

Association of Sex Mismatch Between Patients and Speech–Language Therapists with Favorable Outcome in Eating and Swallowing Functions in Dementia Care: A Pilot Study

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Purpose: This retrospective observational study explored the hypothesis that sex mismatch between patients and their attending speech–language therapists (STs) would contribute to the recovery of patients' eating and swallowing functions.

Patients and Methods: The pilot study was conducted in a single medical institution. The participants were inpatients with dementia and dysphagia aged ≥ 70 years who underwent the established clinical pathway to investigate and treat the causes of their decreased oral intake through a multidisciplinary approach. The participants for analysis consisted of 143 patients (male, $n = 58$; female, $n = 85$; mean age, 87 ± 7 years).

Results: At the time of admission and discharge, the food intake level scale (FILS) and functional oral intake scale (FOIS) were not significantly different between the sex-matched (male patient–male ST; female patient–female ST) and sex-mismatched (male patient–female ST; female patient–male ST) groups. However, in the multivariate analysis using binary logistic regression analysis, FILS and FOIS improvement at the level of ≥ 2 points were significantly affected by sex matching (the sex-mismatched group's odds ratio toward the sex-matched group were 2.25 [95% confidence intervals (CI), 1.00–5.04] and 2.96 [95% CI, 1.36–6.45], respectively). Similarly, patients' sex (female) was identified as a significant factor associated with favor outcomes.

Conclusion: In older patients with dementia and dysphagia, interventions with mismatched sex between a patient and an ST can be more effective in improving eating and swallowing functions than interventions with matched sex.

Keywords: sex mismatch, sex differences, food intake level scale, functional oral intake scale, eating and swallowing training, speech–language therapist

Introduction

The prevalence of swallowing disorder among older people with dementia was estimated at 58%, and it was the highest in people with Alzheimer's dementia.¹ Eating and swallowing problems, such as oropharyngeal dysphagia, can lead to poor prognosis in people with advanced dementia.^{2,3} Failure to improve them will indicate that the person is facing the end-of-life and require end-of-life care.⁴ The etiology of eating and swallowing dysfunction is usually heterogeneous and complicated in each person; therefore, interventions should be individualized after interdisciplinary comprehensive evaluations.^{5,6} One of the challenges to improving functions is dementia, which is an inhibitory factor against rehabilitations, particularly in cases with behavioral and psychological symptoms of dementia.⁷ Few specific



interventional methods have provided the evidence for improving eating and swallowing functions in people with dementia.^{8–10} Nowadays, oropharyngeal dysphagia has become a global health problem.¹¹

Although speech–language therapists (STs) are the most important medical staff providing rehabilitations to patients with dysphagia, no studies have researched effective assessment and management procedures or developed guidance on best practice by STs.¹² However, we identified that STs play important roles on the interdisciplinary comprehensive evaluations for eating and swallowing disorders in the older patients with dementia.⁵ In addition, there was an indication that an ST-related factor affects the effectiveness of eating and swallowing training. Especially, when interventions were performed by an ST opposite the patient's sex, eating and swallowing functions were more likely to be improved.

The gender preferences of patients toward medical providers have been extensively studied.^{13–20} These preferences may influence their adherence to clinical interventions. Reportedly, sex differences in medical providers can affect patient outcomes,^{21–24} suggesting that there may exist a relationship between the effectiveness of clinical interventions and combinations between the sexes of a patient and a medical provider. However, no studies have reported on the effect of sex differences between the patient and ST on the effectiveness of eating and swallowing training. Therefore, this study was conducted to explore the hypothesis that sex differences between patients and STs were a significant factor associated with the recovery from eating and swallowing disorders in older patients with severely decreased oral intake.

Materials and Methods

Study Design

This is a retrospective observational study based on a review of medical records. The study was approved by the Institutional Review Board of Nanto Municipal Hospital (No. Shiminbyouin-352) at August 5, 2022. The need for informed consent was waived because this study did not involve participant intervention and met the requirements for the waiver according to the Japanese Ethical Guidelines for Medical and Biological Research Involving Human Subjects.²⁵ This study was conducted in accordance with the principles stated in the Declaration of Helsinki, and complete confidentiality of patient data was ensured. This report followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement, which is guidelines for reporting observational studies.²⁶

Study Setting and Participants

This retrospective observational study was performed at Nanto Municipal Hospital, which is located in a rural and super-aged area in Japan. This hospital has wards for acute medical care, including emergency, surgery, orthopedics, urology, and internal medicine, and a rehabilitation ward for patients with disability after the acute phase. For eating and swallowing rehabilitation, a single ST is usually assigned to each patient, and a patient rarely receives training by another ST.

The participants were all patients who had received ST intervention, which was completed through the “Clinical Pathway for Evaluating Eating and Swallowing Functions” (CP) at our hospital between April 1, 2013, and July 31, 2022. The inclusion criteria, CP contents, and interventions by STs were already reported elsewhere.⁵ In summary, the eligibility criteria for receiving interventions by the CP were as follows: (1) hospitalized patients with dementia aged ≥ 70 years, (2) scored ≤ 23 in the Japanese version of the Mini-Mental State Examination (MMSE-J),²⁷ or ≤ 20 in the revised Hasegawa dementia rating scale (HDS-R),²⁸ (3) did not receive intravenous or surgical treatment, (4) oral intake of ≤ 500 kcal per day, and (5) dependent on artificial hydration and/or nutrition (AHN). The exclusion criteria of this study were specific factors that could disturb ST interventions, such as (1) dependence on persistent tube feeding, (2) anatomical abnormalities in the pharyngeal and laryngeal area due to surgery or tumors, (3) recipient of end-of-life care, and (4) death before discharge. The criterion (4) for exclusion was adopted because eating and swallowing functions could not be measured at discharge.

Variables and Data Source

All variables were obtained from the database of the CP and patients' medical records. The primary outcome of interest was eating and swallowing functions, which was evaluated by the food intake level scale (FILS) and functional oral

intake scale (FOIS).^{29,30} These two scales were both measured by the ST in charge at the first intervention through the CP and at discharge. Other variables that could influence the primary outcome were collected, such as sex of the attending medical care workers, patients' characteristics at admission (age, sex, diagnosis, past medical history, and types of dementia), HDS-R, MMSE-J, vitality index (VI),³¹ Barthel index (BI),³² AHN types (peripheral infusions, central venous infusions, nasal tube feeding, and others), and repetitive saliva swallowing test (RSST).³³ All the above variables were entered in the medical records and assessment sheets of the CP.⁵ In addition, the sex of the attending ST, years of experience of the ST, and time spent on eating and swallowing training by ST were extracted from the medical records. The sexes were all self-reported and not confirmed with biological data such as chromosomal tests.

Statistical Analysis

When conducting this study, no previous studies served as a reference for determining the sample size. Therefore, all patients who were eligible for inclusion in the study, which was considered as a pilot study, were analyzed.

Initially, whether the outcome would be altered by the combinations of sex between the patients and STs was analyzed. When the sex of the patient and the ST was different, the intervention was defined as an opposite-sex intervention and assigned to the sex-mismatched group (a combination of male patient–female ST or female patient–male ST), and when they were the same, it was defined as a same-sex intervention and assigned to the sex-matched group (a combination of male patient–male ST or female patient–female ST). The sex combination was not determined randomly but was based on selections by the administrator in usual medical practice. For comparisons between the two groups, normally distributed numerical variables were compared using *t*-tests and recorded as means with standard deviations, whereas non-normally distributed numerical variables were compared using the Mann–Whitney *U*-test and recorded as medians with interquartile ranges (IQRs). The proportions of categorical data were compared using Fisher's exact test. To investigate the correlation between the years of experience of the STs and the change in FILS and FOIS, Pearson's product–moment correlation was performed.

Then, binary logistic regression was employed to analyze the factors that contributed to improving eating and swallowing functions in the study population. As criterion variables, whether “improved” or “not improved” on FILS and FOIS was selected, “improved” was defined if the patient's FILS and FOIS had increased at least two points, respectively. Such cutoff point of FILS/FOIS improvement was set because one point of improvement might be achieved by adjusting patients' meals based on the discretion of caregivers even if their eating and swallowing functions were unaltered. Multivariate analysis was carried out using all the indicators as explanatory variables, which were obtained at the first analysis. The variable “the sex of the attending ST” was excluded from this analysis because it was not an independent factor of the opposite-sex/same-sex interventions. Given that the number of explanatory variables used simultaneously in multivariate analysis is usually limited by the number of events (or outcomes), we set 15 event occurrences per explanatory variable. The stepwise selection method using the Akaike's Information Criterion was used for the multivariate analysis to minimize the independent variables adapted to the model. The results were presented as odds ratios with 95% confidence intervals (CI) for FILS/FOIS improvement. All statistical analyses were performed using EZR version 1.54 (Saitama Medical Center, Jichi Medical University, Saitama, Japan), which is a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria, version 4.0.3).³⁴ A two-sided *P*-value <0.05 was considered significant.

Results

Participants' Characteristics and the Time of Interventions

Of all the patients who underwent the CP during the target period, 143 (male, *n* = 58; female, *n* = 85) were eligible in the analysis (Table 1). All participants were Japanese (east Asian) people. The mean age of the participants was very high (87±7 years), and past stroke and pneumonia were seen in 33% and 35% of the participants, respectively. Most attending physicians' sex was male (Table 1). The sexes of other medical care workers were not determined because the attending persons were either several or none. More than half of the participants had scored zero on BI, HDS-R, and MMSE-J, and the others had low scores (Table 1). VI is an objective scale to measure vitality in elderly patients with dementia (the

Table 1 Patients' Characteristics at Baseline

Variables	Total (N = 143)	Sex-Mismatched Group (N = 74)	Sex-Matched Group (N = 69)	P
Sex of the patients: male, N (%)	58 (41)	41 (55)	17 (25)	<0.01
Sex of the attending physicians: male, N (%)	134 (94)	68 (92)	66 (96)	0.50
Age, years — mean \pm SD	87 \pm 7	86 \pm 8	88 \pm 7	0.17
Reason of admission, N (%)				0.37
Reduced intake	38 (27)	15 (20)	23 (33)	
Aspiration pneumonia	26 (18)	15 (20)	11 (16)	
Infectious disease	22 (15)	15 (20)	7 (10)	
Stroke	16 (11)	6 (8)	10 (14)	
Cardiopulmonary disease	12 (8)	6 (8)	6 (9)	
Intestinal disease	7 (5)	5 (7)	2 (3)	
Orthopedic diseases	10 (7)	6 (8)	4 (6)	
Others	12 (8)	6 (8)	6 (9)	
Past stroke, N (%)	47 (33)	25 (34)	22 (32)	0.86
Past pneumonia, N (%)	50 (35)	31 (42)	19 (28)	0.08
AHN type, N (%)				1.00
Tube feeding	16 (11)	8 (11)	8 (12)	
Infusions	127 (89)	66 (89)	61 (88)	
Central venous infusions	12	2	10	
Peripheral infusions	115	64	51	
HDS-R, score — median (IQR)	0 (0–5)	0 (0–8)	0 (0–0)	0.02
HDS-R = 0, N (%)	97 (68)	45 (61)	52 (75)	0.07
MMSE-J, score	0 (0–7)	0 (0–11)	0 (0–1)	0.047
MMSE-J = 0, N (%)	97 (68)	46 (62)	51 (74)	0.15
VI, score — median (IQR)	3 (2–5)	4 (2–5)	3 (1–4)	0.049
BI, score — median (IQR)	0 (0–5)	0 (0–5)	0 (0–5)	0.34
BI = 0, N (%)	89 (62)	43 (58)	46 (67)	0.31
RSST, N (%)				0.66
≥ 3	5 (3)	2 (3)	3 (4)	
2	12 (8)	6 (8)	6 (9)	
1	40 (28)	24 (32)	16 (23)	
0	86 (60)	42 (57)	44 (64)	

Notes: All variables were obtained through the clinical pathway.⁵ P-values were calculated between the sex-mismatched and sex-matched groups.

Abbreviations: AHN, artificial hydration and/or nutrition; BI, Barthel index; HDS-R, revised Hasegawa dementia rating scale; IQR, interquartile range; MMSE-J, the Japanese version of the Mini-Mental State Examination; RSST, repetitive saliva swallowing test; SD, standard deviations; VI, vitality index.

higher score is better),³¹ and was significantly higher in the sex-mismatched group (Table 1). All participants were independent on AHN, 16 (11%) were on nasal tube feeding, and 127 (89%) were on infusions (Table 1). The mean and median total times for eating and swallowing training by ST were 755 and 500 min, respectively (IQR, 215–1020).

Relations Between Sex Combinations and Outcomes

The sex-mismatched and sex-matched groups included 74 (male, n = 41; female, n = 33) and 69 (male, n = 17; female, n = 52) patients, respectively. The sex proportion was significantly different between the two groups (Table 1). HDS-R

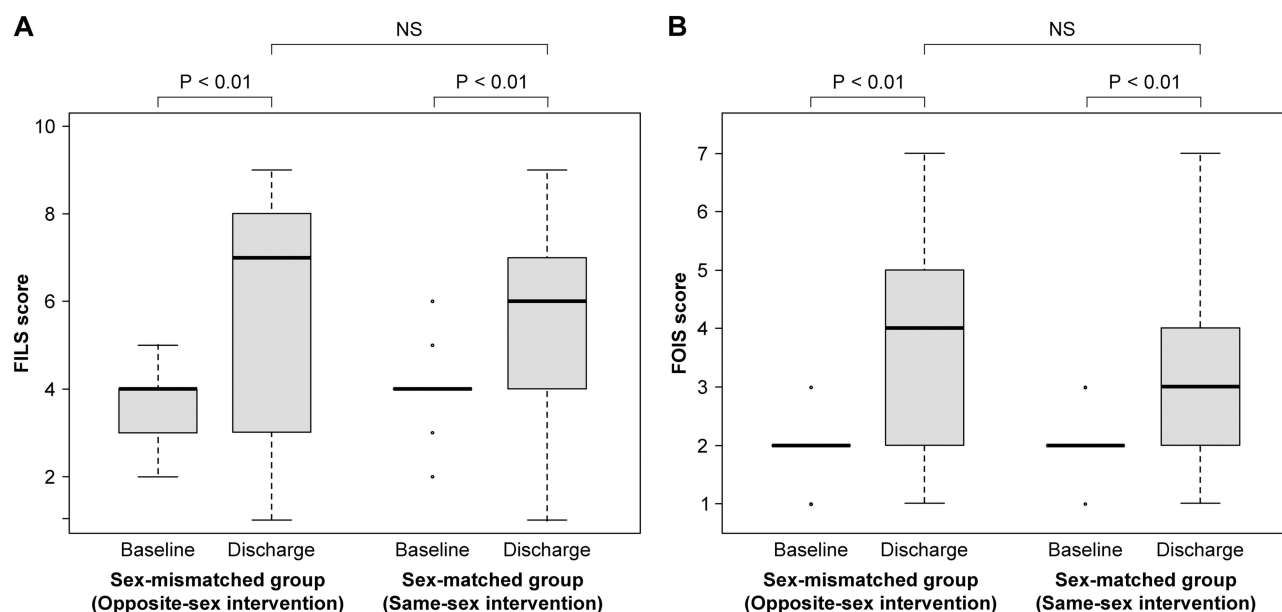


Figure 1 Changes in eating and swallowing functions during the hospitalization. Changes in (A) FILS and (B) FOIS. They had significantly improved during hospitalization; however, no significant difference was found between the two groups at discharge.

Abbreviations: FILS, food intake level scale; FOIS, functional oral intake scale; NS, not significant.

and MMSE-J scores, indicators of cognitive functions, were also significantly higher in the sex-mismatched group than in the sex-matched group (Table 1). Although many patients scored zero per HDS-R and MMSE-J, most could communicate with STs using simple words. No correlation was found between the years of experience of the STs and the change in FILS or FOIS (Figure S1). Although FOIS and FILS had significantly increased after ST interventions, no significant difference was found between the two groups before and after interventions (Figure 1 and Table 2). Between the two

Table 2 Interventions and Outcomes Related to Eating and Swallowing Functions

Variables	Sex-Mismatched Group (N = 74)	Sex-Matched Group (N = 69)	P
Total training time by the ST, minutes — median (IQR)	460 (280–915)	500 (180–1140)	0.94
Years of experience of the ST — median (IQR)	8 (4–15)	8 (3–15)	0.65
FILS			
Score at baseline — median (IQR)	4 (3–4)	4 (4–4)	0.42
Score at discharge — median (IQR)	7 (3–8)	6 (4–7)	0.13
Improved ≥ 1, N (%)	52 (70)	48 (70)	1.00
Improved ≥ 2, N (%)	47 (64)	41 (59)	0.73
FOIS			
Score at baseline — median (IQR)	2 (2–2)	2 (2–2)	0.86
Score at discharge — median (IQR)	4 (2–5)	3 (2–4)	0.21
Improved ≥ 1, N (%)	52 (70)	47 (68)	0.86
Improved ≥ 2, N (%)	45 (61)	32 (46)	0.10

Abbreviations: FILS, the food intake level scale; FOIS, functional oral intake scale; IQR, interquartile range; ST, speech–language therapists.

groups, no significant difference was found in the proportion of the participants who gained at least two points in FILS or FOIS (Table 2). The total time for eating and swallowing training by ST was also not significantly different (Table 2).

Factors Associated with Improvement of FILS and FOIS

Tables 3 and 4 show the results of the logistic regression analysis using the extracted indicators as explanatory variables (univariate and multivariate analysis, respectively). Because the minimum number of criterion variables was 69, the number of explanatory variables used simultaneously in multivariate analysis was 4, and the final model was obtained after repetitive backward stepwise selections using various combinations of explanatory variables (Figures S2 and S3). The multivariate analysis concluded that the sex of the patients, opposite-sex interventions, and FILS at baseline were identified as significant factors associated with FILS improvement (Table 4). Similarly, the sex of patients and opposite-sex interventions were identified as significant factors associated with FOIS improvement (Table 4). Based on these results, the common factors associated with the improvement of FILS and FOIS were the sex of patients and opposite-sex interventions.

Discussion

This study was conducted based on the hypothesis that eating and swallowing training would be more effective when performed by an ST of the opposite sex to the patient rather than the same sex, particularly in rehabilitations for older patients with severe dementia and dysphagia. The assessment for patients' status and functions were identical according to the CP. As a result, opposite-sex combination between the ST and patient was identified as one of the contributing factors for improvement by at least two points in FILS and FOIS (odds ratio, 2.25 [95% CI 1.00–5.04] and 2.96 [1.36–6.45], respectively). Interestingly, significant

Table 3 Factors Associated with FILS and FOIS Improvement (Univariate Logistic Regression Analysis)

No.	Factors	On FILS Improvement Odds Ratio (95% CI)	P	On FOIS Improvement Odds Ratio (95% CI)	P
1	Age, years	1.01 (0.96–1.06)	0.69	1.00 (0.96–1.05)	0.99
2	Sex of the patient, female	3.32 (1.64–6.71)	<0.01	2.35 (1.19–4.64)	0.01
3	Opposite-sex intervention	1.19 (0.61–2.33)	0.62	1.79 (0.92–3.49)	0.08
4	Sex of the attending physician, female	0.77 (0.20–2.99)	0.70	0.67 (0.17–2.60)	0.56
5	Years of experience of the ST	1.02 (0.97–1.08)	0.44	1.02 (0.97–1.07)	0.48
6	Past stroke	0.88 (0.43–1.81)	0.74	0.66 (0.33–1.32)	0.24
7	Past pneumonia	1.03 (0.51–2.09)	0.93	0.89 (0.45–1.78)	0.75
8	AHN, tube feeding	0.59 (0.21–1.67)	0.32	0.47 (0.16–1.38)	0.17
9	HDS-R > 0 (vs =0)	0.84 (0.41–1.72)	0.63	1.17 (0.58–2.38)	0.66
10	MMSE-J > 0 (vs =0)	0.96 (0.47–1.97)	0.91	1.17 (0.58–2.38)	0.66
11	VI, score	0.90 (0.78–1.04)	0.15	0.95 (0.83–1.10)	0.52
12	BI > 0 (vs =0)	1.42 (0.70–2.88)	0.33	1.42 (0.72–2.82)	0.31
13	RSST = 0 (vs >0)	0.79 (0.39–1.58)	0.50	0.76 (0.39–1.50)	0.43
14	FILS at baseline	1.85 (1.13–3.03)	0.02	1.68 (1.03–2.73)	0.04
15	FOIS at baseline	1.78 (0.75–4.25)	0.19	1.13 (0.50–2.58)	0.77
16	Total training time	1.00 (1.00–1.00)	0.69	1.00 (1.00–1.00)	0.37

Notes: The definition of FILS/FOIS improvement was an increase of at least two points from admission to discharge.

Abbreviations: AHN, artificial hydration and/or nutrition; BI, Barthel index; CI, confidence interval; FILS, food Intake level scale; FOIS, functional oral intake scale; HDS-R, revised Hasegawa dementia rating scale; MMSE-J, the Japanese version of the Mini-Mental State Examination; NA, not available; RSST, repetitive saliva swallowing test; VI, vitality index.

Table 4 Factors Associated with FILS and FOIS Improvement (Multivariate Logistic Regression Analysis)

Factors	On FILS Improvement Odds Ratio (95% CI)	P	On FOIS Improvement Odds Ratio (95% CI)	P
Sex of the patient, female	3.73 (1.67–8.34)	0.01	3.22 (1.47–7.09)	<0.01
Opposite-sex intervention	2.25 (1.00–5.04)	0.049	2.96 (1.36–6.45)	<0.01
VI, score	0.89 (0.76–1.05)	0.15	Excluded	NA
FILS at baseline	1.86 (1.10–3.16)	0.02	1.64 (0.99–2.70)	0.054

Notes: FOIS improvement was defined as an increase of at least two points from admission to discharge. “Excluded” indicates that the indicator was excluded through the multivariate logistic regression analysis adapting the backward stepwise selection method (Figures S1 and S2).

Abbreviations: CI, confidence interval; FILS, food Intake level scale; FOIS, functional oral intake scale; NA, not available; VI, vitality index.

results could not be detected by simple comparison between the sex-mismatched and sex-matched groups (Figure 1, Table 2) but could be detected by multivariate analysis using logistic regression analysis (Table 3 and Table 4). In addition, FILS and FOIS could increase more greatly in female patients than in male patients (odds ratio, 3.73 [95% CI 1.67–8.34] and 3.22 [1.47–7.09], respectively). This might have affected the negative results of the simple comparison between the groups because the proportion of female patients was significantly lower in the sex-mismatched group (Table 1).

Recently, the sex of medical providers was reported to affect patient outcomes. Tsugawa et al reported that hospitalized older patients treated by female physicians had significantly lower mortality and readmission rates than those cared for by male physicians.²¹ Miyawaki et al reported similar results and indicated that the benefit of receiving treatments from female physicians is larger for female patients than for male patients.²² On the contrary, in cardiac rehabilitation, Heald et al reported that some of the outcome measurements significantly improved only in women electing to participate in the mixed-sex group but did not in women-only group, and they concluded that the benefit of women-only cardiac rehabilitation was not evident.³⁵ Although very few studies have focused on these sex effects on patients’ outcomes, the above evidence partially supports the validity of our hypothesis and study results.

The mechanism by which opposite-sex interventions affect patients’ outcomes is unclear. Many residents of elderly care facilities spend most of their day alone and often have unmet needs for love and belonging; however, a study suggested that these can be improved through interventions by caregivers.³⁶ Women are more sensitive to emotions through facial or vocal expressions than men.^{37,38} Opposite-sex interventions might have made the most of those effects, particularly in women. Although this mechanism remains merely speculative, the sex mismatch between a patient and ST may be positively applied to draw out the patient’s remaining abilities, because it has nearly no adverse effects.

Limitations

This study has some limitations. First, this is a retrospective study, not a randomized controlled study. In addition, some ST-related factors, such as clinical skills, contents of interventions, and personality incompatibility toward the patients, have not been examined. Therefore, there may be limited conditions and unknown bias in the interventions. Second, the influence of staff members other than STs (such as physicians, dentists, nurses, physical therapists, occupational therapists, caregivers, dietitians, and dental hygienists) were not considered in the analysis. However, considering the role of each profession, other staff had unlikely a greater influence on improving eating and swallowing function than ST. Third, the severity of the underlying disease and treatment course were not considered in the analysis, making their effect on feeding function unclear. Fourth, the intervention by the CP is specific and limited to our institution, making them difficult to reproduce in other facilities. As a result, the findings limit its generalizability. Despite the above limitations, the results of this study could provide a new perspective on selecting more effective eating and swallowing training. Further studies such as randomized controlled trials and multicenter prospective studies are necessary to confirm the reproducibility of the results.

Conclusion

This study presents that in older patients with dementia and dysphagia, training by an ST opposite the patient's sex (opposite-sex intervention) can be more effective in improving eating and swallowing functions than by ST with matched sex (same-sex intervention). Because this is a pilot study, more studies are warranted to prove this effect.

Abbreviations

AHN, artificial hydration and/or nutrition; BI, Barthel index; CI, confidence interval; CP, the Clinical Pathway for Evaluating Eating and Swallowing Functions; FILS, food intake level scale; FOIS, functional oral intake scale; HDS-R, revised Hasegawa dementia rating scale; IQR, interquartile ranges; MMSE-J, the Japanese version of the Mini-Mental State Examination; RSST, repetitive saliva swallowing test; ST, speech–language therapists; VI, vitality index.

Data Sharing Statement

The datasets and protocol of this study are available from the corresponding author upon a reasonable request. The data are inaccessible to the public.

Ethics Approval and Informed Consent

This study was approved by the Institutional Review Board of Nanto Municipal Hospital (No. Shiminbyouin-352) on August 5, 2022. This study did not involve any participants; therefore, the need for informed consent was waived.

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Disclosure

The authors report no conflicts of interest in this work.

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