

A Documentation System to Save Time and Ensure Proper Application of the Fiberoptic Endoscopic Evaluation of Swallowing (FEES®)

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Key Words

Deglutition disorders · Fiberoptic endoscopic evaluation of swallowing · Documentation system · Editing time

Abstract

A properly performed fiberoptic endoscopic evaluation of swallowing (FEES®) is comprehensive and time-consuming. Editing times of FEES protocols and attempts for efficiency maximization are unknown. Here, the protocol editing times of completed FEES examinations were determined. The present study reports the time savings and quality gains of a newly developed documentation system tailored to the FEES standard of Langmore. Four independent examiners analyzed twelve videos of FEES procedures, six without and six with the documentation system. Effectiveness of the documentation system was evaluated according to the times for total evaluation, interpretation, documentation, report writing, and for report completeness. The documentation system reduced editing times and increased report completeness with large effect sizes. Averaged total evaluation time decreased from 42 to 27 min, report completeness increased from 55 to 80%. The use of the documentation system facilitates and improves the assessment of the swallowing process.

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Introduction

Transnasal flexible endoscopy has become a widely used and powerful tool to assess swallowing dysfunction in a variety of settings over an array of patients [1–3]. Performed as fiberoptic endoscopic evaluation of swallowing (FEES®) as defined by Langmore [4], endoscopy even is acknowledged as a gold standard for the diagnosis of oropharyngeal dysphagia and is often used as a benchmark for other methods [5]. Various studies demonstrated that FEES is as sensitive as or more sensitive than the video-fluoroscopic study of swallowing (VFSS) with regard to the parameters penetration, aspiration, delay in swallowing initiation, and pharyngeal residue [6–8]. Hence, many European clinicians, oriented to the international literature [e.g. 9–11], have begun to use the FEES procedure in their daily routine.

With the increased use of FEES in daily practice, FEES, however, has turned out to be time-consuming and costly when performed and analyzed as required. Still, Aviv et al. [12] demonstrated that the FEES with sensory testing appeared to be more cost-effective than VFSS for the inpatient management of dysphagia. Although the FEES procedure itself is completed swiftly, the analysis is rather comprehensive, even for those with many years of clinical experience [13]. In turn, the editing time, that is, in-

interpretation, documentation, and report writing has become time-consuming. Clinicians then have been left with the problem of trying to deal with the demands of health insurance providers, that is, more elaborate documentation while at the same time reducing costs [14, 15]. The consequence of improving time efficiency in order to lower costs, however, has been often incomplete examination, documentation, and reports. Which parameters of FEES are dispensable without too much loss of evaluation quality? Langmore trademarked FEES in order to maintain quality and ensure a standard [16]. Although she established this standard, there is a lack of a consensus among clinicians on the FEES procedure [5]. Ideally, clinicians would have access to a tool that strictly adheres to Langmore's FEES protocol and is time-efficient. There is, however, a paucity of reports on editing times of FEES protocols and attempts for efficiency maximization.

In order to provide a time-efficient solution to document and report a FEES examination without compromising integrity, a documentation system was developed for this study. The aim of this study was to determine (1) time efficiency and (2) report completeness by the application of the proposed documentation system. For these purposes, the time needed for interpretation, documentation, and report writing were assessed. Additionally, time saved and improvement in report quality were quantified.

Methods

Documentation System

The documentation system presented here strictly adheres to the specifications of the FEES protocol [4]. For a structured and concise layout, the evaluation parameters are arranged in tabular form. Each part of the protocol is displayed in a task-tailored checklist of normal and pathological findings which also allows for free text entry. Table 1 depicts an exemplary part of the documentation form. Single issues, like anatomical structures or related functional tasks, are placed on the left side of the form. Figures are provided into which conspicuous findings may be drawn if it is too difficult to describe them precisely in the unified checklist. Normal findings are listed in the middle column. In order to highlight pathologies, the right column contains task-tailored checklists of common pathological findings as choice options.

The documentation system is divided into three parts in accordance with the FEES procedure, namely (1) anatomic-physiologic assessment, (2) direct examination of swallowing food and liquids, and (3) therapeutic maneuvers tried and their effects. The items of the anatomic-physiologic assessment and of the examination of swallowing are shown in appendices 1 and 2. The item order corresponds to the FEES procedure.

The section on anatomic-physiologic assessment documents the essential morphological and functional prerequisites for the oropharyngeal swallowing process. With the provided checklists,

alterations in surface mucosa and structural integrity of velum/epipharynx, tongue base/mesopharynx, and larynx/hypopharynx can be described in detail. The checklists for the biomechanical functions include the parameters symmetry, range/amplitude, speed/briskness, and coordination. As a critical clinical parameter, the occurrence of oropharyngeal secretions, scored by the four-point rating scale of Murray et al. [17], are itemized separately with a specification of its amount, its color and viscosity, the patient's response, and its management. The spontaneous swallows are documented in number of swallows per minute. The last section of the anatomic-physiologic assessment consists of sensation and sensory testing and registers the patient's reaction to the presence of the endoscope or a light touch to the aryepiglottic folds on the right and left sides.

Part 2 of the FEES protocol is a direct examination of swallowing food and liquids and constitutes the core of the examination. It depicts the most central findings of a FEES examination which point to abnormal bolus passage patterns, that is, leaking, penetration/aspiration, and residues. These findings are evaluated with respect to different consistencies and bolus volume and described for the oral stage (from the endoscopic view) and the pharyngeal stage.

Penetration/aspiration is scored by the eight-point penetration-aspiration scale of Rosenbek et al. [18] which enables the comparison of FEES with VFSS because this rating scale is validated for both diagnostic procedures [19, 20].

The description of the preparatory and transit phase of the oral stage from the endoscopic view includes the lingual velar seal, the base of tongue movements during the preparatory stage and its retraction in the transport stage, and a final documentation of the entire duration of the oral stage.

Leaking during the oral preparatory stage is documented separately and specified for the bolus path, and is depicted in figures for the consistencies liquid, semisolid, and solid. Finally, possible penetration or aspiration events for each consistency are scored.

The pharyngeal stage, examined either as instructed swallow with measured bolus amount or as natural eating and drinking, is itemized (1) for the timeliness of the initiation of swallow, (2) for the location of the bolus at the onset of the swallow, (3) for penetration or aspiration, scored as above by the penetration-aspiration scale, with detailed indications about the time of occurrence (pre-, intra-, or postdeglutitive), and (4) for amount and location of residual material left after the swallow.

The third part about therapeutic maneuvers tried and their effects provides checklists for changes in bolus delivery and postures as well as different swallowing maneuvers (table 2).

Evaluation Procedure

Twelve digital video recordings of pathological swallowing processes were taken by the first author according to the FEES protocol with the ENT video endoscopy system EndoStrob-DX [Xion medical GmbH; video system: PAL/NTSC; sensor: CCD matrix with micro-lenses and mosaic filter, 1/3" 752 (h) × 582 (v) pixels (PAL); output: S-Video, DVI-I, VGA IEEE/1394 (DV); input DVI-I, S-Video; illumination: min. 3 lux; filter OLPF; digital interfaces: IEEE/1394 FireWire DV; audio and video; light source: power 50 W; color temperature 5.700 K; camera head with integrated microphone, videoadapter: focal length = 22 m; clip coupling] and a transnasal flexible endoscope 11101 RP2, outside diameter: 3.5 mm (Karl Storz GmbH, Tuttlingen).

Table 1. Exemplary part of the documentation form: morphological findings larynx and function


Morphological Findings Larynx and Function			
<p><i>Morphological findings: larynx</i></p> <p>True vocal cords</p> 	<input type="checkbox"/> Normal	<input type="checkbox"/> Leukoplakia <input type="checkbox"/> Nodulus <input type="checkbox"/> Erythema <input type="checkbox"/> Morphological defects <input type="checkbox"/> Atrophy <input type="checkbox"/> Right <input type="checkbox"/> Left <input type="checkbox"/> Bilateral	<input type="checkbox"/> Neoplasm <input type="checkbox"/> Ulcer <input type="checkbox"/> Polyp <input type="checkbox"/> Synechy <input type="checkbox"/> Edema
Glottic gap	<input type="checkbox"/> Normal	<input type="checkbox"/> Reduced	
<p>Supraglottic region:</p> <input type="checkbox"/> False vocal cords (FVC) <input type="checkbox"/> Aryepiglottic rim <input type="checkbox"/> Arytenoid	<input type="checkbox"/> Normal	<input type="checkbox"/> Leukoplakia <input type="checkbox"/> Nodulus <input type="checkbox"/> Erythema <input type="checkbox"/> Morphological defects <input type="checkbox"/> Atrophy <input type="checkbox"/> Right <input type="checkbox"/> Left <input type="checkbox"/> Bilateral	<input type="checkbox"/> Neoplasm <input type="checkbox"/> Ulcer <input type="checkbox"/> Polyp <input type="checkbox"/> Synechy <input type="checkbox"/> Edema
Epiglottis	<input type="checkbox"/> Normal	<input type="checkbox"/> Leukoplakia <input type="checkbox"/> Nodulus <input type="checkbox"/> Erythema <input type="checkbox"/> Morphological defects <input type="checkbox"/> Atrophy <input type="checkbox"/> Right <input type="checkbox"/> Left <input type="checkbox"/> Bilateral	<input type="checkbox"/> Neoplasm <input type="checkbox"/> Ulcer <input type="checkbox"/> Polyp <input type="checkbox"/> Synechy <input type="checkbox"/> Edema
<p><i>Function: larynx</i></p> <p>Motility of true vocal cords: abduction</p> <p>Respiration</p>	<input type="checkbox"/> Normal	<input type="checkbox"/> Not possible <input type="checkbox"/> Asymmetry <input type="checkbox"/> Limitations in <ul style="list-style-type: none"> <input type="checkbox"/> Range <input type="checkbox"/> Speed <input type="checkbox"/> Coordination <input type="checkbox"/> Right <input type="checkbox"/> Left <input type="checkbox"/> Bilateral	
<p>Motility of true vocal cords: adduction</p> <p>Phonation:</p> <p>Tasks: /ee/ and repeated: /ee/ /ee/ /ee/</p>	<input type="checkbox"/> Normal	<input type="checkbox"/> Not possible <input type="checkbox"/> Asymmetry <input type="checkbox"/> Limitations in <ul style="list-style-type: none"> <input type="checkbox"/> Range <input type="checkbox"/> Speed <input type="checkbox"/> Coordination <input type="checkbox"/> Right <input type="checkbox"/> Left <input type="checkbox"/> Bilateral	
<p>Airway protection</p> <p>True vocal cord – closure:</p> <p>Task: breath-holding lightly</p> <p>Sustain breath hold: 7+ s</p> <p>False vocal cord – closure:</p> <p>Task: breath-holding tightly and/or cough</p> <p>Epiglottal inversion:</p> <p>Task: dry swallow</p>	<input type="checkbox"/> Complete	<input type="checkbox"/> Not possible <input type="checkbox"/> Incomplete <ul style="list-style-type: none"> <input type="checkbox"/> TVC closure <input type="checkbox"/> FVC closure <input type="checkbox"/> Epiglottal inversion 	

Table 2. Exemplary part of the documentation form: therapeutic maneuvers tried and their effect

Therapeutic maneuvers tried and their effect				
Alterations in bolus mode	<input type="checkbox"/> None	<input type="checkbox"/> Liquid <input type="checkbox"/> Semi-solid <input type="checkbox"/> Solid	_____	_____
Alterations in mode of delivery	<input type="checkbox"/> None	<input type="checkbox"/> Syringe <input type="checkbox"/> Straw <input type="checkbox"/> Little portions	<input type="checkbox"/> Spoon <input type="checkbox"/> Cup <input type="checkbox"/> Slow rate of delivery	
Effective postural changes				
Dry swallow	<input type="checkbox"/> None	<input type="checkbox"/> Chin tuck: <input type="checkbox"/> Head turn: <input type="checkbox"/> Prone: <input type="checkbox"/> Side lying:	<input type="checkbox"/> Retroflexion <input type="checkbox"/> Left <input type="checkbox"/> Left <input type="checkbox"/> Left <input type="checkbox"/> Left	<input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right
Liquid	<input type="checkbox"/> None	<input type="checkbox"/> Chin tuck: <input type="checkbox"/> Head turn: <input type="checkbox"/> Prone: <input type="checkbox"/> Side lying:	<input type="checkbox"/> Retroflexion <input type="checkbox"/> Left <input type="checkbox"/> Left <input type="checkbox"/> Left	<input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right
Semi-solid	<input type="checkbox"/> None	<input type="checkbox"/> Chin tuck: <input type="checkbox"/> Head turn: <input type="checkbox"/> Prone: <input type="checkbox"/> Side lying:	<input type="checkbox"/> Retroflexion <input type="checkbox"/> Left <input type="checkbox"/> Left <input type="checkbox"/> Left	<input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right
Solid	<input type="checkbox"/> None	<input type="checkbox"/> Chin tuck: <input type="checkbox"/> Head turn: <input type="checkbox"/> Prone: <input type="checkbox"/> Side lying:	<input type="checkbox"/> Retroflexion <input type="checkbox"/> Left <input type="checkbox"/> Left <input type="checkbox"/> Left	<input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right <input type="checkbox"/> Right
Effective maneuvers				
Dry swallow	<input type="checkbox"/> None	<input type="checkbox"/> Additional dry swallow, number: _____ <input type="checkbox"/> Supraglottic <input type="checkbox"/> Supersupraglottic <input type="checkbox"/> Effortful swallow <input type="checkbox"/> Mendelsohn maneuver <input type="checkbox"/> 3-step (controlled) swallow <input type="checkbox"/> Other maneuver		
Liquid	<input type="checkbox"/> None	<input type="checkbox"/> Additional dry swallow, number: _____ <input type="checkbox"/> Supraglottic <input type="checkbox"/> Supersupraglottic <input type="checkbox"/> Effortful swallow <input type="checkbox"/> Mendelsohn maneuver <input type="checkbox"/> 3-step (controlled) swallow <input type="checkbox"/> Other maneuver		
Semi-solid	<input type="checkbox"/> None	<input type="checkbox"/> Additional dry swallow, number: _____ <input type="checkbox"/> Supraglottic <input type="checkbox"/> Supersupraglottic <input type="checkbox"/> Effortful swallow <input type="checkbox"/> Mendelsohn maneuver <input type="checkbox"/> 3-step (controlled) swallow <input type="checkbox"/> Other maneuver		
Solid	<input type="checkbox"/> None	<input type="checkbox"/> Additional dry swallow, number: _____ <input type="checkbox"/> Supraglottic <input type="checkbox"/> Supersupraglottic <input type="checkbox"/> Effortful swallow <input type="checkbox"/> Mendelsohn maneuver <input type="checkbox"/> 3-step (controlled) swallow <input type="checkbox"/> Other maneuver		

Table 3. Times for total evaluation, interpretation, documentation, and report writing as well as report completeness, for evaluation system A and B and examiner 1–4, and means and standard deviations over examiners

Parameter	Evaluation system									
	examiner 1		examiner 2		examiner 3		examiner 4		mean over examiners	
	A	B	A	B	A	B	A	B	A	B
Total evaluation time, min	36.22	31.58	70.54	33.39	24.19	18.26	37.58	24.46	42.23 ± 19.09	27.12 ± 8.14
Time for interpretation, min	10.56	16.31	24.06	23.36	7.08	6.34	10.00	9.12	13.02 ± 9.32	13.58 ± 7.38
Time for documentation, min	9.21	7.17	22.09	6.14	7.41	5.16	11.49	5.35	12.45 ± 6.36	5.35 ± 2.07
Time for writing final report, min	16.04	8.09	24.39	5.50	9.29	6.36	16.09	9.58	16.36 ± 6.18	7.38 ± 3.21
Report completeness, %	48.4	82.1	70.3	90.2	39.0	69.4	62.2	77.0	54.98 ± 14.65	79.69 ± 10.15

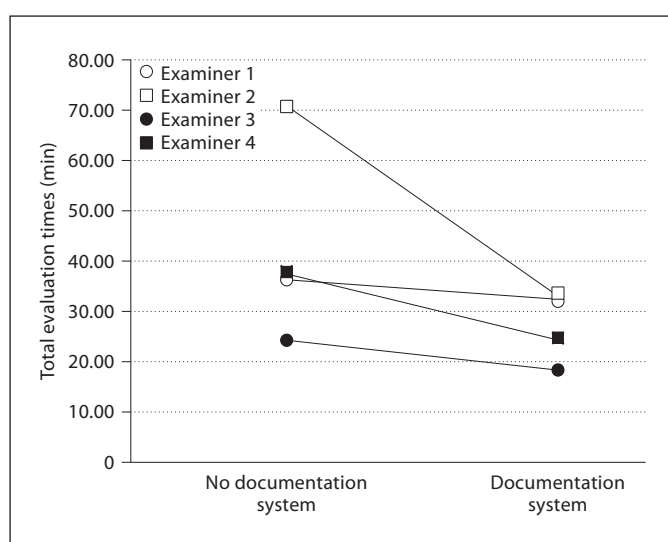


Fig. 1. Mean of the total evaluation times for the 4 examiners with and without documentation system.

The recordings were analyzed by 4 independent examiners, either with or without the documentation system. The examiners were two otolaryngologists, a speech and language pathologist and an oral and maxillofacial surgeon, each one from a different clinic and thus with different professional backgrounds. After being trained in the use of the documentation system, the examiners viewed the FEES video recordings. The depicted patients suffered from oropharyngeal dysphagia, six caused by head and neck cancer, six by neurological diseases (Parkinson's disease, stroke, cerebellar hemorrhage). Six recordings were assessed without the documentation system (evaluation system A) and six with the system (evaluation system B). The independent variables of the study were the evaluation system and the individual examiners. The films were arranged in a randomized balanced order to avoid serial effects. The mean film lengths differed slightly but not significantly between the two evaluation systems, as tested with the Mann-Whitney U test. For group A, the mean film length was

388 s (range 240–509 s), for group B 366 s (range 282–496 s). Depending on the individual need of the examiner, the films were viewed either in real time, with slowed speed, or frame-by-frame with or without repeated viewing.

Five criteria were the dependent variables: (1) total evaluation time (total time needed for interpretation, documentation, and writing a final report); (2) interpretation time; (3) documentation time; (4) time for writing a final report, and (5) completeness of reported parameters required by the original FEES protocol.

Statistical Analysis

A general linear model (GLM) two-factorial analysis was calculated to determine the effect of the evaluation system and examiner as well as the interaction effects on criteria 1–5. Although each examiner used both evaluation systems, they did so with a different film each time. Therefore, the independent variable of evaluation system (A or B) was considered a between-subject variable.

Results

Table 3 shows means and standard deviations of the different dependent variables, specified above as parameters 1–5, for each evaluation system and examiner.

As to total evaluation time, a 2 (Evaluation System A vs. B) by 4 (Examiners) GLM showed a main effect of Evaluation System [$F(3, 40) = 57.01, p < 0.001, \eta^2_{\text{partial}} = 0.59$], a main effect of Examiners [$F(3, 40) = 41.07, p < 0.001, \eta^2_{\text{partial}} = 0.76$], and a significant interaction Evaluation System \times Examiners [$F(3, 40) = 14.30, p < 0.001, \eta^2_{\text{partial}} = 0.52$; fig. 1).

In order to determine the contributions of the single time components (time for interpretation, documentation, report writing) to the total evaluation time, a GLM was calculated for each of them. For the interpretation time, neither the main effect of the Evaluation System nor the interaction Evaluation System \times Examiners was sig-

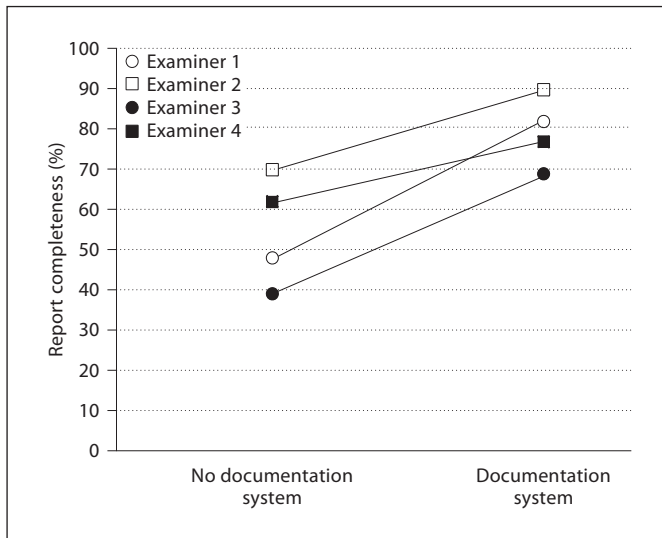


Fig. 2. Mean of the report completeness for the 4 examiners with and without documentation system.

nificant. The main effect of Examiners, however, was significant [$F(3, 40) = 19.78, p < 0.001, \eta^2_{\text{partial}} = 0.60$]. For documentation time, all three effects were significant: Evaluation System [$F(3, 40) = 76.62, p < 0.001, \eta^2_{\text{partial}} = 0.66$], Examiners [$F(3, 40) = 12.15, p < 0.001, \eta^2_{\text{partial}} = 0.48$], and Evaluation System \times Examiners [$F(3, 40) = 20.57, p < 0.001, \eta^2_{\text{partial}} = 0.61$]. Also for report time, all three effects were significant: Evaluation System [$F(3, 40) = 92.57, p < 0.001, \eta^2_{\text{partial}} = 0.70$], Examiners [$F(3, 40) = 10.47, p < 0.001, \eta^2_{\text{partial}} = 0.440$] and the interaction Evaluation System \times Examiners [$F(3, 40) = 13.76, p < 0.001, \eta^2_{\text{partial}} = 0.51$].

For the report completeness, the main effect of Evaluation system was significant [$F(3, 40) = 121.33, p < 0.001, \eta^2_{\text{partial}} = 0.75$], as was the main effect of Examiners [$F(3, 40) = 23.11, p < 0.001, \eta^2_{\text{partial}} = 0.63$]. The interaction effect Evaluation System \times Examiners [$F(3, 40) = 3.89, p < 0.02, \eta^2_{\text{partial}} = 0.23$] was significant (fig. 2).

Discussion

The employment of the presented documentation system in FEES reduced the editing time considerably and enhanced the completeness of the evaluation. In addition, the documentation system decreased the large between-examiner differences of both parameters. Thus, a tool has been developed which facilitates, unifies, and improves

the assessment of a swallowing process, irrespective of examiner background.

When no documentation system was used, total evaluation time ranged from 24 (examiner 3) to 70 min (examiner 2), and report completeness from 39 (examiner 3) to 70% (examiner 2). The mean total evaluation time across the examiners decreased from 42 to 27 min by the use of the documentation system. A partial η^2 larger than 0.14 is considered a large effect size [21]; in this study, a partial η^2 of 0.58 for the total evaluation time was gained by the documentation system. This reduction in total time was mainly due to time savings for the documentation and report writing. The mean interpretation time, however, increased slightly from 13 to 14 min by the use of the documentation system. The reduction in the documentation time was due to the provided display format of the evaluation scheme. The uniform display format facilitates the preparation of the final report.

The time needed for total evaluation, interpretation, and documentation, as well as report completeness varied with individual examiner. A significant interaction between employed documentation system and examiner was found for time needed for total evaluation, documentation, and report writing as well as report completeness. Despite this interaction, an advantage for using the new documentation system was seen for all 4 examiners, even though not equally across all parameters. All 4 examiners profited with respect to report completeness. One of them (examiner 2), who already wrote thorough reports, was able to shorten her time by more than 50% using the documentation system.

This study has several limitations. The number of examiners was too small to establish time norms. However, study participants were difficult to locate because in Germany as well as in many other European countries dysphagia is a young research field, and only few clinicians are specialized in swallowing disorders. Furthermore, the aim of the study was not to investigate agreement between and within examiners. Instead, our primary aim was to reduce editing time by maintaining report completeness according to FEES standard. If report completeness varies between examiners, as it does especially in the absence of a standard documentation system, the agreement between examiners can only be calculated for those report parameters shared by examiners but not for those parameters reported by one examiner but ignored by the other. It would be valuable to use the current standard documentation system to determine inter-judge reliability in future studies.

Conclusion

Without a standard documentation system, the time and quality of written reports from FEES examinations were inefficient and incomplete. Using the presented documentation system developed in this study, both time effectiveness and the quality of the analysis of the FEES improved significantly. The mean total evaluation time across all 4 examiners decreased from 42 to 27 min, and the completeness of the final report improved from 55 to 80%.

The documentation system for FEES examinations is offered as a tool to standardize the reporting of the exam as well as to reduce time needed to write it and improve the quality and thoroughness of the report. Standardization is a necessary step in validating a procedure, and our documentation system is a contribution toward that goal.

Appendix 1

Part 1 of FEES: Evaluated Parameters of Anatomic-Physiologic Assessment

-
- Evaluation of morphological findings and function:
Velum and epipharynx, base of tongue and mesopharynx, larynx and hypopharynx
- Checklist entries for morphological findings:
Neoplasm, ulcer, erythema, morphological defects, hypertrophy, atrophy, asymmetry involuntary movements at rest
- Checklist entries for function (movement qualities for every evaluated task):
Symmetry, limitations in: speed, range and coordination
- Evaluated function and tasks:
Velar and lateral wall movements
Tasks: velopharyngeal closure by dry swallow and phonation
- Retraction of base of tongue
Tasks: dry swallow, repeating of postvocalic /l/ word like 'all'
- Movement of pharynx constrictors and longitudinal muscles
Tasks: phonation of strained loud high /ee/ and repeated /ee/

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- Abduction and adduction of true vocal cords
Tasks: respiration and phonation: sustained and repeated /ee/
Airway protection
Tasks: true vocal folds closure: breath-holding lightly (also, hold for 7+ s), false vocal folds closure: breath-holding tightly, cough, epiglottal inversion: dry swallow
- Secretions and spontaneous swallowing:
Locations of oropharyngeal secretions, appearance of secretions (color, viscosity), awareness to secretions, patient's response, frequency of spontaneous swallows
- Sensation and sensory testing:
Response to presence of endoscope, response to light touch to junction of aryepiglottic folds and arytenoid cartilages
-

Appendix 2

Part 2 of FEES: Direct Examination of Swallowing Food and Liquids

-
- Oral stage (fiberoptic endoscopic view):
Competence of linguovelar seal, base-of-tongue movements, base-of-tongue retraction, bolus transport into the pharynx, duration of complete oral stage
Spillage of bolus during oral preparatory stage (for the different bolus consistencies: liquid, semi-solid, solid): bolus path, penetration and/or aspiration
- Pharyngeal stage:
Checklist entries for different bolus consistencies and bolus volumes:
Measured bolus volumes with instructions to swallow:
Bolus path, swallow initiation, penetration/aspiration, pre-, intra-, and postdeglutitive
Natural drinking and eating behavior:
Bolus path, swallow initiation, penetration/aspiration, pre-, intra-, and postdeglutitive
Hyolaryngeal elevation: epiglottal inversion (impression from all swallows)
- Residues and management:
Checklist entries include the different bolus consistencies and bolus volumes:
Location of residues, amount of residues, awareness to residues, clearing forces, effectiveness of clearing force
-

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