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# A Review of the Multiple Treatment Approaches for Oropharyngeal Dysphagia and the Effectiveness of Intervention

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# A Review of the Multiple Treatment Approaches for Oropharyngeal Dysphagia and the Effectiveness of Intervention

by

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**Report**

Presented to the Faculty of the Graduate School
of the University of Texas at Austin
in Partial Fulfillment
of the Requirements
for the Degree of

**Master of Arts**

The University of Texas at Austin
May, 2010

# Abstract


**A Review of the Multiple Treatment Approaches for Oropharyngeal Dysphagia and the Effectiveness of Intervention**



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This master's report collected the available literature regarding the multiple treatment approaches for oropharyngeal dysphagia and the efficacy of each approach in the remediation of swallowing deficits. A variety of traditional intervention techniques are described and their efficacy data is presented, as well as limitations and contraindications to intervention. Efficacy data for modern oropharyngeal dysphagia intervention techniques such as Vitalstim and E-stim is also presented, and the differences between the two techniques are discussed. Ethical decision-making in dysphagia treatment is also discussed.

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# INTRODUCTION

The term “dysphagia” derives from the Greek root *dys* meaning difficulty or disordered, and *phagia* meaning “to eat.” Dysphagia is the medical term for difficulty in the passage of solids and/or liquids from the mouth to the stomach (Sleisenger, 2002). More simply, dysphagia is difficulty in swallowing, which is a complex activity regulated by cranial nerves of the brainstem, neural regulatory mechanisms of the medulla, and the cortical sensorimotor and limbic systems (Groher, 1992, p. 12). Dysphagia is a symptom of one or more separate causes, not a disorder in and of itself. Swallowing disorders can occur in all age groups, resulting from congenital abnormalities, structural damage, and/or medical conditions. Dysphagia can result from a variety of diseases and conditions such as stroke, dementia, head and neck cancer, Parkinson’s disease, multiple sclerosis, amyotrophic lateral sclerosis, and cerebral palsy. In fact, dysphagia is a major complaint in up to 50% of patients with stroke, 44% with multiple sclerosis, 60% with amyotrophic lateral sclerosis, 50% following brain injury, and 84% with other neurodegenerative diseases (Cook & Kahrilas, 1999). Complications may be morbid, including aspiration pneumonia, dehydration, pulmonary fibrosis, and death. Aspiration pneumonia occurs in up to 50% of patients with poststroke dysphagia during the first year, causing mortality in up to 45% of the individuals affected (Smithard et al., 1996).

Dysphagia can be classified into two major types: oropharyngeal dypshagia and esophageal dysphagia. Oropharyngeal dysphagia arises from abnormalities of muscles, nerves or structures of the oral cavity, larynx, pharynx, and upper esophageal sphincter that compromise the safety and efficiency of the swallow. Esophageal dysphagia arises from the body of the esophagus, lower esophageal sphincter, or cardia of the stomach, usually due to mechanical causes or motility problems (Spieker, 2000). Patients suffering from esophageal dysphagia complain of food getting stuck behind the sternum several seconds after swallowing. This paper will not address esophageal dysphagia in detail, but instead will focus on the multiple methods that have been developed to treat oropharyngeal dysphagia.

## WHY DIAGNOSE DYSPHAGIA?

The primary purpose for diagnosing oropharyngeal dysphagia is to identify weakness and/or incoordination of the anatomical structures involved in swallowing in order to prevent aspiration pneumonia or other respiratory diseases. Aspiration pneumonia occurs when foreign materials (e.g. food, liquid, or saliva) enter into the respiratory passages or lungs, causing inflammation and infection of the respiratory system (Dorland's Medical Dictionary, 2007).

Since the 1980s, speech-language pathologists (SLPs) have been actively involved in the evaluation and treatment of patients with swallowing disorders (Kiger, Brown, & Watkins, 2006) due to their specialized knowledge of the anatomy and physiology of the oral, pharyngeal, and respiratory mechanisms. After a clinical diagnosis of oropharyngeal dysphagia has been made, the SLP will modify the patient's food consistencies or recommend an NPO (nothing by mouth) diet in order to maintain nutrition and increase swallowing safety. The SLP is also in charge of implementing strategies that are designed to increase the strength and coordination of the patient's swallowing mechanism. However, due to the wide variety of etiologies, extensive age-range of individuals with dysphagia, and variability in the severity levels of the deficit, there is not a single treatment approach that has proven effective for all individuals with oropharyngeal dysphagia. Some patients show the most progress by using traditional compensatory swallowing techniques, which will be described later in this paper. A more contemporary technique called neuromuscular electrical stimulation (NMES) has shown a high degree of satisfaction among patients and professionals (Crary, Carnaby-Mann & Faunce, 2007), but this technique has yet to receive research support for its use and many SLPs are wary of implementing a relatively unproven method of swallowing intervention.

Because of the wide variety of treatment options available for dysphagia intervention, SLPs must have research-based evidence to refer to when choosing and implementing intervention. The goal of this paper is to discuss both traditional and contemporary treatment techniques that have proven to be most efficacious for dysphagia management. It is to be used as an evidence-based practice resource for SLPs when planning and implementing oropharyngeal dysphagia intervention.

## DEFINITION AND MEASUREMENT

Oropharyngeal dysphagia has been studied for nearly five decades, but its definition and measurement differ (Martin-Harris, 2007). Traditionally, dysphagia has been defined on the basis of three measures: bolus flow measures of duration, post-deglutitive residual, and/or airway invasion. Of the three, dysphagia is most often measured in terms of airway invasion (i.e., laryngeal penetration or tracheal aspiration) using a present-absent scoring method (Smithard et al., 1996). However, an individual may present with dysphagia without airway invasion, such as the reduction of oral preparation, bolus transit, and coordination of the pharyngeal mechanism.

Defining and measuring dysphagia has become more challenging as knowledge of the variability in normal and abnormal swallowing has increased. Studies have shown that healthy, older adults typically swallow slower and trigger the swallow more frequently when the bolus is in the hypopharynx (Martin-Harris, Brodsky, Michel, Lee, & Walters, 2007). Older adults also have increased incidences of airway invasion (Robbins, Coyle, Rosenbek, Roecker, & Wood, 1999) as compared with younger adults. In addition, bolus type (Bisch, Logemann, Rademaker, Kahrilas, & Lazarus, 1994) and test conditions (Daniels, Schroeder, DeGeorge, Corey, & Rosenbek, 2007) also affect swallowing, further complicating the definition and measurement of dysphagia. Therefore, relying on measures without knowing the normal ranges for healthy adults or using a single incidence of an abnormal measure may artificially increase the diagnoses of dysphagia. Alternatively, evaluation using a single measure or only one bolus volume or consistency may result in underdiagnosis (Daniels, Schroeder, DeGeorge, Corey, Foundas, & Rosenbek, 2009).

## ANATOMY AND PHYSIOLOGY OF LARYNX AND PHARYNX

Because this paper is to be used as a guide for practicing clinicians, the anatomical structures and physiological processes of swallowing will be briefly reviewed to provide a reference for terminology. This is not meant to be a comprehensive description of human anatomy and physiology, but rather an overview of the biological structures as they relate to the oral and pharyngeal stages of swallowing.

### LARYNGEAL ANATOMY

The larynx is found in the anterior neck at the level of the C3-C6 vertebrae. It connects the hypopharynx with the trachea and consists of nine cartilages – most prominantly, the thyroid cartilage that is commonly referred to as the “Adam’s Apple.” The larynx is innervated by branches of the Vagus nerve (cranial nerve X) on each side, and has sensory innervation to the glottis and laryngeal vestibule by the internal branch of the superior laryngeal nerve. Motor innervation to laryngeal muscles and sensory innervation to the subglottis is provided by the recurrent laryngeal nerve. The larynx has numerous intrinsic and extrinsic muscles that serve to open and close as well as lengthen and shorten the vocal folds (Gray, 1918). The biological functions of the larynx are to protect the lower respiratory tract from foreign substances (e.g. food, liquid, debris) as well as to prevent air from escaping, which assists in lifting and pushing. The non-biological function of the larynx is to generate sound through vocal fold vibration.

The larynx is suspended from the hyoid bone, which is the only bone in the human skeleton not articulated to any other bone. The hyoid bone is held in place by ligaments to the styloid processes of the temporal bones of the skull and serves as the articulating point for numerous suprahyoid and infrahyoid muscles (Gray, 1918). Contraction of the suprahyoid muscles elevates the hyoid bone, which in turn elevates the larynx in an anterior-superior motion to bring the airway safely away from the path of the bolus. Contraction of the infrahyoid muscles depresses the hyoid bone (with the exception of the thyrohyoid). Reduced elevation of the larynx is usually due to reduced hyoid bone elevation.

## PHARYNGEAL ANATOMY

The pharynx is part of the digestive tube placed behind the nasal cavities, mouth, and larynx. The pharynx is a musculomembranous tube that serves as a passageway for both food and air, and contains a flap of connective tissue called the epiglottis that closes over the larynx when food is swallowed to prevent choking or aspiration. When the bolus of food is received in the pharynx, pharyngeal constrictor muscles contract upon the bolus and convey it downward into the esophagus (Gray, 1918).

Oftentimes an individual with dysphagia will have a weakened swallow and, thus, residue will remain in the pharynx after the swallow. The two most common locations for pharyngeal residue are in lateral pockets on either side of the larynx, known as the pyriform sinuses, and between the epiglottis and anterior pharyngeal wall, known as the valleculae. The pyriform sinuses and valleculae are “safety nets” that serve as another layer of protection for the larynx. However, if substantial residue builds in these areas there is a risk for penetration or aspiration after the swallow due to overspill into the laryngeal vestibule.

Table 2

*The following chart serves as a summary of the various cranial nerves and muscles used during mastication and deglutition:*

| | | |
|---|---|---|
| *Cranial nerves* | Trigeminal (CN V)<br><br><br>Facial (CN VII)<br><br><br>Glossopharyngeal (CN IV)<br><br>Vagus (CN X)<br><br><br><br><br>Accessory (CN XI)<br><br>Hypoglossal (CN XII) | Sensory and motor innervations of the upper jaw, teeth, lips, buccal nasopharynx, cheek, anterior two-thirds of tongue, floor of mouth, temporomandibular joint (TMJ), and muscles of mastication.<br>Motor innervations of the upper facial muscles, sublingual and submandibular gland, taste from the anterior two-thirds of tongue (controls most facial expressions, secretion of tears and saliva).<br>Taste of the posterior one-third of tongue and soft palate, sense of touch, pain and temperature of the posterior one-third of tongue, faucial pillars, upper pharynx and Eustachian tube.<br>The longest nerve. Reaches from the medulla to the digestive and urinary organs. Motor innervations of the intestines, pancreas, stomach, esophagus, trachea, brachial muscles, kidneys, liver and heart. Inferior pharyngeal constrictor muscle, cricothyroid, palatal muscles (except tensor veli palatine), lower pharynx, larynx, taste from the epiglottis and valleculae.<br>Motor innervations for the sternocleidomastoid, trapezius, intrinsic laryngeal, pharyngeal, and palatal muscles (swallowing movements).<br>All intrinsic and extrinsic tongue muscles except palatoglossus. Elevates the tongue to make contact with the palate. |
| *Facial muscles* | Obicularis Oris:<br>Mentalis<br>Depressor Anguli Oris<br>Zygomatic Major<br>Zygomatic Minor<br>Depressor Labi Inferiors<br>Levator Labi Superiors<br>Levator Anguli Oris<br>Buccinator<br>Risorius | Maintains oral seal (pressing, tightening, thrusting of lips).<br>Elevates lower lip (pout).<br>Depresses corner of lips (sad face).<br>Pulls corner of mouth upward and outward (laughing).<br>Elevates the upper lip (smile).<br>Depresses lower lip and draws laterally.<br>Elevates upper lip.<br>Elevates corners of mouth.<br>Aids in mastication. Maintains bolus between teeth; whistle.<br>Pulls corner of the mouth laterally (grimace). |
| *Mandibular muscles* | Masseter<br>Temporalis<br>Medial Pterygoid<br>Lateral Pterygoid | Elevates the mandible.<br>Elevates the mandible.<br>Elevates the mandible, lateral/protrusion of the mandible.<br>Creates rotary motion and lateral/protrusion of the mandible. |
| *Tongue muscles* | Mylohyoid<br><br>Geniohyoid<br>Digastric<br><br>Superior Longitudinal<br>Inferior Longitudinal<br>Genioglossus<br>Styloglossus<br>Palatoglossus | Raises floor of mouth during chewing, depresses mandible, elevation of hyoid (CN V)<br>Elevates hyoid, weak depressor of mandible (CN VII)<br>Stability of hyoid bone, raises hyoid bone and base of tongue (CN V and VII)<br>Shape of the tongue, shortening, elevates tip (CN XII)<br>Shape of tongue, shortens, lowers tip (CN XII)<br>Protrudes tongue, depresses tongue (CN XII)<br>Retracts tongue (CN XII)<br>Elevates floor of tongue, shuts off oral from nasopharynx (CN XII) |
| *Soft palate muscles* | Palatoglossus<br>Palatopharyngeus | Elevates floor of tongue, shuts off oral from oropharynx (CN X and XI)<br>Elevates pharynx during swallowing, shortens pharynx area while swallowing (CN X and XI) |
| *Suprahyoids (submandibular)* | Digastric<br>Mylohyoid<br>Geniohyoid<br>Stylohyoid | Anterior belly, elevates hyoid (CN V)<br>Elevates hyoid (CN V)<br>Elevates hyoid (CN VII)<br>Elevates hyoid (CN VII and XII) |
| *Infrahyoids* | Omohyoid<br>Sternohyoid<br>Sternothyroid<br>Thyrohyoid | Depresses the hyoid<br>Depresses the hyoid<br>Depresses the hyoid<br>Depresses the hyoid bone thus elevating the larynx by decreasing the distance between the hyoid bone and thyroid cartilage |

## NEURAL PLASTICITY AND THE “SWALLOW RESPONSE”

Neural plasticity refers to the change and adaptation in a neural substrate that leads to associated behavioral changes that occur in response to training, environmental cues, experience, aging, injury, or disease (Tinazzi, Zanette, Volpato, Testoni, Bonato, & Manganotti, 1998; Urasaki, Genmoto, Wada, Yokota, & Akamatsu, 2002). Traditionally, swallowing was not thought to correlate to neural plasticity because it was viewed as a sequence of pharyngeal and esophageal reflexes that had little to no volitional sensorimotor control (Walton, 1985). This assumption lead to limited research and clinical practice that approached dysphagia from a behavioral point of view, and resulted in tube feedings as the primary choice of alternate modes of nutritional intake. However, during the 1980s, a large degree of behavioral, medical, and surgical interventions were conducted that greatly increased the diagnosis and treatment of oropharyngeal swallowing disorders (ECRI Report, 1999). The term “swallow response” was coined and swallowing began to be viewed as an integration of volitional and reflexive sensorimotor events, rather than simply reflexes alone. Progress continues to be made that increases the current understanding of the functional neuroanatomy of voluntary swallowing. The combination of sensorimotor neuromuscular mechanisms of dysphagia and the inventiveness of clinicians has resulted in a variety of techniques that may be used to improve swallowing behavior and promote adaptive neural plasticity (Robbins et al., 2008).

## THE USE OF VIDEOFLUOROSCOPY

Videofluoroscopy (VFS) is the gold standard method used to study the oral and pharyngeal mechanisms of neurogenic dysphagia. VFS is a dynamic assessment tool that evaluates the safety and effectiveness of a patient's deglutition and provides evidence of oropharyngeal dysfunction, such as delay in pharyngeal swallow, aspiration, nasopharyngeal regurgitation and pharyngeal residue (Clavé, et al., 2006). VFS can also be used to assess the short-term effect of therapeutic strategies on patients with dysphagia.

The VFS studies are captured using fluoroscopy in a video or digitized format that provides detailed analysis of the oropharyngeal swallowing process. The patient is asked to sit in an upright position and ingest various foods and liquids covered in barium sulfate, a type of contrast medium that is visible to x-rays. As the patient swallows the barium suspension, the pathway of the bolus is easily visible to the SLP and radiologist and any abnormalities in function and/or structure, laryngeal penetration, or tracheal aspiration can be seen. The VFS does not diagnose the etiology of the swallowing disorder, but instead determines the details of oropharyngeal swallow dysfunction and helps guide the therapist when deciding on the textures, viscosities, and postural changes that are the safest and most effective for the patient.

## TRADITIONAL DYSHPAGIA TREATMENT

SLPs have introduced a variety of therapeutic strategies to improve swallowing impairment. These strategies can range in complexity and the amount of instruction needed to correctly apply them when swallowing. Many of these traditional swallowing techniques are dependent on the patient's cognitive level and may not be suitable for patients who are unable to correctly apply the strategies while swallowing. The level of instruction and supervision that is needed will vary from patient to patient for each of the strategies discussed below.

### BOLUS SIZE

A simple strategy proven to decrease laryngeal penetration and/or aspiration is managing the bolus size. For some patients, increasing bolus volume can severely impact the safety and efficacy of deglutition (Clavé, et al., 2006). Large bolus sizes (10 ml or greater) swallowed as the first in a series of boluses of decreasing size have been observed to penetrate into the larynx more often than when the large bolus followed smaller boluses (Ekberg, Olsson, and Sundgren-Borgstrom, 1988). This can be explained by the theory of adaptation, compensation, and decompensation proposed by Buchholz and colleagues (Buchholz, Bosma, & Donner, 1985). According to this theory, the patients' pharyngeal swallow adapts during swallowing of increasing bolus volumes while decompensation occurs after a large initial bolus is swallowed. Patients who have sustained a stroke generally do not increase the duration of airway closure as bolus volume increases, as is observed in normal subjects (Bisch, Logemann, Rademaker, Kahrilas, & Lazarus, 1994).

For other patients, however, small boluses are the most difficult to manage due to reduced sensory awareness, which increases pharyngeal delay time (Bisch et al., 1994). These patients perform better with larger bolus volumes because of the increased sensory input that is provided. This may explain why some patients have difficulty managing their saliva, as saliva is usually a 1-2 ml volume when swallowed. For patients with decreased sensory awareness, Bisch et al. proposed encouraging patients to hold saliva in their mouth until it increased to a volume sufficient to be recognized and swallowed.

### VISCOSITY CHANGES

For a patient who presents with low oral tone and reduced coordination, diets are commonly changed to a texture that requires less oral strength and coordination, such as a purée. Bisch and colleagues (1994) studied the effects of viscosity change in 18 stroke patients with dysphagia ranging in severity from mild to severe. Results of the study showed a significant reduction in pharyngeal delay time with increased viscosity (1 ml liquid to 1 ml pudding) in all neurologically impaired subjects. Patients also exhibited significantly longer pharyngeal response times, significantly shorter pharyngeal transit times, and earlier airway closure on the pudding viscosity. This study emphasizes the possible therapeutic effects of bolus viscosity for some patients.

A commonly used strategy for dysphagia management is the alteration of the viscosity of a patient’s food and liquid to increase swallowing safety during oral intake. For liquids, viscosities increase in thickness from thin consistencies to nectar consistencies to honey consistencies. For solids, viscosities increase in thickness from pureéd consistencies to mechanical soft consistencies to regular consistencies. Since each patient presents with different capabilities and needs, the SLP and nutritionist must create a diet plan that assures swallowing safety, while also maintaining the patient's nutrition and hydration. In order to obtain an accurate assessment of the patient's current oral and pharyngeal capabilities, VFS studies are conducted using a variety of textures and viscosities.

Clavé, et al. (2006) examined the effects of viscosity changes in brain damaged and neurodegenerative patients. Results of the study showed a high prevalence of penetration and aspiration while swallowing liquid boluses. In brain damaged patients, increasing viscosity significantly improved efficacy of deglutition and dramatically improved swallowing safety by minimizing penetration and aspiration during the swallow, especially with pudding viscosity. In neurodegenerative patients, increasing viscosity improved bolus formation and safety by reducing penetration and aspiration during the pharyngeal phase, with the greatest improvement also being found with pudding viscosity.

The consistency of SLPs when thickening liquids to multiple viscosities was examined by Glassburn and Deem (1998), who indicated that subjective judgment of viscosity is not a valid method for dysphagia management. Results showed that the professionals were not consistent in their attempts to thicken liquids and there was too much variability between attempts. The authors of the study state that practicing SLPs are responsible for providing effective and consistent treatment to their patients with swallowing problems. Without the ability to reliably reproduce consistencies, patients cannot receive consistent treatment across the continuum from evaluation to daily intake. If SLPs are not consistent within their own mixing attempts, then it is even less likely that the consistency judged to be safe for the patient during a VFS or bedside evaluation will be the same consistency the patient later receives from another SLP or hospital staff. The results of this study indicate the need for a standard protocol during dysphagia management to ensure consistent viscosities across evaluation and treatment.

### MULTIPLE SWALLOWS

Another swallowing strategy developed for dysphagia management is the use of multiple swallows, or "dry swallows." The efficacy of this technique is most apparent when performing VFS examinations where pooling can be seen in the valleculae and pyriform sinuses. Sorin et al. (1988) conducted a case study of a 70-year old stroke patient with dysphagia who showed pooling in the valleculae and pyriform sinuses during a VFS study. This visual data resulted in the institution of an additional direct treatment management technique of having the patient take at least two dry swallows following each food swallow to compensate for the pooling. Performing the dry swallows helped this patient clear residue in the valleculae and pyriform sinuses and prevent aspiration after the swallow.

The efficacy of this treatment approach varies among patients depending on their cognitive status. Patients with dementia may not have the mental capacity to remember to utilize dry swallows after each food swallow and may require constant supervision while eating to assure the technique is used properly and consistently.

### POSTURAL CHANGES

The use of VFS studies has increased SLPs' knowledge of the effects postural changes have during swallowing. Positioning the patient in an upright neutral position is the standard guideline that has proven to be the safest posture for swallowing during swallow studies (Palmer, Kuhlemeier, Tippett, & Lynch, 1993) and employing the “chin tuck” technique can also significantly decrease the risk of penetration and aspiration. Tucking the chin toward the sternum produces a posterior shift of anterior pharyngeal structures, which narrows the laryngeal entrance and the distance from the epiglottis to the pharyngeal wall and the laryngeal entrance, while simultaneously widening the angle of the epiglottis to the anterior tracheal wall (Welch, Logemann, Rademaker, & Kahrilas, 1993). Decreasing the laryngeal entrance and widening the epiglottis improves the bolus transit from the pharynx to the esophagus and increases airway protection. Bülow, Olsson, and Ekberg (2001) found that administering the chin tuck technique significantly reduced the depth of penetration into the larynx and the trachea. Three of eight patients in their study reduced the nature of their penetration from tracheal to subepiglottic or no penetration.

Another postural change that can be an effective swallowing technique is turning the head before and during the swallow. A head turn may be beneficial for patients with unilateral vocal fold paralysis to improve vocal fold closure during the swallow or to help patients with hemiparesis affecting movement of the bolus on one side of the throat (Brady, 2008). Furthermore, patients with unilateral pharyngeal paralysis can turn their head towards the paralyzed side, which diverts the bolus down the functioning side of the pharynx.

### SUPRAGLOTTIC SWALLOW

This technique requires the patient to simultaneously swallow and hold their breath, which closes the vocal folds before, during, and after the swallow and protects the airway from foreign particles. Once the swallow has been completed, the patient is instructed to cough in order to expel any residue in the laryngeal vestibule and prevent penetration or aspiration after the swallow. Although sound in principle, there have been very few studies completed that describe the effects on bolus passage and movement of anatomical structures achieved by this technique. Bülow, et al. (2001) examined the effectiveness of the supraglottic swallow on eight patients with moderate-severe dysphagia. In their study, supraglottic swallow did not reduce the number of misdirected swallows. Furthermore, three of the eight patients could not perform the technique, which raised the questions: Is this technique too difficult to perform for patients who suffer from severe pharyngeal dysfunction? Could they not achieve enough breath-holding to protect their airways from tracheal aspiration? Should we give these patients breathing exercises? Responses to these questions may be found in the statement by Martin et al. (1993) that holding the breath does not ensure glottic closure in patients, especially in those who have significant muscle weakness and poor endurance.

Although there is little efficacy data supporting the supraglottic swallow technique during bolus swallows, there has been evidence of its usefulness in dysphagia rehabilitation. Bülow, Olsson, and Ekberg (1999) reported that the prolonged laryngeal elevation caused by inhalation at the beginning of the maneuver causes prolonged relaxation of the upper esophageal sphincter (UES), which may in turn aid in clearing the larynx more efficiently. A separate study indicates that the supraglottic swallow technique, when used as an indirect swallowing exercise, can enhance the effect of airway protection to a greater extent than when used as a direct swallowing exercise, and that due to the maneuver’s complex nature, the technique is not easy to apply in the patients with dementia (Kasahara, Hanayama, Kodama, & Aono, 2009). This study concluded that the supraglottic swallow can be used most efficiently as a warm-up to re-teaching the procedure of airway protection, and that using the technique without a bolus may be useful as an indirect swallowing exercise for strengthening and expanding the range of muscles connected to the hyoid bone.

### SUPER-SUPRAGLOTTIC SWALLOW

The super-supraglottic swallow is a more effortful breath-hold maneuver than the supraglottic swallow maneuver and requires the patient to hold their breath very tightly while simultaneously bearing down (Logemann, 1988). The bearing down helps to tilt the arytenoid cartilages forward, close the false vocal folds, and provide greater protection for the airway. After the completion of the swallow, the patient is instructed to produce a volitional cough to help remove pharyngeal residue. Studies show that airway protection mechanisms such as hyoid excursion, laryngeal elevation and UES relaxation all increased with the implementation of the super-supraglottic maneuver (Boden, Hallgren, & Witt, 2006; Ohmae, Logemann, Kaiser, Hanson, & Kahrilas, 1996). Interestingly, however, little research has been conducted to investigate the effectiveness of a volitional cough immediately following a super-supraglottic swallow; thus, further study is warranted (Wheeler-Hegland, et al. 2009).

Chaudhuri et al. (2001) suggested that prolonged voluntary closure of the glottis during the supraglottic and super-supraglottic swallowing techniques may create the Valsalva maneuver, which has been associated with sudden cardiac death and cardiac arrhythmias. Based on this research, supraglottic and super-supraglottic swallow maneuvers may be contraindicated for patients with a history of stroke or coronary artery disease due to abnormal cardiac findings during the swallowing session.

### EFFORTFUL SWALLOW

Effortful swallowing is another common treatment technique taught by SLPs to help decrease the incidence of aspiration of food and liquid into the trachea. The technique involves directing the patient to swallow “hard”, which results in the use of oral and pharyngeal muscles to a greater extent than they are used with a typical swallow. Effortful swallowing is described as a clinical compensatory approach to increase tongue-base movement posteriorly and to improve bolus clearance from the valleculae (Logemann, 1993). Hind, et al. (2001) studied the effectiveness of effortful swallowing and concluded that, with this type of swallow, the airway is protected longer, offering a smaller window of opportunity for material to be aspirated. Results also showed increased superior movement of the hyoid, which indicates heightened laryngeal elevation, a protective position, as well as diminished residue in the oral cavity due to higher oral pressures.

Bülow et al. (2001) examined the effectiveness of effortful swallowing on eight patients with pharyngeal dysfunction. The study concluded that effortful swallowing can be an effective technique to reduce the instances of laryngeal penetration, although four of eight patients in this study had difficulties performing the technique properly due to lingual weakness. Specifically, these patients had difficulty executing the upward-backward motion of the tongue that is necessary for this technique, and the researchers suggested that these patients receive oral motor exercises (tongue training) in combination with or before starting effortful swallow.

## Lingual Strengthening Exercises

Sarcopenia, the gradual loss of muscle bulk and strength, can put older individuals at greater risk for dysphagia due to reduced lingual strength and range of motion. Specific exercises designed to strengthen lingual muscles can have a positive effect on an individual's ability to control the bolus and propel it into the pharynx using the upward-backward tongue motion. Yeates, Molfenter, and Steele (2008) studied the effects of lingual strengthening exercises on three individuals with dysphagia using biofeedback from the Iowa Oral Performance Instrument (IOPI). The IOPI registers tongue-palate pressures by having the patient hold an air-filled bulb in either the anterior or posterior position of the mouth. When the bulb is in the anterior position, the patient uses the tongue tip to press the bulb toward the center of the alveolar ridge. Exercises in the posterior position require that the patient press the bulb with the midpoint of the tongue to the midpoint of the hard palate. Half of the exercises were isometric strength exercises that required the patient to press the bulb against the palate as hard as possible. The other half of the exercises were accuracy tasks in which the patient was instructed to generate precise pressures in either the anterior or posterior bulb location. Results of the study showed gains in both tongue strength and accuracy, improved bolus control on VFS, and improved functional dietary intake by mouth. It should be noted, however, that gains were slow and gradual and were not always observable until the midway point of treatment. This study indicates that tongue-pressure training can be beneficial for improving swallowing and holds promise as a rehabilitative tool for various dysphagia populations.

A similar study using the IOPI was previously conducted by Robbins et al. (2007) and outcome measures showed significant increases in tongue strength and swallowing pressure. Results also showed a significant reduction in overall oral and pharyngeal residue, as well as instances of penetration and aspiration. Significant decreases were also noted in the patients' oral transit duration, while an increase in the pharyngeal response duration was observed. Additionally, MRI scans of the tongue showed increased lingual volumes after eight weeks of exercises. The patients in the study reported decreased coughing on liquids, dietary upgrades, and an improved ability to use supplemental compensatory strategies (i.e., supraglottic swallow). This study suggests combining lingual strengthening exercises with standard dysphagia intervention to maximize gains in swallowing function and safety.

### THE MENDELSOHN MANEUVER

Another of the volitional swallowing techniques is known as the Mendelsohn maneuver. This maneuver was designed to treat dysphagia characterized by both reduced laryngeal excursion and limited cricopharyngeal opening (Logemann, 1988) and requires the patient to hold the larynx up, either using the muscles of the neck or with the hand, during the swallow for a count of at least two seconds. Studies show that, while the maneuver was originally designed to simply increase the duration of the UES opening, it also increases airway protection and muscle activation patterns by increasing the duration of the anterior-superior excursion of the larynx (Boden, Hallgren, & Witt, 2006; Ding, Larson, Logemann, & Rademaker, 2002: Kahrilas, Logemann, Krugler, & Flanagan, 1991). The potential of increased and prolonged laryngeal muscle activation makes the Mendelsohn maneuver appropriate for direct swallowing exercise (Wheeler-Hegland et al. 2009).

## Shaker Exercise

The Shaker exercise employs isometric and isokinetic neck exercises to strengthen the suprahyoid muscles including the geniohyoid, thyrohyoid, and digastrics muscles. The isometric exercises involved in this technique require the patient to lay on his back and complete three consecutive head lifts for 60 seconds with a 60-second rest period between each head lift, causing muscle tension without movement. The isokinetic strengthening exercises involve slowly lifting the head 30 times because slower movements provide greater strength gains than rapid movements. This exercise regimen is performed three times a day for six weeks (Shaker & Antonik, 2006).

Research shows increases in anterior excursion of the larynx and UES opening after continued use of Shaker exercises (Shaker, Kern, & Bardan, 1997). The Shaker exercises have also been shown to be effective at restoring oral feeding in patients with percutaneous feeding tubes due to severe UES dysfunction, and have also been shown to significantly improve anterior laryngeal excursion and post-deglutitive aspiration (Shaker, Easterling, & Kern, 2002).

## Tongue-Hold Maneuver

Fujiu and Logemann (1996) investigated the effects of a tongue-hold maneuver on the anterior bulging of the posterior pharyngeal wall (PPW). The PPW and base of tongue (BOT) are anatomically linked by way of the glossopharyngeus muscle, and the contraction of the PPW and its contact with the BOT is an essential part of the pharyngeal swallow and the initiation of pharyngeal peristalsis. This study was designed to investigate the potential for compensatory movement of the PPW during swallowing when movement of the BOT is restricted. The normal participants were asked to protrude their tongue and hold it between their incisors after a bolus was introduced into the mouth. Results showed a significant increase in PPW bulging with the maneuver, indicating potential for developing new treatment techniques to facilitate compensatory anterior movement of the PPW. However, VFS studies showed increased pharyngeal residue and risk of aspiration after the swallow due to reduced BOT retraction, which suggests the use of this maneuver as a strengthening exercise (Shaker & Antonik, 2006).

Data shows that the ultimately desired effect of this maneuver does not occur immediately but may arise after regular training. Increased pharyngeal constrictor strength, however, may reduce the anterior movement of the hyoid and this maneuver may be contraindicated for patients with decreased anterior hyoid movement. For these patients, it may be beneficial to provide the tongue-hold maneuver alongside the head-lift exercise that strengthens the submental muscles that move the hyoid anteriorly (Doeltgen, Witte, Gumbley & Huckabee, 2009).

### ORAL MOTOR EXERCISES

Neuromuscular treatment (NMT) is a popular therapeutic practice among physical therapists (PTs), occupational therapists (OTs), and SLPs to increase muscle strength and endurance (Clark, 2003). Although each discipline uses NMT in significantly different ways (e.g., PTs target trunk and limb movement; SLPs target oral and pharyngeal movement), the fundamental principles guiding the practice remain the same – to improve strength, endurance, and range of motion (ROM).

In regards to oropharyngeal dysphagia, oral motor exercises can be used to target specific muscles in the tongue, lips, and jaw in order to improve mastication and bolus formation and decrease oral residue. It is important that the SLP has an adequate understanding of how neuromuscular dysfunctions affect movement and how motor-based treatments influence underlying impairments (Clark, 2003). The ability to accurately assess a patient, evaluate information, and implement appropriate exercises is essential. Gangale (2001) provides a guidebook with a myriad of oral motor exercises designed to increase strength and ROM. Specific exercises include protruding the tongue as far as possible outside the mouth to improve strength and ROM, alternating between pursed and retracted lip movements (e.g., "ooh" and "eee"), and using a bite block to passively stretch and increase strength and ROM, among others. Passive stretching is a technique designed to reduce spasticity (e.g., spastic dysarthria) and rigidity (e.g., hypokinetic dysarthria), which may improve the oral stage of ingestion.

Although oral motor exercises are commonly practiced among clinicians and a variety of oral motor workshops, therapy guidebooks, and commercially developed therapy "kits" are offered, empirical support necessary for the inclusion of NMT in evidence-based practice is lacking and controversy surrounds the use of these techniques. Specifically, opponents of oral motor exercises state that if speech or swallowing activity is the behavior of interest, then speech or swallowing is what should be treated. Individuals who hold this view believe oral motor exercises do not directly address the problem and are not a justifiable means of treatment. Conversely, supporters of oral motor exercises believe that if underlying impairments in neuromuscular function are contributing to dysarthria or dysphagia, then appropriate identification and remediation of the underlying impairments should improve speech and swallowing function, and that the relationship between neuromuscular impairments and resulting limitations in speech and swallowing are variable and cannot be predicted (Clark, 2003).

## SENSORY STIMULATION

The theoretical basis of sensory stimulation techniques, such as thermal stimulation and deep pharyngeal neuromuscular stimulation (DPNS) that use cold temperature, sour taste, and/or deep pressure application, is that these interventions stimulate the sensory receptors in the mucosa of the oral and pharyngeal structures. The stimulation promotes neuromuscular function by facilitating a swallow response or reflex (Suiter & Easterling, 2007).

In its simplest form, the method requires a clinician to touch or stroke one or both of the patient's faucial pillars several times with a cold and/or sour probe (e.g., iced lemon glycerine swab) after which the patient is urged to swallow (Rosenbek, Robbins, Fishback, & Levine, 1991). This technique is recommended for patients exhibiting delayed triggering of the swallowing reflex (Logemann, 1983). Its purpose, according to Logemann (1986), is to heighten the sensitivity for the swallow in the oral cavity so that when the patient voluntarily attempts to swallow, he or she will trigger a reflex more rapidly.

Published research regarding the efficacy of thermal stimulation and DPNS is limited and the findings vary among studies. Lazzara, Lazarus, and Logemann (1986) found that thermal sensitization improved triggering of the swallowing reflex in 23 of the 25 neurologically impaired patients who were studied. They found that total transit time and total speed of the swallow improved significantly enough to reduce the chances of aspiration before the swallow that may result from a delayed reflex. Bisch et al. (1994) examined the effects cold boluses had on dysphagic patients who ranged in severity, and noted that the only positive effects thermal stimulation had were on the pharyngeal delay times of mildly dysphagic patients. This authors of this study hypothesized that patients with severe dysphagia may have been too impaired to be facilitated by the cold bolus. Or, these participants may have suffered a central sensory deficit that reduced their reception, awareness/recognition, or processing of bolus temperature differences. Despite the generally minimal effects of cold observed in this study, it was concluded that the SLP may find individual dysphagic patients for whom a cold bolus provides therapeutic effects. Similarly, a study by Rosenbek, Robbins, Fishback, and Levine (1991) failed to reveal strong evidence that thermal application improves dysphagia for patients who have had multiple strokes. This study suggests that clinicians should be cautious about promising too much, too fast. Further research targeting the effects of thermal stimulation and DPNS is needed.

# NEUROMUSCULAR ELECTRICAL STIMULATION

The first evidence that electrical current can activate muscle occurred in 1771 when Luigi Galvani, an Italian physician and physicist, discovered that the muscles of dead frogs' legs twitched when struck by a spark (Eric Weisstein's World of Biography, 2007). Research studying the effects of electrical current on muscle activation continued throughout the 19th and 20th centuries, and evidence was found that the body functions induced by electrical current had long-term effects on the muscles (Pette, Smith, Staudte, & Vrbova, 1973). Because of these findings, neuromuscular electrical stimulation (NMES) has become common practice in its use as a training tool (Banerjee, Caufield, Crowe, & Clark, 2005) and as a therapeutic tool (Lake, 1992). In medicine, electrical stimulation has been commonly used for rehabilitation purposes and to prevent muscle atrophy after musculoskeletal injuries to bones, tendons, joints, etc. (Gibson, Smith, & Rennie,1988).

In the field of speech-language pathology, NMES is used to rehabilitate and reeducate the oropharyngeal muscles necessary for swallowing, with the most common etiology of dysphagia treated with electrical stimulation being stroke. The majority of SLPs do not have specific dysphagia criteria for application of electrical stimulation and use a variety of traditional clinical techniques in addition to electrical stimulation (Crary, Carnaby-Mann, & Faunce, 2007).

## THEORY OF USE

The underlying principle of electrical stimulation is that when electrodes are bonded to the skin or oral mucosa at low current levels, they activate the sensory nerve endings in the surface layers and provide sensory feedback to the central nervous system (Ludlow et al., 2007).

With increased current amplitude (intensity) and/or phase duration (pulse width), the electric field may depolarize nerve endings in muscles lying beneath the skin surface (Loeb & Gans, 1986) and may spread with diminishing density to produce muscle contraction via motor nerve fibers (E-stim Training Manual, 2007).

When electrodes are placed in the submental (suprahyoid) region, the electrical current is most dense at the skin surface and distributes throughout the platysma muscle and subcutaneous fat, diminishing in intensity as the current travels deeper into the muscle. As the amplitude of the current increases, the deeper muscles may be recruited, such as the anterior belly of the digastric, which can either lower the mandible or pull the hyoid upward depending on whether the mouth is held closed. As the current travels deeper it reaches the mylohyoid and geniohyoid muscles, which pull the hyoid bone in an anterior-superior position. Because these muscles are deeper than the platysma muscle, they are less likely to be activated by surface stimulation. Similarly, if electrodes are placed on the skin overlying the thyroid cartilage, the current will be greater at the skin with less intensity to the underlying platysma muscle and even less intensity to the underlying infrahyoid muscles (sternohyoid and omohyoid) that pull the hyoid bone downward and backward toward the sternum (Ludlow et al., 2007).

**COMPETING THEORIES OF PRACTICE**

There are two major theories of practice governing the implementation of electrical stimulation therapy – VitalStim and E-Stim. In 2003, VitalStim became the only NMES technique approved by the Food and Drug Administration (FDA) for the treatment of dysphagia. During the VitalStim session, the SLP places four electrodes on the surface of the patient's anterior neck. There are a variety of placement options available to the SLP (depending on the specific swallowing deficits) that target both the submental region and the laryngeal region, with the aim of producing a simultaneous contraction of the suprahyoid muscles in the submental region (to elevate the hyoid bone) and the thyrohyoid in the neck (to elevate the larynx to the hyoid bone) (Ludlow, 2007). The VitalStim device is at a pre-set electrical current level and gives continual stimulation, with a small break every 60 seconds. The VitalStim transmitter is different than traditional electric stimulation devices used for other muscles in that it only delivers one quarter of the electrical stimulation. The typical VitalStim session lasts for one hour and the patient is encouraged to take small sips or bites, to swallow hard, and to remember to clear the throat, if needed. These small sips and bites slowly re-educate the throat muscles to handle thin liquids. Throughout the session the patient's health is monitored using a pulsoximeter to measure the patient's blood oxygen saturation levels and heart rate (VitalStim Training Manual, 2003).

The second NMES technique that is gaining in popularity is referred to as E-Stim, which is a budding approach that has not yet been approved by the FDA. E-Stim involves two electrodes that are placed in the submental region to contract the digastric, mylohyoid, and geniohyoid muscles in order to elevate the hyoid bone (Campbell, Polansky, & McAdoo, 1998). Like VitalStim, the patient is encouraged to practice swallowing while receiving E-Stim therapy in order to improve the timing of the swallowing mechanism. In contrast to VitalStim, however, the patient does not swallow liquid of food during the contraction. Also, E-Stim does not place electrodes on the laryngeal region and only targets the elevation of the hyoid bone. Furthermore, E-Stim has a range of electrical current levels and pulse widths that can be increased or decreased by the therapist, as needed, (whereas VitalStim has a fixed current level) and the current only flows for four seconds at a time with a 15-30 second pause in between contractions.

Controversy lies in the placement (or lack thereof) of the electrodes during both types of NMES therapy. Supporters of VitalStim contend that, from an anatomical standpoint, elevation of the hyoid bone without simultaneous stimulation of the thyrohyoid to raise the larynx would leave the larynx down, resulting in further opening of the vestibule and increased risk of aspiration. Only if the mylohyoid and thyrohyoid muscles are activated together, they say, without contraction of the sternohyoid, would both the hyoid and larynx be raised together (Ludlow, 2007).

E-Stim advocates say that the simultaneous contraction of the mylohyoid and thyrohyoid cannot be achieved using surface stimulation because the larger sternohyoid muscle overlies the thyrohyoid and pulls the hyoid downward during contraction. They contend that placing electrodes on the submental region activates the mylohyoid and geniohyoid, which raises the hyoid bone, whereas electrodes over the larynx may activate the sternohyoid and omohyoid, which lower the hyoid bone, and that the muscles below the hyoid (sternohyoid and omohyoid) overpower any elevation effects due to geniohyoid and mylohyoid contraction induced by the upper electrodes. Because the sternohyoid and omohyoid are large, they may be more powerful than the geniohyoid and mylohyoid muscles (Humbert, et al., 2006).

These two competing theories make it difficult for SLPs to know which technique is most effective. Further research directly comparing the efficacy of the two techniques needs to be done to give SLPs the evidence needed to support their clinical decisions.

## EVIDENCE OF EFFICACY FOR NMES

Numerous studies have examined the benefits of NMES in the treatment of dysphagia and have reported positive outcomes. Due to the relatively brief period in which E-Stim therapy has been available, most research focusing on NMES has been based on the VitalStim method of treatment. However, a large number of practicing SLPs are reluctant to implement this technique, stating the need for more objective and systematic data on clinical outcomes and safety of NMES techniques (Crary, Carnaby-Mann, & Faunce, 2007).

Freed et al. (2001) compared clinical outcomes of NMES therapy to the outcomes obtained through thermal stimulation therapy in a group of dysphagic patients, most of which were individuals with acute post stroke dysphagia. The study reported significant improvement in the patient's ability to swallow following electrical stimulation treatment and concluded that NMES appears to be a safe and effective treatment for dysphagia due to stroke and results in better swallow function than conventional thermal stimulation treatment.

Leelamanit et al. (2002) studied 23 chronic dysphagia patients with impaired hyolaryngeal excursion. Using VFS assessment, the study reported improved swallowing ability and a return to normal oral intake in 20 of the 23 individuals who received NMES for prolonged periods (4 hours a day) during 2-3 weeks of intervention. These researchers used three electrodes (two overlying the submandibular gland and one at the ear lobule as a ground) to create a synchronized stimulation that generates a potential to stimulate the thyrohyoid muscle to contract simultaneously with the swallowing act of the posterior tongue.

Ludlow et al. (2007) investigated the effects of VitalStim on both healthy adults and chronic dysphagia patients with multiple etiologies. Their study did not demonstrate any increase in physiological measures at rest in the normal population, but did report improvements in the functional swallow in the dysphagic individuals. These researcher evaluated the immediate effect of surface electrical stimulation on swallowing physiology and discussed the potential confounding factors of attempting to stimulate deep pharyngeal musculature with surface stimulation.

## ELECTRICAL STIMULATION VS. TRADITIONAL THERAPY

Blumenfield et al. (2006) completed a retrospective chart review on patients in a long-term acute care setting, comparing patients who received traditional dysphagia therapy (any combination of laryngeal adduction and elevation exercises, Shaker exercises, and oral motor exercises) with those who were treated solely with VitalStim therapy. The majority (70%) of patients had profound dysphagia before starting treatment with swallowing ability rated at 0 (nothing safe/aspirates everything) or 1 (only safe swallowing saliva). Results of the study suggest that dysphagia therapy with electrical stimulation only is superior to traditional dysphagia therapy alone in individuals in a long-term acute care facility. Individuals receiving NMES therapy required fewer treatment sessions and displayed a trend toward shorter lengths of hospitalization then individuals receiving traditional dysphagia therapy.

Conversely, Kiger, Brown and Watkins (2006) compared swallowing outcomes using VitalStim therapy to outcomes using traditional therapy and found no statistically significant difference in outcomes between the two groups. However, several confounding factors may have limited the results of the individuals receiving VitalStim therapy (e.g., medical complications, receiving treatment further post onset, difficulty tolerating VitalStim, small size of experimental and control groups, etc.)

Bülow, Speyer, Baijens, Woisard, and Ekberg (2008) reported similar findings as Kiger et al. (2006) when they evaluated and compared the outcome of NMES versus traditional swallowing therapy in stroke patients using VFSS, nutritional status, oral motor function tests and patient's subjective self-evaluation of complaints. Results showed no statistically significant differences in outcomes for any measure between NMES and traditional therapy.

Baijens, Speyer, Roodenburg, and Manni (2008) completed a case study of a 76-year old man who three years earlier had experienced two strokes resulting in opercular syndrome – characterized by complete bilateral loss of voluntary control of facial, lingual, pharyngeal and masticatory muscles – resulting in severe dysphagia and PEG tube feeding. Despite traditional dysphagia treatment during the first year after the second stroke, the patient's dysphagia had not improved and he remained on PEG tube feeding. NMES treatment and traditional treatment were simultaneously initiated, and the combination of NMES and traditional treatment improved the reflexive and automatic movements during the swallowing act and, posttreatment, dysphagia with minor diet restrictions was observed. One year after therapy, the patient's clinical condition had not changed and he remained on an oral diet without pneumonia.

## EVIDENCE AGAINST NMES

Along with the numerous studies supporting the use of NMES as an effective tool for treating oropharyngeal dysphagia, there have also been studies that have not supported its effectiveness.

Ludlow (2005) examined the effect electrical stimulation on the external lateral neck had on hyolaryngeal elevation during the swallow. Results of this study found that electrical stimulation on the neck surface actually caused downward movement of the hyoid during the swallow, probably as the result of stimulation to the sternohyoid muscle rather than the thyrohyoid muscle.

Humbert et al. (2006) confirmed the findings of the previous study by providing evidence that surface electrical stimulation causes significant hyoid and laryngeal descent at rest and reduced hyoid and laryngeal peak elevation during the swallow in healthy adults. These authors suggest that surface stimulation would be detrimental to hyolaryngeal elevation in dysphagic individuals, particularly in those with already reduced volitional hyolaryngeal elevation.

Suiter, Leder, and Ruark (2006) conducted two week trials of NMES applied to submental muscles to investigate if there were increases in myoelectric activity. Results of this study failed to produce significant gains in myoelectric muscle activity. Seven of eight participants in this study exhibited no significant gains, while one participant experienced a decrease in myoelectric muscle activity following NMES. The authors propose that individual response to electrical stimulation of the submental muscles may be frequency-specific.

## ETHICAL DECISION-MAKING

In some cases, patients are unable to achieve adequate oral intake after multiple treatment approaches have been exhausted and remain at a high risk for complications secondary to consistent aspiration. In these circumstances, SLPs, in conjunction with a physician or medical team, will usually recommend an alternate means of nutritional support (e.g., nasogastric or gastronomy tubes). These alternate means are typically supported by the patient and their family in order to maintain and/or avoid the complications of aspiration, which may lead to pneumonia, respiratory distress, and sometimes death (Sharp & Genesen, 1996).

Tube feedings are usually consistent with both the medical and ethical standards of care, but occasionally a patient or family will refuse artificially administered nutritional support due to a variety of reasons (e.g., unwillingness to deny the pleasures of oral feeding, possible discomfort associated with NG or PEG tube, or concerns regarding prolonging suffering by sustaining life). In most cases, the use of a feeding tube is ethically justifiable or obligatory, but occasionally there are cases in which a feeding tube may be optional or even inappropriate, such as the case presentations presented by Sharp and Genesen (1996). In these cases, the SLP may encounter an ethical dilemma between their obligation as healthcare provider to benefit the patient and their obligation to do no harm (Johnson & Jacobson, 1998).

Jonsen, Siegler, and Winslade (1992) proposed a clinical and ethical decision-making model illustrating the four components of decision-making. They state that most clinical and ethical decisions can be made by balancing the medical indications with the preferences of the patient because these two features have the most weight in ethical decision-making and thus are depicted above external assessments of quality of life and other contextual features.

Table 2

| **Medical Indications** | **Patient Preferences** |
|---|---|
| Medical history<br>Accurate diagnosis<br>Accurate prognosis<br>Treatment options | Personal history<br>Religious & personal values<br>Expressed preferences<br>Advance directives<br>Self assessment of quality of life<br>Able to make & communicate decisions |
| **Quality of Life** | **Contextual Features** |
| External assessment of benefits and burdens<br>Subjective judgment<br>Who should decide when the patient cannot? | Economic – insurance, availability, cost<br>Family preferences<br>Legal issues<br>Burdens on caregivers |

Although SLPs are never solely responsible for the placement or withdrawal of feeding tubes, they are often involved in a team decision-making process. Because SLPs are frequently fearful of litigation concerning dysphagia management and because there is not a clear cut set of criteria for making treatment decisions, it is important that SLPs be educated in the ethical and legal framework of their profession so that their input is based on objective rather than conscience-led decisions (Goodhall, 1997). SLPs should know that legislation regarding tube-feeding decisions has been strongly influenced by the Patient Self-Determination Act of 1990 and the constitutional right to privacy, and that in general, legal court cases regarding tube feeding have ruled in favor of honoring the patients' rights to refuse artificial nutrition and hydration (Mulholland, 1991). Situations in which the patients' judgment is in question and there are no wishes stated in their will are still a gray area. The often confusing, ever-changing, and differing legal standards from state to state, as well as variations in institutional policies, further compound the confusion (Landes, 1999).

# CONCLUSION

This paper provides an evidence-based outline to practicing SLPs of the various intervention strategies that have been developed for oropharyngeal dysphagia intervention. Due to the multiple treatment approaches available for SLPs in the management of dysphagia and the variability amongst each patient, it is critical that intervention be conducted on a case-by-case basis. No one treatment has proven effective for all patients, and not all patients will improve with treatment. The SLP must use the available diagnostic tools to assess each patient's specific oropharyngeal deficits and draw upon their knowledge of the various treatment options in order to decide which approach is most appropriate for each individual patient. Practicing SLPs must also maintain an adequate knowledge of the anatomy and physiology of the swallowing mechanism in order to accurately decipher the area(s) with the greatest deficit. The ability to pinpoint specific structures in the patient's oropharyngeal anatomy can aid in a more focused and intensive treatment that may yield better results.

Some of the treatment approaches described in this paper have limited research to support their use and some approaches have poor efficacy or contraindications for their use. The SLP must choose which approach, or combination of approaches, will be most beneficial to the patient in order to improve his or her swallowing ability, and must wade through the ethical and legal issues surrounding this delicate human issue.

In a field where evidence-based practice is the guiding force behind treatment, more research needs to be conducted focused on the efficacy of swallowing interventions, particularly electrical stimulation. Until there is a larger base of supporting evidence confirming its effectiveness, many SLPs will continue to be wary of adding electrical stimulation to their list of therapeutic approaches and the technique will remain controversial.

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