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ORIGINAL ARTICLE

Effects of professional oral health care on elderly: randomized trial

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Abstract: *Objective:* To better understand the role of the professional oral health care for elderly in improving geriatric oral health, the effects of short-term professional oral health care (once per week for 1 month) on oral microbiological parameters were assessed. *Methods:* Parallel, open-labelled, randomize-controlled trial was undertaken in a nursing home for elderly in Shizuoka, Japan. Thirty-four dentate elderly over 74 years were randomly assigned from ID number to the intervention (17/34) and control (17/34) groups. The outcomes were changes in oral microbiological parameters (number of bacteria in unstimulated saliva; whole bacteria, *Streptococcus, Fusobacterium* and *Prevotella*: opportunistic pathogens detection: and index of oral hygiene evaluation [Dental Plaque Index, DPI]) within the intervention period. Each parameter was evaluated at before and after intervention period. Four elderly were lost from mortality (1), bone fracture (1), refused to participate (1) and multi-antibiotics usage (1). Finally, 30 elderly were analysed (14/intervention and 16/control). *Results:* At baseline, no difference was found between the control and intervention groups. After the intervention period, the percentage of *Streptococcus* species increased significantly in the intervention group (Intervention, 86% [12/14]; Control, 50% [8/16]: Fisher's, right-tailed, $P < 0.05$). Moreover, DPI significantly improved in the intervention group (Intervention, 57% [8/14]; Control, 13% [2/16]: Fisher's, two-tailed, $P < 0.05$). The improvement in DPI extended for 3 months after intervention. None of side effects were reported. *Conclusion:* The short-term professional oral health care can improve oral conditions in the elderly.

Key words: elderly; professional oral health care; randomized trial

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Introduction

The average life expectancy in Japan is still rising, and elderly people in Japan will account for approximately 25% of the population by 2013 (1). A successful strategy for improving geriatric oral health, the '80/20 movement', which was launched in 1986, set out to help people keep 20 or more teeth until age 80 (2). This programme has increased not only the percentage of dentate elderly but also periodontal disease in the elderly (3).

Poor oral health and periodontitis increase the risk of systemic diseases, such as aspiration pneumonia, in elderly (4, 5). Bacteria from dental plaque (6) may be aspirated into the respiratory tract, influencing the initiation and progression of pneumonia. To improve oral health in the dentate elderly, we must address 'plaque' as a reservoir of respiratory pathogens.

Dental plaque is produced by sequential bacterial adhesion and is known to evade antimicrobial challenges involving antibiotics and host immune defences by multiple mechanisms (6). Antimicrobial agents fail to fully penetrate it (6). Mechanical cleaning is the most effective way to remove plaque, but unfortunately, this can be difficult for dentate elderly in nursing homes, especially those who most need plaque control to reduce respiratory pathogens. Thus, professional oral health care (POHC), simple brushing performed by dental hygienists, is important in controlling oral respiratory pathogens in the elderly, especially in those who require nursing care (6, 7), that is, the functional independence measure (FIM) (8) is <5.

From a public and clinical health viewpoint, the minimum intervention to achieve some efficacy is desired. However, most previous reports mention effects over long periods, such as 5–6 months of POHC in the elderly for improvement of oral health (9–11), and little is known about the effects of short-term POHC, especially how long the effects remain after the intervention.

In 2006, an oral hygiene evaluation, including the Dental Plaque Index (DPI) and Tongue Plaque Index (TPI), for effective oral care in preventing pneumonia in the dentate elderly was reported (12). This evaluation was a simple measure of oral hygiene status and had a significant positive correlation with salivary bacteria and the number of febrile days. DPI in particular showed a significant positive correlation with episodes of pneumonia (12).

We hypothesized using the DPI we can clarify short-term POHC (once per week for 1 month) is enough effort to improve oral conditions in elderly. To better understand the role of POHC in improving geriatric oral health, the effects of the short-term POHC on oral hygiene, including bacteriological parameters, were assessed. We also considered the role of POHC with FIM.

Methods

Participants and interventions

We assessed total 140 residents (>64 years old) who lived in a nursing home in Shizuoka, Japan (Fig 1). Participants had to have at least one tooth, but they could have partial dentures. At the baseline, any pharmacological treatments that would influence the oral conditions were not recognized in the participants. Most of the participants had cognitive disorders; therefore, we obtained consent from their families. In total, 106 were excluded because of death (*n* = 1), edentulous status (*n* = 57), unable to obtain consent (difficulty in contacting the family, *n* = 21) and closing of recruitment (the number of participants reached the expected sample size; therefore, we closed recruitment; *n* = 27). Consequently, we randomized 34 dentate elderly at baseline: 17 to the intervention group and 17 to the control group. We selected the participants randomly by their ID numbers: odd numbers were allocated to the

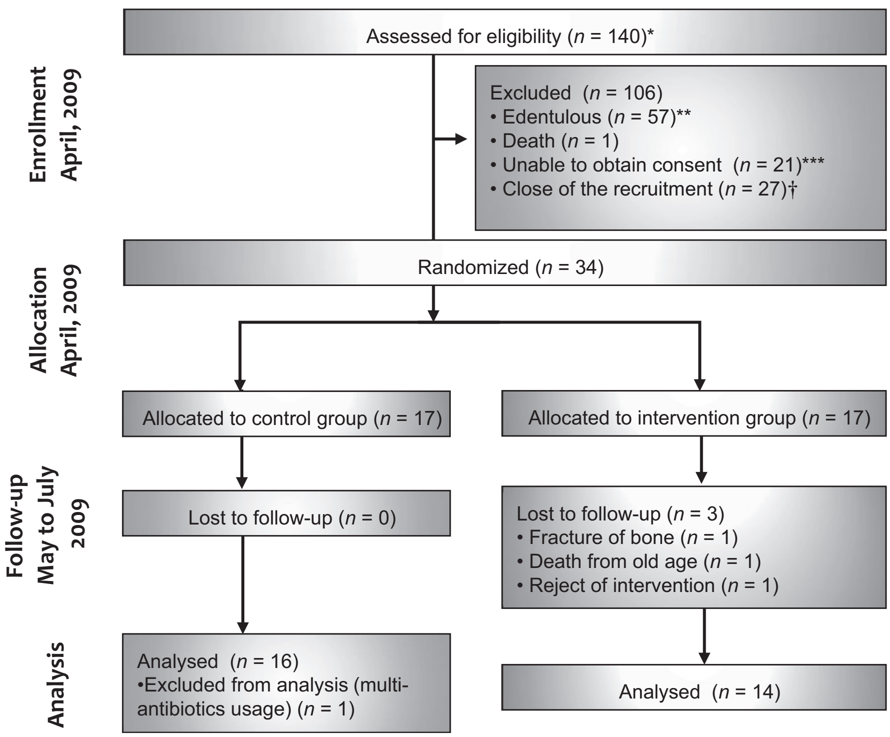

Fig. 1. Flow diagram of the progress through the phases of a parallel randomized trial of two groups. *, Total residents in the nursing home. **, Participants had to have at least one tooth. They could have partial dentures. ***, Difficulty for contact with family of the subjects. Because most of the participants had cognitive disorders, we obtained consent from their families. †, Because the number of participants reached the expected sample size, we closed recruitment.

control group and even numbers to the intervention group. The trial design was a parallel, randomize-controlled trial, and the subjects were open-labelled, but sample examiners were blinded regarding the interventions.

The intervention group received short-term POHC after breakfast once per week for 1 month from two dental hygienists. They performed no dental scaling and no thorough cleaning, but simply brushed. Just in the case with a low risk of aspiration (the modified water swallow test >3), we used disclosing solution as an indicator just before cleaning procedures carefully. Elderly in both groups received their normal oral hygiene procedures (self-care or care with help from nursing home staff) in the follow-up period (baseline to 5 months). The two groups differed only in who was delivering the oral care. Thus, for both POHC and normal oral hygiene procedures, the main equipment included a toothbrush (it was not a powered tooth brush), an end-tufted brush and an interdental brush. New toothbrushes were used in the follow-up period. If necessary, a mouth opener and a portable suction tube were also used. For cleaning dentures, a toothbrush, denture cleaner (tablet type) and ultrasonic cleansing apparatus were provided. The nursing home staffs were trained to use the ultrasonic cleansing apparatuses. After the trial, the control group was not given the intervention.

This study was approved by the ethics committee of Nihon University School of Dentistry (trial registration: https://upload.umin.ac.jp/cgi-open-bin/ctr/ctr.cgi?function=brows&action=brows&recptno=R000003890&type=summary&language=E).

Sample size

Based on the sample size calculations (13), 13 participants per group were needed to achieve a power of 95% to detect a difference between the groups (two-tailed, $\alpha = 0.05$). After adjusting for dropouts (30%), data for 17 participants per group were judged to be necessary.

Outcomes

To assess the effect of POHC in improving geriatric oral health, changes in oral microbiological parameters (number or percentage of bacteria (whole bacteria, *Streptococcus*, *Fusobacterium* and *Prevotella*) and the presence of opportunistic pathogens in unstimulated saliva, index of oral hygiene evaluation (DPI) (12)) within the intervention period were the primary outcomes in this study, and these were assessed by oral microbiological sampling, processing and clinical examination. We also examined oral moisture using an oral moisture checking device, KISO-Wet Tester No. 1 (KISO Science Co. Ltd., Yokohama, Japan) that is an alternative to the L-SALIVO (The Lion Foundation for Dental Health, Tokyo, Japan) (14), before and after the intervention period. After holding the tester on the tongue dorsum vertically for 10 s, we measured the height of the moistened area and recorded the value. Oral moisture is correlated with the sense of oral dryness in elderly or disabled populations, and usually, measured results <1 mm (0 mm) are classified as 'oral dryness' (15).

After the trial began, we performed three additional examinations of DPI: 1, 3 and 5 months after the intervention period to observe the long-lasting effect of POHC.

Data, including gender, age, FIM (8), modified water swallow test (MWST) (16) and number of teeth, were gathered before the intervention period.

Clinical examination, oral microbiological sampling and processing

Each clinical examination and oral microbiological sampling was performed within 2 h after participants got up in the morning. They were performed prior to any routine oral care or meals. After measuring oral moisture, as described previously, DPI was assessed by the two calibrated dental hygienists using the following criteria (12): the accumulation of dental plaque on remaining tooth surfaces was evaluated in three DPI categories: DPI 0, no plaque; DPI 1, plaque covers less than half of the tooth surface; or DPI 2, plaque covers more than half of the tooth surface. The DPI evaluates the accumulation of plaque on the surfaces of the remaining teeth; the highest score was recorded.

Next, sublingual unstimulated saliva was obtained using three swabs (Culture Swab EZII and Culture Swab plus; Becton, Dickinson and Co., Franklin Lakes, NJ, USA). After suspending in 300 µl of phosphate-buffered saline, one swab sample was cultured aerobically at 37°C for 48 h using brain heart infusion agar (Becton, Dickinson and Co.) with 5% sheep blood and mitis salivarius agar (Becton, Dickinson and Co.) with 1% tellurite solution to evaluate the number of total bacteria and *Streptococcus* species, respectively. The second swab was suspended in 300 µl of lysis buffer solution, and DNA was extracted (17) twice. TaqMan real-time PCR assays were performed using the StepOnePlus™ Real-Time PCR System (Applied Biosystems, Foster City, CA, USA), three probe and primer sets (universal (18), *Fusobacterium*, and *Prevotella* species (19)) and three control strains (*Streptococcus mitis*12971^T, *Fusobacterium nucleatum* JCM8532^T, *Prevotella melaninogenica* JCM6325^T) from Riken, Japan, for confirming the amount of DNA. The remaining swab was used for detecting opportunistic pathogens including *Haemophilus influenzae*, beta-haemolytic *Streptococcus*, *Pseudomonas aeruginosa*, *Streptococcus pneumoniae*, *Klebsiella pneumoniae*, *Serratia marcescens*, *Moraxella catarrhalis*, *Branhamella catarrhalis*, methicillin-resistant *Staphylococcus aureus* (MRSA), methicillin-sensitive *S. aureus* (MSSA) and *Candida* species. Sampled swabs were taken in transport fluid to the Biomedical Laboratory, Tokyo, Japan; each pathogen was identified using a culture procedure described previously (20).

Statistical analyses

Data were analysed using JMP software (ver. 7.02; SAS Institute, Cary, NC, USA). Differences in variables between groups were examined using the Fisher's and Wilcoxon tests. Matched-pair differences within the same group between examination times were examined using the Wilcoxon (matched-pairs) test. Considering receiver-operating characteristic analyses plus clinical characteristics, 7 dichotomized variables (gender, age, FIM, MWST, number of teeth, oral moisture and intervention) were obtained. Single and multiple (stepwise) logistic regression analyses were used to confirm the influences of these variables on the previously mentioned outcomes. $P < 0.05$ was considered to indicate statistical significance.

Results

Figure 1 shows the trial profile. The trial started in April 2009. Within a month, the number of participants exceeded the expectation (17 participants per group). From 34 subjects at baseline, four elderly were lost due to death: old age, (1), bone fracture (1), rejection of the intervention (1) and multi-antibiotics usage within the intervention period (1). Finally, 30 elderly (mean age = 85.5 years at baseline; five men, 25 women) were assessed (14/intervention and 16/control) in the analysis.

Baseline characteristics

Baseline characteristics are shown in Table 1. No significant difference was found between the groups (Table 1). Dysphagia (modified water swallow test <4) and functional dependence (FIM ≤5) were observed, respectively, in 30% (9/30) and 47% (14/30) of the elderly. All of the elderly with dysphagia had functional dependence.

At baseline, opportunistic pathogens were found in 30% (9/30) of the samples, with 19% (3/16) in the control and 43% (6/14) in the intervention groups (Table 1). The detection rates for each opportunistic pathogen were as follows: *H. influenzae*, 0%; beta-haemolytic *Streptococcus*, 3% (1/30); *P. aeruginosa*, 17% (5/30); *S. pneumoniae*, 0%; *K. pneumoniae*, 3% (1/30); *S. marcescens*, 0%; *M. catarrhalis*, 0%; *B. catarrhalis*, 0%; MRSA, 0%; MSSA, 0%; *Candida* species, 7% (2/30).

Effects of intervention

Oral moisture, DPI and oral bacteriological parameters were similar at baseline and follow-up in the control group; the percentage of *Streptococcus* species in saliva increased significantly (Fisher's right-tailed test, $P < 0.05$), and DPI decreased significantly (Fisher's two-tailed test, $P < 0.05$) in the intervention group (Table 2, Fig. 2). Compared with the baseline data, the significantly decreased DPI in the intervention group was retained for 3 months after the intervention period (Wilcoxon test, $P < 0.05$), although no differences were observed in the control group (Fig. 3). There were not any differences in other bacteriological parameter or oral moisture in the both groups (Table 2).

A univariate analysis was used to examine the ability of each of the 7 variables to predict each of two significant outcomes (improvement in DPI and increase in the percentage of *Streptococcus* species) during the intervention period. Regarding 'improvement in DPI', only one variable showed a significant association (intervention, yes: odds ratio (OR), 9.33; 95% confidence interval (CI), 1.74–75.66; $P < 0.01$). Regarding 'increase in the percentage of *Streptococcus* species', four variables showed significant associations (gender, age, number of teeth and intervention). 'Intervention' remained significant (intervention, yes: OR, 9.33; 95% CI, 1.29–193.09; $P < 0.05$) even when using multivariate analysis (stepwise).

Table 1. **Baseline characteristics of the total 30 subjects followed up, the control (16/30) and intervention (14/30) groups**

Parameter	Total	Control (n = 16)	Intervention (n = 14)	P
Male, number (%)	5 (16.7)	3 (18.8)	2 (14.3)	0.87*
Age (years), mean (SE)	85.5 (1.1)	84.8 (1.7)	86.2 (1.5)	0.34**
FIM, mean (SE)	5.2 (0.4)	5.6 (0.5)	4.9 (0.6)	0.42**
Modified water swallow test, mean (SE)	4.2 (0.2)	4.4 (0.2)	3.9 (0.3)	0.29**
Number of teeth, mean (SE)	13.0 (1.4)	13.4 (2.1)	12.5 (2.0)	0.72**
Oral moisture (mm), mean (SE)	4.0 (0.5)	3.6 (0.5)	4.6 (0.9)	0.59**
DPI, mean (SE)	1.1 (0.1)	1.2 (0.2)	1.1 (0.2)	0.65**
Number of bacteria (log_{10} CFU/swab), mean (SE)	6.8 (6.0)	6.7 (6.1)	6.8 (6.2)	0.82**
Percentage of *Streptococcus* species, mean (SE)	46.6 (4.4)	50.6 (6.5)	42.0 (5.7)	0.36**
Percentage of *Fusobacterium* species, mean (SE)	2.5 (0.6)	2.9 (1.0)	2.0 (0.5)	0.65**
Percentage of *Prevotella* species, mean (SE)	17.8 (3.3)	19.1 (4.3)	16.4 (5.4)	0.51**
Presence of opportunistic pathogen, number (%)	9 (30.0)	3(18.8)	6 (42.9)	0.30*

*Statistical evaluation using the Fisher's test.
**Statistical evaluation using the Wilcoxon test.

We also considered the role of POHC with FIM (Table 3). In the intervention group, DPI of elderly with functional independence (FIM >5) was not significantly decreased (Wilcoxon test, $P > 0.05$), although that of elderly with functional dependence (FIM ≤5) was significantly decreased (Wilcoxon test, $P < 0.05$). It seems the effect of POHC was mostly obtained from the elderly with functional dependence.

No side effects (e.g., wounds within the oral cavity, uncomfortable reaction with the POHC, fever or sickness after POHC) were reported.

Discussion

We investigated the effects of short-term POHC on oral bacteriological parameters, especially *Streptococcus*, *Fusobacterium*,

Table 2. **Effects of short-term professional oral health care (once per week for 1 month) on oral moisture, DPI and oral bacteriological parameters**

	Control (n = 16)		Intervention (n = 14)	
Parameters	Baseline	After intervention	Baseline	After intervention
Oral moisture (mm), mean (SE)	3.6 (0.5)	4.7 (1.1)	4.6 (0.9)	4.3 (1.0)
DPI, mean (SE)	1.2 (0.2)	1.4 (0.2)	1.1 (0.2)	0.5 (0.2)*
Number of bacteria (log_{10} CFU/swab), mean (SE)	6.7 (6.1)	6.8 (6.1)	6.8 (6.2)	6.8 (6.0)
Percentage of *Streptococcus* species, mean (SE)	50.6 (6.5)	53.7 (6.2)	42.0 (5.7)	56.6 (6.7)*
Percentage of *Fusobacterium* species, mean (SE)	2.9 (1.0)	2.1 (0.5)	2.0 (0.5)	1.3 (0.3)
Percentage of *Prevotella* species, mean (SE)	19.1 (4.3)	33.7 (9.1)	16.4 (5.4)	38.2 (19.7)
Presence of opportunistic pathogen, number (%)	3 (18.8)	7 (43.8)	6 (42.9)	6 (42.9)

*Statistically significant from baseline data using the Wilcoxon test ($P < 0.05$).

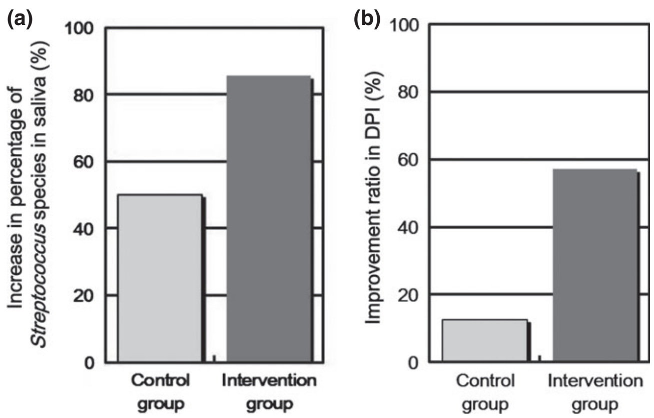

Fig. 2. Effect of professional oral health care on the elderly (1). After intervention, the percentage of *Streptococcus* species in saliva increased significantly in the intervention group [intervention, 86% (12/14); control, 50% (8/16): Fisher's right-tailed test, $P < 0.05$] (a). DPI showed a significant improvement in the intervention group [intervention, 57% (8/14); control, 13% (2/16): Fisher's two-tailed test, $P < 0.05$] (b).

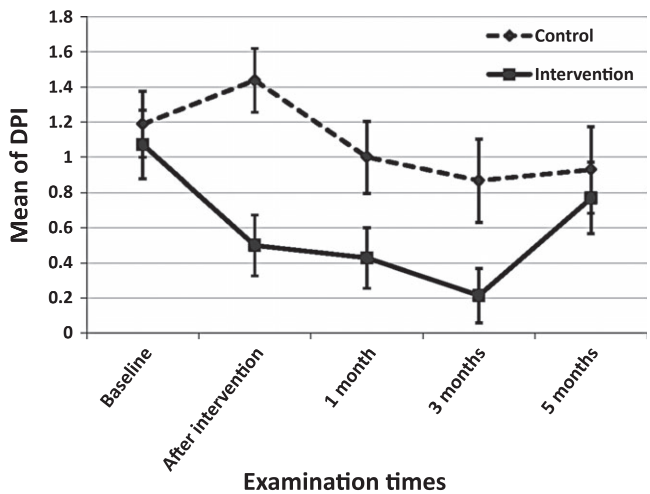

Fig. 3. Effect of professional oral health care on the elderly (2). Compared with the baseline data, the significantly decreased DPI in the intervention group was retained for 3 months after the intervention period, although no differences were observed in the control group (Wilcoxon test, $P < 0.05$). The number of subjects was as follows: baseline, after intervention and 1 month after intervention, 14/intervention and 16/control; 3 months after intervention, 14/intervention and 15/control; 5 months after intervention, 13/intervention and 14/control.

Prevotella species and opportunistic pathogens in unstimulated saliva and DPI to evaluate oral hygiene status before and after intervention. Although the intervention period was only 1 month, short-term POHC (once per week for one month) improved DPI.

In this study, we examined the number of bacteria 'per swab' instead of 'per ml of saliva' because most of the participants had cognitive disorders, which precluded robust collection of liquid saliva samples. We estimated the composition of bacterial species in saliva (e.g., percentage of *Streptococcus* species of the total number of bacteria per swab) because the bacterial composition in saliva is expected to mirror the oral condition more accurately than the total bacterial number per swab. In fact, the total number of bacteria per swab did not increase in the intervention group. By contrast, the percentage of *Streptococcus* species in saliva significantly increased (intervention, 86% (12/14) versus control, 50% (8/16)). The presence of opportunistic pathogens, including streptococcal pathogens, did not increase in the intervention group. Most *Streptococcus* species have reported to be harmless commensal bacteria in the oral cavity (6). Indeed, the increment seemed to be in the group of non-pathogenic *Streptococcus* species. Logistic regression analyses excluded confounding factors, pointing to the improvement in DPI, and increase in the percentage of *Streptococcus* species in the intervention group as due to POHC. Unexpectedly, the significant improvement in DPI persisted for 3 months following the intervention period. It seems possible that the normal hygiene procedures (self-care or care with help from nursing staff) indirectly promoted better oral healthcare practices by watching the clean oral conditions. Moreover, keeping the clean oral condition was easier than establishing the condition for the nursing staff or elderly themselves. This way POHC appeared to have a prolonged effect on plaque coverage of the tooth surfaces even at 3 months post-intervention. Moreover, albeit not statistically significant, a slight

Table 3. **Effects of short-term professional oral health care (once per week for 1 month) on DPI, considering with the Functional Independence Measure (FIM)**

	Control (*n* = 16)		Intervention (*n* = 14)	
FIM	Baseline	After intervention	Baseline	After intervention
>5 (control, *n* = 9; intervention, *n* = 7)	0.8 (0.2)[†]	1.1 (0.3)	0.9 (0.3)	0.7 (0.3)
5 ≥ (control, *n* = 7; intervention, *n* = 7)	1.7 (0.2)	1.9 (0.2)	1.3 (0.2)	0.3 (0.2)*

[†]Mean (SE) of DPI.
*Statistically significant from baseline data using the Wilcoxon test ($P < 0.05$).

decrease in the mean DPI was observed for the control group at 1 and 3 months post-intervention. In addition, we believe that another gain from POHC was achieved through a strengthened motivation of the nursing staff.

DPI has been reported to have a significant positive correlation with the number of febrile days and episodes of pneumonia in the elderly (12). Moreover, it was reported that oral hygiene had an outstanding effect on chronic respiratory disease (21). DPI reduction in the intervention group may contribute to preventing oral diseases and also controlling oral respiratory pathogens in the nursing home.

In this study, we confirmed the significant effectiveness of POHC in the case with functional dependence. The physical conditions of elderly in nursing homes are readily and dramatically changed, and this can greatly influence both the host immune system and oral conditions. Moreover, dental technology has been rapidly improving, and understanding and controlling high technology treatments of the elderly (e.g., dental implants and magnet dentures) has become difficult. To address the issues that nursing staff have in oral care in these settings, the dental professionals can provide an individual treatment plan tailored to elderly. Thus, we recommend on-the-job training of the regular nursing staff by dental hygienists. We encourage the participation of dental professionals in maintaining good oral conditions especially in elderly with functional dependence.

From a public and clinical health viewpoint, short-term POHC is desirable to improve oral conditions in the elderly. These results may contribute to POHC cost savings, especially in developed countries with increasing populations of the elderly.

Other bacteriological parameters, such as the percentage of *Fusobacterium* and *Prevotella* species, and the presence of opportunistic pathogens, including *H. influenzae*, beta-haemolytic *Streptococcus*, *P. aeruginosa*, *S. pneumoniae*, *K. pneumoniae*, *S. marcescens*, *M. catarrhalis*, *B. catarrhalis*, MRSA, MSSA and *Candida* species, did not improve in the intervention group. These results were consistent with previous reports in which the numerical changes in *Staphylococcus* species, *P. aeruginosa* or *C. albicans* in dentate patients were evaluated and the number of these bacteria did not correlate with the amount of visual plaque on tooth surfaces (7, 12).

Fusobacterium and *Prevotella* species are Gram-negative anaerobic bacteria; their main habitats are periodontal pockets, and they are related to periodontal disease. Thus, to control such bacteria, not only POHC but also periodontal disease treatment, for example, scaling or root planning, may be necessary. Dental plaque, especially in patients with periodontal disease, may act as a reservoir of respiratory pathogens (22). Controlling periodontal disease in the elderly is an important issue to address.

Nine study participants had opportunistic respiratory pathogens detected in the oral cavity at baseline. However, after the intervention, the presence of opportunistic pathogens did not change in the intervention group. Three factors have been found to contribute to colonization by these pathogens (6): decreased oral commensal bacteria, a decline in host immunity and increased dental plaque. It may be that the subjects in this study had stable health conditions. Thus, oral immunity could have mainly contributed to maintaining the colonization of opportunistic respiratory pathogens in the oral cavity.

This study had some limitations. First, the study was not performed in multiple locations. Thus, the subjects in this study had almost the same background; it was easy to perform comparisons between control and intervention groups. Second, the interventions were open (subjects were open-labelled). However, the sample examiners were blinded regarding the interventions, and we confirmed significant difference in the percentage of *Streptococcus* species between two groups. Moreover, DPI is simple oral evaluation criteria established to eliminate errors among the surveyors and also to facilitate their use by non-professional dental personnel, including nurses and caregivers (12). In this study, the examiners were two calibrated dental hygienists. Their mistakes on DPI evaluation could be really rare. Thus, the results could not be influenced by this matter. Third, we did not measure the saliva production level that was related to the concentration or numbers of oral bacteria in saliva. Alternatively, we measured oral moisture and confirmed that the oral moisture was stable between before and after the intervention period.

In this nursing home, routinely, elderly received normal oral hygiene procedures (self-care or care with help from nursing home staff). The perform comparisons between control and intervention groups differed in who was delivering the oral care. Therefore, it was realistic interventions and just only one elderly refused the interventions.

Regarding any potential influences from medication, it seems slightly influence from medications in this study. In fact, at baseline, any pharmacological treatments influenced the oral conditions were not recognized in the participants. In the follow-up period, four participants were recognized antibiotics usage. Within four, three elderly were lost due to death (old age, 1), rejection of the intervention (1) and multi-antibiotics usage within the follow-up period (1). Only one elderly who just received 2-day antibiotic treatment was assessed in the analysis.

In conclusion, we investigated the effects of short-term POHC for the elderly in terms of oral bacteriological parameters in unstimulated saliva and an oral hygiene evaluation. Although the intervention period was only once per week for 1 month, short-term POHC was effective in increasing the percentage of *Streptococcus* species and improving DPI. The significantly improved DPI was maintained for 3 months after the intervention period. Thus, short-term POHC can contribute to improving the oral condition of the elderly.

Clinical relevance

This work represents the first report of the short-term professional oral health care (POHC) for elderly. Poor oral health increases the risk of systemic diseases in elderly. To better understand the role of the POHC for elderly in improving geriatric oral health, the effects of short-term POHC (once per week for 1 month) on oral microbiological parameters were assessed. The percentage of *Streptococcus* species and DPI (Dental Plaque Index) significantly improved in the intervention group. The improvement in DPI extended for 3 months after the intervention. We concluded that the short-term POHC can contribute to improving geriatric oral health.

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