Clinical significance
Despite an increase in the number of reports on professional oral care, there is no consensus view on the frequency of intervention. With regard to providing professional oral care to the dependent elderly, a frequency of 4 times per month may be most effective considering the limited time, cost, and manpower.

Abstract
Purpose: Our research aimed at shedding light on the effective frequency of professional oral care for those who require nursing care from oral health specialists.
Methods: Thirty-eight residents (average age, 80.0±9.4 years) of Niigata Prefecture who required nursing care agreed to participate in our study. They were divided into 3 groups: a control group (13 persons), provided with no professional oral health care; Group A (15 persons), provided with professional oral care once or twice per month; and Group B (10 persons), provided with professional oral care 4 times per month (once a week). Three dentists investigated the general health status and oral conditions such as dental formula, gingivitis index (GI), gingival bleeding index (GBI), degree of coating of on the tongue, and the type of pneumonia-causing pathogens on the pharyngeal mucosa. Professional oral care was provided by 14 dental hygienists for 3 months.
Results: Multiple comparison tests revealed that subjects in Group B showed a statistically significant improvement in GI and GBI compared to the controls. Although there was a trend showing some improvement associated with care frequency between pre- and post-intervention, no statistically significant difference was found eventually. Further, no significant difference was found before intervention with regard to the types of pneumonia-causing pathogens on the pharyngeal mucosa. Only Group B manifested a tendency of decreasing number pathogens when compared to the pre-intervention numbers, although it was not statistically significant.
Conclusion: Considering the limited time, cost, and manpower, a frequency of 4 times per month may be the most effective, but a higher frequency is recommended to prevent inflammations of the respiratory system.

Key words: professional oral health care, frequency, dependent elderly, gingival status, pneumonia-causing pathogen

Introduction
Oral health status plays a critical role in the improvement of the quality of life (QOL) in aged people as well as in dependent people. However, oral health care consistently receives less attention in favor of primary necessities of daily life, such as appropriate diet and toilet activities.

Deterioration of oral function in aged people may have an impact on the entire body and lead to lowering of the QOL. Recently, a number of reports have been published on oral flora causing systemic disorders. Because of physical and mental dysfunction, those who require nursing care are more likely to neglect oral hygiene; this frequently results in infection of the respiratory system, and certain severe infections can be fatal.

Recently, an increasing number of people are realizing that oral health care is an effective
means of preventing inflammation of the respiratory system, and the importance of oral health care for those who require nursing care has been widely recognized.\(^7\)\(^\,\)\(^8\)\(^\,\)\(^9\)\(^\,\)\(^10\)\(^\,\)\(^11\)\(^\,\)\(^12\)\(^\,\)\(^13\)\(^\,\)\(^14\)

Consequently, there is an increase in the number of reports on professional oral care such as oral health instruction, oral cleaning and oral function training are performed by oral health specialist personnel. Most of these reports describe the effect of professional oral health care, and evaluate the importance of oral care by comparing the oral condition before and after the intervention of oral health care. However, till date, there is no consensus view on the frequency of oral health care intervention. When providing oral health care to those who require nursing care, it is necessary to effectively manage the time, manpower, and cost involved; thus, the frequency of oral care requires to be clarified.

Therefore, our research aimed at shedding light on the effective frequency of professional oral health care for those require nursing care from oral health specialists.

**Materials and methods**

1. **Subjects**

Residents of Niigata Prefecture who required nursing care and belonged to rank A2–C according to the “Activity of daily living (ADL) classification for disabled elderly,” which was designed by the Ministry of Health, Labor and Welfare of Japan (Table 1), underwent oral examination performed by dentists and were identified to require professional oral care. Thirty-eight residents agreed to participate in our study and were divided in 3 groups as explained below.

2. **Classification of subjects into groups**

The groups were formed by assigning subjects as follows: Control group (13 persons), provided no professional oral health care; Group A (15 persons), provided with professional oral care once or twice per month; and Group B (10 persons), provided with professional oral care 4 times per month (once a week).

3. **Survey items**

We conducted a survey using the following items: 1) General health status

To evaluate the general health status, we included the following factors: age, sex, distribution of long-term care requirement, living conditions, ADL classification for the disabled elderly, and ADL classification for the demented elderly.\(^15\)\(^,\)\(^16\)

2) Oral conditions

a. General dental examination (dental formula and denture status)

b. Gingivitis Index

The marginal gingiva was divided into buccal, lingual, mesial and distal sides. The subjects were scored according to the following scale.\(^17\)\(^,\)\(^18\)

0: Normal

1: Slight degree of inflammation observable with the naked eye, without bleeding on probing

2: Moderate degree of inflammation observable with the naked eye, accompanied with bleeding on probing

3: Severe inflammation observable with the naked eye

---

**Table 1** Activity of daily living (ADL) classification for the disabled elderly.

<table>
<thead>
<tr>
<th>Class</th>
<th>Rank</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living independently</td>
<td>Rank J</td>
<td>Despite the presence of slight disorder, subject is capable of living independently and wandering outside alone. 1. Able to leave home using transport facilities 2. Able to walk just in the immediate neighborhood</td>
</tr>
<tr>
<td>Almost bedridden</td>
<td>Rank A</td>
<td>Generally capable of indoor activities, while unable to leave home without assistance. 1. Leaves home with assistance, capable of living out of bed for most of the daytime 2. Seldom leaves home, and a quite long duration in bed is required during daytime</td>
</tr>
<tr>
<td>Bedridden</td>
<td>Rank B</td>
<td>Can perform indoor activities with assistance, while most of the daytime is spent in bed or seated. 1. Moves on wheelchair, but can leave the bed for food intake and excretion 2. Move on wheelchair with assistance</td>
</tr>
<tr>
<td>Bedridden</td>
<td>Rank C</td>
<td>Spends all day in bed and requires assistance for excretion, food intake, and changing clothes. 1. capable of turning over during sleep by himself/herself 2. can’t turn over during sleep without assistance</td>
</tr>
</tbody>
</table>
The score of each subject was calculated using the formula stated below.

Gingival index (GI) = total score of examined tooth surfaces / the number of examined tooth surfaces

c. Gingival Bleeding Index

Probing of the periodontal pockets in 4 points (centers of the buccal, lingual, mesial, and distal sides) was performed, and the presence or absence of bleeding was judged after 10 to 30 seconds.

Gingival bleeding index (GBI) (%) = number of bleeding tooth sockets / the number of examined tooth sockets.  
19

d. Degree of coating on the tongue

The subjects were requested to protrude their tongues while keeping their mouths open, and the degree of coating on the tongue was scored according to Kojima’s classification.  
20

0: There is no coating on the tongue

1: The coated area is less than 1/3 of the area of the whole tongue, and the thickness of coating is less than 1 mm.

2: The coated area is less than 1/3 of the area of the whole tongue, and the thickness of coating is greater than 1 mm, additionally, the coated area is in the range between 1/3 and less 2/3 of the area of the whole tongue, and the thickness of coating is less than 1 mm.

3: The coated area is less 2/3 of the area of the whole tongue, and the thickness of the coating is greater than 1 mm, additionally, the coated area is greater than 2/3 of the whole tongue, and the thickness of coating is less than 1 mm.

4. The coated area is greater than 2/3 of the whole tongue, and the thickness of coating is greater than 1 mm.

e. Pneumonia-causing pathogens on the pharyngeal mucosa

Pharyngeal secretion was used for the detection of pharyngeal bacteria. Pharyngeal mucous of each subject was collected from 4 different areas of the pharynx by scratching from right to left with a sterile cotton-bud (seed swab No.3 EIKEN, EIKEN, Tokyo, Japan). The sample was then transferred into the Sample Store and Transportation Medium. After anaerobic culture at 37°C for 48 hours, the microorganisms were identified.

Moreover, past studies 21-23 have shown that Staphylococcus spp., Enterobacter spp., Klebsiella spp., Enterococcus spp., Pseudomonas spp., Haemophilus spp., Eschierichia coli, and Proteus spp. can be diagnosed as pneumonia-causing pathogens.

4. Professional oral care

An oral care plan was prepared by 3 dentists and carried out by 14 dental hygienists for 3 months of oral care (scaling, brushing, tongue cleaning, denture cleaning, oral health instruction, peri-oral muscular exercise).

Because a number of dental hygienists were responsible for the professional oral care intervention, the approach and indicators of professional oral care required to be standardized. First, an oral care manual was prepared and then discussed at workshops 3 times, it was finally distributed among dental hygienists in charge.

(Consideration of the ethics aspect)

Our research was approved by the ethics committee of Niigata University Dental School. Moreover, all the examinees and care-givers fully understood the informed consent information of this study, and only residents who provided informed consent were selected to be qualified examinees.

5. Statistics

We used the $\chi^2$ test to analyze the variation in pre-intervention values between the groups and one-way analysis of variance, Bonferroni’s multiple comparison test, and the $\chi^2$ test to analyze the variation in post-intervention values between the groups. The statistically significant differences were assessed at the 5% level of significance.

Results

1. General dental status

The average age of the subjects was 80.0±9.4 years. “Long-term care requirement level 4” was observed in the majority of the subjects (Table 2), and the mean number of remaining teeth was 14.3±8.8. The denture status is shown in Table 3. Dentures were not used by 75% of the subjects.

No significant pre-intervention differences were found between the groups with regard to age, sex, distribution of long-term care requirement, living conditions, ADL classification for the disabled elderly, ADL classification for the demented elderly, number of teeth remaining, denture status, and the factors investigated in this
report, including GI, GBI, degree of coating on the tongue, and the types of pneumonia-causing pathogens on the tunica mucosa pharynges.

2. Oral health status

a. GI

No significant pre-intervention differences in GI were found between the groups. However, variations in the pre-intervention and post-intervention GI values improved with increasing oral care frequency. Multiple comparison tests revealed that the group that was provided care 4 times per month showed a statistically significant improvement \((P<0.05)\) compared to the controls (Fig. 1).

b. GBI

Similarly, before intervention, no significant differences in GBI were found between the groups, whereas variations in the pre-intervention and post-intervention GBI values were found to be associated with oral care frequency. Multiple comparison tests revealed that the group provided care 4 times per month also showed a statistically significant \((P<0.05)\) difference compared to the controls (Fig. 2).

c. Degree of coating on the tongue

Although there was a trend showing some improvement associated with care frequency from pre-intervention to post-intervention values, no statistically significant difference was found eventually (Fig. 3).

d. The number of types of pneumonia-causing pathogens on the pharyngeal mucosa

No significant difference was found before intervention for the types of pneumonia-causing pathogens on the pharyngeal mucosa. Only the group that was provided care 4 times per month manifested a tendency of decreasing number of pathogens when compared to the pre-intervention numbers, although it was not statistically significant (Fig. 4).

### Discussion

The results of this study suggested no improvement in the subjects of the control group, for

| Table 2 Distribution of long-term care requirement of the groups of subjects. |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                            | 1  | 2  | 3  | 4  | 5  |
| Control group (n=13)       | 3  | 0  | 2  | 6  | 2  |
| Group A (n=15)             | 3  | 1  | 1  | 3  | 7  |
| Group B (n=10)             | 2  | 0  | 0  | 5  | 3  |
| Total (n=38)               | 8  | 1  | 3  | 14 | 12 |

Long-term care requirement level 1: Limited nursing care is required for some activities of daily life.
Long-term care requirement level 2: Mild nursing care is required for daily life.
Long-term care requirement level 3: Moderate nursing care is required for daily life.
Long-term care requirement level 4: Intensive nursing care is required for daily life.
Long-term care requirement level 5: Extremely intensive nursing care is required for daily life.

| Table 3 Denture status. |
|-------------------------|-------------------------|-------------------------|-------------------------|
| Group                   | Subjects wearing dentures | Subjects not wearing dentures |
| Control (n=13)          | 2                        | 11                      |
| A (n=15)                | 5                        | 10                      |
| B (n=10)                | 2                        | 8                       |
| Total (n=38)            | 9                        | 29                      |
which no professional oral care was provided and oral hygiene was completely entrusted to the dependent elderly or their caregiver. Further, the oral condition of these subjects was at a risk of worsening. Nakamura et al have mentioned that although the importance of oral health care for the dependent elderly is acknowledged, education and guidance in this field remains unavailable.

Shimoyama et al have also reported that the personnel who had participated in a training program on oral health education were more aware of oral health value and possessed higher assessment ability than those not provided this kind of education. In other words, there is a close association between dentists or dental hygienists providing professional oral care to the dependent, including the guidance of the caregiver, and the improved awareness of oral health, and the adoption of self-care practices. Providing professional health care over a longer time period may further improve the awareness of oral health care.

Our results also show that providing professional oral health care at a frequency of 4 times per month is necessary to significantly improve periodontitis. Considering the limited time, cost, and manpower factor, this may be an effective frequency. In contrast to the statistically significant improvement in the gingival status, no significant improvement was observed in the number of pneumonia-causing pathogens. Yoneyama et al and Hirota et al reported that providing professional oral care daily to the inhabitants of a nursing home led to a significant improvement in the gingival status, fever duration, types of pharyngeal bacteria, and that even when the frequency of oral health care was reduced to once or twice a week, a positive effect could be expected.

Ohsawa et al also reported that providing oral care 2-3 times per week reduced the frequency of fever, decreased the risk of pneumonia, and improved the ability to live independently.

In a study on dependent elderly, Adachi et al reported that providing professional oral care for 24 months led to a significant decrease in the frequency of fever, the number of *Candida albicans* organisms, methylmercaptan amount in expiration, and the number of *Staphylococcus* spp. when compared to the controls. Another study, in which professional oral care was provided twice per week, the authors observed a lower prevalence and reduced cell numbers of *Candida albicans* in elderly patients who required daily care.
care and received professional oral health care than in elderly patients not provided such oral care. The abovementioned study showed that professional oral care in the elderly requiring daily nursing care reduced the cell numbers of potential respiratory pathogens. Consequently, we suggest that oral care should be provided more than 4 times per month to prevent respiratory system inflammation.

Similar to the number of pneumonia-causing pathogens, the degree of coating on the tongue showed no significant improvement when oral health care was provided at a frequency of 4 times per month. Approximately 60% of the volatile sulfur compounds (VSCs) that are responsible for halitosis are caused by coating on the tongue. Many gram-negative bacteria, which produce VSCs are responsible for respiratory system inflammation. In our study, we focused on the quantitative variation in tongue coating, but further studies should be performed on the qualitative changes in the tongue coating.

**Conclusion**

In this study, we compared several indicators of general health and oral status of the dependent elderly in groups provided with oral care at different frequencies and concluded that it is necessary to provide oral health care, including scaling and oral health instructions. Moreover, we found that considering the limited time, cost, and manpower, a frequency of 4 times per month may be the most effective, but a higher frequency is recommended to prevent respiratory system inflammations.

**Acknowledgements:** This work was supported by the scientific research fund provided by Health, Labor and Welfare Ministry (H14—chojyu-013).

**References**


