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An Interprofessional Approach to Oral Hygiene for Elderly Inpatients and the Perception of Caregivers Towards Oral Health Care

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Abstract

ABSTRACT

Objective: The objective of this study was to investigate the effect of an interprofessional oral hygiene support program for elderly inpatients and the perception of caregivers of the elderly towards oral health care.

Materials and methods: Participants comprised 37 elderly inpatients requiring nursing care (17 males, 20 females; mean age, 83.3 ± 4.9 years) and 29 registered nurses who participated in the interprofessional oral health care support program as a caregiver (4 males, 25 females; mean age, 45.2 ± 10.3 years). In this program, inpatients received daily oral cleaning by registered nurses based on each patient's oral health care plan. The number of microbes on the tongue surface of the inpatients was measured once a week for 12 weeks. Additionally, as an investigation of the perception of the caregivers towards oral health care, a questionnaire about the required frequency and duration for oral cleaning was conducted with registered nurses before and after the program to investigate the perception of the caregivers towards oral health care.

Results: Significant differences were observed in the number of microbes on the tongue surface between baseline and at every measurement after the beginning of this program, except for the first week. The mean required frequency and duration for oral cleaning by registered nurses at baseline were 1.5 ± 0.8 times and 3.8 ± 2.2 minutes, whereas those after the program were 2.7 ± 0.7 times and 5.8 ± 2.9 minutes, respectively.

Conclusion: Implementation of the program decreased the number of microbes on the tongue surface of the elderly inpatients and improved the perception of their caregivers towards oral health care.

Introduction

The population is aging in many countries, and at the same time, the number of elderly persons requiring nursing care is increasing.[1] Significant causes of death among elderly persons, in addition to malignant neoplasms and heart disease, include pneumonia, such as aspiration pneumonia, which has become problematic.[2-5] Silent aspiration of saliva containing oral microbes present in the oral cavity and pharynx is considered a cause of aspiration pneumonia.[5-7] Oral cleaning reportedly reduces the risk of aspiration pneumonia,[8-11] indicating that suppression of the number of microbes in the oral cavity by effective oral cleaning is a means of preventing aspiration pneumonia, which is a major cause of death among elderly persons. However, elderly inpatients requiring nursing care often have trouble independently maintaining favourable oral hygiene; thus, caregivers are required to provide effective oral cleaning.[12]

To determine an effective oral cleaning method, we established that the degree of tongue coating and denture plaque adherence is related to the number of microbes in the saliva of edentulous elderly persons.[13] Furthermore, Yasui et al[14] clarified that not only are periodontal pathogens present in the oral cavity of edentulous persons, but that they are detected at a high rate on the dorsum of the tongue, the mucosal surface of the denture base, and on artificial teeth. In addition, Shimizu et al[15] clarified that the degree of tongue coating is related to the

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number of anaerobes on the tongue surface. These reports suggest that the dorsum of the tongue and dentures are oral microbe reservoirs, and effective cleaning of these areas is a valuable means of suppressing oral microbes to reduce the risk of systemic diseases, such as aspiration pneumonia.

Aside from dentists and dental hygienists, many nondental health workers, such as nurses, physicians, physical therapists, speech therapists, and occupational therapists, are involved in the care of individuals requiring nursing care while staying in hospitals and nursing care facilities. Furthermore, oral cleaning is often performed by nondental personnel such as nurses. Individuals requiring nursing care typically have hyposalivation, with crusts containing keratotic epithelial cells as well as food debris and, in many cases, strongly adhering tongue coating.[16,17] Because the condition of the oral environment and the degree of necessity for cleaning varies among patients, no uniform oral cleaning method has been established. Additionally, lack of staff, lack of awareness of the importance of oral cleaning by caregivers, and lack of cooperation among caregivers have led, in many cases, to insufficient maintenance of oral hygiene among elderly inpatients requiring nursing care.[18] In particular, the need for oral health care may be overlooked in elderly patients being fed by tube because they do not eat or drink.[19] To achieve effective oral care, improved adherence to oral health care practices is an important goal that can be achieved by increasing educational opportunities and improving the motivation of dentists, dental hygienists, and nondental staff members.[20,21] By providing oral health care training for interprofessional care workers based on a standardized oral care regime, it is expected that not only oral health but also the systematic health of the elderly persons requiring nursing care will improve. However, little research has been undertaken on methods to improve the motivation of these health care workers.

We have been using an interprofessional oral health care support program with multidisciplinary cooperation since 2011. In this program, which was based on previous studies,[22,23] an effective oral cleaning method was established and put into practice. In this program, interprofessional members comprising dentists, dental hygienists, speech therapists, and nurses developed an oral health care plan at a specific meeting for each patient. The nurses performed routine daily oral cleaning, and dental hygienists performed the oral cleaning routine once a week. However, the subjective and objective effects of this program, such as time-course changes in the number of oral microbes among elderly patients requiring nursing care, and changes in the perception of caregivers who perform oral health care through this program have not been sufficiently clarified.

The objective of the study was to investigate the effect of an interprofessional oral hygiene support program for elderly inpatients and the perception of their caregivers towards oral health care.

The hypothesis of this study was that implementation of the interprofessional oral health care support program would decrease the microbial count on the tongue surface of inpatients and improve their caregivers' perception towards oral health care practices.

Material and methods

Study design and approval for involvement of human participants

This study was a before and after study over 12 weeks with a single group design.

The Ethics Committee of Tokyo Dental College reviewed and approved this study (#453). This study was also approved by Noda Hospital, where the program was performed. The program was performed in accordance with the Edinburgh Revision of the Declaration of Helsinki. Written informed consent was obtained from all participants or from their families.

Participants

The participants that received oral health care in the program were elderly inpatients requiring nursing care because of cerebrovascular disease or dementia who were admitted to a long-term care hospital and fed using a feeding tube and those who were unable to perform their own oral health care. They had not been treated with antibiotics in the preceding 3 months and were incapable of oral cleaning and rinsing on their own. A total of 37 patients participated in this study (17 males and 20 females; mean age, 83.3 $\pm$ 4.9 years). Prior to implementation of the program, nurses were providing daily oral health care for the patients using a toothbrush soaked in tap water without oral moisturizer gel or mouthwash. The duration and protocol of cleaning was unspecified and was based only on the nurses' personal experience. A total of twenty-nine registered nurses (4 males and 25 females; mean age, 45.2 $\pm$ 10.3 years) from the long-term care unit participated in the investigation and agreed to adhere to performing oral health care practices as outlined in the program.

Outline of the oral health care program

The interprofessional oral health care support program started in 2011 and the cleaning protocol was revised in 2014 to the protocol described here.

The program members comprised dentists, dental hygienists, registered nurses, and speech therapists who held meetings as outlined. They also prepared individual oral health care plans and performed oral cleaning based on these plans. The caregivers were trained in the oral cleaning protocol by dental hygienists before the program.

1. The program members all examined each patient prior to the meeting to assess the conditions of general health and oral cavity of the patients.
2. Specific meetings for oral health care were held by the multidisciplinary program members once a month, during which the members shared reports on the patients' conditions of general health and oral cavity they had recorded during their rounds. The care plans, including positioning, tools, and cleaning methods based on the general and oral condition of each patient, were prepared during the meeting based on the professional opinions of interprofessional program members.
3. Based on the discussions at the meetings, individual oral health care plans were prepared and revised for each patient.

For each plan, the tools and methods of oral cleaning and the posture and positioning of the patient were described.

4. Using a check sheet of oral condition (Table 1), oral cleaning was performed based on the prepared individual oral health care plan following the protocol described here. Registered nurses trained in the protocol of the program performed routine cleaning once a day, and dental hygienists performed the oral cleaning routine once a week. The same protocol was used each day unless the protocol was modified at the meeting. After each cleaning, the registered nurses or dental hygienists who performed the cleaning marked on the check sheet that the cleaning had been performed. The caregivers took turns cleaning the different patients.

   (1) Moisturizing and wiping of the oral cavity

   One gram of moisturizing gel (ConCool Mouth Gel, Weltec) was evenly applied to the dorsum of the tongue using an elastomeric tongue scraper (Tongood, Molten) as a spatula. The main ingredients of the moisturizing gel are shown in Table 2.

   (2) Tooth and denture brushing

   Teeth were cleaned for 3 minutes using a toothbrush (Dent EX, Lion Dental Products Company, Ltd.) that was immersed in mouthwash (ConCool Mouth Rinse, Weltec). Brushing was performed using the scrubbing method. Toothpaste was not applied. The main ingredients of the mouthwash are shown in Table 2. For denture wearers, dentures were brushed with a denture brush (Denture brush, Sunstar) under running water for 2 minutes.

   (3) Tongue cleaning

   Tongue surfaces were cleaned using a tongue brush (TongueMate, Kamemizu Chem. Ind. Co., Ltd.) immersed in mouthwash. Tongue brushing was performed in 1 direction from the anterior terminal sulcus to the tip of the tongue with a cleaning pressure of 9.8 kPa applied 5 times on each side. Before the program began, each caregiver was trained in applying proper brushing pressure.

   (4) Wiping of the oral cavity

   Oral microbes, which were spread in the mouth by cleaning, were wiped off using oral wet wipes (Oral care Wetty, Wakodo). The main ingredients of the wipes are shown in Table 2. The tongue surface was wiped 3 times from the terminal sulcus to the tip of the tongue. The teeth were wiped once from the buccal to lingual side, and the oral mucosa excluding the tongue surface was wiped once.

   (5) Application of oral moisturizing gel

   One gram of moisturizing gel (ConCool Mouth Gel, Weltec) was evenly applied to the dorsum of the tongue, as applied before cleaning.

5. The number of microbes on the tongue surface before cleaning was measured weekly by the dental hygienist.
6. Feedback to patients, their family, and meeting members.

Table 1 – Oral condition check sheet including abnormalities in the teeth, soft tissue, and dentures; adhering substances; halitosis; and oral dryness.

Check sheet of oral condition

No.:		Participant name:													
Date (yy/mm/dd)	Dryness/Halitosis		Deposition				Abnormality				Remarks	Signature
	Dryness (+/−)	Halitosis (+/−)	Tongue (+/−)	Food residue (+/−)	Palate (+/−)	Denture (+/−)	Teeth (+/−)	Gingiva (+/−)	Denture (+/−)			

Table 2 – Main ingredients or components of the oral hygiene products.

Material	Main ingredients or components
Mouthwash	Water, propylene glycol, sorbitol, xylitol, cetylpyridinium chloride
Mouth moisturizing gel	Water, glycerine, sodium, xylitol, hinokitiol
Oral wet wipe	Water, ethanol, propylene glycol, glycerine

Based on the program results, each patient's individual oral health care plan was revised as necessary during the meetings, and this procedure was repeated until program completion.

Measurements

To assess oral hygiene, the total number of oral microbes on the tongue surface was measured once a week by the dental hygienists before all patients' oral cavities were cleaned using a rapid oral bacteria detection device (Bacterial Counter DU-AA01NP-H, Panasonic Health Care).[24] Before sample collection, 1 mL of tap water was sprayed onto the tongue surface. A sterile swab was dipped in tap water, and the sample was taken by swabbing with a force of 20 gf anteriorly 5 times from the anterior part of the terminal sulcus on the median groove of the tongue.[25] Swabbing pressure was controlled by using a specific pressure control device. The used swab was then inserted into a disposable cup with pure water, and the total number of oral microbes in the sample was measured. The measurement was performed before cleaning once a week for 12 weeks.

To investigate the perception of the caregivers towards the oral health care practices, the daily required frequency and duration considered necessary for oral cleaning by the registered nurses were measured in this study. Opinions about the frequency and duration needed for oral cleaning were determined by asking the registered nurses who participated in the program and performed oral cleaning to complete a questionnaire at both program initiation and at completion 12 weeks later.

Statistical analysis

Bonferroni correction followed by the Friedman test was used for comparison of the number of microbes on the tongue surface at every measurement for 12 weeks from the beginning of the program. The Wilcoxon signed rank test was used for comparison of the required frequency and duration considered necessary by the caregivers for oral cleaning between before and after the program. A level of .05 was considered significant. Statistical analysis was performed using SPSS software for Windows, version 25 (IBM Corp.).

Results

The mean number of microbes on the tongue surface of the patients at the beginning of the program was $4.54 \times 10^7 \pm 3.38 \times 10^7$ CFU/mL. Changes in the number of

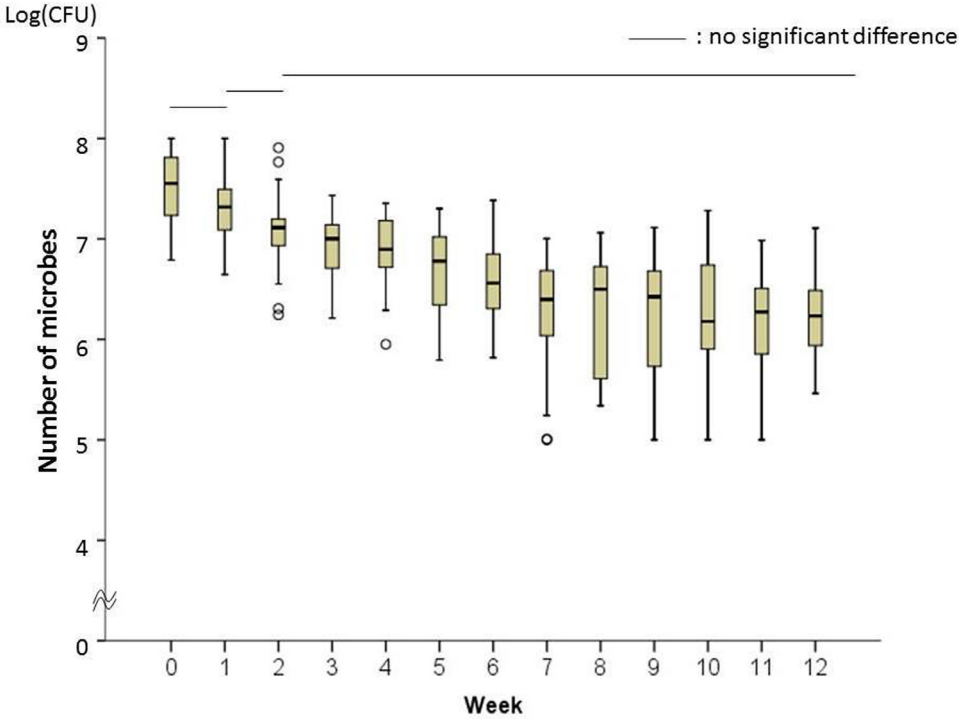

Fig. 1 – Change in the number of microbes on the tongue surface. The bottom of the rectangular box is the lower quartile (25th percentile), those on top are the upper quartile (75th percentile), and the horizontal line segment inside the box is the median. The horizontal line segments extend from each end of the box to the most extreme observations, and the small circles indicate the outliers.

microbes on the tongue surface are shown in Figure 1. There were significant differences between the baseline and weekly measurements during the program except for the first week. The microbial numbers from 3 weeks after the start of the program were less than 25% that of the baseline.

The results of the survey of opinions about the daily frequency of oral cleaning considered necessary by the caregivers before and after implementation of the program are shown in Figure 2. At baseline, "once" was the most frequent answer and the mean was 1.5 ± 0.8 times; however, after practicing the program, "three times" was the most frequent answer and the mean was 2.7 ± 0.7 times, thus showing a significant increase in the frequency considered necessary ($P = .000$). The results of the survey regarding the duration considered necessary for each oral cleaning session performed by registered nurses before and after implementation of the program are shown in Figure 3. The mean duration considered necessary for oral cleaning per each cleaning session by the caregivers was 3.8 ± 2.2 minutes at baseline and 5.8 ± 2.9 minutes at the end of the program, which was a significant increase ($P = .000$). The duration considered necessary for oral cleaning per day by the caregivers was 5.8 ± 2.9 minutes at baseline and increased by nearly three times to 16.0 ± 9.8 minutes after practicing the program.

Discussion

Changes in the number of microbes on the tongue surface

There were significant differences in the number of microbes on the patients' tongue surface between the beginning of the program and at 2 to 12 weeks and between 1 week and 3 to 12 weeks. These results indicate that the number of microbes on the tongue surface decreased after 2 weeks of tongue cleaning. These findings support a previous study in which the number of microbes in the pharynx decreased after several months of oral cleaning.[26] The number of microbes on the tongue surface stabilized at a low median value 7 weeks after initiation of the program and thereafter. This stabilization confirmed that the suppression of the number of microbes in the oral cavity was not a transient effect of the intervention, but that it persisted. These results confirm the importance of continuing oral cleaning to maintain good oral hygiene in elderly inpatients requiring nursing care.

Oral cleaning reportedly reduces the risk of aspiration pneumonia by suppressing the number of microbes in the oral cavity.[10,11] Our findings demonstrate that the program continuously suppressed the number of microbes on the tongue surface, indicating that the program was effective in improving oral hygiene and reducing the potential risk of systemic diseases such as aspiration pneumonia for elderly persons required nursing care.

Oral cleaning protocol

The oral cavity tends to be dry in elderly patients requiring nursing care, and a large amount of tongue coating and keratinocyte-derived products often adhere to the oral cavity.[27] By moisturizing the oral cavity with oral moisturizing gel to soften the substances adhering to the dorsum of the tongue before mechanical cleaning, the cleaning effect can be optimised.[28] The moisturizing gel used in this study contained hinokitiol, an antibacterial agent. Previous studies have shown that simply moistening the tongue without using an antimicrobial moisturizing gel reduces the microbial count on the tongue surface.[23] Therefore, it is expected that the same effect will be obtained even when a moisturizing gel without an antimicrobial ingredient is used.

In elderly persons who cannot gargle, the use of toothpaste during brushing makes it difficult to visualise residual plaque. Additionally, it is not easy to remove residual toothpaste. These observations suggest that brushing should be performed without toothpaste and rather with a brush immersed in mouthwash. It has been reported that mechanical cleaning of the dorsum of the tongue, combined with cleaning with mouthwash and oral moisturizing gel, is the

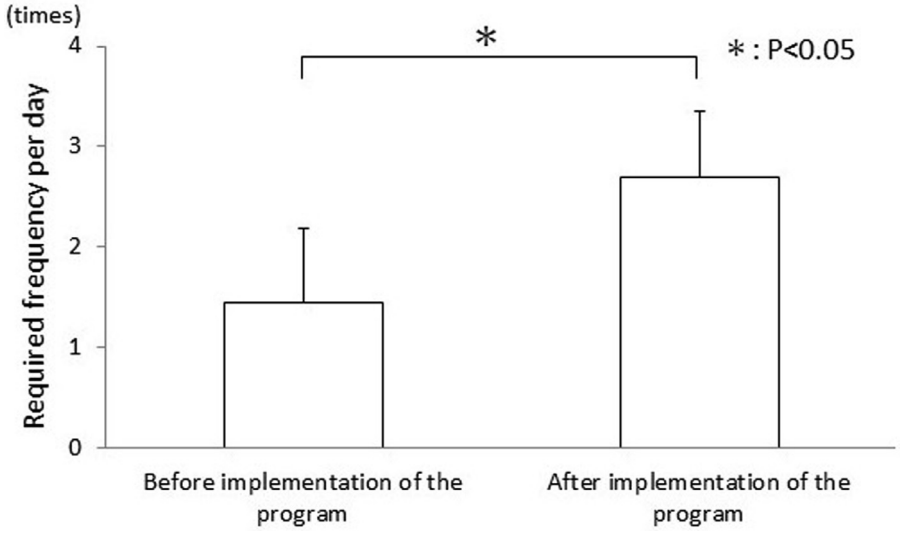

Fig. 2 – The required frequency per day considered necessary for oral cleaning by caregivers.

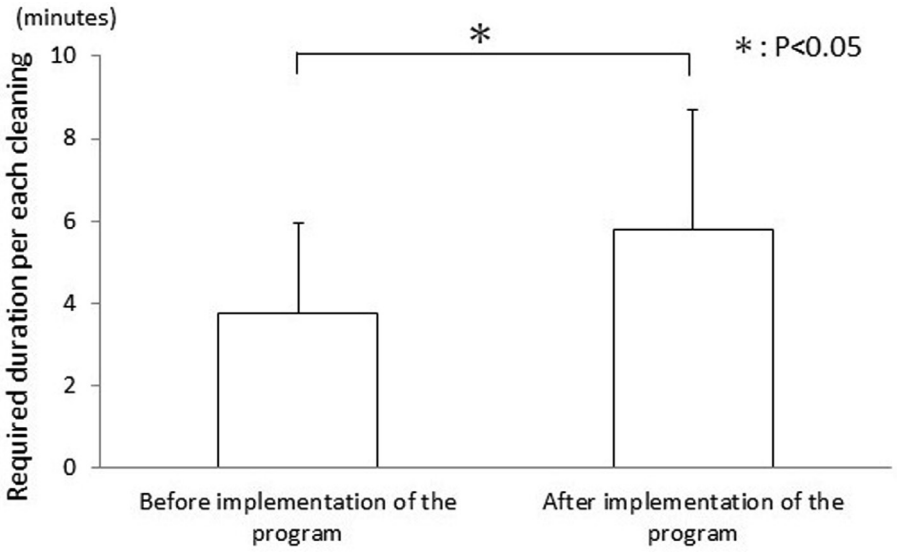

Fig. 3 – The required duration considered necessary for each oral cleaning session performed by caregivers.

most effective method for reducing the number of microbes on the tongue surface and improving the moisture level of the tongue in elderly patients requiring nursing care.[22,23] The mouthwash used in this study included 0.01% of cetylpyridinium chloride. Cetylpyridinium chloride demonstrates both bactericidal activity and a high level of safety,[29,30] and was considered safe for use in subjects of the study.

Although rinsing after oral cleaning clears microbes from the mouth, the number of oral microbes in the saliva increases immediately after oral cleaning when mouth rinsing is impossible.[31] Previous reports have shown that wiping after oral cleaning has a similar effect to rinsing and suctioning the mouth in eliminating oral microbes in elderly persons requiring nursing care.[32] Thus, based on previous resarch we wiped the oral cavity at the end of oral cleaning.

Changes in the required frequency and duration considered necessary for oral cleaning by caregivers

The oral environment and oral function decline markedly in elderly persons requiring nursing care. Although oral cleaning was performed by caregivers before implementation of the program, the frequency and duration of oral cleaning considered necessary were once a day and about 3 minutes per cleaning session, respectively, at baseline. In our facility, actual cleaning may have been performed based only on the experience of the caregivers before the initiation of the program because it was clear that knowledge concerning oral cleaning was lacking, and oral care was further limited by scarcity of staff and lack of cooperation among the caregivers. The frequency and duration considered necessary for oral cleaning by the caregivers was expected to decrease as they became used to the cleaning practices. However, we found that both the frequency and duration considered necessary increased as the caregivers practised the program, and the cleaning duration per day extended by nearly 3 times. It was considered that the knowledge of the caregiver and the cooperation among the caregivers were changed compared with the baseline.

In this program, dental hygienists as professional dental practitioners performed weekly oral cleaning and measurements in addition to the daily oral cleaning performed by the caregivers. The caregivers were also trained in the oral cleaning protocol by dental hygienists before the baseline measurement. By using a common individual oral health care plan and the oral condition check sheet, caregivers could share their findings for each patient. Additionally, the multidisciplinary team staff, including the caregivers, held monthly oral health care meetings and gave feedback on the effect of cleaning. Therefore, the caregivers were able to observe the results of their oral cleaning. Through these discussions, the interest of the caregivers in the oral condition of patients may have increased. Furthermore, their knowledge of oral cleaning techniques may have improved, thus elevating their perception towards oral cleaning and maintaining good oral hygiene. Some research has reported that educational programs on oral health care for caregivers effectively improves both the caregivers' motivation and the oral hygiene status of elderly persons requiring nursing care.[20,33,34] Based on these studies and our results that the required frequency and duration considered necessary for oral cleaning by caregivers increased even with limited manpower, the form and practice of an oral care support program involving multidisciplinary cooperation was highly likely to improve the perception of caregivers towards oral health care practices, which increased their motivation. Even if there is no numerically measured outcome, we believe that the effects of education may be sustainable for prolonged period by recording the outcome of the cleaning using the oral condition check sheet.

The required frequency and duration considered necessary for oral cleaning by dental hygienists at the baseline was 3.0 ± 0 times and 10.6 ± 2.6 minutes, which was almost the same as after the program (data not shown). The caregivers seemed to be considerably closer to the dental hygienist

because of the program. However, it was considered that there was still a gap in the duration of the cleaning. In this study, participating caregivers were all trained before the program. Comparison of the effect between trained caregivers and untrained caregivers should be examined in future studies.

Conclusion

Implementation of an interprofessional oral health care support program decreased the number of microbes on the tongue surface of elderly inpatients for prolonged periods and improved the perception of their caregivers towards oral health care.

Conflict of interest

None disclosed.

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