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Feature Article

Effective elimination of contaminants after oral care in elderly institutionalized individuals

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ABSTRACT

After mechanical cleaning in oral care, eliminating residual oral contaminants has an important role in preventing their aspiration, especially in individuals with weak airway protection. We examined the effectiveness of wiping the oral cavity after oral care on eliminating contaminants in 31 patients who were hospitalized in our neurology inpatient unit. The amount of bacteria on the tongue, palate, and buccal vestibule was counted before and just after oral care, after eliminating contaminants either by rinsing with water and suction or by wiping with mouth wipes, and 1 h after oral care. Oral bacteria amounts were decreased significantly by both elimination procedures after oral care. These findings suggest that wiping with mouth wipes is as effective as mouth rinsing to decrease bacteria following oral care. With a lower risk of contaminant aspiration, wiping may be a suitable alternative to rinsing, especially in dysphagic individuals.

Bacterial colonization of the oral cavity is considered to be the reservoir for respiratory pathogens.[1] Bacterial dental plaque is a dynamic environment composed of extracellular matrix and oral bacteria, wherein certain bacteria initiate biofilm formation on the tooth surface.[2] In the early stages of colonization, colonizers include many species of oral streptococci and other natural microbiota, which are not known as respiratory pathogens.[3] In contrast, later colonizers, such as *Fusobacterium nucleatum, Tannerella forsythia, Treponema denticola*, and *P. gingivalis*, are more pathogenic.[4] These earlier and later colonizers exhibit interspecies adhesive interactions to enhance biofilm formation.

Enzymes and immunoglobulins in the saliva control the colonization of microorganisms in the oral cavity and protect against biofilm build-up on the tooth surface. However, in frail institutionalized elderly patients, poor oral hygiene from diminished physical function, xerostomia derived from medication, systemic diseases, oral breathing, and other factors provide favorable conditions for the formation of dental plaque biofilm. Such patients often unconsciously aspirate saliva. If they have poor oral hygiene, micro-aspiration of pathogenic aerodigestive secretions from the oral cavity may lead to aspiration pneumonia[1,5]; Teramoto et al reported that the incidence of aspiration pneumonia was high in hospitalized patients in the forms of health care-acquired pneumonia (HCAP) and hospital-acquired pneumonia (HAP).[6]

Several studies have reported that oral care to improve oral hygiene reduces the risk of HAP, including ventilator-associated pneumonia, and HCAP.[7–12] Although oral care is now recommended to prevent respiratory complications, it is sometimes difficult for caregivers, who have expressed a desire for effective oral care standards. In order to standardize the oral care procedure, protocols of mechanical dental plaque removal with an electric or hand toothbrush, along with the use of sponge swabs, a tongue scraper, and/or chemical decontamination with chlorhexidine, have

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been broadly established.[10,11,13] Standardized protocols that unify such procedures are expected to maintain universal oral health standards.[13]

Previous studies on oral care protocols have typically focused on cleaning and less on the elimination of contaminants after cleaning.[10,11] An amount of displaced contaminants remain in oral cavity saliva after the mechanical removal of dental plaque and food debris. If not properly removed, these contaminants flow into the pharynx and may eventually be aspirated into the lower airway in individuals with weak airway protection. To eliminate contaminants after oral care, swishing/rinsing and spiting is normally performed if the patient is able to gargle. Rinsing and suction can also be used for patients who are not fully conscious or who are totally dependent on assistance.[8] In such cases, however, rinse water can easily reach the pharynx due to its rheological properties, thus increasing the risk of aspiration.

In a preliminary study of healthy subjects, we earlier examined the effect of wiping the oral cavity on eliminating contaminants after oral care as compared with rinsing.[14] We demonstrated that wiping with mouth wipes decreased the amount of oral bacteria on soft tissue surfaces in the oral cavity more effectively than with water rinsing. Wiping can avoid the risk of rinse water aspiration, and was considered to be an alternative procedure for contaminant elimination after oral care. The present study therefore aimed to evaluate wiping as a method of eliminating contaminants after oral care in a cohort of elderly institutionalized individuals.

Methods

Subjects and materials

We conducted a prospective cross-over trial in the neurology unit of our hospital from June 2013 to November 2013. The sample size was calculated based on our previous study with healthy individuals for a two-tailed significance level, a type I error of 0.05, and a type II error of 0.10 (power = 0.90).[14] Patients who were not able to properly brush their teeth by themselves were recruited. Patients were excluded if they were edentulous, of unstable general physical condition, or had a bleeding tendency. This study's protocol was approved by the Institutional Review Board of Fujita Health University (Approval ID: 13–094).

A total of 37 patients were approached for this study, and all agreed to participate. Before commencement, informed consent was obtained from each participant or the caregiver if the subject could not adequately communicate (Glasgow Coma Scale grades below 4-4-6). Six patients dropped out before or during the study since five refused to continue and one died due to recurrent cerebral infarction. Overall, 31 individuals (17 men, 14 women; mean age: 69.9 ± 15.1 years) participated in this study. Physical function was assessed using the Barthel Index (BI, adapted from Granger et al)[15] by neurology unit nurses. The BI is a scale that measures ten basic aspects of activity related to self-care and mobility. A normal BI score is 100, with lower values indicating a need for assistance in activities of daily living. Comorbidities, medications, and diet status were also evaluated. The number of teeth and denture use were assessed by hospital dentists. The cohort's characteristics are shown in Table 1.

Table 1
Characteristics of the study population.

	Mean ± SD
Age (yrs)	69.9 ± 15.1
Barthel index	28.7 ± 28.6
No. of teeth	19.8 ± 8.3
	N (%)
Gender	
Male	17 (55)
Female	14 (45)
Disease	
Cerebral infarction	18 (58)
Parkinson's disease	6 (19)
Spinocerebellar degeneration	2 (6)
Multiple sclerosis	1 (3)
Others	4 (13)
Diet status	
Peripheral parenteral nutrition	2 (6)
Enteral nutrition	6 (19)
Enteral nutrition with small amount of oral diet	1 (3)
Oral diet with some modifications	15 (48)
Oral diet with no restrictions	7 (23)
Denture use	
Yes	13 (42)
No	18 (58)

Procedures

Neurology unit nurses performed oral care after breakfast on patients who were fed orally or after 7 am on patients who were not. Participants who could somewhat brush their teeth were instructed to abstain from brushing during the study period. Subjects were also instructed not to consume any food or drink during the period of oral bacteria measurement until the final assessment 1 h after oral care.

The oral care protocol was developed with a nurse certified in dysphagia, neurology unit nursing staff, a dentist, and a dental hygienist. Oral moisturizing gel (Oral plus moisturizing gel for oral care, Wakodo Co. Ltd., Tokyo, Japan) was first applied to the soft surfaces of the oral cavity to soften any dried or hard secretions. The moisturizing gel contained hyaluronic acid and trehalose and had a high water content (75% or more) to prevent transpiration and moisten the inside of the mouth. Afterward, the teeth were brushed without a dentifrice with a hand toothbrush and interdental brush if necessary. The toothbrush was dipped into one of two cups of tap water before brushing, and was occasionally rinsed first in one cup, and then the other, when needed. The tongue was cleaned with a tongue scraper by scraping from the back to the front of the tongue surface 10 times. The palate and the other soft tissues were mechanically cleaned with a sponge swab. After oral care, residual contaminants in the oral cavity were eliminated using one of the two procedures described below. Finally, a measured amount of moisturizing gel was applied to the soft tissues of the oral cavity.

Two procedures for eliminating contaminants were adopted after mechanical cleaning of the teeth, tongue, and gums: (1) Rinse; the mouth was rinsed with 30 mL tap water from an irrigating syringe and suctioned with an oral suction handle. (2) Wipe; the entire mouth, including the teeth, gums, tongue, and palate, was wiped with an oral care mouth wipe (Oral Plus, Wakodo Co. Ltd., Tokyo, Japan). The mouth wipe had a texture similar to that of a baby wipe and was designed to clean the soft tissues of the mouth. The sheet was composed mainly of cellulose fibers, with a small amount of plastic fibers to bind them. It contained hyaluronic acid and trehalose for moisturization, but no alcohol or antimicrobial compounds. Both procedures were conducted on each subject on different days that were at least 24 h apart.

The amount of bacteria on the following places in the oral cavity was measured by a bacteria detection apparatus (Panasonic healthcare, Tokyo, Japan) before oral care, just after oral care, after eliminating contaminants, and 1 h after oral care (Fig. 1): (1) the dorsal surface of the tongue (tongue); (2) the palatal area between the hard and soft palates (palate); and (3) the buccal vestibule area of the lower right molars (buccal vestibule).