Professional Dental Care to Reduce the Recurrence of Aspiration Pneumonia: A Prospective Cohort Study

Taiju Miyagami
Juntendo University Faculty of Medicine

Yuji Nishizaki (ynishiza@juntendo.ac.jp)
Juntendo University Faculty of Medicine

Ryoko Imada
Tokyo Medical and Dental University

Kohei Yamaguchi
Tokyo Medical and Dental University

Masanori Nojima
The University of Tokyo

Koshi Kataoka
Juntendo University School of Medicine

Mizuki Sakairi
Juntendo University Faculty of Medicine

Nozomi Aoki
Juntendo University Faculty of Medicine

Takayuki Funusaka
Juntendo University Faculty of Medicine

Seiko Kushiro
Juntendo University Faculty of Medicine

Kwang-Seok Yang
Juntendo University Faculty of Medicine

Toru Morikawa
Nara City Hospital

Haruka Tohara
Tokyo Medical and Dental University

Toshio Naito
Juntendo University Faculty of Medicine
Abstract

BACKGROUND

Aspiration pneumonia has a high recurrence rate, and oral care by dentists has been reported to be effective in preventing the onset of aspiration pneumonia; however, this has not been evaluated using prospective studies. Therefore, we conducted a prospective study to evaluate the effectiveness of professional oral care by dentists in reducing the recurrence of aspiration pneumonia in older adult patients.

METHODS

This was a prospective cohort study to evaluate a dental oral care intervention with a historical control. It was conducted at a single-center regional core hospital in Japan that serves a large number of patients aged > 80 years. Patients who were hospitalized for aspiration pneumonia were included in this study. The historical control group received oral care from nurses as usual and was followed retrospectively for 1 year. The dentist oral care group received weekly professional oral care from a dentist and was followed prospectively for 1 year. A Kaplan–Meier analysis was used to evaluate the timing of recurrent aspiration pneumonia or death events. A Cox proportional hazards model was used to obtain a hazard ratio and to determine the 95% confidence intervals.

RESULTS

There were 91 participants in the dentist oral care group and 94 in the control group. The mean age of participants in this study was 85 years, and 75 (40.5%) were women.

The recurrence rate was 27.5% in the dentist oral care group and 44.7% in the control group, a statistically significant difference ($P = 0.005$). Dentist oral care reduced the risk of recurrence of aspiration pneumonia by approximately 50% (adjusted hazard ratio, 0.465; 95% confidence interval, 0.278–0.78).

CONCLUSIONS

Dentist-provided professional oral care was associated with a lower rate of aspiration pneumonia recurrence than nurse-provided conventional oral care.

Background

The older adult population is increasing worldwide. In particular, Japan has the oldest population, where in 2013, those over 65 years of age exceeded 25% of the population and are expected to exceed 40% by 2060. The global population of persons over 65 years of age is expected to double between 2019 and 2050. In 2020, the Japanese Ministry of Health, Labour and Welfare reported that aspiration pneumonia was the sixth leading cause of death in Japan. The rate of mortality due to aspiration pneumonia, compared with that in 2017, is on the rise, with more deaths from pneumonia occurring in the older age
groups. In addition, there are reports that most cases of community-acquired pneumonia in older adults are due to aspiration pneumonia and that 50% of older adults have an impaired swallowing function and are therefore at a high risk for aspiration pneumonia. Hence, aging is a risk factor for aspiration pneumonia, and improving aspiration pneumonia care is an important issue for the world's aging populace. As Japan has one of the world's largest aging populations, appropriate countermeasures against aspiration pneumonia are urgently required.

Conventional aspiration pneumonia has a high recurrence rate. Prior studies have suggested that 32.4% of the older adult patients hospitalized for pneumonia will have a recurrence within 30 days of admission. Furthermore, 24.2% of the older adult dementia patients with aspiration pneumonia will have a recurrence within 5 years. Moreover, there is no effective treatment, and the mortality rate is high. Therefore, reducing recurrence is one of the most important objectives in treating aspiration pneumonia.

The greatest risk for aspiration pneumonia is dysphagia. Dysphagia can exacerbate the oral environment and result in aspiration pneumonia. In addition, periodontal disease increases the risk of pneumonia by 19%, and consequently, the risk of death from pneumonia. Keeping the oral cavity clean is an extremely important measure to prevent pneumonia in older adults. The effectiveness of oral care by dentists in preventing aspiration pneumonia has attracted the attention of researchers. Patients with Parkinson's disease, a risk factor for aspiration pneumonia, are encouraged to consult a dentist and request oral care as soon as it is diagnosed. There are also reports that professional oral care by a dental hygienist once a week, as compared to regular daily care by nurses, reduced bacteria in the oral cavity.

Hence, dentists' oral care may prevent aspiration pneumonia effectively. However, to the best of our knowledge, there is no evidence based on any prospective studies that indicates that professional oral care actively reduces the risk of recurrence of aspiration pneumonia. Therefore, we conducted this prospective cohort study to evaluate the effectiveness of professional oral care by dentists in reducing the recurrence of aspiration pneumonia in older adult patients.

### Methods

#### Study Design

This study was a prospective cohort study that compared dentist oral care with a historical control group.

#### Setting and Participants

The Juntendo Tokyo Geriatric Medical Center, located in the city-side of Tokyo, is a 404-bed (as of 2021) regional core hospital that specializes in the care of older people. The dentist oral care group consisted of patients who were admitted to the Juntendo Tokyo Koto Geriatric Medical Center between April 1, 2021
and March 31, 2022 for aspiration pneumonia and who subsequently received an intervention of oral care by a dentist. The historical control group included patients aged $\geq 20$ years with a diagnosis record of aspiration pneumonia, according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) code J69.0: Pneumonitis due to inhalation of food and vomit, who were hospitalized between April 1, 2020 and March 31, 2021.

**Dentist Oral Care**

Since the Juntendo Tokyo Geriatric Medical Center does not have a dentist who specializes in the oral care of patients who experience difficulty in swallowing, a dentist from the Tokyo Medical and Dental University Hospital was requested to provide oral care for approximately 10 minutes per patient once a week, as was done in a previous study.\(^{13}\)

The professional oral care consisted of the following in sequence: checking the patient's vital signs and general condition, including the respiratory status; engaging in conversation to reduce anxiety; desensitization as needed (a gradual approach to accessing the oral cavity in a manner that reduces tension and refusal at the contact site); and oral care consisting of light-assisted visualization of the entire oral cavity to assess the dryness, crusts, and loose teeth while placing the patient in a safe position intended to prevent aspiration. For feasibility reasons, including the dentist's availability, the intervention was conducted for up to 4 weeks after the patient was admitted to the hospital. Conventional oral care was then provided by the nurse or by the patients themselves.

**Endpoints**

The primary endpoints were recurrence of aspiration pneumonia within 30 days following remission and death from aspiration pneumonia. We also evaluated the time from remission to recurrence as the secondary endpoint.

**Definition of Aspiration Pneumonia**

Based on the findings of a prior study,\(^7\) aspiration pneumonia was confirmed when the following three conditions were met: (1) imaging findings (such as chest X-ray or chest computed tomography) that were compatible with aspiration pneumonia; (2) aspiration was witnessed by a family member or caregiver or a person was at risk for aspiration pneumonia; and (3) acute respiratory symptoms suggestive of pneumonia were present. Cases with diagnosis of cancer, tuberculosis, or viral pneumonia after admission were excluded.\(^7\) Moreover, patients who developed aspiration pneumonia after hospitalization or did not meet the diagnostic criteria were excluded. Patients who were discharged and readmitted during the observation period were enrolled as independent cases.
Clinical Data

Clinical data including age, sex, length of hospitalization, date of admission, the Clinical Frailty Score (CFS) at admission, and death were collected. The cutoff value for the CFS was 7, based on reports of higher mortality 1 year after admission in patients with a CFS of 7 or higher. According to the findings of prior studies, data were also collected on diseases with a high risk of aspiration pneumonia (history of stroke, multiple sclerosis, Parkinson's disease, diabetes mellitus, chronic obstructive pulmonary disease, lung cancer, gastric and esophageal cancer, history of upper gastrointestinal tract surgery, and dementia). The details of the medications that were used that could lead to a risk of aspiration (for example, proton pump inhibitors) were also collected. The vital signs, including the body temperature, were measured by the nursing staff at the hospital three times a day. They also noted the presence or absence and amount of sputum on four levels (none, small, moderate, and large).

Controlling Bias

The patients included in the control group were determined by the researchers TM and RI. The agreement rate between TM and RI was 97.1%. In the cases where the opinions between TM and RI were divided on whether or not the diagnosis met the diagnostic criteria for aspiration pneumonia, the researcher KS independently determined if they were eligible. The patients included in the dentist oral care group were selected after consulting with the research group (TM, SK, MS, TF, or NA). Any disagreement in the cases was discussed with the other research members to decide independently if they were eligible.

Definition of Recurrent Aspiration Pneumonia

According to a previous study, recurrent aspiration pneumonia was confirmed when the following conditions were met: the patients clinical symptoms specific to pneumonia (such as fever >37.5°C or increased sputum production) were on the nursing record after remission of pneumonia during the observation period (after completion of antimicrobial therapy and fever resolution), and they were re-infused with antimicrobial therapy at the discretion of their physician.

Statistical Analysis

The results are presented as medians (interquartile range) for the continuous variables or as prevalence (%) for the categorical variables. The comparisons between the two groups were performed using the chi-square test. A Kaplan–Meier analysis was used to evaluate the timing of recurrent aspiration pneumonia or death events. Hazard ratios (HRs) and 95% confidence intervals [CIs] were defined using a Cox proportional hazards model. We estimated adjusted HRs using three models to confirm the consistency of the intervention effect. Model 1 was adjusted for dentist oral care, age, and sex. Model 2 was adjusted for dentist oral care, age, sex, diabetes mellitus, and a history of aspiration pneumonia. Model 3 was
adjusted for dentist oral care, age, sex, diabetes mellitus, a history of aspiration pneumonia, dementia, and CFS $\geq 7$. Two types of censoring of patients without recurrent aspiration pneumonia were used: First, patients without recurrence were censored 30 days after remission. Second, patients who were discharged within 30 days after remission were censored on the day of discharge. All the calculations were performed using SAS version 9.4 (SAS Institute, Cary, NC, USA), and $P$ values $< 0.05$ were considered to be statistically significant.

Sample Size and Power Calculation

The sample size for this study depended on the number of patients hospitalized during a defined time period for both the dental care group and the control group and was not set based on a specific statistical hypothesis. For the number of events in this study, 66 cases, the unadjusted log-rank test had a power of 80% when the recurrence rate in the dental care group was assumed to be 49.2%, compared to 24.2%, which was the recurrence rate observed in the control group in this study (alpha was 0.05 on both sides).

Results

In the dental care group, 104 patients were hospitalized and evaluated. After hospitalization, 99 patients were included, excluding the five patients who were diagnosed with cancer, fungal, or viral infections. The number of candidates in the control group was 180. After excluding 58 patients who developed the disease after hospitalization and 21 patients who did not meet the diagnostic criteria, 101 patients were included in the study. In the dentist oral care group, six patients died without remission, two patients terminated the dentist intervention, and the data of 91 patients were analyzed finally. In the control group, seven patients died without remission, and the data of 94 patients were analyzed ultimately (Fig. 1).

The mean age of the participants in this study was $85 \pm 8$ years (mean $\pm$ standard deviation). As shown in Table 1, 96 (40.5%) were women, 54 (29.2%) had Parkinson's disease, 135 (73.0%) had dementia, and 122 (66.0%) had a CFS of 7 or higher. There were no statistically significant differences between the dentist oral care and control groups regarding these factors. Conversely, having diabetes mellitus and a history of cerebrovascular disease differed significantly between the two groups.
Table 1

<table>
<thead>
<tr>
<th></th>
<th>All (n = 185)</th>
<th>Dentist oral care group (n = 91)</th>
<th>Control group (n = 94)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age mean (SD)</td>
<td>85 (8)</td>
<td>84 (8)</td>
<td>85 (8)</td>
<td>0.53</td>
</tr>
<tr>
<td>Sex (Women) n (%)</td>
<td>75 (40.5)</td>
<td>38 (41.8)</td>
<td>37 (39.4)</td>
<td>0.74</td>
</tr>
<tr>
<td>Stroke, n (%)</td>
<td>56 (30.3)</td>
<td>20 (22.0)</td>
<td>36 (38.3)</td>
<td>0.02</td>
</tr>
<tr>
<td>Multiple sclerosis, n (%)</td>
<td>1 (0.5)</td>
<td>0 (0)</td>
<td>1 (1.1)</td>
<td>0.32</td>
</tr>
<tr>
<td>Parkinson's disease, n (%)</td>
<td>54 (29.2)</td>
<td>27 (29.7)</td>
<td>27 (28.7)</td>
<td>0.89</td>
</tr>
<tr>
<td>Diabetes mellitus, n (%)</td>
<td>40 (21.6)</td>
<td>14 (15.4)</td>
<td>26 (27.7)</td>
<td>0.04</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease, n (%)</td>
<td>26 (14.1)</td>
<td>12 (13.2)</td>
<td>14 (14.9)</td>
<td>0.74</td>
</tr>
<tr>
<td>Lung cancer, n (%)</td>
<td>16 (8.7)</td>
<td>9 (9.9)</td>
<td>7 (7.5)</td>
<td>0.56</td>
</tr>
<tr>
<td>Esophageal or gastric cancer, n (%)</td>
<td>18 (9.7)</td>
<td>9 (9.9)</td>
<td>9 (9.6)</td>
<td>0.94</td>
</tr>
<tr>
<td>Upper gastrointestinal operation, n (%)</td>
<td>15 (8.1)</td>
<td>9 (9.9)</td>
<td>6 (6.4)</td>
<td>0.38</td>
</tr>
<tr>
<td>Dementia, n (%)</td>
<td>135 (73.0)</td>
<td>64 (70.3)</td>
<td>71 (75.5)</td>
<td>0.43</td>
</tr>
<tr>
<td>Proton pump inhibitor, n (%)</td>
<td>64 (34.6)</td>
<td>34 (37.4)</td>
<td>30 (31.9)</td>
<td>0.44</td>
</tr>
<tr>
<td>Clinical Frailty Score ≥ 7, n (%)</td>
<td>122 (66.0)</td>
<td>57 (62.6)</td>
<td>65 (69.2)</td>
<td>0.35</td>
</tr>
<tr>
<td>History of aspiration pneumonia, n (%)</td>
<td>46 (24.9)</td>
<td>22 (24.2)</td>
<td>24 (25.5)</td>
<td>0.83</td>
</tr>
</tbody>
</table>

The Kaplan–Meier analysis result showed that 44.7% of patients in the control group had recurrence within the period compared to 24.2% of patients in the dentist oral care group. The comparisons between the two groups using survival analysis with a log-rank test showed a significantly lower recurrence rate in the dentist oral care group (P = 0.0048). The time to relapse averaged 20.0 days for the dentist oral care group versus 12.2 days for the control group (Fig. 2). Table 2 shows the results of the univariate analysis. The HR of dentist oral care was 0.464 (95% CI, 0.277–0.777, P = 0.0035). All the other variables were not statistically significant. Table 3 shows the results of the multivariate analysis. The HR of dentist oral care was 0.465 (95% CI, 0.284–0.805, P = 0.0055) in Model 1. The HR of dentist oral care was 0.479 (95% CI, 0.285–0.807, P = 0.0057) in Model 3. All other variables were not statistically significant.
Table 2
Univariate analysis of the factors associated with the recurrence of aspiration pneumonia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>HR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentist oral care</td>
<td>-0.768</td>
<td>0.464</td>
<td>0.277–0.777</td>
<td>0.0035*</td>
</tr>
<tr>
<td>Age (per 1 year)</td>
<td>0</td>
<td>1</td>
<td>0.971–1.029</td>
<td>0.977</td>
</tr>
<tr>
<td>Sex (Women)</td>
<td>-0.133</td>
<td>0.876</td>
<td>0.53–1.447</td>
<td>0.604</td>
</tr>
<tr>
<td>Stroke</td>
<td>-0.006</td>
<td>0.994</td>
<td>0.586–1.688</td>
<td>0.984</td>
</tr>
<tr>
<td>Multiple sclerosis</td>
<td>-13.015</td>
<td>0</td>
<td>0</td>
<td>0.989</td>
</tr>
<tr>
<td>Parkinson's disease</td>
<td>-0.114</td>
<td>0.892</td>
<td>0.522–1.526</td>
<td>0.677</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>0.339</td>
<td>1.403</td>
<td>0.796–2.474</td>
<td>0.242</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>0.0997</td>
<td>1.105</td>
<td>0.526–2.321</td>
<td>0.792</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>-0.0352</td>
<td>0.965</td>
<td>0.35–2.662</td>
<td>0.946</td>
</tr>
<tr>
<td>Esophageal or gastric cancer</td>
<td>0.0407</td>
<td>1.042</td>
<td>0.475–2.283</td>
<td>0.919</td>
</tr>
<tr>
<td>Upper part gastrointestinal operation</td>
<td>-0.2003</td>
<td>0.818</td>
<td>0.328–2.04</td>
<td>0.667</td>
</tr>
<tr>
<td>Dementia</td>
<td>0.092</td>
<td>1.096</td>
<td>0.615–1.955</td>
<td>0.756</td>
</tr>
<tr>
<td>Clinical Frailty Score ≥ 7</td>
<td>0.01</td>
<td>1.01</td>
<td>0.591–1.728</td>
<td>0.970</td>
</tr>
<tr>
<td>History of aspiration pneumonia</td>
<td>0.122</td>
<td>1.129</td>
<td>0.655–1.948</td>
<td>0.662</td>
</tr>
</tbody>
</table>

HR = Hazard ratio, CI = Confidence interval, * means P< 0.05.
Table 3
Multivariable analysis of the factors associated with the recurrence of aspiration pneumonia

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Variables</th>
<th>Coefficient</th>
<th>Adjusted HR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dentist oral care</td>
<td>-0.765</td>
<td>0.465</td>
<td>0.278–0.78</td>
<td>0.0037*</td>
</tr>
<tr>
<td></td>
<td>Age (per 1 year)</td>
<td>0.001</td>
<td>1.001</td>
<td>0.972–1.031</td>
<td>0.938</td>
</tr>
<tr>
<td></td>
<td>Sex (Women)</td>
<td>-0.115</td>
<td>0.892</td>
<td>0.533–1.492</td>
<td>0.662</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 2</th>
<th>Variables</th>
<th>Coefficient</th>
<th>Adjusted HR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dentist oral care</td>
<td>-0.737</td>
<td>0.479</td>
<td>0.284–0.805</td>
<td>0.0055*</td>
</tr>
<tr>
<td></td>
<td>Age (per 1 year)</td>
<td>0.002</td>
<td>1.002</td>
<td>0.973–1.032</td>
<td>0.880</td>
</tr>
<tr>
<td></td>
<td>Sex (Women)</td>
<td>-0.129</td>
<td>0.879</td>
<td>0.522–1.479</td>
<td>0.627</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
<td>0.267</td>
<td>1.306</td>
<td>0.733–2.326</td>
<td>0.365</td>
</tr>
<tr>
<td></td>
<td>History of aspiration pneumonia</td>
<td>0.104</td>
<td>1.11</td>
<td>0.636–1.938</td>
<td>0.713</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 3</th>
<th>Variables</th>
<th>Coefficient</th>
<th>Adjusted HR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dentist oral care</td>
<td>-0.735</td>
<td>0.479</td>
<td>0.285–0.807</td>
<td>0.0057*</td>
</tr>
<tr>
<td></td>
<td>Age (per 1 year)</td>
<td>0.002</td>
<td>1.002</td>
<td>0.973–1.032</td>
<td>0.899</td>
</tr>
<tr>
<td></td>
<td>Sex (Women)</td>
<td>-0.133</td>
<td>0.875</td>
<td>0.52–1.474</td>
<td>0.617</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
<td>0.273</td>
<td>1.314</td>
<td>0.733–2.356</td>
<td>0.359</td>
</tr>
<tr>
<td></td>
<td>History of aspiration pneumonia</td>
<td>0.098</td>
<td>1.103</td>
<td>0.624–1.951</td>
<td>0.735</td>
</tr>
<tr>
<td></td>
<td>Dementia</td>
<td>0.1</td>
<td>1.105</td>
<td>0.614–1.987</td>
<td>0.740</td>
</tr>
<tr>
<td></td>
<td>Clinical Frailty Score ≥ 7</td>
<td>0.001</td>
<td>1.001</td>
<td>0.567–1.765</td>
<td>0.999</td>
</tr>
</tbody>
</table>

HR = Hazard ratio, CI = Confidence interval, * means P< 0.05.

Discussion
In this study, the dentist oral care group (in which dentists provided professional oral care) had a lower rate of aspiration pneumonia recurrence and a longer time to recurrence after remission than the control group in which nurses provided conventional oral care. To the best of our knowledge, this is the first report of a prospective cohort study on dentist oral care intervention with the primary endpoint being the recurrence of aspiration pneumonia.
Results of the Multivariable Analysis

Due to the limited number of patients in this study, a multivariable analysis was performed using multiple models. Comparing the results of the three models, we found little difference in the HRs for dentist oral care. Since we had originally speculated that the effect of dentist oral care was unlikely to be confounded by anything other than the timing of intervention (change in quality of treatment with time), these results support our speculation.

Effectiveness of Professional Oral Care

A previous systematic review of relevant literature recommended that weekly professional oral care be provided to older frail patients to prevent aspiration pneumonia. Another study also reported that after 1 month of weekly professional oral care in older patients, oral commensal bacteria decreased in the dentist oral care group and that the effect lasted for 3 months. In addition, case reports have shown the effectiveness of professional oral care by dentists in treating recurrent aspiration pneumonia.

The Importance of Team Medical Care for Aspiration Pneumonia

After a cerebral infarction, the oral hygiene environment is likely to become unsanitary, and patients are at risk for aspiration pneumonia; therefore, thorough preventive oral care is recommended. The effectiveness of oral dental care in preventing aspiration pneumonia in stroke patients has also been shown. In addition, oral care by dentists for patients scheduled to undergo surgery for esophageal cancer can help prevent aspiration pneumonia after surgery. Parkinson's disease is a risk factor for aspiration pneumonia; therefore, patients with Parkinson's disease should consult a dentist and request oral care when they are diagnosed. Collaboration between these areas of specialization should be promoted in future.

Recurrence Rate of the Control Group

The 44.7% 30-day recurrence rate of aspiration pneumonia in our study’s control group was higher than that found in previous studies. In a study by Takeda et al, the recurrence of pneumonia within 30 days was 5.5%. The proportion of recurring cases attributed to aspiration pneumonia was not determined. Additionally, the mean age of the participants was younger than in our study (80 versus 85 years), and the patient backgrounds were unknown, making a simple comparison difficult.

Yoon et al. reported a recurrence rate of 24.2% over 5 years. Their study also differed from the present study in that the mean age was lower (78 versus 85 years), and the outcome was assessed by rehospitalization for aspiration pneumonia rather than by aspiration pneumonia recurrence alone.

In a study with participants whose mean age was similar to that in our study, Chojin et al. reported a recurrence rate of 32.4% at 30 days. However, in their study, the proportion of cases of pneumonia
attributed to diagnoses other than aspiration pneumonia was not determined. Therefore, the population
of our study was different from that in previous studies with respect to the recurrence rate, and our study
may represent a true recurrence rate of aspiration pneumonia in a population with an average age of 85
years.

Effects of Dentist Oral Care

Our study showed a marked decrease in the frequency of aspiration pneumonia recurrence after oral care
by dentists. We had a case of an 89-year-old woman with Parkinson's disease who was hospitalized for
aspiration pneumonia and who underwent dentist oral care in this study. The first dentist intervention was
performed on the third day of her hospitalization. At that time, the patient had a lot of phlegm, a dry
mouth, crusts in the mouth, and was almost unable to open her mouth (Fig. 3A). The dentist proceeded to
desensitize the patient, as explained in the Methods section. The dentist then moistened the lips and
removed the intraoral phlegm by wiping it off with gauze. At the same time, the crusts were collected
using a hard plastic Yanker suction device. After the oral care, the dryness of the oral cavity was
noticeably reduced, all the visible phlegm was removed, and the patient was able to open her mouth to a
greater extent than before (Fig. 3B). The patient underwent four subsequent dentist interventions, and the
observation period ended without aspiration pneumonia recurrence. Oral gels and lip moisturizer were
used to remove the dryness and crusting. The effectiveness of this method was also demonstrated in a
simulation in a previous study by a group of dentists who participated in this study.24

In our study, the results of the Kaplan–Meier curve showed a marked difference in recurrence rates
immediately after the remission of aspiration pneumonia. These results indicated that oral care by
dentists is highly effective in preventing recurrence as early as possible after remission. Therefore, it is
important to provide oral care by a dentist from the early stage of hospitalization.

The Lack of Progress in Geriatric Dental Care

Older people are often frail and in need of dental care but are unable to seek dental care; this is a global
problem.25–27 In Japan, only 28% of hospitals have a dentist on their staff.27 Frail older patients are often
homebound or in institutions and often cannot afford to visit a hospital. Therefore, in recent years,
measures to enhance high-quality mobile dental care have been emphasized in Japan.28 In Europe and
the United States, it has been reported that young dentists lack training in geriatric dentistry and that they
need to learn more about it.29–31 With this background, and considering the current situation regarding
the increasing number of older people worldwide, we believe it is important to improve visiting dental care
and further train more existing dentists to be proficient in geriatric dentistry.

Limitations

There were a few limitations to this study. First, currently, there are no clear criteria for the diagnosis of
aspiration pneumonia, nor are there criteria for the recurrence of aspiration pneumonia. We reviewed
several references and found that the definition of recurrence was not described in detail, and we defined
it after repeated discussions with several physicians with experience in the treatment of aspiration
pneumonia in Japan. Second, this study was not a randomized controlled trial (RCT). Although possible residual confounding owing to the presence of unmeasured confounding factors cannot be ruled out, results based on three models of multivariate analysis consistently showed that dentist oral care was effective, which suggests that the intervention was effective. Third, this was a single-center study in Japan, and generalizability may not be appropriate. As a next step, a multicenter RCT is needed to validate these findings. Finally, there was an improvement in the skills of the attending nurses over time. During the intervention period, the nurses learned oral care skills from the dentists, including how to use tools such as the Yanker suction device, and it is possible that the nurses also improved their oral care skills later in patient care.

In future, we aim to conduct a similar study in a multicenter setting to improve the external validity of the findings.

Conclusions

We conducted the first prospective study that demonstrated the effectiveness of professional oral care by dentists in reducing the recurrence rate of aspiration pneumonia from an early stage. These findings may be useful in developing and fostering future healthcare inter-professional collaborations between doctors, nurses, and dentists.

Abbreviations

CFS, Clinical Frailty Score; CI, confidence interval; HR, hazard ratio

Declarations

Ethics approval and consent to participate

The Institutional Ethics Committee of the Juntendo Tokyo Koto Geriatric Medical Center approved the study protocol (No. 111-10). This study was conducted in accordance with the principles of the Declaration of Helsinki. All the methods were performed in accordance with the Ethical Guidelines for Medical and Health Research Involving Human Subjects. We posted a research explanatory document on the institution's website and the participants were offered the opportunity to opt out. In the prospective dentist oral care group, written inform consent was obtained from the patients or their families.

Consent for publication: Not applicable

Availability of data and materials: Data from this study are not available. The corresponding author will respond to requests on the analyses of the data.

Competing interests

There are no conflicts of interest to declare.
Funding

This study was funded by the Japanese Society of Hospital General Medicine. However, it played no role in the design and conduct of this study, data analyses and interpretation of the results, preparation, review, or approval of this manuscript, and the decision to submit this manuscript for publication.

Authors’ contributions:

TaijuM, YN, KSY, ToruM, HT, and TN made substantial contributions to the conception; TaijuM and YN, the design of the work; TaijuM, YN, MN, and KK, the acquisition, analysis, and interpretation of the data; TaijuM, RI, KY, MS, NA, TF, and SK, the creation of new software used in the work; TaijuM, YN, RI, KY, KSY, ToruM, HT, and TN, the drafting of the work and its revision.

All the authors have approved the submitted version (and any substantially modified version that involves the author's contribution to the study). All the authors have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

ACKNOWLEDGMENTS

Contributors:

We would like to thank all the Juntendo Koto Geriatric Medical Center staff who were involved in the treatment of aspiration pneumonia during the research period.

Prior Presentations:

This paper has not been presented at a conference.

References


Figures
Figure 1

Patient flow. The control group received conventional oral care from nurses. The dentist oral care group received weekly oral care from a dentist in addition to conventional care. The control group was extracted retrospectively from the names of diseases in the medical records. The dentist oral care group was prospectively selected from patients admitted to the hospital with a diagnosis of aspiration pneumonia.
Figure 2

Kaplan–Meier curve. Thirty days from the date of remission, or the last day of discharge for cases discharged within 30 days of remission, patients were censored.
Figure 3

Intraoral photograph before dentist's intervention (Figure 3A); intraoral photograph immediately after dentist's intervention (Figure 3B). Figure 3A, with dry mouth, crusting, and phlegm. (arrow) Mouth does not open wide. Figure 3B shows moist mouth, no phlegm, no crusting, mouth wide open. (arrow)