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Instrumental Evaluation of Pediatric Dysphagia: FEES Versus Videofluoroscopy

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INSTRUMENTAL EVALUATION OF PEDIATRIC DYSPHAGIA:
FEES VERSUS VIDEOFLUOROSCOPY

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B.A., Indiana University, 2009

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
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Introduction

Problems with swallowing, dysphagia, can occur in infants and children, which may have devastating effects. When a child with dysphagia is not treated properly, it may cause aspiration pneumonia, gastroesophageal reflux, and inability to develop and maintain adequate nutrition and hydration, and failure to thrive. This is why it is critical to properly evaluate children that are showing signs and/or are at risk for dysphagia (Prasse & Kikano, 2009).

Instrumental assessments provide images of the oral, pharyngeal, and upper esophageal phases of swallowing and are generally used to address particular diagnostic questions which may determine what type of therapy would be beneficial (Arvedson, 2008; Rogers and Arvedson, 2005). The two most common types of instrumental assessments to evaluate dysphagia are videofluoroscopy (aka Modified Barium Swallow examination, MBS, or VFSS) and FEES (aka videoendoscopy or flexible fiberoptic examination of swallowing). Over the years, there has been a debate about whether FEES/FEEST or videofluoroscopy is, or should be, the “gold-standard” for assessing dysphagia. However, there has been a lack of research that directly compares them, and an even smaller number of investigations that have concentrated on the pediatric population. The focus of this research paper is to compare and contrast the use of FEES versus MBS for pediatric dysphagia evaluations. First, a description of each instrumental evaluation tool is provided followed by a discussion of the strengths and limitations of each procedure. VFSS and FEES can be compared based on each procedure’s ability to enable feedback during intervention, assess sensory threshold, evaluate and diagnose GER, provide patient comfort, and assess a wide range of appropriate candidates. There

are limited studies that have attempted to compare VFSS and FEES directly in their ability to assess pediatric dysphagia, but a discussion of these studies can provide some insight for clinicians contemplating the use of instrumental assessment procedures.

Instrumental Assessments

FEES/FEES-ST

Flexible endoscopic examination of swallowing (FEES) is one type of instrumental evaluation that is generally performed by a SLP and a pediatric otolaryngologist both working together. A flexible endoscope is inserted through the client's nose and is held in place so that the examiner(s) can observe the events that transpire right before and after the pharyngeal swallow. During this evaluation, the examiner(s) may also wish to administer a sensory test (FEESST), which uses air pressure to test laryngeal reflexes (Arvedson, 2008).

VFSS

Another instrumental examination is the videofluoroscopic swallow study (VFSS). This radiographic examination can be completed in the anterior-posterior or lateral view (more common), depending on which structures need to be assessed (Arvedson, 2008). The patient is seated in an upright, seated position and is presented with various amounts and consistencies of barium sulfate, with or without food (Crary & Groher, 2003). If the clinician sees aspiration occur, she/he should document when it happened and the type of consistency of the bolus (Arvedson, 2008). Arvedson (2008) contends that the majority of children who need an instrumental evaluation are

recommended to have a VFSS. Since VFSS is an x-ray study, there is concern over radiation exposure for young children (Arvedson, 2004).

Comparison of FEES vs. VFSS

Radiation

Although Logemann (1998) states that the amount of radiation exposure during a videofluoroscopy examination is relatively low, the exact amount of radiation exposure that a child undergoing a VFSS exam is not clear. To reduce radiation exposure, the time for a VFSS exam should be limited. Typically a VFSS evaluation can be completed in 1-1.5 minutes, depending on if therapeutic techniques were evaluated during the study. The clinician is encouraged to stay at or below this time and protective shields should be placed on the child to reduce the amount of radiation exposure (Arvedson, 2004).

Arvedson (2004) asserts that “radiation safety must be a high priority, particularly for infants and young children who may need to undergo many x-rays in their first few years of life, and indeed throughout their life time” (p. 18).

Unlike VFSS, FEES does not subject the child to any radiation exposure. Family preference might determine the choice between VFSS and FEES. If radiation exposure during a videofluoroscopy examination is an area of concern for the family, FEES would be a more appropriate tool to use, because it does not expose the client to any radiation.

Observation of Oral Phase

VFSS provides observation of the oral phase of a swallow. During this phase, the clinician is able to monitor chewing and the bolus transfer (Migliore, Scoopo, & Robey,

1999). Observing the oral phase would assist the examiner in discovering several structural and functional abnormalities that are linked to different swallowing disorders. Migliore, Scoopo, and Robey (1999) explain that, “in order to fully understand any individual’s feeding problems, whether results from developmental disability or not, it is important to examine the oral-motor and swallowing stages in tandem” (p. 304). Common observations of pediatric dysphagia are difficulty with bolus formation and decreased anatomical movement or coordination during oral transit (Arvedson, 2008).

One structural anomaly that can impact early swallowing is the presence of a cleft palate. Cleft palate can prevent the oral pressure that is necessary for an infant to suck. One can argue that a VFSS is a more useful with this population, because of its ability to view the oral phase. FEES, does not allow the examiner to directly view the oral stage (Crary & Groher, 2003).

Applications to Intervention

FEES offers the opportunity to be utilized during intervention in order to provide feedback to the client and the clinician. Since there is not time constraints during this procedure, the clinician would be able to teach, educate, and monitor the client’s behavior during intervention. The client and their caregivers are given feedback and reinforcement by allowing them to witness the occurrence of aspiration and the efficacy of the intervention techniques provided by the speech pathologist (Langmore, 2001). Although many speech pathologists believe that this can also be done during a videofluoroscopy evaluation, the more compensatory strategies they teach, the more the client is exposed to radiation (Boesch, 2006).

Assessing Sensory Threshold

Another significant advantage that FEES has over videofluoroscopy is that a sensory test (FEESST) can be applied to this evaluation (Aviv & Murry, 2005). During this test, a puff of air is used to test the laryngeal adductor (swallow) reflex. FEESST is the only swallowing evaluation that directly tests airway protection by determining if the larynx can fulfill its airway protection function while at the same time assessing bolus transfer (Aviv & Murry, 2005). This procedure is ideal for the pediatric population, because it does not require the client to provide a subjective response and/or maintain cognitive awareness (Thompson, 2003).

Thompson (2003) asserts that VFSS has been commonly used to assess airway-protection, but it does not provide a quantitative measurement of the sensory reflex like FEESST does. A study by Thompson (2003) used FEESST to evaluate the laryngeal adductor reflex to determine if a heightened sensory threshold was related to laryngeal penetration, aspiration, a history of pneumonia, neurologic disorder, or gastroesophageal reflux (GER). Thompson and colleagues observed 100 pediatric patients, whose ages ranged from 1 month to 24 years old (mean age was 5 years old). This study found that assessing children's sensory threshold using FEESST is practical and correlative (Thompson, 2003).

Assess/Diagnose GER

Gastroesophageal reflux (GER) is a common problem in infants and has been present in as many as 67% of four-month old infants (Arvedson, 2008). According to Arvedson (2008), a videoendoscopy examination is preferred when evaluating infants

with GER. Arvedson (2008) asserts that to make a GER diagnosis, the examiner is required use an endoscopic evaluation to observe changes in the mucus, which cannot be done by a VFSS. Wilging and Thompson (2005) also note that FEESST can now also be used to “study the effects of gastroesophageal reflux on the larynx and swallowing function” (p. 242).

Cua, Dantas, Rodrigues, and Sawamura (2008) compared healthy infants and those with gastroesophageal reflux (GER) using VFSS. The researchers found that there was no apparent difference in the oral and pharyngeal phases in healthy infants and those with GER (Duca, Dantas, Rodrigues, Sawamura, 2008). This suggests that VFSS is not sensitive to the differences that are present in the healthy infant participants and those with GER.

While a controlled study of FEES has not been conducted with infants and children, an investigation with adults will provide some insight on the usefulness of FEES in assessing GER. One prospective controlled study investigated the association between double-probe pH testing, FEESST, and FEES evaluation results. All 76 of the adult participants had dual channel 24-hour pH testing 7 days after completion of proton pump inhibitor treatment, FEESST, and FEES evaluations, which were completed by otolaryngologists that were not informed of the pH status and FEESST evaluation results. The participants were placed into three groups: those with GER disease (GERD) who had signs of laryngopharyngeal reflux (LPR) were placed in group A, participants with GERD but no signs of LPR formed group B, and group C was made up of the individuals without any GERD or signs of LPR. This investigation found that FEESST was in essence as responsive and precise as 24-hour pH testing when diagnosing acid reflux

disease (Aviv & Murry, 2005). Due to the compelling results from this study, it is assumed that researchers would find the same results with pediatrics. However, further testing would need to be conducted to verify this belief.

The ability of FEESST to quickly and accurately diagnose acid reflux disease in pediatrics would reduce the side effects GERD has on infants and children such as, vomiting, regurgitation, dysphagia, and experiencing pain while swallowing (Duca et al., 2007). These effects may then cause the child to dislike eating or refuse to eat altogether, which can have negative effects on their growth and development. Using FEESST to diagnose GER would allow the examiner to provide their client with a diagnosis and begin the treatment process, since they would not have to wait for the results (Aviv & Murry, 2005).

Comfort

It is difficult for many individuals to imagine something foreign being inserted into their nose. Langmore (2001) contends that some clients experience discomfort as the clinician passes the endoscope, even when anesthesia has been used. In particular, individuals that have oral aversion or hypersensitivity might have an intense response as the scope first enters the nasal cavity. A few patients might even gag or vomit, but this usually decreases as the examination proceeds (Langmore, 2001). Some advanced examiners may also cause discomfort while attempting to achieve the best observation of the velopharynx by moving the scope from the inferior position of the nasal meatus to the middle of it (Crary & Groher, 2003). Therefore, some researchers recommend that topical

anesthesia be applied to the nose when FEES/FEEST is conducted on children (Willging & Thompson, 2005).

Discomfort is not universal as there are reports that most people typically do not need anesthesia (Migliore et al., 1999). In the past, both vasoconstrictor and an anesthetic have been applied within the nasal cavity before the examination, however, compelling data has shown that neither of these medications is mandatory for the majority of the procedures (Crary & Groher, 2003). Crary & Groher (2003) also advocate that before the examination starts, the patients should be told that the "...procedure is not painful, but it may be uncomfortable for some individuals" (pg. 142). This can be verified by an experiment conducted by Migliore et al. (1999) that attempted to complete 30 FEES procedures on 27 individuals who had developmental disabilities and ranged from 5-47 years old. Migliore et al. (1999) found that they were not able to complete the examination with the two participants who had Down syndrome due to patient discomfort that was attributed to hypersensitivity caused by their diagnosis. Three additional participants reported discomfort, which required the examiners to limit the length of the procedure (Migliore et al., 1999). For the remaining 22 participants, not discomfort was reported validating the argument that FEES can be administered with minimal patient discomfort.

Candidates

There is debate regarding the minimal age for FEES. Logemann (1998) advocates that FEES should not be used on children younger than 6-8 years old, because she contends that children simply do not cooperate well before this. Willging and Thompson

(2005) state that FEES/FEESST “can be performed safely in persons of all ages including premature infants” (p. 240).

Langmore (2001), who examined over 600 children by using FEES, reported data suggesting a younger age threshold for FEES. Over a five year period, Langmore reported that only three of the 600 children were not appropriately evaluated using FEES. However, the ages of these children are not mentioned in this text and Langmore does not suggest a minimum age to her readers. Recommendations for the use of FEES with younger children include modifications such as a variety of endoscopes are available for the examiner to choose from when assessing pediatric clients (Langmore, 2001).

However, information from the medical history should not be ignored and may restrict the individual from participating in a FEES examination. FEES is not recommended if there is a history of arrhythmia or heart conditions where stress is not advised, seizures disorders, the presence of tracheotomy tubes, or having neurological conditions that force secretions to pool in the hypopharynx and need to be suctioned out (Langmore, 2001). More obviously, if the individual has something that is blocking the nasal cavity, choanal atresia, or nasal stenosis, FEES cannot be used (Langmore, 2001). Also, children that are classified as medically fragile should only have a FEES evaluation when pediatric CPR equipment and rescuers available (Langmore, 2001). As one might expect, clients that are combative or have bleeding disorders are also not good candidates for this type of assessment (Crary & Groher, 2003). If the individual has a condition that causes spasticity or hyperreflexivity, they are more likely to inadvertently damage the mucosal tissue if they moved abruptly during a FEES evaluation (Migliore et al, 1999).

VFSS has fewer restrictions for clients appropriate for participation. The only requirement is that the child must ingest the right amount of food or liquid. This can be difficult to obtain if the child consumes very small amounts of food and liquid or have never ate/drank through their oral cavity before (Langmore, 2001).

Additional Advantages of FEES and VFSS

An additional advantage of FEES includes fewer restrictions on placement of the child and that the equipment is portable, which can make family involvement during this process easier. For infants and young children this means that the child can be held by a parent or seated in the parent/caregiver's lap during the procedure. This generally helps to reduce the child's anxiety, especially if the child has severe cognitive deficits, special emotional needs, or is very young (Migliore et al., 1999). The parents can also act as a restraint for the children that are under 8 years old and those with special disabilities (Langmore, 2001). Willging & Thompson (2005) recommend that any pediatric patient be placed in the caregiver's lap during FEESST. Since FEES is portable, the examiner should conduct the evaluation in a room the client is familiar with whenever it is feasible (Migliore et al., 1999). It is common for individuals to feel anxious or scared when having any type of evaluation, but these accommodations may help to alleviate some of these feelings.

When trying to recreate a typical meal for the client during their assessment, the professional often provides him/her with foods and consistencies that they usually eat. Another significant advantage FEES has over VFSS is that it does not require barium to be applied to the food, since it is not a radiographic assessment. Barium likely reduces

patient comfort and some argue can change the consistency of the food presented (Crary & Groher, 2003). For example, it is difficult for an examiner to observe how well the individual swallows thin liquids during VFSS, because when barium is added, the viscosity increases. Children might demonstrate less compliance in eating or drinking items that have the added barium (Langmore, 2001). In particular, Arvedson (2004) found through her clinical experience that if the client has never been fed by mouth or has been NPO for awhile, using food or liquid with barium is not an enjoyable way to initiate oral feeding and may cause the child to be fussy or not cooperative.

A variety of textures can be examined, but in their natural state during FEES (Crary & Groher, 2003). FEES also enables observation of the swallow without having to give any food or drink at all (Langmore, 2001). This would be extremely beneficial for individuals that are known or predicted to aspirate frequently.

Budget concerns and cost-cutting measures might increase the frequency of FEES use. FEES costs about as half as much as VFSS (Migliore et al., 1999). Some individuals may believe that a cheaper price insinuates lower quality, but not in this case. This procedure allows the examiner to view a colored image of the pharyngeal anatomy and management of secretions that is superior to the image provided during a VFSS examination (Langmore, 2001).

Conversely, FEES is still a newer procedure and is used less than VFSS (Crary & Groher, 2003). Unlike VFSS, many speech pathologists find that it is generally not available in many facilities (Boesch et al., 2006). VFSS shows the clinician why the individual is aspirating. FEES only identifies the occurrence of aspiration (Logemann,

1998). Determining the etiology of pediatric dysphagia can be a complex process, because it can occur alone or comorbid with other medical conditions. Yet, it is mostly commonly attributed to prematurity, neurological conditions, reflux and/or congenital malformations (Prasse & Kikano, 2009). Knowing why an individual aspirates will facilitate the clinician in providing treatment that targets the specific areas that are causing the dysphagia. It also enables a referral to a professional in a different field. Perhaps this is why many individuals still believe that VFSS is the “gold-standard” instrumental assessment is due to its well-known ability to be successfully used when evaluating infants and children (Prasse & Kikano, 2009).

Direct Comparison Studies

There is limited research comparing the effectiveness of using FEES and/or VFSS with pediatric patients. A small number of studies have been conducted with adults that might provide some indication of comparative benefits for either FEES or VFSS. An examination of the current literature directly comparing these two instrumental procedures should provide clinicians with additional information for evidence-based practice.

Langmore (2001) compared FEES with videofluoroscopy in six participants, ranging from 4 months to 6 years old. The results demonstrated that FEES provided a better observation of premature spillage and irregularities of anatomical structures. Not surprisingly, the VFSS was more advanced in gathering information from the oral and pharyngeal phases. VFSS was also able to provide a better holistic view of the interaction between the phases of swallowing. Both instrumental evaluations found similar results

for laryngeal penetration and aspiration. There were slight differences in the amount of residuals found, but this did not change clinical decisions for intervention.

Recommendations were consistent for all but two of the pediatric participants. This was likely due to the two participants' inability to independently ingest barium, which hindered the use of the VFSS (Langmore, 2001). This study is consistent with strengths and weaknesses discussed in the literature regarding FEES and VFSS. This might be beneficial for clinicians when choosing which instrumental assessment would provide the most beneficial information based on the client's specific complaints or suspected difficulties.

Another study, conducted by Migliore et al. (1999), sought to verify if one of these instrumental evaluation tools detected aspiration in individuals with developmental disabilities better than the other. Ten participants, who ranged from 5-47 years old, participated in this study. The results indicated aspiration occurred in six participants during both videofluoroscopy and FEES examinations. FEES identified aspiration in three participants. There was also one instance where neither FEES nor VFSS identified the occurrence of aspiration. The most likely explanation for the three participants, whose aspiration was found during the FEES evaluation and not in the VFSS, is the brevity of VFSS. It is difficult to lengthen this examination for individuals with developmental disabilities, because they are not able to remain in the required seated position and continue to be cooperative. However, these results should be interpreted with caution, because there were a small number of participants, details about the participants were absent, and the procedures were not available (Migliore et al., 1999).

Aviv (2000) performed a prospective, randomized, outcome study and also suggested benefits to the increased length of assessment for FEES. Aviv (2000) investigated which evaluation tool was better for assessing behavioral and dietary management of 126 individuals with dysphagia. There were 78 VFSS evaluations, with 14 of the clients (18.4%) acquiring pneumonia. Out of the 61 FEESST evaluations, 6 individuals (12.0%) developed pneumonia. While not statistically significant differences in the number of individuals who acquired pneumonia, it does appear that fewer patients developed pneumonia following a FEESST assessment (Aviv, 2000). The researcher contributed the superior performance of FEESST dietary and behavioral management to its ability to be used longer during the evaluation compared to VFSS. This allowed the examiner to observe and provide intervention if the participants began to show signs of fatigue. The examiner is also able to directly evaluate the sensory threshold during FEESST and indirectly during a VFSS evaluation. Yet, the results of the VFSS and FEESST evaluations were not statistically significant with regard to pneumonia incidence and pneumonia-free interval (Aviv & Murry, 2005). Aviv (2005) poses an interesting question, that if there is not a difference between these results, why would the examiner choose to expose their client to radiation and be restrained to only performing the evaluation in a radiologic room? It is important that clinicians be sensitive to the future development and side-effects of their clients.

Kelly, Drinnan, and Leslie (2007) conducted a prospective, single-blind study that was intended to compare whether the use of FEES or VFSS affects the diagnosis of penetration and aspiration during dysphagia evaluations. Results indicated that SLPs did find more evidence of penetration and aspiration with FEES than with VFSS. The

average score obtained from the FEES examinations, was a point more than the mean score from the VFSS recordings which was statistically significant. Also of interest to researchers, was consistency of interpretation of FEES and VFSS data. Intra- and inter-rater reliability extended from 0.64 to 0.79 using weighted Kappa. The researchers of this study highlight the lack of observer reliability is affected by the subjective nature for interpreting dysphagia evaluations. Yet, the overall results reveal that FEES and VFSS do not report the same results, as the FEES results were consistently rated as more severe. Changing the instrumental evaluation tool may reveal a change in the client's swallowing performance, but this could also simply be due to using another evaluation tool. However, future research should be conducted to determine if this is clinically significant. It should also be noted that the Penetration-Aspiration Scale shows that neither tool leads to the "correct answer" (Kelly et al., 2007). Therefore, it is not appropriate to label either VFSS or FEES as the "gold-standard" tool for dysphagia evaluation (Kelly et al., 2007). Even though this study was conducted with fifteen adults, ranging from ages 40-78, it shows the variability between the results obtained from each procedure and they are not interchangeable.

Although the debate is often between whether FEES or VFSS is the best tool to use, Aviv and Murry (2005) go as far as to state that, "neither FEES nor (VFSS) alone allows the clinician to safely make a decision to feed the patient", because neither of them examine both the sensory and motor functions of the individual (p. 3). Each procedure has advantages and disadvantages which have been documented. The next question is to determine when and with whom to use either VFSS or FEES.

Future Research

Future research should not only continue to directly compare the results from FEES and VFSS evaluations, but also how each of the results might alter the interpretations and recommendations of their findings. The more studies that are conducted, adjusting to obtain results in a variety of settings, and with numerous individuals, will increase clinicians' understanding about the differences between these instrumental evaluation tools. A significant amount of research is especially needed to determine how results from assessments of adults and children with dysphagia differ. It would also be beneficial if more studies compared the interpretations of pediatric swallowing assessments and establish a way to standardize the assessments so all clinicians would reach the same diagnosis for a client. This would help improve reliability among clinicians and allow them to provide more consistent diagnoses and intervention.

It is imperative that more research is conducted with this population, because as the American Speech-Language-Hearing Association (ASHA) (2001) reminds clinicians in a technical report, that research studies conducted with only adult participants cannot always be relevant and appropriate to use with the pediatric population. Some of the differences between these populations include: varied anatomy and physiology mechanisms, different etiologies or lack of a clear diagnosis, atypical anatomy and physiology within the prenatal and perinatal stages, and their physical growth and development indicates frequent changes with time (ASHA, 2001). Determining which of these instrumental evaluation tools is best for specifically assessing the pediatric

population so they can develop a safe swallow and functional eating habits to maximize their overall growth and development.

Conclusion

There has been an ongoing debate on whether FEES or VFSS is a better instrumental examination. However, the majority of the research on evaluation of dysphagia does not concentrate on the pediatric population. There is still not a clear answer on superiority of either procedure or best practices for the use of each. Since each child is different, with their own unique developmental strengths and challenges, the clinician should weigh each assessment tool's pros and cons to determine which would provide them with the most comprehensive information pertaining to the individual's specific symptoms of dysphagia. In addition to clinical needs, the child's personality, development, and other comorbid factors might affect the way the child responds the evaluation. The value of each procedure has been discussed as well as a comparison of VFSS and FEES with the intention of providing clinicians with some guidance on the use of FEES and VFSS when working with infants and children.

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