



Flexible Endoscopic Evaluation of Swallowing (FEES): Technique and Interpretation

6

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Introduction

The inspection and evaluation of the interior of body cavities improved by leaps and bounds with the advent of the rod lens and optical fibre systems. Over the last few decades, flexible endoscopy using the tensile strength, transparency and homogeneity of glass has further revolutionized this modality. It was in 1968 that Sawashima and colleagues reported the first laryngeal images captured with transnasal flexible scopes [1]. This has now become an almost routine investigation modality in most ENT centres. As such, most ENT surgeons are familiar with the basic technique of this procedure. However, this was almost always used merely for a closer look at the structure of the larynx and to diagnose any organic lesion or neuromuscular dysfunction. Flexible endoscopic evaluation of swallowing (FEES) has widened the horizons of the use of this instrument. As described by Susan Langmore, FEES has been conceived as a comprehensive evaluation of the swallowing process, inclusive of laryngeal anatomic integrity, motor and sensory

functions, ability to swallow and response to prescribed changes in posture and/or diet [2].

Technique

The technique of FEES can broadly be discussed under two sections—preparation for the procedure and details of the procedure itself. The latter, in turn, would consist of pre-swallowing and swallowing evaluation.

Preparation

Prerequisite

First and foremost, basic cognition level of the patient has to be ascertained. This is to ensure compliance of the patient to understand and follow commands about the act of swallowing. Otherwise, there can only be an evaluation of the anatomy and secretions management and not full FEES.

Venue

Once the decision to perform FEES is taken, the venue for the procedure is to be decided. Ideally, this would be the endoscopy suite in the setting of the dysphagia clinic or the ENT outpatient department. However, where indicated, it may have to be done bedside, this being one of the advantages of FEES over VFSS. In the author's setting, the lack of monitors in rooms and wards has precluded bedside FEES.

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Hardware

The sterilized flexible scope, monitor, suction apparatus and supportive paraphernalia such as lubricant jelly, gloves and decongestant nasal drops should be kept ready. All these would be applicable in every case. The food items to be tried could differ with each instance. In general, the attempt should be to include a liquid, a jelly and a solid item. In our practice, we have been using ice-cream as the default food item. Before the use of edible dyes, the material used was pista (almond) flavour, to obtain green colouring. Coloured juice and biscuits are also items used when felt necessary. With the availability of edible dyes, almost any type of food material can be utilized for FEES. Spoon and straw would also be needed in the FEES shelf.

Software

Video capture, along with an editing software, is ideal. The former is essential for a detailed assessment and biofeedback. The latter is needed for use in talks and presentations on the topic.

Personnel

Apart from the person doing FEES, at least two more persons, one, the nursing staff and another to give feeds to the patient on cue, are required.

Initial steps would include reassurance of the patient and a brief explanation of the planned procedure. This can be done by giving an analogy with the nasogastric tube, if already in situ (“We will be passing a tube similar to this, to help us look inside your throat...”).

Positioning: As far as possible, FEES should be done with the patient sitting comfortably—this resembles the normal physiological situation while swallowing. However, this may not always be possible. In the case of moribund patients, an option would be to lift up the head. Care should be taken to ensure that the head is well-supported. Many centres prefer the patient to be facing the monitor, allowing for real-time feedback. Alternately, there can also be the provision of a mirror on the opposite wall, for the same effect. In our setting, the monitor is positioned facing the personnel, which usually includes at least one attender or caretaker of the patient.

Decongestion of the nose is strongly recommended and always practised by this author. Few drops of oxymetazoline or xylometazoline are instilled in both nostrils at least 10 min prior to the introduction of the scope. Surface anaesthesia is a slightly grey area. The debate is between ensuring no gag versus risking suppression of normal pharyngeal responses during swallowing. We do not use any form of anaesthesia for the throat. We have also not found the need to instil lignocaine drops in the nose. Lignocaine jelly, adequately smeared over the distal third of the scope, is sufficient.

The indwelling nasogastric tube is almost always to be expected in this set of patients. This is usually never an impediment. Intuitively, the preference is to use the other nostril for FEES. However, we have often found it easier to pass the scope per NGT-containing nostril. This is explained by a septal deviation which would have prevented successful insertion of the NGT. The slight amount of manoeuvring needed to get a view around the NGT comes quickly enough with experience.

Procedure

Once all the above are in place, the procedure is initiated with the introduction of the flexible scope into the selected nostril (Video 6.1). The ‘first look’ would necessarily be at the anatomy of all the areas within the scope view. These would include the nasopharynx, oropharynx, hypopharynx, supraglottis and glottis. Any apparent structural abnormality is noted. The position and placement of the NGT may be noted. Occasionally, a twisted or doubled-over tube could be an impediment to the swallowing process (Fig. 6.1).

Concomitantly, two more aspects can be looked at—the status of secretions and the movement of vital structures. The former does not involve any instruction to the patient. Both consistency and location of the pooled secretions are significant, indicating the extent of dysphagia and likelihood of aspiration. Next, as in a routine laryngoscopy, the patient is asked to phonate and

make a dry swallow. Movements of the base of the tongue, soft palate, pharyngeal walls and vocal folds are noted.

The next step is to check the laryngeal sensation. The author prefers to gently touch the tip of the scope to the arytenoid and aryepiglottic fold. The patient is forewarned about a possible cough and/or gag. The alternative technique is FEESST (FEES with sensory testing), wherein the scope is fitted with an extra port that delivers a pulse of cold air onto the arytenoids.



Fig. 6.1 Double coiled nasogastric tube. This, in itself, was the cause of the patient's swallowing difficulty

Actual Swallow

This is the major part of the examination. As per set protocol, we use ice-cream as the standard test bolus. Usually, 2–3 boluses are given. The assistant (or patient's attendant) feeds a small bolus, and the patient is asked to hold it in the oral cavity until instructed to swallow. The scope is pulled back up into the nasopharynx to check for regurgitation and then moved down again, to look for the completion of the swallow. At the same time, it is advisable to ensure that the bolus has gone past the oropharynx. This has special relevance if the patient's cognition status is not adequate. The second bolus is now given, and its passage at the level of the hypopharynx is observed. Without too much suction clearance, the supraglottis and glottis should be carefully inspected for penetration and/or aspiration. The author usually proceeds to do a complete suction clearance of residue, followed by another bolus trial with the scope tip just above the vocal folds. The examiner should also take note of the number of swallows made to clear hypopharyngeal and post-cricoid residue.

Further bolus type and the therapeutic trial will depend entirely on the findings till now, and hence, tailored to the case. As a rule of thumb, if the patient has had difficulty in completing the oral stage with the ice-cream, then a trial of fluid bolus (coloured juice) is given. Conversely, if the ice-cream bolus passage appeared uneventful, a trial of solid bolus (dye-coated biscuit) is given. Some centres recommend outpatients getting their food and inpatients using the hospital menu for testing; the idea is to simulate normal eating habits. Next, boluses can be given with trials of therapeutic techniques, which would be dependent on the findings, as pointed out earlier. Broadly, these would be either compensatory or rehabilitative. Combining the latter, especially swallow manoeuvres, with biofeedback can be extremely beneficial.

The reader is invited to check the entire spectrum of steps in FEES, recommended by Susan Langmore et al. [2]. All of these may not always be done in every case. This author follows a case and need-based policy, in this regard.

Technical Issues

Fogging of the scope due to food residue can often be a problem. Here, the examiner has to be patient enough to avoid immediately switching on the suction. Withdrawing the scope away from the bolus contact area before suctioning or gently scraping the tip against an unstained mucosal surface often does the trick. Another demand on the examiner would be the time taken. Unlike a conventional flexible laryngoscopy which lasts for not more than 4–5 min, the FEES examiner has to be physically prepared for up to 15 min of standing in slightly awkward positions.

Interpretations

If one were to perform FEES in a normally swallowing person, the actual act would be barely visible. The rapid ascent and closure of the larynx and the instantaneous clearance of the bolus from the hypopharynx create what is called the ‘white-out’ effect. However, in the case of structural or functional pathology, relevant findings become observable as a result of slowing down or incoordination of the component acts of swallowing. Interpretation of these would then help in managing the swallowing problem. It should be borne in mind that interpretation is not only during the time of performance of FEES but necessarily also at a second (or even third) look at the recorded video. At the outset, it is also worth mentioning that a majority of interpretations in FEES tend to be related to neurological disorders.

Interpretation of FEES can be considered in three parts: first, the look at basic anatomy and function, without giving any edible bolus (the ‘pre-swallow’ part); next, the look at how an administered bolus is managed (the ‘swallow’ part); and lastly, the examination of effects of therapeutic measures.

Pre-swallow

Observation and interpretation should begin from the nasopharynx and soft palate movement itself. As the scope passes down into the hypopharynx, an undue collection of saliva/secretions is noted, including the location and thickness (Video 6.2, Fig. 6.2). Once the vocal folds are visualized, their mobility (adduction and abduction) is noted. It must be mentioned here that the finding of vocal fold palsy with the resultant phonatory gap is never to be interpreted as an automatic association with laryngeal aspiration unless directly noted as such after a bolus is given. Next, touching the scope gently to the epiglottis and arytenoid mucosa helps to interpret the laryngeal sensation (Video 6.3). Asking the patient to simulate a swallow helps in understanding the functional status. ‘White-out’ (normal), difficulty in initiating on command, laryngeal elevation and clearance of pooled secretion (if any)—all these can be assessed. An occasional interesting interpretation is the role of the NGT itself (Video 6.4).

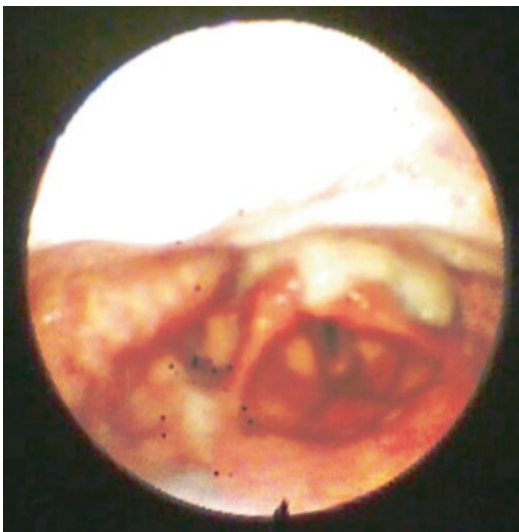


Fig. 6.2 Pooled thick secretions in the left pyriform fossa, extending into the post-cricoid area, in a case of post-stroke left vocal fold palsy

Swallow

The next set of interpretations begins after the food bolus is delivered into the oral cavity. The major types of altered swallowing function that may be noted now are delay in the oral phase, incoordination of the swallow, laryngeal penetration and/or aspiration, bolus residue and inability to clear it.

Oral phase is, by the very nature of the procedure, out of the purview of FEES. However, some cues can be interpreted by the experienced team. The accompanying staff can maintain a check on the clearance of bolus from the oral cavity even as the scope tip is at the oropharynx. Conceivably, one could also note the time it was taken (using a stopwatch) from delivery of the bolus into the mouth to its first appearance in the field of vision of FEES. The delay in clearance from the oral cavity can also be correctly interpreted by observing the multiple excursions of the soft palate with the scope tip in the nasopharynx, as the patient attempts a swallow (Video 6.5, Fig. 6.3).



Fig. 6.3 The soft palate is abutting against the Passavant's ridge, as the patient attempts to clear a bolus from the oral cavity

Incoordination of swallow can be interpreted as a continuation of the above-described sequence. Once the examiner is assured of the clearance of bolus from the oral cavity, the expectation is for it to be seen in the hypopharynx, trickling down into the valleculae, pyriform fossae and post-cricoid area. Abnormality can be noted in both the way and delay in which the above happens. The latter has been termed as ‘pharyngeal delay’—a measure of how long the bolus remains in the pharynx before the rest of the swallow occurs. The examiner should bear in mind that some amount of hold-up and delay in the valleculae are to be expected. But, as a part of the normal process, there would be symmetry and coordination in the bolus movement. Incoordination can occur in the form of prolonged stasis and/or unilateral residue, especially after the next oral swallow has pushed another bolus down (Video 6.6, Fig. 6.4).

This leads on to the next possible finding, whence the incoordination worsens to a stage where the uncleared residue may start to drip on and into the larynx. Here, we come to the cardinal application of FEES—the detection of laryngeal penetration and aspiration. The primary utility of FEES lies in reliably demonstrating this important pathology in the swallowing process. Laryngeal penetration is defined as passage of material beyond the level of aryepiglottic folds, up to false cords level, but not through the vocal

folds, and aspiration as the passage of material through the vocal folds [3].

It is reiterated here that vocal fold mobility issue leading to a phonatory gap is not synonymous with aspiration (Video 6.7). Conversely, pure sensory loss of the supraglottis and poor cough reflex can lead to aspiration even in the presence of mobile vocal folds. Hence, it is imperative that the examiner ensures at least two to three boluses, preferably liquid and suitable solid, are administered before interpreting this

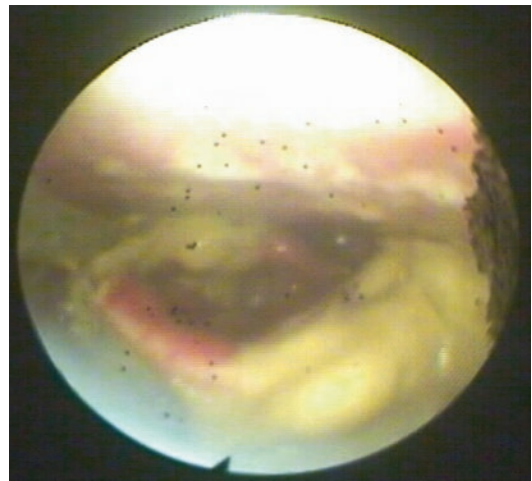


Fig. 6.4 Significant stasis and residue of the semisolid bolus, despite multiple swallows, in the valleculae and right pyriform fossa. This is an example of the delayed pharyngeal trigger

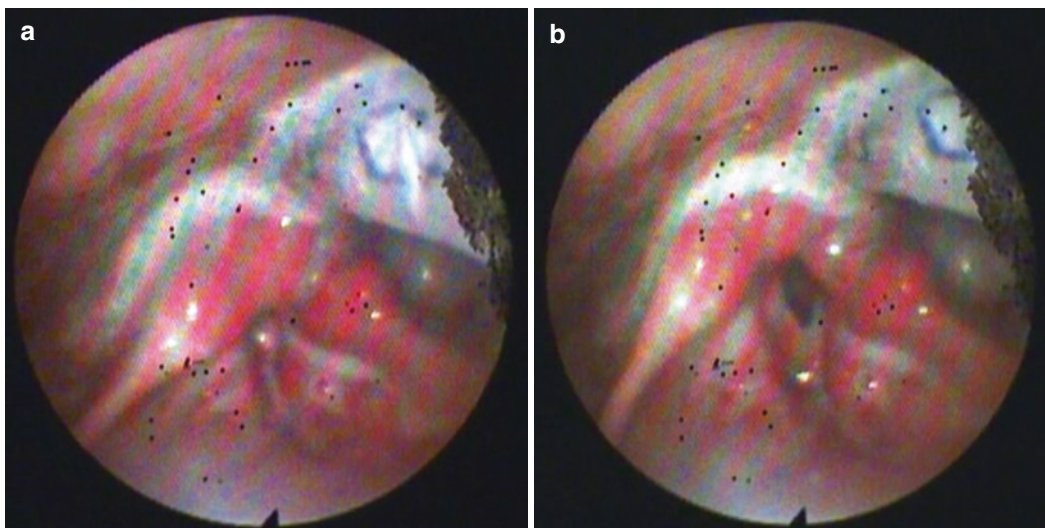


Fig. 6.5 Spillage of ice-cream bolus onto the false vocal folds, but not reaching the true folds (a. open, b. closed). Post-cricoid residue can also be seen

abnormal finding. It also has to be stressed that laryngeal penetration/aspiration may not be seen immediately at the swallow itself, due to the ‘white-out’ effect. Few seconds of patient waiting are in order, without applying suction. Then the bolus stains are carefully looked for. If found below the aryepiglottic folds and up to the false cords’ level, it indicates penetration (Video 6.8, Fig. 6.5a, b). Aspiration to a varying extent may be noted (Videos 6.9 and 6.10, Fig. 6.6). The examining team should also note the presence or absence of cough reflex. If there is no cough, the patient may be instructed to do so, to note the ability to clear the aspirated material. Also, secondary aspiration should be considered and

patiently looked for. This happens whenever there is a prolonged delay in clearance of bolus, which then inadvertently slips into a normally functioning larynx (Video 6.11).

The bolus residue and inability to clear it can be of varied aetiology—structural or functional. While some of the causes may not be noted at FEES (e.g. oral tumours or resection, neuromuscular weakness), most can be visualized and correctly interpreted. One of the causes is the inability to clear the ‘final exit point’, viz. the cricopharynx (UES). This is demonstrated at FEES (Video 6.12, Fig. 6.7a, b). This is most likely due to the entity known as cricopharyngeal spasm. Alternately, there could be an obstructive lesion in the esophagus.

Fig. 6.6 Swallowed bolus has almost entirely coated the larynx, going below the level of true vocal folds. This represents significant aspiration

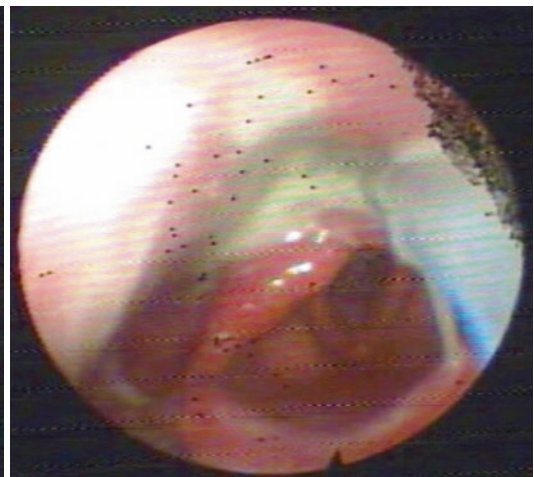
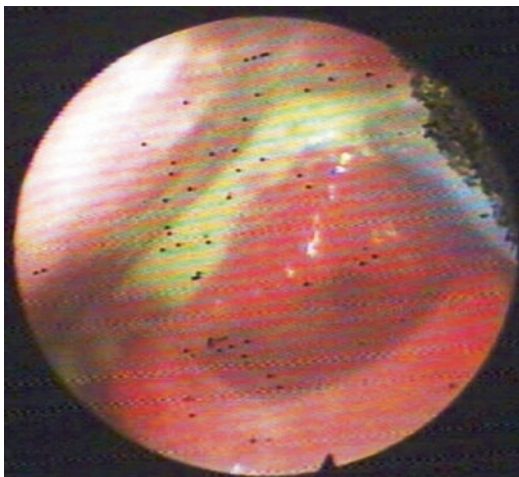
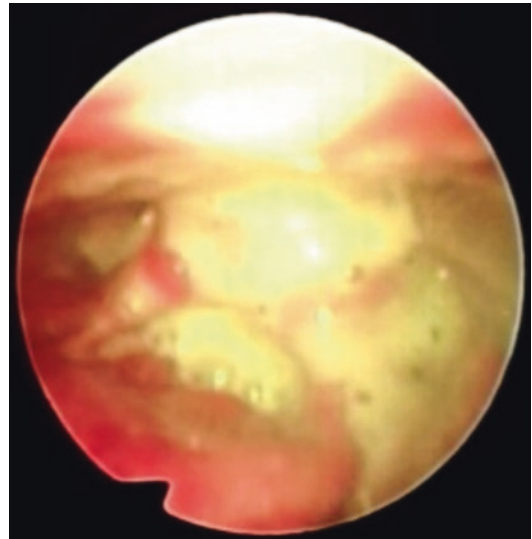


Fig. 6.7 Persisting bolus residue limited to the post-cricoid area, despite multiple swallows, images from two different moments of the swallow captured. This is most probably due to cricopharyngeal spasm

Therapeutic Interventions

This is the final segment on FEES interpretations. Here, the examiner notes the response to therapeutic interventions (dietary, positional, manoeuvres). This is another significant benefit of the procedure—direct visualization of the effect of an attempted therapy and, at the same time, feedback to the patient and caregivers as they witness the clinical improvement live. It

would be out of the purview of the present chapter to go into full details of all the swallowing therapeutic measures. Suffice it to say that depending on the correct interpretation of findings, the examining team can immediately decide on the suitable action. Chin tuck positioning and supraglottic manoeuvre are two such actions, which can remarkably improve the course of the swallow in indicated cases (Videos 6.11 and 6.13, Figs. 6.8a, b and 6.9).

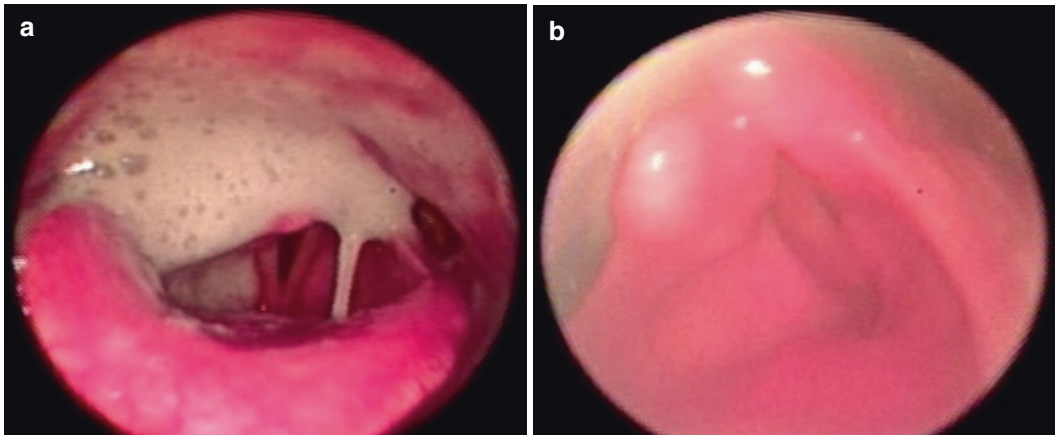


Fig. 6.8 (a) Significant residue and penetration seen in this image of a patient with postoperative right vocal fold palsy. (b) The completely cleared residue after the patient made to swallow with chin tuck and head tilt to the right

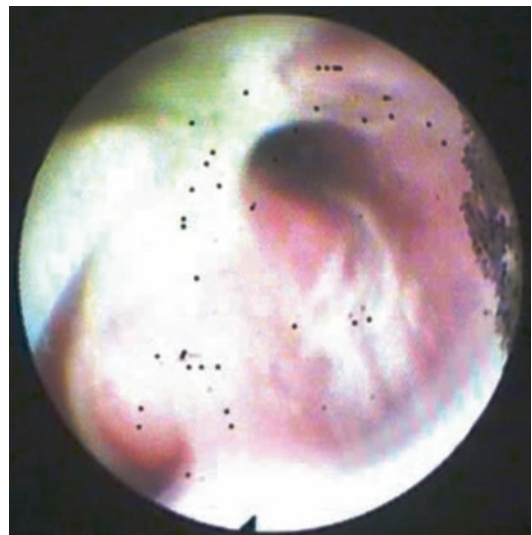


Fig. 6.9 Split-second opening of the cricopharynx (upper esophageal sphincter) has been captured as the patient with vocal fold palsy and aspiration swallows using chin tuck and supraglottic manoeuvre

Conclusion

Flexible endoscopic evaluation of swallowing is a comprehensive evaluation of the swallowing process, inclusive of laryngeal anatomic integrity, motor and sensory functions, ability to swallow and response to prescribed changes in posture and/or diet. Interpretation of FEES is done in three parts: basic anatomy and function, without giving any edible bolus ('pre-swallow'), management of administered bolus ('swallow') and the examination of effects of therapeutic measures. The oral phase will be out of the purview of FEES, while laryngeal penetration/aspiration and hypopharyngeal residue are reliably and sensitively detected.

Pearls

- FEES represents one of two 'gold standard' evaluation procedures for patients with swallowing disorders.
- The procedure can be easily learnt and performed successfully by the trained laryngologist and/or speech-language pathologist.
- Nasal decongestion, without anaesthesia, is recommended as preparation for FEES. Good-quality monitor and recording device are essentials to derive the full benefit.
- The oral phase will be out of the purview of FEES, while laryngeal penetration/aspiration and hypopharyngeal residue are reliably and sensitively detected.
- Multiple boluses, with different consistencies, should be attempted in every patient, along with the patient and detailed examination of the pre- and post-swallow status.
- FEES allows for the trial of therapeutic manoeuvres at the same sitting, along with feedback training for the patient and caregivers.

References

1. Unnikrishnan K, Menon C. A historical review of laryngology. In: Nerurkar NK, editor. Textbook of laryngology. New Delhi: Jaypee Brothers Medical Publishers; 2017. p. 7.
2. Langmore SE. Endoscopic evaluation of oral and pharyngeal phases of swallowing. *GI Motility Online*; 2006.
3. Logemann JA. Preface. In: Berman D, editor. Evaluation and treatment of swallowing disorders. 2nd ed. Texas: Pro Ed; 1998. p. 5.