

ORIGINAL ARTICLE

Safety and the effectiveness of a new education program for nurses to assess swallowing function using fiberoptic endoscopic evaluation of swallowing (FEES)

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Abstract

Aim: Nurses have the potential to perform fiberoptic endoscopic evaluation of swallowing (FEES) in Japan, which can aid in their provision of swallowing care appropriate to individual patients' swallowing functions. We aimed to confirm the safety and effectiveness of a new nursing education program on FEES by examining its impact on autonomy in performing FEES and accuracy in observing bolus swallowing.

Methods: In this prospective descriptive study, we developed a FEES education program comprising three phases: (a) obtaining knowledge and skills through e-learning and a practical workshop; (b) becoming proficient in skills for assessing healthy adults through self-learning; and (c) obtaining clinical competence through 30 cases of on-the-job training (OJT). The trends in autonomy and in accuracy of FEES were evaluated by the data during OJT.

Results: Of the three certified nurses in dysphagia nursing, a trainee completed 30 cases of OJT and the other two trainees experienced 20 cases and 10 cases, respectively without any adverse event. Autonomy in the four major FEES skills gradually increased over the OJT. The correct answer rate, sensitivity, and specificity of the penetration-aspiration scale and severity of residue in the pyriform sinus and epiglottis valley were above 95% at the first 10 cases of OJT among three trainees and they were 100% after the 11th case of OJT.

Conclusions: Our results suggest that the developed education program helped nurses with experience being present at FEES obtain sufficient knowledge and skills to appropriately and safely perform FEES with 30 cases of OJT.

KEYWORDS

autonomy, clinical competence, deglutition disorders, education program, flexible endoscopic evaluation of swallowing

1 | INTRODUCTION

Dysphagia is a life-threatening symptom among older adults because of its relation to aspiration pneumonia, which is one

of the leading causes of death (Ministry of Health, Labour and Welfare, 2016). Restricted eating or drinking is a frequent care for prevention of aspiration pneumonia; however, the care has some problems regarding decreased muscle

mass (Shimizu, Maeda, Tanaka, Ogawa, & Kayashita, 2018), malnutrition, and low quality of life (Morisaki, 2017; Serra-Prat et al., 2012), because swallowing function dramatically decreases due to disuse of swallowing muscles once an older adult stops eating food. Therefore, a basic strategy in dysphagia care should be to help patients with swallowing dysfunction continue consuming food and liquid safely for as long as possible by preventing aspiration and pharyngeal residue (Fujishima et al., 2019).

Videofluoroscopic swallowing studies and fiberoptic endoscopic evaluation of swallowing (FEES) are the gold standard methods for directly observing aspiration and pharyngeal post-swallow residue (Fattori et al., 2016; Giraldo-Cadavid et al., 2017). The former is used when swallowing function is speculated to be worsening. However, it has a serious disadvantage in that the use of ionizing radiation does not allow for frequent observation (Martin-Harris & Jones, 2008). Presently, FEES became popular to objectively assess swallowing. It can be used to observe the pharyngeal phase of swallowing, including penetrations, aspirations, and pharyngeal residues, with greater accuracy (Kelly, Drinnan, & Leslie, 2007; Kelly, Leslie, Beale, Payten, & Drinnan, 2006; Wu, Hsiao, Chen, Chang, & Lee, 1997), and it has high interrater reliability (Dziewas et al., 2008; Leder, Sasaki, & Burrell, 1998).

In western countries, FEES is predominantly performed by speech-language pathologists (SLPs) and speech-language therapists (SLTs), and there are a number of education programs teaching SLPs /SLTs to perform FEES (American Speech-Language Hearing Association, 2002; Dziewas et al., 2016; Royal College of Speech and Language Therapists, 2015). In Japan, only a few physicians and dentists currently provide FEES for older adults with dysphagia. This fact, coupled with the fact that Japan is now a super-aged society, means that there is a surplus of older adults who are unable to receive dysphagia care based on accurate assessment of the pharyngeal phase of swallowing.

We believe that nurses have the potential to perform FEES because they can legally insert nasogastric tubes, which is considered to be a more hazardous procedure than the insertion of an endoscope, and a few nurses currently perform FEES under the supervision of a physician (Ministry of Health, Labour, and Welfare, 2012). Furthermore, nurses are the primary providers of dysphagia care. Nurses introduce patients to the multidisciplinary dysphagia care team, including the physician and speech therapist, when they suspect patients have severe dysphagia. Nurses are expected to observe the morphology and function of the pharyngeal cavity to evaluate the severity of dysphagia, and observe bolus swallowing when patients have mild dysphagia. We think that these skills are different from those developed in the FEES educational programs designed for SLPs/SLTs in western countries. In addition,

the introduction of FEES educational programs for nurses in western countries is not possible because: (a) the FEES educational programs for SLPs /SLTs are too complicated, including severe dysphagia care skills; (b) these educational programs require more than 60 cases of FEES under both direct and indirect supervision; and (c) it is difficult to find physicians with the necessary experience in FEES to instruct nurses on how to perform it in Japan.

FEES requires four major skills: (a) inserting the endoscope through the nostril and observing of morphology and function to assess whether patients are able to swallow bolus; (b) observing the penetration/aspiration and residue during/after bolus swallowing; (c) selecting the next examination condition of bolus swallowing; and (d) planning both direct and indirect training based on the results of FEES (The Japanese Society of Dysphagia Rehabilitation, 2013). Skills 2 and 3—observing bolus swallowing and the selection of the next examination condition, respectively—require a considerable amount of clinical experience.

To better equip nurses with these skills in clinical practice, we developed a nursing education program with on-the-job training (OJT). The program focused on observing bolus swallowing and taught nurses two algorithms to assess bolus swallowing. Although FEES is a useful method to evaluate dysphagia, immature skill put patients at risk of adverse events such as suffocation, laryngospasm, and vasovagal reactions. Consequently, this study aims to confirm the safety of this education program and to clarify its effectiveness by showing its impact on nurses' autonomy to perform FEES and accuracy in observing bolus swallowing.

2 | MATERIALS AND METHODS

2.1 | Study design and participants

This prospective descriptive study was conducted at a research facility in which the trainer in charge of the FEES education program worked in Japan. The study is registered with the University Hospital Medical Information Network (UMIN) Clinical Trials Registry (UMIN000032853). We invited nurses with over 5 years of clinical experience in dysphagia care to participate in this study. The exclusion criteria were as follows: (a) experience performing FEES in clinical settings; or (b) experience of a FEES educational program.

2.2 | FEES education program

The FEES education program involved three phases: (a) obtaining knowledge and skills through e-learning

and a practical workshop; (b) becoming proficient, via self-learning, in the skills needed to assess healthy adults; and (c) obtaining clinical competence through OJT (Figure 1 and Appendix 1). We set examinations at the end of each phase to confirm whether a trainee had acquired the skills and knowledge necessary to safely perform the more advanced skills taught in the subsequent phase. Two physiatrists and two nursing researchers, specializing in dysphagia care, along with a physician and two nursing researchers, specializing in medical education, created the final version of this new program for nurses.

2.2.1 | Phase 1: Obtaining knowledge and skills through e-learning and a practical workshop

E-learning provided nurses with theoretical and practical knowledge through three modules of 15- to 40-min video lectures. These provided them with basic knowledge of dysphagia and its rehabilitation, basic knowledge of FEES, and the FEES procedure and selection of training including two algorithms (Figures 2–4, Appendix 1). The e-learning modules were available on the Internet, and trainees could view the lectures and complete the assignments according to their own schedules. The tests were presented at the end of each module, and a score of 90%

or higher was required to proceed to the practical workshop.

The practical workshop consisted of a brief lecture and the opportunity to practice basic skills, as well as the skills necessary to perform FEES, on a healthy adult. After a demonstration by a physician or dentist, acting as a trainer, trainees practiced inserting an endoscope into a phantom (M175-1 Transparent Suction Model, Sakamoto Model Co. Kyoto, Japan). Subsequently, the trainees practiced inserting the endoscope into each other.

At the end of the workshop, the trainer used a brief written test and a practical examination to evaluate confirmed trainees' knowledge and skills in performing FEES via a brief paper test and practical examination. The brief written test asked about cause, prevention, and care for five adverse events and the cleanup method for the endoscope. The practical examination was evaluated on eight points regarding FEES major skills 1 and 2, such as the insertion of the endoscope through the nostril, observation of morphology and function of swallowing, and the observation of normal bolus swallowing. When the trainee had scores of 90% or higher for both the written test and the practical examination, it was determined that they could safely engage in self-learning without real-time advice from a trainer.

2.2.2 | Phase 2: Becoming proficient in skills to assess healthy adults through self-learning

The trainees then practiced FEES with each other as a form of self-learning. In order to prevent adverse events, they were asked not to perform FEES on healthy adults who had not participated in the research. At the trainee's request, trainers could provide practical guidance and feedback onsite. Following a period of self-learning, an objective structured clinical examination (OSCE) was used to assess trainees' clinical FEES skills. This included their ability to observe the morphology and function of swallowing and observe bolus swallowing using five different test foods and liquids in a healthy person.

OSCE is a well-designed method of testing student performance and competence in practical skills (Harden, Stevenson, Downie, & Wilson, 1975). Based on a fictional scenario in which they needed to perform FEES, each trainee performed FEES on a healthy volunteer recruited by the trainers from their colleagues. Only the examiner, the simulated patient, and a nurse, who assisted by inserting the bolus during FEES, attended the OSCE. Trainees' skills were evaluated by the examiner in charge of the education program. The examiner checked small items of the procedure on a list during the FEES and

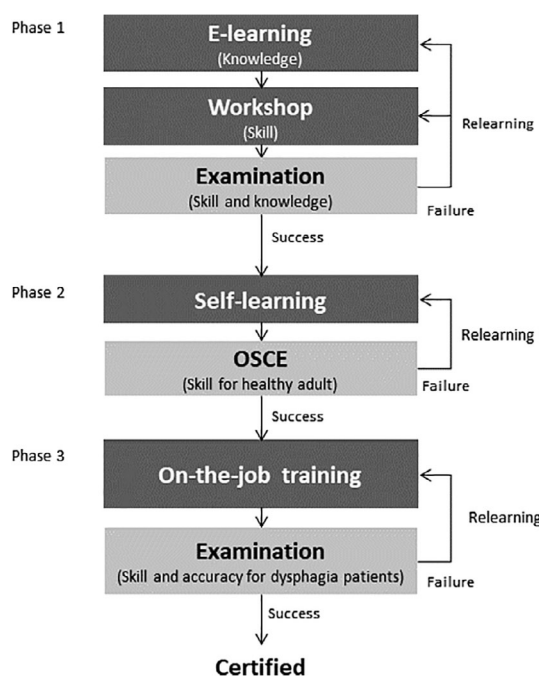


FIGURE 1 Detailed overview of educational program on the use of fiberoptic endoscopic evaluation of swallowing (FEES). OSCE: objective structured clinical examination

scored trainees based on an overall evaluation, ranging from 1 (clear failure) to 6 (excellent [i.e., equal to the level of the trainer]; Appendix 2). When a trainee received a score of four (above the minimum requirement) or above, they could proceed to the OJT, in which they would treat dysphagia patients.

2.2.3 | Phase 3: Obtaining clinical competence via OJT

The FEES OJT was performed on 30 hospitalized dysphagia patients over 20 years of age who were consecutively recruited. The OJT focused on the four major FEES skills mentioned above (Table 1). The trainees began the OJT under the direct supervision of trainers. The supervision

was gradually reduced until trainees could perform FEES independently by the end of the OJT. Trainers gave practical guidance and feedback based on a standardized checklist after each OJT case. After the 30th case, the examiner in charge of the education program evaluated the trainees on the four major FEES skills using the same scoring system that was used in the OSCE (Appendix 2).

2.3 | Measurements

2.3.1 | Safety

Safety was evaluated in terms of the: (a) incidence of adverse events during the program; and (b) the number of times that a trainer stopped a trainee from performing

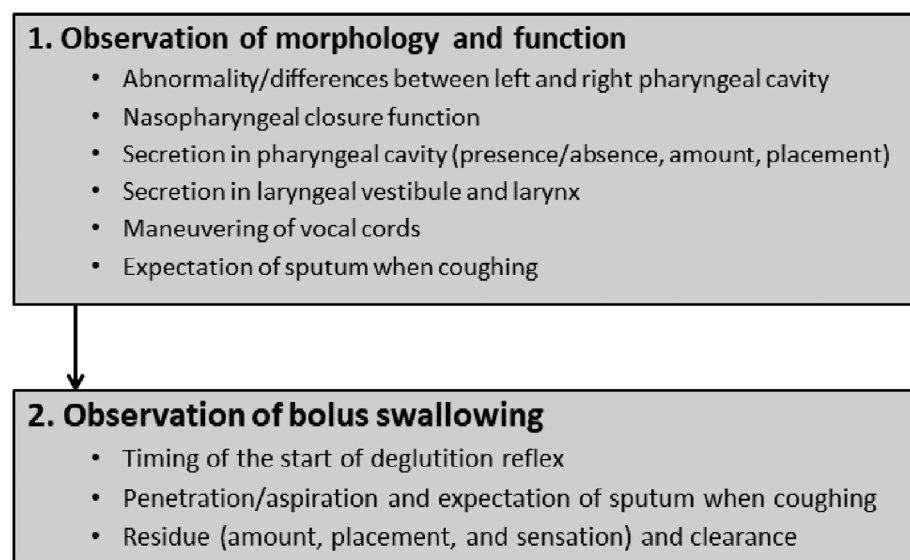


FIGURE 2 Fiberoptic endoscopic evaluation of swallowing (FEES) procedure

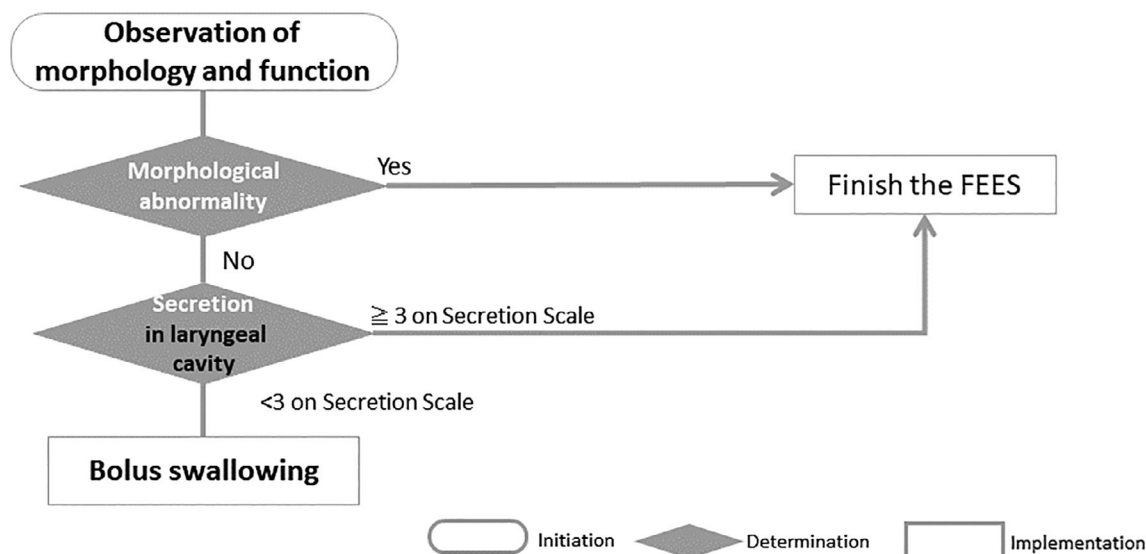


FIGURE 3 Algorithm to determine whether swallow observation can be performed

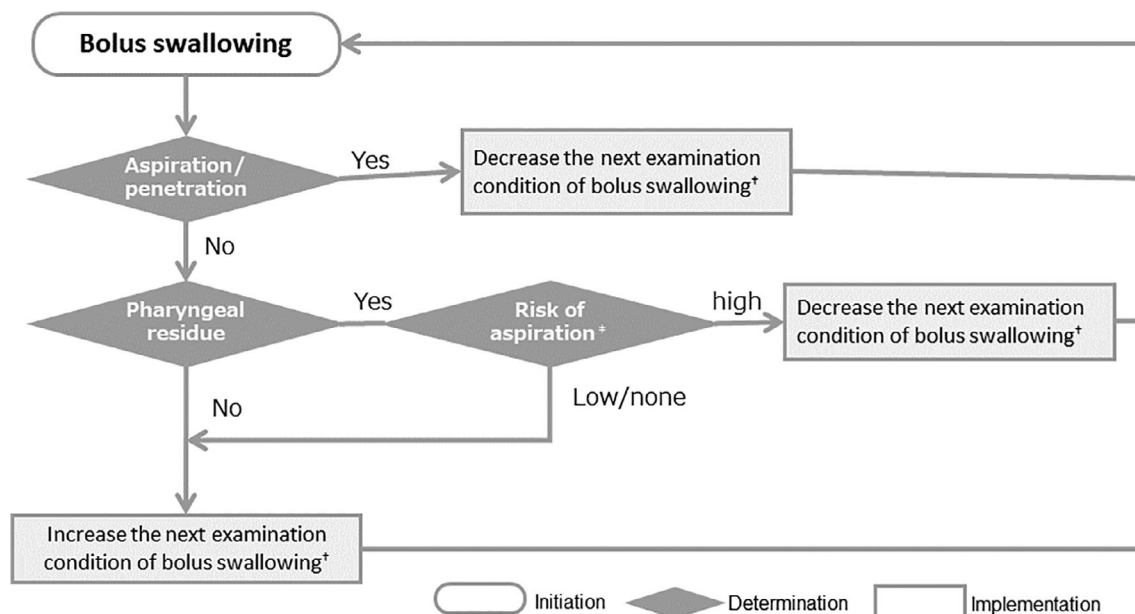


FIGURE 4 Algorithm for selection of the next examination condition for bolus swallowing. †Conditions of bolus swallowing: diet modifications, adjustment of posture, and feeding strategies. ‡Risk of aspiration: high (i.e., a large amount of bolus residue in the pharynx) or low (i.e., none or a very small amount of bolus residue in the pharynx)

TABLE 1 Four major skills for FEES

(1) Observation of morphology and function
Safely insert the endoscope from the nostril into the pharyngeal cavity
Observe morphology and function of organs related to the swallowing process at three points
Determine whether the patient is able to swallow bolus based on the algorithm
(2) Observation of bolus swallowing
Operate the endoscope to secure the necessary image without disturbing bolus swallowing
Observe penetration/aspiration and residue during/after bolus swallowing
Deal with penetration/aspiration and residue (e.g., instructions on coughing, suctioning)
(3) Selecting the next examination condition of bolus swallowing
Select the next examination condition on the algorithm
Decide the timing to end the FEES
(4) Planning direct/indirect training based on the results of the FEES
Make direct/indirect training plans based on the results of the FEES
Set the next evaluation day

Abbreviations: FEES, fiberoptic endoscopic evaluation of swallowing.

FEES in order to prevent harm coming to the healthy volunteers or patients based on the trainer's judgment (The Japanese Society of Dysphagia Rehabilitation, 2013).

There are two reasons why a trainer stopped a trainee from performing FEES: to prevent adverse events, or to take sufficient images to evaluate dysphagia. We used the case of the first reason for safety evaluation.

2.3.2 | Autonomy in performing FEES during OJT

We measured trainees' autonomy in performing the four major FEES skills (Table 1). A researcher who was not involved in the OJT evaluated trainees' autonomy in performing these skills by watching movies with audio of trainees performing FEES. Autonomy was classified as follows: 0 = physician took over; 1 = physician provided guidance and advice for almost every bolus swallowing; 2 = physician sometimes provided guidance and advice; 3 = no guidance or advice needed. We evaluated the trends in autonomy by examining its increase over the course of 10 cases.

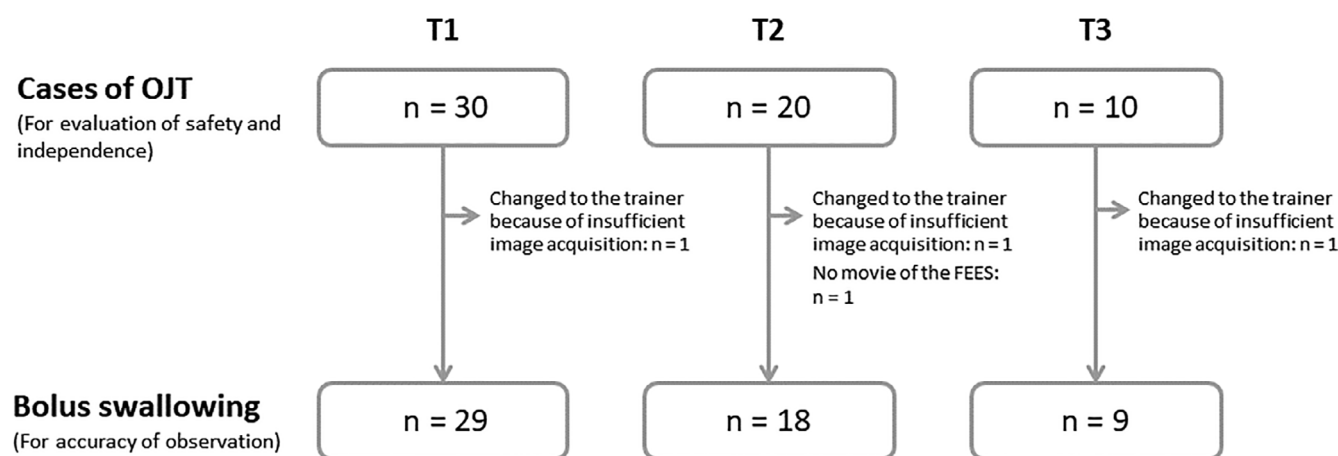
2.3.3 | Accuracy in observing bolus swallowing in dysphagia patients

We evaluated trainees' accuracy in observing bolus swallowing using the penetration-aspiration scale (PAS; Rosenbek, Robbins, Roecker, Coyle, & Wood, 1996) and four levels of severity of residue in the pyriform sinus and epiglottis valley at each bolus swallowing; both the

TABLE 2 Details of participants

	T1	T2	T3
A. Characteristics			
Age	40s	30s	40s
Work setting	Hospital	Hospital	Hospital
Higher education (yes)	CNDN	CNDN	CNDN
Experience being present at FEES	More than 1 year	More than 1 year	More than 1 year
B. Examination results of the education program			
E-learning			
I. Basic knowledge of dysphagia rehabilitation (0–100)	100	100	100
II. Basic knowledge for FEES (0–100)	100	100	100
III. Procedure of FEES and selection of training (0–100)	100	100	100
Practical workshop			
Brief paper test on adverse events (0–100)	100	100	100
Practical examination of FEES (0–100)	100	100	100
After self-learning			
OSCE of bolus swallowing for a healthy adult (1–6)	6 (excellent)	6 (excellent)	6 (excellent)

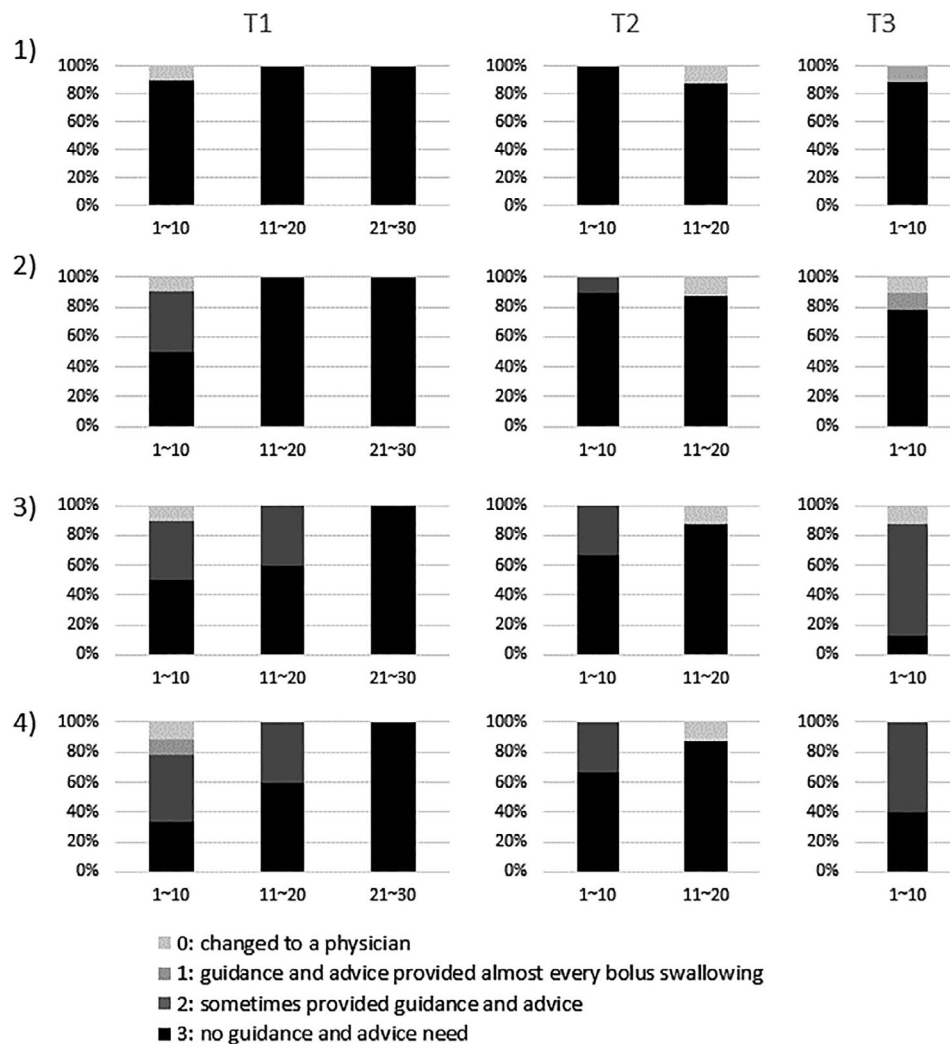
Abbreviations: CNDN, certified nurse in dysphagia nursing through the Japanese Nurses Association; FEES, fiberoptic endoscopic evaluation of swallowing; OSCE, objective structured clinical examination.

**FIGURE 5** Cases of on-the-job training for evaluation of the education program

trainees and the trainer completed these measures. The trainer was a physician or dentist that the research facility placed in charge of FEES. The trainers' evaluations of the PAS and the severity of residue were obtained from the medical chart and were considered correct data. A researcher collected the trainees' evaluation data from the movies of trainees performing FEES in the OJT; this researcher classified each trainee's evaluation as correct or incorrect by comparing it with the trainers' evaluation. A correct evaluation was defined as when a trainee took

images suitable for observation of bolus swallowing without correction from the trainer and their evaluation results matched those of the trainer. An incorrect evaluation included the following two situations: (a) the trainee received guidance from the trainer because the image was not suitable for observation of bolus swallowing; and (b) the trainee had to hand over the operation of the endoscope to the trainer because of insufficient images for observation of bolus swallowing. We calculated the correct answer rate, sensitivity, and specificity for every

FIGURE 6 Changes in autonomy in performing fiberoptic endoscopic evaluation of swallowing (FEES). (1) Observation of morphology and function. (2) Observation of bolus swallowing. (3) Selecting the next examination condition of bolus swallowing. (4) Planning direct/indirect training based on the result of the FEES



10 OJT cases, comparing the trainees' results with the trainer's evaluation, which was considered correct data.

2.3.4 | Other factors

We used registration forms or direct interviews to collected the demographic data of the trainees, including, age, higher education, and previous experience involving FEES.

2.4 | Ethical considerations

The study protocol was approved by the Fujita Health University Research Ethics Committee (approval no. HM17-386). We received approval of informed consent, respect for voluntary participation, no restriction on discontinuation, and protection of anonymity and individual data. Based on this approval, trainee candidates in the research facility were given a comprehensive

participant information sheet and asked to give their written informed consent before participating in the study. Healthy volunteers for OSCE were fully informed about the study by research assistants. The research assistants also gave dysphagia patients a research information sheet and asked them to provide written informed consent before the OJT.

3 | RESULTS

Three certified nurses in dysphagia nursing (CNDNs) by the Japanese Nurses Association participated in the FEES education program (Table 2). All three CNDNs successfully completed the e-learning, the brief written test of knowledge on the prevention and care of adverse events, and the practical examination of performing FEES on a healthy adult at the end of the practical workshop. In addition, they all received a score of six ("excellent" [i.e., equal to the level of the trainer]) on the OSCE. As of this study, one trainee had completed all 30 OJT cases,

TABLE 3 Accuracy of observing bolus swallowing in dysphagia patients

	PAS	Residue in the pyriform sinus	Residue in the epiglottis valley
Correct answer rate (%)			
1–10 cases	92.8	94.8	94.8
11–20 cases	100	100	100
21–30 cases	100	100	100
Sensitivity (%)			
1–10 cases	93.1	94.8	94.8
11–20 cases	100	100	100
21–30 cases	100	100	100
Specificity (%)			
1–10 cases	93.4	95.9	94.2
11–20 cases	100	100	100
21–30 cases	100	100	100

Note: Data are the mean of every 10 cases.

Abbreviations: PAS, penetration-aspiration scale.

while the other two trainees had completed 20 and 10 cases (Figure 5). No adverse events occurred during these cases, and there were no cases in which a trainer stopped the trainee from performing FEES because of possible harm to healthy volunteers or patients. Each trainee did have a case in which the trainer took over the operation of the endoscope because the trainee was unable to obtain a sufficient image for observation of morphology and function of swallowing; as a result, the trainee could not perform FEES to observe bolus swallowing (Figure 5).

The trainees' autonomy in performing the four FEES skills gradually increased through the OJT (Figure 6). All participants were able, from the beginning of the OJT, to insert the endoscope into the pharyngeal cavity, observe the morphology and function of organs related to swallowing, and observe bolus swallowing. The trainees needed much more supervision in selecting the next examination condition of bolus swallowing and planning direct/indirect training based on the result of FEES. The correct answer rate, sensitivity, and specificity were all above 95% in the first 10 cases of OJT among the three trainees, after which they were all 100% among two trainees (Table 3).

4 | DISCUSSION

This prospective descriptive study demonstrated that the developed education program helped nurses obtain the

knowledge and skills necessary to appropriately and safely perform FEES in 30 cases of patients with dysphagia.

The prevention of adverse events is an exceedingly serious issue in FEES education (Royal College of Speech and Language Therapists, 2015), especially during OJT. Severe adverse events, such as vasovagal reactions, can cause airway obstruction, which can lead to insufficient respiration. Importantly, we observed no adverse events or instances in which the trainer stopped the trainee from performing FEES due to a possible health risk to a healthy volunteer or harm to patients. The use of tests at the end of each of the three phases of the program might have contributed to the prevention of adverse events, because these tests allowed trainers to determine whether the trainees were able to safely perform more advanced tasks.

Observation of bolus swallowing is one of the most difficult FEES skills to master. Western education programs often include a class on the interpretation of endoscopic findings using video sequencing (American Speech-Language Hearing Association, 2002; Dziewas et al., 2016; Royal College of Speech and Language Therapists, 2015). We did not adopt this method because students must also master simultaneous operation of the endoscope to effectively observe bolus swallowing. This is particularly true of penetration/aspiration, which requires intentional operation of the endoscope to observe the areas around the vocal cord immediately after bolus swallowing. Our education program provided nurses with the skills to perform FEES autonomously and accurately. The use of OJT after obtaining basic skills, such as inserting the endoscope into the pharyngeal cavity, might promote effective learning of understanding endoscopic findings.

This education program improved FEES skills and knowledge. Selecting the next examination condition is a complex clinical skill, and, in the case of FEES, requires observation of bolus swallowing, as well as knowledge of dysphagia care (including diet modifications, adjustment of posture, and feeding strategies). The trainees needed far more guidance and advice in selecting the examination condition compared to their observation skills in the first 10 cases of OJT. Nevertheless, their autonomy in selecting the examination condition gradually increased during their OJT. This learning curve seems to be related to trainees' understanding of using an algorithm based on the endoscopic findings of bolus swallowing to select the examination condition.

The increase in older adults with dysphagia in Japan has brought a concomitant increase in the need for appropriate dysphagia care based on swallowing function in a variety of settings. Nurses who completed the FEES

education program may be able to contribute to such dysphagia care. However, observation of bolus swallowing using an endoscope can be difficult, particularly in cases of severe dysphagia that cannot be assessed before inserting the endoscope (Royal College of Speech and Language Therapists, 2015). Even though nurses stop the FEES before bolus swallowing, they are still able to roughly speculate on the severity of dysphagia and the causes of dysphagia symptoms. It is important for nurses to learn to observe abnormalities in the morphology of organs related with swallowing or large amounts of secretions in the laryngeal cavity. Using the algorithm we developed to determine whether swallowing observation can be performed, nurses may be able to confidently and securely proceed with FEES during bolus swallowing to safely provide appropriate dysphagia care.

The first limitation of this study is that two of the three trainees have not yet completed all 30 OJT cases. Nevertheless, the mean correct answer rate, sensitivity, and specificity of the first 10 cases of OJT were high among all trainees, and they were 100% for the next 10 cases (cases 11–20) among the two trainees who had completed 20 cases. We therefore expect that the two trainees still in the process of completing the OJT phase will show good FEES performance. The second limitation is that all three nurses had experience being present for FEES in clinical practice before participating in the education program. This experience might have affected the learning curve of the four FEES skills.

5 | CONCLUSION

Our results suggest that the education program developed in this study helped nurses, who had experience being present for FEES, obtain the knowledge and skills necessary to appropriately and safely perform FEES in 30 cases of OJT. Future studies should test the feasibility of the education program among nurses without previous experience of FEES.

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DISCLOSURE AND CONFLICT OF INTERESTS

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AUTHORS' CONTRIBUTIONS

M.Y. contributed to the conception, design, data collection, and analysis of the study, and drafted and critically revised the article for important intellectual content. H.K., Y. K., and E.S. contributed to the conception, design, data collection, and analysis of the study, and critically revised the article for important intellectual content. Y.M. and Y.O. contributed to the acquisition of the data and analysis of the study. H.S. contributed to the conception and design of the study, critically revised the article for important intellectual content, and approved the final version to be published.

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APPENDIX 1 THE CONTENTS OF THE FEES EDUCATION PROGRAM

Phase 1: Obtaining knowledge and skills

A. E-learning (lectures and tests)

I. Basic knowledge of dysphagia and its rehabilitation (40 min)

(1) Theory of dysphagia rehabilitation

- a. Definition of dysphagia
- b. Aim and procedure of dysphagia rehabilitation

(2) Normal swallowing

- a. Models of swallowing process
- b. Anatomy and maneuvering of organs and muscles related to swallowing process

(3) Causes and pathophysiology of dysphagia

- a. Symptoms of dysphagia in relation to the swallowing process
- b. Aging
- c. Stroke

(4) Details of dysphagia rehabilitation

(Continues)

- a. Screening and evaluation methods of dysphagia
- b. Scales of dysphagia severity
- c. Direct and indirect training

II. Basic knowledge of FEES (30 min)

- (1) Legal basis for nurses to perform FEES
- (2) System of FEES
 - a. Equipment
 - b. Precautions in handling the endoscope
 - c. Methods of preventing infection through the endoscope
 - d. Characteristics of endoscopic image for handling endoscope safely
- (3) Standard procedure of inserting the endoscope
 - a. Nursing scope of patient's medical condition for FEES
 - b. Required articles
 - c. Preparations
 - d. Endoscope handling and placement
 - e. Adverse events

III. FEES procedure and selection of training (15 min)

- (1) Observation of morphology and function of swallowing
 - a. First observation point: nasopharyngeal cavity closure
 - b. Second observation point: residue in the pyriform sinus and epiglottis valley
 - c. Third observation point: penetration
- (2) Observation of bolus swallowing
 - a. Normal swallowing
 - b. Penetration/aspiration during/after bolus swallowing
 - c. Residue after bolus swallowing
- (3) Standard procedure of bolus swallowing
 - a. Algorithm to proceed bolus swallowing examination
 - b. Algorithm for the selection of the next examination condition of bolus swallowing
 - c. Contents of the condition of bolus swallowing
 - d. Recording the results of FEES and planning direct/indirect training

IV. Examination (minimum requirement: 90% correct)

- 20 questions of "I. Basic knowledge of dysphagia and its rehabilitation"
- 20 questions of "II. Basic knowledge of FEES"
- 20 questions of "III. FEES procedure and selection of training"

B. Practical workshop (lecture and practice)

I. Basic skills in operating the endoscope (lecture: 45 min, practice: 40 min)

- a. Handling and insertion of endoscope into the phantom

II. Basic skills in performing FEES (lecture: 30 min, practice on healthy people: 105 min)

- a. Observation of morphology and function of swallowing in a healthy adult
- b. Observation of normal bolus swallowing

III. Examination

- a. Brief written test on knowledge of prevention and care for adverse events (30 min)
- b. Practical examination of FEES for a healthy adult (30 min)

Phase 2: Becoming proficient in skills for assessing healthy adults through self-learning

A. Self-learning

(Continues)

- (1) FEES practice among trainees
- (2) Practical guidance and feedback from trainers

B. Objective structured clinical examination (OSCE) (30 min, minimum requirement: above four overall evaluation score)

- (1) Observation of morphology and function of swallowing
- (2) Observation of bolus swallowing using five different test foods or liquids for a healthy person

Phase 3: Obtaining clinical competence via OJT

A. OJT of FEES among dysphagia patients

- (1) Observation of morphology and function of swallowing
- (2) Observation of bolus swallowing
- (3) Selecting the next examination condition of bolus swallowing
- (4) Planning direct/indirect training based on the results of FEES
- (5) Practical guidance and feedback from trainers

B. Examination (each OJT case, minimum requirement: above four overall evaluation score at 30th case)

- (1) Safety of FEES
- (2) Accuracy in observing morphology and function
- (3) Accuracy in observing bolus swallowing while selecting the next examination condition

Abbreviations: FEES, fiberoptic endoscopic evaluation of swallowing; OJT, on-the-job training.

APPENDIX 2 OVERALL EVALUATION SCORES OF OBJECTIVE STRUCTURED CLINICAL EXAMINATION AND FINAL EXAMINATION OF ON-THE-JOB TRAINING

Score	Criteria	Definition
6	Excellent (equal to the level of the trainer):	Completed the examination within 20 min without advice from the examiner and without hesitation.
5	Good (good as a trainee):	Completed the examination within 20 min without advice from the examiner, while occasionally pausing
4	Above the minimum requirement:	Completed the examination within 20 min with advice from the examiner and with some pausing
3	Border level:	Completed the examination within 20 min, but failed some action even given the advice of the examiner.
2	Failure but improvable level:	Needed more than 20 min to complete the examination, or failed more than one-third of actions even given the advice of the examiner.
1	Clear failure:	Suspended the exam, or needed more than 20 min to complete the examination, with actions that failed even given the advice of the examiner.