumatic events, and disease.

The prevalence of dysphagia and feeding disorders is higher in developmental disability than in the normal population and varies widely by etiology, by the severity and multiplicity of involvements and by the age of the population (Rogers et al., 1994; Sheppard, Liou, Hochman, Laroia, & Langlois, 1988). Individuals with DD are unique among those with dysphagia and feeding disorders in that their developmental, pediatric disorders are often retained into adulthood. These persisting problems may be complicated by adult-onset disorders that degrade swallowing, by the deleterious effects of aging on the physiological capabilities for feeding and swallowing, and by the side effects of the long-term and complex medical regimens that may be required to treat coincidental disorders.

The progressive nature of oral-pharyngeal dysphagia in this population was demonstrated in retrospective data obtained from 75 individuals with developmental disabilities over a 15-year period (Sheppard, 1998). In this study, the proportion of individuals with evidence of oral pharyngeal dysphagia increased from 35% to 100% at the beginning and end of the study, respectively.

The dysphagia and feeding disorders that are seen in adults with developmental disability include poorly developed and absent feeding and oral preparation skills and competencies, physiological and anatomical impairments that degrade oral-pharyngeal and esophageal bolus motility, and disruptive or maladaptive mealtime behaviors. Nutrition, hydration, saliva management, ingestion of medications, and management of the oral hygiene bolus may be involved. Upper airway obstruction (choking), aspiration, malnutrition, and dehydration may result from the disorder (Rogers et al., 1994, Sheppard et al., 1988). Significant interactions have been noted between disordered feeding skills and survival in children and adults with severe DD (Eyman, Grossman, Tarjan, & Miller, 1987; Eyman, Grossman, Chaney & Call, 1990). Intervention may be warranted intermittently throughout life, as changes in the disorder occur.

Role of Speech-Language Pathologists in Swallowing and Feeding Disorders

Specialized knowledge, skills, and clinical experience related to the evaluation and management of individuals with swallowing and swallowing problems may be acquired on the graduate or postgraduate level, in formal coursework, and/or in a continuing education framework. The standards for certification effective in 2005 require competence in dysphagia. It is particularly important that speech-language pathologists who evaluate and treat infants and young children get specific academic and practicum experience from supervisors and/or mentors who have themselves had considerable knowledge and experience with this population. Competencies need to be demonstrated specific to settings, populations, and procedures. Details of the knowledge and skills areas can be found in ASHA policy documents, “Knowledge and Skills for Speech-Language Pathologists Providing Services to Individuals With Swallowing and Feeding Disorders” (ASHA, 2001b) and “Instrumental Diagnostic Procedures for Swallowing” (ASHA, 1992). An ASHA relevant paper, “Graduate Curriculum on Swallowing and Swallowing Disorders” (ASHA Special Interest Division 13, Swallowing and Swallowing Disorders [Dysphagia], 1997), provides direction to graduate programs in devising appropriate content for coursework on dysphagia.

The speech-language pathologist is a primary professional involved in assessment and management of individuals with swallowing and feeding disorders. These areas include:

- Performing clinical swallowing and feeding evaluation;
- Performing instrumental assessment of swallowing function with medical professionals as appropriate;
- Identifying normal and abnormal swallowing anatomy and physiology;
- Identifying signs of possible or potential disorders in upper aerodigestive tract swallowing and making referrals to appropriate medical personnel;
- Making decisions about management of swallowing and feeding disorders;
- Developing treatment plans;
- Providing treatment for swallowing and feeding disorders, documenting progress, and determining appropriate dismissal criteria;
- Providing teaching and counseling to individuals and their families;
- Educating other professionals on the needs of individuals with swallowing and feeding disorders and the speech-language pathologists' role in the diagnosis and management of swallowing and feeding disorders;
- Serving as an integral part of a team as appropriate;
- Advocating for services for individuals with swallowing and feeding disorders;

- Advancing the knowledge base through research activities.

Speech-language pathologists have extensive knowledge of anatomy, physiology, and functional aspects of the upper aerodigestive tract for swallowing and speech across the age spectrum including infants, children, and adults (including geriatrics). The upper aerodigestive tract includes oral, pharyngeal, and cervical esophageal anatomic regions. Speech-language pathologists also have extensive knowledge of the underlying medical and behavioral etiologies of swallowing and feeding disorders. In addition, they have expertise in all aspects of communication disorders that include cognition, language, and behavioral interactions, many of which may affect the diagnosis and management of swallowing and feeding disorders. Because of the complexities of assessment and treatment in most persons with swallowing and feeding disorders, speech-language pathologists and other professionals work as a team with families, caregivers, and patients. Those teams may vary in their composition of specialists depending on the setting, population, and needs of individuals.

Evaluation[1]

Assessment of swallowing and feeding disorders forms the basis for developing management strategies. Different assessments provide different kinds of information. Rarely does one form of assessment provide complete diagnostic information. Additionally, reassessment is needed throughout the course of treatment to determine changes in the status of the individual with dysphagia and to make adjustments in the management plan. As indicated in the Code of Ethics (ASHA, 1994), speech-language pathologists who perform the assessment procedures described below should be educated and trained to do so.

Clinical Examination

A clinical examination of swallowing, often referred to as a clinical/bedside examination, is often the first part of a comprehensive swallowing evaluation. Regardless of the patient's age, one component of the swallowing evaluation may include an assessment of feeding/mealtime techniques used by the caregivers. In adult populations, clinicians vary regarding the measures they prefer and utilize (McCullough, Wertz, Rosenbek, & Dineen, 1999). In general, however, there are four sections to the clinical examination: (1) a case history, including a comprehensive review of medical/ clinical records, as well as interviews with the patient, family, and other health care professionals; (2) an assessment of oral motor structures and their function; (3) an assessment of speech and vocal quality; and (4) a method of assessing the individual's skills and abilities in a natural environment, incorporating judgments of the adequacy of airway protection and coordination of respiration and swallowing for boluses of various sizes and consistencies. A clinical examination may also include an assessment of the effect of alterations in bolus delivery or use of rehabilitative/habilitative or compensatory techniques on the swallow. Functional rating scales may also be used to provide additional information, such as the patient's perception of function, severity, change in functional status, and quality of life (ASHA NOMS, 1998, 2000; Cherney, Cantieri, & Pannell, 1986; Hillel et al., 1989; McHorney et al., 2000).

[1] Evaluation, assessment, and examination are used interchangeably in this document.

At times, this examination alone may form the basis for recommendations for management of dysphagia. Research suggests that dietary recommendations based on clinical examinations alone may differ from recommendations based on instrumental examinations, such as videofluoroscopy (Splaingard, Hutchins, Sulton, & Chaudhuri, 1988). Ideally, the clinical examination serves as a tool for identifying clinical presentations of dysphagia, for determining the need for instrumental evaluation, and for specifying diagnostic questions to be answered by instrumental evaluations.

Instrumental Assessment

Instrumental techniques used to evaluate oral, pharyngeal, laryngeal, upper esophageal, and respiratory function as they apply to normal and abnormal swallowing may include, but are not limited to: videofluoroscopy, ultrasonography, scintigraphy, endoscopic assessment of swallowing function, electromyography (EMG), and manometry (ASHA, 1992). The techniques used to examine swallowing (videofluoroscopy, ultrasonography, endoscopic assessment of swallowing function, EMG, and manometry) are usually conducted either independently by the speech-language pathologist or by the speech-language pathologist and physician as a team. Speech-language pathologists should participate in decisions regarding the severity and nature of swallowing deficits, and the appropriateness of these procedures. Speech-language pathologists should be able to interpret and apply the results of objective testing to the formulation of dysphagia treatment plans, and to determine patient capacity and safety for oral feeding. Instrumental procedures may also be used to monitor the execution of compensatory swallowing maneuvers.

Videofluoroscopic Swallow Study/Modified Barium Swallow

The videofluoroscopic swallow study (VFSS) incorporates a set of modifications in bolus size, texture, patient positioning, and radiographic focus to facilitate optimum visualization of the oral-pharyngeal-laryngeal structures and their function during swallowing. The effects of rehabilitative and compensatory maneuvers on bolus transport during swallowing may be studied radiographically. Studies demonstrate that the videofluoroscopic study allows the speech-language pathologist to identify specific problems of the swallow and try appropriate compensatory techniques (Logemann et al., 1993; Welch, Logemann, Rademaker, & Kahrilas, 1993). The modified barium swallow (MBS) has been shown to be more accurate than the bedside examination in identifying whether aspiration is occurring and in identifying the cause of aspiration (Martin-Harris, McMahon, & Haynes, 1998). In addition, the modified barium swallow can prevent unneeded or trial and error treatment (Logemann et al., 1992; Martin-Harris, McMahon, & Haynes, 1998) and can provide immediate, clinically useful information (Martin-Harris, Logemann, McMahon, Schleicher, & Sandidge, 2000).

Endoscopic Assessment of Swallowing Function

This examination utilizes the fiberoptic nasopharyngolaryngoscope to evaluate the anatomy and physiology of the pharynx and larynx and certain aspects of pharyngeal swallowing function. The endoscopic evaluation of swallowing has two basic parts. The first is an examination of the structures and function of the pharynx and larynx, including assessment of the patient's ability to manage secretions. The second part involves presentation of food and liquids as the swallow is assessed (Langmore, Schatz, & Olson, 1988). A modification of this

procedure, called flexible endoscopic evaluation of swallowing with sensory testing (FEESST), utilizes pulses of air to assess sensory perception of the larynx (Aviv et al., 1996).

Several studies have been conducted comparing the effectiveness of the endoscopic assessment of swallowing function and the MBS in evaluating and managing dysphagia. Unfortunately, most of these studies do not compare simultaneous use of the procedures (Perie et al., 1998, Langmore, Schatz, & Olson, 1991; Leder, 1998; Leder, Sasaki, & Burrell, 1998). One study, however, does compare the two instrumental procedures simultaneously (Ohmae, Logemann, Kaiser, Hanson, & Kahrilas; 1995).

Other Instrumental Procedures

Other instrumental procedures are used primarily in research at this time but may develop into clinical diagnostic tools. Ultrasonography involves use of a transducer to observe movement of structures used for swallowing, including the tongue and hyoid (Shawker, Sonies, Hall, & Baum, 1984; Shawker, Sonies, Stone, & Baum, 1983). Surface electromyography records electrical activity of muscles involved in swallowing (Crary, 1995; Huckabee & Cannito, 1999).

Speech-language pathologists should also be familiar with other diagnostic procedures performed by different medical specialists that yield information about swallowing function. These include such procedures as the esophagram/barium swallow, manofluorography, scintigraphy (which in the pediatric population may also be referred to as radionuclide milk scanning), pharyngeal manometry, 24-hour pH monitoring, and esophagoscopy.

Specific Considerations for Pediatrics

In the pediatric population, it is extremely important that the parameters of oropharyngeal dysphagia be diagnosed effectively and accurately, as complications of dysphagia have a far-reaching impact for developing children. Similar to the adult population, oral, pharyngeal, and esophageal phases of swallowing in infants and children may need to be assessed with a dynamic instrumental technique.

The methods used to examine swallowing function in pediatric patients include videofluoroscopic swallow study, endoscopic assessment of swallowing function, and ultrasonography. Scintigraphy, or radionuclide milk scanning, is used to identify aspiration from swallowing or gastroesophageal reflux and to examine gastric emptying time (Balan et al., 1998; Estevao-Costa et al., 2001; Latini et al., 1999; McVeagh, Howman-Giles, & Kemp, 1987; Tolia, Kuhns, & Kauffman, 1993). Other markers of aspiration may include evaluation of lipid-laden macrophage index (Bauer & Lyrene, 1999).

Videofluoroscopy when used with infants and children must be age-appropriate with regard to positioning, presentation, and viscosity of material (Arvedson & Lefton-Greif, 1998). Seating must accommodate a range from premature infants to fully grown adolescents, in addition to adaptations for children with developmental disabilities and skeletal abnormalities. Presentation and viscosity of the material must also be age-appropriate. A standard protocol to begin the radiographic examination is recommended (Logemann, 1993a) because it gives

clinicians a starting point and allows for collection of baseline data and comparisons between repeated videofluoroscopic studies. Thus, protocols should be age-appropriate, answer specific diagnostic questions, and assess therapeutic options. Interpretation of videofluoroscopy must also be appropriate and consistent with normal swallowing function, which may differ among infants, children, and adults (Newman, Cleveland, Blickman, Hillman, & Jaramillo, 1991).

Endoscopic assessment of swallowing function in infants and children is described in a variety of clinical settings (Hartnick, Miller, Hartley, & Willging, 2000; Leder & Karas, 2000; Link, Willging, Miller, Cotton, & Rudolph, 2000; Migliore, Scoopo, & Robey, 1999; Willging, 1995; 2000; Willging, Miller, Hogan, & Rudolph, 1996). The standard endoscopic assessment of swallowing can be combined with a technique that determines laryngopharyngeal sensory discrimination thresholds (Link et al., 2000). Innervation of the laryngeal adductor reflex (LAR) by the superior laryngeal nerve is tested (Link et al., 2000; Liu, Kaplan, Parides, & Close, 2000). Swallowing function parameters evaluated include pharyngeal pooling of secretions, premature spillage, laryngeal penetration, aspiration, residue, vocal fold mobility, gag reflex, and laryngeal adductor reflex (Gisel, Birnbaum, & Schwartz, 1998; Willging, 2000).

Ultrasonography has been used to study suck and oral transit in infants. The ultrasonographic scanner can visualize the nipple, tongue surface, hard and soft palates, and usually the hyoid, and does not fully view the pharynx and upper esophagus (Bosma, Hepburn, Josell, & Baker, 1990; Bu'Lock, Woolridge, & Baum, 1990; Weber, Woolridge, & Baum, 1986; Yang, Loveday, Metrewell, & Sullivan, 1997).

Due to the heterogeneity of diagnoses and the complexity of managing dysphagia across the age spectrum, a team approach is often necessary for diagnosis. The team should include representatives of different disciplines, for example, a speech-language pathologist who specializes in swallowing and feeding, a pediatrician (developmental and/or gastroenterologist), nutritionist/dietitian, nurse, occupational therapist, psychologist, social worker, and physical therapist. The team may vary depending on the type of facility and the specific population being served.

Treatment

Management of individuals with dysphagia should be based on results of the comprehensive assessment. Decision-making must take into account many factors about the individual's overall status. These might include information concerning the individual's health, cognition, social situation, cultural values, economic status, motivation, and personal choice. Of primary concern is how the individual's health status can be maintained or maximized.

This information will form the basis for an appropriate management/treatment plan. Questions that must be answered include:

- Can the individual eat safely? Factors to be included are pulmonary status, overall medical condition, mobility, cognition.

- Can the individual receive adequate nutrition and hydration by mouth, given length of time to eat, efficiency, and fatigue factors? If the individual cannot meet nutritional needs by mouth, what recommendations need to be made concerning nonoral intake?
- How can the individual's functional abilities be maximized? This might involve decisions about whether the individual can safely eat an oral diet that meets nutritional needs, whether that diet needs to be modified in any way, or whether the individual needs compensatory strategies in order to eat the diet. Does the individual have the potential to improve swallowing function with direct treatment?
- How can the individual's quality of life be preserved and/or enhanced? Consideration should be given to the time it takes to eat a meal, fear of eating, pleasure obtained from eating, social implications of eating, etc. (Huckabee & Pelletier, 1999).
- What are the ethical issues involved in managing dysphagia? For example, individuals with dysphagia or their care providers may choose not to follow the recommendations made by the speech-language pathologist. In these instances, it is the responsibility of the speech-language pathologist to adequately educate them about the rationale for the recommended treatment plan and the consequences of choosing not to participate. When ethical issues arise, other members of the multidisciplinary team should be involved as appropriate.

In providing treatment, the etiology of the dysphagia and the progression of the disease must be considered. Different management decisions may be made for individuals with dysphagia resulting from an acute event, chronic/stable condition, or progressive neurological disorder. The role of the speech-language pathologist in treating individuals with progressive neurological disorders is designed to maximize current function, compensate for irreversible loss of function, assess and reassess changes in status, and counsel patients on probable future nonoral means of nutrition.

If the individual's swallowing safety and efficiency cannot reach a level of adequate function, or does not support nutrition and hydration adequately, the swallowing and feeding team may recommend alternative avenues of intake (e.g., nasogastric tube [NG], gastrostomy). In these instances, team members consider whether the individual will need the alternative source for a short or extended period of time. Education and counseling may be provided concerning issues related to tube feeding, such as appropriate positioning and duration of feeding times. Alternative feeding does not preclude the need for habilitative/rehabilitative techniques to facilitate sensory and motor capabilities necessary for oral feeding. The specific techniques will vary; speech-language pathologists must have adequate knowledge and skills that are directly applicable to the population being served to determine the most appropriate management.

Treatment of swallowing disorders involves the use of compensatory and habilitative/ rehabilitative techniques. Compensatory techniques are designed to help the individual swallow safely, not to alter physiology. Habilitative/ rehabilitative techniques are designed to change swallowing physiology and in some circumstances can be used as compensation. For example, the super-

supraglottic swallow is a rehabilitative technique that increases closure at the entrance to the airway. If used during a meal, it can serve as a compensation to protect the airway.

The use of postures has been examined in adults as one type of compensatory strategy to change direction of the flow of foods and liquids. Examples of postural techniques include: chin tuck posture (Logemann, Rademaker, Pauloski, & Kahrilas, 1994; Rasley et al., 1993; Shanahan, Logemann, Rademaker, Pauloski, & Kahrilas, 1993); head back posture (Logemann, 1983); head rotation posture (Logemann, 1983; Logemann, Kahrilas, Kobara, & Vakil, 1989; Logemann, Rademaker, Pauloski, & Kahrilas, 1994; Ohmae, Ogura, Kitahara, Karaho, & Inouye, 1998); side-lying (Logemann, 1983); and head tilt (Logemann, 1983). Modifications of bolus volume and viscosity can compensate for inadequate swallowing function (Dantas et al., 1990; Kahrilas, Lin, Logemann, Ergun, & Facchini, 1993; Lazarus et al., 1993; Robbins, Hamilton, Lof, & Kempster, 1992).

Habilitative/rehabilitative techniques include, but are not limited to: supraglottic swallow (Logemann, 1993b; Martin, Logemann, Shaker, & Dodds, 1993); super-supraglottic swallow (Logemann, 1993a; Martin et al., 1993); effortful swallow (Logemann, 1993a); Mendelsohn (Kahrilas, Logemann, Krugler, & Flanagan, 1991; Lazarus, 1993; Logemann & Kahrilas, 1990). Another form of habilitative/rehabilitative technique involves increasing sensory awareness, such as with thermal-tactile stimulation (Lazzara, Lazarus, & Logemann, 1986; Rosenbek, Roecker, Wood, & Robbins, 1996). Temperature, taste, and texture changes in food and liquid are often used to stimulate increased sensory awareness and to facilitate oral and pharyngeal activity.

Intervention With Pediatric Feeding and Swallowing Problems

Regardless of the patient's age and skill levels, primary goals of feeding and swallowing intervention are to support adequate nutrition and hydration, minimize the risk of pulmonary complications, and maximize the quality of life. Optimizing a child's neurodevelopmental potential is an additional goal for the pediatric patient with swallowing and feeding problems. Speech-language pathologists strive to facilitate the development of coordinated movements of the mouth, respiratory, and phonatory systems for communication as well as for oral feeding. Intervention processes and techniques must never jeopardize the child's nutrition and pulmonary status. Primary to a successful oral sensorimotor and swallowing program is the overall health of the child. Medical, surgical, and nutritional considerations are all important. In addition to oral-motor function, positioning, seating, muscle tone, and sensory issues all need to be addressed during treatment. If gastroesophageal reflux is a factor, adequate management is fundamental to other aspects of treatment. Underlying disease state(s), chronological and developmental age of the child, social/environmental arena, and psychological/behavioral factors all affect treatment recommendations.

Infants and young children typically respond to changes in the environment for improving safety and efficiency of feeding. Aspects for change that can affect oral and pharyngeal transit include posture and position, timing and pacing, bolus characteristics (e.g., texture, temperature, taste), and sensory input. Postural changes are different among infants, older children, and adults. A semi-reclined position with a neutral head/neck posture and flexion at the hips and knees is classic

for the young infant. Varied nipples and containers can be tried to find optimal rate of flow (Mathew, 1991; Mathew, Belan, & Thoppil, 1992). Infants have been shown to improve efficiency and reduce duration of nipple feedings with a self-pacing system and vacuum-free bottles (Lau & Schanler, 2000). Individual differences must always be considered, as exceptions to general principles may be needed. It is critical that oral and pharyngeal stages of swallowing are well described from clinic assessments and, when indicated, from instrumental assessments.

Sensory input may need to be heightened for some children; those who demonstrate aversive responses to stimulation may need approaches that reduce the level of sensory input initially, with incremental increases as the child indicates tolerance. A critical component for all intervention with infants and children is the care provider's or clinician's ability to interpret the child's stress signals to keep the oral sensorimotor practice and feeding situations pleasurable and nonstressful, with no adverse health consequences.

Children who are tube fed may have difficulty transitioning to oral feeding and may also become orally hypersensitive or orally defensive. Preventing oral defensiveness in tube-fed children should be one of the goals (Senez et al., 1996). Senez and colleagues compared the results of weaning two groups of children from tube to oral feeding: one with previous oral-feeding experience and one without. Children without previous oral feeding took significantly more time to complete the transition from tube to oral feedings. Dello Strologo et al. (1997) examined children with severe chronic renal failure who received tube feedings for at least 9 months. The children who were older than 1 year at the beginning of tube feeding had less difficulty transitioning to oral feedings than children whose tube feedings began at less than 1 year of age. Individualized decisions are required through team approaches in these highest risk infants and children whose conditions and needs are likely to change over time.

Some areas that are being investigated include use of intra-oral appliances (e.g., Gisel, Schwartz, & Haberfellner, 1999; Gisel, Schwartz, Petryk, Clarke, & Haberfellner, 2000). This type of intervention is shown to result in significant improvement in functional feeding skills in children with moderate dysphagia (Haberfellner, Schwartz, & Gisel, 2001). Neurophysiologic facilitation of orofacial muscles by stretching, brushing, vibrating, icing, and stroking areas of the face and mouth is reported effective in some children with cerebral palsy (Gallender, 1979, 1980; Sobsey & Orelove, 1984). However, once facilitation is withdrawn, regression has been noted. Oral sensorimotor treatment strategies have been reported in children with cerebral palsy (Gisel, 1994, 1996; Gisel, Applegate-Ferrante, Benson, & Bosma, 1995, 1996).

Problems and Issues

Although research on normal and abnormal swallowing has increased dramatically, there is still a significant need for additional research in areas related to swallow physiology, epidemiological information, complications from dysphagia, treatment outcomes, and efficacy. In addition, there is an urgent need for research in the area of pediatric swallowing and dysphagia to assist clinicians in diagnosing and managing this diverse and challenging population. The following list delineates future research needs.

Swallow Physiology:

- What are the neurophysiologic relationships between speech and swallowing?
- How do specific CNS lesions affect neuromotor control for speech and swallowing and how do speech and swallowing relate?
- How do sensory and motor issues relate to swallow functioning?
- How do food characteristics affect the normal and abnormal swallow (e.g., taste, texture, viscosity, and temperature)?
- What stimuli elicit a pharyngeal response and what is the mechanism by which the response is triggered?
- How does swallowing change across the age continuum and what are the gender differences?

Epidemiologic Needs:

- Epidemiologic studies of occurrence of swallowing disorders in infants and children across medical diagnoses.
- Epidemiologic studies of incidence and occurrence of swallowing problems following various medical procedures (e.g., uvulopharyngoplasty).

Complications of Dysphagia:

- What is the relationship between dysphagia and malnutrition (undernutrition) and dehydration?
- What is the relationship of dysphagia to health complications?
- What is the relationship between aspiration and respiratory conditions (e.g., pneumonia, bronchiolitis, asthma)?
- What are the costs of managing dysphagia and the costs related to the complications from dysphagia?
- What are the mortality and morbidity related to dysphagia and its complications?

Treatment Outcome and Efficacy Needs:

- Outcome studies of various swallow management techniques, including long-term effects.
- Outcome studies across populations and medical diagnoses.
- Treatment efficacy studies for newer therapeutic interventions.
- Outcome and efficacy studies on swallow function after surgical intervention to improve swallowing (e.g., cricopharyngeal myotomy).
- Optimal time to initiate intervention after surgical or radiotherapeutic treatment to the head and neck.
- Optimal frequency, duration, and intensity of practice of therapeutic swallow interventions.
- Consequences for oral feeding in individuals on prolonged tube feedings.
- The role of spontaneous recovery and how it relates to swallow intervention across populations and diagnoses.
- Research clinical protocols will add benefit to children and their families.

Terminology

Aspiration: entry of secretions, food, or any foreign material into the airway that travels below the level of the true vocal folds. Aspiration may occur before, during, or after the pharyngeal phase of swallowing. It can also occur from reflux of gastric contents.

Barium Swallow Study/Esophagram: fluoroscopic assessment of the esophageal phase of the swallow conducted by a radiologist. The study may include screening of the pharyngeal phase of swallow.

Bolus: the food, liquid, or other material placed in the mouth for ingestion.

Cough: a brainstem reflex protecting the entrance of the airway from foreign material. Cough can also be produced voluntarily.

Deglutition: refers only to acts associated with bolus transfer and transport from the oral cavity to the stomach.

Diagnostic Technique: an imaging or nonimaging instrumentation procedure used to study various aspects of normal and/or abnormal swallow physiology.

Dysphagia: a swallowing disorder. The signs and symptoms of dysphagia may involve the mouth, pharynx, larynx, and/or esophagus.

Endoscopic Assessment of Swallowing Function: an instrumental procedure utilizing nasendoscope passed transnasally to examine the anatomy of the larynx and pharynx and certain aspects of the pharyngeal phase of the swallow.

Esophagoscopy: instrumental procedure involving visualization of the esophagus via an endoscope.

Feeding Disorder: disordered placement of food in the mouth; difficulty in food manipulation prior to initiation of the swallow, including mastication; and the oral stage of the swallow when the bolus is propelled backward by the tongue. In pediatrics, this term may be used to describe a failure to develop or demonstrate developmentally appropriate eating and drinking behaviors.

Functional Swallow: a swallow that may be abnormal or altered but does not result in aspiration or reduced swallow efficiency. This type of swallow does ensure maintenance of adequate nutrition and hydration.

Gag: a brainstem reflex commonly elicited by contact of a foreign stimulus with the back of the tongue, soft palate, or pharynx, resulting in contraction and elevation of the pharynx and larynx to push the stimulus up and out of the pharynx or to prevent entrance to the pharynx. This neuromuscular action is the opposite of the neuromuscular coordination used in swallow. The gag cannot be used to predict the presence or adequacy of a swallow and is not a protective reflex for a swallow. Gag can be elicited in some children by other factors, such as the smell or presence of food or an object on the tip of the tongue.

Ingestion/Swallow: refers to all processes, functions, and acts associated with bolus introduction, preparation, transfer, and transport.

Laryngeal Penetration: the entry of secretions, food/liquid, or any foreign material into the laryngeal vestibule above the level of the true vocal folds (i.e., supraglottic area), which are then ejected from the airway. This can occur normally and can also occur before, during, or after the pharyngeal swallow.

Management: involves all aspects of evaluating, treating, counseling, and discharge planning.

Manofluorography: concurrent manometric and videofluoroscopic imaging of oropharyngeal swallowing.

Oral Intake: placement of food in the mouth; oral gestures used to prepare food for the swallow and gain pleasure from eating; and, tongue movement to initiate the oral stage of the swallow. This sometimes also refers to the amount of food or liquid the individual is able to take in by mouth.

Pharyngeal Manometry: instrumental procedure to measure pressures in the pharynx and upper esophageal sphincter.

Scintigraphy: instrumental nuclear medicine to assess aspiration, reflux, and gastric emptying (usually as a percentage of radioactive contents left in the stomach after 1 hour). Images produced by gamma camera record the emissions of radionuclide energy from the individual being examined.

Self-Feeding: arm and hand coordination required to bring food from plate to mouth.

Stages of Swallow: three-stage event of swallowing: oral, pharyngeal, esophageal, including two phases within the oral stage: oral preparatory phase and oral transport phase.

Surface Electromyography: instrumental procedure that records electrical activity of muscles involved in swallowing.

Team: collection or representation of different disciplines or specialists; may be multidisciplinary, interdisciplinary, or transdisciplinary in approach to assessment and management of complex patients with swallowing and feeding disorders.

Treatment Strategy: Examples: Habilitative/rehabilitative: techniques that include exercises and movements designed to change swallowing physiology. Compensations: strategies that impose alteration in behavior (i.e., posture, rate), bolus characteristics (i.e., volume, consistency) to achieve functional swallowing. These strategies are not intended to alter swallow physiology.

Ultrasonography: instrumental procedure involving use of transducers using high-frequency sound waves to create images that allow observation of movement of structures for swallowing. Tissue contrast is provided by the differences in each tissue's ability to reflect sound.

Upper Aerodigestive Tract: the region involved in swallowing and breathing that includes the oral cavity, oropharynx, pharynx, larynx, upper trachea, and upper esophagus.

References

American Speech-Language-Hearing Association. (1987). Report of the ad hoc committee on dysphagia. *Asha, 29*(4), 57-58.

American Speech-Language-Hearing Association. (1992). Position statement and guidelines for instrumental diagnostic procedures for swallowing. *Asha, 34*(Suppl. 7), 25-33.

American Speech-Language-Hearing Association. (1994). Code of Ethics. *Asha, 36*(Suppl. 13), 1-2.

American Speech-Language-Hearing Association. (2000). *Omnibus survey*. Rockville, MD: Author.

American Speech-Language-Hearing Association. (2001a). Roles of speech-language pathologists in swallowing and feeding disorders: Position statement in press. In Rockville, MD: Author.

American Speech-Language-Hearing Association. (2001b). Knowledge and skills for speech-language pathologists providing services to individuals with swallowing and feeding disorders in press. In Rockville, MD: Author.

Arvedson, J.C., & Lefton-Greif, M.A. (1998). *Pediatric videofluoroscopic swallow studies: A professional manual with caregiver guidelines*. San Antonio, TX: Communication Skill Builders, Psychological Corp.

Arvedson, J., Rogers, B., Buck, G., Smart, P., & Msall, M. (1994). Silent aspiration prominent in children with dysphagia. *International Journal of Pediatric Otorhinolaryngology, 28*, 173-181.

ASHA National Outcomes Measurement System (NOMS). (1998). Adult speech-language pathology training manual. In Rockville, MD: Author.

ASHA National Outcomes Measurement System (NOMS). (2000). Prekindergarten speech-language pathology users guide. In Rockville, MD: Author.

ASHA Special Interest Division 13, Swallowing and Swallowing Disorders (Dysphagia). (1997). Graduate curriculum on swallowing and swallowing disorders (adult and pediatric dysphagia). *ASHA Desk Reference, 3*, 248a-248n.

Aviv, J. E., Kim, T., Sacco, R. L., Kaplan, S., Goodhart, K., Diamond, B., & Close, L. G. (1998a). FEEST: A new bedside endoscopic test of the motor and sensory components of swallowing. *Annals of Otology, Rhinology, and Laryngology, 107*, 378-387.

Aviv, J. E., Kim, T., Thomson, J. E., Sunshine, S., Kaplan, S., & Close, L. G. (1998b). Fiberoptic endoscopic evaluation of swallowing with sensory testing (FEEST) in healthy controls. *Dysphagia, 13*, 87-92.

Aviv, J. E., Martin, J. H., Sacco, R. L., Zagar, D., Keen, M. S., & Blitzer, A. (1996). Supraglottic and pharyngeal sensory abnormalities in stroke patients with dysphagia. *Annals of Otology, Rhinology, and Laryngology, 105*, 92-97.

Babbitt, R. L., Hoch, T. A., Coe, D. A., Cataldo, M. F., Kelly, K. J., Stackhouse, C., & Perman, J. A. (1994). Behavioral assessment and treatment of pediatric feeding disorders. *Journal of Developmental & Behavioral Pediatrics, 15*, 278-291.

Balan, K. K., Vinjamuri, S., Maltby, P., Bennett, J., Woods, S., Playfer, J. R., & Critchley, M. (1998). Gastroesophageal reflux in patients fed by percutaneous endoscopic gastrostomy (PEG): Detection by a simple scintigraphic method. *American Journal of Gastroenterology, 93*, 946-949.

Bath, A. P., & Bull, P. D. (1997). Management of upper airway obstruction in Pierre Robin sequence. *Journal of Laryngology & Otology, 111*, 1155-1157.

Bauer, M. L., & Lyrene, R. K. (1999). Chronic aspiration in children: Evaluation of the lipid-laden macrophage index. *Pediatric Pulmonology, 28*, 79-82.

Ben-Yosef, R., & Kapp, D. S. (1992). Persistent and/or late complications of combined radiation therapy and hyperthermia. *International Journal of Hyperthermia, 8*, 733-745.

Bentzen, S. M., Thames, H. D., & Overgaard, M. (1989). Latent-time estimation for late cutaneous and subcutaneous radiation reactions in a single follow-up clinical study. *Radiotherapy and Oncology, 15*, 267-274.

Blonsky, E., Logemann, J., Boshes, B., & Fisher, H. (1975). Comparison of speech and swallowing function in patients with tremor disorders, and in normal geriatric patients: A cinefluorographic study. *Journal of Gerontology, 30*, 299-303.

Bosma, J. F., Hepburn, L. G., Josell, S. D., & Baker, K. (1990). Ultrasound demonstration of tongue motions during suckle feeding. *Developmental Medicine & Child Neurology, 32*, 223-229.

Brine, E. A., Rickard, K. A., Brady, M. S., Liechty, E. A., Manatunga, A., Sadove, M., & Bull, M. J. (1994). Effectiveness of two feeding methods in improving energy intake and growth of infants with cleft palate: A randomized study. *Journal of American Dietetic Association, 94*, 732-738.

Buchholz, D. W., & Robbins, J. A. (1997). Neurological diseases affecting oropharyngeal swallowing. In Perlman, A. L. & Delrieu, K. S. (Eds.), *Deglutition and its disorders: Anatomy, physiology, clinical diagnosis, and management*. San Diego, CA: Singular Publishing Group.

Bu'Lock, F., Woolridge, M. W., & Baum, J. D. (1990). Development of coordination of sucking, swallowing and breathing: Ultrasound study of term and preterm infants. *Developmental Medicine & Child Neurology, 32*, 669-678.

Burklow, K. A., Phelps, A. N., Schultz, J. R., McConnell, K., & Rudolph, C. (1998). Classifying complex pediatric feeding disorders. *Journal of Pediatric Gastroenterology and Nutrition, 27*, 143-147.

Carpenter, R. J., McDonald, T. J., & Howard, F. H. (1978). Otolaryngologic presentation of amyotrophic lateral sclerosis. *Otorhinolaryngology, 96*, 478-484.

Cherney, L. R., Cantieri, C. A., & Pannell, J. J. (1986). *Clinical evaluation of dysphagia*. Gaithersburg, MD: Aspen.

Crary, M. A. (1995). A direct intervention program for neurogenic dysphagia secondary to brainstem stroke. *Dysphagia, 10*, 6-18.

Daly, D., Code, C., & Anderson, H. (1962). Disturbances of swallowing and esophageal motility in patients with multiple sclerosis. *Neurology, 12*, 250-256.

Daniels, S. K., Foundas, A. L., Iglesia, G. C., & Sullivan, M. A. (1996). Lesion site in unilateral stroke patients with dysphagia. *Journal of Stroke and Cerebrovascular Disease, 6*, 30-34.

Dantas, R. O., Kern, M. K., Massey, B. T., Dodds, W. J., Kahrilas, P. J., Brasseur, J. G., Cook, I. J., & Lang, I. M. (1990). Effect of swallowed bolus variables on oral and pharyngeal phases of swallowing. *American Journal of Physiology, 258*, G675-G681.

Darrow, D. H., Hoffman, H. T., Barnes, G. J., & Wiley, C. A. (1992). Management of dysphagia in inclusion body myositis. *Archives of Otolaryngology-Head & Neck Surgery, 118*, 313-317.

Davis, R. K., Vincent, M. E., Shapshay, S. M., & Strong, M. S. (1982). Anatomy and complications of “T” versus vertical closure of the hypopharynx after laryngectomy. *Laryngoscope, 92*, 16-20.

Day, J. C. (1995). Population projections of the United States by age, sex, race and Hispanic origin: 1995 to 2050. In *Current Population Reports* (p. 25). Washington, DC: Bureau of the Census.

D'Cruz, O. F., Swisher, C. N., Jaradeh, S., Tang, T., & Konkol, R. J. (1993). Mobius syndrome: evidence for a vascular etiology. *Journal of Child Neurology, 8*, 260-265.

Dello Strologo, L., Principato, F., Sinibaldi, D., Appiani, A. C., Terzi, F., Dartois, A. M., & Rizzoni, G. (1997). Feeding dysfunction in infants with severe chronic renal failure after long-term nasogastric tube feeding. *Pediatric Nephrology, 11*(1), 84-86.

Driscoll, B. P., Gracco, C., Coelho, C., Goldstein, J., Oshima, K., Tierney, E., & Sasaki, C. T. (1995). Laryngeal function in postpolio patients. *Laryngoscope, 105*, 35-41.

Eisele, D. W., Koch, D. G., Tarazi, A. E., & Jones, B. (1991). Aspiration from delayed radiation fibrosis of the neck. *Dysphagia, 6*, 120-122.

Ekberg, O., & Nylander, G. (1983). Pharyngeal dysfunction after treatment for pharyngeal cancer with surgery and radiotherapy. *Gastrointestinal Radiology, 8*, 97-104.

Ertekin, C., Audogdu, I., Tarlaci, S., Turman, A. B., & Kiylioglu, N. (2000). Mechanisms of dysphagia in suprabulbar palsy with lacunar infarct. *Stroke, 31*, 1370-1376.

Estevao-Costa, J., Campos, M., Dias, J. A., Trindade, E., Medina, A. M., & Carval, J. L. (2001). Delayed gastric emptying and gastroesophageal reflux: A pathophysiologic relationship. *Journal of Pediatric Gastroenterology and Nutrition, 32*, 471-474.

Eyman, R. K., Grossman, H. J., Chaney, R. H., & Call, T. L. (1990). The life expectancy of profoundly handicapped people with mental retardation. *New England Journal of Medicine, 323*, 584-589.

Eyman, R. K., Grossman, H. J., Tarjan, G., & Miller, C. R. (1987). Life expectancy and mental retardation, A longitudinal study in a state residential facility. *Monographs of the American Association on Mental Deficiency, 7*.

Fein, A. M. (1999). Pneumonia in the elderly: Overview of diagnostic and therapeutic approaches. *Clinical Infectious Disease, 28*, 726-729.

Gallender, D. (1979). *Eating handicaps: Illustrated techniques for feeding disorders*. Springfield, IL: C.C. Thomas.

Gallender, D. (1980). *Teaching eating and toileting skills to the multi-handicapped in school settings*. Springfield, IL: Thomas.

Garrigues, V., Ponce, J., Garcia, E., Vilchez, J., Moles, J. R., & Berenguer, J. (1994). Pharyngo-oesophageal dysfunction in a patient with Duchenne muscular dystrophy. *European Journal of Gastroenterology and Hepatology, 6*, 565-566.

Gibson, J., Lamey, P. J., Zoma, A., & Ballantyne, J. (1991). Tongue atrophy in mixed connective tissue disease. *Oral Surgery, Oral Medicine, Oral Pathology, 71*, 294-296.

Gisel, E. (1994). Oral-motor skills following sensorimotor intervention in the moderately eating-impaired child with cerebral palsy. *Dysphagia, 9*, 180-192.

Gisel, E. G. (1996). Effect of oral sensorimotor treatment on measures of growth and efficiency of eating in the moderately eating-impaired child with cerebral palsy. *Dysphagia, 11*, 48-58.

Gisel, E. G., Applegate-Ferrante, T., Benson, J., & Bosma, J. (1995). Effect of oral sensorimotor treatment on measures of growth, eating efficiency and aspiration in the dysphagic child with cerebral palsy. *Developmental Medicine and Child Neurology, 37*, 528-543.

Gisel, E., Applegate-Ferrante, T., Benson, J., & Bosma, J. (1996). Oral-motor skills following sensorimotor therapy in two groups of moderately dysphagic children with cerebral palsy: Aspiration vs nonaspiration. *Dysphagia, 11*, 59-71.

Gisel, E. G., Birnbaum, R., & Schwartz, S. (1998). Feeding impairments in children: Diagnosis and effective intervention. *International Journal of Orofacial Myology, 24*, 27-33.

Gisel, E. G., Schwartz, S., & Haberfellner, H. (1999). The Innsbruck sensorimotor activator and regulator (ISMAR): Construction of an intraoral appliance to facilitate ingestive function. *Journal of Dentistry for Children, 66*, 180-187.

Gisel, E. G., Schwartz, S., Petryk, A., Clarke, D., & Haberfellner, H. (2000). "Whole body" mobility after one year of intraoral appliance therapy in children with cerebral palsy and moderate eating impairment. *Dysphagia, 15*, 226-235.

Gonzalez, C. L., & Calia, F. M. (1975). Bacteriologic flora of aspiration-induced pulmonary infection. *Archives of Internal Medicine, 135*, 711-714.

Goode, R. L., & Smith, R. A. (1970). Surgical management of sialorrhea. *Laryngoscope, 80*, 1078-1089.

Gordon, C., Hewer, L., & Wade, D. T. (1987). Dysphagia in acute stroke. *British Medical Journal, 295*, 411-414.

Gresham, S. L. (1990). Clinical assessment and management of swallowing difficulties after stroke. *Medical Journal of Australia, 153*, 397-399.

Griggs, C. A., Jones, P. M., & Lee, R. E. (1989). Videofluoroscopic investigation of feeding disorders in children with multiple handicaps. *Developmental Medicine and Child Neurology, 31*, 303-308.

Haberfellner, H., Schwartz, S., & Gisel, E. G. (2001). Feeding skills and growth after one year of intraoral appliance therapy in moderately dysphagic children with cerebral palsy. *Dysphagia, 16*, 83-96.

Hamlet, S., Faull, J., Klein, B., Aref, A., Fontanesi, J., Stachler, R., Shamsa, F., Jones, L., & Simpson, M. (1997). Mastication and swallowing in patients with postirradiation xerostomia. *International Journal of Radiation Oncology, Biology and Physics, 37*, 789-796.

Hanlon, M., Tripp, J., Ellids, R., Flack, F., Selley, W., & Shoesmith, H. (1997). Deglutition apnoea as indicator of maturation of suckle feeding in bottle-fed preterm infants. *Developmental Medicine & Child Neurology, 39*, 534-542.

Hartnick, C., Miller, C., Hartley, B., & Willging, J. (2000). Pediatric fiberoptic endoscopic evaluation of swallowing. *Annals of Otorhinology and Laryngology, 109*, 996-999.

Hawdon, J. M., Beauregard, N., Slattery, J., & Kennedy, G. (2000). Identification of neonates at risk for developing feeding problems in infancy. *Developmental Medicine & Child Neurology, 42*, 235-239.

Helfrich-Miller, K. R., Rector, K. L., & Straka, J. A. (1986). Dysphagia: Its treatment in the profoundly retarded patient with cerebral palsy. *Archives of Physical Medicine and Rehabilitation, 67*, 520-525.

Hillel, A. D., Miller, R. M., Yorkston, K., McDonald, E., Norris, F. H., & Konikow, N. (1989). Amyotrophic lateral sclerosis severity scale. *Neuroepidemiology, 8*, 142-150.

Hirano, M., Kuroiwa, Y., Tanaka, S., Matsuoka, H., Sato, K., & Yoshida, T. (1992). Dysphagia following various degrees of surgical resection for oral cancer. *Annals of Otology, Rhinology, and Laryngology, 101*, 138-141.

Horner, J., Alberts, M. J., Dawson, D. V., & Cook, G. M. (1994). Swallowing in Alzheimer's disease. *Alzheimer Disease and Associated Disorders, 8*(3), 177-189.

Horner, J., Brazer, S. R., & Massey, E. W. (1993). Aspiration in bilateral stroke patients: A validation study. *Neurology, 43*, 430-433.

Horner, J., Buoyer, F. G., Alberts, M. J., & Helms, M. J. (1991). Dysphagia following brainstem stroke: Clinical correlates and outcome. *Archives of Neurology, 48*, 1170-1173.

Horner, J., Massey, E. W., & Brazer, S. R. (1990). Aspiration in bilateral stroke patients. *Neurology, 40*, 1686-1688.

Horner, J., Massey, E. W., Riski, J. E., Lathrop, D. L., & Chase, K. N. (1988). Aspiration following stroke: Clinical correlates and outcomes. *Neurology, 38*, 1359-1362.

Huckabee, M. L., & Cannito, M. P. (1999). Outcomes of swallowing rehabilitation in chronic brainstem dysphagia: A retrospective evaluation. *Dysphagia, 14*(2), 93-109.

Huckabee, M. L., & Pelletier, C. A. (1999). *Management of adult neurogenic dysphagia*. San Diego, CA: Singular Publishing Group.

Hughes, C. V., Baum, B. J., Fox, P. C., Marmary, Y., Yeh, C., & Sonies, B. C. (1987). Oral-pharyngeal dysphagia: A common sequela of salivary gland dysfunction. *Dysphagia, 1*, 173-177.

Johnson, E. R., McKenzie, S. W., Rosenquist, C. J., Lieberman, J. S., & Sievers, A. E. (1992). Dysphagia following stroke: Quantitative evaluation of pharyngeal transit times. *Archives of Physical Medicine and Rehabilitation, 75*, 419-423.

Johnston, B. T., Castell, J. A., & Shumacher, S., et al. (1997). Comparison of swallowing function in Parkinson's disease and progressive supranuclear palsy. *Movement Disorders, 12*, 322-327.

Kahrilas, P. J., Lin, S., Logemann, J. A., Ergun, G. A., & Facchini, F. (1993). Deglutitive tongue action: Volume accommodation and bolus propulsion. *Gastroenterology, 104*, 152-162.

Kahrilas, P. J., Logemann, J. A., Krugler, C., & Flanagan, E. (1991). Volitional augmentation of upper esophageal sphincter opening during swallowing (Gastrointestinal Liver Physiology, 23). *American Journal of Physiology, 260*, G450-G456.

Kendall, K. A., McKenzie, S. W., Leonard, R. J., & Jones, C. (1998). Structural mobility in deglutition after single modality treatment of head and neck carcinomas with radiotherapy. *Head and Neck, 20*, 720-725.

Kessler, D. B., & Dawson, P. (Eds.). (1999). *Failure to thrive and pediatric undernutrition: A transdisciplinary approach*. Baltimore, MD: Paul H. Brookes Publishing Co.

Kilman, W., & Goyal, R. (1976). Disorders of pharyngeal and upper esophageal sphincter motor function. *Archives of Internal Medicine, 136*, 592-601.

Kirshner, H. S. (1989). Causes of neurogenic dysphagia. *Dysphagia, 3*, 184-188.

Koenig, J., Davies, A., & Thach, B. (1990). Coordination of breathing, sucking and swallowing during bottle feedings in human infants. *Journal of Applied Physiology, 69*, 1623-1629.

Kotz, T., Abraham, S., Beitler, J., Wadler, S., & Smith, R. V. (1999). Pharyngeal transport dysfunction consequent to an organ-sparing protocol. *Archives of Otolaryngology Head and Neck Surgery, 125*, 410-413.

Langmore, S., Schatz, K., & Olson, N. (1988). Fiberoptic endoscopic examination of swallowing safety: A new procedure. *Dysphagia, 2*(4), 216-219.

Langmore, S., Schatz, K., & Olson, N. (1991). Endoscopic and videofluoroscopic evaluations of swallowing and aspiration. *Annals of Otology, Rhinology , and Laryngology, 100*, 678-681.

Larsen, G. L. (1972). Rehabilitation for dysphagia paralytica. *Journal of Speech and Hearing Disorders, 37*, 187-194.

Latini, G., De Vecchio, A., De Mitri, B., Giannuzzi, R., Presta, G., Quartulli, H., Rosati, E., Scarano, B., & Pili, G. (1999). Scintigraphic evaluation of gastroesophageal reflux in newborns. *La Pediatria Medica e Chirurgica, 21*, 115-117.

Lau, C., & Schanler, R. J. (2000). Oral feeding in premature infants: Advantage of a self-paced milk flow. *Acta Paediatrica, 89*, 393-398.

Law, M. P. (1981). Radiation-induced vascular injury and its relation to late effects in normal tissues. *Advances in Radiation Biology, 9*, 37-73.

Lazarus, C. (1991). Diagnosis and management of swallowing disorders in traumatic brain injury. In Yorkston, K. M. & Beukelman, D. R. (Eds.), *Communication disorders following traumatic brain injury: Management of cognitive and motor impairments* (pp. 367-417). Austin, TX: Pro-Ed..

Lazarus, C. L. (1993). Effects of radiation therapy and voluntary maneuvers on swallow function in head and neck cancer patients. *Clinics in Communicative Disorders, 3*, 11-20.

Lazarus, C. L. (2000). Management of swallowing disorders in head and neck cancer patients: Optimum patterns of care. *Seminars in Speech and Language, 31*, 293-309.

Lazarus, C., & Logemann, J. (1987). Swallowing disorders in closed head trauma patients. *Archives of Physical Medicine and Rehabilitation, 68*, 79-84.

Lazarus, C., Logemann, J. A., Pauloski, B. R., Colangelo, L. A., Kahrilas, P. J., Mittal, B. B., & Pierce, M. (1996). Swallowing disorders in head and neck cancer patients treated with radiotherapy and adjuvant chemotherapy. *Laryngoscope, 106*, 1157-1166.

Lazarus, C. L., Logemann, J. A., Pauloski, B. R., Rademaker, A. W., Larson, C. R., Mittal, B. B., & Pierce, M. (2000). Swallowing and tongue function following treatment for oral and oropharyngeal cancer. *Journal of Speech, Language and Hearing Research, 43*, 1011-1023.

Lazarus, C., Logemann, J. A., Rademaker, A. W., Kahrilas, P. J., Pajak, T., Lazar, R., & Halper, A. (1993). Effects of bolus volume, viscosity and repeated swallows in nonstroke subjects and stroke patients. *Archives of Physical Medicine and Rehabilitation, 74*, 1066-1070.

Lazzara, G., Lazarus, C., & Logemann, J. A. (1986). Impact of thermal stimulation on the triggering of swallowing reflex. *Dysphagia, 1*, 73-77.

Leder, S. B. (1998). Serial fiberoptic endoscopic swallowing evaluations in the management of patients with dysphagia. *Archives of Physical Medicine and Rehabilitation, 79,* 1264-1269.

Leder, S. B., & Karas, D. E. (2000). Fiberoptic endoscopic evaluation of swallowing in the pediatric population. *Laryngoscope, 110*(7), 1132-1136.

Leder, S. B., Sasaki, C. T., & Burrell, M. J. (1998). Fiberoptic endoscopic evaluation of dysphagia to identify silent aspiration. *Dysphagia, 13*(1), 19-21.

Lefton-Greif, M. A., Crawford, T. O., Winkelstein, J. A., Loughlin, G. M., Koerner, C. B., Zahurak, M., & Lederman, H. M. (2000). Oropharyngeal dysphagia and aspiration in patients with ataxia-telangiectasia. *Journal of Pediatrics, 136*(2), 225-231.

Leopold, N. A., & Kagel, M. C. (1996). Prepharyngeal dysphagia in Parkinson's disease. *Dysphagia, 11,* 14-22.

Leopold, N. A., & Kagel, M. C. (1997a). Pharyngo-esophageal dysphagia in Parkinson's disease. *Dysphagia, 12,* 11-18.

Leopold, N., & Kagel, M. C. (1997b). Dysphagia in progressive supranuclear palsy: Radiologic features. *Dysphagia, 12,* 140-143.

Lespargot, A., Langevin, M., Muller, S., & Guillemont, S. (1993). Swallowing disturbances associated with drooling in cerebral-palsied children. *Developmental Medicine and Child Neurology, 35,* 298-304.

Link, D. T., Willging, J., Miller, C. K., Cotton, R., & Rudolph, C. D. (2000). Pediatric laryngopharyngeal sensory testing during flexible endoscopic evaluation of swallowing: Feasible and correlative. *Annals of Otology, Rhinology and Laryngology, 109,* 899-905.

Litchy, W., & Engel, A. (1992). Inclusion body myositis with cricopharyngeus muscle involvement and severe dysphagia. *Muscle Nerve, 15,* 115.

Litvan, I., Mangone, C. A., McKee, A., Verny, M., Parsa, A., Jellinger, K., D'Olhaberriague, L., Chaudhuri, K. R., & Pearce, R. K. (1996). Natural history of progressive supranuclear palsy (Steele-Richardson-Olszewski syndrome) and clinical predictors of survival: A clinicopathological study. *Journal of Neurology, Neurosurgery, & Psychiatry, 60,* 615-620.

Liu, H., Kaplan, S., Parides, M., & Close, L. (2000). Laryngopharyngeal sensory deficits in patients with laryngopharyngeal reflux and dysphagia. *Annals of Otorhinology and Laryngology, 109,* 1000-1006.

Logemann, J. A. (1983). *Evaluation and treatment of swallowing disorders.* San Diego, CA: College Hill.

Logemann, J. A. (1993a). The dysphagia diagnostic procedure as a treatment efficacy trial. *Clinics in Communicative Disorders, 3*(4), 1-10.

Logemann, J. A. (1993b). *Manual for the videofluorographic study of swallowing* (2nd ed.). Austin, TX: Pro-Ed.

Logemann, J. A. (1998). *Evaluation and treatment of swallowing disorders.* Austin, TX: Pro-Ed.

Logemann, J., & Bytell, D. (1979). Swallowing disorders in three types of head and neck surgical patients. *Cancer, 81,* 469-478.

Logemann, J. A., & Kahrilas, P. J. (1990). Relearning to swallow post CVA: Application of maneuvers and indirect feedback: A case study. *Neurology, 40,* 1136-1138.

Logemann, J., Kahrilas, P., Kobara, M., & Vakil, N. (1989). Benefit of head rotation on pharyngoesophageal dysphagia. *Archives of Physical Medicine and Rehabilitation, 70,* 767-771.

Logemann, J. A., Pauloski, B. R., Rademaker, A. W., McConnel, F. M. S., Heiser, M. A., Cardinale, S., Shedd, D., Stein, D., Beery, S., Johnson, J., & Baker, T. (1993). Speech and swallow function after tonsil/base of tongue resection with primary closure. *Journal of Speech and Hearing Research, 36,* 918-926.

Logemann, J. A., Rademaker, A. W., Pauloski, B. R., & Kahrilas, P. J. (1994). Effects of postural change on aspiration in head and neck surgical patients. *Otolaryngology Head and Neck Surgery, 4,* 222-227.

Love, R. J., Hagerman, E. L., & Taimi, E. G. (1980). Speech performance, dysphagia, and oral reflexes in cerebral palsy. *Journal of Speech and Hearing Disorders, 45*, 59-75.

Mancinelli, J. M. (1994). Dysphagia and dysarthria: The role of the speech-language pathologist. In Mitsumoto, H. & Norris, F. H. (Eds.), *Amyotrophic lateral sclerosis: A comprehensive guide to management*. New York: Demos Publications.

Mansson, I., & Sandberg, N. (1975). Oro-pharyngeal sensitivity and elicitation of swallowing in man. *Acta Otolaryngologica, 79*, 140-145.

Martin, B. J. W., Logemann, J. A., Shaker, R., & Dodds, W. J. (1993). Normal laryngeal valving patterns during three breath-hold maneuvers: A pilot investigation. *Dysphagia, 8*, 11-20.

Martin-Harris, B. S., Logemann, J. A., McMahon, S., Schleicher, M., & Sandidge, J. (2000). Clinical utility of the modified barium swallow. *Dysphagia, 15*(4), 136-141.

Martin-Harris, B. S., McMahon, S. I., & Haynes, R. (1998). Aspiration and dysphagia: Pathophysiology and outcome. *Phonoscope, 1*(2), 32-123.

Mathew, O. P. (1991). Science of bottle feeding. *Journal of Pediatrics, 119*, 511-519.

Mathew, O. P., Belan, M., & Thoppil, C. K. (1992). Sucking patterns of neonates during bottle feeding: Comparison of different nipple units. *American Journal of Perinatology, 9*, 265-269.

McConnel, F. M. S., Cerenko, D., & Mendelsoh, M. S. (1988). Manofluorographic analysis of swallowing. *Otolarygologic Clinics of North America, 21*, 625-635.

McConnel, F. M. S., Logemann, J. A., Rademaker, A. W., Pauloski, B. R., Baker, S. R., Lewin, J., Shedd, D., Heiser, M. A., Cardinale, S., Collins, S., Graner, D., Cook, B. S., Milianti, F., & Baker, T. (1994). Surgical variables affecting postoperative swallowing efficiency in oral cancer patients: A pilot study. *Laryngoscope, 1*, 87-90.

McConnel, F. M. S., Mendelsohn, M. S., & Logemann, J. A. (1986). Examination of swallowing after total laryngectomy using manofluorography. *Head & Neck Surgery, 9*, 3-12.

McConnel, F. M. S., Pauloski, B. R., Logemann, J. A., Rademaker, A. W., Colangelo, L., Shedd, D., Carroll, W., Lewin, J., & Johnson, J. (1998). Functional results of primary closure vs flaps in oropharyngeal reconstruction. *Archives of Otolaryngology Head and Neck Surgery, 124*, 625-630.

McCullough, G. H., Wertz, R. T., Rosenbek, J. C., & Dineen, C. (1999). Clinicians' preferences and practices in conducting clinical/bedside and videofluoroscopic swallowing examinations in an adult neurogenic population. *American Journal of Speech-Language Pathology, 8*(2), 149-163.

McHorney, C. A., Bricker, D. E., Kramer, A. E., Rosenbek, J. C., Robbins, J., Chignell, K. A., Logemann, J. A., & Clarke, C. (2000). The SWAL-QOL outcomes tool for oropharyngeal dysphagia in adults. *Dysphagia, 15*, 115-134.

McHorney, C. A., & Rosenbek, J. C. (1998). Functional outcome assessment of adults with oropharyngeal dysphagia. *Seminars in Speech and Language, 19*(3), 235-247.

McVeagh, P., Howman-Giles, R., & Kemp, A. (1987). Pulmonary aspiration studied by radionuclide milk scanning and barium swallow roentgenography. *American Journal of Diseases of Children, 141*(8), 917-921.

Meadows, J. C. (1973). Dysphagia in unilateral cerebral lesions. *Journal of Neurology, Neurosurgery, and Psychiatry, 36*, 853-860.

Menon, A. P., Schefft, G. L., & Thach, B. T. (1994). Frequency and significance of prolonged apnea in infants. *American Review of Respiratory Diseases, 130*, 969-973.

Meyers, T. (1986). Unpublished doctoral dissertation. In *Analysis of tongue strength and swallowing efficiency in amyotrophic lateral sclerosis*. Evanston, IL: Northwestern University.

Migliore, L. E., Scoopo, F. J., & Robey, K. L. (1999). Fiberoptic examination of swallowing in children and young adults with severe developmental disability. *American Journal of Speech-Language Pathology, 8*, 303-308.

Miller, R. G., Rosenberg, J. A., Gelinas, D. F., Mitsumoto, H., Newman, D., Sufit, R., Borasio, G. D., Bradley, W. G., Bromberg, M. B., Brooks, B. R., Kasarskis, E. J., Munsat, T. L., & Oppenheimer, E. A. (1999). Practice parameter: The care of the patient with amyotrophic lateral sclerosis (an evidence-based review). Report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology, 52*, 1311-1323.

Miller, R. M., & Chang, M. W. (1999). Advances in the management of dysphagia caused by stroke. *Physical Medicine and Rehabilitation Clinics of North America, 10*(4), 925-941.

Miller, R. M., & Groher, M. E. (1993). Speech-language pathology and dysphagia: A brief historical perspective. *Dysphagia, 8*, 180-184.

Mirrett, P. L., Riski, J. E., Glascott, J., & Johnson, V. (1994). Videofluoroscopic assessment of dysphagia in children with severe spastic cerebral palsy. *Dysphagia, 9*, 174-179.

Myer, C. M., Reed, J. M., Cotton, R. T., Willging, J. P., & Shott, S. R. (1998). Airway management in Pierre Robin sequence. *Otolaryngology-Head and Neck Surgery, 118*, 630-635.

Neumann, S., Buchholz, D. W., Wuttge-Hannig, A., Hannig, C., Prosiegel, M., & Schroter-Morasch, H. (1994). Bilateral pharyngeal dysfunction after lateral medullary infarction. *Dysphagia, 9*, 263.

Newman, L. A., Cleveland, R. H., Blickman, J. G., Hillman, R E., & Jaramillo, D. (1991). Videofluoroscopic analysis of the infant swallow. *Investigative Radiology, 26*, 870-873.

Ohmae, Y., Logemann, J. A., Kaiser, P., Hanson, D. G., & Kahrilas, P. J. (1995). Timing of glottic closure during normal swallow. *Head and Neck, 17*, 394-402.

Ohmae, Y., Ogura, M., Kitahara, S., Karaho, T., & Inouye, T. (1998). Effects of head rotation on pharyngeal function during normal swallow. *Annals of Otolaryngology, Rhinology, and Laryngology, 107*, 344-348.

Pauloski, B. R., Logemann, J. A., Fox, J. C., & Colangelo, L. A. (1995). Biomechanical analysis of the pharyngeal swallow in postsurgical patients with anterior tongue and floor of mouth resection and distal flap reconstruction. *Journal of Speech and Hearing Research, 39*, 110-123.

Pauloski, B. R., Logemann, J. A., Rademaker, A. W., McConnel, F. M. S., Heiser, M. A., Cardinale, S., Shedd, D., Lewin, J., Baker, S., Graner, D., Cook, B., Milianti, F., Collins, S., & Baker, T. (1993). Speech and swallowing function after anterior tongue and floor of mouth resection with distal flap reconstruction. *Journal of Speech and Hearing Research, 36*, 267-276.

Pauloski, B. R., Logemann, J. A., Rademaker, A. W., McConnel, F. M. S., Stein, D., Beery, Q., Johnson, J., Heiser, M. A., Cardinale, S., Shedd, D., Graner, D., Cook, B., Milianti, F., Collins, S., & Baker, T. (1994). Speech and swallowing function after oral and oropharyngeal resections: One-year follow-up. *Head & Neck, 16*, 313-322.

Périé, S., Laccourreye, L., Flahault, A., Hazebroucq, V., Chaussade, S., & St. Guily, J. L. (1998). Role of videoendoscopy in assessment of pharyngeal function in oropharyngeal dysphagia: Comparison with videoendoscopy and manometry. *Laryngoscope, 8*, 1712-1716.

Prodoehl, D. C., & Shattuck, K. E. (1995). Nasogastric intubation for nutrition and airway protection in infants with Robin sequence. *Journal of Perinatology, 15*(5), 395-397.

Rasley, A., Logemann, J. A., Kahrilas, P. J., Rademaker, A. W., Pauloski, B. R., & Dodds, W. J. (1993). Prevention of barium aspiration during videofluoroscopic swallowing studies: Value of change in posture. *American Journal of Roentgenology, 160*, 1005-1009.

Reddy, P., & Malon, M. (1998). Cost and outcome analysis of home parenteral and enteral nutrition. *Journal of Parenteral and Enteral Nutrition, 22*(5), 302-310.

Reilly, S., & Skuse, D. (1992). Characteristics and management of feeding problems of young children with cerebral palsy. *Developmental Medicine and Child Neurology, 34*, 379-388.

Reilly, S., Skuse, D., & Poblete, X. (1996). Prevalence of feeding problems and oral motor dysfunction in children with cerebral palsy: A community survey. *Journal of Pediatrics, 129*(6), 877-882.

Reilly, S., Skuse, D., Wolke, D., & Stevenson, J. (1999). Oralmotor dysfunction in children who fail to thrive: organic or non-organic. *Developmental Medicine & Child Neurology, 1*, 115-122.

Robbins, J., Hamilton, J. W., Lof, G. L., & Kempster, G. B. (1992). Oropharyngeal swallowing in normal adults of different ages. *Gastroenterology, 103*, 823-829.

Robbins, J., & Levine, R. (1988). Swallowing after unilateral stroke of the cerebral cortex. *Dysphagia, 3*, 11-17.

Robbins, J., Levine, R. L., Maser, A., Rosenbek, J. C., & Kempster, G. (1993). Swallowing after unilateral stroke of the cerebral cortex. *Archives of Physical Medicine and Rehabilitation, 74*, 1295-1300.

Robbins, J., Logemann, J., & Kishner, H. (1986). Swallowing and speech production in Parkinson's disease. *Annals of Neurology, 19*, 283-287.

Rogers, B., Arvedson, J., Buck, G., Smart, P., & Msall, M. (1994). Characteristics of dysphagia in children with cerebral palsy. *Dysphagia, 9*, 69-73.

Rogers, B., Stratton, P., Msall, M., Andres, M., Champlain, M. K., Koerner, P., & Piazza, J. (1994). Long-term morbidity and management strategies of tracheal aspiration in adults with severe developmental disabilities. *American Journal on Mental Retardation, 98*, 490-498.

Rosenbek, J. C., Roecker, E. B., Wood, J. L., & Robbins, J. (1996). Thermal application reduces the duration of stage transition in dysphagia after stroke. *Dysphagia, 11*, 225-233.

Rubin, I. L., & Crocker, A. C. (Eds.). (1989). *Developmental disabilities, delivery of medical care for children and adults*. Philadelphia: Lea & Febiger.

Senez, C., Guys, J M., Mancini, J., Paz Paredes, A., Lena, G., & Choux, M. (1996). Weaning children from tube to oral feeding. *Child Nervous System, 12*(10), 4-590.

Shanahan, T. K., Logemann, J. A., Rademaker, A. W., Pauloski, B. R., & Kahrilas, P. J. (1993). Chin down posture effects on aspiration in dysphagic patients. *Archives of Physical Medicine and Rehabilitation, 74*, 736-739.

Shapiro, J., Martin, S., DeGirolami, U., & Goyal, R. (1996). Inflammatory myopathy causing pharyngeal dysphagia: A new entity. *Annals of Otology, Rhinology, & Laryngology, 105*, 331-335.

Shaw, W. C., Bannister, R. P., & Roberts, C. T. (1999). Assisted feeding is more reliable for infants with clefts: A randomized trial. *Cleft Palate - Craniofacial Journal, 36*(3), 262-268.

Shawker, T. H., Sonies, B., Hall, T. E., & Baum, B. F. (1984). Ultrasound analysis of tongue, hyoid, and larynx activity during swallowing. *Investigative Radiology, 19*, 82-86.

Shawker, T. H., Sonies, B., Stone, M., & Baum, B. J. (1983). Real-time ultrasound visualization of tongue movement during swallowing. *Journal of Clinical Ultrasound, 11*, 485-490.

Sheppard, J. J. The natural history of dysphagia in developmental disability. 1998. Paper presented at the Dysphagia Research Society. Seventh Annual International Meeting. New Orleans, LA.

Sheppard, J. J., Liou, J., Hochman, R., Laroia, S., & Langlois, M. (1988). Nutritional correlates of dysphagia in individuals institutionalized with mental retardation. *Dysphagia, 3*, 85-89.

Shprintzen, R. J., Goldberg, R., Young, D., & Wolford, L. (1981). The velo-cardio-facial syndrome: A clinical and genetic analysis. *Pediatrics, 67*, 167-172.

Sobsey, R., & Orelove, F. P. (1984). Neurophysiological facilitation of eating skills in children with severe handicaps. *Journal of the Association for Persons with Severe Handicaps, 9*(2), 98-110.

Sonies, B. (1992). Swallowing and speech disturbances. In Litvan, I. & Agi, Y. (Eds.), *In Progressive supranuclear palsy: Clinical and research approaches* (pp. 240-253). New York: Oxford University Press.

Sonies, B. C. (1995). Long-term effects of post-polio on oral-motor and swallowing function. In Halstead, L. N. & Grimle, G. (Eds.), *Post-polio syndrome* (pp. 125-137). Philadelphia: Hanley & Belfus.

Sonies, B. C. (1997). Evaluation and treatment of speech and swallowing. *Current Opinion in Rheumatology, 9*(6), 186-495.

Sonies, B. C., & Dalakas, M. (1991). Dysphagia in patients with the postpolio syndrome. *New England Journal of Medicine, 324*, 1162-1167.

Splaingard, M. B., Hutchins, B., Sulton, L., & Chaudhuri, G. (1988). Aspiration in rehabilitation patients: Videofluoroscopy vs. bedside clinical assessment. *Archives of Physical Medicine and Rehabilitation, 69*, 637-640.

Taylor, S. G., Murthy, A. K., Griem, K. L., Recine, D. C., Kiel, K., Blendowski, C., Bul Hurst, P., Showel, J. T., Hutchinson, J. C., Campanella, R. S., Chen, S., & Caldarelli, D. D. (1997). Concomitant cisplatin/5-FU infusion and radiotherapy in advanced head and neck cancer: 8-year analysis of results. *Head and Neck, 19*, 684-691.

Teichgraeber, J., Bowman, J., & Goepfert, H. (1986). Functional analysis of treatment of oral cavity cancer. *Archives of Otolaryngology-Head and Neck Cancer Surgery, 112*, 959-965.

Tolia, V., Kuhns, L., & Kauffman, R. (1993). Correlation of gastric emptying at one and two hours following formula feeding. *Pediatric Radiology, 23*, 26-28.

Veis, S., & Logemann, J. (1985). Swallowing disorders in persons with cerebrovascular accident. *Archives of Physical Medicine & Rehabilitation, 66*, 372-375.

Vokes, E. E., Kies, M., Haraf, D. J., Mick, R., Moran, W. J., Kozloff, M., Mittal, B., Pelzer, H., Wenig, B., Panje, W., & Weichselbaum, R. R. (1995). Induction chemotherapy followed by concomitant chemoradiotherapy for advanced head and neck cancer: Impact on the natural history of the disease. *Journal of Clinical Oncology, 13*, 876-883.

Weber, F., Woolridge, M., & Baum, J. (1986). An ultrasonographic study of the organization of sucking and swallowing by newborn infants. *Developmental Medicine and Child Neurology, 28*, 19-24.

Welch, M. V., Logemann, J. A., Rademaker, A. W., & Kahrilas, P. J. (1993). Changes in pharyngeal dimensions effected by chin tuck. *Archives of Physical Medicine and Rehabilitation, 74*, 178-181.

Willig, T. N., Paulus, J., Guily, L. C., Beon, C., & Navarro, J. (1994). Swallowing problems in neuromuscular disorders. *Archives of Physical Medicine & Rehabilitation, 75*, 1175-1181.

Willging, J. P. (1995). Endoscopic evaluation of swallowing in children. *International Journal of Pediatric Otorhinolaryngology, 32*, S107-S108.

Willging, J. P. (2000). Benefit of feeding assessment before pediatric airway reconstruction. *Laryngoscope, 110*, 825-834.

Willging, J. P., Miller, C. K., Hogan, M. J., & Rudolph, C. D. (1996). Fiberoptic endoscopic evaluation of swallowing in children: A preliminary report of 100 procedures. *Dysphagia, 11*, 162.

Yang, W. T., Loveday, E. J., Metrewell, C., & Sullivan, P. B. (1997). Ultrasound assessment of swallowing in malnourished disabled children. *British Journal of Radiology, 70*, 992-994.

Yorkston, K. M., Beukelman, D. R., & Bell, K. R. (1988). *Clinical management of dysarthric speakers* (pp. 119-120). Austin, TX: Pro-Ed.

Young, E. C., & Durant-Jones, L. (1997). Gradual onset of dysphagia: A study of patients with oculopharyngeal muscular dystrophy. *Dysphagia, 12*, 196-201.

Zackai, E. H., McDonald-McGinn, D. M., Driscoll, D. A., Feuer, J., Emanuel, B. S., & Eicher, P. (1996). Dysphagia in patients with a 22q11.2 deletion: Unusual pattern found on modified barium swallow (abstract). *American Journal of Human Genetics, 59,* A109-600.