Cook

A Clinical Audit of Dysphagia Practices: Is the management of clients altered following videofluoroscopic examination?

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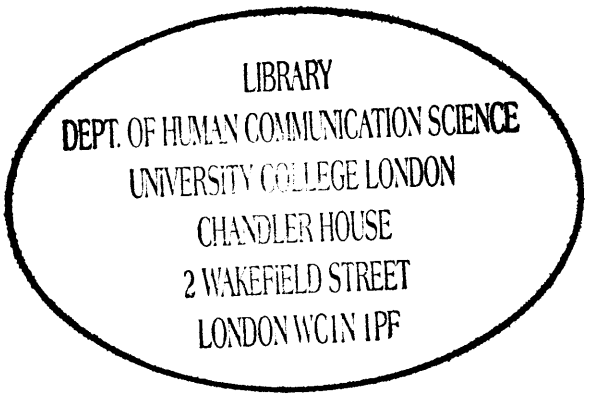

Abstract

The videofluoroscopic procedure (VFSS) is currently considered the "gold standard" in assessing, diagnosing and informing the management of clients with dysphagia. The purpose of this investigation was to evaluate the clinical utility of the VFSS and whether it altered management of dysphagic clients. The present study replicated and extended previous research by Martin-Harris, Logemann, McMahon, Schleicher and Sandidge (2000). Files from one hundred inpatients with neurological disorders who had undergone a VFSS at the National Hospital of Neurology and Neurosurgery were reviewed. Data was obtained according to six variables; dysphagia severity ratings, referral onwards, mode of intake alterations, diet consistency alterations, compensation strategies and swallowing therapy that improved the swallow. As found by Martin-Harris *et al.* (2000), over three quarters (82%) of the sample experienced change in at least one of the variables, with the majority experiencing change in more than two variables. The VFSS resulted in significant alterations in severity ratings, mode of intake, diet consistencies, in addition to identifying effective compensation strategies. However, no significant changes were found following VFSS in referral onwards or the implementation of swallowing therapy. These findings are discussed with reference to their external validity in light of the current limitations of the VFSS.

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Introduction & Literature Review

1.1 Introduction

For most eating and drinking are pleasurable social activities that are engaged in daily without thought. However many individuals are deprived of this enjoyment when difficulties, discomfort or pain on swallowing is experienced, known as *dysphagia*. The present study is concerned with how dysphagia is managed in clients presenting with swallowing difficulties. The existing patient care pathway usually consists of a swallowing screen (optional), followed by a clinical bedside examination by a speech and language therapist and a management programme being implemented. A further instrumental procedure may be carried out if deemed suitable or necessary. The videofluoroscpic study of swallowing (VFSS) is considered the "gold standard" instrumental procedure for assessing, diagnosing and informing subsequent management. However, debates continue surrounding issues such as its purpose, timing, lack of standardized protocols, inter-rater reliability and scoring of the results. Given these issues, it leaves the question that if client's swallowing difficulties are being managed following the clinical bedside examination, what does a VFSS contribute towards this and is management altered in any way following this procedure. Based on a study by Martin-Harris, Logemann, McMahon, Schleicher & Sandidge (2000), the current study considers several variables chosen to investigate the clinical utility of the VFSS.

1.2 What is dysphagia?

Dysphagia refers to difficulty moving fluids or solid food from the mouth to the stomach, resulting in a delay or misdirection of food (Crary & Groher, 2003). Problems can arise during any part of the swallowing process in which food and liquid are moved from the oral cavity, through the pharynx, into the oesophagus and eventually into the stomach. Problems may also occur around the preparation for a swallow, such as with sensory and primary motor acts (Logemann, 1998).

Swallowing disorders can occur across all age groups and result from a variety of medical conditions, congenital abnormalities or structural damage. As such, dysphagia is not a primary medical diagnosis, rather a symptom of a disorder. Dysphagia may present acutely, for example following a stroke or inflammatory conditions, and in chronic form. Chronic dysphagia is most common in those with a progressive neurologic disease such as motor neurone disease (MND), Dementia and Parkinson's disease and its variants; amyotrophic

lateral sclerosis (ALS), multiple sclerosis (MS), myasthenia gravis (MG). Other causes include head/neck cancer, infections, gastro-intestinal reflux, perforation of the oesophagus during intubation, and poisoning or burns of the oral and pharyngeal cavities (Kuhlemeier, 1994). It is estimated that approximately 14% of hospital patients and 30-35% of rehabilitation patients experience symptoms of dysphagia (www.speech-pathology.org). Dysphagia is also particularly common among older patients. Approximately 45% of those aged over 75 suffer symptoms and 66% of those in long term care (www.dysphagiaonline.com).

1.3 The consequences of dysphagia

The ability to swallow is an important determiner of quality of life (Padilla & Grant, 1985; Robbins, Priefer, Gunter-Hunt, Johnson, Singaram, Schilling & Watts, 1997). Swallowing difficulties can upset the enjoyment of mealtimes and adversely affect a person's psychological well being (European Study Group for Diagnosis & Therapy of Dysphagia & Globus, 1999, cited in www.dysphagiaonline.com). Many patients report experiencing anxiety or panic during mealtimes (Ekberg, Hamdy, Woisard, Wuttge-Hannig & Ortega, 2002). Pain, fatigue or a slow rate of ingestion may also result in a person shortening or avoiding mealtimes. As a result, patients are often at great risk of weight loss, dehydration and malnutrition (Finestone, Greene-Finestone, Wilson & Teasell, 1995; Logemann, 1998). It is estimated that up to 90% of hospitalised patients with dysphagia exhibit symptoms of malnutrition and dehydration (Huckabee & Pelletier, 1999). Nutritional compromise is also associated with other serious health risks such as impaired wound healing, increased susceptibility to infection and impaired mental and physical function (Huckabee & Pelletier, 1999; King Edwards Hospital Fund for London, 1992).

A further complication is aspiration pneumonia. Oropharyngeal dysphagia may result in food or liquid passing into the pharynx in an uncoordinated manner and entering the airways, below the level of the true vocal folds. Whilst aspiration does not necessarily result in aspiration pneumonia (Terpenning, 1994, cited in Marks & Rainbow, 2003), research indicates that up to 25% of dysphagic patients experience pneumonia due to aspiration (Teasell, Foley, Fisher & Finestone, 2002). The consequence of aspiration pneumonia can be fatal (Terry & Fuller, 1989), and aspiration is related to increased morbidity, mortality and cost of care (Odderson, Keaton & McKenna, 1995), with the mortality rate over 52% (Low, Wyles, Wilkinson & Sainsbury, 2001). Therefore it is vital that the risk of aspiration is identified early to avoid such complications.

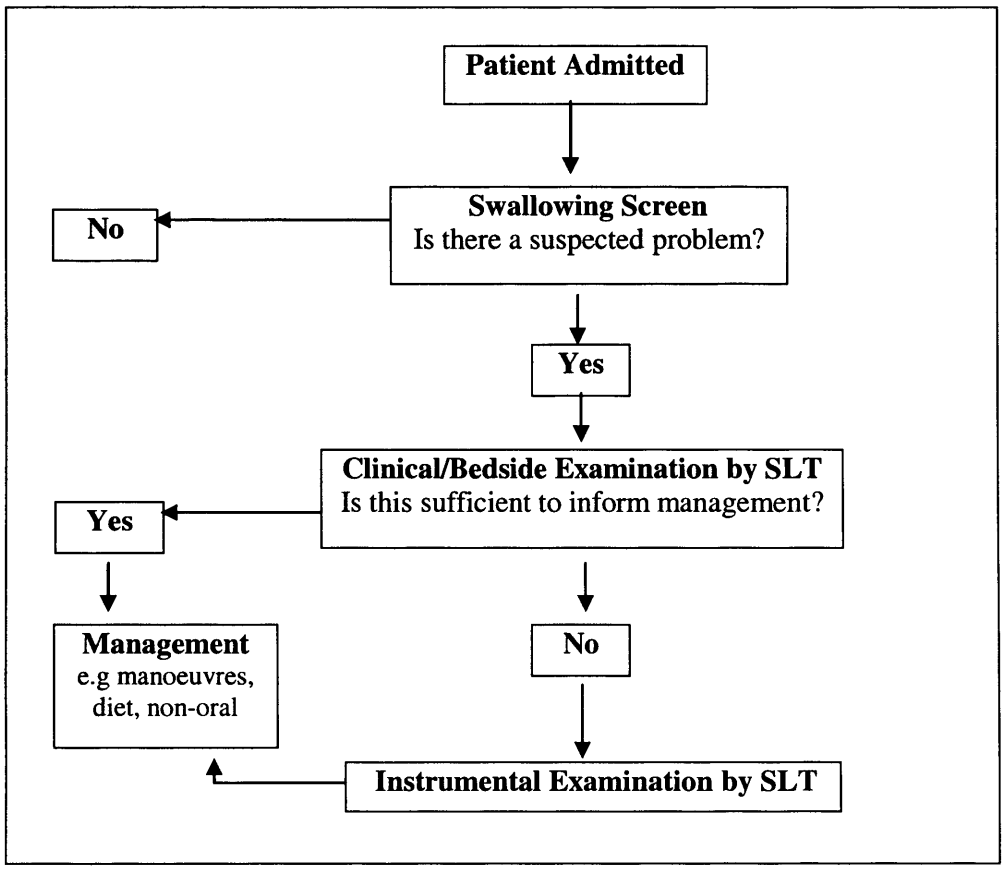
1.4 The Patient Care Pathway

For several decades Speech and Language Therapists (SLT's) have been involved in the assessment, management and treatment of patients with dysphagia. Comprehensive assessment by an SLT aims to establish the presence or absence of a swallowing disorder and avoid potential complications. The two main parameters considered in assessment and management of patients are (1) the efficiency of bolus preparation and transport through the upper digestive tract and (2) airway protection. Dysphagia clinicians strive to accurately assess the safety and efficiency of a swallow and weigh this against a management programme with the least possible risks and most benefits, whilst maximizing life quality (Martino, 2002). Generally a preventative approach is taken towards aspiration in order to minimise it (Marks & Rainbow, 2003). However, this is not a clear task as there are no current guidelines to indicate how much aspiration can be tolerated before aspiration pneumonia arises. Moreover, the SLT's role is to identify the symptoms and detail underlying abnormalities in the anatomy or physiology that cause these (Logemann, 1998).

Given that dysphagia has varying underlying causes and is a symptom of different disorders, patients are increasingly managed by a variety of health care professionals working with and alongside SLT's. Ideally, these professionals work together toward the mutual central goal of either restoring or maximising swallow function. Current guidelines and best practice models advocate this multi-disciplinary approach to dysphagia (RCSLT, 2005). Whilst protocols vary, Figure 1 highlights a common clinical pathway that a hospital inpatient with a suspected swallowing disorder may experience.

Increasingly, swallowing screening procedures are being implemented within hospitals in order to improve patient care, reduce the number of inappropriate dysphagia referrals to SLT's (Magnus, 2001) and enable SLT's to make initial contact with patients within recommended 48 hours (RSCLT, 1996). Following this, a clinical bedside assessment is carried out by an SLT (see Section 1.5 for detailed consideration of a bedside examination) and a treatment plan is formulated. Where possible, clinicians attempt to maximize the amount of oral intake that can safely and efficiently sustain patients (Martino, 2002). The management options are detailed below.

FIGURE 1. A Care Pathway for In-patients with Dysphagia



Management

- Postural modifications may have a significant impact on the safety and efficiency of the swallow (Logemann, 1993). They can be applied to various patients and require little ability to learn. These may include; chin-tuck position, head tilt, chin-up, head rotation to either the damaged or non-effective side.
- Swallow manoeuvres require voluntary control over the swallow, for example a cough post-swallow or Mendelsohn manoeuvre. These require that patients have good language and cognitive skills, as well as stamina as they can be fatiguing.
- Where required, alterations may be made in terms of the volume and consistency of the food and drink that a patient ingests. Consistency modifications may include thin or thick liquids, soft foods, purees and smooth cold foods. For further details of how these may be incorporated into a management plan, see Appendix I.
- Swallowing therapy exercises may be recommended to improve strength, range of movement and motor control of an impaired structure (Logemann, 1998). These include oral tongue, base of tongue, palatal and falsetto exercises. However, there is little empirical evidence supporting their use in improving swallowing.

- For those deemed at risk of significant aspiration, management options may involve non-oral (enteral or alternative) methods of feeding. Within the UK these are generally divided into two categories; Naso-gastric and Percutaneous Endoscopic Gastrostomy. Naso-gastric (NG) tubes are often inserted in the initial stages following swallowing assessment. However, intolerance issues means NG tubes are not generally used for long-term nutrition or hydration. The more invasive procedure of a Percutaneous Endoscopic Gastrostomy (PEG) is most common for longer-term management. It involves insertion into the wall of the gut and is generally safe and well tolerated.

As is evident from Figure 1., the management of swallowing difficulties usually begins following the clinical assessment. However, for some an SLT may wish to carry out further instrumental assessments to further inform management (see Section 1.6 for further detail). Thus, management is an ongoing dynamic process within the patient care pathway.

1.5 Clinical / Bedside examination

A clinical bedside examination commonly consists of the following; information gathering of current swallowing difficulties, reviewing medical history, observation of signs relevant to the patient's medical status, conducting a functional examination of swallowing and speech structures and observing a patient during trial swallows (Logemann, 1998; Miller, 1992).

However, research indicates several drawbacks of the bedside examination. There is little consistency between clinicians in both what they feel should be included in the examination and clinical practice (Mathers-Schmidt & Kurlinski, 2003; McCullough, Wertz, Rosenbek, Mills, Ross & Ashford, 2000). There is also debate surrounding its sensitivity and specificity, with evidence suggesting that silent aspiration is not detected (McCullough, 2001). It is estimated that 40% of patients silently aspirating are missed on the bedside examination (Linden, Kuhlemeier & Patterson, 1993). As such, current research is focusing upon increasing the positive predictive value of this assessment (see Hinds & Wiles, 1998; Leder & Espinosa, 2002; Ramsey, Smithard & Kalra, 2003; Teramoto & Fukuchi, 2000; Wu, Chang, Wang & Lin, 2004).

Regardless of this, the false negative rate (the failure of a test to identify a group at risk for aspiration) is 14% with the bedside examination, compared to 0% with instrumental evaluation (Aviv, Sacco, Mohr, Thompson, Levin, Sunshine, Thomson & Close, 1997, cited in Aviv, 2002). According to the authors, this data reveals the fallacy of relying solely on a bedside examination when instrumentation is possible.

1.6 Videofluoroscopic Study of Swallowing (VFSS)

The videofluoroscopy, or 'modified barium swallow' allows clinicians to visualise the swallowing process. This radiological examination can act as a means of diagnosing, assessing and managing patients with swallowing disorders (Eckberg, 1997; Logemann, 1993, 1998). A large body of research proposes the VFSS is required for clinicians to accurately determine laryngeal penetration and aspiration, and identify the possible cause of dysphagia by allowing the examination of the oral, pharyngeal and cervical oesophageal structures and physiology (Logemann, 1998; Mari, Matei, Ceravolo, Pisani, Montesi & Provinciali, 1997).

More commonly, VFSS is used when the results of the clinical bedside examination are inconclusive, to confirm the symptoms described by patients and identified by the bedside examination (Marks & Rainbow, 2003). The consensus is that VFSS should have a dual purpose, not only to diagnose disorders, but to evaluate the usefulness of treatment strategies and the impact of compensations on the swallowing process (Crary & Groher, 2003). Most importantly, and the subject of the current research, is the view that VFSS should only be performed if it will benefit the client's management and functional outcome. The benefit may vary from using the image as a baseline measure to assess change in swallow function, to utilising the fluoroscopic image (see Figure 3.) to demonstrate a problem to either the patient or team members involved to increase awareness or compliance. This latter use is particularly important as evidence indicates that clinical outcomes are associated with the degree of compliance of patients who have been given advice of dysphagia management. Non-compliance is associated with adverse outcomes and correlates with the incidence of chest infections, aspiration pneumonia and readmissions (Low *et al.*, 2001).

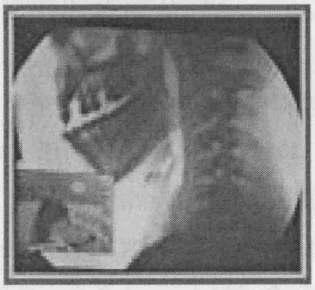
1.7 The VFSS procedure, positioning and material

Videofluoroscopy is the most widely recommended instrumental procedure and access to VFSS facilities proliferate throughout the UK (Mathers-Schmidt & Kurlinski, 2003). A VFSS usually involves a radiologist or radiographer and an SLT. The assessment may only be performed on patients who are alert and possess sufficient cognitive awareness. The VFSS examination is usually accomplished with patients in an upright, seated position at the fluoroscopy machine, with sufficient support for the head and body. Typically, the VFSS begins with the patient in a lateral position to the fluoroscopic image, as evident in Figure 2. A patient may then be positioned for the anterior perspective to evaluate any asymmetries along the swallowing mechanism.

FIGURE 2. Anterior Positioning at the Videofluoroscopy Machine

Barium is mixed with the bolus to be trialled. This material comes in various forms and is radiopaque, so that it appears as black on the fluoroscopic image (see Figure 3.). The general categories of textures trialled include thin liquid, thickened liquid, paste or pudding and masticated material (Crary & Groher, 2003). Finally, compensatory manoeuvres may be introduced to evaluate their impact on any observed swallow impairment in terms of swallow safety or efficiency.

FIGURE 3. Fluoroscopic image of the head and neck



1.8 Problems with the VFSS

As a "gold standard" technique, the VFSS has many strengths that merit the designation. It provides a comprehensive perspective on swallowing, and can be reviewed multiple times by replaying and pausing, as well as having dual diagnostic and therapeutic purposes. Moreover, within a hospital setting it is typically readily accessible for both clinicians and patients. However, despite these strengths there are several weaknesses currently under debate.

Firstly, there is the concern of exposure to radiation. However, the radiation dose in a single examination is quite small and the radiation detriment associated with VFSS is well within acceptable levels (Wright, Boyd & Workman, 1998). The examination can only be performed on those who are alert and responsive and therefore misses a percentage of the dysphagic population. There are also practical drawbacks such as transport to the radiology department may be a problem. Furthermore, performance on the VFSS may not accurately reflect true swallowing ability, based on reports of false-positive results for aspiration (Warms, 1998). One possibility is that a patient's swallowing behaviour may have changed under VFSS. In determining the safety of a swallow, VFSS also cannot always simulate clinical feeding conditions (e.g. temperatures, fatigue etc.) that may be important factors in this. Often VFSS consistencies differ from mealtime consistencies (Cichero, Jackson, Halley & Murdoch, 2000), and thus are not reflective of true swallowing ability.

Another concern is the lack of one standard protocol and the lack of unanimous agreement regarding this. The two main schools of thought are (1) a uniform standardised protocol with all patients or (2) a functional tailor-made study to elicit a sample of swallowing representative of typical feeding patterns. A review of the literature suggests that protocols applied to adults tend toward the uniform protocol (O'Donoghue & Bagnall, 1999). However, protocols may vary between clinics, clinicians and between examinations of the same patient at different times (Glassburn & Deem, 1998; Steele, Van Lieshout & Goff, 2003). These inconsistencies render comparisons extremely difficult and detract from videofluoroscopic validity to measure the effects of therapy (Ott, 1998).

Inconsistencies also exist in the reviewing and scoring of the examination due to being based on subjective judgements (Becker, McLeroy & Carpenter, 2005; McCullough, *et al.*, 2000; McCullough, Wertz, Rosenbek, Mills, Webb & Ross, 2001; Ott, Hodge, Pikna, Chen, & Gelfand, 1996; Scott, Perry & Bench, 1998). Only aspiration is evaluated with high reliability amongst clinicians (Kuhlemier, Yates & Palmer, 1998; Stoeckli, Huisman, Seifert & Martin-Harris, 2003). There is also the issue of intra-reliability and whether clinicians consistently employ the same standards across patients and time (Becker *et al.*, 2005; Kuhlemeier *et al.*, 1998; McCullough *et al.*, 2000). As such, there is a need for exact definitions of the parameters assessed by VFSS to raise intra- and inter-rater reliability. Thus, O'Donoghue and Bagnall (1999) state "specialists should achieve greater consistency in the VFSS procedure before claiming to be implementing a 'gold standard' technique" (pp. 1021).

1.9 What is the clinical utility of the VFSS?

Given the identified drawbacks of the VFSS procedure and that dysphagia management programmes may be implemented following the clinical bedside examination, this begs the question of what exactly is the clinical utility of the VFSS. Evidence suggests that only two-thirds of clinicians always conduct a clinical examination before recommending an instrumental evaluation, possibly indicating that instrumental examinations are being recommended prematurely or inappropriately (Mathers-Schmidt & Kurlinski, 2003). Yet, given the changing health care climate, clinicians are increasingly required to provide justification for the use of the VFSS procedure with patients and demonstrate how this is expected to impact on treatment outcomes.

There is little research to date however, which evaluates what a VFSS procedure contributes to how patients with dysphagia are being managed, whether it alters this and what these alterations are. A study by Martin-Harris and colleagues (2000) investigated the relevant information gained from the VFSS and the impact of this on patient management. The authors reviewed a database of 608 swallowing studies and found high clinical utility of the VFSS. They considered five variables of whether VFSS resulted in; (1) referral onto another speciality, (2) mode of intake alteration, (3) dietary changes, (4) implementation of strategies that improved the swallow, (5) the recommendation of swallowing therapy. Results indicated that 83% of the studies resulted in a change of at least one variable and only 10% were considered normal. As such, the false-positive rate of the VFSS was low and Martin-Harris *et al.,* (2000) concluded that referring clinicians were correct in their referral of the vast majority of patients. In terms of the variables investigated, strategies that improved swallow function were recommended for over half the sample, but swallow therapy was only recommended for 37% of patients. Of more interest is that for 68.8% of patients mode of intake was altered in an upward direction (i.e. non-oral to partial/oral) following VFSS. Dietary modifications were also recommended for 43.8% of patients, with the majority being upgrades. These modifications are likely to impact greatly on a patient's quality of life. Moreover, Martin-Harris *et al.,* (2000) argue that the cost of a VFSS can be justified on the basis that it can save money by "preventing the lengthy guessing game of trial-and-error diet selection and treatment methods that take place in trial therapy following only indirect bedside observations " (pp 140).

Whilst these results are clinically relevant to practitioners wishing to substantiate the use of a VFSS, the study was not able to employ formal statistical procedures on the basis that the database represented a non-random sample gathered over a period of time. If clinical utility is

to be more strongly inferred, it would be useful to investigate whether there is a significant difference between a patient's management pre- and post-VFSS on the variables investigated by Martin-Harris and colleagues (2000). Furthermore, the majority of the sample were outpatients and their condition was likely to be more stable when VFSS was performed, which is likely to impact on the variables measured. Little is known about whether the clinical utility of the VFSS is higher or lower for inpatients presenting with more acute dysphagia. This is particularly important given the changing severity status of inpatients and that this procedure may be more justifiable and useful when patients are more clinically stable (Sonies & Frattali, 1997).

The purpose of the present study is to further investigate whether VFSS alters the management of clients with acute dysphagia. Based on the Martin-Harris *et al.,* (2000) study, the present investigation aims to determine whether VFSS results in change in the following six variables;

1. Does VFSS result in referral to another speciality for intervention? (e.g. dietician)
2. Does VFSS result in a change in dysphagia severity status? (e.g. mild to moderate)
3. Does VFSS result in a change in the mode of intake status? (e.g. oral to enteral)
4. Does VFSS result in a change of diet consistency? (e.g. thick to thin liquids)
5. Does VFSS result in strategies being implemented that improved the swallow? (e.g. chin tuck)
6. Does VFSS result in recommendations of swallow therapy? (e.g. palatal exercises)

The addition of the variable relating to severity rating is included to assess how VFSS may alter the subjective rating of the swallow disorder following a bedside examination. Whilst indirectly under investigation, if the VFSS does alter management, this would call into question the utility of the bedside examination. In addition, the severity rating may be more informative to an inpatient population and will allow for the investigation of relationships with the other five variables. Any replication of results as found in the previous study will serve to further validate the clinical utility of the VFSS.

Method

2.1 Patient Population

The most recent and available one hundred patients files referred for videofluoroscopic examination at the National Hospital for Neurology and Neurosurgery were retrospectively reviewed. Files were selected from a record sheet of all videofluoroscopic examinations performed between October 2002 and January 2005. All files audited were no longer current inpatients. Patient consent was not obtained for this clinical audit project, as agreed with the Director of Research and Development at the trust (see Appendix II). In order to ensure full data protection in accordance with research governance practice, all data entered onto the database ensured anonymity of participants.

2.2 Procedure

All the data was entered into an SPSS 12.0 for Windows statistical database. For the purposes of this clinical audit, demographic information was extracted from an individual's speech and language therapy file notes including; age (in years), sex, primary medical diagnosis, secondary diagnoses, date of admittance and date of VFSS.

Further information was extracted from the hospital's VFSS score sheet (see Appendix III), which is an adaptation and collation of score sheets recommended by Logemann (1993) and Palmer, Kuhlemeier, Tippett & Lynch. (1993). Each score sheet is completed at the time that the VFSS tape is replayed and reviewed by two experienced clinicians according to a locally agreed rating scale, in order to improve inter-rater reliability. The patient's swallow is rated on a 5-point scale; normal, mild, moderate, severe, profound against parameters relating to the oral, pharyngeal and oesophageal stages of the swallow. A record is made of how many trials are performed and the size and consistency of boluses during each trial. The use of any swallow manoeuvre is documented and whether it was effective in improving swallow safety or efficiency. A descriptive summary is produced with a severity rating of the patient's swallow. Recommendations are also documented for; onward referral, liquid consistency, food consistency and effective postures that improved the swallow and/or swallowing therapy.

Using a combination of the score sheet and file notes, information was obtained in accordance with the six variables listed in Table 1. The options (levels) available within each

variable were coded accordingly. This information was collected both pre and post videofluoroscopy in order to assess for any alterations. For the purposes of analysis, a variable was also created to document the type of change in (1) mode of intake, and (2) diet consistency. Any missing data was coded appropriately.

TABLE 1. Variables investigated and the levels available and coded within each

Variable	Levels	
Dysphagia severity rating	1 = Normal 2 = Mild 3 = Mild to moderate 4 = Moderate	5 = Moderate to severe 6 = Severe 7 = Severe to profound 8 = Profound
Mode of intake	1 = Full Oral 2 = NBM 3 = Partial Oral	4 = Enteral feeding 5 = NBM + Enteral 6 = Partial Oral + Enteral
Diet consistency	1 = Normal 2 = Soft 3 = Puree 4 = Smooth cold 5 = Thick fluid only 6 = Thin fluid only 7 = Soft + Thin fluid 8 = Soft + Thick fluid	9 = Normal + Thin fluid 10 = Normal + Thick fluid 11 = Smooth cold + Thin fluid 12 = Smooth cold + Thick fluid 13 = Puree + Thin fluid 14 = Puree + Thick fluid 15 = Nil by mouth
Strategies	0 = None 1 = Chin down 3 = Effortful swallow 4 = Double swallow 5 = Clearing swallow 6 = Liquid wash-through	7 = Mendelsohn manoeuvre 8 = Head tilt 9 = Cough post-swallow 10 = Combination 11 = Chin up 12 = Supraglottic swallow
Swallow therapy	0 = None 1 = Oral tongue 2 = Base of tongue 3 = Falsetto	4 = Palatal 5 = Vocal cord adduction 6 = Mixture
Referral onwards	0 = None 1 = ENT 2 = Physiotherapist 3 = Dietician	4 = Gastro-enterologist 5 = Radiographer 6 = Community services

Results

All the raw data can be found in Appendix IV. The design contained two variable types; continuous variables (e.g. age) and categorical variables (e.g. sex, group). These allowed for descriptive summary statistics including percentages and distributions. Furthermore, the data was subjected to chi-square analyses to investigate the relationships between two or more of the categorical variables. On analysis, it was acknowledged that as many of the 2*2 contingency tables' cells had low counts (i.e. under 5), Fisher's Exact test should have been applied. However, due to SPSS programme limitations, this was not possible so for the purposes of the study Pearson's Chi-square is reported.

3.1 Demographic variables

The details of the sample participants are presented in Table 2. The total number of participants was 100, therefore all percentages reported are frequency counts. Worthy of note is that whilst the mean age across this time span was 55.7 years (SD = 15.96), there was a high frequency in the 70 years age range.

TABLE 2. Details of participants

	Age (years)		Gender %	Diagnosis Group	%
Participants	mean	55.7	Male 63	Neuromuscular	43
(n = 100)	range	16-84	Female 37	CVA	10
	SD	15.96		Neurological	17
				Neurosurgical	13
				Other	17

3.2 Referral Onwards

Of the participants, 14% were referred on to other specialities for potential intervention. The majority of these referrals (5%) were onto community services for further intervention and management by community SLT's. The other common referral was 4% on to Ear, Nose and Throat specialists, particularly for those falling under the category of "other" where the diagnosis was unknown or for difficulties such as dystonia. General observations indicated that of the 14% referred on, 10% of these were on a full oral intake and of these 5% were on full diets (see Table 3.).

TABLE 3. Details of those referred on post VFSS

Speciality		**Severity post**		**Mode of intake**		**Diet consistency**	
Community	5	Normal	2	Full oral	10	Normal	5
ENT	2	Mild	4	Partial oral	0	Soft	4
Gastro-enter.	4	Mild-Moderate	4	Enteral	1	Thick fluid	1
Physiotherapy	1	Moderate	2	Partial+Enteral	3	Soft+Thin fl	1
Radiography	0	Moderate-Sever	2	NBM+Enteral	0	Soft+Thick fl	1
						Puree+Thin fl	2
Total	**14**	**Total**	**14**	**Total**	**14**	**Total**	**14**

Whilst chi-square analysis do not reveal any significant relationships between referral onwards and any of the other five variables under investigation, it is interesting to note that strategies were attempted in 10 out of the 14 referred on, and of these 9% were effective. These were chin tuck (1%), liquid wash-through (2%), double swallow (3%) and a combination (3%). There was only one participant who was referred on (1%) where the strategy trialled was not effective in improving the swallow and this was one of the "combination" strategies. Strategies trialled for the whole sample will be considered in Section 3.6.

3.3 Severity Ratings

Examination of the severity ratings pre-VFSS indicated that ratings following a bedside examination were altered following VFSS. Severity ratings were altered in 64% of the sample. Prior to VFSS, only 4% were assessed as having severe-to-profound dysphagia, whereas most were distributed towards the milder end of the scale; 23% were mild, 25% were mild-to-moderate and 13% were rated as normal. In comparison to the ratings given post-VFSS (see Table 4.), the percentage of those rated as normal or mild had increased, 17% and 29% respectively, with the largest difference of 6% for those rated as mild. Furthermore, those rated towards the opposite end of the scale as severe and severe-to-profound decreased following VFSS. Further analysis revealed a significant relationship between severity ratings pre and post VFSS ($\chi_2 = 61.55$, df = 30, $p < 0.01$), suggesting that VFSS significantly alters ratings, although no direction is shown.

TABLE 4. Severity ratings of dysphagia pre and post- VFSS

	Severity Scale	Severity pre %	Severity post %	Difference pre & post %
Valid	Normal	13	17	+ 3
	Mild	23	29	+6
	Mild-Moderate	25	23	-2
	Moderate	16	14	-2
	Moderate-Severe	7	10	+3
	Severe	6	5	-1
	Severe-Profound	4	0	-4
	Profound	0	0	0
Missing	99	6	6	0

A significant relationship was also found between severity rating post VFSS and alterations in mode of intake ($\chi 2 = 18.63$, df = 5, $p < 0.05$). When the type of alteration was recoded as; an upgrade (e.g. NBM to Full Oral), downgrade (e.g. Full Oral to NBM) or no change, the type of alteration was significantly related to severity rating post VFSS ($\chi 2 = 31.00$, df = 10, $p < 0.01$). The majority of upgrades (4%) were those classified as mild-to-moderate, whereas the downgrades (4%) were classified towards the more severe end of the scale (see Table 5.).

Severity rating post VFSS was also significantly related to diet modifications made following VFSS ($\chi 2 = 34.98$, df = 15, $p < 0.05$). In particular, the significant relationship between severity rating post VFSS and the type of modification ($\chi 2 = 25.36$, df = 10, $p < 0.05$) highlights that ratings on the milder end of the scale result in most upgrades. In comparison, those on the more severe end tended to have more downgrades in diet consistency, as evident in Table 5.

TABLE 5. Severity post-VFSS with mode of intake and diet consistency alterations

	Mode of Intake alteration			Diet consistency alteration		
Severity post VFSS	Upgrade %	Downgrade %	Same %	Upgrade %	Downgrade %	Same %
Norm	1	0	16	2	2	13
Mild	3	1	25	9	4	15
Mild-Mod	4	0	18	8	6	8
Mod	2	2	10	3	7	5
Mod-Severe	1	4	5	3	6	1
Severe	0	3	2	0	2	3
Missing (n=3)						
Total	**11**	**10**	**76**	**25**	**28**	**45**

Severity rating post VFSS was significantly related to whether strategies were trialled ($\chi 2$ = 25.93, df = 10, $p < 0.05$) with the most strategies trialled for those rated towards the middle of the scale; mild (18%), mild-moderate (21%). In addition, severity ratings post VFSS were related to whether strategies improved the swallow ($\chi 2 = 45.38$, df = 15, $p < 0.01$). Strategies were less effective in those rated towards the more severe end of the scale. Whilst it is acknowledged that there were less strategies trialled for those rated as severe, the ratios of effective to non-effective strategies indicated a higher failure rate of strategies attempted with those rated severe (see Table 6.).

TABLE 6. Severity ratings post-VFSS and the effectiveness of compensation strategies

	Severity rating post-VFSS						
Was the strategy effective?	**Normal**	**Mild**	**Mild - Mod**	**Moderate**	**Mod - Severe**	**Severe**	**Total**
Yes %	5	17	20	8	7	1	**58**
No %	0	1	1	2	2	3	**9**
Total	**5**	**18**	**21**	**10**	**9**	**4**	**67**

3.4 Mode of intake

Overall, VFSS altered the mode of intake for 21% of the patient population. Whilst those on full oral diets decreased from 73% to 69% following VFSS, those nil by mouth also decreased from 7% to 5%. Similarly, those on partial oral + enteral intakes increased by 7%, suggesting that more patients are having some oral intake introduced into their management post-VFSS. Further details of the types of alteration are available in Table 7, with the total columns showing the total frequencies for each mode of intake.

Confirmation of a significant difference between intake pre and post VFSS ($\chi 2 = 72.07$, df = 16, $p < 0.01$) indicated that VFSS had a significant impact on altering the mode of intake of patients. Referring back to Table 5, 11% were upgraded whilst 10% were downgraded out of the 21% whose intake was altered. There is also a significant relationship between the type of mode of intake alteration (i.e. upgrade, downgrade, no change) and the whether diet consistency was altered ($\chi 2 = 56.01$, df = 4, $p < 0.01$). All those upgraded on their mode of intake were also upgraded on their diet consistency, whereas 9% of those downgraded on mode of intake were also downgraded on diet consistency.

TABLE 7. Mode of intake pre and post- VFSS

		Mode of intake post-VFSS (%)						
		Full	Partial oral	Enteral	NBM+ Enteral	Partial+ Enteral	Missing	**Total**
Intake pre-VFSS (%)	Full	66	1	1	1	4	-	**73**
	NBM	2	1	0	2	2	-	**7**
	Partial oral	0	1	0	1	1	-	**3**
	NBM+Enteral	0	0	0	1	4	-	**5**
	Partial+Enteral	1	2	0	1	6	-	**10**
	Missing	-	-	-	-	-	-	**2**
Total		**69**	**5**	**1**	**6**	**17**	**2**	**100**

Another finding was a significant relationship between alterations in mode of intake and whether compensation strategies were attempted ($\chi 2 = 100.37$, df = 4, $p < 0.01$). Of the 21% in which mode of intake was altered, compensation strategies were attempted for 18% of these. In particular, the effectiveness of strategies was significantly related to the type of alteration ($\chi 2 = 22.86$, df = 4, $p < 0.01$), demonstrating that where mode of intake had not changed, more strategies were effective. Of the 58% of strategies that were effective, 7% were with those who had an upgrade in mode of intake and 4% with downgrades. The remaining 44% effective strategies were with patients whose mode of intake had not altered.

3.5 Diet consistency

Oral diets were altered following VFSS in 53% of the current sample and the numbers were fairly equal with 25% upgrades and 28% downgrades in diet consistency (see Table 5.). Further inspection revealed that the number of those on normal diets reduced from 47% to 34%, but the number of those nil by mouth also reduced by half from 14% to 7% post-VFSS, indicating that diet modifications have been introduced. A more comprehensive breakdown can be seen in Table 8. Chi-square analysis confirmed a significant difference between pre and post VFSS diet consistencies ($\chi 2 = 317.93$, df = 156, $p < 0.01$).

Whilst the relationships with the other variables have been explored in the previous sections (e.g. the significant relationships between diet consistency post VFSS and referral onwards, mode of intake post VFSS and severity rating), it is interesting to note that there was also a significant relationship between whether modifications in diet consistency were made and whether compensation strategies were attempted ($\chi 2 = 104.46$, df = 6, $p < 0.01$). Of the 53% those whose diets altered following VFSS, strategies were trialled in 41%. In contrast, in the 43% where there was no alteration, strategies were trialled in only in 25% of the sample.

TABLE 8. Diet consistency modifications pre and post VFSS

Consistencies		Diet pre VFSS %	Diet post VFSS %	Difference pre & post VFSS (%)
Valid	Normal	47	34	13
	Soft	4	12	8
	Puree	2	1	1
	Smooth cold	1	1	0
	Thick fluid	4	3	1
	Thin fluid	1	1	0
	Soft+Thin fluid	8	19	11
	Soft+Thick fluid	10	11	1
	Smooth cold+Thick fluid	0	1	1
	Smooth cold+Thin fluid	3	1	2
	Puree+Thick fluid	1	4	3
	Puree+Thin fluid	3	3	0
	NBM (+ Enteral)	14	7	7
	Missing	2	2	0
Total		**100**	**100**	-

In particular, a relationship was found between diet consistency post VFSS and whether compensation strategies were trialled ($\chi 2 = 21.49$, df = 12, $p < 0.05$). Most strategies (17%) were attempted with those on normal diets and 14% on soft + thin liquid diets. The effectiveness of these strategies was also significantly related to diet post VFSS ($\chi 2 = 67.40$, df = 24, $p < 0.01$). Only one strategy (chin tuck) was not effective with those on normal diets, but all were effective with those trialled in patients on soft + thin fluids. Of interest is that strategies were trialled in 5% of those nil by mouth and none of these were effective, hence being placed NBM. Further information is available from Table 9.

TABLE 9. Effectiveness of compensation strategies and diet consistencies post VFSS

Diet consistency	Compensation strategies								
Effective strategy?	Chin tuck %	Head turn %	Double sw %	Repeat sw %	Effort sw %	Liquid wash %	Mend Man* %	Cough post sw %	Mix %
Yes									
Normal	1	0	3	1	0	7	1	0	3
Soft	0	0	2	1	0	4	0	1	4
Puree	0	0	0	0	0	1	0	0	0
Thick fluid	1	0	1	0	1	0	0	0	0
Soft+thin fl	1	1	2	4	0	2	0	0	4
Soft+thick fl	1	0	2	1	1	0	0	0	1
Smooth+thin	0	0	0	0	1	0	0	0	0
Puree+thick	0	0	0	2	0	0	0	1	0
Puree+thin	0	0	1	0	0	0	0	0	2
Total	**4**	**1**	**10**	**9**	**3**	**14**	**1**	**2**	**14**
No									
Normal	1	0	0	0	0	0	0	0	0
Soft+thick fl	1	0	1	0	0	0	0	0	1
NBM	0	2	0	0	0	0	1	0	2
Total	**2**	**2**	**1**	**0**	**0**	**0**	**1**	**0**	**3**

* Mendelsohn manoeuvre

3.6 Compensatory strategies

Compensation strategies were attempted in 67% of the current sample. The most common strategies were "combination" of strategies (17%), liquid wash-through (14%) and double swallow (11%). Of these 58% were effective in improving the swallow. The effectiveness of strategies was significantly related to the type of strategy ($\chi 2 = 122.04$, df = 18, $p < 0.01$). General observations indicated that the majority of strategies had a higher success rate than failure rate in improving swallowing; the only strategy with a higher failure rate was a head turn (2% failure, 1% successful). Further detail is available in Table 10.

TABLE 10. Diet consistencies post VFSS and effective compensation strategies trialled

	Compensation strategies								
Effective strategy?	Chin tuck %	Head turn %	Double sw %	Repeat sw %	Effort sw %	Liquid wash %	Mend Man* %	Cough post sw %	Mix %
Yes	4	1	10	9	3	14	1	2	14
No	2	2	1	0	0	0	1	0	3
Total	**6**	**3**	**11**	**9**	**3**	**14**	**2**	**2**	**17**

* Mendelsohn manoeuvre

As previously discussed, the effectiveness of strategies was significantly related to severity ratings post VFSS (see Section 3.3), mode of intake alteration (see Section 3.4) and diet consistency (see Section 3.65. The type of strategy attempted was significantly related to patients' diet consistency post-VFSS ($\chi 2$ = 147.25, df = 108, p < 0.01). The most common strategy for those on normal diets was liquid wash-through (7%) and a combination of strategies were applied predominantly to those on soft (4%) and soft + thin fluid (4%) diets (see Table 9.). Worthy of note is that there was a significant relationship between the effectiveness of compensation strategies and the recommendation of swallowing therapy ($\chi 2$ = 100.92, df = 6, p < 0.01). For 54% of the sample where compensation strategies were effective, swallowing therapy was not recommended.

3.7 Swallowing therapy

Swallowing therapy was recommended in only 6% of the present sample and only three types were recommended; base of tongue, palatal and a combination. Interestingly, 4% of the recommended swallowing therapy was for those for whom compensation strategies were effective, and only recommended in 1% where the strategies trialled were unsuccessful at improving the swallow (see Table 11.). There was no evidence of any relationship between swallowing therapy and severity rating post VFSS ($\chi 2$ = 11.10, df = 15, p = 0.745). Whilst altered mode of intake was not significantly related to recommendations of swallowing therapy ($\chi 2$ = 1.96, df = 3, p = 0.581), swallowing therapy was only recommended to those whose intake had stayed the same. In addition, no significant relationships were found between recommendations of swallowing therapy and diet consistency post VFSS or diet modifications (i.e. upgrades, downgrades or the same).

TABLE 11. Details of swallowing therapy recommended

Was swallow therapy recommended	**Was the strategy effective?**			**Types of swallow therapy**						
	Not tried	Yes	No	Oral tongue	Base of tongue	Palatal	Falsetto	Adduct	Mix	**Total**
Yes (%)	1	4	1	0	2	1	0	0	3	**6**
No (%)	30	54	8	0	0	0	0	0	0	**92**
Missing	-	-	-	-	-	-	-	-	-	**2**

3.8 Clinical utility

Of particular interest was the question of whether VFSS resulted in change in at least one of the outcome variables under investigation. In the present sample, 92% of the 100 records examined showed change in at least one of the six variables. Furthermore, there was evidence of change in at least two of the variables for 70% of the sample and change in three or more variables for 38%. When the variable 'severity ratings' was removed from analysis, change was shown in 82% of the variables.

3.9 Summary of results

The present results indicated that VFSS resulted in changes for 90% of the sample in at least one of the six variables examined. Furthermore, the majority demonstrated change in two or more variables following VFSS. In terms of the variables under investigation, VFSS did not lead to a significant number of referrals onwards in the present sample. Referral onwards was also not related to any of the other outcome variables. However, VFSS significantly altered severity ratings of patients and these were significantly related to mode of intake changes, diet modifications and the effectiveness of compensation strategies on improving the swallow. Moreover, VFSS resulted in significant alterations in mode of intake status. Where mode of intake altered following VFSS, changes were also found in diet consistency, and related to the type of strategies that were trialled and how effective these were.

Further analysis revealed that VFSS resulted in alterations of oral diet consistencies in this population. The compensation strategies that were attempted and their effectiveness was shown to be linked to the diet consistency patients were recommended post VFSS. Strategies were implemented in over half the sample received and the majority of these were effective in improving the swallow. Finally, there was weak evidence for VFSS resulting in swallow therapy recommendations, with only 6% of the sample receiving therapy. The implication of these results is further discussed in Section 4.

Discussion

4.1 Clinical utility of the VFSS

The results of the present study corresponded well with the findings of the similar study by Martin-Harris and colleagues (2000). Videofluoroscopy altered management in 82% of the present population, which compares favourably to the 82.6% found by Martin-Harris *et al.* (2000). Despite the hypothesis that this figure may differ for a population of inpatients presenting with acute dysphagia, it appears that VFSS is equally clinically useful in informing management of both inpatients and outpatients. Furthermore, VFSS may have a greater effect than just altering one aspect of management, as over half the sample showed evidence of two altered variables and 38% showed change in three variables. In the following sections, the results of the analyses of each of the six variables investigated will be discussed and related to the findings by Martin-Harris *et al.* (2000). Attention will also focus on the implications of this on future dysphagia management and clinical practice in light of the limitations of the present study.

4.2 Population variables

Worthy of comment is the high frequency of those in the 70 years age range in the present sample. This is likely to reflect the high percentage (43%) of those classified within the neuromuscular degenerative diagnostic category, such as Parkinson's Disease. National figures indicate that 1% of the population over 65 years have Parkinson's Disease (www.parkinsonsdisease.com). As such, the current population sample reflects the trends evident in these disease groups.

On closer examination of the population, the diagnostic category "other" contained many unknown diagnoses. This is not unexpected given that many patients admitted to the present hospital are there for initial investigations and examinations with the intention of achieving a medical diagnosis. As such, VFSS is often used in a diagnostic capacity to determine any underlying pathologies and contribute to a medical diagnosis. This suggests that VFSS is used in the capacity that much of the research proposes, that is, to identify the possible causes of dysphagia (Mari et *al.,* 1997). The following sections consider whether VFSS is fulfilling a therapeutic purpose of evaluating the usefulness of treatment and compensation strategies (Crary & Groher, 2003).

4.3 Referral onwards

The present study found that 14% of the population sampled were referred onwards to other specialists for potential intervention. This figure is lower than the percentage reported by Martin-Harris *et al.* (2000) who found that VFSS resulted in 26.3% referrals. Given that their study was comprised predominantly of outpatients, VFSS may have been used in a more diagnostic capacity as they report that 87% were initial evaluations of outpatients. Whilst many inpatients at the National Hospital for Neurology and Neurosurgery are there for initial investigations, due to the progressive nature of many of the conditions, many are repeatedly re-admitted. In such cases where a diagnosis is known, intervention from another speciality may be deemed unnecessary.

However, comparison of these figures is not possible due to different referral procedures. No information was available on the criteria clinicians were using to refer onwards and neither was it within the study's remit to consider any differences in employment of criteria by individual clinicians. Most importantly, the reason for referral onwards does not necessarily have to be directly related to the swallow. Whilst no strong links to the other variables were found, strategies were still being trialled with the majority of those referred on, of which most were effective in improving the swallow. This highlights that VFSS was being used both diagnostically and to inform therapy. Thus, management may still be informed and implemented, despite the opinion that a patient may require further investigation or input.

4.4 Severity ratings

The inclusion of this variable demonstrated that VFSS can significantly change the rating of a swallowing disorder, as severity ratings changed in 64% of the population. It is acknowledged that severity ratings were based on subjective judgements and clinical expertise, which may differ between clinicians. However, the validity of the ratings was higher, having been agreed by two experienced clinicians. Interestingly, VFSS led to a decrease in the number of more severe ratings, which was mirrored in the increase in milder ratings. This suggests that ratings following VFSS were less cautious than those made from a bedside examination. Whilst it could be inferred that this demonstrates a lack of sensitivity and specificity of the bedside examination, no measure was made of the time delay between the severity ratings resulting from the bedside examination and the severity ratings made from the VFSS. As a result, dysphagia status may have significantly altered before a VFSS was performed, but this does not mean that the bedside examination can be called into question. Future studies may wish to investigate this further to assess the utility, sensitivity and specificity of the bedside examination.

Severity ratings post VFSS were also related to and resulted in changes in mode of intake. The finding that upgrades in intake status were more common in those with milder severity ratings, whereas downgrades were more predominant in those with more severe disorders is clinically expected. Those with more severe dysphagia are likely to be on a more restricted intake (Logemann, 1998). More positively, the present study demonstrated that VFSS led to upgrades for those on the milder end of the severity scale, which has important implications for a patient's quality of life. It is possible that upgrades in mode may result in improved quality of life, such as reduced anxiety or panic (c.f. Eckberg *et al.,* 2002). Similarly, the relationship between severity ratings post VFSS and altered diet consistency has quality of life implications. The diet upgrades associated with milder dysphagia and downgrades with more severe dysphagia is anticipated in clinical practice and confirms that VFSS results in accurate recommendations being made.

A particularly useful finding is that severity ratings post VFSS were related to whether strategies were attempted and their effectiveness in improving the swallow (i.e. safety or efficiency). Clinicians attempted more strategies with patients with less severe dysphagia. It could be argued that clinicians were only utilising the VFSS to inform therapy with milder dysphagic patients, consequently disadvantaging a large proportion of dysphagic patients. However, these strategies were more effective were with milder dysphagic patients. The most likely reason that strategies were less effective with severe dysphagics is their overall more complex swallow patho-physiology, where no one strategy would benefit. These findings reflect that clinicians were effectively using their expertise and judgement to decide whether to trial strategies and which particular ones to attempt. Furthermore, this provides support that VFSS is clinically useful in informing appropriate management strategies.

4.5 Mode of intake

Changes in intake status were recommended to optimise patient safety and nutrition for 21% of the present population. This is approximately 10% lower than the 31.4% found by Martin-Harris *et al.* (2000) but proved statistically significant, providing further validation for the clinical utility of the VFSS in informing dysphagia management. In accordance with the findings of the Martin-Harris *et al.* study, the majority whose intake status changed were in an upward direction (11%), that is, from non-oral to partial oral or full oral, although this is only marginally greater than the downgrades (10%). Combined with the evidence of VFSS resulting in a reduction in the number of those placed nil by mouth (from 7% to 5%) it could be argued that as VFSS results in a return to more "normal" intake status, VFSS can be promoted as an instrumental procedure that may improve life quality.

Further, the finding that intake status alteration was linked to diet modifications was not surprising as both these variables are linked and so a change in one is likely to result in a change in the other. For example, where intake altered to full oral, some form of diet will be implemented. Hence, those upgraded on mode of intake were also upgraded on diet consistency and conversely, those downgraded were also downgraded on diet consistency. Again, the impact of this on improving a patient's quality of life should not be underestimated. Upgrades in consistency may increase enjoyment of foods and drinks ingested, which may in turn affect psychological well being (Eckberg *et al.*, 2002).

4.6 Diet consistency

The present study found support for VFSS altering diet consistencies, with modifications deemed necessary in over half (53%). This figure is 10% higher than the 43.8% reported in the Martin-Harris *et al.* (2000) study, and provides stronger evidence to validate the clinical utility of the VFSS. Unlike the other study, the present research found that the majority of alterations were downgrades in diet modifications (28%), although this is similar to the figure for upgrades (25%). This suggests that VFSS results in more cautious diet recommendations than patients were previously on, in order to ensure safe or efficient bolus transport. It appears that VFSS is able to more accurately determine the most suitable consistencies, but also highlights that clinicians may be recommending diets that are not the most appropriate. As a result, patients may not be on a low risk management programme with the most benefits as recommended within the literature (Martino, 2002) and may be at higher risk of aspiration prior to VFSS. The potential consequences of this have been discussed in Section 1.3.

Worthy of note is that diet modifications were also related to compensation strategies attempted and their effectiveness. Most strategies were trialled with those who were on higher grade diets (i.e. normal and soft + thin fluids) and the majority were effective, whereas strategies were less likely to be attempted with those on lower grade diets (i.e. nil by mouth) and were less effective. The clinical implication of this is that compensation strategies may be most effective with those who are able to manage a higher grade diet. Whilst it is acknowledged that compensation strategies can improve a swallow, further research is required to investigate such findings and related variables to validate the use of such management techniques.

4.7 Compensation strategies

The finding that strategies were trialled in 67% lends support to VFSS being used to inform management. A "combination" of strategies was most frequently trialled (17%) and this is likely to be due to the complexity of the swallowing disorders and diagnoses that this patient population presents with. Strategies were effective and recommended for 58% of the total sample, with only the head turn having a higher failure rate. This is not unexpected as this strategy is recommended for unilateral paralysis of the pharynx (Logemann, 1993) and most neurological patients are likely to have other swallowing problems (Miller & Groher, 1997) and therefore require more comprehensive compensation strategies.

Where VFSS demonstrated that strategies improved swallowing, alterations have been indicated in other areas, such as diet consistency, which is not unexpected as discussed previously. However, the clinical relevance of the finding that most effective strategies were with those for whom intake status had not altered (44%) is not clear. The more likely anticipation is that effective strategies would be associated with increased intake alterations in an upward direction. Yet, Martin-Harris and colleagues (2000) also found that 61.2% of their sample demonstrated no intake alteration despite effective strategies being identified. Therefore this finding is not unique to the present study and this is not investigated further, although future research may wish to examine possible explanations.

4.8 Swallowing therapy

Recommendation rates post VFSS for swallowing therapy were lower than those reported by Martin-Harris *et al.* (2000). Their study found evidence that 37% were recommended for swallowing therapy, in comparison to the 6% found in the present study. Swallowing therapy referred to exercises involving range of movement and resistance (c.f. Table 1). The present study highlights that swallowing therapy was not widely recommended in clinical practice following VFSS. This may be due to the lack of research demonstrating the outcomes and validity of swallowing therapy or alternatively, clinicians lack of knowledge about swallowing. It is also possible that such exercises were recommended prior to VFSS, either to aid oral flexibility or to aid speech intelligibility, as often happens with those who have suffered a CVA (Logemann & Karhilas, 1990). As such, swallowing therapy may have had an indirect effect on the swallow but this is not possible to measure. If this is the case then it is possible that VFSS is not adding to management programmes in terms of identifying therapeutic swallowing strategies.

These findings indicate VFSS was not being fully utilised to identify the need for therapeutic exercises. However, the boundaries between compensation strategies and swallowing therapy are not clear, as compensation strategies, such as the Mendelsohn manoeuvre may be used as a form of swallow therapy. When assessing whether VFSS fulfils a dual purpose of diagnosis and informing therapy, it is useful to consider the broader definition that encompasses both strategies and swallowing therapy. On this basis the present study demonstrates that VFSS is used to inform therapeutic management of clients with acute dysphagia.

4.9 Implications and limitations on external validity

The findings of this investigation contribute to the increasing evidence that VFSS has practical benefits for patients with dysphagia and not only as a tool for identifying aspiration. The importance of VFSS as having a dual purpose has been highlighted, with the finding that VFSS can be used to inform clinicians of the most useful therapy techniques in the management programmes of dysphagia patients. This study also demonstrates the need for further investigation into the potential lack of swallowing therapy as a recommendation following VFSS, such as with alternative populations or taking measures of whether this is implemented prior to VFSS.

Furthermore, in the present study VFSS resulted in upgrades in mode of intake (11%) and diet consistency (25%), with severity ratings being altered in 64% of the population. Taken together, this infers that VFSS has an impact on improving the management of dysphagia. With the increasing focus on measures of how management of dysphagia affects quality of life (e.g. McHorney, Robbins, Lomas, Rosenbek, Chignell, Kramer & Bricker, 2002), this investigation provides evidence that VFSS can be used as a means by which to balance safety and efficiency issues with maximising a patient's quality of life. In particular, VFSS could be used to guide clinicians to when it is appropriate to alter management, as it is possible that clinicians are more cautious with the timing in recommending upgrades.

The VFSS procedure could also be used to demonstrate to patients why an upgrade or downgrade is necessary, or to reassure patients that their management is appropriate and allay any fears that they may be experiencing. In addition, as mentioned previously, clinical outcomes are associated with compliance to dysphagia management plans (Low *et al.*, 2001). It is possible that VFSS could be used as above to increase compliance, and thus decrease the number of re-admittances.

However, it is also important to acknowledge that whilst the present findings may have practical implications, there are some restrictions on their external applicability. Not only was this a specific patient population, but the management of their problems may differ for different populations or in different settings. In addition, as many of the population have degenerative disorders, where multiple VFSS's may be recommended, it is not clear whether the impact would be the same each time on altering management.

Moreover, the issues surrounding VFSS discussed in Section 1.8, such as differences in protocols, expertise levels of clinicians, consistencies trialled during the VFSS procedure, and the intra- and inter-rater inconsistencies mean that the findings of the present study may not be present in other settings. For example, the timing of when the VFSS occurred is likely to influence the amount it may impact on management. Alternatively, utilising a different protocol VFSS may have a lesser or greater impact on informing management. As it was not within the remit of this investigation, these variables were not taken into consideration as to their impact on the findings. Future research may wish to investigate these further and determine if the VFSS continues to have such high clinical utility.

4.10 Conclusion

The results of this investigation support the findings of Martin-Harris *et al.* (2000) that VFSS has validity as a method of informing management of patients with dysphagia. Together these studies demonstrate that this is applicable with both outpatients and with the more acute dysphagic inpatient population. Furthermore, VFSS was found to have a dual purpose as both a diagnostic and therapeutic tool, with alterations implemented in patient's dysphagia management, including mode of intake and diet consistencies. The VFSS procedure was also found to have clinical utility in identifying appropriate strategies to improve the swallow, possibly often being the reason behind an upgrade elsewhere, such as in diet consistency. However, there was little change observed in the number of those referred onwards or swallowing therapy being recommended as a result of the VFSS procedure. Practical implications have been explored with reference to the limitations on external validity. The present study has acted to heighten awareness and reinforce previous research that VFSS can alter the management of patients with dysphagia.

Word Count: 9,015

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Appendices

Appendix I

Table of postures and food consistencies

Replicated from "Manual for the Videofluoroscopic Study of Swallowing" (Logemann, 1993).

Postures & Food Consistencies Most Often Helpful to Patients with Particular Swallowing Disorders.

Swallowing Disorder	Posture	Food Consistency
Tongue dysfunction	Chin up	Thickened liquids
Delayed pharyngeal swallow	Chin down	Thickened liquids, purees
Reduced posterior motion of tongue base	Chin down	Liquids & thickened liquids
Unilateral pharyngeal paresis	Head rotated to damaged side	Liquids, thinner foods
Unilateral tongue & pharyngeal weakness, same side	Lean toward stronger unaffected side	Liquids & thickened liquids
Bilateral pharyngeal weakness	Lie on side or back	Liquids, thinner foods
Reduced laryngeal closure	Chin down, head rotated to damaged side	Purees
Reduced laryngeal elevation	Chin down, lie on side or back	Purees
Cricopharyngeal dysfunction, reduced anterior laryngeal movement	Head rotated to either side	Liquids

Appendix II

Letter to the Research & Development Director at the National Hospital for Neurology & Neurosurgery

Dear Sir

Re: Clinical Audit of Dysphagia Practices: Is the management of clients altered following videofluoroscopic examination?

I am writing to you to request your opinion and advice on an audit project I am interested in conducting. I am a final year MSc Speech & Language Sciences student studying at University College London. To fulfil the dissertation requirement for my degree I am interested in carrying out an audit to determine if and how the management of dysphagia patients within an in-patient setting is altered following a videofluoroscopic (VFSS) examination. This examination is recommended by a Speech and Language Therapist following the routine clinical bedside examination, to detect or confirm whether the patient is having swallowing difficulties.

I have approached Susan McGowan, Clinical Specialist Speech and Language Therapist at the National Hospital for Neurology and Neurosurgery in Queen's Square, who has agreed to act as Project Supervisor. Susan has recommended that I contact you to seek your opinion on whether, if I am to carry out this audit, ethical approval will be required. I would require access to only the Speech and Language Therapy notes in the Department on the last 100 patients who underwent a VFSS examination. The data I require would be anonymized and only the gender, age and medical diagnosis would be recorded in my database. I would also require access to the VFSS form that is completed following the examination. I would be recording data for analysis on the following:

- Whether the VFSS resulted in referral to another speciality for intervention. If so, whom?
- Whether the VFSS resulted in a change in nutritional intake status e.g. from non-oral to oral feeding and vice versa?
- Whether the VFSS resulted in a change of diet consistency e.g. from thin to thickened liquids?
- Whether the VFSS resulted in recommendations of swallowing therapy e.g. strengthening exercises?
- Whether strategies implemented during the VFSS (e.g. posture) improved the patient's swallowing?
- Whether the VFSS resulted in an alteration of the dysphagia severity rating?

I would appreciate your advice on whether I am required to apply to the Ethics Committee for approval to carry out this retrospective audit.

I look forward to hearing from you.

Appendix III

Videofluoroscopy Scoring Sheet

National Hospital for Neurology and Neurosurgery

Videofluoroscopy of Swallowing

Summary Assessment Report

UCL HOSPITALS

Patient name:		Hosp #:	DOB:
Medical diagnosis:		Consultant:	
Date of assessment:		Tape number:	

Texture / contrast assessed: thin liquid ☐ thick liquid ☐ paste ☐ biscuit ☐ other_____

Oral stage	**None**	**Mild**	**Moderate**	**Severe**	**Profound**
Lip closure					
Bolus preparation / mastication					
Bolus transport / tongue movement					
Residue (oral)					
Pharyngeal stage	**None**	**Mild**	**Moderate**	**Severe**	**Profound**
Initiation of swallowing					
Soft palate elevation					
Tongue base retraction					
Hyolaryngeal elevation					
Laryngeal closure					
Pharyngo-oesophageal segment opening					
Laryngeal penetration: before ☐ during ☐ after ☐ silent ☐ Cleared? How?					
Aspiration: before ☐ during ☐ after ☐ silent ☐ Cleared? How?					
Residue: base of tongue ☐ pharyngeal wall ☐					
Residue: valleculae - right ☐ - left ☐					
Residue: piriform sinuses - right ☐ - left ☐					

Oesophageal stage:

_____

Manoeuvres trialled:

_____

Summary:

☐ high risk of aspiration with oral intake – consider augmentative / alternate feeding
☐ recommended textures:
liquid ☐ thick liquid ☐ puree ☐ soft diet ☐ as desired ☐ other _____
☐ safety precautions:
bolus size _____ implements _____ rate _____
positioning _____ manoeuvres _____
☐ follow up speech and language therapy
☐ therapy recommendations: _____

Radiologist (print name): _____ Speech and Language Therapist(print name): _____

National Hospital for Neurology and Neurosurgery

Videofluoroscopy of Swallowing

Full Assessment Report

PROCEDURE

Positioning: _____

Counting: _____

Tracheostomy status: _____

Lateral View	Trial 1	Trial 2	Trial 3
Thin liquid			
Thick liquid			
Paste			
Biscuit			
Other			

AP View	Trial 1	Trial 2	Trial 3
Thin liquid			
Thick liquid			
Paste			
Biscuit			
Other			

Appendix IV
Raw Data

Key to abbreviations in the Table

VARIABLE	ABBREVIATION	ABBREVIATION
SEX	M	Male
	F	Female
GROUP	CVA	Cardio-vascular accident
	Neuro M	Neuromuscular degenerative disorders
	Neuro	Neurological disorders
	Neuro S	Neurological surgical disorders
	Other	ENT conditions, mental health etc.
REFER ON	Diet	Dietician
	Gastro	Gastro-enterologist
	ENT	Ear, nose & throat specialist
	Comm	Community services
	Radio	Radiographer
SEVERITY PRE & SEVERITY POST	99	Missing data
	Mild	Mild
	Mild-Mod	Mild to Moderate
	Mod	Moderate
	Mod-Sev	Moderate to Severe
	Sev	Severe
	Sev-Prof	Severe to Profound
	Prof	Profound
INTAKE PRE & INTAKE POST	Full	Full oral
	P-O	Partial oral
	Ent	Enteral feeding (e.g. NG tube, PEG)
	NBM	Nil by mouth
	P-O+Ent	Partial oral + Enteral feeding
	NBM+Ent	Nil by mouth + Enteral feeding
DIET PRE & DIET POST	Norm	Normal
	Soft	Soft
	Puree	Puree
	Sm-C	Smooth Cold
	Thin-F	Thin fluids
	Thick-F	Thick fluids
STRATEGY	/	None
	Ch-D	Chin down
	H-Turn	Head turn
	H-Tilt	Head tilt
	Eff Sw	Effortful swallow
	Dbl Sw	Double swallow
	Rep Sw	Repeated/Clearing swallow
	C P-Sw	Cough post-swallow
	Liq WT	Liquid wash-through
	Mand M	Mandelson Manoeuvre
	Comb	Combination
THERAPY	/	None
	BOT	Base of tongue
	Pal	Palatal
	Comb	Combination

PART NO.	AGE	SEX	GROUP	SEVERITY PRE	SEVERITY POST	REFER ON	INTAKE PRE	INTAKE POST	DIET PRE	DIET POST	STRATEGY	THER
1	71	M	CVA	99	99	/	Full	Full	Sft+Thick-F	Sft+Thick-F	/	/
2	57	M	CVA	Severe	Norm	/	P-O+Ent	Full	Puree	Sft+Thin-F	/	/
3	66	M	Neuro M	Mild	Mod-Sev	Diet	Full	P-O+Ent	Sft+Thin-F	Sft+Thick-F	Comb	/
4	69	M	Neuro	Mild-Mod	Mild-Mod	/	Full	Full	Norm	Norm	Comb	/
5	50	F	Neuro S	Sev-Prof	Mild	/	NBM	Full	NBM	Sft+Thick-F	/	/
6	48	M	Neuro M	Mild	Mild	/	Full	Full	Norm	Norm	Liq WT	/
7	67	M	CVA	Mild-Mod	Mod	/	Full	Full	Soft	Pur+Thick-F	/	/
8	53	M	Neuro	Mild-Mod	Mild-Mod	/	Full	Full	Pur+Thin-F	Pur+Thick-F	Rep-Sw	/
9	55	M	CVA	Norm	Norm	/	Full	Full	Norm	Norm	/	/
10	33	M	Other	99	Norm	/	Full	Full	Norm	Norm	Liq WT	/
11	19	M	Neuro	Mild-Mod	Mild-Mod	/	NBM+Ent	P-O+Ent	NBM	SmC+Thin-F	Eff-Sw	/
12	76	F	CVA	Mild	Mild	/	Full	Full	Soft	Norm	/	/
13	55	F	Other	Mild	Norm	/	Full	Full	Norm	Sft+Thin-F	Rep-Sw	/
14	56	F	CVA	Mod	Mild-Mod	/	Full	Full	Sft+Thick-F	Sft+Thick-F	Eff-Sw	/
15	16	M	Neuro M	Mild-Mod	Norm	Comm	Full	Full	Norm	Norm	/	/
16	29	F	Neuro M	99	Mild	Comm	Full	Full	Norm	Norm	Ch-D	/
17	56	F	Neuro S	Mild-Mod	Norm	/	P-O+Ent	P-O+Ent	SmC+Thin-F	Sft+Thin-F	Dbl-Sw	/
18	38	M	Neuro	Severe	Mild-Mod	/	NBM+Ent	P-O+Ent	NBM	Thick-F	Eff-Sw	/
19	50	F	Neuro S	Mild	Mild-Mod	/	Full	Full	Sft+Thick-F	Sft+Thin-F	Comb	BOT
20	77	M	Neuro	Mild	Mild-Mod	/	Full	Full	Sft+Thin-F	Sft+Thin-F	Liq WT	/
21	55	F	Neuro M	Mild	Mild-Mod	/	Full	Full	Norm	Sft+Thick-F	Ch-D	/
22	54	F	Neuro	Mild	Mild	/	P-O+Ent	P-O+Ent	Norm	Norm	Liq WT	/
23	75	M	Neuro	99	Mod	/	Full	Full	Norm	Soft	Comb	/
24	58	M	Neuro M	Mild	Mild	/	Full	Full	Norm	Sft+Thin-F	Rep-Sw	/
25	67	M	Neuro M	Mild-Mod	Mild	/	Full	NBM+Ent	Sft+Thick-F	NBM	/	/
26	59	M	Neuro M	Norm	Norm	/	Full	Full	Norm	Norm	Liq WT	/
27	82	M	Neuro	Mod	Mod	/	NBM	P-O	NBM	Sft+Thin-F	Rep-Sw	/
28	49	M	Neuro	Severe	Mild	/	NBM	P-O+Ent	NBM	Thin-F	/	/

29	71	F	Other	Mild-Mod	Mild	/	Full	Full	Norm	Norm	Dbl-Sw	/
30	71	F	Neuro M	Mod	Mod-Sev	/	P-O+Ent	NBM+Ent	SmC+Thin-F	NBM	Comb	/
31	68	M	Neuro M	Norm	Norm	/	Full	Full	Norm	Norm	/	/
32	48	M	CVA	Norm	Mod	/	P-O+Ent	P-O	Sft+Thin-F	Sft+Thin-F	/	/
33	25	F	Neuro S	Mod	Mild-Mod	/	Full	Full	Norm	Norm	Dbl-Sw	/
34	73	F	Neuro M	Mild	Mod	/	Full	Full	Sft+Thin-F	Sft+Thin-F	Dbl-Sw	/
35	53	F	Neuro S	Sev-Prof	Mod	/	NBM+Ent	P-O+Ent	NBM	Sm-C	/	/
36	65	M	Neuro M	Mild	Mild-Mod	Radio	P-O+Ent	P-O+Ent	Pur+Thick-F	Soft	Comb	/
37	40	F	Other	Norm	Norm	/	Full	Full	Norm	Norm	/	Comb
38	61	M	Neuro M	Mild-Mod	Mod-Sev	/	Full	Full	Sft+Thin-F	Sft+Thin-F	Ch-D	/
39	32	M	Neuro S	Severe	Mild-Mod	/	P-O+Ent	P-O	NBM	Pur+Thin-F	Comb	/
40	49	M	Neuro S	Severe	Mild-Mod	/	99	99	99	99	99	99
41	50	F	Neuro S	Mod-Sev	Mod-Sev	/	P-O+Ent	P-O+Ent	Thick-F	Pur+Thick-F	C P-Sw	Comb
42	58	F	Neuro M	Mild-Mod	Mod	/	Full	Full	Sft+Thin-F	Sft+Thin-F	/	/
43	35	F	Other	Mod-Sev	Mod-Sev	/	Full	Full	Pur+Thick-F	Thick-F	Ch-D	/
44	64	M	Neuro	Norm	Mild	/	Full	Full	Norm	Norm	/	/
45	53	M	Neuro M	Norm	Mild	/	Full	Full	Norm	Norm	/	/
46	51	F	Neuro S	Mild-Mod	Mild	/	P-O+Ent	P-O+Ent	SmC+Thin-F	SC+Thick-F	/	/
47	54	M	Neuro M	Mod-Sev	Severe	/	Full	P-O+Ent	Norm	Sft+Thin-F	Liq WT	/
48	44	F	Other	Mod-Sev	Mild	/	Full	Full	Thin-F	Sft+Thin-F	/	/
49	62	M	Neuro M	Mild	Mild	Gastro	Full	Full	Norm	Norm	Liq WT	/
50	47	M	Neuro	Norm	Mild	/	Full	Full	Norm	Norm	Comb	BOT
51	73	M	Neuro M	Severe	Severe	/	NBM+Ent	NBM+Ent	/	/	/	/
52	78	M	Neuro M	Mild	Mild-Mod	/	Full	Full	Norm	Norm	Comb	/
53	27	F	Neuro M	Mod	Mod-Sev	Diet	P-O	P-O+Ent	Sft+Thick-F	Pur+Thin-F	Dbl-Sw	/
54	42	M	Neuro M	Mod	Severe	/	Full	P-O+Ent	/	/	Mand M	/
55	25	F	Other	Norm	Norm	/	Full	Full	Norm	Norm	/	/
56	33	F	Neuro M	Mild	Mild	/	Full	Full	Norm	Norm	Ch-D	Comb
57	84	F	Other	Mild	Mild-Mod	ENT	Full	Full	Norm	Sft+Thin-F	/	/
58	58	F	Other	Norm	Mild	ENT	Full	Full	Norm	Norm	/	/
59	73	M	Neuro	Mild-Mod	Mod	/	Full	Full	Norm	Sft+Thin-F	Comb	/
60	61	M	Neuro S	Mod	Mild	/	NBM	Full	NBM	Sft+Thin-F	Comb	/

61	78	M	Neuro M	99	Mild	/	Full	Full	Soft	Soft	Liq WT	/
62	58	M	CVA	Sev-Prof	Mod-Sev	/	NBM+Ent	P-O+Ent	NBM	Pur+Thick-F	Rep-Sw	/
63	72	M	CVA	Sev-Prof	Mod-Sev	/	P-O+Ent	P-O+Ent	Thick-F	Sft+Thick-F	/	/
64	62	F	Neuro M	Mild-Mod	Mild-Mod	/	Full	Full	Norm	Soft	Liq WT	/
65	63	M	Neuro M	99	Mod	Mod	99	99	/	/	/	.
66	65	M	Neuro	Mild	Norm	/	Full	Full	Norm	Norm	/	/
67	69	M	CVA	Norm	Mild	/	Full	Full	Norm	Norm	Dbl-Sw	/
68	69	M	Neuro M	Mod	Mod	/	Full	P-O	Sft+Thin-F	Sft+Thick-F	Dbl-Sw	/
69	50	F	Neuro M	Norm	Norm	Radio	Full	Full	Norm	Norm	/	/
70	37	M	Neuro M	Mild-Mod	Mild-Mod	Comm	Full	Full	Norm	Soft	Dbl-Sw	/
71	47	F	Neuro M	Mild	Mild	Comm	Full	Full	Norm	Soft	Liq WT	/
72	46	F	Neuro M	Mild-Mod	Mild	/	Full	Full	Thick-F	Norm	Liq WT	/
73	64	F	Other	Mild	Norm	/	Full	Full	Norm	Norm	/	/
74	45	F	Neuro	Mod	Mild-Mod	/	Full	Full	Sft+Thin-F	Sft+Thick-F	Ch-D	/
75	70	M	Neuro M	Mod	Mod	ENT	Full	Full	Norm	Pur+Thin-F	Comb	/
76	38	F	Neuro M	Mild	Norm	/	Full	Full	Norm	Norm	/	/
77	58	M	Neuro S	Mod-Sev	Severe	/	NBM	NBM+Ent	/	/	H-Turn	/
78	35	M	Neuro M	Norm	Norm	/	Full	Full	Norm	Norm	/	/
79	73	M	Other	Mild	Mild-Mod	ENT	Full	Full	Norm	Soft	Comb	/
80	63	M	Neuro M	Mod	Mod	Comm	Full	Ent	Sft+Thick-F	Thick-F	Dbl-Sw	/
81	72	M	Neuro M	Mod	Mod-Sev	/	Full	Full	Norm	Sft+Thin-F	Comb	/
82	32	F	Neuro M	Mild-Mod	Mild	/	Full	Full	Soft	Soft	Dbl-Sw	/
83	31	F	Other	Mod	Mild-Mod	/	NBM	P-O+Ent	NBM	Puree	Liq WT	/
84	57	M	Neuro	Mild	Norm	/	Full	Full	Norm	Norm	/	/
85	74	M	Neuro M	Mod	Mild-Mod	/	Full	Full	Thick-F	Sft+Thick-F	Dbl-Sw	/
86	82	M	Neuro S	Mild-Mod	Mild	/	Full	Full	Sm-C	Soft	Liq WT	/
87	68	M	Neuro M	Mod-Sev	Mild-Mod	/	P-O	P-O	Sft+Thick-F	Sft+Thick-F	Comb	/
88	68	M	Other	Mild-Mod	Mild	/	Full	Full	Sft+Thick-F	Sft+Thin-F	H-Turn	/
89	40	M	Neuro M	Mild-Mod	Mod	/	Full	Full	Sft+Thick-F	Sft+Thin-F	Rep-Sw	Pal
90	59	F	Neuro M	Mod	Mod-Sev	/	Full	P-O+Ent	Norm	Sft+Thick-F	Rep-Sw	/
91	34	F	Other	Mild	Mild	/	Full	Full	Norm	Norm	Liq WT	/
92	82	M	Neuro	Mod-Sev	Mod	/	NBM	NBM+Ent	NBM	NBM	H-Turn	/

93	48	M	Neuro M	Mild-Mod	Mild	/	Full	Full	Sft+Thick-F	Norm	/	/
94	30	M	Other	Mild-Mod	Norm	/	Full	Full	Norm	Norm	Rep-Sw	/
95	72	M	Neuro M	Mod	Severe	/	P-O	NBM+Ent	Puree	NBM	Comb	/
96	78	M	Other	Mild-Mod	Mod	/	Full	Full	Norm	Soft	C P-Sw	/
97	33	M	Other	Mild-Mod	Mild-Mod	/	Full	Full	Norm	Norm	Mand M	/
98	62	M	Neuro	Mild-Mod	Mild-Mod	/	Full	Full	Pur+Thick-F	Soft	Rep-Sw	/
99	53	M	Neuro M	Mild	Mild	/	Full	Full	Norm	Norm	/	/
100	69	F	Neuro S	Mild-Mod	Mild	/	Full	Full	Norm	Soft	Comb	/