1997

Speech-Language Pathologists' Opinions of the Reliability of the Modified Evan's Blue Dye Test for Detecting Aspiration

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Speech-Language Pathologists' Opinions of the Reliability

of the Modified Evan's Blue Dye Test for Detecting Aspiration
(TITLE)

BY

Amy N. Sanders

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Science

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1997
YEAR

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Running head: OPINIONS OF MEBDT

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Abstract

This study attempted to determine if there was a relationship between speech-language pathologists (SLP) opinion of the reliability of the Modified Evan's Blue Dye Test (MEBDT) for assessing aspiration in tracheostomized patients and three factors: (1) number of years working in the field of speech-language pathology, (2) amount of hours per week spent treating dysphagia patients, and (3) number of seminars/conferences attended related to dysphagia management in the last two years. One hundred and six SLPs in the medical setting were surveyed, 52 responded resulting in a return rate of 49.5%. The data collected through the survey was subjected to statistical analyses which included the Pearson r correlation, an ANOVA using three factors, and a chi-square analysis. The Pearson r correlation showed a significant correlation involving the amount of hours per week spent treating dysphagia patients and the total score on the survey. Results revealed an $r = .5720$ ($p = .000$). The ANOVA revealed a significant main effect ($p = .026$) between hours per week spent treating dysphagia patients and the total score on the survey. The remaining two factors, years of experience and number of seminars/conferences attended related to dysphagia management, showed no significant correlation or main effect. Chi-square results revealed that: (1) those who use food dye to assess aspiration tend to view the MEBDT as a reliable measure for

detecting aspiration, (2) those who treat patients with tracheostomies deem the MEBDT to be as reliable as videofluoroscopy for detecting aspiration, and (3) those who use food dye to assess aspiration consider the MEBDT to be as reliable as videofluoroscopy for detecting aspiration. These findings suggest that those who use the MEBDT most frequently deem it to be a reliable measure of detecting aspiration perhaps reflecting an unconscious bias toward this technique. This bias appears to exist regardless of the fact that there is no research base to support the MEBDT as a reliable measure of aspiration.

Acknowledgments

I would like to begin by thanking my thesis committee members. Frank Goldacker, chair of my committee, was always willing to take time to explain things to me and created humor in circumstances when I believed there was none to be found. Mary Anne Hanner, committee member, whose input was always right on the mark and assisted me in improving my writing ability. Brenda Wilson, committee member, who always had confidence in me even when I could not find it in myself.

Secondly, I wish to thank all of the speech-langauge pathologists who took the time out of their busy schedules to fill out my survey. Without them, none of this would have been possible.

I would also like to extend my thanks to the faculty at Eastern Illinois University who pushed me to ensure that I became the best speech-language pathologist possible.

Lastly, I would like to thank my family and friends. Without your support I would have never been able to complete this project.

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Introduction

The diagnosis and treatment of dysphagia have become a significant part of the field of speech-language pathology over the last several years. In a survey taken in 1985, over 35% of speech-language pathologists (SLPs) were involved in dysphagia management (ASHA, 1987). With this new area of practice comes the responsibility of demonstrating that the methods and techniques that are used are valid and reliable. The videofluoroscopy swallow study (VFSS) and the Modified Evan's Blue Dye Test (MEBDT) are two techniques that are commonly used to identify aspiration, a symptom of dysphagia. While the effectiveness of the VFSS for diagnosing alterations in swallowing function is well established (Crogan, Burke, Caplan, & Denman, 1994; Groher, 1984), the reliability of the MEBDT for detecting aspiration has recently been questioned (Thompson-Henry & Braddock, 1995). This presents a challenge for the profession to produce evidence which either supports or disproves the effectiveness of the MEBDT before continuing its use as a diagnostic tool.

Aspiration, or penetration of material below the true vocal folds, is a frequent consequence of dysphagia. Aspiration can be life threatening because of the danger of aspiration pneumonia and the risk of airway obstruction. Unfortunately, aspiration is not always detectable by coughing or choking because some patients silently aspirate

(Logemann, 1983). Silent aspiration occurs when material penetrates below the true vocal folds but the patient does not display a cough reflex to expectorate the material. Thus the material proceeds to the lungs possibly resulting in aspiration pneumonia.

The videofluoroscopy study is used to observe the stages of swallowing, and allows viewing of aspiration (Logemann, 1983). It also permits simultaneous voice recording for further analysis of swallowing. Although videofluoroscopy is a valuable tool, it is not practical for use with patients who cannot be transported to a radiology suite or for those who need frequent reassessment (Bastien, 1993).

The Modified Evans Blue Dye Test (MEBDT) is a diagnostic technique used to detect aspiration in a patient with a tracheostomy tube that can be given at bedside (Logemann, 1993). Although aspiration may be detected using this technique, there is little information regarding its reliability. A study of five cases using retrospective data in which the MEBDT was utilized, revealed that aspiration was not present in these patients when they were tested using the MEBDT (Thompson-Henry & Braddock, 1995). The results of the MEBDT were thus judged to be false negatives because when the patients were subsequently administered a videofluoroscopy study aspiration was detected. This has given rise to questions concerning the reliability of the

MEBDT as a bedside assessment technique.

Significant limitations existed in the study by Thompson-Henry and Braddock (Tippett & Siebens, 1996). One limitation noted in the study is the interval of time between administration of the MEBDT procedure and either the videofluoroscopy swallow study (VFSS) or the fiberoptic endoscopic examination of swallowing (FEES) varied from four to 22 days. FEES is another procedure in which aspiration or the evidence of aspiration can be directly observed (Langmore, Schatz, & Olsen, 1988). The MEBDT may have been correct in its assessment of a negative finding that no aspiration was present, but the patients' conditions could have changed by the time the other type of swallowing assessment was administered (Leder, 1996). Without administering the tests concurrently, judgements cannot be made regarding the reliability of the MEBDT. Another limitation of the study is that the amount of aspiration, which could vary from a trace to a large amount, was not indicated for any of the five subjects. It is acknowledged that the MEBDT does not detect trace amounts of aspiration, therefore, it is necessary to know the amount of aspiration detected in the VFSS (Thompson-Henry & Braddock, 1996). A third limitation is that the basis of referral for the VFSS or the FEES is not described. This makes comparisons between patients difficult. For example, the referral may have requested that the SLP examine

different aspects of swallowing in different patients and thus did not focus specifically on aspiration. None of these questions were addressed in the Thompson-Henry and Braddock study making their conclusion that the MEBDT is not a reliable measure invalid (Tippett & Siebens, 1996).

Despite recent evidence that the MEBDT may not be a reliable method of aspiration detection in tracheostomized patients, this technique is widely employed by SLPs working in medical settings. SLPs apparently believe that the MEBDT is a reliable procedure for bedside assessment of aspiration. When this author unsuccessfully initiated a study comparing findings of MEBDT and VFSS, there was an unenthusiastic response to the request for subjects. This led the researcher to conclude that perhaps one reason for the poor response was that SLPs who engage in dysphagia management harbor an unconscious bias toward the MEBDT and do not recognize a need for research in this area. A broad search of the literature using terms and combination of terms such as speech-language pathologists, opinions, attitudes, health professions, MEBDT, blue dye test, Evan's blue dye, and videofluoroscopy yielded no related studies. This indicated that no current literature pertaining to SLP opinions concerning the the MEBDT is available.

The purpose of this study is to survey SLPs to determine if opinions of the MEBDT are influenced by factors such as: a) number of years working in the field, b) amount

of time spent working with dysphagia patients, and c) number of seminars/conferences attended related to dysphagia management.

Review of the Literature

A review of related literature provided information concerning the anatomy and physiology of swallowing, etiologies which result in disturbances of swallowing, descriptions of swallowing disturbances, aspiration, assessment of aspiration, and the effect of tracheostomy tubes on swallowing.

Anatomy and Physiology of Swallowing

Logemann (1983) describes normal swallowing or deglutition as occurring in four separate phases: the oral preparatory, oral, pharyngeal and esophageal. These phases involve the intricate coordination of the structures in each phase for proper swallowing. These anatomic areas can be divided into the oral cavity, pharynx, larynx, and the esophagus (Logemann, 1983). The oral cavity consists of the lips, teeth, hard palate, soft palate, uvula, mandible, floor of the mouth, tongue and the faucial arches. Abnormalities in anatomical structures can cause swallowing difficulty. An example of a difficulty that could result from an anatomical abnormality is the pocketing of food in the lateral sulcus due to scarring of the buccal musculature.

According to Logemann (1983), there are three major structures of the pharynx which are important for normal deglutition: the superior, medial and inferior pharyngeal

constrictors. All three constrictors assist in the downward propulsion of the bolus. In addition to propelling the bolus downward, the inferior pharyngeal constrictors connect to the thyroid cartilage anteriorly creating a space between the sides of the thyroid cartilage and the fibers of the inferior constrictors. These spaces are called the pyriform sinuses. Material can fall into these spaces and enter the open airway after the swallowing response has been triggered. The most inferior portion of the sinuses are adjacent to the most inferior structure of the pharynx, the cricopharyngeus muscle. The cricopharyngeus, also called the pharyngoesophageal segment or the PE segment, is the superior portion of the esophagus. In its resting state, the PE segment is in a state of tonic contracture. This prevents the bolus, or material, from refluxing back into the pharynx, as well as preventing air entering the esophagus during normal respiration. As the bolus reaches this point in the swallow, the PE segment relaxes allowing the bolus to pass from the pharynx into the esophagus.

The esophagus consists of two layers of muscle. The inner layer of muscle is circular, while the outer is longitudinal (Logemann, 1983). Each of these layers contains three types of muscle. In the top third of the esophagus there is striated muscle, the middle is a combination of both striated and smooth muscle, and the

lower third is all smooth muscle. These muscles cause a hollow tube to be formed that is approximately 23 to 25 cm long. At the juncture between the esophagus and the stomach is the inferior sphincter, also called the lower esophageal sphincter, or LES. When open, the sphincter allows material to pass from the esophagus into the stomach.

The entrance to the larynx is at the base of the tongue and Logemann (1983) describes it as a valve to protect the airway from entrance of material. At the top of the larynx is the epiglottis. It rests against the base of the tongue forming a wedge-shaped space between the base of the tongue and epiglottis known as the valleculae. The valleculae, along with the pyriform sinuses, are known as the pharyngeal recesses. These recesses can present difficulties because of the possibility of collection of food in these areas before or after the swallow response is triggered if there is not adequate swallowing mechanism to clear these spaces. This "pooled" material can overflow into the open airway and result in aspiration. The opening into the larynx is known as the laryngeal vestibule. The laryngeal vestibule consists of the area from the epiglottic-aryepiglottic folds to the superior surface of the false vocal folds.

The aryepiglottic folds are part of the intrinsic muscles of the larynx. These attach to the lateral margins of the epiglottis, and circle the arytenoid cartilages, controlling the movement of the true vocal folds. The

aryepiglottic folds end at the inferior portion of the false vocal folds. The area between the false and the true vocal cords is called the laryngeal ventricle and is located on both sides of the larynx. These three structures, the epiglottic/aryepiglottic folds, false folds, and true vocal folds, form three levels of protection from aspiration at the superior portion of the trachea (Logemann, 1983). This system is capable of completely shutting the airway off from the pharynx, thus preventing material from entering the airway.

Logemann (1983) described the act of swallowing as consisting of four stages: the oral preparatory, oral, pharyngeal, and the esophageal. During the oral preparatory stage, the lips create a seal to be maintained throughout the process to keep material from escaping anteriorly out of the mouth. Material requiring mastication is mixed with saliva by rotary and lateral movement of the mandible and the tongue. The upper and lower teeth are used to crush the material, which then falls back onto the tongue. The tongue proceeds to place the material back onto the teeth as the mandible opens. This process continues until the material is formed into a cohesive bolus. This cycle is repeated over and over again until the bolus is thoroughly masticated and ready to swallow. While this cycle is occurring the posterior section of the tongue is elevated to keep the bolus in the oral cavity. Also during this stage, the velum

is pulled anteriorly to rest against the back of the tongue (Dikeman & Kazandjian, 1995). The combination of these two movements prevents the bolus from entering the pharynx prematurely.

The larynx and pharynx are at rest during the oral preparatory stage. This allows for nasal breathing to continue until the swallowing response as been triggered. Difficulties, such as aspiration, can arise if the bolus falls into the pharynx and into the open airway before the person is ready to swallow.

The oral stage is initiated when the tongue begins to move the bolus posteriorly. This tongue movement can be described as a stripping action, because the tongue tip elevates anteriorly to posteriorly squeezing the bolus from the oral cavity into the oropharynx. This stage ends when the bolus reaches the oropharynx and the swallow response is triggered (Fox, 1990). The entire process takes less than one second.

Logemann (1983) depicts the third stage, the pharyngeal stage, as beginning with the triggering of the swallow response. This response can be seen with the elevation of the hyoid bone and the larynx. This elevation also results in closure of all three laryngeal sphincters which serves to protect the airway. The tongue will stay elevated during this stage to prevent the bolus from returning to the oral cavity and the velum will remain raised to prevent the bolus

from entering the nasal cavity. Simultaneously, the initiation of pharyngeal contraction and relaxation of the cricopharyngeus occurs. Pharyngeal contraction carries the bolus to the PE segment. With the relaxation of the cricopharyngeus, the bolus passes into the esophagus. The entire pharyngeal stage lasts approximately one second in the normal swallow (Fox, 1990). A swallow response must be triggered in order for any of the four physiologic activities of the pharyngeal stage to occur. The pharyngeal stage of swallowing is considered the most physiologically vital for three reasons: (a) protection of the airway, (b) opening of the esophagus, (c) and the downward propulsion of the bolus (Logemann, 1983).

Fox (1990) states that the esophageal stage begins with the passage of the bolus through the PE segment and into the esophagus. A contractional wave carries the bolus through the esophagus until it reaches the gastroesophageal junction or LES. When the bolus reaches the LES, the muscle relaxes and allows the bolus to continue on into the stomach. The normal transit time for this stage lasts about eight to twenty seconds.

Etiologies and Examples of Swallowing Disorders

Dysphagia, or difficulty in swallowing, can result from either neurologic or mechanical disorders. These disorders can be due to difficulties in the transport of the bolus, aspiration, or a combination of both (Groher, 1984). An

example of a neurological etiology resulting in dysphagia is a cerebral vascular accident. However, specific symptoms of the dysphagia will depend on the site and size of the lesion (Cherney, 1994). Some disturbances in swallowing that a stroke may cause include a delayed swallow response and/or reduced pharyngeal contraction. These disturbances in swallowing place the patient at high risk of aspiration (Horner, Massey, Riski, Latrop, and Chase, 1988). This is because both the delayed swallow response and reduced pharyngeal contraction give the bolus the opportunity to fall into the open airway, first, before the swallow response and/or later, after it has been triggered.

Mechanical problems associated with swallowing result from removal or alteration of the structures of the oral cavity, pharynx, larynx, or esophagus which hinders the ability of the structures to move the bolus through the stages of swallowing. The largest group of patients with these swallowing disorders have had structures removed due to carcinoma surgery (Groher, 1984). Many times because of the extent of the tumor, surgery involves resection of a combination of the oral, pharyngeal, laryngeal, and esophageal structures. The severity of the dysphagia often depends on the extent of the surgery. Problems in swallowing can range from a partial loss of sensation to a delay in triggering the swallowing response. Often a tracheostomy must be performed when surgery has affected

the ability to swallow. Tracheostomies are commonly accompanied by aspiration because of the affects of the tube upon the patient's swallowing response (Arms, Dines, & Tinstman, 1974; Muz, Hamlet, Mathog, & Farris, 1989). A tracheostomy tube anchors the strap muscles by connecting to the anterior neck skin to the trachea. This inhibits elevation of the larynx. Normally, when the larynx elevates, the epiglottis inverts to cover the open airway (Groher, 1984). By reducing the elevational movement of the larynx, the airway becomes partially unprotected allowing aspiration to occur (Mason, 1993).

Aspiration

Minimal aspiration occurs with normal swallowing functions, however, when aspiration occurs in greater amounts, serious implications may be present for the individual with a swallowing disorder (Groher, 1984). Aspiration occurs when material penetrates the larynx and enters the airway beneath the true vocal folds. Therefore, to be considered aspirated, material must pass through all three levels of laryngeal protection (Logemann, 1986). In a patient with an adequate cough reflex, the material may be expectorated. Patients without an intact cough reflex are at greater risk for aspiration (Logemann, 1983). The material may continue into the lungs without the patient realizing it. This material can cause aspiration pneumonia which poses life-threatening consequences. If the

substance is a solid food that is not well masticated, an airway obstruction can result.

Aspiration is often mistakenly thought of as a swallowing disorder, but it is actually a symptom of a swallowing disorder. Therefore, in order to be appropriately treated, aspiration should be defined according to its etiology and its timing in the swallowing response (Logemann, 1986). Timing refers to whether aspiration occurs before, during or after the swallow response.

When aspiration occurs before the response, the cause is usually a damaged tongue function or a delayed triggering of the response. In cases where the tongue is damaged, there is often less mobility and control of the bolus, and the bolus may fall into the pharynx before the airway is closed resulting in aspiration. In persons with normal function, the response is triggered as the bolus passes the faucial arches at the back of the tongue (Pommerenke, 1928). When the bolus passes this point without triggering the response, the timing is defined as being delayed or absent. When the swallow is delayed or absent, the airway remains open and the bolus then has the opportunity to fall into the pharynx and perhaps the open airway resulting in aspiration. The location where the bolus will settle depends on three factors; the amount of

bolus, the consistency of the bolus and the positioning of the patient (Logemann, 1986).

Aspiration during the swallowing response is related to reduced laryngeal closure (Logemann, 1986). Laryngeal closure is intended to protect the airway, but if the laryngeal valves are not functioning properly the bolus may enter the airway.

Logemann (1983) described aspiration after the swallow as occurring when the larynx lowers and reopens for inhalation and residue is sucked into the open airway. Residue in the pharynx may result from reduced pharyngeal contraction, unilateral pharyngeal dysfunction, reduced laryngeal elevation or cricopharyngeal dysfunction.

Aspiration before, during or after the swallow response can have serious effects on the patient. One of these effects is aspiration pneumonia which can become life threatening. Detection of aspiration is a primary reason for conducting swallowing examinations. Two methods of detecting aspiration are the videofluoroscopy swallow study and the Modified Evans Blue Dye Test.

Assessment

A Videofluoroscopy Study (VFSS), also known as the Modified Barium Swallow (MBS), is utilized for patients experiencing swallowing problems especially if aspiration is suspected. The VFSS enables analysis of all four stages of deglutition and is helpful for identifying the stages

affected (Keohane, Lampe, & Polune, 1988). The major purpose of a VFSS swallowing study is to define the etiology of aspiration (Logemann, 1983). The VFSS study is also useful: (a) to discover if the etiology is anatomically or neurologically based, (b) to determine if the patient should be restricted from oral feeding or to determine which consistencies are safe for swallowing, and (c) to plan treatment.

The VFSS swallowing study takes place in a radiology suite and is conducted by the SLP and the radiologist. The results of the test are analyzed by both professionals (Cherney, 1994). The patient is brought into the suite and positioned in a way that allows viewing of swallowing in the lateral position. By positioning the patient laterally, many measures and observations are permitted that are crucial for determining the cause of aspiration (Dodds, Logemann, & Stewart, 1990; Jones, Kramer, & Donner, 1985). For instance, a lateral view allows recording of both oral and pharyngeal transit times and a determination of the timing of aspiration. An anterior/posterior (A-P) view can also give valuable information pertaining to asymmetries in function, although it does not give information pertaining to aspiration.

Once the patient is positioned, the boluses will begin to be presented. Three consistencies of barium are provided for the patient to swallow during a videofluoroscopy study:

liquid barium, barium paste, and a material coated with barium that requires mastication (Logemann, 1993). If aspiration is suspected, a smaller bolus is given for the patient to swallow to avoid airway obstruction. Once the reason for the aspiration is determined, the study is terminated unless it is decided that the patient may be able to tolerate other consistencies without aspiration, thus providing valuable information for planning therapy. The entire procedure is videotaped and can be analyzed frame by frame. The VFSS also allows for voice overs, or recording the examiners' speech onto the video, as the study occurs. Voice overs are used to assist in accurately recording observations and the results of treatment without stopping the procedure. Voice overs also aid in reporting the details of the examination, for example, describing when and how instructions were given.

Although the VFSS procedure is effective and beneficial, disadvantages also exist (Bastien, 1993). Many patients are bedfast and are unable to be transported to the radiological suite for evaluation. Other disadvantages include the cost and the exposure to radiation that the patient must endure. The MEBDT is an alternative method that has been employed for patients with tracheostomies. The MEBDT procedure is used, in combination with suctioning of the patient through the tracheostomy tube, after administering color-contrasted food and liquid

through the mouth (Thompson-Henry & Braddock, 1995). The original Blue Dye Test varied from the MEBDT because the original only placed the colored dye in sterile water rather than in food consistencies (Dikeman & Kazandjain, 1995). At set intervals, tracheal suctioning is administered. If the secretions extracted are tinged with the blue dye, then aspiration is assumed. This test can be modified by using different consistencies of food and liquids with the blue dye. The MEBDT procedure has typically been employed by speech-language pathologists and other medical personnel as an essential tool in detecting aspiration in patients with tracheostomies. The MEBDT is advantageous because the procedure can be done at bedside, is a noninvasive procedure, and is thought to reliably detect aspiration. The primary disadvantages are that the etiology of the aspiration cannot be determined nor can the timing of the aspiration be measured.

Tracheostomy

The tracheostomy tube provides a bypass for the compromised upper airway by allowing air to pass through the tube rather than the upper airway. This bypass also allows access to the lower airway for basic air exchange, ventilation, and pulmonary toilet (Dettelbach, Gross, Mahlmann, & Eibling, 1995). Pulmonary toilet refers to removal of mucous secretions from the bronchi and lungs (Mason, 1993). Tracheostomy tubes are used for different

reasons. Often tracheostomy tubes are inserted at the base of the neck into the trachea because of an upper airway obstruction above the level of the true vocal cords. Tracheostomy tubes may also be employed if there is a potential for upper airway obstruction which may occur due to edema following oral, pharyngeal, or laryngeal surgery (Logemann, 1983). Tracheostomy tubes are also used for patients with diseases that may cause airway obstruction such as Chronic Obstructive Pulmonary Disease (COPD) and neurofibromatosis (Passey, Baydur, Prentice, & Darnnel-Neal, 1993). The tracheostomy tube is typically left in place until the potential for obstruction has passed. Occasionally, the tracheostomy tube is left in permanently. Generally, tracheostomy tubes have three main components: the outer cannula, the inner cannula, and the obturator (Mason). The outer cannula stays in place, while the inner cannula can be removed for cleaning. The obturator is used to create a smooth tip for the initial insertion of the tracheostomy tube. There are two important variations in tracheostomy tubes; cuffed or uncuffed and fenestrated or unfenestrated (Logemann).

The cuffed tracheostomy tube is put in place when it is suspected that there may be a risk for aspiration. The cuff acts as a balloon at the end of the tube and fills the space between the tracheal wall and the tube. When material falls into the trachea, it collects on top of the cuff.

Suctioning is essential in preventing aspiration when the cuff is deflated. A cuffed tracheostomy tube is also used for ventilation purposes. An inflated cuff prevents air from escaping around the tube and provides more adequate ventilation.

The second variation is fenestration. If a patient is having difficulty producing voicing with a normal tracheostomy tube, a fenestration, or window, may be cut into the tracheostomy tube to allow for more air to pass (Logemann, 1983). This fenestration is only cut into the outer cannula, so if the patient wants to speak the inner cannula must be removed.

A tracheostomy tube frequently cause difficulties in swallowing. Groher (1984) states that a tracheostomy tube will reduce laryngeal elevation and limit laryngeal rotation which may affect relaxation of the cricopharyngeaus. The limitation of laryngeal elevation can cause aspiration to occur (Bonanno, 1971). An overinflated cuff can cause esophageal obstruction from the pressure placed on the tracheoesophageal wall. This obstruction can create spillover from the superior portion of the PE segment into the open airway with possible aspiration (Betts, 1965). The existence of a tracheostomy tube can also cause a cough to be ineffective, may reduce subglottic laryngeal pressures, and impairs laryngeal closure (Eisele, 1991). A combination of any of these difficulties may create difficulty

swallowing and increase the tracheostomized patient's risk of aspiration (Dettelbach et al., 1995).

Detecting aspiration in patients with dysphagia is the primary goal of a swallowing evaluation. Although VFSS has been the standard for determining aspiration, the disadvantages, particularly radiation exposure and the need to transport the patient to the radiology suite make this procedure often unrealistic in certain circumstances. When an alternative procedure which is more convenient and less costly is available and provides the same information, its use becomes more prevalent. These circumstances have led to the increased use of MEBDT as an alternative for the VFSS.

Because of the anatomy of the patient with a tracheostomy tube, aspiration can be detected by dyeing the bolus in order to detect aspirated material when it is expelled or suctioned from the tracheostomy site. Speech-language pathologists have used this procedure routinely with the opinion that it is a reliable measure of detecting aspiration. The only study to date that questioned the reliability of the MEBDT was a retrospective study that reported five cases of false negative outcomes. Although this study by Thompson-Henry and Braddock (1996) had a number of design limitations, valid doubts were raised concerning the reliability of the MEBDT. Despite these doubts, an effort made by this author to study the reliability of the MEBDT in comparison to VFSS was not

successful in obtaining subjects. One reason may be that SLPs do not see the need for this research because they believe the MEBDT to be a reliable diagnostic tool for assessing aspiration.

Three factors were considered to have an effect on SLPs' opinions of the MEBDT. Years of experience was selected as a relevant factor because as of 1989, only some institutions had incorporated dysphagia training into their curriculum (Logemann, 1989). In fact, dysphagia training in university training programs has only become a regular part of the curriculum in the last five years. If a person graduated 15 years ago and did not remain current with the literature, they may not have current knowledge on dysphagia. Persons who had taken a course in dysphagia management would, as part of their graduate training, be expected to be more knowledgeable concerning the MEBDT.

A second factor is hours per week spent working with dysphagia patients. This factor seems relevant because the amount of time or percentage of a caseload of a disorder may determine how much continuing education a professional receives in that area. The amount of continuing education received could reflect a professional's general and/or current knowledge concerning dysphagia. In addition, if a speech-language pathologist has a caseload that contains dysphagia patients, they will have more of an opportunity to use the MEBDT and form an opinion regarding its reliability.

The third factor selected was the number of seminars/conferences related to dysphagia because the degree of involvement in continuing education expands a professional's current knowledge and is believed to influence the preferred choice for assessment procedures in dysphagia. Logemann (1989) stated that continuing education is essential for SLPs to remain current with new information and advances in the area of dysphagia. All of these factors are areas that could influence the SLPs' opinion regarding the MEBDT.

The purpose of this study is to address the following research questions:

1. Is there a relationship between years of experience in the field of speech-language pathology and opinions of the MEBDT for assessing aspiration in tracheostomized patients?
2. Is there a relationship between amount of time spent working with dysphagia patients and opinions of the MEBDT for assessing aspiration in tracheostomized patients?
3. Is there a relationship between number of seminars/conferences attended related to dysphagia and opinions of the MEBDT for assessing aspiration in tracheostomized patients?

Methodology

Procedures

Explanatory letters (Appendix A) and surveys (Appendix B) were mailed to SLPs. A total of 106 surveys were dispersed to selected SLPs in medical settings. Respondents were asked to return surveys in the stamped, addressed envelopes provided. Of the 106 SLPs who were sent surveys, 52 responded resulting in a return rate of 49.5 percent.

Surveys

The surveys asked respondents to provide information regarding their knowledge, use, and opinion concerning the MEBDT. Respondents were requested to indicate their answers to questions 1 - 5 by completely darkening in an oval on the op-scan form that was be provided. Respondents were asked to rank the items based on the following scale:

(A) To a very little or no extent.

(B) To a little extent.

(C) To a moderate extent.

(D) To a great extent.

(E) To a very great extent.

The surveys also had a written section. Questions 6-9 of the survey asked respondents to provide information regarding the years of experience they have working in the field, amount of time spent working with dysphagia patients, and the amount of seminars/conferences related to dysphagia. The written segment also asked respondents to provide their

opinion on the reliability of the MEDBT and VFSS, and their reason for that opinion. This survey was designed to answer three questions:

1. Is there a relationship between years of experience in the field of speech-language pathology and opinions of the MEBDT for assessing aspiration in tracheostomized patients?
2. Is there a relationship between amount of time spent working with dysphagia patients and opinions of the MEBDT for assessing aspiration in tracheostomized patients?
3. Is there a relationship between number of seminars/conferences attended related to dysphagia and opinions of the MEBDT for assessing aspiration in tracheostomized patients?

The independent variables in this study were the three factors (years of experience, amount of time spent working with dysphagia patients, and number seminars/conferences related to dysphagia attended). The dependent variable was the sum total of the rankings on questions one through five on the survey.

Data Analysis

The data obtained from this study was subjected to two types of statistical analyses: a) Pearson product moment correlation and b) an Analysis of variance (ANOVA) using three factors. Three Pearson product moment correlations were performed to determine the degree and direction of the relationship between a) years of experience working in the

field, b) number of hours per week spent working with dysphagia patients, and c) number of continuing education activities and the sum of the scaled opinion items (#1-5) on the survey. Additionally, an ANOVA using three factors was performed to determine significant differences in the means of the groups based on the above factors. An ANOVA was also used to identify the presence of interaction effects between the three factors.

Results

Questions one through five (Appendix B) on the survey were subjected to a reliability analysis. A reliability analysis evaluates each question to confirm that it is appropriate for the confines of the test. To be considered reliable, a set of questions must have a total scale or alpha of >.7. The set of questions used in the survey achieved an alpha of .8102. This demonstrates high intercorrelation between questions one through five and the total scale.

A Pearson product moment or Pearson r correlation was performed on the data to determine a relationship between each of the three factors (years of experience; hours per week spent treating dysphagic patients; and number of seminars/conferences attended related to dysphagia management) and the sum total of rankings on questions one through five on the survey. A Pearson r is used to determine if there is a relationship between two sets of paired numbers. To be considered a significant correlation, the p value must be < .05 and the correlation coefficient near +/- 1.0. The closer the coefficient is to +/- 1.0 the stronger or higher the correlation. Values closer to zero indicate weaker or lower correlations (Huck, Cormier, & Bounds, 1974).

An ANOVA was also utilized in this study. An ANOVA using three factors permits analysis of one set of variables

in combination with other sets and showed whether there were overall differences among the levels of each factor (Bruning & Kintz, 1987). To be considered significant, a significance of F of <.05 was required. An ANOVA using three factors was applied to determine the significance of the group differences from the data collected for the three research questions in this study. The three factors were years of experience, hours spent working with dysphagic patients, and number of seminars/conferences attended related to dysphagia management.

For research question one (Is there a relationship between years of experience in the field of speech-language pathology and opinions of the MEBDT for assessing aspiration in tracheostomized patients?), no significance was found. The correlation coefficient (r) = -.0077 from the Pearson r (p = .957) showed no significant correlation for this factor (Table 1).

Table 1

Pearson r

Research Questions	(r)	p value
Question One	-.0077	.957
Question Two	.5720	.000*
Question Three	.2497	.074

* significant

For the ANOVA, years of experience was divided into two groups. Group one contained professionals who had been

working for at least five years, 11 months and the second group contained those who had been working six or more years. This demarcation was chosen because the frequency distribution gave the two groups an n that equaled 24 and 28 respectively. The ANOVA results also revealed no significant main effect for years of experience and the total score of the survey. These results revealed a significance of F of .890 (Table 2).

Table 2

Analysis of Variance

Source of Var.	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	161.201	3	533.734	4.160	.011
YRS1	.248	1	.248	.019	.890
HRS1	68.639	1	68.639	5.314	.026*
CONF1	15.643	1	15.643	1.211	.277
Explained	184.240	6	30.707	2.377	.044
Residual	581.202	45	12.916		
Total	765.442	51	15.009		

* significant

The reason for this result may be that some SLPs, although they have been working for a number of years, do not have caseloads which contain significant numbers of dysphagia patients. Therefore, a limited opportunity in dysphagia management, as opposed to years of experience, may be a more accurate indicator of SLPs' opinions of the MEBDT.

For research question two (Is there a relationship

between amount of time spent working with dysphagia patients and opinions of MEBDT for assessing aspiration in tracheostomized patients?), a Pearson r and an ANOVA were computed. The Pearson r correlation resulted in r = .5720 (p = .000) showing a positive correlation between the total survey score and hours spent per week with dysphagia patients (Table 1). As the number of hours spent working with dysphagia patients increased, the total survey score increased. For the ANOVA, the data was separated into two groups. The groups were separated by the different amounts of hours per week spent with dysphagia patients. The first group was comprised of those professionals who worked with dysphagia patients zero to 13 hours per week. The second group was comprised of those professionals who had more than 13 hours a week working with dysphagia patients. The n = 26 for the first group and n = 26 for the second group provided an equal distribution between the two groups. The ANOVA revealed a significant main effect between hours per week spent with dysphagia patients and the total score on the survey. A significance of F of .026 demonstrated a significant main effect between time spent with dysphagia patients and opinions of the MEBDT (Table 2). This suggested that the more time spent with dysphagia management, the more likely that an SLP considered the MEBDT to be reliable.

Question three (Is there a relationship between number

of seminars/conferences attended that relate to dysphagia and opinions of the MEBDT for assessing aspiration in tracheostomized patients?), did not show any significant values. The Pearson r attained a p value of .074 and an r value of .2497, thus signifying that there was no significant correlation between the number of seminars/conferences attended and the total survey score (Table 1). For this question the results were also divided into two groups to be computed using the ANOVA. The groups were divided according to how many dysphagia seminars/conferences had been attended in the last two years. The first group (n=23) attended two seminars/conferences, while the second group (n=29) attended three or more seminars/conferences. The ANOVA using three factors found no significant main effect for number of seminars/conferences attended related to dysphagia. A significance of F of .277 (Table 2) was too great to be considered significant.

Questions one through five of the survey were subsequently subjected to a chi-square statistical analysis. This was not proposed in the original methodology, but in retrospect, it appeared that question three and four, two and five, and three and five, appeared more closely related than others. For example, for those who rated that they use food dye (question three) to a great extent, one could logically conclude that they consider the MEBDT to be

reliable (question five) because the MEBDT utilizes food dye in its assessment. The chi-square is used when interest is in the number of responses that are found in two or more categories (Huck, Cormier, & Bounds, 1974). A chi-square determines a relationship between expected and actual frequency of responses in the two categories. To be considered a significant relationship, a p value of $< .05$ must be achieved. Each question was rated on the following scale: (a) to no extent, (b) to a little extent, (c) to a moderate extent, (d) to a great extent, and (e) to a very great extent. From these five ratings two groups were recoded. One group contained the ratings from no extent to little extent and the second group contained the ratings moderate, great and very great extent. This was done to express those with minimal experience, those who selected no or little extent in one group, and place those with more significant experience, those who selected moderate, great, and very great extent in another group. Number of responses from questions one through three were compared to number of responses to questions four and five.

Results revealed a significant relationship between some of the questions. Of the 32 persons who rated question three (use of food dye) as moderate/great/very great (m/g/vg), 29 or 90.6 percent rated question four (reliability of MEBDT) as m/g/vg (Table 3).

Table 3

Chi-Square Analysis

Q3B Use Food Dye by Q4B MEBDT Reliable

Q4B Page 1 of 1

Q3B	Count / Row Pct / Col Pct	Little/No Extent 1.00	Mod/Great/V Grea 2.00	Row Total
1.00 Little/No Extent		10 50.0 76.9	10 50.0 25.6	20 38.5
2.00 Mod/Great/V Grea		3 9.4 23.1	29 90.6 74.4	32 61.5
Column Total		13 25.0	39 75.0	52 100.0

The p value of .001 shows a significant relationship between cells, indicating that those who use the MEBDT are more likely to consider it reliable. Of the 23 persons who rated question two as m/g/vg, 15 or 65.2 percent rated question five (video) as m/g/vg (Table 4).

Table 4

Chi-Square Analysis

Q2B Patients with Tracheostomies by Q5B MEBDT as reliable as VIDE

Q5B Page 1 of 1

Q2B	Count / Row Pct / Col Pct	Little/No Extent 1.00	Mod/Great/V Grea 2.00	Row Total
1.00 Little/No Extent		19 65.5 70.4	10 34.5 40.0	29 55.8
2.00 Mod/Great/V Grea		8 34.8 29.6	15 65.2 60.0	23 44.2
Column Total		27 51.9	25 48.1	52 100.0

The p value of .027 shows a significant relationship between cells, demonstrating that those who treat patients with tracheostomies consider the MEBDT to be as reliable as videofluoroscopy. However, this is not surprising since the MEBDT is only used for patients with tracheostomies. Results also revealed an p value of .039 between question three (use of food dye) and question five (video). Of the 25 persons who rated question five (video) as m/g/vg, 19 or 76 percent rated question three (use of food dye) as m/g/vg (Table 5).

Table 5

Chi-Square Analysis

Q3B Use Food Dye by Q5B MEBDT as reliable as VIDEO

		Q5B		
	Count Row Pct Col Pct	Little/No Extent 1.00	Mod/Great/V 2.00	Row Total
Q3B				
1.00 Little/No Extent		14 70.0 51.9	6 30.0 24.0	20 38.5
2.00 Mod/Great/V		13 40.6 48.1	19 59.4 76.0	32 61.5
Column Total		27 51.9	25 48.1	52 100.0

Page 1 of 1

This displays a significant relationship between cells, showing that those who use the MEBDT consider it to be as reliable as videofluoroscopy. All three questions which have significant relationships reflect the fact that those who are in position to use the MEBDT, believe it to be

reliable. The remainder of the questions had an F value greater than .05 and therefore, were not considered to have significant differences.

Discussion

The results of this study suggest that although there is no empirical evidence supporting the MEBDT for detecting aspiration in tracheostomized patients, a majority (90%) of SLPs surveyed still use it as a diagnostic tool and consider it to be a reliable measure of aspiration in tracheostomized patients. Results from the Pearson product moment or Pearson r correlation revealed only one significant correlation. The significant correlation was found between the total score and number of hours spent per week working with dysphagia patients. This is interpreted to suggest that those who treat dysphagia patients on a regular basis find the MEBDT to be a reliable measure of aspiration. No correlation was found between the total score and years of experience. These results could be due to the fact that although the SLP has been working for years, they may not have dysphagia patients in their caseload and therefore do not have the opportunity to become familiar with and form opinions regarding the MEBDT.

There was also no correlation found on the Pearson r between number of seminars/conferences attended related to dysphagia management and the total score. This again could be due to a lack of dysphagia patients in the SLPs' caseload and therefore, no opportunity or limited opportunity to gain experience with the MEBDT.

The results from the ANOVA were comparable to the Pearson r in that the same factors were found to be significant and insignificant. In the ANOVA, the only factor in which a significant main effect was found was hours spent treating dysphagia patients per week. These are the professionals who do have the opportunity to treat patients who may need the MEBDT. This indicates that those who are most likely to administer the MEBDT consider it to be reliable for detecting aspiration in tracheostomized patients.

No significant main effect was found between years of experience in the field of speech-language pathology and total score. Perhaps the number of years of experience is not directly an indicator of amount of experience treating dysphagia patients.

There was also no significant main effect found between number of seminars/conferences attended and the total score. The lack of significance may have occurred because although the SLPs are continuing their education in the area of dysphagia, their caseload does not contain the population that would give them the opportunity to use the knowledge gained concerning the MEBDT.

Results found using the chi-square analysis on questions one through five also demonstrated the opinion that MEBDT is a reliable measure. A significant relationship was found between those who do not or seldom use food dye

was found between those who do not or seldom use food dye (question 3) and those who consider the MEBDT to have poor reliability (question 4) when compared to those who use dye to a moderate, great, and very great extent (question 3) and consider the MEBDT to be highly reliable (question 4). This result shows that those who use food dye tend to view it as being a reliable measure for detecting aspiration.

A significant relationship was also found between those who have little or no tracheostomy patients in their caseload (question 2) and those who consider the MEBDT to have low reliability compared to the VFSS (question 5) when compared to those who do have a moderate, great, and very great extent (mod, g, and vg) of their caseload composed of tracheostomy patients (question 2) and those who consider the MEBDT to be as reliable as the VFSS (question 5). This demonstrates that those who treat patients with tracheostomies deem the MEBDT to be as reliable as videofluoroscopy. This is logical considering that the MEBDT is a test only for patients with tracheostomies.

A significant relationship was also found between those who do not or seldom use food dye (question 3) and those who do not regard the MEBDT as being as reliable as VFSS (question 5) when compared to those who do use the food dye to a m, g, and vg extent (question 3) and consider the MEBDT to be as reliable as the VFSS (question 5). This illustrates that SLPs who use food dye consider the MEBDT

that food dye is an essential part of the MEBDT and if SLPs are using it, they must deem it reliable. All three of the significant relationships involved SLPs' whose caseloads contained patients for which the MEBDT is appropriate and whose opinions reflected that the reliability of MEBDT was comparable to VFSS. Each of these support the findings that those who use the MEBDT most frequently deem it to be a reliable measure perhaps reflecting a bias toward this technique.

Question nine of the survey was open ended and asked for the SLPs to comment on which test they believed to be more reliable and why. The majority responded by stating that they regarded both tests to be accurate indicators of aspiration with their own set of strengths and weaknesses. Most preferred the VFSS because of the ability to observe the cause of aspiration and to try different dysphagia management techniques, but they regarded the MEBDT as a reliable measure at bedside for detecting aspiration.

These findings suggest that although there is no empirical evidence to support it, there is an unconscious bias toward the MEBDT as a reliable measure of aspiration, and therefore, a need for research in this area has not been recognized.

Limitations

Some limitations were present in the study which may have influenced the results. For this study, only a small sample was collected, n = 52. If the n had been larger, perhaps a significant difference may have been found in the statistical results. For example, if the n would have been larger, a significant relationship may have been obtained between question two (tracheostomies) and question four (reliability). These questions attained an p value of .07, just outside the .05 criteria.

Another limitation is that research question number one related years of experience in the field of speech-language pathology to opinions of the MEBDT for assessing aspiration. This question did not examine the fact that many of these professionals, though working in the field for many years, may not have experience treating dysphagic patients. In future research, this limitation should be addressed.

An additional limitation exists with question number one on the survey. This question inquired as to the familiarity of the SLP with the MEBDT. The respondent continued with the survey regardless of their answer to question one. The limitation is if someone answers "to no extent", they should discontinue the study. If they have no familiarity with the MEBDT, they cannot be expected to have valid opinions of the MEBDT on the remainder of the questions.

Implications for Future Research

This study provided valuable information regarding SLPs opinions of the MEBDT. It has shown that a significant number of SLPs not only use the MEBDT, but consider it a reliable tool for detecting aspiration. However, this opinions exists without published clinical research support. As of 1996, there have been no published studies researching the reliability of the MEBDT. Only one retrospective study by Thompson-Henry and Braddock looking at five patients was performed in 1995 and this study had many limitations. This study questioned the reliability of the MEBDT in assessing aspiration in tracheostomized patients in comparison to VFSS and raised questions for further research. One such research project was attempted by this author but was unsuccessful due to inability to obtain sites and subjects. This may be, as this study suggests, because SLPs regard the MEBDT as a reliable tool and do not see the need for that type of research. However, there is a need for that type of research to establish a support and outcomes data for this technique. At this time, the MEBDT lacks this research base. One of the comments written on the survey stated that at a conference in March of 1997, Logemann reported that the MEBDT was only 20-40 percent accurate. This then presents a challenge for the profession in that evidence must be produced to either support or disprove the effectiveness of the MEBDT before continuing its use as a diagnostic tool.

Appendix A

April 15, 1997

Dear Professional:

As part of research for a graduate thesis at Eastern Illinois University, we are collecting data on the familiarity and opinion of speech-language pathologists regarding the Modified Evan's Blue Dye Test. We would appreciate your participation by completing the enclosed questionnaire and returning it in the stamped, addressed envelope by April 24, 1997.

If you have any questions, please contact us at the Eastern Illinois University Speech-Language-Hearing Clinic.

Sincerely,

Amy Sanders
Graduate Researcher

Frank Goldacker
Associate Professor and Thesis Chair

Appendix B

Survey Regarding
Modified Evan's Blue Dye Test

As a speech-language pathologist in the medical setting, we would appreciate your response to the following questionnaire. It will take approximately five minutes to complete. This survey is being conducted to collect data from medical speech-language pathologists regarding knowledge and opinions about use of the Modified Evan's Blue Dye Test (MEBDT). The MEBDT (commonly referred to as the blue dye test) is a procedure for detecting aspiration in patients with tracheostomy tubes. This procedure involves mixing a bolus with blue dye and evaluating secretions from the tracheostomy tube for evidence of blue dye that would indicate aspiration. The information gathered from this survey will provide a focus for future research.

Please return this questionnaire and response form by April 24, 1997 in the stamped, addressed envelope provided. Confidentiality of information contained herein will be strictly maintained. Thank you for your cooperation.

For items 1-5, answer the questions using the ranking scale below. Indicate your responses by darkening the appropriate circles on the enclosed response form. Please use a #2 pencil.

A. To no extent.

B. To a little extent.

C. To a moderate extent.

D. To a great extent.

E. To a very great extent.

1. To what extent are you familiar with the Modified Evan's Blue Dye Test (MEBDT)?

2. To what extent are patients with tracheostomies a part of your caseload?

3. To what extent do you use food dye to assess aspiration in tracheostomized patients?

4. To what extent do you consider the MEBDT to be a reliable indicator of aspiration?

5. To what extent do you consider the MEBDT to detect aspiration with the same reliability as videofluoroscopy?

Appendix B cont.

For items 6-9, see back of this page.

For items 6-9, please indicate your answer on this page.

6. Please indicate the number of years of working experience that you have in the field of speech-language pathology: _____

7. In the past year, what is the average number of hours per week you spent working with dysphagia patients: _____

8. In the past two years, how many seminars/conferences related to dysphagia have you attended: _____

9. Which do you consider to be a more reliable indicator of aspiration in patients with tracheostomy tubes, the MEBDT or videofluoroscopy? Why?

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