

# Relationships between lifestyle and dental health behaviors in a rural population in Japan

Harada S, Akhter R, Kurita K, Mori M, Hoshikoshi M, Tamashiro H, Morita M. Relationships between lifestyle and dental health behaviors in a rural population in Japan. Community Dent Oral Epidemiol 2005; 33: 17–24. © Blackwell Munksgaard, 2005

*Abstract* – *Objectives:* The aim of this study was to determine associations of lifestyle with dental health behaviors such as tooth brushing frequency, use of extra cleaning devices, and regular dental visits to a dentist. Methods: Data were collected from 1182 dentate residents 18 years of age or older who resided in a typical farming district. The data included data on the demographic factors, dental health behavior, and various aspects of lifestyle, i.e. mental condition, alcohol consumption, smoking habit, physical activity, social activity, dietary habits, and presence of systemic diseases. Results: Multiple logistic regression analysis revealed that subjects in a younger group (18-39 years of age) and subjects who had never smoked brushed their teeth more frequently. Experience of social volunteer work and presence of systemic disease were correlated with use of extra cleaning devices. Associations of female gender with frequency of tooth brushing and use of extra cleaning devices were weakly positive. The subjects who considered dietary combination carefully and those who lived alone were predisposed to visit a dentist regularly. Conclusions: The results indicate that dental health behavior is associated with lifestyle as well as demographic factors.

#### Shoji Harada<sup>1</sup>, Rahena Akhter<sup>1</sup>, Keiko Kurita<sup>1</sup>, Miyako Mori<sup>2</sup>, Misuzu Hoshikoshi<sup>2</sup>, Hidehiko Tamashiro<sup>3</sup> and Manabu Morita<sup>1</sup>

<sup>1</sup>Department of Oral Health Science, Hokkaido University Graduate School of Dental Medicine, Kita-ku, Sapporo, Japan, <sup>2</sup>Minami Furano Health Center, Minami Furano, Hokkaido, Japan, <sup>3</sup>Division of Social Medicine, Hokkaido University Graduate School of Medicine, Kita-ku, Sapporo, Japan

Key words: dental health behavior; lifestyle; rural area

Manabu Morita, Department of Oral Health Science, Hokkaido University Graduate School of Dental Medicine, North 13, West 7, Kita-ku, Sapporo 060-8586, Japan Tel: +81-11-706-4254 Fax: +81-11-706-4918 e-mail: mmorita@den.hokudai.ac.jp

Submitted 10 March 2004; accepted 23 June 2004

## Introduction

Researchers are beginning to study the combined influences of lifestyles, psychological factors and social conditions on human well being, not only the standard risk factors, which do not explain everything (1). This concept is also accepted in dental science (2–18). Dental health behavior is associated with gender and socioeconomic status. Females are more likely than males to brush their teeth, use dental floss, and visit dentists for prevention of dental diseases (4, 6, 8, 12, 15). Daily brushing has been shown to be significantly related to education and income in a US (8) and a Japanese (14) adult population. Dental health behavior is associated with smoking habit, alcohol consumption, physical activity and dietary habits (4, 11, 15). Family characteristics and dental health behavior of the parents affect regular dental visits by adolescents (17). These findings suggest that dental health behavior is multidimensional.

There have been several multivariate studies on the relationship between dental health behavior and lifestyle (8, 15). However, there have been few multivariate studies in Japan. In addition, these past studies were carried out in urban areas. However, rural areas contain the most rapidly aging communities where the behavior of individuals would be expected to be more typical and might provide a more appropriate sample for epidemiological study. We also hypothesized that mental condition, social activity and presence of systemic disease also affect dental health behavior. The aim of this study was to determine the association of lifestyle with dental health behavior such as tooth brushing frequency, use of extra cleaning devices and regular visits to a dentist.

## Methods

All of the 2359 residents 18 years of age or older of a rural district (Minami Furano) in the northern prefecture (Hokkaido) of Japan were invited to take part in this study. The list of names came from government census. This rural district had a total population of 3055 in 665.53 km<sup>2</sup>. The percentage of people of 65 years or over was 27%, which was higher than that of the national data (18%) (19). Two regional health officers visited residents' homes to explain the purpose of the study and to ask the residents to fill in questionnaires. Verbal consent for participation in the study was obtained from all residents. The officers visited their homes again to collect the questionnaires.

The first page of the questionnaire included questions on demographic factors, i.e. age, gender, occupation (none, farming, manufacturing, or service/others) and type of household (living alone, a couple, parent and child, or with other family members) and questions on body weight and height. Body mass index (BMI) was calculated as body weight (kg) divided by height<sup>2</sup> ( $m^2$ ). Aspects of dental health behavior included frequency of tooth brushing (more than twice/day, twice/day, once/day, or less frequently), frequency of use of extra cleaning devices such as dental floss or an interdental brush (every day, less than daily, never), and regular visits to a dentist for the purpose of dental disease prevention (yes or no). The condition of remaining teeth (edentulous or not edentulous) was also recorded.

Lifestyle was assessed by means of questions about mental condition, alcohol consumption, smoking habit, physical activity, social activity, dietary habits and presence of systemic disease. This study was originally a part of the survey on the lifestyle relating to health. This original survey was based on the statement of national health objectives for the nation to achieve over the first decade of the 21st century (20), and the variables used in this study were selected from a large set of the questionnaires. Mental condition was assessed by questions on current mental health status (good, relatively good, relatively poor, or poor), duration of sleep, consumption of alcohol or taking medicine for the purpose of falling asleep (no, occasionally, or every day), effectiveness of sleep for overcoming fatigue (good, relatively good, relatively poor, or poor), and mental stress (never, rarely, sometimes, or often). Alcohol consumption was based on the frequency of consumption of beverages per week (everyday, three times or more, less than three times, or none). For assessment of smoking habit, residents were asked to classify themselves as non-smokers, regular smokers, occasional smokers, or ex-smokers (15). Physical activity was assessed by the frequency of active movement for work for 30 min or more (every day, sometimes, rarely, or never) and extra physical exercise during leisure time (every day, sometimes, rarely, or never) (21). Social activity was assessed by experience of social volunteer work (often, sometimes, rarely, or never), living a worthy life (yes or no), and number of intimate relatives and friends. Dietary habits were based on frequency of eating breakfast (every morning, three to five times/week, one to two times/week, or never), degree of likes and dislikes of foods (much, moderate, slight, or none), attention to dietary combination (always, sometimes, rarely, or never), and attention to intake of sugar and salt (always, sometimes, rarely, or never). The presence of systemic disease was recorded as positive if one or more typical systemic diseases were checked in the checklist of diseases that included cancer, hypertension, heart diseases, hyperlipidemia and diabetes mellitus.

The data from dentate subjects were analyzed. Each dental health behavior, i.e. frequency of tooth brushing, frequency of use of extra cleaning devices and regular visits to a dentist, was separately analyzed for association with lifestyle. First, each lifestyle factor was employed as an independent variable in a univariate unconditional logistic regression analysis in which the dependent variables were three dental health behaviors, and the odds ratio (OR) together with the 95% confidence interval (95% CI) were calculated. In stepwise multivariate logistic analysis, the factors that showed a significant correlation with dental health behavior in the univariate unconditional logistic analysis were used as the independent variables, and variables with a significant relation to each dental health behavior were selected. All data were analyzed using an SPSS statistical package (11.0 J for Windows; SPSS Japan, Tokyo, Japan).

## Results

Questionnaires were distributed to all 2359 residents, and responses were received from 1533 residents (response rate: 65%). A total of 1181 residents were dentate. Table 1 shows the percent distributions of the target population and respondents by age and gender.

The data from the dentate residents were used for further analysis. The distribution of subjects according to oral health behaviors is shown in Table 2. About 54% of the subjects brushed their teeth twice/day or more, and 29% of them used extra tooth cleaning devices sometimes or more frequently. The percentage of subjects who regularly visited a dentist for the purpose of dental disease prevention was low (6.2%).

Table 3 shows the relationships between dental health behaviors and all of the dependent variables

Table 1. Percent distributions of target population and respondents by age and gender

	Target population $(n = 2359)$	Respondents		
		Total $(n = 1533)$	Dentate $(n = 1181)$	
Age (years)				
18–29	14.2	10.2	11.4	
30–39	14.1	12.8	14.7	
40-49	15.8	14.4	16.9	
50-59	16.3	16.8	19.4	
60–69	17.6	20.0	20.4	
≥70	22.0	25.8	17.2	
Gender				
Male	50.1	47.3	48.9	
Female	49.9	52.7	51.1	

Table 2. Distribution of subjects according to tooth brushing frequency, use of extra cleaning devices and regular visits to a dentist

Dental health behaviors	Number of subjects (%)
Tooth brushing frequency	
<1 time/day	22 (1.9)
1 time/day	517 (43.8)
Twice/day or more	642 (54.4)
Use of extra cleaning devices	
Every day	66 (5.6)
Less than daily	277 (23.5)
Never	(68.6)
No answer	28 (2.3)
Regular visits to a dentist	
Yes	73 (6.2)
No	1080 (91.4)
No answer	28 (2.4)
Total	1181 (100.0)

analyzed using univariate unconditional logistic analysis. Advanced age, male gender, and smoking habit showed significantly negative associations with tooth brushing frequency and use of extra cleaning devices. The residents who felt stress and those who considered dietary combination were apt to brush their teeth more frequently and to use extra cleaning devices. Occupation and lifestyle variables such as duration of sleep and physical exercise during leisure time were related to tooth brushing frequency but not to the use of extra cleaning devices. Experience of social volunteer work was positively associated with use of extra cleaning devices. Demographic factors showed no significant associations with regular visits to a dentist. However, physical activity and physical exercise were significantly associated with regular visits to a dentist. The subjects who gave consideration to dietary combination were more predisposed to visit dentists regularly compared with those who did not.

More detailed analysis by stepwise logistic regression analysis revealed further information in some cases. Six factors were selected as significant variables for tooth brushing frequency, five factors were selected for use of extra cleaning devices, and two factors were selected for regular visits to a dentist (Table 4). Tooth brushing frequency was still clearly related with advanced age and smoking habit. Subjects in the older age group (OR = 0.49 for the 40–64-year-old group; OR = 0.27 for the group of subjects 65 years old or over) and subjects who smoked or had smoked (OR = 0.47 for the regular or occasional smokers;OR = 0.51 for the ex-smokers) brushed their teeth less frequently. More physical exercise in leisure time (OR = 1.47) and more attention to intake of sugar (OR = 1.56) were significantly associated with increase in tooth brushing frequency. Associations of female gender with increase in tooth brushing frequency (OR = 1.65) and use of extra cleaning devices were weak (OR = 1.71) but significant. The subjects who had more experience of social volunteer work (OR = 1.75) and those who had one or more systemic diseases (OR = 1.64) tended to use extra cleaning devices. The feeling of stress (OR = 1.46) was associated with use of extra cleaning devices. Two factors showed associations with regular visits to a dentist, but the associations were weak. The subjects who considered dietary combination and who lived alone tended to visit a dentist regularly. Associations of physical activity and physical exercise became

### Harada et al.

	Dental health behaviors		
	Tooth brushing frequency twice/ day or more [OR (95% CI)]	Use of extra cleaning devices several times or more [OR (95% CI)]	Regular visits to a dentist yes [OR (95% CI)]
Age (years)			
18–39	1.00	1.00	1.00
40-64	0.51 (0.38–0.68)***	1.08(0.80-1.46)	1.10(0.59-2.04)
>65	0.21 (0.15–0.30)***	$0.58 (0.40 - 0.84)^{**}$	1.73(0.91-3.29)
Gender	0.21 (0.12 0.00)		
Male	1.00	1.00	1.00
Female	2 96 (2 33–3 76)***	2 03 (1 57–2 64)***	1 13 (0.70 - 1.81)
Occupation	2.50 (2.66 6.76)	2.00 (1.07 2.01)	1.10 (0.70 1.01)
None	1.00	1.00	1.00
Farming	0.54 (0.37 - 0.79) **	0.90(0.60-1.36)	0.69(0.32 - 1.52)
Manufacturing	$0.59 (0.35 - 0.99)^*$	0.72 (0.41 - 1.36)	0.35(0.02-1.02)
Services/others	1.62 (1.25–2.10)***	0.96 (0.72 - 1.26)	0.66(0.39-1.11)
Type of household	1102 (1120 2110)	0000 (0012 1120)	
Alone	1.00	1.00	1.00
A couple	$0.63 (0.43 - 0.91)^*$	0.93 (0.66 - 1.30)	0.76(0.40-1.43)
Parent and child	0.78 (0.53 - 1.14)	1.21 (0.80 - 1.82)	$0.39 (0.19 - 0.82)^*$
Others	0.61 (0.37 - 0.99)*	1.21(0.00, 1.02) 1 42 (0.84–2.42)	0.37 (0.12 - 1.15)
BMI	0.01 (0.07 0.77)	1.12 (0.01 2.12)	0.07 (0.12 1.10)
19 8-24 2	1.00	1.00	1.00
<19.8	1.00	1.00 1.26 (0.84-1.90)	1.00 1 19 (0 56-2 56)
>24.2	0.72 (0.55-0.93)*	0.76 (0.54 1.90)	1.13(0.67-1.93)
Current mental health state	18	0.70 (0.50 1.01)	1.10 (0.07 1.93)
Relatively poor poor	1.00	1.00	1.00
Good relatively good	0.85(0.61-1.16)	1.00 1 04 (0 72–1 49)	1.00 1 30 (0.63-2.70)
Duration of sleep	0.00 (0.01 1.10)	1.04 (0.72 1.49)	1.50 (0.05 2.70)
7_8 h	1.00	1.00	1.00
<6 >9 h	1 42 (1 11_1 81)**	1.00 1 27 (0.98-1.65)	1.00 1.07 (0.65–1.76)
Taking alcohol/medicine fo	1.42 (1.11-1.01)	1.27 (0.96–1.05)	1.07 (0.05–1.70)
Occasionally every day	1 00	1.00	1.00
No	1 32 (1 01_1 69)*	1.00 1 27 (0.94-1.69)	1.00 1.00 (0.58–1.69)
Effectiveness of sleep for o	vercoming fatigue	1.27 (0.94-1.09)	1.00 (0.00-1.07)
Good relatively good		1.00	1.00
Relatively poor poor	1 83 (1 18-2 84)**	1.00 1 45 (0 93-2 25)	0.79 (0.31 - 2.00)
Feeling stress	1.05 (1.10 2.04)	1.45 (0.95 2.25)	0.77 (0.01 2.00)
Never rarely	1.00	1.00	1.00
Sometimes often	1 79 (1 42-2 27)***	1.00	0.62 (0.37 - 1.02)
Alcohol consumption	1.77(1.42-2.27)	1.03 (1.23–2.11)	0.02 (0.07-1.02)
>3 times /week	1.00	1.00	1.00
23 times/week	1.00 1.20 (0.95-1.52)	1.00	1.00 1.22 (0.74-2.01)
Smoking	1.20 (0.95-1.52)	1.20 (0.93–1.50)	1.22 (0.74-2.01)
Never	1.00	1.00	1.00
Regularly occasionally	0.44 (0.34_0.58)***	0.63 (0.47_0.84)**	1.00 1 13 (0 59–2 16)
Previously	0.41 (0.94 0.96)	$0.63 (0.43 - 0.04)^{*}$	0.71 (0.35 - 1.48)
Physical activity	0.40 (0.2)-0.30)	0.03 (0.43-0.72)	0.71 (0.35-1.40)
Rarely never	1.00	1.00	1.00
Every day sometimes	1.00 1.25 (0.95-1.67)	1.00 1.06 (0.78-1.44)	3 23 (1 39_7 69)**
Physical evercise	1.20 (0.90 1.07)	1.00 (0.70 1.44)	3.23 (1.37 7.07)
Paroly povor	1.00	1.00	1.00
Every day comptimes	1.00	1.00 1 14 (0.89, 1.49)	2 13 (1 30 3 57)**
Social valuetare work	1.47 (1.15–1.89)	1.14 (0.89–1.49)	2.13 (1.30-3.37)
Baroly nover	1.00	1.00	1.00
Often compting a	1.00 1 10 (0.02 1 40)	1.UU 1 64 (1 07 0 10\***	1.00 1.20 (0.72, 1.04)
Worthy life	1.17 (0.70-1.47)	$1.04(1.27-2.13)^{200}$	1.20 (0.73-1.90)
No	1.00	1.00	1.00
	1.00 1.47 (1.00, 2.00)*	1.00 1.50 (1.06 0.17)*	1.00 1.07(0.56, 2.04)
105 Number of intimate friends	1.47 (1.07-2.00)	1.32 (1.00-2.17)"	1.07 (0.30-2.04)
rumber of intimate mends	1.00	1.00	1.00
20	1.00	1.00	1.00

Table 3. Relationships	between lifestyle and	dental health behaviors
------------------------	-----------------------	-------------------------

## Table 3. Continued

	Dental health behaviors		
	Tooth brushing frequency twice/ day or more [OR (95% CI)]	Use of extra cleaning devices several times or more [OR (95% CI)]	Regular visits to a dentist yes [OR (95% CI)]
≥4	1.30 (1.02–1.67)*	1.32 (1.01–1.73)*	1.45 (0.89–2.35)
Number of intimate rela	atives		
≤3	1.00	1.00	1.00
≥4	1.07 (0.85–1.35)	1.01 (0.78–1.31)	1.12 (0.69–1.81)
Eating breakfast			
Less than daily	1.00	1.00	1.00
Every day	0.81 (0.59–1.11)	1.08 (0.78–1.32)	1.47 (0.71–3.03)
Degree of likes and disl	likes of foods		
Much, moderate	1.00	1.00	1.00
Slight, none	0.99 (0.78–1.26)	0.99 (0.76–1.29)	1.68 (0.99–1.86)
Attention to dietary cor	nbination		
Rarely, never	1.00	1.00	1.00
Always, sometimes	1.96 (1.52–2.56)***	2.22 (1.64–3.13)***	3.13 (1.47-6.67)**
Attention to sugar intak	Ke la		
Rarely, never	1.00	1.00	1.00
Always, sometimes	1.49 (1.10-2.04)*	1.43 (0.99–2.04)	1.69 (0.79–3.57)
Attention to salt intake			
Rarely, never	1.00	1.00	1.00
Always, sometimes	1.20 (0.88–1.64)	1.72 (1.18–2.56)**	1.75 (0.91–5.00)
Systemic disease			
No	1.00	1.00	1.00
Yes	0.65 (0.65–1.06)	1.39 (1.05–1.82)*	0.98 (0.57–1.67)

\*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001.

	Dental health behaviors		
	Tooth brushing frequency twice/ day or more [OR (95% CI)]	Use of extra cleaning device several times or more [OR (95% CI)]	Regular visits to a dentist yes [OR (95% CI)]
Age (years)			
18–39	1.00	1.00	
40-64	0.49 (0.32-0.74)***	1.21 (0.82–1.79)	
≥65	0.27 (0.15-0.50)***	0.56 (0.32-0.97)*	
Gender			
Male	1.00	1.00	
Female	1.65 (1.07–2.53)*	1.71 (1.13-2.59)*	
Occupation			
None	1.00		
Farming	0.73 (0.40-1.35)		
Manufacturing	0.71 (0.35-1.47)		
Services/others	1.57 (1.03–2.40)*		
Type of household			
Alone			1.00
A couple			0.47 (0.22–1.01)
Parent and child			0.41 (0.18-0.93)*
Others			0.50 (0.15-1.62)
Feeling stress			
Never, rarely		1.00	
Sometimes, often		1.46 (1.03–2.06)*	
Smoking			
Never	1.00		

#### Table 4. Results of multiple logistic regression analysis for dental health behaviors

#### Harada et al.

#### Table 4. Continued

	Dental health behaviors		
	Tooth brushing frequency twice/ day or more [OR (95% CI)]	Use of extra cleaning device several times or more [OR (95% CI)]	Regular visits to a dentist yes [OR (95% CI)]
Regularly, occasionally Previously Physical exercise	0.47 (0.31–0.72)*** 0.51 (0.31–0.84)**		
Rarely, never	1.00		
Every day, sometimes	1.47 (1.05–2.08)*		
Social volunteer work			
Rarely, never		1.00	
Often, sometimes		1.75 (1.27-2.44)***	
Attention to dietary combin	nation		
Rarely, never			1.00
Always, sometimes			2.33 (1.01-5.56)*
Attention to sugar intake			
Rarely, never	1.00		
Often, sometimes	1.56 (1.01–2.44)*		
Systemic disease			
No		1.00	
Yes		1.64 (1.18–2.33)*	

\*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001.

non-significant, although they were selected by univariate analysis.

## Discussion

In a national oral health survey of Japan (22), the percentage of subjects who brushed their teeth twice/day or more was 67% in urban areas and 41% in rural areas. In our study, about 40% of the subjects answered that they brushed their teeth twice/day or more. Therefore, the population in this study is thought to be a representative of rural area populations rather than the general population of Japan.

Females were more apt than were males in brushing their teeth more frequently and using extra cleaning devices. This result is supported by those of past studies (4, 6, 8, 12, 15). Among 1012 55-year-old Finnish citizens, 30.4% of the females brushed their teeth twice/day and 27.0% used extra cleaning devices, whereas only 14.4 and 22.7% of the males did so. This trend was significant after adjusting the other factors examined using multiple logistic analyses (15). The reason for more frequent tooth brushing by females has been reported to be esthetic or caused by social norms (3, 15). Encouragement for tooth brushing is therefore needed more for males than for females (8).

Aging was a factor contributing to decrease in tooth brushing frequency. These results are supported by results of a previous Japanese study (23). However, Ronis et al. (8) found no significant association between aging and tooth brushing frequency. However, they compared the percentages of subjects who brushed daily (once/day or more) in several age groups, whereas we focused on subjects who brushed their teeth twice/day or more. With regard to the use of extra cleaning devices, OR was 1.21 for the 40-64-year-old group. This generation generally loses teeth because of periodontal disease (24), and people in this age group are more conscious of their oral health (23). Therefore, aging might have a greater effect on the use of extra cleaning devices than on tooth brushing frequency. However, the oldest group (65 years old or over) used extra cleaning devices less frequently (OR = 0.56) than did the youngest group. This result contradicts those of studies in Canada (6) and the US (8). The percentage of subjects in the oldest group (65 years old or over) who used an inter-dental brush (34%) was significantly higher than that (25%) in the younger group ranging from 50-64 years of age (6). The OR of flossing was 2.47 for the older group (55 years old or over) when compared with that in the younger (30-39 years old) group (8). Thus, in Japan, more encouragement should be given, particularly to older people, to use extra cleaning devices.

Healthier smoking behavior and more physical exercise were significantly associated with increase in tooth brushing frequency. Even ex-smokers, as well as current regular or occasional smokers, brushed their teeth less frequently than subjects who have never smoked. This result is supported by the results of a past study (11). It was also found in the present study that social activity as assessed by experience of social volunteer work was correlated with dental health behavior.

Deinzer et al. (16) found psychological stress induces more accumulation of dental plaque among medical students. Therefore, we hypothesized that any mental stress has an adverse effect on dental health behavior. However, frequent feeling of stress was significantly related to increase in tooth brushing frequency or use of extra cleaning devices (Tables 3 and 4). The reason of the difference between our result and the finding by Deinzer et al. (16) remains unclear. One possibility is that we could not identify the type of stress exactly by the questionnaire. They focused on only academic stress and assumed that this type of stress induces neglect of oral hygiene (16). Although we asked the subjects about their mental situation based on duration of sleep and use of alcohol/medicine for falling asleep, the results were not significant.

We also hypothesized that people with systemic disease are more conscious about their health and consequently have healthier dental behavior. It was in fact found in the present study that the presence of systemic disease was correlated with use of extra cleaning devices (Table 4): 35.3% of subjects with hyperlipidemia and 44.8% of those with diabetes mellitus used extra cleaning devices, whereas only 29.6% and 29.4% of the subjects without those diseases used extra cleaning devices (data not shown).

Strong factors related to regular visits to a dentist were not identified. Subjects living alone were more apt to visit a dentist regularly than were subjects living together with many family members. It is possible that subjects living alone visited a dentist more regularly because they were oriented to self-consciousness. A significant effect of parental characteristics on regular visits to a dentist by children has been reported (17). It is possible that family characteristics also affect dental health behavior in adults. Careful consideration to dietary combination was related to regular visits to a dentist, indicating an association between healthier lifestyle and dental health behavior. However, unlike the results of previous studies (10, 15), neither demographic factors (age and gender) nor socioeconomic factors were correlated with regular visits to a dentist. Those previous studies were conducted in urban areas, and the percentages of subjects who visited dentists regularly were over 70%, much higher than the 6.2% in our study.

Occupational status was not a factor strongly influencing tooth-brushing behavior. This result differs from results of past studies (8, 9, 12, 15). The reason for the discrepancy between the results of past studies and the present study might result from the difference in occupational classification. In those previous studies, income and education were taken into consideration for classification of subjects. However, as Japanese generally feel uncomfortable to answer to such questions, we were only able to divide subjects according to type of work. The classification used in the present study is not suitable for determination of socioeconomic status.

The results of our study were slightly different from those of the previous European or US studies because of the discrepancy of the characteristics of the subjects and lifestyle variables used. However, positive association between better lifestyle and dental health behaviors were commonly confirmed, indicating that these associations are not entirely culturally driven, but may be more universal, at least in the developed countries. It would be important to investigate the associations in Asian citizens or developing countries.

In summary, aging and smoking behavior were factors contributing to decrease in tooth brushing frequency. Experience of social volunteer work and presence of systemic diseases were correlated to the use of extra cleaning devices. Associations of female gender with frequency of tooth brushing and use of extra cleaning devices were weakly positive. The subjects who considered dietary combination carefully and those who lived alone were predisposed to visit a dentist regularly. These results indicate that dental health behavior is associated with lifestyle as well as demographic factors.

#### References

- 1. Regional Office for Health Education, WHO Regional Office for Europe. Life-styles and health. Soc Sci Med 1986;22:117–24.
- 2. Rajara M, Honkala E, Rimpelä M, Lammi S. Toothbrushing in relation to other health habits in Finland. Community Dent Oral Epidemiol 1980;8:391–5.

#### Harada et al.

- 3. Hodge HC, Holloway PJ, Bell CR. Factors associated with toothbrushing behaviour in adolescents. Br Dent J 1982;152:49–51.
- 4. Schou L, Currie C, McQueen D. Using a 'lifestyle' perspective to understand toothbrushing behaviour in Scottish schoolchildren. Community Dent Oral Epidemiol 1990;18:230–4.
- Keogh T, Linden GJ. Knowledge, attitudes and behaviour in relation to dental health of adults in Belfast, Northern Ireland. Community Dent Oral Epidemiol 1991;19:246–8.
- Payne BJ, Locker D. Oral self-care behaviours in older dentate adults. Community Dent Oral Epidemiol 1992;20:376–80.
- Hansen BF, Bjertness E, Gronnesby JK. A socioecologic model for periodontal diseases. J Clin Periodontol 1993;20:584–90.
- 8. Ronis DL, Lang WP, Passow E. Tooth brushing, flossing, and preventing dental visits by Detroit-area residents in relation to demographic and socioeco-nomic factors. J Public Health Dent 1993;53:138–45.
- 9. Sakki TK, Knuuttila MLE, Vimpari SS, Kivelä SL. Lifestyle, dental caries and number of teeth. Community Dent Oral Epidemiol 1994;22:298–302.
- 10. Lang WP, Farghaly MM, Ronis DL. The relation of preventive dental behaviors to periodontal health status. J Clin Periodontol 1994;21:194–8.
- Sakki TK, Knuuttila MLE, Vimpari SS, Hartikainen MSL. Association of lifestyle with periodontal health. Community Dent Oral Epidemiol 1995;23:155–8.
- Payne BJ, Locker D. Relationship between dental and general health behaviors in a Canadian population. J Public Health Dent 1996;56:198–204.
- Steele JG, Walls AWG, Ayatollahi SMT, Murray JJ. Dental attitudes and behaviour among a sample of dentate older adults from three English communities. Br Dent J 1996;180:131–6.
- Fukai K, Maki Y, Takaesu Y. The association between oral health behavior and occupational categories in adults. J Dent Health 1997;47:89–97.

- 15. Sakki TK, Knuuttila MLE, Anttila SS. Lifestyle, gender and occupational status as determinants of dental health behavior. J Clin Periodontol 1998;25:566–70.
- Deinzer R, Hilpert K, Bach K, Schawacht M, Herforth A. Effects of academic stress on oral hygiene – a potential link between stress and plaque associated disease? J Clin Periodontol 2001;28:459–64.
- 17. Scott G, Brodeur JM, Olivier M, Benigeri M. Parental factors associated with regular use of dental services by second-year secondary school students in Quebec. J Can Dent Assoc 2002;68:604–8.
- 18. Ostberg AL, Lindblad U, Halling A. Self-perceived oral health in adolescents associated with family characteristics and parental employment status. Community Dent Health 2003;20:159–64.
- 19. Health and Welfare Statistics Association. Kokumin Eisei no Doukou (in Japanese). Tokyo: Health and Welfare Statistics Association; 2003. p. 35.
- 20. Sonoda T, Mori M. Path-analysis model of lifestyle factors and subjective health: The Healthy Japan 21 questionnaire survey in Obihiro. Jpn J Public Health 2003;50:1006–16.
- 21. Liebman M, Pelican S, Moore SA, Holmes B, Wardlaw MK, Melcher LM, et al. Dietary intake, eating behavior, and physical activity-related determinants of high body mass index in rural communities in Wyoming, Montana, and Idaho. Int J Obesity 2003;27:684–92.
- 22. Statistics and Information Department Ministry of Health, Labor and Welfare of Japan. Hoken Fukushi Doukou Chousa (in Japanese). Tokyo: Health and Welfare Statistics Association; 1994. p. 64–75.
- 23. Fukai K, Maki Y, Takaesu Y. Oral health behavior of adults in relation to age groups. J Dent Health 1996;46:676–82.
- 24. Morita M, Kimura T, Kanegae M, Ishikawa A, Watanabe T. Reasons for extraction of permanent teeth in Japan. Community Dent Oral Epidemiol 1994;22:303–6.

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.