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The relationship between number of natural teeth and oral health behavior in adult Japanese people

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Abstract

Objectives: The Survey of Dental Diseases in Japan in 2005 has reported that most of 80 year old people have fewer than 20 teeth. The aim of the present study was to investigate the association of tooth loss with oral health behavior among Japanese people.

Methods: Subjects were 825 persons over 50 years in the eastern part of Hokkaido, Japan. The survey items were age, sex, smoking status, oral health behavior such as frequency of tooth brushing, and so on. Furthermore, among the 825 subjects, we selected 750 subjects who had over 5 present teeth. The analysis of the relationship between number of natural teeth and tooth brushing, using an interdental brush or dental floss used those subjects. Odds ratios (ORs) and their 95% confidence intervals (CIs) of variables related to having teeth fewer than 20 were evaluated using the unconditional logistic regression model by sex.

Results: Habitual smoking was significantly associated with risk of having teeth fewer than 20 in the male subjects (OR=2.46, 95%CI: 1.05-5.78) as well as in the female subjects (OR=2.94, 95%CI: 1.09-7.94). Tooth brushing less than or equal to once a day (OR=2.57, 95%CI: 1.38-4.80), nonuse of either an interdental brush (OR=2.14, 95%CI: 1.27-3.59) or dental floss (OR=3.56, 95%CI: 1.48-8.55) and no complaint of oral condition (OR=0.56, 95%CI: 0.34-0.95) were significantly associated with risk of having teeth fewer than 20 in the female subjects.

Conclusion: Frequent oral health behavior may reduce the risk of tooth loss.

keywords: tooth loss, oral health behavior, smoking, ageing

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I. Introduction

The 8020 movement was initiated in 1989 in Japan, with the objective of helping individuals to retain 20 or more teeth at 80 years of age. The Survey of Dental Diseases in Japan in 2005 has reported that the proportion of elderly individuals with 20 or more teeth has increased year by year, but that most 80 year old people still have fewer than 20 teeth. The proportion of 80 year old people having 20 or more teeth was 24.1% [1]. Having 20 or more teeth at 80 years old contributed to enjoying a rich and varied diet. Most studies reported the impact of dentition status on nutritional conditions and dietary habits [2-8].

Several reports suggested that impaired mastication ability by tooth loss might be a risk factor for cardiovascular

disease, gastrointestinal disease, and other health problems [2, 7]. Therefore, sustaining teeth is very important. In previous studies of risk factors for tooth loss, most surveys focused on the association of tooth loss with socioeconomic status [4, 9, 10], osteoporosis [11-18], smoking [4, 9, 19-24] and drinking alcohol [19,20]. However the relationship of tooth loss to oral health behavior were studied less well. Tamura[25] reported relationship between oral health behavior and oral health status in Japanese adult, but her analysis focused only on having a family dentist and smoking status. Although Fukuda et al. [26] reported association between oral health habits and the number of teeth present in Japanese aged 50-80 years at dental clinics, survey items did not include frequency of tooth brushing, using an interdental brush and having a family dentist. Yoshino et al. [27] reported on the

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relationship between tooth loss and oral health behavior in Japanese aged 20-59 years by cohort study, but the number of subject was small. Kondo et al. [28] and Ando et al. [29] reported on the relationship between tooth loss and oral health behavior in adult Japanese by cohort study.

The aim of the present study was to investigate the association of number of natural teeth with oral health behavior among adult Japanese people.

II. Methods

1. Subjects

The participants in this survey were 1034 subjects (457 males, 577 females) over 20 years of age who had a dental examination municipality conducted from June of 2010 to March of 2011, in Obihiro city and Honbetsu town of the Tokachi area, located in the eastern part of Hokkaido, the northern island of Japan. The subjects in Obihiro city were 39,609 people aged 20 years or over who joined the national health insurance. The subjects in Honbetsu town were 513 people aged 40 years or over who participated in a health checkup to preventive metabolic syndrome which was started in 2008 by the government. The people who had a dental examination in Obihiro city were 791 subjects (365 males, 426 females), and 243 subjects (92 males, 151 females) in Honbetsu town. Among them, we selected 825 subjects (357 males, 468 females) aged over 50 years. Also, 209 subjects aged less than or equal to 49 years of age were excluded because people who had few teeth were fewer. The analysis of the relationship between number of natural teeth and age, smoking status, having a family dentist, regular dental check-ups, and complaints about oral condition used 825 subjects.

Furthermore, among the 825 subjects, we selected 750 subjects (331 males, 419 females) who had over 5 present teeth. The analysis of the relationship between number of natural teeth and tooth brushing, using an interdental brush or dental floss used those subjects. This is because the few present teeth suffer under the influence of oral health behavior such as tooth brushing.

This study was approved by the Ethical Committee of Sapporo Medical University.

2. Method of Survey

For the survey, public health nurses in Honbetsu town or dental hygienists of a dental clinic in Obihiro city interviewed the subjects with a structured questionnaire on the day of the dental check-up. The surveyed items were age, sex, smoking status (current, former and non smoker), oral satisfactory degree, frequency of tooth brushing at present, using an interdental brush and dental floss at present, having regular dental check-ups, having a family

dentist.

The dental examination was conducted by a trained dentist of a local dental clinic under sufficient artificial light, with dental mirrors, and explorers. The contents of the dental examination were the diagnoses of dental caries (sound teeth, filled teeth, decayed teeth and missing teeth).

3. Analyses

We compared subjects who had fewer than 20 teeth with subjects who had more than 20 teeth using an unconditional logistic regression model by sex. We analyzed data by sex, because sex was thought to be a prominent confounding factor. The odds ratios (ORs) and their 95% confidence intervals (95% CIs) were estimated with regard to risk factor for tooth loss. Before the multivariate logistic regression analysis was conducted, we confirmed that multicollinearity among the variables did not exist by the Spearman rank correlation test by sex. Tests of statistical significance were based on a two-sided P value, and the α -error was set at the 5% level. The SAS system (ver.9.2) was employed for the analysis.

III. Results

The average age among the 357 males was 69.5 years old (standard deviation, SD=9.7, range 50-96), and among the 468 females, 68.2 years old (SD=8.4, range 50-92).

Table 1 shows characteristics of the subjects by number of teeth and sex. The number of subjects who brushed 2 times a day mostly included both males and females, and subjects who didn't brush at all were a few. The proportion of nonsmoker in the male subjects was 58.7%, and in the female subjects it was 86.9%.

Table 2 shows tooth characteristics of the 825 subjects by sex. The average number of present teeth in the male subjects was 18.1 (SD=7.6), and in the female subjects it was 17.4 (SD=7.9). DMFT (Average number of decayed teeth, missing teeth or filled teeth) in the male subjects was 20.8 (SD=6.3), and in the female subjects, 22.3 (SD=5.3). For both males and females in our study, DMFT and the average number of treated teeth was higher than results of The Survey of Dental Diseases in Japan in 2005. The proportion of people with an edentulous jaw in the male subjects was 1.4%, and in the female subjects was 3.2%.

Table 3 shows a crude odds ratio with 95% confidence intervals for number of teeth by sex. At an age of 70 years or more (OR=2.11, 95%CI: 1.09-4.11) was significantly associated with the risk of having teeth fewer than 20 in the male subjects. At an aged from 60 to 69 years (OR=2.36, 95%CI: 1.31-4.23), and at an age of 70 years or more (OR=3.80, 95%CI: 2.12-6.81), tooth brushing less than or equal to once a day (OR=2.67, 95%CI: 1.59-4.46) and no

usage of an interdental brush (OR=2.03, 95%CI: 1.37-3.02) or dental floss (OR=2.76, 95%CI: 1.39-5.49) were significantly associated with the risk of having teeth fewer than 20 in the female subjects. Current smoking (OR=2.11, 95%CI: 1.01-4.40) was significantly associated with the risk of having teeth fewer than 20 in the female subjects. However oral complaint, no regular dental check-ups and having no family dentist were not associated with the risk of having teeth fewer than 20.

To adjust for potential confounding factors, a multivariate unconditional logistic regression model was used by sex. As shown in Tables 4, for the multivariate analysis of the male subjects, we compulsively included age, complaint of oral condition, frequency of tooth brushing, using an interdental brush and dental floss, regular dental check-ups, having a family dentist and smoking status in the model. Current smoking was significantly associated with the risk of having teeth fewer than 20 in the male subjects

Table 1 Characteristics of the subjects by number of teeth by sex

	males			females		
	n	number of teeth		n	number of teeth	
		≤19 n (%)	≥20 n (%)		≤19 n (%)	≥20 n (%)
Age(year): 50-59	47	17(36.2)	30(63.8)	70	21(30)	49(70)
60-69	132	58(43.9)	74(56.1)	193	97(50.3)	96(49.7)
70-79	139	67(48.2)	72(51.8)	163	94(57.7)	69(42.3)
80+	39	30(76.9)	9(23.1)	42	33(78.6)	9(21.4)
Complaint of oral condition: No	125	54(43.2)	71(56.8)	169	95(56.2)	74(43.8)
Yes	214	108(50.5)	106(49.5)	259	128(49.4)	131(50.6)
Frequency of tooth brushing: Nothing	17	10(58.8)	7(41.2)	4	4(100)	0(0)
Sometimes	15	6(40.0)	9(60.0)	17	9(52.9)	8(47.1)
Once a day	101	51(50.5)	50(49.5)	59	40(67.8)	19(32.2)
2 times a day	122	51(41.8)	71(58.2)	181	76(42.0)	105(58.0)
≥3 times a day	63	23(36.5)	40(63.5)	135	58(43.0)	77(57.0)
Using an interdental brush: Ever	69	25(36.2)	44(63.8)	177	65(36.7)	112(63.3)
Never	262	121(46.2)	141(53.8)	242	131(54.1)	111(45.9)
Using a dental floss: Ever	19	5(26.3)	14(73.7)	46	12(26.1)	34(73.9)
Never	312	141(45.2)	171(54.8)	373	184(49.3)	189(50.7)
Regular dental check-ups: Yes	179	89(49.7)	90(50.3)	217	114(52.5)	103(47.5)
No	156	71(45.5)	85(54.5)	216	119(55.1)	97(44.9)
Having own family dentist: Yes	262	127(48.5)	135(51.5)	339	176(51.9)	163(48.1)
No	61	29(47.5)	32(52.5)	72	40(55.6)	32(44.4)
Smoking status: Nonsmoker	201	94(46.8)	107(53.2)	373	197(52.8)	176(47.2)
Ex-smoker	62	29(46.8)	33(53.2)	19	9(47.4)	10(52.6)
Current smoker	79	45(57.0)	34(43.0)	37	26(70.3)	11(29.7)

Table 2 Tooth characteristics of 825 subjects by sex

	males	females
Number of present teeth: 0-9 teeth	58(16.3%)	103(22.0%)
10-19 teeth	114(31.9%)	142(30.3%)
≥20 teeth	185(51.8%)	223(47.7%)
Average number of present teeth(SD)	18.1(7.6)	17.4(7.9)
Average number of decayed teeth(SD)	1.2(2.5)	0.9(2.1)
Average number of treated teeth(SD)	9.7(5.5)	10.8(6.0)
Average number of intact teeth(SD)	7.2(6.3)	5.7(5.3)
DMFT(SD)	20.8(6.3)	22.3(5.3)

SD: Standard Deviation

DMFT: average number of decayed teeth, missing teeth or treated teeth

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(OR=2.46, 95%CI: 1.05-5.78).

As shown in Tables 5, for the multivariate analysis of the female subjects, we compulsively included age, complaint of oral condition, frequency of tooth brushing, using an

interdental brush and dental floss, regular dental check-ups, having a family dentist and smoking status in the model. At an age from 60 to 69 years (OR=3.38, 95%CI: 1.58-7.23), and at an age of 70 years or more (OR=3.91, 95%CI:

Table 3 Crude odds ratios(ORs), and 95% confidence intervals(CIs) of having less than 20 existing teeth with univariate logistic regression analysis by sex

Variables	males		females	
	OR(95%CI)	p-value	OR(95%CI)	p-value
Age: 50-59 years	1.00(reference)		1.00(reference)	
60-69 years	1.38(0.70-2.75)	0.355	2.36(1.31-4.23)	0.004
70+ years	2.11(1.09-4.11)	0.027	3.80(2.12-6.81)	<0.001
	p for trend=0.001		p for trend<0.001	
Complaint of oral condition: No	1.00(reference)		1.00(reference)	
Yes	1.34(0.86-2.09)	0.197	0.76(0.52-1.12)	0.170
Frequency of tooth brushing: ≥2 times a day	1.00(reference)		1.00(reference)	
≤Once a day	1.52(0.97-2.39)	0.067	2.67(1.59-4.46)	<0.001
Using an interdental brush: Ever	1.00(reference)		1.00(reference)	
Never	1.51(0.87-2.61)	0.140	2.03(1.37-3.02)	<0.001
Using a dental floss: Ever	1.00(reference)		1.00(reference)	
Never	2.31(0.81-6.57)	0.117	2.76(1.39-5.49)	0.004
Regular dental check-ups: Yes	1.00(reference)		1.00(reference)	
No	0.85(0.55-1.30)	0.442	1.11(0.76-1.62)	0.594
Having own family dentist: Yes	1.00(reference)		1.00(reference)	
No	0.96(0.55-1.68)	0.896	1.16(0.69-1.93)	0.575
Smoking status: Nonsmoker	1.00(reference)		1.00(reference)	
Ex-smoker	1.00(0.57-1.77)	0.999	0.80(0.32-2.02)	0.643
Current smoker	1.51(0.89-2.55)	0.126	2.11(1.01-4.40)	0.046

Table 4 Multivariate odd ratios(ORs), and 95% confidence intervals(CIs) of having less than 20 existing teeth with multivariate logistic regression analysis in males

Variable	OR(95%CI)	p-value
Age: 50-59 years	1.00(reference)	
60-69 years	0.94(0.42-2.11)	0.879
70+ years	1.69(0.76-3.75)	0.195
Complaint of oral condition: No	1.00(reference)	
Yes	1.47(0.87-2.48)	0.154
Frequency of tooth brushing: ≥2 times a day	1.00(reference)	
≤Once a day	1.26(0.75-2.11)	0.386
Using an interdental brush: Ever	1.00(reference)	
Never	1.53(0.82-2.86)	0.182
Using a dental floss: Ever	1.00(reference)	
Never	2.26(0.69-7.39)	0.177
Regular dental check-ups: Yes	1.00(reference)	
No	0.65(0.38-1.10)	0.113
Having own family dentist: Yes	1.00(reference)	
No	1.09(0.58-2.08)	0.781
Smoking status: Nonsmoker	1.00(reference)	
Ex-smoker	1.17(0.42-3.25)	0.771
Current smoker	2.46(1.05-5.78)	0.038

Table 5 Multivariate odd ratios(ORs), and 95% confidence intervals(CIs) of having less than 20 existing teeth with multivariate logistic regression analysis in females

Variable	OR(95%CI)	p-value
Age: 50-59 years	1.00(reference)	
60-69 years	3.38(1.58-7.23)	0.002
70+ years	3.91(1.80-8.49)	<0.001
Complaint of oral condition: No	1.00(reference)	
Yes	0.56(0.34-0.95)	0.030
Frequency of tooth brushing: ≥ 2 times a day	1.00(reference)	
\leq Once a day	2.57(1.38-4.80)	0.003
Using an interdental brush: Ever	1.00(reference)	
Never	2.14(1.27-3.59)	0.004
Using a dental floss: Ever	1.00(reference)	
Never	3.56(1.48-8.55)	0.005
Regular dental check-ups: Yes	1.00(reference)	
No	0.73(0.44-1.22)	0.233
Having own family dentist: Yes	1.00(reference)	
No	1.07(0.54-2.15)	0.841
Smoking status: Nonsmoker	1.00(reference)	
Ex-smoker	1.20(0.39-3.68)	0.754
Current smoker	2.94(1.09-7.94)	0.034

1.80-8.49), no complaint of oral condition(OR=0.56, 95%CI:0.34-0.95), tooth brushing less than or equal to once a day (OR=2.57, 95%CI: 1.38-4.80), no usage of an interdental brush (OR=2.14, 95%CI: 1.27-3.59) or dental floss (OR=3.56, 95%CI: 1.48-8.55) were significantly associated with the risk of having teeth fewer than 20. Current smoking was significantly associated with the risk of having teeth fewer than 20 in the female subjects (OR=2.94, 95%CI: 1.09-7.94).

IV. Discussion

In this study, a lower tooth brushing, the non-use of an interdental brush or dental floss was significantly associated with few natural teeth in females.

Aida et al. [30] reported that about of 85% permanent teeth extracted were extracted due to caries and its sequela, and periodontal disease in Japan. Therefore, dental caries and periodontal disease are strong contributors to tooth loss. Tseveenjav et al. [31] reported that people who brush teeth less than 2 times a day were more likely to have decayed teeth compared to those who brush teeth twice or more daily among adults aged 33 to 64 years. Pakpourl et al. [32] reported a significant relation between a high DMFT (average number of decayed teeth, missing teeth or filled teeth) and a lower frequency of tooth brushing and dental flossing among adolescents aged 14 to 18 years. Ojima et al. [33] reported that the frequency of daily brushing was significantly correlated with the prevalence of

a more severe form of periodontitis among adults aged ≥ 40 years. Oshikohji et al. [34] reported that a lower frequency of tooth brushing was significantly associated with the proportion of teeth with a probing depth ≥ 4 mm (periodontitis) among 35-44 years old. Therefore, depending on the lower frequency of tooth brushing, nonuse of an interdental brush and dental floss, oral cavities become poor hygiene and cause dental caries and periodontal disease. Finally these oral problems lead to tooth loss.

Yoshino et al. [27] and Kondo et al.[28]reported lower tooth brushing, the non-use an interdental brush or dental floss were not significantly associated with tooth loss by cohort study. Ando et al.[29]reported that no habit of using an interdental brush or dental floss were significantly associated with tooth loss by cohort study. Yanagisawa et al. [22] showed similar findings to our results, but subjects were only men and their analysis was unadjusted for confounders. Gillbert et al.[35]reported the association of tooth loss with tooth brushing and flossing, but the ages of the subjects were over 65 years old and the analysis was unadjusted for age and sex. We conducted a multivariate analysis of people over 50 years old by sex.

The Healthy Nippon 21 program began in 2000 in Japan [36]. The program did not contain frequency of tooth brushing. In the future, this program should include increasing the proportion of people who brush their teeth over once a day to prevent tooth loss. Additionally, in

particular, for elderly females, municipality had better recommend the brushing of teeth over once a day, using an interdental brush and dental floss to prevent from tooth loss. People in the Tokachi area of Hokkaido had more dental problems compared to people nationwide. To encourage tooth brushing more than once a day, using an interdental brush and dental floss, an oral health strategy concerning school-age children is important. We would like to communicate with the school board of municipality about this result.

In our study, current smoking was significantly associated with few natural teeth both males and females. Most studies [4, 9, 19-24] reported that smoking was associated with tooth loss. Klein et al. [20] reported that current smokers and past smokers were more likely to have lost teeth than nonsmokers adjusted for age and sex. Krall et al. [21] indicated that individuals who continued to smoke cigarettes had a 2.4-fold (men) to 3.5-fold risk (women) of tooth loss compared with non-smokers by a longitudinal analysis. Yanagisawa et al. [22] reported that current smokers were more likely to have more than eight missing teeth compared to non-smokers adjusted for age and oral health behavior, the adjusted ORs of having more than eight missing teeth were significantly higher in current smokers who smoked 21 or more cigarettes per day compared with those who had never smoked among Japanese men. Hanioka et al. [19] reported that current smoking was significantly associated with tooth loss both in males and females among Japanese people. Although our results were not significant in males, the odds ratios (ORs) of current male smokers was 1.51 relative to nonsmokers. Current smokers might be more likely to have fewer than 20 teeth compared to non-smokers.

There are some limitations to our study. First, our results clearly fail to identify the cause of tooth loss because of the cross-sectional study. Further study such as a cohort study is necessary to establish the relationship between tooth loss and oral health behavior. Secondly, our study did not investigate socioeconomic status. Several studies [4, 9, 10] reported on the impact of socioeconomic status on tooth loss. Thirdly, self-selection bias might exist in our study because relatively healthy subjects participated in a dental examination of municipality. Additionally, the subject region was only Hokkaido prefecture in Japan. However, the average number of teeth and average number of decayed teeth in the subjects were similar to the data of the survey of dental disease in 2005 by the Ministry of Health, Labour and Welfare of Japan [1]. However, our study subjects had more DMFT (average number of decayed teeth, missing teeth or filled teeth), but a smaller proportion of subjects with a edentulous jaw than the data of the survey of dental

disease in 2005.

V. Conclusion

In this study, people who brush teeth less than or equal to once a day were more likely to have few teeth compared to those who brush teeth twice or more daily in the females. Females people who did not use an interdental brush and a dental floss were more likely to have few teeth compared to those who use that.

Both males and females, current smokers were more likely to have few teeth compared to nonsmokers.

This study suggests that there is a significant relationship between few natural teeth, oral health behavior such as frequency of tooth brushing, using an interdental brush or dental floss and smoking status. Good oral health behavior and nonsmoking are important to prevent tooth loss. We need to highlight that these results are available for health promotion planning for the municipality in the eastern region of Hokkaido Prefecture.

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