

Original Article

Oral Flora in Independent over 80-year-olds with more than 20 Teeth

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Abstract

The purpose of this study was to investigate oral flora in independent persons aged over 80 years with more than 20 remaining teeth. The subjects were 22 participants of the 8020 campaign (6 males and 16 females) with a mean age of 81.3 ± 1.6 years and an average of 24.7 teeth (Independent 8020 group). This group was compared with a group of 38 elderly people residing in nursing homes (10 males and 28 females) who had a mean age of 81.3 ± 8.5 years and an average of 4.2 teeth (Nursing group with fewer teeth). Saliva samples were collected from the vestibular areas of the maxilla and mandible using cotton swabs. Cell numbers of microorganisms were expressed as colony forming units/ml (CFUs/ml) and compared between the two groups. The average number of *Staphylococcus* species was 65.2 ± 74.4 CFUs/ml in the Independent 8020 group and 400.3 ± 352.1 CFUs/ml in the group with fewer teeth ($p < 0.01$); that of *Candida albicans* was 18.0 ± 37.7 CFUs/ml in the Independent 8020 group and 152.9 ± 211.9 CFUs/ml in the Nursing group with fewer teeth ($p < 0.05$). Both species showed statistically significant differences between the two groups. This suggests that the Independent 8020 achiever group had better oral hygiene and that the presence of many teeth may be associated with an increased awareness of dental health.

Key words: Participants of 8020 campaign—Oral flora—*Candida albicans*—*Staphylococcus* species—Elderly in Nursing home

Introduction

With the aging of the population, studies are needed on the recovery and maintenance of oral health in elderly people, which are closely

associated with the functions of eating and swallowing. The normal microbial flora in the oral cavity is comprised of several hundred species of microorganisms which maintain a relatively stable commensal relationship with

Table 1 Subjects

Group	N	Males/Females	Mean age \pm SD	Mean no. present teeth
Independent 8020 group	22	6/16	81.3 \pm 1.6	24.7 \pm 3.6
Nursing group with fewer teeth	38	10/28	81.3 \pm 8.5	4.2 \pm 7.1

the host¹²⁾. Disruption of this balance because of aging or medical conditions may result in proliferation of the *Candida* and *Staphylococcus* species, both of which normally only account for a small proportion of the oral flora⁶⁾. The *Candida* species, in particular, is known to increase with the use of dentures. Oral Candidiasis is more prevalent, however, and may be a manifestation of underlying systemic disease, in elderly denture wearers¹¹⁾. Oral healthcare in elderly people is, therefore, vital in maintaining and promoting not just oral health but general health, as well^{1,3,9,13)}. However, most studies, so far, have enrolled elderly subjects with a compromised status of general health^{2,4,10,15,16)}.

We conducted oral examinations in independent elderly people who had achieved the campaign goal of retaining more than 20 teeth at the age of 80 years (Independent 8020 achievers) to determine whether they had a good general status of oral hygiene. We analyzed the oral microbial flora of these Independent 8020 achievers through detection and enumeration of *Staphylococcus* species and *Candida albicans* in order to test our hypothesis that elderly people with many teeth would have a more favorable oral flora.

Methods

The study included 22 Independent 8020-achievers (6 males and 16 females) living in Chiba prefecture with a mean age of 81.3 \pm 1.6 years (Independent 8020 group) and an average of 24.7 teeth. This group was compared with a group of 38 elderly people residing in

Nursing homes in Chiba Prefecture (10 males and 28 females) with a mean age of 81.3 \pm 8.5 years (Nursing group with fewer teeth) and an average of 4.2 teeth (Table 1).

Saliva samples were collected from the vestibular areas of the maxilla and mandible using cotton swabs (swab technique). Each sample was suspended in 5 ml of sterile phosphate buffer saline solution (PBS, pH7.4) and agitated. One hundred μ l of each 5 ml suspension was inoculated onto a selective culture medium. Medium No.110 (Nissui, Tokyo) was used for *Staphylococcus* species and *Candida* GE Medium (Nissui, Tokyo) for *Candida albicans*. The cell numbers of these microorganisms were expressed as colony forming units/ml (CFUs/ml) and compared between the two groups. A statistical analysis was performed with the Mann-Whitney U test. The relationship between remaining number of teeth and number of CFUs/ml was also analyzed in 57 of the subjects

Results

The average number of *Staphylococcus* species was 65.2 \pm 74.4 CFUs/ml in the Independent 8020 group and 400.3 \pm 352.1 CFUs/ml in the Nursing group with fewer teeth ($p < 0.01$); that of *Candida albicans* was 18.0 \pm 37.7 CFUs/ml in the Independent 8020 group and 152.9 \pm 211.9 CFUs/ml in the Nursing group with fewer teeth ($p < 0.05$). Both species showed statistically significant differences between the two groups (Table 2). The proportion of non-infected individuals was 72.7% in the Independent 8020 group and 30.8%

Table 2 Cell numbers of microorganisms(CFU)

Group	<i>Staphylococcus</i> species	<i>Candida albicans</i>
Independent 8020 group	65.2 ± 74.4	18.0 ± 37.7
Nursing group with fewer teeth	400.3 ± 352.1	152.9 ± 211.9
	p<0.01	p<0.05

in the group with fewer teeth for *Candida albicans*, and 9.1% in the Independent 8020 group and 0% in the Nursing group with fewer teeth for *Staphylococcus* species.

No inverse correlation was found between number of sound teeth and number of CFUs/ml for either *Candida albicans* or *Staphylococcus* species.

Discussion

Abe *et al.*¹⁾ have shown that oral microorganisms exert an effect on aspiration pneumonia, cardiovascular and coronary diseases, and diabetes mellitus in compromised hosts. Pneumonia resulting from aspiration of oropharyngeal microorganisms is the most common cause of death in elderly people requiring daily nursing care. Cleaning of the oral cavity is, therefore, of the utmost importance in reducing the number of pathogens in oral flora.

Yoneyama *et al.*¹⁶⁾ and Kikuchi *et al.*⁸⁾ have reported that senile pneumonia is mostly due to silent aspiration, whereby saliva or regurgitated gastric contents are aspirated, little by little, into the lower respiratory tract. They have also shown that regular professional mechanical tooth cleaning and anti-microbial mouth rinsing were effective in significantly reducing the number of febrile days and number of individuals infected with pneumonia among residents of nursing homes.

The present study employed swab technique to collect saliva samples, as it is a simple and widely used method for sampling saliva.

So far, there have been no studies compar-

ing the status of oral hygiene in Independent 8020 achievers, a group who are reputed to have good oral hygiene, with that of age-matched non-achievers of the Independent 8020 goal from a microbiological viewpoint. The present study was, therefore, carried out to compare oral flora between Independent 8020 achievers and elderly people requiring daily nursing care by detecting and enumerating *Staphylococcus* species and *Candida albicans*. The mean CFUs/ml of both *Staphylococcus* species and *Candida albicans* were significantly lower in the Independent 8020 group. The p value was smaller for *Staphylococcus* species than *Candida albicans*. This may be because *Candida albicans* was not detected in some subjects in the Nursing group with fewer teeth.

The infection rate, that is, the proportion of non-infected individuals, was higher in the Independent 8020 group, with a smaller number of subjects infected with either *Staphylococcus* species or *Candida albicans*. This, together with the finding that the Independent 8020 group had lower CFUs/ml of these microorganisms per subject, seems to support our hypothesis that Independent 8020 achievers have more favorable oral hygiene conditions.

Ikebe⁵⁾ have reported that *Candida albicans* increased significantly with denture wear. Mutoh *et al.*¹¹⁾ have also shown that denture wear caused both *Candida* and *Staphylococcus* species to multiply. Usage conditions of denture wear vary greatly, so it was not possible to determine the relationship between denture wear and number of these microorganisms in this study. Further analysis is needed on the relationship between denture use and

number of these microorganisms in subjects with dentures.

In the present study, no inverse correlation was found between number of sound teeth and CFUs/ml. This may be partly because there were some subjects who had retained many sound teeth in the Nursing group with fewer teeth.

Shinada *et al.*¹⁴⁾ and Kawarai *et al.*⁷⁾ showed an inverse correlation between number of teeth and the number of *Candida albicans*. No correlation was found between the number of sound teeth and the CFUs/ml of the microorganisms in the present study. However, these researches support our results showing a significant difference between the two groups. We believe that the low number of *Candida* species in the Independent 8020 group reflected a higher standard of oral hygiene, which itself may have been caused by a higher awareness of such through the presence of a high number of teeth.

References

- 1) Abe S, Ishihara K, Okuda K (2001) Prevalence of potential respiratory pathogens in the mouths of elderly patients and effects of professional oral care. *Arch Gerontol Geriatr* 32:45–55.
- 2) Adachi M, Ishihara K, Abe S, Okuda K, Ishikawa T (2002) Effect of professional oral health care on the elderly living in Nursing homes. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 94:191–195.
- 3) Bagramian RA, Heller R (1977) Dental health assessment of a population of Nursing home residents. *J Gerodontology* 32:168–174.
- 4) Hirota K, Yoneyama T, Ota M, Hashimoto K, Miyake Y (1997) Pharyngeal bacteria and professional oral health care in elderly people. *Nippon Ronen Igakkai Zasshi* 34:125–129. (in Japanese)
- 5) Ikebe K (2002) Epidemiology of dental diseases in the elderly people. *Elderly Dentistry* 16:398–399. (in Japanese)
- 6) Ishihara K, Adachi M, Eguchi J, Washizu M, Kosugi M, Okuda K (2000) Prevalence of *Staphylococcus* species and *Candida albicans* in the oral cavities of elderly who require daily care in a Nursing home. *Bull Tokyo Dent Coll* 41:169–174.
- 7) Kawarai C, Nakabayashi Y, Yasui T (2002) Necessity of oral care for adults and the aged wearing dentures. *Meikai Univ Dent J* 31:192–196. (in Japanese)
- 8) Kikuchi R, Watanabe N, Konno T, Mishima N, Sekizawa K, Sasaki H (1994) High incidence of silent aspiration in elderly patients with community-required pneumonia. *Am J Respir Crit Med* 150:251–253.
- 9) Mikkonen M, Nyssonen V, Paunio I, Rajala M (1984) Oral hygiene, dental visits and age of denture for prevalence of denture stomatitis. *Community Dent Oral Epidemiol* 12:402–405.
- 10) Mojon P, Rentsch A, Budtz-Jorgensen E, Baehni PC (1998) Effects of an oral health program on selected clinical parameters and salivary bacteria in a long-term care facility. *Eur J Oral Sci* 106:827–834.
- 11) Mutoh T, Honda E, Maeda N, Matsumoto K, Morito M (2000) Oral microbial flora in institutionalized elderly people. *J Dent Hlth* 50:351–360. (in Japanese)
- 12) Slots J, Taubman MA (1992) *Contemporary Oral Microbiology and Immunology*, p.267, Mosby Co., St. Louis.
- 13) Schou L, Wight C, Cumming, C (1987) Oral hygiene habits, denture plaque, presence of yeasts and stomatitis in institutionalized elderly in Lothian, Scotland. *Community Dent Oral Epidemiol* 15:85–89.
- 14) Shinada K, Teraoka K, Asaka T, Cordeiro JG, Ozaki F, Shimoyama K, Nagao M (1997) Distribution of *Candida* species and *Mutans Streptococci* related to oral conditions in elderly persons. *Kokubyo Gakkai Zasshi* 64:512–517. (in Japanese)
- 15) Ueda K, Toyosato A, Nomura S (2003) A study on the effects of short-, medium- and long-term professional oral care in elderly persons requiring long-term Nursing care at a chronic or maintenance stage of illness. *Gerodontology* 20:50–56.
- 16) Yoneyama T, Yoshida M, Ohru T, Mukaiyama H, Okamoto H, Hoshiba K, Ihara S, Yanagisawa S, Ariumi S, Morita T, Mizuno Y, Ohsawa T, Akagawa Y, Hashimoto K, Sasaki H (2002) Oral care reduces pneumonia in older patients in Nursing homes. *J Am Geriatr Soc* 50:584–585.

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