The effect of nasal introduction of anaesthetic in adults undergoing Fibreoptic Endoscopic Evaluation of Swallowing (FEES): A systematic review protocol

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Review question/objective

The primary objective of this systematic review is to identify and synthesise the best available evidence on the effect of anaesthetic on the physiological aspects of swallowing (rate, strength, and risk of laryngeal penetration or aspiration) as well as client pain and/or discomfort in adults undergoing Fibreoptic Endoscopic Evaluation of Swallowing (FEES). This procedure is also described as Fibreoptic Endoscopic Evaluation of Swallowing with Sensory testing (FEESS or FEESST) and Videoendoscopic Evaluation of Dysphagia (VEED).

Background

Dysphagia is the medical term for swallowing disorder. Aetiologies include medical (respiratory illness, medications, general deterioration), neurological or neuromuscular (cerebrovascular accident [CVA], dementia, progressive disease such as Motor Neurone Disease, Multiple Sclerosis, Parkinson's Disease), congenital (cerebral palsy, cleft palate, intellectual disability), traumatic (brain injury, structural change, damage or cancer surgery, radiation therapy), psychiatric, psychological, functional (no known aetiology) and oesophageal structural deformities. ¹ Oropharyngeal dysphagia may be described as a 'sensation that solids or liquids are not being swallowed correctly'. ¹[p.339] Patients may
also have symptoms such as coughing, choking, or a feeling of material still in their throat. Impaired swallowing is a problem because it may lead to significant medical conditions such as aspiration pneumonia, malnutrition, dehydration, and weight loss.  

The FEES is a procedure which allows visualisation of the anatomical structures involved in swallowing. This technique allows assessment of swallow competency, diagnosis of pharyngeal dysphagia, and laryngeal penetration of food or fluids. 3-5 FEES gives a 'real time' evaluation, and allows for trialling techniques and modifications of food and fluids to determine therapy strategies for safe swallowing that work for that particular client. It does not expose the client to ionising radiation associated with Modified Barium Swallow (MBS) and provides immediate information about the efficiency of the protective cough reflex. 1,4-6

The FEES procedure is typically undertaken by speech pathologists and otolaryngologists (Ear Nose and Throat specialists) to evaluate and diagnose swallowing disorders/competence. It involves the transnasal introduction of a flexible nasendoscope through the nose and into the hypopharynx. Food or fluid is then introduced orally and the pharyngeal phase of swallowing process observed. 6 The FEES procedure is an assessment tool designed to aid patients with swallowing difficulties. Figure 1 (adapted from 7) presents a schematic diagram of the flexible nasendoscope placement during the FEES procedure.

During FEES swallowing function is evaluated using anatomical and functional criteria. Food and/or fluid are introduced and there is an evaluation of any premature spillage of the bolus into the pharynx or larynx, whether there is a risk of penetration or aspiration of the bolus before the swallow is triggered. Once the swallow has been completed, evidence of residue within the hypopharynx, or around it, suggests laryngeal or pharyngeal weakness. Evidence of bolus in the trachea is an indication of aspiration. Multiple swallows for each bolus may indicate weakness of the tongue base or posterior pharyngeal wall. 1,8-9 FEES allows a physical examination of structural movements during a swallow of different foods and liquids. Interventions, which commonly include dietary and/or behavioural modifications, are prescribed to lessen swallowing difficulty if swallow impairment is diagnosed. 9

A 'competent' swallow is commonly defined as timely (less than three seconds after oral preparation of the bolus), complete such that the whole bolus is swallowed without pharyngeal residue, and propulsion to the oesophagus occurs, with no penetration or aspiration into the larynx. A 'competent' swallow is not effortful and does not generally require double or multiple swallows. 8 An accurate result of the swallow evaluation is critical as it facilitates appropriate patient referral and treatment, outcomes that can significantly affect quality of life 9 and health 3.

For many years dysphagia assessment and management was conducted using clinical (bedside) assessment, or videofluoroscopic studies (MBS). 10 Bedside assessment involves a trial of food and fluids, and an oro-motor examination. The result of a bedside assessment is reliant on the clinician's ability to detect, and evaluate oral and pharyngeal dysphagia and gain knowledge of oesophageal symptoms based on the patient's medical history. When the FEES swallow evaluation procedure is used, there is a visual assessment of what is actually happening which is not possible in the bedside assessment. Calculated evaluations can be made using results from the bedside approach, but a clear diagnosis is often difficult, 11 and even the most experienced clinicians can fail during a bedside examination to identify approximately 40% of aspirating patients. 11 Clinical evaluation has its place,
however it is problematic in that silent aspiration (i.e. no overt evidence such as coughing or choking when food or fluids enter below the vocal cords) is not detected.4

Scott et al12 have pointed out that swallowing is a complex activity involving several rapid, integrated movements, few of which could be observed directly which makes evaluating it complex. In addition, a cough can be an unreliable indicator of aspiration.13 Whilst reasonable conclusions can be made with clinical evaluation, there is the danger of inaccurate diagnosis and inappropriate recommendations leading to negative impacts on patient health outcomes and quality of life.3

Videofluoroscopic studies, such as the MBS, have been used for diagnosis and evaluation of dysphagia since the 1980’s.6 This procedure evaluates the oral phase, pharyngeal phase and the oesophageal transit. Small amounts of food and liquid (with barium paste) are introduced and followed radiographically from mouth to the lower oesophageal sphincter. This procedure is carried out in a radiology suite, with a radiologist and radiology technician present, and generally a speech pathologist. It requires the patient to be able to sit upright. At times this precludes very ill patients and those who find the physical demands of the procedure too difficult.8

The FEES procedure was formalised by Susan E Langmore in the late 1980’s. Its introduction was a "collaborative effort"8 (p.1386) between the specialties of speech pathology and otolaryngology. Prior to this development, otolaryngologists had largely screened patients and diagnosed swallowing disorders8. Langmore identified the clinical usefulness of FEES for analysis of function as compared with medical pathology which would only allow assessment of anatomical not functional pathologies.

The advantages of FEES over MBS include its portability and easy access for physically disadvantaged patients, the lack of need for a radiology suite (and radiologist), its relative cost-effectiveness, no radiation exposure (and therefore any amount of time can be used to determine a diagnosis), the ability to directly visualise and record the pharynx and larynx, and its sensitivity in detection of and severity rating of aspiration.3,5,6,14

FEES is the evaluation of choice where a patient is compromised by radiation necessary for the MBS, and especially where repetitive examinations are required, for example for biofeedback.

During FEES the food and fluid is dyed with colour to enhance visibility. At times, the end of the scope can become covered with oropharyngeal secretions or food or fluid, although this can be easily cleared by an experienced endoscopist using techniques to slightly change the position of the scope to clear the residue. In addition, during swallowing the endoscope will be momentarily pushed against the posterior pharyngeal wall, causing ‘white-out’ (this occurs for about half a second).11 Some clinicians may consider this a disadvantage of FEES, as visual recording, or observation, is briefly lost.

The risk of complications with FEES is regarded as low, but may include: a reaction to the anaesthetic, laryngospasm, epistaxis (nosebleeds), fainting, laryngospasm.9 Hence, the availability of medical response if required is necessary when performing a FEES.

Swallowing function includes three main phases, namely the oral, pharyngeal and oesophageal phase. Dysphagia may occur in any one of these phases1 and in individuals of any age.14 FEES effectively evaluates the pharyngeal phase and any laryngeal penetration and aspiration (liquid or food going into the ‘wind pipe’).1,6,8,11 However, it is unable to evaluate either the oral or oesophageal swallow phases as the scope is passed through the nasopharynx (nose and back of the throat). FEES is effective at
identifying silent aspiration\textsuperscript{3}, which may be defined as entry of the bolus below the level of the true vocal folds without any external behavioural signs such as coughing or choking.\textsuperscript{4}

Speech pathologists have specific training to make recommendations about a safe diet and fluid consistency for a dysphagic client to swallow. Based on the outcomes of the FEES procedure, they can be more certain of the efficacy of their recommendations. The recommended foods and fluids may need to be modified in consistency depending on the evaluation of dysphagia, thereby affecting quality of life of the client. FEES is important in that it facilitates a more precise determination of the food and fluids safe for swallowing as the procedure allows visualisation of the client swallowing those actual consistencies.\textsuperscript{3,15,16} This is why it is important to understand whether the use of anaesthetic during FEES affects the accuracy of the swallow function diagnosis.

![Figure 1](image_url)

**Figure 1** Illustration of laryngoscope placement during the FEES procedure, adapted from\textsuperscript{7}

During FEES the thin flexible nasendoscope is introduced into the client’s nose and then passed through to the back of the throat (Figure 1). For accurate placement and prevention of tissue damage, the client is advised to stay still. Anaesthetic is commonly introduced as a means to reduce client anxiety, pain and discomfort and minimise client movement during the procedure. The most common form of anaesthetic introduction is via the application of a topical or spray anaesthetic into the nostril prior to the introduction of the nasendoscope.\textsuperscript{1,10,15,17}

The use of anaesthetic during the FEES procedure is a topic of debate both in the literature and practice relating to diagnosing and treating swallow function.\textsuperscript{2,18,19} In practice, otolaryngologists frequently use anaesthetic to evaluate structure whereas speech pathologists are not authorised to use anaesthetic.
and therefore require the presence of an Ear, Nose and Throat Specialist or other medically trained professional when it is being used. The tendency for FEES to be conducted with anaesthetic, and restrictions relating to which health professionals can administer anaesthetic during FEES limits access to FEES in facilities where there is unavailability of medical practitioners authorised to administer anaesthetic. As is explained in more detail below, the debate on the use of and need for anaesthetic when conducting FEES focuses on whether application of anaesthetic influences swallowing function and the accuracy of the diagnosis of dysphagia as well as anaesthetic’s effectiveness for reducing client pain/discomfort and anxiety.

The amount of anaesthetic, timing of anaesthetic, use of vasoconstrictor in addition to the anaesthetic and the method of application, have all been shown to vary across research studies and in clinical practice. Types and amounts of anaesthetic as described in the literature include Lidocaine 5, 20 20mg Cophenylcaine, 21 Cocaine, 22 2% Tetracaine. 1, 17 Application methods also vary and include being applied nasally, orally, or with a cotton bud 23 or orviaaerosol puff. 18 In addition, a vasoconstricting drug may also be applied in order to constrict the nasal mucosa and create a wider space to introduce the scope. 23

The sensation required for efficient swallowing is controlled by three cranial nerves innervating muscles of the mouth and pharynx. These nerves are the trigeminal, glossopharyngeal and vagus nerves. 2 The superior laryngeal branch of the vagus nerve is regarded as the most important trigger for swallowing. Anaesthesia of areas innervated by these nerves can affect, but not completely diminish, the ability to swallow. This suggests that a person may have a less efficient swallow due to anaesthesia. 2, 7, 18, 19, 24. Aspiration with anaesthesia is described in the literature 18, suggesting increased risk during a FEES procedure if using anaesthetic. 2, 4, 7, 18, 19, 25 Therefore the clinician is potentially disadvantaged in their decision making.

Another advantage of using anaesthetic during the FEES procedure, aside from its potential to reduce patient pain and discomfort raised in the debate over use of anaesthetic and FEES, is its potential to allow a more thorough assessment by the endoscopist because it is less distressing for the patient. However, some practitioners are of the view that the scope manoeuvres easily without anaesthetic.

A disadvantage of using anaesthetic during FEES, raised both in discussions amongst those using the FEES procedure in practice in South Australia as well as in the literature 2, 20, is that it may cause a patient to experience a bitter taste. The client also has a ‘numb’ sensation for some time after application of the anaesthetic and is unable to drink or eat, because of the risk of aspiration, for around a half hour after the procedure.

In the context of this debate over the use of anaesthetic when undertaking FEES it is important to conduct the systematic review proposed to enhance understanding about whether: (i) anaesthetic has a significant effect on the pain/comfort and anxiety experienced by the patient during the procedure; and/or (ii) it effects swallow function and swallow function diagnosis and thereby leads to an inappropriate management plan being recommended. No systematic review has been undertaken to date on the effects of anaesthetic during the FEES procedure. A preliminary search of the JBI Library of Systematic Reviews, Cochrane Library, PubMed and CINAHL found no systematic review protocols or reports on this topic.
It is anticipated that the findings of this review will be used to enhance endoscopists’ decision making on the use of an anaesthetic agent when conducting FEES.

Keywords

topical anaesthesia; nasendoscopy; flexible endoscopy; lignocaine; nasal cavity; anaesthesia local; cocaine; saline solution; nasal septum; aspiration; fibreoptic endoscope; deglutition; dysphagia; pharynx; fibreoptic evaluation of swallowing; FEES; fibreoptic endoscopic evaluation of swallowing studies (FEEST); videoendoscopic evaluation of dysphagia (VEED); videoendoscopic swallowing study (VESS); mucosal anaesthesia; oropharynx; pharyngeal dysphagia; sensation; swallowing; discomfort; anxiety

Inclusion criteria

Types of participants

This review will consider adults (defined for the purposes of this review as being 16 years and over), regardless of gender or reason for undergoing the FEES procedure. Paediatric patients will not be considered for this review due to the challenges of conducting this procedure on this patient group including the size of the nasal passages and nasopharynx, and poor tolerance of the procedure. Participants must have no known co-morbidities that might affect the outcomes of interest (e.g. nasal surgery, deviated nasal septum, traumatic brain injury, reaction to anaesthetic, known allergies, hypertrophic turbinate, nasal scars, craniofacial disorders). Only studies involving patient clients/participants, not volunteers, will be included, as this best reflects the population seen in clinical practice.

Types of intervention(s)

The intervention of interest for this review is the topical application of an anaesthetic prior to conducting the FEES procedure. Studies comparing swallow function/competency during a FEES procedure, with and without anaesthetic, will be considered for inclusion in the review.

With respect to the kind of anaesthetic used, only studies that examined the effects of nasal introduction of anaesthetic (spray or direct application to the nasal mucosa), regardless of dosage, anaesthetic, type of anaesthetic, timing of introduction of the anaesthetic and who applies the anaesthetic, will be included, as this best reflects clinical practice. Comparators are anticipated to include placebo, lubricant or vasoconstrictor only.

Types of outcomes

The main outcomes of interest for this review are measures of physiological aspects of swallow function and measures of client pain and/or discomfort.
Measures of physiological aspects of swallow function

Studies where objective measures (such as videofluoroscopy) of swallow function/competency have been utilised will be preferentially sought. The review will however consider studies that have utilised subjective measures, such as validated swallow rating scales. These features of swallowing are regularly evaluated to determine dysphagia. Speech pathologists routinely evaluate normal and abnormal function in these parameters. Measurement will be the clinicians’ evaluations of evidence of dysphagia. Measurement might also include simultaneous videofluoroscopic evaluation, and inter-rater reliability evaluation.

Client pain and/or discomfort

Studies that report any measures of client discomfort and/or pain related to undergoing a FEES procedure either with or without an anaesthetic will be considered for inclusion in this review. Anticipated outcome measures include but are not limited to: self-reported pain/discomfort (such as via visual analogue scales), behavioural observation by clinician, pain/discomfort, patient anxiety measured by index scales, visual analogue score sheets, questionnaires.

Types of studies

This review will consider for inclusion any experimental and epidemiological study designs including randomised controlled trials, non-randomised controlled trials, quasi-experimental, pre-test and post-test studies and case control studies.

Whilst there are obvious cost implications of using anaesthetic versus not using anaesthetic when undertaking FEES, cost effectiveness studies are outside the scope of this review and will not be considered. Qualitative studies may provide valuable additional insights to those provided by quantitative studies on the question of how anaesthetic during FEES affects swallow function, the accuracy of diagnosis and patient comfort and pain. However, only quantitative studies comparing the effect of FEES with and without anaesthetic will be considered.

Search strategy

The search strategy aims to find both published and unpublished studies. This is particularly important as the issue of whether or not to use anaesthetic during a FEES procedure is currently a contentious one, suggesting that there may be many conference papers and other discussion papers on the topic that have not been published in the peer reviewed literature.

A three-step search strategy will be utilised in the review. An initial limited search of MEDLINE and CINAHL will be undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe articles. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference list of all identified reports and articles will be searched for additional studies. Studies published in English from January 1988 to October 2012 will be considered for inclusion in this review. This start of this date range has been specified because Susan Langmore formalised the FEES process in 1988.
The databases to be searched include:
PubMed, CINAHL, Embase, Cochrane (CENTRAL), Scopus

The search for unpublished studies will include:
Clinical trials registers, MedNar, ProQuest Dissertations and Theses.

Experts in this field of research will also be contacted for unpublished work.

Initial keywords to be used will be:
topical anaesthesia; nasendoscopy; flexible endoscopy; lignocaine; nasal cavity; anaesthesia local; cocaine; saline solution; nasal septum; aspiration; fibreoptic endoscope; deglutition; dysphagia; pharynx; fibreoptic evaluation of swallowing; FEES; fibreoptic endoscopic evaluation of swallowing studies (FEEST); videodenscopic evaluation of dysphagia (VEED); videodenscopic swallowing study (VESS); mucosal anaesthesia; oropharynx; pharyngeal dysphagia; sensation; swallowing; discomfort; anxiety

**Assessment of methodological quality**

Papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardised critical appraisal instruments from the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix I). Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

**Data collection**

Data will be extracted from papers included in the review using the standardised data extraction tool from JBI-MAStARI (Appendix II). The data extracted will include specific details about the FEES interventions, the type of scope used, the healthcare professional administering the procedure (otolaryngologist or speech pathologist), co-morbidities that could impact on the outcomes of the FEES (as described in the Background), types of anaesthetic and dosage and method of application and timing between application and procedure, study methods and outcomes of significance to the review question and specific objectives.

**Data synthesis**

Quantitative data will, where possible, be pooled in statistical meta-analysis using JBI-MAStARI. All results will be subject to double data entry. Effect sizes expressed as odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard Chi-square and also explored using subgroup analyses based on the different study designs included in the review. Where statistical pooling is not possible, the findings will be presented in narrative form including tables and figures to aid in data presentation where appropriate.
Conflicts of interest
The primary and secondary reviewers are practising speech pathologists who deal with dysphagia management as part of their professional role.

Acknowledgements
As this review forms partial submission for the award of a Masters of Clinical Sciences through the Joanna Briggs Institute, the University of Adelaide, a secondary reviewer (Stephanie Martin B.App.Sc (Speech Pathology)) will only be used for critical appraisal. Drs White, Streak and Tivey are acknowledged for their supervision.
References


Appendix I: Joanna Briggs critical appraisal instruments

MAStARI Appraisal instrument

### JBI Critical Appraisal Checklist for Randomised Control / Pseudo-randomised Trial

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**Overall appraisal:**
- Include ☐
- Exclude ☐
- Seek further info. ☐

**Comments (Including reason for exclusion):**

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**Note:**
- This is an example of a checklist for assessing the quality of a randomised controlled trial. The checklist includes questions to evaluate the randomisation process, blinding of participants and assessors, loss to follow-up, and other aspects of the trial design and conduct.
- The checklist is part of the MAStARI (Methodology Assessment for Systematic Reviews and Implementation Reports) framework developed by the Joanna Briggs Institute (JBI).
- Each question is scored with a box to select Yes, No, Unclear, or Not Applicable.
- The overall appraisal and comments section are included to provide an evaluation of the trial and any additional notes.
JBI Critical Appraisal Checklist for Comparable Cohort/Case Control

Reviewer ____________________________ Date ____________________________

Author ____________________________ Year _________ Record Number ________

1. Is sample representative of patients in the population as a whole?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

2. Are the patients at a similar point in the course of their condition/illness?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

3. Has bias been minimised in relation to selection of cases and of controls?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

4. Are confounding factors identified and strategies to deal with them stated?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

5. Are outcomes assessed using objective criteria?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

6. Was follow up carried out over a sufficient time period?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

7. Were the outcomes of people who withdrew described and included in the analysis?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

8. Were outcomes measured in a reliable way?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

9. Was appropriate statistical analysis used?  Yes ☐ No ☐ Unclear ☐ Not Applicable ☐

Overall appraisal:  Include ☐ Exclude ☐ Seek further info. ☐

Comments (Including reason for exclusion)
________________________________________________________________________
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JBI Critical Appraisal Checklist for Descriptive / Case Series

Reviewer ___________________________ Date ___________________________

Author ___________________________ Year __________ Record Number ________

1. Was study based on a random or pseudo-random sample? □ □ □ □
2. Were the criteria for inclusion in the sample clearly defined? □ □ □ □
3. Were confounding factors identified and strategies to deal with them stated? □ □ □ □
4. Were outcomes assessed using objective criteria? □ □ □ □
5. If comparisons are being made, was there sufficient descriptions of the groups? □ □ □ □
6. Was follow up carried out over a sufficient time period? □ □ □ □
7. Were the outcomes of people who withdrew described and included in the analysis? □ □ □ □
8. Were outcomes measured in a reliable way? □ □ □ □
9. Was appropriate statistical analysis used? □ □ □ □

Overall appraisal: Include □ Exclude □ Seek further info □

Comments (Including reason for exclusion)
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Appendix II: Joanna Briggs Institute data extraction instruments

**MAStARI data extraction instrument**

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**Study Method**

- RCT □
- Quasi-RCT □
- Longitudinal □
- Retrospective □
- Observational □
- Other □

**Participants**

- Setting

- Population

**Sample size**

- Group A ____________________
- Group B ____________________

**Interventions**

- Intervention A
  ____________________________________________________________
- Intervention B
  ____________________________________________________________

**Authors Conclusions:**

- ____________________________________________________________
- ____________________________________________________________
- ____________________________________________________________

**Reviewers Conclusions:**

- ____________________________________________________________
- ____________________________________________________________
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Study results

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