

New Zealand Speech-language Therapy Clinical Practice Guideline on Videofluoroscopic Swallowing Study (VFSS)

Revised by Miles, A., Davison, F., Greig, L., Keesing, M., Kerrison, G.,
Perry, S.

Revised March 2020

Miles, A., Benoit, A., Keesing M., McLauchlan, H., Ong, E., Rigby, H.,
Sargent, M., Whitaker, L., White, J. & Williams, P.

Originally published March 2011

Endorsed by:

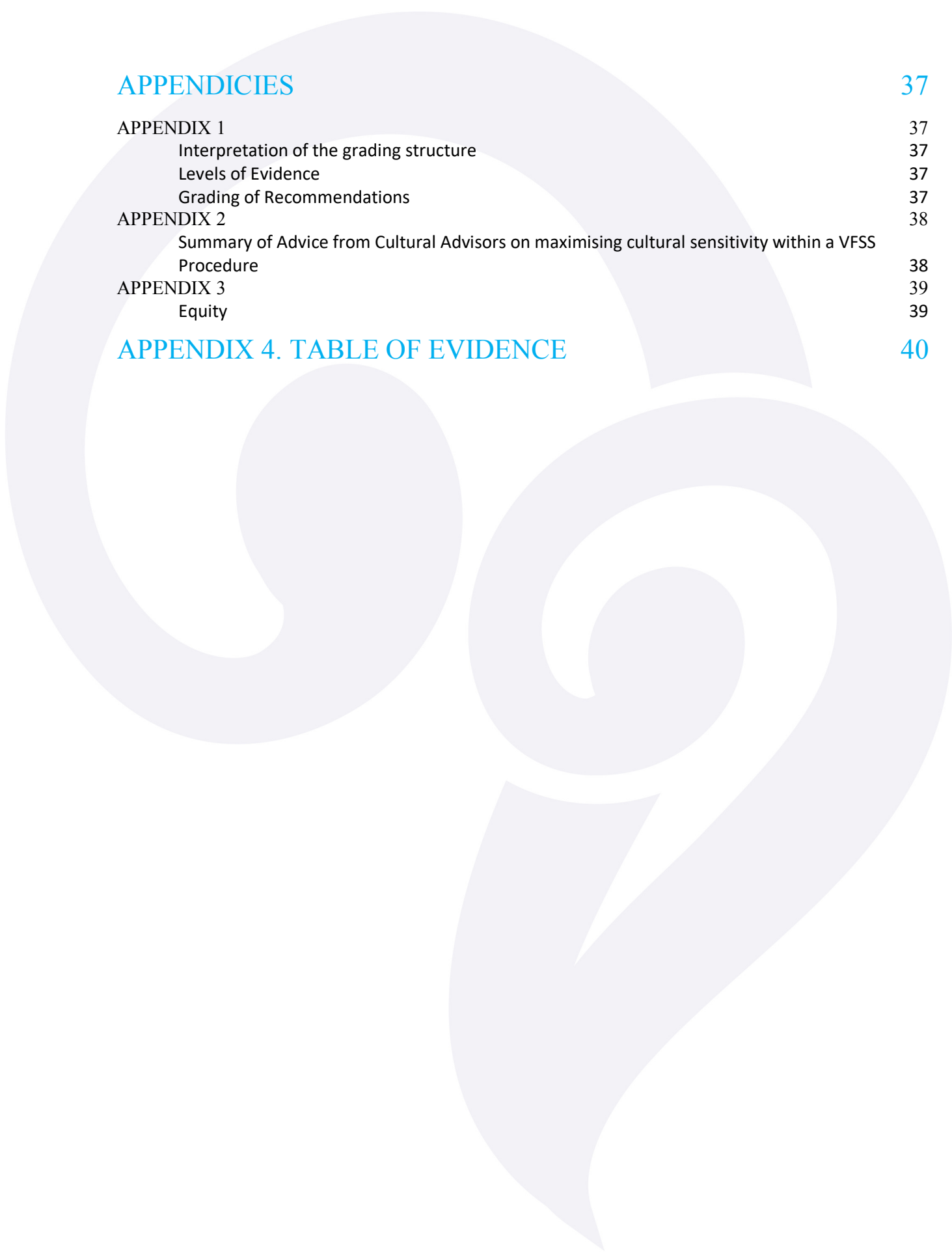
The New Zealand Speech-language Therapists' Association (NZSTA) 2011, 2020
The Royal Australian and New Zealand College of Radiologists 2011, 2020 pending
New Zealand Medical Radiation Technologists Board 2020 pending

Copyright © 2020 The New Zealand Speech-language Therapists' Association. All rights reserved.

Disclaimer: To the best of the New Zealand Speech-language Therapists' Association (NZSTA) ("the Association") knowledge, this information is valid at the time of publication. The Association makes no warranty or representation in relation to the content or accuracy of the material in this publication. The Association expressly disclaims any and all liability (including liability for negligence) in respect of the use of the information provided. The Association recommends you seek independent professional advice prior to making any decision involving matters outlined in this publication.

Contents

INTRODUCTION	4
Scope of the Guideline	4
Purpose of the Guideline	4
Definition	4
Context and Use	5
Population	5
Acknowledgements	5
Declarations	5
2020 Working Group Members	6
2011 Working Group Members	6
2011 Consultation Group	6
METHODOLOGY	6
Working Group	7
Recruitment of Consultation Group	7
Literature Search	7
Appraisal of the Evidence	7
The Unique New Zealand Context	8
Equity/Safeguarding	8
GUIDELINE SUMMARY	10
RECOMMENDATIONS	12
1. PURPOSE	12
Indications for using VFSS	12
Use of VFSS in comparison to Flexible endoscopic evaluation of swallowing (FEES)	15
2. TRAINING	16
SLT Competency	16
3. SAFETY	19
Code of Conduct	19
Radiation Safety Protocol	19
Barium Safety	21
Infection control	22
Adverse incident reporting	22
Privacy	23
4. PEOPLE INVOLVED	24
Team Members and roles	24
Education to patient and whānau	25
5. ASSESSMENT PROCEDURE	27
Assessment procedure	27
Preparation of Food and Fluids with Contrast Agents	28
Termination of Procedure	29
Image Acquisition	30
Positioning of Patient	31
Delivery of trials	32
6. INTERPRETATION AND REPORTING	35
Interpretation of VFSS	35
Reporting on VFSS	36



APPENDICIES	37
APPENDIX 1	37
Interpretation of the grading structure	37
Levels of Evidence	37
Grading of Recommendations	37
APPENDIX 2	38
Summary of Advice from Cultural Advisors on maximising cultural sensitivity within a VFSS Procedure	38
APPENDIX 3	39
Equity	39
APPENDIX 4. TABLE OF EVIDENCE	40

INTRODUCTION

Scope of the Guideline

In 2009, the National SLT Health Leaders' Group identified the need for a New Zealand clinical guideline for speech-language therapists (SLTs) working with Videofluoroscopic Swallowing Study (VFSS), also known as Modified Barium Swallow (MBS).

It was acknowledged that VFSS is a proven valid tool and is clinically important. Instrumental assessment of dysphagia is vital given the limitations of the clinical swallowing/feeding evaluation. VFSS is the most readily available instrumental assessment tool for SLTs in New Zealand. Despite its 'gold standard' status, there is often a discrepancy between international policy statements, rapidly increasing scientific evidence and actual practice.

This guideline aims to be relevant to the assessment of both **children** and adults and to support practice across the breadth of services of New Zealand (i.e. rural and urban, community and hospital-based). It aims to source evidence internationally but to be specific to the New Zealand context.

Purpose of the Guideline

The aim of this clinical guideline is to support consistent speech-language therapy practice through explicit evidence-based statements. This guideline is aimed at leaders and clinicians and may be used to support clinical decision-making and service delivery decision-making. Where evidence is not available, expert opinion and professional consensus have been included.

This guideline is written for speech-language therapists and has been produced using multidisciplinary literature and with multidisciplinary consultation. It may be used as part of a multidisciplinary document at a local level. The working group also have a vision for developing a national multidisciplinary VFSS guideline, of which this guideline would be incorporated.

Definition

A VFSS should be distinguished from a barium swallow procedure. A VFSS is a medical imaging procedure performed by a radiologist and/or speech-language therapist with focus on the biomechanics of the oral, pharyngeal, laryngeal and upper oesophageal parameters of swallowing. A variety of foods, fluids and compensatory strategies are usually trialled. In comparison, a barium swallow is a medical imaging procedure used to examine the upper gastrointestinal tract focusing on the oesophagus and stomach. This is performed by a radiologist to identify oesophageal abnormalities such as motility issues or structural abnormalities and often requires larger volumes of liquids to be ingested.

Context and Use

This guideline has been written with the unique New Zealand population and health service in mind in order to allow clinicians and leaders to easily apply evidence to practice. The guideline must always be used within the context of local governance. Statements must be interpreted with clinical judgement on a case-by-case basis.

Population

Dysphagia can occur at any stage of life and may have many causes. Speech-language therapists working in the area of dysphagia engage with many patient groups with the aim of habilitating, maintaining and rehabilitating swallowing. In the paediatric sector, SLTs work with children with congenital, acute and/or chronic conditions which include but are not limited to TBI, cerebral palsy, prematurity/chronic lung disease, Down Syndrome, complex congenital heart disease and intracranial tumours. In the adult sector, SLTs work with patients with acute, chronic and progressive conditions which include but are not limited to stroke, progressive neurological conditions (Parkinson's disease, Motor Neurone disease, Multiple Sclerosis, Huntington's disease), cognitive impairment (dementia, intellectual disability) and head and neck cancer. SLTs work across many settings including acute hospitals, rehabilitation centres, residential facilities, schools and community-based or home-based services. VFSS is deemed an appropriate instrumental assessment tool with all population groups in all settings.

Acknowledgements

Thank you to the National SLT Health Leaders' Group for initiating this project and for agreeing to take responsibility for implementing and reviewing it. We would like to thank the New Zealand Guideline Group (NZGG) for their resources and support in producing this guideline and for use of the NZGG grading of recommendations system. Thank you to the Royal College of Speech and Language Therapists (RCSLT) for permission to use RCSLT Clinical Guidelines 2005 critical appraisal forms and levels of evidence process. Due to the extensive work done by NZGG and RCSLT this guideline was made achievable. Thank you to all the speech-language therapists who were involved in developing this guideline and to the New Zealand Speech-language Therapists' Association (NZSTA) for their support and encouragement. Thank you to the consultation group for reading drafts and providing expert advice. Many thanks to Fran Clements at the University of Auckland Medical School Library for her support in the initial literature searching.

Declarations

The authors have no declarations of funding and no conflicts of interest to disclose.

Anna Miles, Project Leader

2020 Working Group Members

Project Lead: Anna Miles PhD – *Senior Lecturer, Speech Science, The University of Auckland*

Freya Davison – *Speech Language Therapy, Nelson DHB*

Lucy Greig – *Clinical Director & Speech-language Therapist, Rose Rehabilitation Clinics, University of Canterbury Rose Centre for Stroke Recovery and Research.*

Melissa Keesing – *Speech Language Therapy, Starship Children’s Hospital, Auckland DHB*

Gwen Kerrison – *Clinical Lead Speech Language Therapy, Waikato DHB*

Sarah Perry PhD – *Senior Research Fellow, Biobehavioral Sciences, Columbia University*

2011 Working Group Members

Project Lead: Anna Miles – *Senior Tutor, Speech Science, The University of Auckland*

Andrea Benoit – *Professional Leader, Speech-Language Therapy, Waitemata DHB*

Melissa Keesing – *Speech-Language Therapist- paediatric dysphagia, Auckland DHB*

Helen McLauchlan – *Professional Leader, Speech-Language Therapy, Counties Manukau DHB*

Esther Ong – *Speech-Language Therapist- ENT/ORL, Auckland DHB*

Helen Rigby – *Professional Leader, Speech-Language Therapy, Capital and Coast DHB*

Margaret Sargent – *Clinical Specialist, Speech-Language Therapist, Community Stroke Team, Canterbury DHB*

Leanne Whitteker – *Speech-Language Therapist, Stroke Unit, Canterbury DHB*

Jodi White – *Speech-Language Therapist, Midcentral DHB*

Philippa Williams – *Clinical Director, Speech Science, The University of Auckland*

2011 Consultation Group

Beverley VanZyl – *Speech-Language Therapy Manager- rural and remote, Northland DHB*

Bianca Gordon – *Senior Tutor- paediatric dysphagia, Speech Science, The University of Auckland*

Clare McCann PhD – *Professional Standards Portfolio, The New Zealand Speech-language Therapists’ Association (NZSTA)*

Dr David Vokes – *Consultant ORL, Auckland DHB*

Diane Brown – *Team Leader, Medical Radiation Technician, Starship Hospital, Auckland DHB*

Dr Glyn Thomas – *Consultant Radiologist, Palmerston North Hospital, Midcentral DHB*

Dr Jacob Twiss – *Consultant Paediatric Respiratory Medicine, Starship Hospital, Auckland DHB*

Ian Kaihe-Wetting – *TIP Facilitator, Te Kaahui Oro (Māori Health Services), Counties Manukau DHB*

Kerrie Gallagher – *Māori and Cultural Development Portfolio, The New Zealand Speech-language Therapists’ Association (NZSTA)*

Dr Jacqueline Allen – *Consultant ENT, North Shore Hospital; Senior Lecturer, Department of Surgery, University of Auckland*

Jenni Palmer – *Unit Charge Medical Radiation Technician, Angiography/Fluoroscopy, Capital and Coast DHB*

Karla Rika-Heke – *Te Kaahui Ora Nurse Educator, Counties Manukau DHB*

Maggie-lee Huckabee PhD – *Senior Lecturer/ Researcher- Dysphagia, University of Canterbury, Christchurch; The Van der Veer Institute for Parkinson’s and Brain Research, Christchurch*

Dr Richard Annand – *Consultant Radiologist, Christchurch Radiology Group*

Dr Russell Metcalf – *Paediatric Radiologist, Starship Hospital, Auckland DHB*

METHODOLOGY

Working Group

In 2011, a working group was established from volunteers through the National SLT Health Leaders' Group. Members varied in locality, service and experience. The group worked through email and teleconferences as well as locality-based small working parties for evidence appraisal. In 2019, a second working group was established to revise the guideline based on new evidence and new service changes in New Zealand.

Recruitment of Consultation Group

A range of specialists within the speech-language therapy profession and within relevant associated professions was asked to form a consultation group. The aim was to gain advice on draft guidelines from experienced professionals who worked with VFSS across the variety of different client groups (e.g. paediatric and adults, radiologists, medical radiation technologists (MRTs) as well as across a variety of contexts of New Zealand (e.g. rural, community-based).

Literature Search

A structured review of the literature was carried out in 2011 and then again in 2019. The working group devised a list of clinical questions and these were turned into key words for the database search. Search databases included Medline, Embase, Cochrane, Scopus, CINAHL as well as searches on various websites and smaller databases e.g. Speechbite, Google scholar, NHS Evidence (NICE) and relevant national and international professional association sites e.g. Ministry of Health NZ, American Speech-Language-Hearing Association (ASHA). Key textbooks were read to gauge expert opinion/professional consensus on specific areas of the guideline and hand searching through reference lists and bibliographies of relevant reviews and research was carried out.

Appraisal of the Evidence

Literature was read and appraised by the working group and their speech-language therapy colleagues. This guideline aligns its appraisal of evidence with the New Zealand Guideline Group (NZGG) and the Royal College of Speech Language Therapists (RCSLT). The Health Service Assessment Cooperation (HSAC) recommendations of high quality, regularly used grading tools were taken into account (Ali 2009).

With permission from the RCSLT, each paper was critically appraised using one of seven data extraction forms depending on its methodological design; analytic cohort/one sample longitudinal, case control/case series, cross-sectional/survey, randomised controlled trial, single subject, systematic review and meta-analysis and qualitative. These checklists taken from the RCSLT Clinical Guidelines were based on work carried out by the Scottish Intercollegiate Guidelines Network (SIGN) and the Royal College of Nursing, UK.

Each paper was given an evidence level based on the critical appraisal. These levels of evidence were taken from the RCSLT Guidelines (based on AHCPR 1992) and range from Ia-IV (see appendix). Papers with a focus solely on paediatric feeding are reported in bold.

Recommendations were assessed using the NZGG considered judgment forms (see appendix) and graded based on the volume of evidence, consistency, applicability and clinical impact. A grade was allocated for each recommendation following the NZGG grading of recommendations (see appendix);

A *The recommendation is supported by good evidence.*

B *The recommendation is supported by fair evidence.*

- C** *The recommendation is supported by expert opinion only and/or limited evidence.*
- I** *No recommendation can be made because the evidence is insufficient. Evidence is lacking, of poor quality or conflicting and the balance of benefits and harms cannot be determined.*
- ✓** *Recommended good practice based on the clinical experience of the guideline development group and where guidance is needed.*

As always, interpretation of grading of literature must be taken cautiously. A low grading means that there has not been a large amount of research in that particular area of practice NOT that the recommendation is a poor one.

The Unique New Zealand Context

NZ Population Data from 2019 Census:

- European (largest major ethnic group) 70.2%
- Māori 16.5%
- Asian 15.1%
- Pacific peoples 8.1%
- Middle Eastern, Latin American and African 1.20%

Statistics New Zealand (Tatauranga Aotearoa) www.stats.govt.nz/information-releases/2018-census-population-and-dwelling-counts

It is important to address the unique cultural context of New Zealand and the guideline group wanted to reflect its commitment to a Treaty of Waitangi/Te Tiriti o Waitangi relationship with Māori. Māori and Pacific Island consultation occurred throughout guideline development. Key literature on culturally sensitive practice in health was appraised and incorporated into the recommendations. Māori and Pacific Island Advisors were asked to observe a VFSS procedure in a New Zealand District Health Board and provide advice on providing a culturally sensitive service (see appendix). This advice was incorporated into the recommendations.

In today's dysphagia practice, we need to expand our definition of culture to include not only patients who are ethnically diverse, but also consider socioeconomic status and those who may belong to a religious group, follow a specific lifestyle or even eat specific foods. All of these factors may influence the patient's view of disability, of western medical treatment, the roles of family members and of clinicians, the different gender roles, and the ways in which we show respect (Riquelme, L. 2004).

Equity/Safeguarding

The World Health Organization states:

“Equity is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically. Health inequities therefore involve more than inequality with respect to health determinants, access to the resources needed to improve and maintain health or health outcomes. They also entail a failure to avoid or overcome inequalities that infringe on fairness and human rights norms.”

“Reducing health inequities is important because health is a fundamental human right and its progressive realization will eliminate inequalities that result from differences in health status (such as disease or disability) in the opportunity to enjoy life and pursue one's life plans.”

Excerpt taken from <https://www.who.int/healthsystems/topics/equity/en/>

With this in mind, this guideline group wishes to acknowledge the importance of equity and encourages all SLTs to make allowances within our practice to ensure equity of access to VFSS and also equity of outcomes. Further reading on this topic can be found in *Reducing Inequalities in Health*, published in 2002 by the Ministry of Health.

“In New Zealand, ethnic identity is an important dimension of health inequalities. Māori health status is demonstrably poorer than other New Zealanders; actions to improve Māori health also recognise Treaty of Waitangi obligations of the Crown. Pacific peoples also have poorer health than Pakeha. In addition, gender and geographical inequalities are important areas for action.”

Reducing Inequalities in Health. Published in September 2002 by the Ministry of Health. This document is available on the Ministry of Health website: <http://www.moh.govt.nz>

SLTs should be aware of their role in promoting health equity for vulnerable populations. For example:

- The rate of referral for a VFSS (e.g. Consider what the barriers are for making a referral - What can we do to improve access?)
- The rate of acceptance/consent for VFSS (e.g. How can we improve communication with vulnerable populations?)
- Timeliness of access (How should we triage vulnerable populations?)
- Attendance (i.e. Did not attend (DNA) rates – What are the barriers to access?)
- Developing relationships and partnerships that allow trust and shared understanding and decision making
- Recommendations (e.g. What extra support is needed? How can we adapt our communication and education to improve understanding and informed decision making?)

New Zealand Speech-language Therapy Clinical Practice Guideline on Videofluoroscopic Swallowing Study (VFSS)

Published March 2011; Revised 2020.

GUIDELINE SUMMARY

Recommendation	Strongly recommended with Good Evidence	Recommended with Fair Evidence	Recommended Expert Opinion but little research in area
VFSS is a clinically valid assessment tool	✓		
A clinical swallowing/feeding evaluation should occur prior to the VFSS			✓
SLTs should receive ongoing training in using VFSS	✓		
SLTs should ensure they have good knowledge of normal swallowing biomechanics	✓		
SLTs should be aware of the principles of cultural safety	✓		
SLTs should receive radiation safety training	✓		
A staff member of radiology must be present to work the fluoroscopy equipment	✓		
A radiologist must be present or available to review recordings of the procedure			✓
SLTs are not qualified to make medical diagnosis or identify structural deviations	✓		
SLTs should have access to high quality images and slow motion playback	✓		
VFSS should be recorded at 30 frames per second where possible	✓		
Voice recording and a counter timer are recommended			✓

SLTs should take responsibility for educating patients and their family/whānau	✓		
SLTs should follow a standardised procedure with standardised use of contrast agents	✓		
SLTs should use low density barium where possible	✓		
SLTs should use clinical judgment on the termination of the procedure	✓		
All efforts should be made to simulate normal feeding positions within the procedure		✓	
Patients should be viewed in lateral and anterior-posterior projection as appropriate			✓
The oesophageal stage should be viewed where possible		✓	
Consistencies and delivery modes should be selected based on specific patient needs		✓	
Compensatory strategies should be trialled within the procedure		✓	
Many rehabilitative approaches should not be recommended without objective assessment such as VFSS		✓	
A locally agreed objective VFSS procedure should be used for interpretation	✓		
A comprehensive report should be written. An additional radiologist report should be written (if present)			✓

Endorsed in 2011 by:

The New Zealand Speech-language Therapists' Association (NZSTA)
The Royal Australian and New Zealand College of Radiologists

Endorsed in 2020 by:

The New Zealand Speech-language Therapists' Association (NZSTA)

The full guideline can be accessed through The New Zealand Speech-language Therapists' Association (NZSTA) website at www.speechtherapy.org.nz

RECOMMENDATIONS

- A** *The recommendation is supported by good evidence.*
- B** *The recommendation is supported by fair evidence.*
- C** *The recommendation is supported by expert opinion only and/or limited evidence.*
- | *No recommendation can be made because the evidence is insufficient.*
- ✓ *Recommended good practice.*

A* *Where a recommendation is New Zealand legislation or policy, the recommendation has been given a **Grade A****

1. PURPOSE

Indications for using VFSS

VFSS is useful clinically for a variety of population groups in both acute and non-acute settings. **A**

VFSS is considered the instrumental swallowing assessment of choice by the majority of clinicians due to its proven validity. Examples of population groups who can benefit from VFSS include: acquired neurological disorders, benign and malignant head and neck conditions, tracheostomised and/or ventilated patients, respiratory conditions, spinal injuries, burns and trauma, developmental and congenital conditions (RCSLT, 2013). The sensitivity and specificity of the ‘bedside’ clinical swallowing evaluation (for identifying patients who aspirate) has been found to be poor (e.g. Splaingard et al., 1988). Therefore, the use of instrumental assessments such as VFSS is a vital part of speech-language therapy practice.

Evidence:

Arvedson & Lefton-Greif (1998 and 2007) Evidence level IV

Hiorns & Ryan (2006) Evidence level IV

Trace et al (2018) Evidence level III

Leonard & Kendall (2018) Evidence level IV

Logemann (1998) Evidence level IV

Logemann et al (2008) Evidence level IIa

Glo Re et al (2019) Evidence level IV

Mari et al (1997) Evidence level III

Martin-Harris et al (2000) Evidence level III

Mason (1993) Evidence level IV

Miller (2011) Evidence level IV

NZSTA Paediatric Dysphagia Guidelines (2019)

Ott et al (1996) Evidence level III

RCSLT (2013) Evidence level IV

Smithard et al (1998) Evidence level III

Splaingard et al (1988) Evidence level III

Stroudley & Walsh (1991) Evidence level IIb

Tippett (2000) Evidence level IV

Zerilli et al (1989) Evidence level III

N.B. Papers with a focus solely on paediatric feeding are reported in bold.

VFSS is considered useful for investigation of the following:

- To confirm and/or differentially diagnose dysphagia including normal and abnormal swallowing biomechanics, bolus flow and airway protection during swallowing **A**
- To enhance nutritional adequacy and safety through compensatory strategies and diet modification **A**
- To monitor change in a patient already known to have dysphagia **C**
- To support an inconclusive clinical swallowing/feeding evaluation (e.g. due to cognitive or communication difficulties or where the clinical condition does not match the clinical swallowing/feeding evaluation) **C**
- To determine appropriate rehabilitative strategies **A**
- To support decisions regarding quality of life (e.g. choices about alternative feeding methods) **C**
- To provide objective information for patient, family and multidisciplinary team (MDT) about swallowing function. **C**

Evidence:

Arvedson & Lefton-Greif (1998 and 2017) Evidence level IV

Baylow et al (2009) Evidence level IIa

Bisch et al (1994) Evidence level III

Daniels & Huckabee (2008) Evidence level IV

De Matteo et al (2005) Evidence level III

Huckabee & Pelletier (1999) Evidence level IV

Kim et al (2014) Evidence level III

Leonard & Kendall (2018) Evidence level IV

Logemann et al (1994) Evidence level IIb

Logemann et al (1995) Evidence level III

Logemann & Kahrilas (1990) Evidence level III

Martin-Harris et al (2000) Evidence level III

NZSTA Paediatric Dysphagia Guideline (2019)

Pikus et al (2003) Evidence level III

Shaker et al (2002) Evidence level Ib

VFSS is useful in identifying aspiration in patients with dysphagia. **A**

Rationale:

Studies have shown good intra- and inter-rater reliability for SLTs identifying aspiration using VFSS.

Evidence:

Dharmarathna et al (2019) Evidence level IV

Irace et al (2018) Evidence level III

Langmore et al (2003) Evidence level III

Mari (1997) Evidence level III

Martin-Harris et al (2000) Evidence level III

McGratton et al (2019) Evidence level III

Miller (2011) Evidence level IV

Newman et al (2001) Evidence level III

Ott et al (1996) Evidence level III

Rugiu (2007) Evidence level IV

Singh et al (2009) Evidence level III

A clinical swallowing/feeding evaluation should occur prior to a VFSS and the detailed results of this must be available to the team performing and analysing the VFSS.

This should include:

- case history from patient, family, MDT
- medical history
- speech and voice assessment
- oral motor examination / cranial nerve examination
- observation of eating and drinking/feeding (optional). **C**

Evidence:

Arvedson & Lefton-Greif (1998 and 2017) Evidence level IV

Daggett et al (2006) Evidence level III

Daniels & Huckabee (2008) Evidence level IV

Dematteo et al (2005) Evidence level IV

Leonard & Kendall (2018) Evidence level IV

NZSTA Paediatric Dysphagia Guideline (2019)

O'Donoghue & Bagnall (1999) Evidence level IV

Rugiu 2007 Evidence level I

A VFSS is not considered appropriate for the following:

- Medically unstable, drowsy or agitated patients
- Patients who are unable to be positioned safely
- Patients with allergies to barium/contrast
- Patients without a clear rationale for assessment or where management is unlikely to change as a result of the VFSS

An SLT should have a clear reason for a referral for VFSS and be prepared for the management decisions as a result of the procedure (SPA 2005). **C**

Evidence:

Speech Pathology Australia (2005) Evidence level IV

Use of VFSS in comparison to Flexible endoscopic evaluation of swallowing (FEES)

The decision to complement a clinical/feeding swallowing evaluation with an instrumental investigation such as a VFSS should be made with considered judgement of the advantages and disadvantages of the instrumental options available in the workplace **B**

Rationale:

Many researchers have investigated the merits of one instrumental dysphagia assessment tool over another. There is evidence that both VFSS and FEES provide good sensitivity and specificity when assessing swallowing biomechanics, bolus flow and aspiration risk (see NZSTA FEES Practice Standards). There is some evidence to suggest FEES is slightly more sensitive than VFSS in detecting aspiration, penetration, and residue (e.g., Giraldo-Cadavid, 2016) however, there is emerging literature to demonstrate that the presence of an endoscope can increase the incidence of aspiration and increase residue severity in the same individual (Adachi, 2017).

VFSS and FEES have different clinical and practical merits (see ASHA, <https://www.asha.org/Practice-Portal/Clinical-Topics/Adult-Dysphagia>). VFSS has the advantage over FEES in being able to observe the oral, pharyngeal, and oesophageal phases of swallowing, as well as visualising hyoid displacement and pharyngo-oesophageal segment (PES) opening, which cannot be seen during FEES. It has been demonstrated that using both VFSS and FEES for the same patient increases sensitivity in detection of aspiration across different cases (Park 2015). Direct comparison of penetration/aspiration severity across the two methodologies should be made with caution, as there has been evidence that clinicians rate these parameters higher on the penetration-aspiration scale (PAS) with FEES than VFSS (Kelly et al., 2007). Where other tools such as manometry are available, the assessment tool should be chosen based on the specific case (e.g. mobility, risk with radiation exposure) and specific clinical question (e.g. aspiration risk, pharyngeal mobility, UES opening).

In exclusively breast-fed infants, FEES is the only instrumental option for accurately assessing swallowing function. Otherwise, it should be noted that VFSS and FEES are complementary, and not exclusive, tools.

Evidence:

Adachi et al (2017) Evidence level Ib

Allen et al (2010) Evidence level III

Armstrong et al (2019) Evidence level IV

Arvedson & Lefton-Greif (2017) Evidence level IV

ASHA (n.d.) Evidence level IV

Aviv (2000) Evidence level Ib

Butler et al (2009a) Evidence level III

Butler et al (2009b) Evidence level III

Dharmarathna et al (2019) Evidence level IV

Dodrill et al (2015) Evidence level IV

Giralda-Cadavid et al (2016) Evidence level IIa

Hiorns et al (2006) Evidence level IV

Kelly et al (2007) Evidence level III

Langmore et al (2003) Evidence level III

Langmore et al (1991) Evidence level III

Leder 1998 Evidence level III

Miller (2011) Evidence level IV

Park et al (2015) Evidence level III

Willette et al (2016) Evidence level III

2. TRAINING

SLT Competency

All SLTs using VFSS should maintain competency through continuous professional development to maximise the accuracy of their interpretations including peer review/group interpretation sessions. **A**

Rationale:

Interpretation of VFSS is an **entry-level requirement** for SLTs in New Zealand. Further on-the-job training is required before a graduate can perform a VFSS in the workplace. This must include formal orientation to the radiation suite and local policies / procedures as well as radiation and procedural training. A local competency package is recommended before a graduate can perform a VFSS without direct supervision. Student SLTs are not expected to receive direct experience in VFSS and all students attending a VFSS suite should be supervised.

Researchers have discovered highly variable and often poor intra- and inter-rater reliability for VFSS analysis and interpretation. There are some clear correlations between level of experience and training and improved intra/inter-rater reliability and accuracy. Group discussion is believed to help with intra/inter-rater consensus and therefore accessing opportunities for peer review and mentoring is recommended. In Nightingale & Mackay (2009), education/training not only improved accuracy of interpretation but also led to improvements in service delivery/protocol development.

Evidence:

Arvdeson and Lefton-Greif (2017) Evidence level IV

ASHA (2002) Evidence level IV

Becker et al (2005) Evidence level III

CASLPO (2008) Evidence level IV

Dodrill et al (2015) Evidence level IV

Edwards et al (2018) Evidence level IV

Gibson et al (1995) Evidence level III

Kuhlmeier et al (1998) Evidence level III

Logemann et al (2000) Evidence level IIb

McCullough et al (2001) Evidence level III

Nightingale & Mackay (2009) Evidence level III

RCSLT (2007) Evidence level IV

Scott et al (1998) Evidence level III

SPA (2005) Evidence level IV

Stoekli et al (2003) Evidence level III

Wilcox et al (1996) Evidence level III

SLTs need a good understanding of normal infant feeding development, normal adult swallowing and normal ageing swallowing in order to accurately identify abnormality. This includes an understanding of the effects of bolus volume, viscosity, nasogastric tube presence and verbal cueing on presentation. **A**

Rationale:

Studies show a great range of swallowing biomechanics amongst the normal population. There is now good normative data for the young adult and older adult in the literature although normative data for the paediatric population are less documented. SLTs need to have a good understanding of, for example, the normal range of hyoid movement, the normal range of position of bolus at point of swallow initiation and the normal range of residue in an older adult. There are studies that also give good normative data for the effects of bolus size and viscosity on the duration of different components of a swallow. Daniels and colleagues (2007) found that verbal cueing affected swallow biomechanics in their healthy older cohort, and this should be considered during the VFSS. Nasogastric tubes have been shown to change swallow dynamics in normal and stroke patients and this should, therefore, be taken into account. There is emerging evidence of the effects of sensory variations (hot versus cold), taste, and carbonation, and these may also need to be considered during the assessment.

Evidence:

Allen et al (2010) Evidence level III

Alnassar et al (2011) Evidence level III

Arvedson & Lefton-Greif (2017) Evidence level IV

Butler et al (2009) Evidence level III

Butler et al (2009) Evidence level III

Daggett et al (2006) Evidence level III

Daniels et al (2007) Evidence level IIIb

Hiorns et al (2006) Evidence level IV

Huggins et al (1999) Evidence level III

Lazarus et al (1993) Evidence level IIa

Leonard & Kendall (2018) Evidence level IV

Logemann et al (1998) Evidence level IIb

Martin-Harris et al (2007) Evidence level III

Martin-Harris et al (2019) Evidence level III

McGratton et al (2019) Evidence level III

Miura et al (2009) Evidence level III

Newman et al (1991) Evidence level III

NZSTA Paediatric Dysphagia Guideline (2019)

Wang et al (2006) Evidence level III

SLTs must be aware of the unique relationship with Māori and the fundamental principles of cultural safety for a cross section of cultures represented within New Zealand. This includes Asian and Pacific Island cultures.

SLTs must be responsible for the use of these principles within the radiology suite. A*

Although no single clinician can be expected to have a complete knowledge of all the different cultures in his or her geographic area, each should actively demonstrate willingness to access information needed to provide a culturally competent service. A*

Rationale:

Consideration must be given to providing New Zealand specific training for SLTs on Treaty of Waitangi/Te Tiriti o Waitangi and cultural awareness, particularly given our internationally-trained workforce. Significantly relevant for SLTs are protocols for: engagement, the importance of relationship building, disengagement, acknowledgement and inclusion of relevant beliefs, values and potential role of whānau and other support people (including, but not restricted to Māori support staff and interpreters). When working with people with dysphagia in particular, SLTs should have an awareness of beliefs and customs around food since this will assist them with the provision of appropriate assessment and management (Manna et al., 2003). It is the responsibility of the SLT to incorporate a holistic approach to health and ensure food is prepared, stored and served in accordance with relevant cultural beliefs and practices of each patient.

Evidence:

Davis-McFarland, E. (2008) Evidence level IV
Dikeman & Riquelme (2002) Evidence level IV
Manna et al. (2003) Evidence level III

Riquelme, L.F. (2004) Evidence level IV
Riquelme, L.F. (2007) Evidence level IV

* This recommendation has been given a Grade A due to its significance to New Zealand legislation and New Zealand's commitment to a Treaty of Waitangi/Te Tiriti o Waitangi.

3. SAFETY

Code of Conduct

All SLTs participating in VFSS should abide by their own DHBs' or organisations' Code of Conduct and the NZSTA Principle and Code of Ethics. A *

Radiation Safety Protocol

All SLTs participating in VFSS should gain and maintain knowledge of radiation safety practices for themselves and their patients within the workplace. A *

All SLTs conducting VFSS should wear lead aprons and thyroid shields. Radiation monitoring badges should be worn if required by the institution. Lead gloves and glasses should be worn if close proximity to the patient is needed for feeding A *

All SLTs should understand the implications of prolonged radiation and minimise patient exposure through carefully considered liquid/food/strategy selection. A *

Rationale:

The VFSS exposes both patients and clinicians to ionising radiation. The radiation exposure is considered low, irrespective of age, the aetiology of dysphagia, or screening of pharynx alone versus pharynx and oesophagus. However, it is still prudent to keep the radiation dose as low as reasonably achievable (ALARA), and care must be taken for patients that require multiple examinations. Screening time must be recorded and reviewed by the Principal Licencee on a regular basis. Although the legal responsibility for monitoring/controlling radiation doses lies with the radiologist (or MRT in their absence), including the right to control who is present in the x-ray room (Ministry of Health- NRL C5), the SLT also has a duty of care to reduce or limit the amount of radiation that a patient may experience during a VFSS. The Ministry of Health Radiation Protection Act (1965) states that a shared monitoring badge approach is adequate for low dose personnel but that it is not acceptable to perform procedures without a monitoring badge. All staff, patient and family members present should be asked if they are pregnant. Radiation of

pregnant personnel should be avoided. Radiation of pregnant patients should be justified on an individual basis (The Royal Australian and New Zealand College of Radiologists, 2017).

Dose to the patient

Fluoroscopy time is one major factor influencing radiation dose during VFSS. Although researchers have found a linear relationship between the effective dose of radiation and the screening time, it is important to note that exposure time is not a good indicator of the amount of radiation used to perform a VFSS (Bonilha et al., 2019). This is because more radiation is required to penetrate thicker body parts (such as the mid-thorax and abdomen) compared to smaller body parts (such as the larynx). As such, the dose area product (DAP; the total amount of radiation used in an examination) is considered to be a better indicator of radiation exposure (and guide for termination of the examination) than time (Bonilha et al., 2019).

It has been reported in the literature that VFSS times range from 150 to 1080 seconds for adults (Bonilha et al., 2013) and 149 – 161 seconds on average for children (Im et al., 2019; Weir et al., 2007), with variables such as swallowing impairment scores and clinician experience significantly associated with increased fluoroscopy time. Other factors, such as medical diagnosis and the use of a standardised protocol, are not related to fluoroscopy time (Bonilha et al., 2013).

Internationally, there are no specific dose references recommended for VFSS but SLTs should be guided by the Ministry of Health Code of Safe Practice (in accordance with their radiologists and MRTs). The VFSS procedure allows for longer screening time with lower effective dose levels in comparison with a barium swallow procedure. Published estimates from international sources estimate a mean effective dose of 0.35-0.44 mSv (Moro & Cazzani, 2006; Bonilha et al., 2013) from dose-area product (DAP) measurements from a mean fluoroscopy time of 174 seconds. Therefore, VFSS procedures are considered relatively low risk, with a 1 in 39,000 chance of a patient developing a fatal radiation-induced cancer (Moro & Cazzani, 2006). The most significant contributor to the effective dose is the thyroid dose (median 6 mGy).

At the time of this review, there is emerging published data regarding paediatric VFSS. Weir et al. (2007) reported an effective dose range for paediatric patients of 0.01–0.25 mSv, the dose decreasing with age and relative radiosensitivity. Hersh et al. (2016) report a similar effective dose range of 0.03–0.59 mSv. In New Zealand, a similar dose was reported of 30.16 cGycm² (range 6.5-85 SD 15.17) (Henderson et al., 2018)

SLTs have a responsibility to follow the ALARA principles (Straus, 2006) alongside radiology personnel. This means SLTs have a responsibility to minimise radiation exposure time through i) ensuring there is a clear rationale/plan for the study, ii) ensuring that the patient understands what is required (Hayes et al. 2009; Sulieman et al., 2018), iii) directing the MRT to areas of specific interest e.g. oesophagus in the anterior/posterior plane and iv) directing the MRT about when to continue versus halt screening (e.g. during chewing) to avoid unnecessary radiation. Dose optimisation is essential to ensure that the radiation exposure is kept ALARA *while achieving the required medical objective* (Australian Radiation Protection and Nuclear Safety Agency 2015; New Zealand Ministry of Health, 2018; International Commission on Radiological Protection, 2013; International Atomic and Energy Agency, 2014; International Commission on Radiological Protection, 2007). Dose optimisation for paediatric patients is particularly important given their greater inherent radio-sensitivity and potentially longer life expectancy, compared to adult patients.

The following dose optimisation strategies are recommended from the international, published literature:

- If possible, once an area/event of interest is identified, the radiation beam should be collimated to focus on that anatomic region. Collimating the beam reduces the volume of scatter and can improve the image contrast (Brateman, 1999).

- Where possible, the X-ray beam should be routinely collimated to ensure that the patient’s eyes are not in the primary beam.
- Exposure to the thyroid should be considered and minimized (Morishima et al., 2016). Bonilha et al. (2017) recommend using a posterior–anterior beam projection instead of anterior–posterior where possible to reduce the dose to the thyroid.
- Image magnification leads to higher patient doses. Using the lowest magnification possible to obtain the necessary information is recommended.

Dose to the clinician

As a result of the proximity to the patient during the VFSS, the performing specialist can be exposed to the primary X-ray beam and scattered X-ray radiation from the patient (Warren-Forward et al., 2008; Morishima et al., 2016). The exposure of operators and other staff members to the direct or scattered X-rays increases their long-term risk for radiation-induced cancers. The doses received by operators will vary depending on the clinical needs of the patient and the fluoroscopic parameters used. It is essential that appropriate steps be taken to minimise the dose to operators and other staff members and ensure they receive necessary training in radiation safety. Studies that have addressed speech-language therapy education and awareness of radiation risks and safe practices recommend education and knowledge of radiation safety practices should be provided at a university level and then maintained through formal education sessions/packages in the workplace by both SLTs and radiology departments.

Evidence:

Arvedson (2004) Evidence level IV

Bonilha et al. (2013) Evidence Level III

Bonilha et al. (2017) Evidence Level III

Bonilha et al. (2019) Evidence Level III

Brateman (1999) Evidence Level IV

Chan et al. (2002) Evidence Level III

Chau & Kung (2009) Evidence Level III

Cohen (2009) Evidence Level IIb

Crawley et al. (2004) Evidence Level III

Hayes et al. (2009) Evidence Level III

Henderson et al., 2018 Evidence Level III

Hersh et al. (2016) Evidence Level III

Im et al. (2019) Evidence Level III

Jones (2003) Evidence Level IV

Ko et al (2019) Evidence level IV

Ministry of Health (2010) Evidence Level IV

Ministry of Health (1965) Evidence Level IV

Morishima et al. (2016) Evidence Level III

Moro & Cazzani (2006) Evidence Level III

Strauss & Kaste (2006) Evidence Level IV

Suliman et al. (2018) Evidence Level III

Warren-Forward et al. (2008) Evidence Level III

Weir et al. (2007) Evidence Level III

Wright et al. (1998) Evidence Level IIb

Zammit-Maempel et al. (2007) Evidence Level IIa

** This recommendation has been given a Grade A due to its significant clinical impact and applicability as a New Zealand policy statement.*

Barium Safety

SLTs should use low density barium (20-40% w/v concentration) in suspension where possible and avoid patients aspirating high density barium. **A**

Rationale:

The literature suggests that high- and low-density barium in suspension are commonly used during VFSS procedures. Gross aspiration of high-density barium and gastrografin should be avoided due to the increased risk of acute lung inflammation. If high levels of aspiration are anticipated, then water-soluble non-ionic contrast should be used. SLTs should understand the differences between different contrasts.

Low density barium is adequate for visibility of material on x-ray imaging but limits the chance of post-swallow residue in the oral cavity, pharynx, and oesophagus being attributable to the barium concentration rather than a pathophysiological abnormality (Steele et al., 2013).

Evidence:

Gray et al (1989) Evidence Level III
Katsanoulas et al (2007) Evidence Level III
Pracy et al (1993) Evidence Level III
Rasley et al (1993) Evidence level Ib
Steele et al (2013) Evidence level IV
Hazelwood et al, 2017 Evidence level III

Infection control

Local infection control advice **must** be sought for patient populations with known or suspected infectious diseases **prior** to completing VFSS. **A***

Rationale:

Local infection control advice **must** be sought for patient populations with known or suspected infectious diseases **prior** to completing VFSS. Use of personal-protective equipment for VFSS procedures with patients with known infectious diseases should always be in accordance with local policy e.g. wearing respiratory masks when working with patients with known/suspected/potentially airborne diseases. Local protocol for handling food safely must be followed at all times.

Adverse incident reporting

Local policy should be followed to report any adverse incident. **A***

Rationale:

Local policy should be followed to report any adverse incident. It is the responsibility of the SLT to ensure they know the procedure for reporting an adverse event.

Privacy

All SLTs participating in VFSS should abide by the Health Information Privacy Code 1994. A*

Rationale:

All SLTs participating in VFSS should abide by the Health Information Privacy Code 1994 (<https://www.privacy.org.nz/the-privacy-act-and-codes/codes-of-practice/health-information-privacy-code-1994/>).

This includes patient expectations that their information:

- is kept **confidential**
 - is treated as **sensitive**
 - may have **ongoing use** if a piece of medical information becomes clinically relevant even a long time after it was initially collected
- will be **used for the purposes** for which it was originally collected and they will be told about those purposes.

** This recommendation has been given a Grade A due to its significant clinical impact and applicability as a New Zealand policy statement.*

4. PEOPLE INVOLVED

Team Members and roles

The VFSS procedure and analysis should be a multidisciplinary activity with clear roles and responsibilities for those professionals involved. This is especially important with a complex patient (e.g. presence of a tracheostomy where the responsibilities for suctioning and the ventilator adjustments must be clear prior to the procedure). **C**

An NRL licensed staff member of radiology must be present to work the equipment (radiographer or medical radiation technologist (MRT)). An SLT is not qualified to use radiology equipment. **A ***

It is considered best practice internationally for a radiologist to be present during the VFSS procedure. Where an SLT is leading the procedure, the SLT should have appropriate access to a radiologist or medical support and have permission from the employing authority. **C**

Rationale:

A VFSS requires the skills of different professionals in order to be performed safely and to maximise its benefits. Essential team members are: a medical radiation technologist (MRT), a speech-language therapist (SLT), a radiologist (present or access to) and a nurse (present or access to). Other team members may include a physiotherapist, whānau, relevant cultural support, an interpreter, a therapy assistant, a specialist medical practitioner (e.g. intensivist, ENT/ORL surgeon).

Evidence:

ASHA (2004) Evidence level IV
CASLPO (2008) Evidence level IV
Medicare (2008) Evidence level IV
SPA (2005) Evidence level IV

RCSLT (2007) Evidence level IV
Sinden et al (2013) Evidence level IV
Thompson et al (2018) Evidence level IV

* This recommendation has been given a Grade A due to its significant clinical impact and applicability as a New Zealand policy statement.

SLTs are not qualified to make a medical diagnosis or identify structural deviations. The SLT should refer all oesophageal abnormalities and anatomical abnormalities to a medical practitioner immediately if there is not one present in the procedure. **A ***

Where a patient is medically complex (e.g., ventilator dependant or spinal injury), a medical practitioner should attend the procedure. **C**

Where oesophageal abnormalities and anatomical abnormalities are suspected, a medical practitioner should attend the procedure. **C**

SLTs should have the knowledge and skills to recognise anatomical abnormalities and “recognize patient signs and symptoms that may be associated with cervical-esophageal and esophageal phase dysphagia” (ASHA 2004) and know when to refer to a radiologist if one is not present.

Evidence:

Arvedson and Lefton-Greif (1998) Evidence level IV
ASHA (2004) Evidence level IV
ASHA (2008) Evidence level IV
CASLPO (2018) Evidence level IV
Hiorns et al (2006) Evidence level IV

Medicare (2008) Evidence level IV
RCSLT (2013) Evidence level IV
SPA (2012) Evidence level IV
Ward & Morgan (2009) Evidence level IV

** This recommendation has been given a Grade A due to its significant clinical impact and applicability as a New Zealand policy statement.*

Education to patient and whānau

SLTs must gain informed consent (or proxy consent through next-of-kin) and take responsibility for working with patients and their whānau by educating them on the procedure and its purpose. **A***

Rationale:

Literature supports the relevance of sensitivity around ‘how’ information is provided to patients and their whānau both in relation to consenting to the procedure and the feedback of results. Information methods need to be flexible, innovative and relevant to the individual situation. SLTs should provide an opportunity and an environment where the patient can invite/include whānau or others who support them. In many cultures the importance of the whānau as a collective must be acknowledged. By including whānau and other support people a broader and clearer

understanding of the procedure and its purpose can be achieved. This may also reduce any anxiety for the patient and support a higher level of participation.

In paediatrics, use of play therapy prior to the study can help with compliance and understanding of the procedure by children. This can also facilitate a study that does not involve unnecessary radiation exposure due to noncompliance, reduce stress for the child and family in an unfamiliar environment and ensure SLT goals are met by completion of the study.

Evidence:

Manna et al (2003) Evidence level III

** This recommendation has been given a Grade A due to its significance to New Zealand legislation and New Zealand's commitment to a Treaty of Waitangi/Te Tiriti o Waitangi.*

5. ASSESSMENT PROCEDURE

Assessment procedure

Assessment should include:

- Oral parameters at rest and during swallowing of a variety of consistencies
- Oral transit parameters including calculating transit timings
- Pharyngeal parameters at rest and during swallowing with a variety of consistencies
- Laryngeal parameters including a penetration-aspiration measure
- Crico-oesophageal parameters
- Oesophageal parameters **A**

An oesophageal visualisation, or a conjoint VFSS/barium swallow, should be conducted wherever possible. **A**

SLTs must use a standardised, objective VFSS procedure to maximise the accuracy of their interpretations. **A**

The VFSS procedure should assess structures at rest and swallowing biomechanics as well as dysphagic symptoms such as aspiration and residue. To ensure maximum benefit and information can be gained from the radiation exposure to patients, a standardised VFSS protocol and an objective reporting approach must be used. Effects of cognition, respiration and fatigue should also be observed.

An oesophageal visualisation in an anterior-posterior projection, or a conjoint VFSS/ barium swallow, should be conducted wherever possible. Oesophageal visualisation protocols have been validated against gold standard assessments (i.e., barium swallow and manometry, Allen et al., 2012; Gullung et al., 2012). Normative data is available for comparison (Jou et al., 2009; Miles et al., 2016a). Oesophageal difficulties are common in many aetiologies (e.g. ageing swallow, stroke). Two thirds of SLT VFSS clinic referrals have oesophageal abnormalities with or without concurrent oropharyngeal abnormalities (Miles et al., 2015) and SLTs are reliable at reporting oesophageal visualisation results and deciding on the necessity for specialist referral (Miles et al., 2016b). Oesophageal screening should be considered in all patients, particularly where the pharyngeal findings do not explain the complaints. If the SLT feels the findings are inconsistent with the clinical history, they should endeavour to ensure oesophageal phase visualisation is included. The additional radiation time will be at the discretion of the radiologist or MIT present.

Evidence:

Allen et al., 2012 Evidence level III

Arvedson & Lefton-Greif (2017) Evidence level IV

ASHA (2004) Evidence level IV

Daniels & Huckabee (2008) Evidence level IV

Daniels et al. (1996) Evidence level III

Eisenhuber et al. (2013) Evidence level III

Gosa et al (2015) Evidence level III

Gullung et al., 2012 Evidence level III

Han et al. (2001) Evidence level III

Henderson et al., Evidence level III

Hind et al. (2009) Evidence level Ib

Huckabee & Pelletier (1999) Evidence level IV

Hutcheson et al. (2017) Evidence level III

Jones et al., 1985 Evidence level III

Jones (2003) Evidence level IV

Jou et al., 2009 Evidence level IV

Kellen et al. (2010) Evidence level III

Kelly et al. (2006) Evidence level III

Lee et al., 2017 Evidence level III

Leonard & Kendall (2018) Evidence level IV

Leonard et al. (2011) Evidence level III

Logemann (1998) Evidence level IV

Martin-Harris et al. (2008) Evidence level III

Martin-Harris et al. (2019) Evidence level III

Miles et al., 2015 Evidence level III

Miles et al., 2016a Evidence level III

Miles et al., 2016b Evidence level III

Miller (2011) Evidence level IV

Nordin et al., 2017 Evidence level III

O'Donoghue & Bagnall (1999) Evidence level IV

O'Neil et al. (1999) Evidence level III

Park et al. (2009) Evidence level IIb

Palmer et al. (1993) Evidence level III

Pearson et al. (2013) Evidence level III

Perlman et al. (1995) Evidence level IIb

Rosenbek et al. (1996) Evidence level III

Ryu et al. (2012) Evidence level III

SPA (2005) Evidence level IV

Triadafilopoulos et al. (1992) Evidence level II

Preparation of Food and Fluids with Contrast Agents

Departments should follow a standardised use of contrast agents and materials to ensure uniform consistency administration (i.e. the product and mixture of product with food/fluid)

Barium recipes (especially for liquids) should be tested using the IDDSI flow test at the point of administration to confirm the consistency of the test liquid C

Barium liquids should use water as the liquid medium to barium powders are added, including in preparation of thickened liquid barium stimuli C

Barium concentration should be included in report ✓

Rationale:

Chicero et al. (2000) found a poor correlation between mealtime fluids and VFSS fluids. VFSS fluids were more viscous, denser and showed higher yield stress values than their mealtime counterparts. Chicero (2011) also identified that liquid barium is not representative of infant formula. Both thickened and unthickened formula and heated or cooled barium-impregnated liquids all had altered rheological and material property parameters. Additionally, Frazier et al. (2016) identified varying thickness of formulas and expressed breast milk when mixed with barium contrast agents.

Many barium sulphate powders include non-barium ingredients (e.g. gum or starches) that facilitate good suspension of barium powder in a liquid medium. However, an interaction may occur between these ingredients in the sulphate powder and thickening agents in pre-thickened liquids, or between these ingredients and proteins or other components of liquids such as milk or nutritional supplements (Steele et al, 2013).

Stokely et al (2014) found that swallowing behaviours can vary based on the changing concentration of barium in a test liquid. This supported Fink and Ross's (2009) findings that there is a marked difference in patients' responses to various 'thin liquid' barium solutions on the market.

The literature concludes that clinicians should use standardised recipes so that the addition of barium to fluids is more objective and thus will improve inter-and intra-study comparisons, and diet modification recommendations (Chicero et al., 2000; Steele et al., 2013; Stokely et al., 2014; Barbon & Steele, 2018). Barbon & Steele (2018) provide non-barium and barium liquid recipes that match the IDDSI levels.

Evidence:

Barbon & Steele (2018) Evidence level III

Cichero, et al (2017) Evidence level III

Chicero, et al (2000) Evidence level IIIa

Chicero et al., 2011 Evidence Level IIIb

Dantas et al (1989) Evidence level III

Frazier et al., 2016 Evidence level IIb

Fink & Ross (2009) Evidence level III

Groher et al (2006) Evidence level III

Hiorns et al (2006) Evidence level IV

Logemann et al (1995) Evidence level III

Mason 1993 Evidence level IV

Nightingale & Mackay (2007) Evidence level III

Power et al (2006) Evidence level IV

RCSLT (2007) Evidence level IV

Steele et al (2013) Evidence level IV

Stokely et al (2014) Evidence level III

SPA (2005) Evidence level IV

Gosa et al (2015) Evidence level IIb

Gosa et al (2017) Evidence level IIb

Termination of Procedure

SLTs need to carefully balance minimising aspiration risk and radiation exposure with **maximising** clinical yield and facilitating the goals of the study **A***

SLTs should use clinical judgement on the density and quantity of aspirated material and the physical condition of the patient when considering the need for treatment of the aspiration (i.e. nursing, medical, physiotherapy intervention) **B**

Rationale:

Complications depend on the density and quantity of aspirated material and the physical condition of the patient. A degree of aspiration may be necessary and unavoidable in order to gain a clear assessment of swallowing biomechanics, plan rehabilitation and guide management. Penetration/aspiration is also unlikely to occur consistently within a person when the same task is repeated several times (Power et al., 2009). SLTs must balance gathering adequate information about the patient's swallowing with medical risk / duty of care. The study should not necessarily be terminated if the patient aspirates. Instead, the trial should be repeated (same volume and consistency), unless strongly contraindicated, as the patient's swallowing may improve after the first or second swallow, and/or compensation strategies should be trialled. Where possible, medical advice should be obtained before continuing a procedure after aspiration has occurred.

Where significant aspiration occurs or the patient's physical condition deteriorates, the procedure must be terminated and early treatment and follow-up based on clinical judgement is recommended e.g. contacting a medical professional, nurse or physiotherapist.

Evidence:

Gray et al (1989) Evidence Level III
Hazelwood et al, 2017 Evidence level III

Katsanoulas et al (2007) Evidence Level III
Power et al, 2009. Evidence level II

Image Acquisition

SLTs should have access to high quality images to maximise the accuracy of their interpretations. A high image rate (using either continuous or pulsed fluoroscopy) is recommended. Imaging below 30 frames/pulses per second is not recommended. **A**

The procedure must be recorded to allow for video freeze-frame and slow motion playback. **A**

Voice recording is recommended to record presence of coughing/throat clearing and need for external prompting. **C**

A counter timer is strongly recommended to ascertain meaningful timing measures of swallowing. **C**

Rationale:

SLTs should consult with radiological personnel to ensure that the recording is sufficient to capture adequate information. This includes use of a high-resolution videofluoroscopic recording medium, views of oral cavity, pharynx, larynx, and upper oesophagus, and an adequate temporal resolution. There is an increasing body of evidence suggesting that both the judgment of swallowing impairment, and treatment recommendations are altered when pulse rate is decreased to 15 frames per second (Mulheren et al., 2018; Bonilha et al. 2013; Cohen, 2009). Oropharyngeal swallowing lasts approximately one second, and it has been established in both paediatrics and adults that events of penetration and aspiration may occur in a single image frame captured at 30 frames per second. If pulse rates are reduced from 30 to 15 pulses per second, the diagnostic accuracy of the test is diminished (Bonilha et al. 2013; Zarzour et al., 2018; Cohen, 2009). Therefore, **imaging below 30 frames per second or pulses per second is not recommended.**

The availability of video freeze-frame, slow motion playback and a good quality image is important for reliability (Martin-Harris and Jones 2008). Where clinicians are able to enhance the images and improve contrast/brightness,

intra/inter-rater reliability has been shown to be greater (e.g. access to a Kay Swallowing Workstation (KayPentax) (Hind et al 2009). Images should be acquired using a ‘last-image-hold cine’ (also known as ‘fluoro loop’ or ‘fluoro store’) (Jaffer et al. 2015).

Evidence:

ASHA (2002) Evidence level IV

Bonilha et al (2013) Evidence level III

CASLPO (2008) Evidence level IV

Cohen (2009) Evidence level IIb

Daniels & Huckabee (2009) Evidence level IV

Hind et al (2009) Evidence level Ib

Hiorns et al (2006) Evidence level IV

Jaffer et al (2015) Evidence level IV

Leonard & Kendall (2018) Evidence level IV

Logemann (1998) Evidence level IV

Martin-Harris & Jones (2008) Evidence level IV

Mulheren et al (2018) Evidence level III

RCSLT (2007) Evidence level IV

SPA (2005) Evidence level IV

Logemann (1998) Evidence level IV

Peladeau-Pigeon & Steele 2015 Evidence level IV

RCSLT (2007) Evidence level IV

SPA (2005) Evidence level IV

Weir et al (2007) Evidence level III

Positioning of Patient

All efforts should be made to ensure the patient’s positioning simulates their normal feeding position. This should include the ability to use the patient’s own wheelchair or a specifically designed chair for radiology. In the spinal population, this may entail feeding lying down. **B**

Evidence:

Arvedson & Lefton-Greif (1998 and 2017) Evidence level IV

Cox & Petty (1999) Evidence level III

Hiorns et al (2006) Evidence level IV

Martin-Harris et al (2019) Evidence level III

Ott & Pikna (1993) Evidence level IV

O’Donoghue & Bagnall (1999) Evidence level IV

Ward & Morgan (2009) Evidence level IV

All patients should ideally be examined first in a lateral position to review all the swallowing phases and to assess for abnormalities in the timing of swallowing. Next examine in the anterior-posterior view to assess symmetry and anatomy/structure. Where external bracing is present, slight angling (15-30 °) may be necessary. **C**

Rationale:

The lateral plane will identify small degrees of aspiration more than an anterior-posterior plane and should therefore be performed first. Regions of visualization in the lateral view include the oral cavity, pharyngeal cavity, larynx, and

cervical oesophagus. The visualization field should include the lips anteriorly, the nasal cavity superiorly, the cervical spine posteriorly, and the entire pharyngo-oesophageal segment inferiorly.

The anterior-posterior plane is essential to judge symmetry of bolus flow, pharyngeal wall contraction, and symmetry of structure and function. It is also used to determine the immediate effectiveness of compensatory strategies or postures. Other abnormalities that may be seen in the anterior-posterior plane include unilateral pharyngeal paresis or paralysis, unilateral vocal fold paralysis, pharyngeal diverticula and post-surgical anastomotic leaks.

Evidence:

Arvedson & Lefton-Greif (2017) Evidence level IV

ASHA (2008) Evidence level IV

Daniels & Huckabee (2008) Evidence level IV

Hiorns et al (2006) Evidence level IV

Leonard & Kendall (2018) Evidence level IV

Logemann (1998) Evidence level IV

Martin-Harris & Jones (2008) IV

Nightingale (2009) Evidence level III

Weir et al (2007) Evidence level III

Zarzour et al (2018) Evidence level IV

Delivery of trials

Consistencies and delivery modes (e.g. via spoon, cup, bottle) selected for the study should be based on specific patient needs. **B**

Varied bolus consistencies and volumes should be trialed, with several repetitions of each task **B**

Rationale:

The goals of VFSS are to identify swallowing impairment **and** assess biomechanical adaptation and compensation that will **improve swallowing**. In order to meet these goals, visual interpretation of swallowing biomechanics and safety across varied bolus consistencies and swallowing tasks that sufficiently challenge the swallowing mechanism are required (Hazelwood et al, 2018). Studies have shown that presenting a variety of consistencies and delivery modes leads to an increased chance of identifying a safe diet consistency or method of presentation (Butler et al, 2011; Clave, 2006; Leonard et al, 2014; Rofes et al, 2014; Steele & Grace-Martin, 2017). No one swallowing task provides extreme impairment information for all physiological components of swallowing, as consistencies are managed differently from each other.

It is recommended that more than one swallow for each consistency is viewed in order to make accurate interpretations (Steele & Grace-Martin, 2017). Studies suggest 2-3 trials per volume/consistency are required to reliably judge swallowing function and account for individual variability between swallows (Lazarus et al, 1993; Lof & Robbins, 1990; Molfenter & Steele, 2011). It is also important for SLTs to be aware that the first swallow may not be representative of general swallowing functioning (Martin-Harris et al, 2008) and thus protocols need to account for the individual variability between swallows (Steele & Grace-Martin 2017; Martin-Harris et al, 2008)

VFSS protocols are found throughout the literature (Palmer et al., 1993; Gramigna, 2006; Martin-Harris et al., 2008b; Leonard & Kendall., 2018) and it is recommended that each organisation performing VFSS have an agreed standard protocol that all SLTs adhere to as is deemed clinically appropriate.

Eating/drinking should be made as natural as possible including self-feeding wherever possible, and without verbal cueing.

Diet options of specific relevance or difficulty to a patient, should be brought into the procedure (e.g. rice, medication). The relationship with food can have a specific cultural relevance and etiquette. SLTs must ensure they are aware of any potential cultural or religious beliefs and practices towards food (type of food, how it is prepared, how it is presented and how it is offered). Many cultures will not refuse food out of respect for the host and this needs to be considered in relation to VFSS as it may later cause conflict around any future recommendations. It is recommended that SLTs consider inviting whānau to bring appropriate food to the procedure. It is recommended that SLTs offer the opportunity of karakia (a blessing/prayer) prior to consumption of food.

Evidence:

Butler et al, 2011 Evidence level III
Clave et al (2006) Evidence level IIb
Daniels & Godzikowska (2019) Evidence level IV
Gramigna (2006) Evidence level III
Hazelwood et al (2018) Evidence level IIb
Hiorns et al (2006) Evidence level IV
Kuhlmeier et al (2001) Evidence Level IIb
Leonard & Kendall (2018) Evidence level IV
Logemann (1998) Evidence level IV

Manna et al (2003) Evidence level III
Martin-Harris et al (2008) Evidence level III
Molfenter & Steele (2011) Evidence level IV
Lazarus et al (1993) Evidence level IIa
Lof & Robbins (1990) Evidence level III
Palmer et al (1993) Evidence level III
Rofes et al, 2014 Evidence level IIb
Steele & Grace-Martin IV

SLTs should trial compensatory strategies during the VFSS to assess their efficacy. **B**

Rationale:

Trialling a compensatory strategy, including diet and fluid modification during the VFSS procedure allows the SLT to assess its efficacy and safety. A clinical swallowing/feeding evaluation has been found to be **unreliable** for assessing if a compensatory strategy has reduced aspiration risk e.g. chin tuck. It may be useful to teach a strategy prior to the VFSS e.g. supraglottic swallow however implementation of this while swallowing should only be implemented post trial during objective assessment. Strategies may include postural changes (e.g. chin tuck and head rotation), manoeuvres (e.g. supraglottic swallow), bolus modifications (e.g. consistency changes) and volume changes or sensory enhancement (e.g. flavour, texture or temperature changes).

Evidence:

Arvedson & Lefton-Greif (1998) Evidence level IV

Baylow et al (2009) Evidence level IIa

Bisch et al (1994) Evidence level III

Bulow et al (1999) Evidence level IIa

Bulow et al (2001) Evidence level IIa

Logemann et al (1994) Evidence level IIb

Logemann et al (1995) Evidence level III

Shanahan et al (1993) Evidence level IIa

Many rehabilitative approaches should not be commenced without identification of swallowing biomechanics through objective assessment such as VFSS. **B**

Rationale:

Studies have shown that exercises intended to strengthen the muscles of deglutition may have unexpected consequences resulting in no improvement in swallowing and even harm. Using VFSS to ensure the impairments are correctly diagnosed, reduces the risk of causing harm and ensures beneficence of the rehabilitative approach.

Evidence:

Bulow et al (1999) Evidence level IIa

Bulow et al (2001) Evidence level IIa

Daniels & Huckabee (2008) Evidence level IV

Daniels, Huckabee, & Godzikowska (2019) Evidence level IV

Garcia et al (2004) Evidence level III

Ludlow et al (2007) Evidence level IIa

Steele (2006) Evidence level IV

6. INTERPRETATION AND REPORTING

Interpretation of VFSS

A locally agreed objective VFSS procedure should be used for interpretation **B**

Without criterion-based ratings and quantitative measures, the reliability of VFSS reporting has been shown to be poor. Criterion-based rating scales are recommended such as Penetration-Aspiration Scale (Rosenbek et al., 1998), Modified Barium Swallow Impairment Profile (MBSImp; Martin-Harris et al., 2008) and The Dynamic Imaging Grade of Swallowing Toxicity (DIGEST; Hutcheson et al., 2017). Objective timing and displacement measures (e.g. Leonard and Kendall, 2018) such as bolus transit times, hyolaryngeal elevation, pharyngeal constriction ratio and maximal pharyngoesophageal segment (PES) opening measures offer quantifiable biomechanical referents for comparison with age and gender-matched healthy norms (in adults) and outcome measurement.

The inclusion of a dysphagia severity rating is recommended for ensuring the consistency of documentation and recommendations across and within clinicians, and providing a basis for comparing patients with each other and measuring progress over time (O’Neil, Purdy, Falk, & Gallo, 1999). Tools such as the Dysphagia Outcome and Severity Scale (O’Neil et al., 1999) and MBSImp (Martin-Harris et al., 2008) have been found to have excellent reliability at describing dysphagia severity, and have the advantage of guiding clinical recommendations based on factors such as airway invasion and bolus clearance, cognition, and use of compensatory strategies. The DIGEST (Hutcheson et al., 2017) considers both swallowing safety and efficiency to assign an overall severity score for patients with head and neck cancer. Other tools, such as the Penetration Aspiration Scale (Rosenbek et al., 1996) may be used to focus specifically on the depth of, and response to, airway invasion. The scale described by Daniels et al. (Daniels et al., 1996) may be used to quantify the extent and consistency of airway invasion. There are also several published protocols specifically for quantifying pharyngeal residue, both perceptually (e.g., Eisenhuber et al., 2013; Han et al., 2001; Kelly et al., 2006; Ryu et al., 2012) and using the free ImageJ software (Pearson et al., 2013).

Evidence:

Allen et al., 2012 Evidence level III

Arvedson & Lefton-Greif (1998) Evidence level IV

ASHA (2004) Evidence level IV

Daniels & Huckabee (2008) Evidence level IV

Daniels et al. (1996) Evidence level III

Eisenhuber et al. (2013) Evidence level III

Gullung et al., 2012 Evidence level III

Han et al. (2001) Evidence level III

Henderson et al., Evidence level III

Hind et al. (2009) Evidence level Ib

Huckabee & Pelletier (1999) Evidence level IV

Hutcheson et al. (2017) Evidence level III

Jones et al., 1985 Evidence level III

Jones (2003) Evidence level IV

Jou et al., 2009 Evidence level IV

Kellen et al. (2010) Evidence level III

Kelly et al. (2006) Evidence level III

Lee et al., 2017 Evidence level III

Leonard & Kendall (2018) Evidence level IV

Leonard et al. (2011) Evidence level III

Logemann (1998) Evidence level IV

Martin-Harris et al. (2008) Evidence level III

Martin-Harris et al. (2019) Evidence level III

Miles et al., 2015 Evidence level III

Miles et al., 2016a Evidence level III

Miles et al., 2016b Evidence level III

Nordin et al., 2017 Evidence level III

O’Donoghue & Bagnall (1999) Evidence level IV

O’Neil et al. (1999) Evidence level III

Park et al. (2009) Evidence level Ib

Palmer et al. (1993) Evidence level III

Pearson et al. (2013) Evidence level III

Perlman et al. (1995) Evidence level IIb
Rosenbek et al. (1996) Evidence level III
Ryu et al. (2012) Evidence level III

SPA (2005) Evidence level IV
Triadafilopoulos et al. (1992) Evidence level II

Reporting on VFSS

Written documentation should describe:

- the symptoms observed including details of any aspiration that occurred
- the hypothesised swallowing pathophysiology
- a dysphagia severity rating
- the hypothesised prognosis for recovery of swallowing
- safety of oral intake and compensatory strategy recommendations
- recommendations for dysphagia rehabilitation
- recommendations for referrals to other professionals (e.g. ENT, dietitian)
- recommendations for SLT follow-up assessment e.g. by clinical evaluation or repeat VFSS. **C**

Reports should be written in a timely manner and be easily accessible to relevant multidisciplinary members. If a radiologist is directly involved, they should also provide a radiological report on the study. The SLT report should provide sufficient detail such that another professional can fully comprehend the nature of the dysphagia and use this information to inform rehabilitation.

Clinicians should consider the health literacy of their patients and strive to ensure patients and their whānau receive a VFSS report that they can understand.

Evidence:

ASHA (2004) Evidence level IV
Logemann (1998) Evidence level IV

Huckabee & Pelletier (1999) Evidence level IV
SPA (2005) Evidence level IV

APPENDICES

APPENDIX 1

Interpretation of the grading structure

It is vital to recognize that the grade does not relate to the importance of the recommendation but to the methodological strength of the supporting evidence, using the grading system below.

Levels of Evidence

- Ia** Evidence obtained from meta-analysis of randomised controlled trials
- Ib** Evidence obtained from at least one randomised controlled trial
- IIa** Evidence obtained from at least one well-designed controlled trial without randomisation
- IIb** Evidence obtained from at least one other type of well-designed quasi-experimental study
- III** Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case-control studies
- IV** Evidence obtained from expert committee reports or opinions and/or clinical experience of respected authorities

(Evidence level taken from RCSLT Clinical Guidelines, based on AHCPR 1992)

Grading of Recommendations

A The recommendation (course of action) is supported by good evidence

The evidence consists of results from studies of strong design for answering the question addressed.

B The recommendation (course of action) is supported by fair evidence

The evidence consists of results from studies of strong design for answering the question addressed but there is some uncertainty attached to the conclusion either because of inconsistencies among the results from the studies or because of minor flaws; or the evidence consists of results from weaker study designs for the question addressed but the results have been confirmed in separate studies and are reasonably consistent. There is fair evidence that the benefits of the course of action being proposed outweigh the harms.

C The recommendation (course of action) is supported by expert opinion only

For some outcomes, trials or studies cannot be or have not been performed and practice is informed only by expert opinion.

| No recommendation can be made because the evidence is insufficient

Evidence for a course of action is lacking, of poor quality or conflicting and the balance of benefits and harms cannot be determined.

APPENDIX 2

Summary of Advice from Cultural Advisors on maximising cultural sensitivity within a VFSS Procedure

The following advice was gained from a variety of cultural advisors who observed radiology procedures and reviewed the guideline document. This advice is aimed at supporting speech-language therapists to maximise the cultural responsiveness and sensitivity of their services within Radiology.

Whānau

- Value and acknowledge the role and/or participation of whānau and other support people. Provide an opportunity for patient to invite or include others. In many cultures the importance of the family/whānau as a collective must be acknowledged. Including whānau and other support people can contribute to a broader and clearer understanding of the procedure and its purpose. This may also reduce any anxiety for patient and support a higher level of participation with recommendations.

Information

- If relevant cultural support services are available, inform patient and/or whānau of these services as early as possible. If patient and/or whānau consent, provide an opportunity for these services to be involved.
- Information methods need to be flexible, innovative and relevant to the individual patient and the service they are accessing.

Food

- Demonstrate an awareness and openness of diverse beliefs and customs around food as this will assist with the provision of appropriate assessment and management.
- Consider: the type of food, how it is prepared, how it is presented and how it is offered
- Invite family/whānau to bring appropriate food to the procedure or check with patients and their whānau about the appropriateness of your food options.
- Ensure food is prepared, stored and served in accordance with the relevant cultural beliefs and practices of each patient.
- Offer the opportunity of karakia (a blessing/prayer) prior to consumption of food.

Thank you to the following cultural advisors at Counties Manukau DHB for giving time to observing VFSS/MBS procedures and viewing the Guideline drafts and providing valuable advice to our profession. Thank you also to NZSTA for their valuable contribution.

Ian Kaihe-Wetting- *TIP Facilitator, Te Kaahui Oro (Māori Health Services), Counties Manukau DHB*

Karla Rika-Heke- *Te Kaahui Ora Nurse Educator, Counties Manukau DHB*

Kerrie Gallagher- *Māori and Cultural Development Portfolio, The New Zealand Speech-language Therapists' Association (NZSTA)*

APPENDIX 3

Equity

The World Health Organization states:

“*Equity* is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically. *Health inequities* therefore involve more than inequality with respect to health determinants, access to the resources needed to improve and maintain health or health outcomes. They also entail a failure to avoid or overcome inequalities that infringe on fairness and human rights norms.”

“Reducing health inequities is important because health is a fundamental human right and its progressive realization will eliminate inequalities that result from differences in health status (such as disease or disability) in the opportunity to enjoy life and pursue one's life plans.”

Excerpt taken from <https://www.who.int/healthsystems/topics/equity/en/>

With this in mind, this guideline wishes to acknowledge the importance of equity and encourages all SLTs to make allowances within our practice to ensure equity of access to VFSS and also equity of outcomes. Further reading on this topic can be found in *Reducing Inequalities in Health*, published in 2002 by the Ministry of Health.

“In New Zealand, ethnic identity is an important dimension of health inequalities. Māori health status is demonstrably poorer than other New Zealanders; actions to improve Māori health also recognise Treaty of Waitangi obligations of the Crown. Pacific peoples also have poorer health than Pakeha. In addition, gender and geographical inequalities are important areas for action.”

Reducing Inequalities in Health. Published in September 2002 by the Ministry of Health. This document is available on the Ministry of Health website: <http://www.moh.govt.nz>

SLTs should be aware of their role in promoting health equity for vulnerable populations. For example:

- The rate of referral for a VFSS (eg. Consider what the barriers are for making a referral - What can we do to improve access?)
- The rate of acceptance/consent for VFSS (eg. How can we improve communicate with vulnerable populations?)
- Timeliness of access (How should we triage vulnerable populations?)
- Attendance (i.e. DNA rate – What are the barriers to access?)
- Recommendations (eg. What extra support is needed to improve compliance with recommendations?)

SLTs are encouraged to consider the following set of 10 questions with patients (from the Health Equity Assessment Tool (HEAT) guide)

1. What inequalities exist in relation to the health issue under consideration?
2. Who is most disadvantaged and how?
3. How did the inequalities occur? What are the mechanisms by which the inequalities were created, maintained or increased?
4. When/How will you intervene to tackle this issue?
5. How will you improve Māori health outcomes and reduce health inequalities experienced by Māori?
6. How could this intervention affect health inequalities?
7. Who will benefit most?
8. What might the unintended consequences be?
9. What will you do to make sure the intervention does reduce inequalities?
10. How will you know if inequalities have been reduced?

Signal, L., Martin, J., Cram, F., and Robson, B. (2008). *The Health Equity Assessment Tool: A user's guide*. 2008. Published in June 2008 by the Ministry of Health, PO Box 5013, Wellington, New Zealand.

APPENDIX 4. TABLE OF EVIDENCE

Reference	Design	Sample	Objective of Study	Conclusion	Level
Allen, J.E., White, C.J., Leonard, R.J., & Belafsky, P.C. (2010) Prevalence of Penetration and Aspiration on videofluoroscopy in normal individuals without Dysphagia. <i>Otol Head Neck Surg.</i> ,142: 208-213.	Cross sectional	149 participants VFSS	To determine the prevalence of penetration and aspiration on videofluoroscopic swallow studies (VFSS) in normal individuals without dysphagia.	Aspiration on VFSS is not a normal finding. Penetration is present in 11.4 percent of normal adults and is more common with a liquid bolus.	III
Alnassar M. , et al (2011). Nasogastric tube and Videofluoroscopic Swallow Studies in children. <i>Pediatric Radiology</i> 41(3): 317-321	Case series	92 VFSS of Children	Investigate the reliability of the findings of VFSS when a NGT is in place at the time of the study.	The presence of a NGT does not alter the findings of the VFSS however it might increase the incidence of respiratory compromise when aspiration is present.	III
Allen J, White C, Leonard R, Belafsky P. Comparison of esophageal screen findings on videofluoroscopy with full esophagram results. <i>Head & Neck.</i> 2012;34(2):264-269.	Cross sectional	74 patients undergoing VFSS	To compare findings from "esophageal screening" with the results of full esophagram.	Esophageal screening identified 44/70 (63%) patients with esophageal disease.	III
American College of Radiology. ACR practice guideline for the performance of the modified barium swallow in adults. (2001). Retrieved from: http://www.acr.org/SecondaryMainMenuCategories/quality_safety/guidelines/dx/gastro/modified_barium_swallow.aspx	Practice Standards	-	Support safe, consistent practice	Good summary of roles of MDT	IV
American Speech-Language-Hearing Association (2002) Clinical Indicators for Instrumental assessment of dysphagia (guidelines). <i>ASHA Desk Ref</i> ; 4: 231-239.	Practice Standards	-	Support safe, consistent practice	Detailed policy	IV
American Speech-Language-Hearing Association (2008) Esophageal Dysphagia: Diagnosis and Treatment Options; collated articles from ASHA Special Interest Division Newsletters. ASHA.	Series of newsletter articles collated into a self-study publication	-	Continual Education	Detailed information on oesophageal dysphagia symptoms and treatment	IV
American Speech-Language-Hearing Association (2004) Guidelines for Speech-Language Pathologists Performing Videofluoroscopic Swallowing Studies. <i>ASHA</i> .	Practice Standards	-	Support safe, consistent practice	Detailed policy	IV
Armstrong ES, Reynolds J, Carroll S, Sturdivant C, Suterwala MS. Comparing videofluoroscopy and endoscopy to assess swallowing in bottle-fed young infants in the neonatal intensive care unit. <i>Journal of Perinatology.</i> 2019 Sep;39(9):1249-1256	Case series	Paediatric cases	Compare VFSS and FEES in bottle fed infants	FEES appears to be more accurate in detecting penetration in this population, and both assessments are valuable tools in a	IV

				comprehensive feeding and swallowing evaluation.	
Arvedson, J.C., & Lefton-Greif, M.A. (1998) Pediatric Videofluoroscopic Swallow Studies. <i>Communication Skill builders</i> .	Textbook	Paediatric practice	-	VFSS in the paediatric population	IV
Arvedson, J.C., & Lefton-Greif, M.A. (2017) Instrumental Assessment of Pediatric Dysphagia. <i>Seminars in Speech and Language</i> 38, (2)	Clinical practice	Paediatric practice	Support safe, consistent practice	SLTs require multiple skills to achieve accurate assessment and interpretation of results	IV
Arvedson, J.C. (2004) Balance between radiation risks and obtaining a complete VFSS in pediatric patients. <i>Swallowing and Swallowing Disorders</i> (October)	Expert opinion		Expert opinion on considerations for completing a VFSS in paediatrics.	Understanding how to balance the medical necessity for VFSS with the principles of ALARA.	IV
Aviv, J.E. (2000) Prospective, randomised outcome study of endoscopy vs. modified barium swallow in patients with dysphagia. <i>Laryngoscope</i> , 100: 563-574.	Randomised clinical trial	126 outpatients. 78MBS exams and 61 FEEST exams	An initial investigation into whether FEEST or VFSS/MBS is superior as diagnostic test.	Outcome measure: pneumonia incidence Both exams have advantages and disadvantages but outcomes are comparable.	Ib
Barbon, C.E.A. & Steele, C.M. (2009) Characterising the flow of thickened barium and non-thickened barium liquid recipes using the IDDSI flow test. <i>Dysphagia</i> 34;73-79	Cross sectional	Barium and non-barium stimuli prepared using starch and gum thickeners to reach the slightly, mildly and moderately thick liquid categories	Comparison of barium and non-barium plus thickeners using the IDDSI flow test.	Combination of barium plus thickeners particularly starch resulted in further thickening compared to non-barium liquid plus thickener	III
Baylow, H.E., Goldfarb, R., Taveira, C.H. & Steinberg, R.S. (2009) Accuracy of Clinical Judgement of the Chin-Down Posture for Dysphagia During the Clinical/Bedside Assessment as Corroborated by Videofluoroscopy in Adults with Acute Stroke. <i>Dysphagia</i> , 24:423-433.	Clinical trial without randomization	15 participants following acute strokes	To examine the sensitivity and specificity of the accuracy of using the chin-down posture during the clinical assessment	Clinical/bedside assessment is not adequate to determine the effect of the chin-down posture on aspiration.	Ila
Becker, S., McLeroy, K., & Carpenter, M. (2005) Reliability of Observations from Modified Barium Swallow Studies. <i>Journal of Medical Speech-Language Pathology</i> , June: 97–108.	Reliability study	10 certified SLTs with experience of over 50 MBS	To assess inter- and intra-judge reliability.	Intra-judge reliability relatively strong. Inter-judge reliability stronger for observations with bolus presence but not for structural judgements.	III
Bisch, E. M., Logemann, J. A., Rademaker, A. W., Kahrilas, P. J., & Lazarus, C. L. (1994) Pharyngeal effects of bolus volume, viscosity, and temperature in patients with dysphagia resulting from neurologic impairment and in normal subjects. <i>Journal of Speech and Hearing Research</i> , 37: 1041-1059.	Comparative study	28 participants; 10 mild dysphagia (acute stroke), 10 normal 8 moderate-severe (neurological disorder other than stroke)	To determine the effects of volume, viscosity and temperature on the pharyngeal stage of swallowing	There were differences in how stroke patients' and normal subjects' swallowing responded to some bolus volumes and viscosities.	III
Bonilha, Heather Shaw, Kate Humphries, Julie Blair, Elizabeth G. Hill, Katlyn McGrattan, Brittini Carnes, Walter Huda, and Bonnie Martin-Harris. 2013. "Radiation Exposure Time during MBSS: Influence of Swallowing Impairment Severity, Medical Diagnosis, Clinician Experience, and Standardized Protocol Use." <i>Dysphagia</i> 28	Cross-sectional study	739 VFSSs performed on 612 patients with suspected dysphagia	To examine the influence of clinician experience, medical diagnosis, swallowing impairment severity, and use of a standardised protocol on fluoroscopy time	Fluoroscopy time was not significantly associated with medical diagnosis. The severity of the MBSImP™ Oral Total and Pharyngeal Total scores were	III

(1): 77–85.				associated with significant increases in fluoroscopy time. Studies by novice clinicians had longer exposure times compared to experienced clinicians. Average radiation exposure time using the MBSImP™ approach was 2.9 min. Use of a VFSS protocol did not cause unnecessary radiation exposure time.	
Bonilha, Heather Shaw, Janina Wilmskoetter, Sameer V. Tipnis, Bonnie Martin-Harris, and Walter Huda. 2017. “Effective Dose per Unit Kerma-Area Product Conversion Factors in Adults Undergoing Modified Barium Swallow Studies.” <i>Radiation Protection Dosimetry</i> 176 (3): 269–77.	Computational modelling	Computational models were used to calculate patient organ doses during VFSSs, from which effective dose was calculated. Five standard projections were studied.	To investigate adult effective dose (E) per unit Kerma-Area Product (KAP) in VFSS, and the importance of X-ray beam size and patient size (body mass index).	The average E/KAP was highest for anterior–posterior projections and lowest for posterior–anterior projections. E/KAP always increased with increasing filtration and/or X-ray tube voltage. Small patients have the E/KAP conversion factors that are twice those of a standard adult.	III
Brateman, Libby. 1999. “The AAPM/RSNA Physics Tutorial for Residents: Radiation Safety Considerations for Diagnostic Radiology Personnel.” <i>Imaging and Therapeutic Technology</i> 19: 1037–55.	Academic tutorial	-	To become familiar with the fundamental principles of radiation safety as they pertain to fluoroscopy	Detailed review	IV
Bulow, M., Olsson, R., & Ekberg, O. (1999) Videomanometric Analysis of Supraglottic Swallow, Effortful Swallow, and Chin Tuck in Healthy Volunteers. <i>Dysphagia</i> , 14: 67-72.	Clinical trial without randomization	8 healthy volunteers	To determine the effect of different swallowing techniques on videographic and manometric variables	Chin tuck significantly reduces pharyngeal contraction in healthy volunteers, therefore, may be contraindicated in patients with already decreased pharyngeal contraction	IIa
Bulow, M., Olsson, R., & Ekberg, O. (2001) Videomanometric Analysis of Supraglottic Swallow, Effortful Swallow, and Chin Tuck in Patients with Pharyngeal Dysfunction. <i>Dysphagia</i> , 16: 190-195.	Clinical Trial without randomization	8 patients with pharyngeal dysfunction	To determine the effect of different swallowing techniques in participants with pharyngeal dysfunction	Chin tuck, effortful swallow and supraglottic swallow did not reduce the number of penetration events.	IIa
Butler, S.G., Stuart, A., & Kemp, S. (2009) Flexible endoscopic evaluation of swallowing in healthy young and older adults. <i>Ann Otol Rhinol Laryngol</i> , 118: 99-106.	Case Series	23 young adults 21 older adults	To determine normal swallowing features as assessed by endoscopy/manometry. Study effects of age, gender, bolus size, bolus condition (milk vs water)	Endoscopic data on normal swallowing physiology were generated. This will serve as a landmark for clinicians and researchers in interpretation of dysphagia.	III
Butler, S.G., Stuart, A., Markley, L., & Rees, C. (2009) Penetration and aspiration in healthy older adults as assessed during endoscopic evaluation of swallowing. <i>Ann Otol Rhinol Laryngol</i> , 118: 190-198.	Cross-sectional study	20 older adults (560 swallows analysed)	To determine the incidence of penetration/ aspiration in normal adults (FEES)	A number of normal subjects penetrate or aspirate. Significantly more aspiration on thin fluids than puree and solids	III

Chan, C.B., Chan, L.K., & Lam, H.S. (2002) Scattered Radiation Level During Videofluoroscopy for Swallowing Study. <i>Clinical Radiology</i> , 57: 614-616.	Cross-sectional study	17 adult patients	To investigate scattered radiation level during VFSS	Estimated scattered radiation dose well within limits	III
Chau, K.H.T., & Kung, C.M.A. (2009) Patient Dose During videofluoroscopy Swallowing Studies in a Hong Kong Public Hospital. <i>Dysphagia</i> , 24 (4): 387-390.	Cross-sectional study	398 participants (all age ranges)	Measurement of Dose Area Product (DAP) values and fluoroscopic time for VFSS exams.	DAP figures were comparable to similar published literature. There is no known national dose reference for VFSS (Hong Kong) but recommended national doses for barium meal and swallow exam are 11 and 14 Gy cm ² .	III
Chicero, J., Jackson, O., Halley, P., & Murdoch, B. (2000) Rheological differences between mealtime and videofluoroscopy fluids. <i>Dysphagia</i> , 15: 188-200.	Clinical Trial without randomization	10 major metropolitan hospitals. Each hospital had to provide 200ml samples	To determine whether there is a perceived subjective difference between mealtime fluids and VFS fluids.	Conclusion: poor correlation between mealtime fluids and VFS over all parameters.	IIa
Chicero, J., et al. (2011) Liquid Barium is not Representative of Infant Formula: Characterisation of Rheological and Material Properties. <i>Dysphagia</i> 26(3): 264-271	Cross-sectional study	prethickened antiregurgitation formula, regular (thin) infant formula, and two types of regular infant formula	Impact of barium on rheological properties of infant formula.	The effect of adding barium to infant formula changes rheological properties which may effect outcomes of VFSS and subsequently interpretation and mangagement of infant swallowing	IIb
Clave, P., de Kraa, M., Arreola, V., Girvent, M., Farre, R., Palomera, E., Serra-Prat, M. (2006) The effect of bolus viscosity on swallowing function in neurogenic dysphagia. <i>Aliment Pharmacol Ther</i> , 24 (9): 1385-94.	Comparative study	46 patients with brain damage, 46 with neurodegenerative diseases and eight healthy volunteers	To assess the pathophysiology and treatment of neurogenic dysphagia	Increasing bolus viscosity greatly improves swallowing function in neurological patients.	IIb
Wu, C-H., Hsiao, T-Y., Chen, J-C., Chang, Y-C., & Lee, S-Y.(1997) Evaluation of Swallowing Safety With Fiberoptic Endoscope: Comparison With Videofluoroscopic Technique. <i>The Laryngoscope</i> , 107(5): 396-401.	Comparative study	28 participants?	To assess validity of FEES compared with VFSS	Validity of FEES	III
Cohen, M.D. (2009) Can we use pulsed fluoroscopy to decrease the radiation dose during videofluoroscopic feeding studies in children? <i>Clinical Radiology</i> , 64: 70-73.	Cross-sectional study	10 children aged 1 month to 2yrs nine months	To investigate the possibility of reducing the radiation dose during VFSS below the current 30 frames/s (continuous fluoroscopy)	The pharyngeal phase of swallowing is too quick for pulse fluoroscopy and may be missed. Decreasing fluoroscopic pulse rates may result in non-detection of supraglottic penetration of barium liquid and is therefore not recommended.	IIb
College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO). (2018) Practice Standards and Guidelines for Speech Language Pahtology Practice in the area of Dysphagia. Retrieved from: http://www.caslpo.com/Portals/0/ppg/Dysphagia_PSG.pdf	Practice Standards	-	Support safe, consistent practice	Detailed Guideline	IV
Cox, M.S., & Petty, J. (1999) A videofluoroscopy chair for the evaluation of dysphagia with patients with severe neuromuscular disease. <i>Arch Phys Med Rehabil.</i> , 72: 157-9.	Case Series	2 participants?	To determine the use and practicality of Rehab Tech Video Fluoro Chair	Useful for severely physically impaired group	III

<p>Crawley, M.T., Savage, P., & Oakley, F. (2004) Patient and Operator Dose During Fluoroscopic Examination of Swallow Mechanism. <i>The British Journal of Radiology</i>, 77: 654-656.</p>	<p>Case Series</p>	<p>21 patients with oral/pharyngeal dysphagia from spinal or neurological condition</p>	<p>Used to estimate effective dose to patient to provide measures of radiation risk Dose to operators (SLT and Radiologist) measured to estimate annual exposure</p>	<p>Median DAP for patients 3.5 Gy.cm² (3.1-5.2), effective dose 0.85 mSv (0.76-1.3) Median screen time 3.7 minutes Low associated risk mainly of cancer induction of around 1 in 16 000. Organ receiving greatest dose was thyroid (13.9mSv) Total operator dose (for all 21 studies) less than 0.3mSv for whole body (under lead apron- 0.5 mSv equivalent dose eyes, 0.9mSv equivalents dose extremities). Average for 50 patients per year would be less than 0.6 mSv whole body, 1mSv eyes and 1.8 extremities against corresponding legal dose limits of 20mSv, 150mSv and 500mSv National Radiological Protection Board quote median DAP value of 6.6-8.3 Gy.cm² for standard barium swallow of 104 seconds, approximately twice the median for VFSS with less study time.</p>	<p>III</p>
<p>Daggett, A., Logemann, J., Rademaker, A., & Pauloski, B. (2006) Laryngeal penetration during deglutition in normal subjects of various ages. <i>Dysphagia</i>, 21: 270-4.</p>	<p>Cross-sectional study</p>	<p>98 normal subjects</p>	<p>To study the frequency of penetration of liquid, paste and masticated materials into the airway during VFSS</p>	<p>Results showed that penetrations were significantly more frequent after age 50 and thick viscosities penetrated only in subjects age 50 and over. For persons under 50, 7.4% of swallows exhibited penetration, while for people age 50 and over, 16.8% of swallows showed penetration. Significantly more penetration occurred on larger liquid boluses.</p>	<p>III</p>
<p>Daniels, S.K. & Huckabee, M.L. (2008) Dysphagia After Stroke. <i>Plural Publishing Ltd.</i></p>	<p>Textbook</p>	<p>-</p>	<p>-</p>	<p>Overview of the literature on dysphagia after stroke assessment and treatment</p>	<p>IV</p>
<p>Daniels, S., Schroeder, M., DeGeorge, P., Corey, D., & Ronsenk, J. (2007) Effects of verbal cue on bolus flow during swallowing. <i>American Journal of speech-language pathology</i>, 16: 140-147.</p>	<p>Cross-sectional study</p>	<p>12 healthy older adults</p>	<p>To assess whether bolus timing and bolus direction are affected by verbal cues in healthy adults.</p>	<p><u>Verbal cue</u>: effect on oral transit time.</p>	<p>IIb</p>

			5mls used.		
Dantas, R.O., Dodds, W.J., Massey, B.T., & Kern, M.K. (1989) The effect of high- vs low- density barium preparations on the quantitative features of swallowing. <i>American Journal of Roentgenology</i> , 153: 1191-1195.	Cross-sectional study	9 healthy control subjects	To compare the effects of high-density and low-density preparations. Concurrent VFSS and manometric studies.	Density as well as viscosity of the barium preparation has an influence on bolus transit time and on UES opening.	III
Davis-McFarland, E. (2008). Family and cultural issues in a school swallowing and feeding program. <i>Language, Speech, and Hearing Services in Schools</i> , 39 (2): 199-213.	Descriptive/Expert opinion	1 case study included	To present a rationale for SLT to provide culturally competent evaluation, diagnostic and intervention services for children with oral motor, swallowing and feeding disorders in school settings.	Culturally competent SLT practice strengthens clinical skills and effectiveness, optimizing opportunities for success in working with children and families in the school setting.	IV
DeMatteo, C., Matovich, D., & Hjartarson, A. (2005) Comparison of clinical and videofluoroscopic evaluation of children with feeding and swallowing difficulties <i>Developmental Medicine and Child Neurology</i> , 47 (3): 149-157.	Comparative study	75 paediatric participants	1. Evaluate the accuracy of CFE compared with VFSS in the detection of penetration and aspiration in children 0-15y. 2. Assess the relationship between therapists' confidence ratings in making judgments about the presence or absence of penetration and aspiration and the accuracy of their evaluation as confirmed by VFSS. 3. To identify clinical predictors of penetration and aspiration during CFE of children with feeding and swallowing difficulties.	CFE with experienced clinicians can detect aspiration and penetration of fluids in children of varied ages and diagnoses, but it is not accurate with solids.	III
Dikeman, K.J., & Riquelme, L.F. (2002). Food for thought: Ethnocultural concerns in dysphagia management. Newsletter of the ASHA Special Interest Division 13: Perspectives on Swallowing and Swallowing Disorders. <i>Dysphagia</i> , 11 (3): 31-35.	Review	-	To bring up issues relating to dysphagia and cultural sensitivity/safety for discussion	Cultural sensitivity and safety are very important for SLPs working in dysphagia.	IV
Dharmarathna I., Miles A., Allen J.E., (2018). Current approaches to instrumental assessment of swallowing in children. <i>Current Opinion Otolaryngology Head Neck Surgery</i> , 26:349-355	Review	Paediatric study	To review recent developments in the instrumental assessment of swallowing in children.	Need to improve quantitative analysis to improve swallowing management in paediatrics	IV
Dodrill, P and Gosa M.A., (2015) Pediatric Dysphagia: Physiology, Assessment and Management. <i>Annals of Nutrition and Metabolism</i> 66 (suppl 5):24-31	Practice Standards		Overview on assessing and managing children with difficulties eating and drinking	Swallowing impacts on nutritional status. Options for management	IV
Edwards, A. et al (2018). Developing competent Videofluoroscopic Swallow Study analysts, <i>Current Opinion Otolaryngology Head and Neck Surgery</i> . 26(3): 162-166	Practice standards	-	Summary of the developments in training clinicians to analyse VFSS	Need for better information on andragogical and personal influences on the successful development of VFSS analytical skill development.	IV
Fink, T.A., & Ross, J.B. (2009) Are We Testing a True Thin Liquid? <i>Dysphagia</i> , 24:285-289.	Case series	40 patients with variety of aetiologies including those	VFSS investigation comparing swallowing of Ultrathin liquid vs	Fifty percent of patients aspirated on the Ultrathin liquid but not on the	III

		without likely dysphagia risk	Varibar Thin Liquid. Clinical question was “is our thin liquid used in a VFSS reliable for real life thin liquids”?	Varibar Thin liquid in at least one condition	
Frazier, J. et al. (2016) Understanding the viscosity of liquids used in infant dysphagia management. <i>Dysphagia</i> 31(5):672-679	Practice standards	Infant formula, Expressed Breast Milk, standard barium products.	Objective viscosity measurement for typical infant liquid diet options and barium contrast media.	Variations in barium product viscosity despite identical barium concentration. Adding barium to standard formula or EBM increased viscosity but all stayed the thin range.	IIb
Garcia, J.M., Hakel, M., & Lazarus, C. (2004) Unexpected consequence of effortful swallowing: case study report. <i>Journal of Medical Speech-Language Pathology</i> , 12 (2): 59-66.	Case study	1 male, adolescent with cranial nerve damage	Investigate/explain unexpected nasal regurgitation as a result of effortful swallow	Swallowing manoeuvres can have unexpected consequences, thus VFSS is necessary to determine effects of such manoeuvres on swallowing physiology.	III
Gibson, E., Phyland, D., & Marchner, I. (1995) Rater Reliability of the Modified Barium Swallow. <i>Australian Journal of Communication Disorders</i> , 23: 54-60.	Reliability study	8 subjects; 20 swallows 4 SLT raters with between 40-200 VFS experiences.	Comparison of inter and intra rater reliability for 6 defined variables (defined by researchers)	High inter and intra rater reliability for numerical variables (e.g. transit time) ‘good’ agreement on aspiration ‘poor’ agreement on residue	III
Gosa, M. et al (2015) Reliability for identification of a select set of temporal and physiologic features of infant swallows. <i>Dysphagia</i> 30(3): 365-372	Reliability study	10 subjects, 25 swallows analysed by 2 novel analysts after training.	To determine a set of temporal and physiologic features from infant swallowing that can be measured.	15 features can be measured during VFSS to assist with determining normal versus abnormal swallow features.	IIb
Gosa, M.M. & Dodrill, P. (2017) Effect of time and temperature on thickened infant formula. <i>Nutrition in Clinical Practice</i> . Vol 32, 238-244	Comparative study	Pre-packaged barium consistencies and 1 standard infant formula that was thickened with rice cereal and with 2 commercially available thickening agents	Identification of factors that influence thickening of liquids in paediatrics.	Thickened liquids can vary with time and temperature. Clinical follow up of children who are recommended to have thickened liquids.	IIb
Gray, C., Sivaloganathan, S., & Simpkin, K.C. (1989) Aspiration of high-density barium contrast medium causing acute pulmonary inflammation- Report of two fatal cases in elderly women with disordered swallowing. <i>Clinical Radiology</i> , 40: 397-400.	Case Study	2 elderly women (74 and 85) who died following aspiration of barium sulphate during barium meal/swallow	Case study of aspiration of high density barium sulphate preparation (250%) resulting in death.	The aspiration of high density barium should be avoided. If there is a chance of aspiration a low density preparation (50% or non-ionic low osmolar contrast medium should be considered. If aspiration of high density preparation occurs, the study should be terminated and appropriate treatment implemented.	III
Groher, M.E., Crary, M.A., Carnaby, G., Vickers, Z., & Aguilar, C. (2006) The Impact of Rheologically Controlled Materials on the identification of airway compromise on the clinical &	Comparative study	22 participants?	To determine the difference between a bedside evaluation and VFSS when the materials are	Vital to match consistencies in VFSS with bedside	III

videofluoroscopic swallowing examinations <i>Dysphagia</i> , 21 (4): 218-225.			identically matched		
Gullung J, Hill E, Castell D, Martin-Harris B. Oropharyngeal and esophageal swallowing impairments: Their association and the predictive value of the modified barium swallow impairment profile and combined multichannel intraluminal impedance-esophageal manometry. <i>Annals of Otolaryngology, Rhinology & Laryngology</i> . 2012;121(11):738-745.	Cohort study	164 patients referred for VFSS and manometry	To examine the relationship between measures of oropharyngeal and esophageal swallow function.	A functional interrelationship between abnormalities of oropharyngeal and esophageal swallowing does exist	IIIb
Hayes, A., Alspaugh, J.M., Bartlet, D., Campion, M.B., Eng, J., Gayler, B.W., Henkel, S.E., Jones, B., Lingaraj, A., Mahesh, M., Rostkowski, M., Smith, C.P., & Haynos, J. (2009) Radiation Safety for the Speech-Language Pathologist. <i>Dysphagia</i> , 24 (3): 274-9.	Qualitative Study	6 SLTs conducting 130 VFSS exams in an acute-care setting over a 2 month period	To measure radiation exposure to SLTs in a clinical setting and to provide practical recommendations to keep radiation exposure as low as possible	Average VFSS time was 165secs; average radiation exposure was 0.0015 mGy per day, which extrapolates to 0.55 mGy per year. The authors concluded this exposure was quite low. Pharynx plus oesophagus studies took greater screening time and resulted in greater exposure but still well within acceptable limits. Recommendations made to reduce radiation exposure to SLTs included distance from the source of radiation and shielding. Also education and knowledge of radiation patterns and safe practices.	III
Henderson, M., Miles, A., Holgate, V., Peryman, S., Allen, J. (2016) Development and validation of quantitative objective videofluoroscopic swallowing measures in children. <i>Journal of Pediatrics</i> , 178: 202-205. 10.1016/j.jpeds.2016.07.050.	Cohort study	121 children (9 days- 21yrs with feeding difficulties	To investigate the feasibility of obtaining and utilizing objective measures of timing and displacement from videofluoroscopy performed in paediatrics.	Quantitative measures were obtained in all children. Values were congruent with validated adult data. Mean radiation time was 1.58 minutes (range 0.15-3.47, SD 0.66), and mean radiation dose was 30.16 cGycm2 (range 6.5-85 SD 15.17). Radiation dose ($P = .21$) and radiation time ($P = .72$) were not significantly different using the increased frame rate compared with an age-matched cohort (n =100) prior to protocol change.	III
Hersh, Cheryl, Carissa Wentland, Sarah Sally, Marie de Stadler, Steven Hardy, M. Shannon Fracchia, Bob Liu, and Christopher Hartnick. 2016. "Radiation Exposure from Videofluoroscopic Swallow Studies in Children with a Type 1 Laryngeal Cleft and Pharyngeal Dysphagia: A Retrospective Review." <i>International Journal of Pediatric Otorhinolaryngology</i> 89: 92-96.	Cohort study	78 children with type 1 laryngeal cleft being treated for aspiration over a 5 year period	To quantify the amount of ionizing radiation received by children being treated for aspiration secondary to a type 1 laryngeal cleft	Each child received, on average, 3.24 studies over their course of treatment (range: 1-10). The average effective radiation dose per VFSS was 0.16 mSv (range: 0.03 mSv - 0.59 mSv). This was the equivalent	III

				to 30.6 paediatric chest x-ray exams.	
Hind, J.A., Gensler, G., Brandt, D.K., Miller Gardner, P.J., Blumenthal, L., Gramigna, G.D., Kosek, S., Lundy, D., McGarvey-Toler, S., Rockafellow, S., Sullivan, P.A., Villa, M., Gill, G.D., Lindblad, A.S., Logemann, J.A., & Robins, J. (2009) Comparison of Trained Clinician Ratings with Expert Ratings of Aspiration on Videofluoroscopic Images from a Randomised Clinical Trial. <i>Dysphagia</i> , 24 (2); 211-217.	Clinical Trial as part of a large multi-site clinical trial	669 patients 76 clinicians 10,200 swallows	To examine the accuracy of judgements of aspiration of SLPs vs expert judges using Pen/Asp scale. Clinicians were given 2 day intensive training	Found high accuracy for SLPs using the scale compared with expert judges Recommendations: extensive training for SLP and image enhancement.	Ib
Hiorns, M.P., & Ryan, M.M. (2006) Current practice in paediatric videofluoroscopy. <i>Pediatric Radiology</i> , 36: 911-919.	Practice review	Paediatric study-	Reviews the scope and limitations of the examination, explores the current techniques and illustrates some of the main findings.	-	IV
Huckabee, M.L. (unpublished) New Zealand Index for the Multidisciplinary Evaluation of Swallowing (NZIMES). <i>University of Canterbury/ The Van der Veer Institute for Parkinson's and Brain Research, Christchurch, New Zealand.</i>	Assessment Tool	-	A tool for analysing and reporting VFSS procedures	-	IV
Huckabee, M.L., & Pelletier, C.A. (1999) Management of Adult Neurogenic Dysphagia. <i>Singular Publishing Group.</i>	Textbook	-	-	Detailed evidence-based review	IV
Huggins, P.S., Tuomi, S.K., & Young, C. (1999) Effects of Nasogastric tubes on young normal swallow mechanism. <i>Dysphagia</i> , 14: 157-161.	Case Series	10 normal subjects with nasogastric tubes - MBS	To investigate the effects of wide bore and fine bore NGT's on the swallow of normal people	Large bore tubes significantly affected durational measures with similar results for small bore tubes	III
Im, Hyo Won, Seung Yeun Kim, Byung Mo Oh, Tai Ryoan Han, and Han Gil Seo. 2019. "Radiation Dose During Videofluoroscopic Swallowing Studies and Associated Factors in Pediatric Patients." <i>Dysphagia</i> , no. 0123456789: 3-8.	Cross-sectional study	290 VFSSs from 217 paediatric patients aged 0-17 years	To investigate the radiation dosage using dose-area product (DAP) for VFSS in paediatric cases and to identify factors affecting the radiation dose	The mean DAP was 5.78 ± 4.34 Gy cm^2 with a mean screening time of 2.69 ± 1.30 min. The factors associated with the DAP included screening time, appearance of metal objects in the field, and use of collimation. In 98 cases with no metal object in the field and with collimation, the mean DAP was decreased to 2.96 ± 2.53 Gy cm^2 .	III
Irace, A, Dombrowski D., Kawai K., Dodrill P, Perez J, Hernandez K., 2018 Aspiration in children with unilateral vocal fold paralysis. <i>The Laryngoscope</i> Vol 129, Issue 3.	Retrospective chart review	28 patients with UVCP	VFSS completed and all patients silently aspirated.	UVCP with respiratory issues and/or feeding difficulties likely to silently aspirate.	IV
Jones B, Ravich W, Donner M, Kramer S, Hendrix T. Pharyngoesophageal interrelationships: Observations and working concepts. <i>Gastrointestinal Radiology</i> . 1985;10(3):225-233.	Expert opinion	-	-	Simultaneous disorders of the pharynx and esophagus are so frequent that the complete swallowing chain should be examined in all patients with dysphagia.	IV
Jones, B. (ed) (2003) Normal and Abnormal Swallowing: imaging in diagnosis and therapy. 2 nd Ed. <i>Springer- Verlag New York Inc.</i>	Textbook	-	-	Detail of VFSS procedure including radiation Normal and abnormal swallowing	IV

				physiology	
Jou J, Radowsky J, Gangnon R, et al. Esophageal clearance patterns in normal older adults as documented with videofluoroscopic esophagram. <i>Gastroenterology Research and Practice</i> . 2009; September:1-6.	Cohort study	24 young (45-64 years) and old (65+years) men and women - healthy	To assess radiographic esophageal bolus movement patterns in healthy adults using videofluoroscopic recording	Intraesophageal reflux was observed more frequently in older males than in their younger counterparts. The rates of intraesophageal stasis and intraesophageal reflux were high	I Ib
Katsanoulas, C., Passakiotou, M., Moulodi, E., Georgopoulou, V., & Gritsi-Gerogianni, N. (2007) Severe Barium Sulphate aspiration: a report of two cases and review of the literature. <i>Signa Vitae</i> , 2 (1): 25-28.	Case Report and Literature Review	2 patients who developed acute respiratory failure requiring mechanical ventilation following aspiration of large amounts of barium during upper GI radiographic contrast study (1 deceased)	Case study of aspiration of barium. Aspiration of barium sulphate is not expected to cause severe lung injury due to its relatively non-irritant manner Review of reported mortality and treatment	Complications depend on density and quantity of aspirated material, and the physical condition of the patient. Early treatment and follow up are important to prevent progression towards fibrosis. Treatment is based on clinical judgement Acute inflammation and death due to aspiration of high or low preparations of barium sulphate have been reported. Mortality rate associated with massive aspiration is approximately 30% (> with co-morbidities)	III
Kellen, P.M., Becker, D.L., Reinhardt, J.M., & Van Daele, D.J. (2010) Computer-Assisted Assessment of Hyoid Bone Motion from Videofluoroscopic Swallow Studies. <i>Dysphagia</i> , 25 (4): 298-306.	Case series	9 cases from 3 subjects	To demonstrate use of a computerised system of hyoid range of motion measurement	High correlations with manually defined hyoid trajectories. Computerised system can provide fast, easy, objective assessment using VFSS image sequences	III
Kim, B.R. , et al (2014) Long term outcomes in children with swallowing dysfunction. <i>Developmental Neurorehabilitation</i> 17(5): 298-305	Retrospective case series.	90 children (1-120 months)	VFSS measurement of long term swallowing function outcomes.	Outcomes are favourable. Severity of VFSS decreased with age.	I Ib
Ko, E. J. , et al (2019) Radioation exposure during videofluoroscopic swallow studies in young children. <i>International Journal of pediatric Otorhinolaryngology</i> 121: 1-5. Doi: 10.1016/j.ijporl.2019.02.038	Prospective study	89 children referred for swallow difficulties	Evaluate radiation dose during VFSS and factors associated with it.	<ul style="list-style-type: none"> The effective dose during VFSS in young children is affected by screening time, age and body size and is considerably lower than the pediatric radiation exposure limit per year. 	I Ib
Kuhlmeier, K. V., Palmer, J. B., & Rosenberg, D. (2001). Effect of liquid bolus consistency and delivery method on aspiration and pharyngeal retention in dysphagia patients. <i>Dysphagia</i> , 16: 119-122.	Quasi-experimental study	190 patients with dysphagia	To determine if aspiration rates varied for thin, thick, and pudding consistencies. Also, to determine whether aspiration rates were influenced by mode of bolus presentation	<ul style="list-style-type: none"> Using thin, thick and pudding consistencies and varying delivery with spoon and cup during MBS can increase the chances of identifying a 	I Ib

				<p>consistency and mode of presentation the patient can use without aspirating</p> <ul style="list-style-type: none"> • MBS procedure should include bolus presentation via spoon and cup. • Different consistencies should be used to determine aspiration as it can become more evident with a different consistency 	
Kuhlemeier, K.V., Yates, P., & Palmer, J. (1998) Intra- and Interrater Variation in the Evaluation of Videofluorographic Swallowing Studies. <i>Dysphagia</i> , 13:142-147.	Reliability study	9 raters – 4 physicians and 5 SLPs. Viewed 20 patients’ VFSS who were selected by severity to match the typical caseload.	To determine intra- and inter-rater variation between clinicians evaluating VFSS	Inter- and intra-rater reliability did not differ greatly Reliability was greatest for detecting aspiration. It was adequate for evaluating oral stage, LP and pharyngeal retention. Reliability was poor for judging functional components of the swallow (e.g. Timing of the swallow)	III
Langmore, S.E. (2003) Evaluation of oropharyngeal dysphagia: which diagnostic tool is superior? <i>Laryngology and bronchoesophagology</i> , 11(6): 485-489.	Literature review	37 Studies reviewed	Examine efficacy of VFSS/MBS vs FEES	Both VFSS/MBS can be used to manage dysphagia successfully. The view obtained from each tool is different. VFSS/MBS is better for examining UES problems while FEES is better at identifying aspiration.	III
Langmore, S.E, Schatz, K., & Olsen, N. (1991) Endoscopic and Videofluoroscopic Evaluations of Swallowing and Aspiration. <i>Ann Otol Rhinol Laryngol.</i> , 100: 678-681.	Comparative study	21 subjects	To evaluate the accuracy of FEES compared with VFSS for identifying aspiration	FEES is a valid, valuable tool. Some specific patients and conditions lend themselves to this procedure rather than VFSS	III
Lazarus, C., Logemann, J., Rademaker, A.W., Kahrilas, P.J., Pajak, T., Lazar, R., & Halper, A. (1993) Effects of bolus volume, viscosity and repeated swallows in non stroke subjects and stroke patients. <i>Arch Phys Med Rehabil.</i> , 74: 1066-70.	Clinical Trial	20 participants; 10 post-CVA 10 age matched non-CVA.	Effects of volume, viscosity and repeated swallowing.	<u>Volume effects (1ml, 3ml, 5ml)</u> CVA: shorter pharyngeal delays as bolus volume increased. ↓ Duration BOT to PPW as volume ↑ CVA and Normal: ↑laryngeal closure time and CP opening as bolus size ↑ <u>Viscosity effects (liquid vs paste).</u> Normal: longer mean CP opening	Ila

				and lower mean pharyngeal swallow efficiency on paste than liquid. CVA: nil differences in CP and pharyngeal swallow. CVA and normal patients: ↑BOT to PPW on paste than liquid <u>Repeated swallows/ learning effects:</u> No statistically significant effects were found in normals and CVA.	
Lee, J. W., Randall, D. R., Evangelista, L. M., Kuhn, M. A., & Belafsky, P. C. (2017). Subjective Assessment of Videofluoroscopic Swallow Studies. <i>Otolaryngology–Head and Neck Surgery</i> , 156(5), 901-905.	Comparative study	76 patients referred to VFSS	To evaluate the accuracy of subjective VFSS analysis.	Evaluators correctly classified only 61.5% of VFSS videos as normal or abnormal, with moderate interrater agreement	Iib
Leder, S.B., Sasaki, C.T., & Burrell, M.I. (1998) Fiberoptic Endoscopic Evaluation of Dysphagia to Identify Silent Aspiration. <i>Dysphagia</i> , 13:19–21.	Case Series	400 subjects	To assess validity of FEES compared with VFSS	Validity of FEES	III
Leonard, R., Rees, C.J., Belafsky, P., & Allen, J. (2011) Fluoroscopic Surrogate for Pharyngeal Strength: The Pharyngeal Constriction Ratio (PCR). <i>Dysphagia</i> , 26 (1): 13-17.	Case Series	25 subjects	To evaluate the correlation between pharyngeal constriction ratio (PCR) during VFSS with manometric pharyngeal strength	Results suggest utility of the objective VFSS measure for pharyngeal strength when manometry is not available	III
Leonard, R., & Kendall, K. Dysphagia Assessment and treatment planning – A team approach. 2 nd Ed. <i>Plural Pub, San Diego, 2018</i> .	Textbook	-	-	Particularly Ch 8, 14-17	IV
Leonard, R.J., White, C., McKenzie, S., Belafsky P.C. (2014) Effects of rheology on aspiration in patients with dysphagia. <i>J Acad Nutr Diet</i> , 114 (4): 590-4.	Cohort study	100 patients with dysphagia	To investigate the effects of viscosity on aspiration	A clinically significant reduction in the incidence of penetration and aspiration was observed for gum-thickened barium compared with thin liquid barium	Iib
Lof, G.L., Robbnis, J. (1990) Test-retest variability in normal swallowing. <i>Dysphagia</i> , 4 (4): 236-42.	Comparative study	Sixteen normal subjects (8 men, 8 women) were organized into 2 age groups: middle-aged group (mean, 45 years) and old-age group (mean, 66 years).	Test-retest variability of the modified barium swallow study	Normal subjects perform similarly on test and a retest. However, the variability displayed by these normal subjects may be clinically significant, indicating that test-retest swallowing duration measures require careful interpretation.	Iib
Lo Re, G., Vernuccio, F., Di Vittorio, M. L., Scopelliti, L., De Piazza, A., Terranova, M.C., Picone, D., Tudisca C., Salerno S. (2019) Swallowing evaluation with videofluoroscopy in the pediatric population. <i>ACTA Otorhinolaryngologica Italica</i> . Oct; 39(5): 279-288	Practice standards	Pediatric patients with feeding difficulties	This review focuses on the different possible aetiologies of paediatric swallowing disorders and related videofluoroscopic swallowing study procedures and appearances.	Feeding and swallowing disorders present in different manners and the underlying aetiology may be difficult to determine. Behavioural, structural and physiological disorders often coexist, complicating diagnosis and management. For this reason, a multidisciplinary	IV

				approach to diagnosis and management is helpful.	
Logemann, J.E. (1998) Evaluation & Treatment of Swallowing Disorders. <i>Pro-ed.</i>	Textbook	-	-	Detailed review of literature and current practice in paediatrics and adults	IV
Logemann, J.A., Gensler, G., Robbins, J., Lindblad A.S., Brandt, D., Hind, J.A., Kosek, S., Dikeman, K., Kazandjian, M., Gramigna, G.D., Lundy, D., McGarvey-Toler, S., & Gardner, P.J.M. (2008) A Randomized Study of Three Interventions for Aspiration of Thin Liquids in Patients With Dementia or Parkinson's Disease. <i>Journal of Speech, Language, and Hearing Research, 51 (1): 173-183.</i>	Randomised Clinical Trial	711 participants?	To determine which treatment eliminates aspiration	Identifies best short term intervention to prevent aspiration of thin liquid in patients with dementia and/or PD	IIa
Logemann, J.A., & Kahliras, P.J. (1990) Re-learning to swallow after stroke- application of manoeuvres & biofeedback: A case study. <i>Neurology, 40: 1136-1138.</i>	Case Study	1 patient with medullary stroke (monitored until 45 months post stroke)	-	Using repeat VFSSs allowed ability to monitor change in people with chronic dysphagia receiving therapy	III
Logemann, J.A., Lazarus, C., Keeley, Sanchez, A., & Rademaker, A.W. (2000) Effectiveness of 4hrs of Education in Interpretation of Radiographic Studies. <i>Dysphagia, 15: 180-183.</i>	Quasi-experimental study	39 Clinicians enrolled on a course at a state conference	To review the outcome of 4hrs of training on therapists' interpretation skills	There was a significant ↓ in incorrect answers. Amount of previous experience affected the amount of improvement (i.e. less room for improvement in experienced clinicians).	IIb
Logemann, J. A., Pauloski, B. R., Colangelo, L., Lazarus, C., Fukui, M., & Kahrilas, P. (1995) Effects of a sour bolus on oropharyngeal swallowing measures in patients with neurogenic dysphagia. <i>Journal of Speech and Hearing Research, 38: 556-563.</i>	Quasi-experimental study	19 people with dysphagia post stroke 8 people with dysphagia from other neurological etiologies e.g. Parkinson's Disease	Effects of sour bolus on pharyngeal swallow	Significant improvement in oral onset time, sign reduction in pharynx swallow delay, reduction in aspiration	IIb
Logemann, J. A., Rademaker, A. W., Pauloski, B. R., & Kahrilas, P. J. (1994) Effects of postural change on aspiration in head and neck surgical patients. <i>Otolaryngology Head and Neck Surgery, 4: 222-227.</i>	Quasi-experimental study	32 patients with dysphagia following head and neck diagnosis	To define effects of postural change on liquid aspiration using VFSS	Showed importance of introducing postural techniques during the VFSS to facilitate safe feeding	IIb
Logemann, J. A., Rademaker, A. W., Pauloski, B. R., Ohmae, Y., & Kahrilas, P.J. (1998) Normal Swallowing Physiology as viewed by videofluoroscopy and videendoscopy. <i>Folia Phoniatrica et Logopaedica, 500: 311-319.</i>	Comparative study	8 adults 12 swallows each	To examine normal swallowing with VFSS and endoscopy	For laryngeal events before and after the swallow, endoscopy is useful. For pharyngeal anatomy and presence of food/fluid in the pharynx, either endoscopy or VFSS is useful. For pharyngeal physiology during swallow, VFSS is a better procedure.	III
Ludlow, C.L., Humbert, I., Saxon, K., Poletto, C., Sonies, B., & Crujido, L. (2007) Effects of Surface Electrical Stimulation Both at Rest and During Swallowing in Chronic Pharyngeal Dysphagia. <i>Dysphagia, 22: 1-10.</i>	Quasi-experimental study	10 people with chronic stable pharyngeal dysphagia	To examine the effect of surface electrical stimulation on the hyoid bone/larynx, and on the incidence of aspiration during stimulation at low sensory levels and maximum	Electrical stimulation can interfere with hyolaryngeal elevation required for airway penetration. Therefore, the baseline ability to raise the hyolaryngeal complex must be	IIa

			tolerated motor levels	determined prior to the use of electrical stimulation in therapy.	
McGratton, K.E., McGhee, H.C., Mckelvey, K.L., Clemmens, C.S., Hill, E.G., DeToma, A, Hill, J.E., Simmons, C.E., Martin-Harris, B. (2019) Capturing infant swallow impairment on videofluoroscopy: timing matters. <i>Pediatric Radiology</i> , September	Cohort study	Thirty bottle-fed infants with clinical signs of swallow dysfunction	Testing key timepoints of swallow physiology and airway protection in pediatric VFSS	Infants with dysphagia exhibit a change in swallow physiology throughout the VFSS. Development of procedural guidelines is crucial for maximizing the exams diagnostic and treatment yield.	IIb
Manna, A., Wurtzburg S.J., Huckabee, M.L., & Blake, T.K. (2003) Cultural Issues Influencing Dysphagia management practices in New Zealand Māori Population: A Descriptive Study. <i>New Zealand Journal of Speech- Language Therapy</i> , 58: 35-46.	Qualitative	15 Semi-structured interviews. (5 Māori patients who had experienced dysphagia 5 Health Professionals 6 Kaumatua)	Health professionals should have some understanding of their patients' cultures in order to provide the most appropriate treatment.	Māori health and beliefs surrounding food and its consumption should be considered by speech–language therapists who want to assist members of this population with effective dysphagia management practices. Recommendations are provided.	III
Mari, F., Matei, M., Ceravolo, M.G., Pisani, A., Montesi, A., & Provinciali, L. (1997) Predictive value of clinical indices in detecting aspiration in patients with neurological disorders. <i>Journal of Neurology, Neurosurgery & Psychiatry</i> , 63(4): 456-60.	Case Series	93 consecutive patients	(1) To evaluate the predictive value of a detailed clinical screening of aspiration in patients with neurological diseases, both with and without symptoms of dysphagia taking videofluoroscopy as the gold standard; (2) to assess the existence of risk factors for silent aspiration, measuring the cost-benefit ratio of radiological examination.	The association of two clinical items (such as history of cough on swallowing and 3oz test positivity) provides a useful screening tool, the cost benefit ratio of which seems very competitive in comparison with videofluoroscopy in aspiration risk evaluation.	III
Martin-Harris, B., Brodsky, M.B., Michel, Y.B., Brodsky, M.B., Michel, Y., Lee, F.S., & Walters, B. (2007) Delayed Initiation of Pharyngeal Swallow: Normal Variability in Adult Swallows. <i>J Speech Lang Hear Res</i> , 50(3): 585-94.	Cross Sectional	82 Normal Ageing	To identify measure of swallow initiation and compare it to age and the PA scale.	Beware of normal variation in swallow initiation points especially in aging population. Delay swallow rarely the only feature of dysphagia.	III
Martin-Harris, B., Brodsky, M. B., Michel, Y., O'Castell, D., Schleicher, M., Sandidge, J., Maxwell, R., & Blair, J.(2008). MBS Measurement Tool for Swallow Impairment – MBSImp: Establishing a Standard. <i>Dysphagia</i> , 23: 392-405.	Cross-sectional	300 participants?	Benefits of standardisation of MBS	Standardised training, protocols, contrast materials and measurements should improve reliability of MBS studies.	III
Martin-Harris, B. M. , et al (2016) BaByVFSSImp. A Novel Measurement Tool for Videofluoroscopic Assessment of Swallow Impairment in Bottle Fed Babies: Establishing a Standard. <i>Dysphagia</i> 31(6): 788-789	Practice Standards	7 SLTs participated in training of 24 components of swallowing in paediatrics	Examines the reliability of raters trained in the use of a novel tool for quantification of swallowing physiology in bottle fed children	Standardisation of VFSS protocols and training with precise operational definitions enables reliable identification and quantification of swallowing function in bottle fed children.	IIb
Martin-Harris, B., Logemann, J., McMahon, S., Scheicher, M., & Sandridge, J. (2000) Clinical utility of the Modified barium Swallow.	Case Series	608 participants?	Support use of MBS	90% of MBS show abnormality 82% show change in outcome	III

<i>Dysphagia</i> , 15: 136-141.				measures	
Mason, M.F. (1993) Speech Pathology for Tracheostomized & Ventilator Dependant patients. <i>Voicing Inc.</i>	Textbook	-		Review of use of VFSS with patients with tracheostomies.	IV
Mathers-Schmidt, B., & Kurlinski, M. (2003) Dysphagia Evaluation Practices: Inconsistencies in Clinical Assessment and Instrumental Examination Decision-Making. <i>Dysphagia</i> , 18:114-125.	Qualitative Survey	72 returned surveys	Components of clinical exam, consistency of clinical exam practices, consistency of clinical decision making.	There is considerable clinician variability both in conducting clinical examinations and in making clinical decision. This finding is consistent with other studies.	III
McCullough, G.H., Wertz, R. T., Rosenbek, J.C., Mills, R.H., Webb, W.G., & Ross, K.B. (2001). Inter- and Intrajudge Reliability for Videofluoroscopic Swallowing Evaluation Measures. <i>Dysphagia</i> , 16:110-118.	Reliability study	3 SLPs with their CCCs and >300 hrs assessment and treatment of dysphagia and >200 hours experience with VFS. Viewed 20 patients' VFSS – all had a stroke.	To determine the inter- and intra-judge reliability of VFS interpretation	Good intra-judge reliability (sample of only 1 clinician), but unacceptable inter-judge reliability across all measures.	III
Medicare (2009) Medicare Benefit Policy Manual- Therapy Policies, Part B Outpatient CR 3648, 15 (220 & 230). Retrieved from: http://www.cms.gov/manuals/Downloads/bp102c15.pdf	Practice Standards	-	Support safe, consistent practice	Detailed policy	IV
Miles A, McMillan J, Ward K, Allen J. Esophageal screening as an adjunct to videofluoroscopic study of swallowing. <i>Otolaryngology Head Neck Surgery</i> .2015;152(3):488-493.	Cross sectional study	111 patients referred to VFSS	To investigate the prevalence of esophageal abnormalities in an SLP-led videofluoroscopic study of swallowing (VFSS) clinic.	Fluoroscopic evaluation of the pharynx alone, without esophageal review, risks incomplete diagnosis of patients with esophageal disorders.	IIb
^a Miles A, Clark S, Jardine M, Allen J. Esophageal swallowing timing measures in healthy adults during videofluoroscopy. <i>Annals of Otorhinolaryngology</i> . 2016;125(9):764-769.	Cohort study	118 healthy adults	To measure esophageal transit of liquid, paste, and pill during upright videofluoroscopy.	normative values provide a standardized protocol and guidance in interpretation when completing esophageal visualization as part of videofluoroscopy	IIb
^b Miles, A. (2016) Inter-rater reliability for speech-language therapists' judgement of oesophageal abnormality during oesophageal visualisation. <i>Journal of Communication & Language Disorders</i> . 10.1111/1460-6984.12283.	Cohort study	74 speech-language therapists	To measure the inter-rater reliability of oesophageal abnormality judgement in speech and language therapists during upright videofluoroscopy.	Speech and language therapists demonstrated substantial agreement in judging oesophageal abnormality during videofluoroscopy.	IIb
Miller, C., K. Aspiration and Swallowing Dysfunction in Pediatric Patients. ICAN: Infant, Child, & Adolescent Nutrition. December 2011	Practice Standards	-	Define instrumental studies of swallowing physiology and therapeutic strategies to improve airway protection when swallowing in paediatrics	Regardless of the objective exam used the clinician's goal should be defining swallowing physiology and the conditions in which safe swallowing can be achieved.	IV
Ministry of Health (1965) The Radiation Protection Act. Retrieved from: http://www.nrl.moh.govt.nz/regulatory/c16.pdf	Practice Standards	-	NZ Legislation of Radiation Use	-	IV
Ministry of Health (2010) Code of Safe Practice For The Use of x-rays in medical diagnosis: NRL C5; Version 1.3. Retrieved from: http://www.nrl.moh.govt.nz/regulatory/c12.pdf	Practice Standards	-	-	Sets out requirements and recommendations for radiation safety associated with the use of x-rays for medical diagnosis and for	IV

				research on humans.	
Miura, Y., Morita, Y., Koizumi, H., & Shingai, T. (2009) Effects of Taste Solutions, Carbonation, and Cold Stimulus on the Power Frequency Content of Swallowing Submental Surface Electromyography. <i>Chemical Senses</i> , 34: 325-331.	Quasi-experimental study	5 taste solutions 20 healthy volunteers	To explore the effects of 5 taste solutions on the power frequency content of sEMG.	Taste, carbonation and cold stimuli have qualitatively different influences on the power frequency content of swallowing sEMG.	III
Molfenter, SM., Steele, CM. (2011) Physiological variability in the deglutition literature: hyoid and laryngeal kinematics. <i>Dysphagia</i> , 26 (1): 67-74.	Literature review		Review of hyoid and/or laryngeal displacement during swallowing in healthy populations	large degree of variability across studies for each structure and plane of movement	IV
Morishima, Yoshiaki, Koichi Chida, and Hiroshi Watanabe. 2016. "Estimation of the Dose of Radiation Received by Patient and Physician during a Videofluoroscopic Swallowing Study." <i>Dysphagia</i> 31 (4): 574-78.	Cross-sectional study	56 patients undergoing VFSS and one physician performing the study	To estimate the dose of radiation (entrance skin dose, ESD) received by a patient during VFSS as well as the effective dose (ED) and dose equivalent (DE) received by a clinician during a VFSS.	On average, patients were estimated to receive a radiation dose of 12.79 mGy per VFSS. The physician ED and DE during was 0.9 mSv/year and 2.3 mSv/year, respectively.	III
Moro, L., & Cazzani, C. (2006) Dynamic Swallowing Study and Radiation Dose to Patients. <i>La Radiologia Medica (Torino)</i> , 111 (1): 123-9.	Case series	22 patients aged 29-84 years acute or chronic pathological neurological conditions	To define the optimal radiological procedure for VFSS and calculate the effective and organ dose to the patient and provide a measure of the radiation risk associated with the procedure.	The optimal radiological VFSS procedure involving the lowest dose per patient while producing adequate diagnostic information was defined using kerma-area product (KAP) measurements. The KAP measurements confirmed that VFSS provides useful diagnostic and treatment planning information in swallowing disorders with a low associated radiological risk.	III
Mulheren, Rachel W., Alba Azola, and Marlís González Fernández. 2018. "Do Ratings of Swallowing Function Differ by Videofluoroscopic Rate? An Exploratory Analysis in Patients After Acute Stroke." <i>Archives of Physical Medicine and Rehabilitation</i> .	Comparison study	Two experienced SLP-researchers rated 20 VFSSs from patients with acute stroke	To determine differences on ratings of swallowing function between VFSSs recorded with a pulse rate and frame rate of 30 to the same swallows presented at 15 frames per second	VFSSs presented at 30 vs. 15 frames per second yielded contrasting results on certain measures of swallowing, including pharyngeal transit time, bolus entry into the hypopharynx, oral residue, UES opening, bolus transport, and initiation of pharyngeal swallowing. There were no differences in Penetration-Aspiration Scale scores. VFSS should be administered continuously or at 30 pulses per second for valid assessment.	III
Newman, L.A., Cleveland, R.H., Blickman, J.G., Hillman, R.E., & Jaramillo, D. (1991) Videofluoroscopic Analysis of the Infant Swallow Investigative <i>Radiology</i> , 26 (10): 853-920.	Case series	23 paediatric participants	Understanding normal infant swallow	VFSS provides an objective and systematic method for analyzing the infant swallowing mechanism	III
Newman, L.A., Keckley, C., Peterson, M.C., & Hamner, A. (2001)	Case Series	43 infants videos	To review the swallow physiology	Silent aspiration is common. Most	III

Swallowing function and medical diagnoses in infants suspected of Dysphagia. <i>Paediatrics</i> , 108 (6): e106.			of infants referred for VFSS	infants did not demonstrate abnormalities in the first few swallows but deteriorated as they continued to feed.	
Nightingale, J., & Mackay, B. (2009) An analysis in changes in practice introduced during an education programme for practitioner-led swallow investigations. <i>Radiography</i> , 15: 63-69.	Quasi-experimental study	24 practitioners (SLTs and Radiographers)	To analyse any change in practice after an education programme	Between 4-19 practice changes were made post training-service improvements, communication, protocols and quality assurance	III
Nordin, N., Miles, A. & Allen, J. (2017) Measuring competency development in objective evaluation of videofluoroscopic swallowing studies. <i>Dysphagia</i> 32 (3): 427-436.	Experimental study	Six novice (no VFSS experience) and four experienced (2-10 years of VFSS experience) SLPs	To investigate competency development in selected standardized objective VFSS measures	SLPs can reliably learn and incorporate objective VFSS measures within a reasonable time frame. Level of experience has limited influence on the learning curve.	IIB
O'Donoghue, S., & Bagnall, A. (1999) Videofluoroscopic evaluation in the assessment of swallowing disorders in paediatric & adult populations. <i>Folia Phoniatr Logop.</i> , 51: 158-171.	Review	-	To review the literature on use of VFSS and evaluate the applicability of protocols to the paediatric population.	Dysphagia specialists should achieve greater consistency in VFSS.	IV
O'Neill, K. H., Purdy, M., Falk, J., & Gallo, L. (1999). The dysphagia outcome and severity scale. <i>Dysphagia</i> , 14(3), 139-145.	Descriptive	4 SLTs rated 135 VFSS studies	Establish inter- and intra-rater reliability for dysphagia severity ratings using the DOSS	There was high inter-rater (90%) and intra-rater (93%) reliability using this scale	III
Ott, D.J., Hodge, R.G., Pikna, L.A., Chen, M.Y.M., & Gelfand, D.W. (1996) Modified barium swallow: clinical & radiographic correlation & relation to feeding recommendations. <i>Dysphagia</i> , 11 (3): 187-190.	Comparative study	148 patients	Clinical and VFSS correlated to determine agreement and relationship to feeding recommendations	Combined clinical and radiographic examinations correlated well, but clinical evaluation alone was limited by failure to evaluate the pharynx in many patients. The swallowing severity correlated well with final feeding recommendations.	III
Ott, D.J., & Pikna, L.A. (1993) Clinical & Videofluoroscopic Examination of Swallowing Disorders- Review Article. <i>American Journal Roentgenology</i> 161, 507-513.	Review	-	Summary of literature of Dysphagia Practice	Good information on barium materials.	IV
Palmer, J., Kuhlemeier, K., & Tippett, D. (1993) A protocol for the VFS study. <i>Dysphagia</i> , 8: 209-214.	Case Series	More than 350 (neurological) patients over 30-month period.	Testing was standardised by development of a sequence of liquid and solid foods	Table for the procedure provided. Takes 4-10mins.	III
Park, T., Kim, Y., Ko, D., & McCullough, G. (2009) Initiation & Duration of Laryngeal Closure during the pharyngeal swallow in post-stroke patients. <i>Dysphagia</i> , 25 (3): 177-182.	Case Series	10 stroke patients who aspirate 10 stroke patient who do not aspirate 10 normal controls	To measure initiation of laryngeal closure (ILC) and laryngeal closure duration (LCD) through objective temporal measurements from VFSS recordings	Both delayed ILC and reduced LCD were associated with post-stroke aspiration. Delayed ILC is a significant indicator of overall risk of aspiration.	IIB
Peladeau-Pigeon M, Steele C. Understanding image resolution and quality in videofluoroscopy. <i>Perspectives on Swallowing and Swallowing Disorders (Dysphagia)</i> . 2015;24:115-124.	Expert opinion	-	Current best practice recommendations for videofluoroscopic swallowing studies (VFSS)	Image capture Frame rates Technical settings	IV

Perlmann, A.L., VanDaele, D.J., & Otterbacher, M.S. (1995) Quantitative Assessment of Hyoid Bone Displacement from Video Images during swallowing. <i>Journal of Speech and Hearing Research</i> , 38: 579-585.	Case Series	20 males 10 normal 10 reduced hyoid movement	To validate a quantitative method for clinically assessing hyoid bone movement during VFSS	Significant different anterior and superior movement measurement between normal and impaired group. Simple to perform. Could be used for other structural measurements.	Iib
Pikus, L., Levine, M.S., Yang, Y-X., Rubesin, S.E., Katzka, D.A., Laufer, I., & Geftter, W.B. (2003) Videofluoroscopic Studies of Swallowing Dysfunction and the Relative Risk of Pneumonia. <i>American Journal of Roentgenology</i> , 180; 1613-1616.	Case Series-retrospective study of notes	381 patients	Compare results of penetration/aspiration on VFSS with pneumonia rates over 6 months	Severity of penetration/aspiration directly proportional to rates of pneumonia.	III
Power, M., Laasch, H., & Kasthuri, R. (2006) Videofluoroscopic assessment of dysphagia: A questionnaire survey of protocols, roles and responsibilities of radiology and speech and language therapy personnel. <i>Radiography</i> , 12: 26-30.	Qualitative survey	73 SLTs 40 Radiologists	Identify: <ul style="list-style-type: none"> • Ax protocols • Food materials • Use of therapeutic interventions • Data analysis • Reporting • Training • Radiation protection 	VFSS is carried out infrequently and protocols vary widely. Intra and inter-disciplinary training and supervision are minimal. More work is needed to develop standard guidelines to improve quality of exam and its reproducibility.	IV
Pracy, J.P.M., Montgomery, P.Q., & Reading, N. (1993) Acute pneumonitis caused by low density barium sulphate aspiration. <i>Journal of Laryngology and Otology</i> , 107: 347-348.	Case Study	Case of chemical pneumonitis following the aspiration of low density (100%) barium sulphate suspension	To illustrate the risks/problems associated with the aspiration of a relatively non-irritant contrast medium	Previous studies have been based on low density barium suspensions (50%) and therefore thought to be harmless, whereas higher density solutions (250%) appeared to provoke a more intense pneumonitis. This study concludes that even lower density solutions (100%) may also cause significant morbidities. Precautions should be taken to avoid aspiration whatever the density and patients at known risk may benefit from the use of a water soluble non-ionic contrast medium.	III
Rasley, A., Logeman, J., Kahrilas, P., & Rademaker, A.W. (1993) Prevention of barium aspiration during videofluoroscopic swallowing studies. <i>American Journal Roentgenology</i> , 160: 1005-1009.	Randomised Clinical Trial	165 patients - variable causes of dysphagia From neurological to anatomical (head and neck, Zenkers)	Investigate the frequency of whether changes in posture can eliminate aspiration in patients with oro-pharyngeal dysphagia.	Postural changes (techniques) eliminated aspiration for at least one bolus volume in 77% of subjects. 23 % with techniques had no effect on the frequency or amount of aspiration.	Ib
Riquelme, L.F. (2004). Cultural Competence in Dysphagia. <i>The ASHA Leader</i> . Retrieved from:	Qualitative	-	Need to define culture more broadly in order to provide best clinical services possible.	Recommended strategies provided.	IV

http://www.asha.org/Publications/leader/2004/040413/f040413b3.htm					
Riquelme, L.F. (2007). The role of cultural competence in providing services to persons with dysphagia. <i>Topics in Geriatric Rehabilitation, 23</i> (3): 228-239.	Qualitative	-	To investigate the role of cultural competence in dysphagia	Importance of cultural knowledge and sensitivity in working with food in different cultures.	IV
Rofes, L., Arreloa, V., Mukherjee, R., Clave, P. (2014) Sensitivity and specificity of the Eating Assessment Tool and the Volume-Viscosity Swallow Test for clinical evaluation of oropharyngeal dysphagia. <i>Neurogastroenterol Motil, 26</i> (9): 1256-65.	Comparative study	120 patients	To determine the accuracy of the Eating Assessment Tool (EAT-10) and the Volume-Viscosity Swallow Test (V-VST) for clinical evaluation of OD	Clinical methods for screening (EAT-10) and assessment (V-VST) of OD offer excellent psychometric properties that allow adequate management of OD	Iib
Rosenbek, J.C., Robbins, J., Roecker, E.V., Coyle, J.L., & Woods, J.L. (1996) A penetration-aspiration scale. <i>Dysphagia, 11</i> : 93-98.	Reliability study	75 swallows	Identify reliability of use of Rosenbek Pen-Asp Scale	Acceptable intra and inter-reliability found.	III
Royal College Speech Language Therapists (2013) VFSS in Adults: The role of SLTs. Policy Statement.	Practice Standards	-	Support safe, consistent practice	Clear scope of practice.	IV
Rugiu, M.G. (2007). Role of videofluoroscopy in evaluation of neurologic dysphagia. <i>Acta Otorhinolaryngologica Italica, 27</i> : 307-316.	Review	-	To analyse the technical procedure of VFSS and the principle indications in the study of neurologic dysphagia to reveal the advantages and disadvantages of the investigation.	It should always be preceded by careful and overall clinical evaluation of the patient.	IV
Scott, A., Perry, A., & Bench, J. (1998). A Study of interrater Reliability when Using Videofluoroscopy as an Assessment of Swallowing. <i>Dysphagia, 13</i> : 223-227.	Reliability Study	9 SLPs – 2 very experienced; 5 moderately and 2 minimal experience in the area of VFSS	To clarify the process of interpreting VFSS and to define the areas of inconsistency and potential misinterpretation.	Higher agreement for semi-solids than for liquids. Highest level of agreement occurred after group discussion.	III
Shaker, R., Easterling, C., Kern, M., Nitschke, T., Massey, B., Daniels, S., Grande, B., Kazandjian, M., & Dikeman, K. (2002) Rehabilitation of Swallowing by Exercise in Tube-Fed Patients With Pharyngeal Dysphagia Secondary to abnormal ues opening. <i>Gastroenterology, 122</i> : 1314-1321.	Randomised Clinical Trial	27 patients	Evaluated effect of head lift exercise on restoration of swallowing caused by abnormal UES opening	The proposed suprahyoid muscle strengthening exercise programme is effective in restoring oral feeding in some patients with deglutitive failure because of abnormal UES opening.	Ib
Shanahan, T.K., Logemann, J.A., Rademaker, A.W., Pauloski, B.R., & Kahrilas, P.J. (1993) Chin-down posture effect on aspiration in dysphagic patients. <i>Archives of Phys. Med. & Rehab, 74</i> (7): 736-739.	Clinical Trial without randomization	30 participants with dysphagia from neurological impairment	Determine effectiveness of chin-down posture in eliminating aspiration.	Chin-down posture is not effective in eliminating aspiration in all cases of neurological dysphagia.	Iia
Sinden, N., et al (2013) A multidepartment initiative to reduce cumulative radiation from pediatric Modified Barium Swallows: Methods and Outcomes. <i>Pediatric Radiology 2</i> . S386	Multidepartment quality improvement initiative	SLT, Radiology Pediatrics and Quality Improvement departments	Standardisation across departments of completing MBS to reduce radiation exposure	Achieved reduction in unnecessary radiation exposure by a team approach.	IV
Singh, V., Berry, S., Brockbank, M.J., Frost, R., Tyler, S.E., & Owens, D. (2009) Investigation of aspiration: milk nasendoscopy versus videofluoroscopy. <i>Eur Arch Otorhinolaryngol., 266</i> : 543-545.	Case Series-retrospective notes review	100 sets of clinical notes reviewed	Aim to review the correlation between milk nasendoscopy and VFSS/MBS in the detection of aspiration among patients with clinically diagnosed neurological dysphagia.	Milk nasendoscopy was able to detect post swallow aspiration more than VFSS/MBS with no significant difference in pre-swallow phase while VFSS/MBS better at detecting aspiration during the swallow.	III

Smithard, D., O'Neill, P., Park, C., England, R., Renwick, D., Wyatt, R., Morris, J., & Martin, D.F. (1998). Can bedside assessment reliably exclude aspiration following acute stroke? <i>Age Ageing</i> , 27, 99-106.	Comparative study	94 patients	Blinded study comparing VFSS and bedside clinical swallowing evaluation	Bedside clinical swallowing evaluation lacks sensitivity a screening tool for detecting aspiration in acute stroke	III
Splaingard, M., Hutchins, B., Sulton, L., & Chaudhuri, G. (1988). Aspiration in rehabilitation patients: videofluoroscopy vs bedside clinical assessment. <i>Archives of Physical Medicine and Rehabilitation</i> , 68(8), 637-640.	Comparative study	107 inpatients	Blinded study comparing VFSS & bedside clinical swallowing evaluation	Bedside clinical swallowing evaluation under-estimates aspiration.	III
Speech Pathology Australia (2005) Dysphagia: Modified Barium Swallow, Position Paper.	Practice Standards	-	Support safe, consistent practice	Clear scope of practice. Very detailed protocol.	IV
Steele, C.M. (2006) Primum Non Nocere- The Potential for Harm in Dysphagia Intervention. <i>ASHA Swallowing and Swallowing Disorders</i> , 19-23.	Expert Opinion	-	-	There is potential for swallowing interventions to result in unintended negative outcomes. Instrumental evaluation is important in determining appropriateness and safety of intervention.	IV
Steele & Grace-Martin (2014) Reflections on Clinical and Statistical Use of the Penetration-Aspiration Scale. <i>Dysphagia</i> , 32 (5): 601-616.	Expert Opinion	-	review the properties of the Penetration Aspiration scale	Discussion of common errors made in the statistical analysis of the PAS	IV
Stoeckli, S.J., Huisman, T.A.G.M., Burkhardt, A., Seifert, G.M., & Martin-Harris, B.J.W. (2003) Interrater Reliability of Videofluoroscopic Swallow Evaluation. <i>Dysphagia</i> , 18 (1): 53-57.	Reliability study	9 independent raters of the VFSSs of 51 consecutive dysphagic patients	To assess the inter-observer reliability of videofluoroscopy for swallow evaluation.	Only aspiration is evaluated with high reliability by videofluoroscopy, whereas the reliability of all other parameters of oropharyngeal swallow is poor	III
Strauss, K.J., & Kaste, S.C. (2006) The ALARA (as low as reasonably achievable) concept in pediatric interventional and fluoroscopic imaging: striving to keep radiation doses as low as possible during fluoroscopy of pediatric patients—a white paper executive summary. <i>Pediatric Radiology</i> , 36 (Suppl 2): 110-112.	Practice Standards	Paediatric patients-	Support safe, consistent practice	Recommendations to keep radiation doses as low as possible in paediatrics.	IV
Stroudley, J., & Walsh, M. (1991) Radiological assessment of dysphagia in Parkinson's disease. <i>The British Journal of Radiology</i> , 64; 890-893.	Case Series	24 patients	Evaluate swallowing abnormalities in Parkinson's Disease	Abnormalities detailed and common. VFSS is an appropriate method of investigation.	IIb
Teasell, R.W., McRae, M., Heitzner, J., Bhardwaj, A., & Finestone, H. (1999) Frequency of Videofluoroscopic Modified Barium Swallow Studies and Pneumonia in Stroke Rehabilitation Patients: A comparative Study. <i>Arch PhysMed Rehabil.</i> , 80; 294-298.	Comparative Study	1024 participants?	Is increased use of MBS associated with reduced aspiration?	Increased use of MBS after initial 15 days post stroke was not associated with decreased aspiration pneumonia with stroke patients.	III
Thomson, B., et al. (2018) Standardization of Radiologic Procedures for Pediatric Videofluoroscopic Swallow Studies: A Service based Quality Improvement Initiative. <i>Pediatric Quality and Safety</i> 3(6): e123	Experimental study	Quality improvement project in paediatric VFSS	Standardization of pediatric VFSS.	Using a systematic quality improvement protocol targeting simple, inexpensive interventions can improve radiologist performance with 3 identified standards with no increase in radiation exposure.	III
Tippett, D.C. (2000) Tracheostomy & Ventilator Dependency. <i>Thieme</i> .	Textbook	-	-	VFSS are feasible for medically	IV

				stable tracheostomised patients. MDT- outline responsibilities e.g. suctioning	
Triadafilopoulos G, Hallstone A, Nelson-Abbott H, Bedinger K. Oropharyngeal and esophageal interrelationships in patients with nonobstructive dysphagia. <i>Digestive diseases and sciences</i> . 1992;37(4):551-557.		12 patients with oropharyngeal dysphagia 29 patients with esophageal motor dysfunction	To examine the esophageal phase of swallowing in patients	Esophageal motility and videofluoroscopy of both the oropharyngeal and esophageal phases of swallowing may improve diagnosis and therapy in patients with nonobstructive dysphagia.	III
Wang, T.G., Wu, M.C., Chang, Y.C., Hsiao, T.Y., & Lien, I.N. (2006) The effect of nasogastric tubes on the swallow function of persons with dysphagia following stroke. <i>Arch Phys Med Rehabil.</i> , 87; 1270-1273.	Case Series	22 participants?	To investigate the effects of wide bore and fine bore NGTs on the swallow of person following stroke	Presence of large bore tubes increased bolus flow timing, but this was not significant	III
Ward, E., & Morgan, A. (2009) Dysphagia post trauma. Clinical Dysphagia Series. <i>Plural Publishing</i> .	Textbook	-	-	Must be guided by physician re: stability. View is different with bracing Radiologist presence Use patient's usual meal position Own seating where possible	IV
Warren-Forward, B., Mathisen, S., Best, P., Boxsell, J., Finlay, A., Heaseman, D., Hodis, C., Morgan, A., & Nixon, J. (2008) Knowledge and Practice of Radiation Protection While Performing Videofluoroscopic Swallowing Studies. <i>Dysphagia</i> , 23:371-377.	Qualitative Study	Questionnaire responses from 69 SLPs in Australia	To assess the level of current knowledge and practice of radiation protection among SLPs performing VFSS in Australia	Participants had some general knowledge of radiation protection but no formal teaching. They were uncertain of the specifics of radiation protection (e.g.: sensitive organs, minimum distance). Protective apron, shields and radiation badges worn to differing degrees. Recommendation that education on radiation protection and safety be provided at a university level. For practising SLPs there should be formal education and an increased emphasis on the application of radiation protection. SLPs should also always wear lead aprons, thyroid shields and radiation monitoring badges.	III
Weir, K.A., McMahon, S.M., Long, G., & Bunch, J.A. (2007) Radiation doses to children during modified barium swallow studies. <i>Pediatric Radiology</i> , 37: 283-290.	Case series	90 paediatric participants	Documenting radiation doses in VFSSs	Screening times, DAP, effective dose and child and procedural factors associated with higher effective doses are presented for children undergoing MBS studies.	III

Wilcox, F., Liss, J.M., & Siegel, G.M. (1996) Interjudge Agreement in Videofluoroscopic Studies of Swallowing <i>Journal of Speech & Hearing Research, 39</i> :144-152.	Reliability study	10 SLTs	To examine agreement among SLTs	The level of inter-judge agreement for videofluoroscopic evaluations is not encouragingly high.	III
Wright, R.E.R., Boyd, C.S., & Workman, A. (1998) Radiation Doses to Patients during Pharyngeal Videofluoroscopy. <i>Dysphagia, 13</i> : 113-115.	Case Series	23 adult patients aged 28-95 years (mean 65) weight 50-90kg (mean 64)	Measurement of Dose Area Product (DAP) values and fluoroscopic time for VFSS exams. To establish effective dose to patient during VTF (VFSS) and compare radiation exposure with other common radiological procedures	There is a linear relationship between DAP and screening time. The effective dose was 0.4 mSieverts (mSv) (range 0.027-1.1). This compares favourably with other common radiological procedures and the authors conclude the radiation detriment associated with VFSS is well within acceptable levels	IIB
Wu, C.H., Tzu-Yu, H., Jiann-Chyuan, C., Yeun-Chung, C., & Shiann-Yann, L. (1997) Evaluation of Swallowing Safety with Fiberoptic Endoscope: Comparison with Videofluoroscopic Technique. <i>Laryngoscope, 107</i> : 396-401.	Comparative study	28 subjects	Comparison of benefits of each type of study. Identified strengths and weaknesses of each type of assessment.	FEES more sensitive in detecting pharyngeal stasis and laryngeal aspiration. VFSS/MBS better at detecting premature spillage.	III
Yin T, Jardine M, Miles A, Allen J. What is a normal pharynx? A videofluoroscopic study of anatomy in older adults. <i>European Archives of Oto-Rhino-Laryngology. 2018</i> ;275(9):2317-2323.	Cohort study	138 mixed gender adults with no history of dysphagia	To help our understanding of the normal anatomic changes in swallowing that occur with age	A significant number of healthy adults with no swallowing complaints have variant pharyngeal anatomic findings such as cervical vertebral osteophytes and cricopharyngeal bars	IIB
Zammit-Maempel, I., Chapple, C.L., & Leslie, P. (2007) Radiation Dose in Videofluoroscopic Swallow Studies. <i>Dysphagia, 22</i> :13-15.	Case Series	230 adult patients over 45 months (69 F, 161 M) Median 67 years (17-95), 170 cm (147-196), 67 kg (38-102) Head and Neck cancer, TBI, CVA, neurological impairment and unknown aetiology	Measurement of radiation dose in VFSS to show VFSS can be performed using minimal radiation doses. Comparison of dose of Barium Swallow of 41 patients assessed in same conditions evaluated Comparison to previous studies Operator with 15 years experience	Median Dose Area Product (DAP) 1.4 Gy.cm ² (0.5-10), Median effective dose 0.2 mSv (0.01-1.4) Length of study 171 sec (18-564) Barium swallow time 144 sec (18-510), DAP 2.5 Gy.cm ² (0.4-24.1) In the UK exposure to background radiation is estimated at 1.5-7.5 mSv per year, therefore a VFSS of 0.2 mSv is extremely small comparatively. Associated risk of radiation induced fatal cancer is 1 in 100 000 for an average VFSS, 5%/Sv 18-64 years, less for > 69 years, however double risk for paediatric population Results comparison show VFSS less risk than barium swallow and previous studies	IIB
Zarzour, Jessica G., Loretta M. Johnson, and Cheri L. Canon. 2018.	Review article	-	-	Although a relatively low radiation	IV

“Videofluoroscopic Swallowing Study Examination: An Overview of Fluoroscopic Imaging and a Perspective on Radiation Exposure.” <i>Perspectives of the ASHA Special Interest Groups</i> 3 (13): 5–12.				exposure study, the radiologist and speech-language pathologist can employ measures to further reduce the dose to the patient and to themselves.	
Zerilli, K.S., Stefans, V.A., & Dipietro, M.A. (1989) Protocol for the use of videofluoroscopy in pediatric swallowing dysfunction. <i>The American Journal of Occupational Therapy</i> , 44 (5): 441-446.	Retrospective case series	Retrospective review of 33 bedside and VFSS assessment in children.	To review management changes following VFSS	VFSS provides therapists with more objective evidence than a bedside swallow assessment for directing management and treatment	III

Additional references:

Ali, W. (2009). Brief Report: What assessment tools are used both in New Zealand and in other countries for grading of evidence? Health Services Assessment Collaboration. Retrieved from: <http://www.healthsac.net/downloads/publications/HSAC26%20Grading%20Evidence%20030909%20FINAL.pdf>

New Zealand Guideline Group (2010). Handbook for the preparation of explicit Evidence-based Clinical Practice Guidelines. Retrieved from: www.nzgg.org.nz

Royal College Speech and Language Therapists (2005). Clinical Guidelines.

Statistics New Zealand (Tatauranga Aotearoa). Retrieved from: www.stats.govt.nz/census/2006CensushomePage

The Royal Australian and New Zealand College of Radiologists (2017) Diagnostic Radiology and Pregnancy, Version 2.0. Position Statement.

Royal College of Speech and Language Therapists. Videofluoroscopic evaluation of oropharyngeal swallowing function (VFS): The role of speech and language therapists. RCSLT Position Paper 2013. London: RCSLT, 2013.

NZSTA Paediatric Dysphagia Guideline 2019