Lifestyles and Periodontal Disease of Japanese Factory Workers

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Abstract

The association between lifestyle and periodontal disease as classified by the Community Periodontal Index of Treatment Needs (CPITN) was investigated in 1,821 factory workers, 20-69 years of age, residing in Osaka, Japan. Lifestyles were examined using a questionnaire concerning the smoking habits, alcohol consumption, physical exercise, sleeping hours and dietary habits of male factory workers.

Age and sex were strongly associated with the CPITN score. In the male factory workers, the CPITN scores of each age group were significantly greater for smokers than for nonsmokers; $\text{mean} \pm \text{S.D.}$, 2.41 ± 0.96 and 2.28 ± 0.87 , respectively. The CPITN scores were also greater in high-consumption and long-duration smokers, compared to low-consumption and short-duration smokers in male factory workers.

Our results show that sex, aging and smoking are risk indicators for periodontal disease.

Key words: Lifestyles, Periodontal disease, Smoking, Japanese factory workers

Introduction

According to population statistics estimates, the percentage of the aged population in Japan 65 years and older will more than double by the year 2,030. Thus the so-called "aged society" is about to become a reality in Japan. To prepare for this eventuality, various health policies are being implemented in accordance with the Health for the Elderly Law, to maintain and promote the health of the aged.

Nagai et al.¹⁾ and Teraoka et al.²⁾ have reported that in such a social environment, it is essential that the elderly keep their teeth to maintain satisfactory quality of life (QOL). They reported that physical and social activities may be enhanced by preventing tooth loss and preserving the masticatory capability. We also believe that maintenance and promotion of oral health are important objectives for improving the QOL of the aged.

To accomplish this, periodic examination, treatment, and self-care of the teeth are necessary. Proper health education, beginning at an early age and continuing through middle age is highly recommended.^{3,4)} In addition, we have been conducting a series of studies to formulate health education plans for the main-

tenance of teeth by the elderly. The main cause of tooth loss after middle age is periodontal diseases.⁵⁾ In the present study, we have examined the correlation between the incidence of periodontal diseases and lifestyle throughout youth and middle age and tried to pinpoint the specific factors that exacerbate periodontal diseases.

In general, it is assumed that the incidence of periodontal diseases will be readily affected by one's lifestyle, but there has not been sufficient epidemiological evidence in Japan to warrant this assumption. In the United States, however, Grossi et al.^{6,7)} conducted an extensive epidemiological survey to find the factors that may have a direct or indirect effect on the progression of this disease entity. Based on this survey, they reported that lifestyle has a significant effect on the incidence of periodontal diseases. Such precise epidemiological surveys are scarce in Japan, and most of those that have been done are suspected to have bias in selecting subjects. In the present study, therefore, we focused on approximately 2,000 factory workers and investigated the relationship between the incidence of periodontal disease, as classified by the Community Periodontal Index of Treatment Needs (CPITN)⁸⁾ and lifestyle factors such as smoking, alcohol consumption, and dietary habits.

Subjects and Methods

The subjects were factory workers employed at a chemical plant in Osaka, Japan. Table 1 shows the number of subjects by

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Table 1 The number of subjects by sex and age

Age (years)	Males	Females	Total
20-29	463	96	559
30-39	377	24	401
40-49	521	20	541
50-59	260	12	272
60-69	42	6	48
Total	1,663	158	1,821

sex and age. Oral examinations of these workers were carried out as one of their regular health examinations. They were asked to respond to a self-administered questionnaire about their smoking habits, alcohol consumption, physical exercise, hours of sleep, and dietary habits.

CPITN scores, which are indexes to screen and monitor individual or group periodontal treatment needs, were determined by using the probe by the World Health Organization (WHO) and according to the method of Ainamo et al.⁸⁾ The maximum value of the results was used for the evaluation of periodontal diseases.

The relationships between CPITN scores, sex, and age were investigated. Differences in the CPITN scores between lifestyle categories (smoking, alcohol consumption, hours of sleep, and physical exercise) and six dietary habit categories were tested by 1- or 2-way analysis of variance (ANOVA). The level of significance was set at $p < 0.05$. These analyses were conducted by using the SPSS 6.1J computer program.

Results

CPITN scores by sex and age

Fig. 1 shows the mean scores of CPITN by sex and age of the factory workers. In both males and females, the CPITN scores increased with age. CPITN scores of the males were significantly higher than those of the females ($p < 0.01$).

Fig. 1 Mean scores of CPITN by sex and age

★: $p < 0.05$ Data are presented as means $\pm$ S.D.

Table 2 Mean scores of CPITN by lifestyle factors in male factory workers

	N	Mean $\pm$ S.D.	F Values
Cigarettes			
Smoking	944	2.41 $\pm$ 0.96	8.42***
Quit	166	2.30 $\pm$ 0.87	
Never	501	2.28 $\pm$ 0.87	
Alcohol consumption			
Drinking	1,375	2.35 $\pm$ 0.92	0.86
Quit	36	2.55 $\pm$ 1.02	
Never	200	2.37 $\pm$ 0.93	
Sleeping hours per day			
6 or less	265	2.29 $\pm$ 0.88	0.76
6.1-8.9	1,323	2.36 $\pm$ 0.93	
9 or more	15	2.93 $\pm$ 0.96	
Physical exercise			
Almost every day	223	2.36 $\pm$ 0.90	1.81
Once or twice per week	259	2.24 $\pm$ 0.98	
Sometimes	659	2.38 $\pm$ 0.92	
Never	452	2.43 $\pm$ 0.90	

F values were computed by two-way analysis of variance, in which age (20-29, 30-39, 40-49 and 50-59 years) and each lifestyle factor were the two factors

*: $p < 0.05$ **: $p < 0.01$ ***: $p < 0.001$

Table 3 Mean scores of CPITN by dietary habits in male factory workers

	N	Mean $\pm$ S.D.	F Values
Meals per day			
3	620	2.45 $\pm$ 0.95	3.35*
2	116	2.29 $\pm$ 1.06	
Irregularity	501	2.33 $\pm$ 0.89	
Snack between meals			
Yes	547	2.29 $\pm$ 0.90	0.34
No	1,061	2.39 $\pm$ 0.93	
Eating out			
Always	319	2.21 $\pm$ 0.87	0.22
Sometimes	1,292	2.39 $\pm$ 0.93	
Daily diet pattern			
Regularity	964	2.41 $\pm$ 0.92	0.70
Irregularity	647	2.27 $\pm$ 0.91	
Vegetable intake			
Enough	994	2.43 $\pm$ 0.92	0.78
Little	613	2.24 $\pm$ 0.91	
Taste of diet			
Strongly flavored	351	2.35 $\pm$ 0.90	0.88
Moderate	1,037	2.33 $\pm$ 0.93	
Bland	223	2.48 $\pm$ 0.93	

F values were computed by two-way analysis of variance, in which age (20-29, 30-39, 40-49 and 50-59 years) and each dietary habit factor were the two factors

*: $p < 0.05$ **: $p < 0.01$ ***: $p < 0.001$

CPITN scores by lifestyle and dietary habits in males

The mean scores of CPITN by response categories for each of the lifestyle and dietary habit factors are shown in Tables 2 and 3, respectively. The results of two-way ANOVA showed that the following were significantly related to the CPITN scores: (a) habitual smoking; and b) the number of meals per day. On the other hand, the following were not significantly related to the scores: (c) the frequency of alcohol consumption, physical exercise and the number of hours of sleeping; and d) frequency of snacks between meals, eating out, daily dietary pattern, vegetable consumption, and the use of certain condiments in the daily diet.

CPITN scores and smoking in males

Fig. 2 shows the mean scores of CPITN by smoking and age in the entire study population. In both the nonsmokers and current smokers, the CPITN scores increased with the age of the

Fig. 2 Mean scores of CPITN by smoking and age

Fig. 3 Mean scores of CPITN by number of cigarettes per day in males

Table 4 Mean scores of CPITN by duration of smoking in male factory workers

Age (Years)	Duration of smoking (Years)	N	CPITN. Mean ± S.D.	F Values
20-29	0.1-10.0	264	1.94 ± 0.88	0.14
	10.1-20.0	26	2.04 ± 0.85	
	20.1 over	0	-	
30-39	0.1-10.0	32	2.15 ± 0.88	1.09
	10.1-20.0	210	2.35 ± 0.84	
	20.1 over	11	2.54 ± 0.68	
40-49	0.1-10.0	22	2.36 ± 1.09	2.07
	10.1-20.0	112	2.59 ± 0.85	
	20.1 over	153	2.74 ± 0.92	
50-59	0.1-10.0	3	1.66 ± 0.88	3.27*
	10.1-20.0	16	2.87 ± 0.95	
	20.1 over	120	3.01 ± 0.89	

F values were computed by one-way analysis of variance.

*: $p < 0.05$

subject. The CPITN scores of the current smokers were significantly higher than those of the nonsmokers ($p < 0.01$).

The relationship between CPITN scores and the number of cigarettes smoked and smoking duration is shown in Fig. 3 and Table 4. The CPITN scores were significantly greater in the heavy smokers and those who had been smoking for longer periods than in light smokers and those who had been smoking for fewer years.

Discussion

It is believed that periodontal disease is triggered by a disruption of the balance between host resistance and the factors provoking the disease. Previous studies have focused on bacteria that may be responsible for this condition. For the prevention of periodontal disease, emphasis has been placed on dental plaque control and scaling. Hiraiwa et al.⁹ conducted a health education program for department store employees and reported that they achieved a 76% improvement in oral health within one year. Yoshida et al.¹⁰ also engaged in health guidance for factory workers, which resulted in a reduction in the incidence of tooth loss. However, periodontal disease is a chronic condition that is affected by various factors related to everyday life over a long period. As an initial step toward the prevention of this disease, therefore, it is necessary to conduct a comprehensive study encompassing the life environment surrounding the host, i.e., lifestyle, educational achievement, economic status, and medical services available, in addition to examining the host resistance and the direct cause of the destruction of periodontal tissue. Grossi et al.^{6,7} examined the relationship between periodontal disease and the lifestyles of 1,426 subjects from the ages of 25 to 74 years in New York and noted the significant effects of smoking and age. They detected a high odds ratio for age, smoking, history of diabetes mellitus, and the presence of subgingival *P. gingivalis* and *B. forsythus* in relation to the development of periodontal disease. Ismail et al.¹¹ conducted a 28-year follow-up study on oral caries and noted high odds ratios for smoking and aging. Brown et al.¹²,

on the other hand, conducted a survey on more than 400 items concerning the relationship between periodontal diseases and the lifestyles of individuals over 65 years of age. Although the factors showing statistically significant odds ratios varied among races, the authors found high odds ratios for smoking among both whites and blacks; and that factors such as low levels of educational achievement and health care-seeking behavior constituted high risks among whites.

Taken together, the results of the previous studies suggest that aging, the presence of dental calculus, systemic disease such as diabetes mellitus, stress, a low level of educational achievement and smoking have effects on the severity of periodontal disease.

As stated earlier, there have been active studies on the risk factors related to periodontal diseases overseas but studies on Japanese with acceptable coverage and selection bias are scarce. Fujita et al.¹³⁾ investigated 2,300 factory employees to examine the relationship between CPITN and lifestyle that had been described by Breslow.¹⁴⁾ They found a significant difference in the highest and lowest ratings on health-related habits for all age groups and concluded that the quality of health-related lifestyles has an effect on the state of periodontal tissue. A report by Wada et al.¹⁵⁾ showed a similar tendency: they reported that good health habits produce a desirable effect on periodontal tissue. These studies indicate that a healthy lifestyle is necessary to preserve teeth.

In the present study, the CPITN scores were higher in the males than in the females, and they rose with age. Kani et al.^{16, 17)} conducted a study on CPITN and age among 149 male employees and reported that the CPITN scores increased with age. Konishi et al.¹⁸⁾ investigated the relationship between CPITN and behaviors related to oral health among factory workers at various sites in Japan and reported that the CPITN was significantly higher among men than women in the 30 to 44 and 45 to 64 age groups. In view of these results, together with those of the present study, the epidemiological surveys on Japanese indicated that two factors -sex and age- were related to the incidence of periodontal diseases. In other words, sex and aging are significant factors that help determine oral health.

In the relationship between periodontal diseases and lifestyle, the frequency of meals and smoking were significant in the present study. Of the two, smoking was more significant: as smokers exhibited significantly higher CPITN scores than did nonsmokers. Furthermore, CPITN scores showed a tendency to increase as the duration of smoking and number of cigarettes smoked daily increased. There are many reports on periodontal diseases and smoking. According to studies conducted in the 1970s, however, the difference in periodontal tissue between smokers and nonsmokers was not well-defined. Only recently have studies acquired the necessary precision and reliability to ascertain this relationship.

Bergstrom et al.¹⁹⁾ conducted a survey of 210 dental hygienists in Sweden and reported that in spite of their high level of oral hygiene, the severity of periodontal disease was more pronounced among smokers. Horning et al.²⁰⁾ surveyed 1,783 patients at a large military dental clinic and reported that the incidence of periodontal diseases with an intermediate or high level of severity was significant among current smokers; and their odds ratio was 1.8 times that of nonsmokers. Locker et al.²¹⁾ conducted a survey on the periodontal condition of 624 smokers and nonsmokers in Canada and reported that the odds ratio of the smokers was 2.9 times that of the nonsmokers.

Haber et al.²²⁾ studied the state of periodontal tissue in diabetic and non-diabetic patients. They proved that the periodontal morbidity was higher among smokers regardless of the presence of a diabetic condition; and that this morbidity rose proportionally with increases in the number of cigarettes that were smoked. In the aforementioned survey in the United States, Grossi et al.^{6, 7)} reported that smoking and age are closely related to periodontal diseases. As for smoking, they reported that the odds ratio increased among smokers even if they smoked rarely or only a few cigarettes each day. Studies on smoking and periodontal diseases among Japanese are extremely rare. Hanioka et al.²³⁾ noted a significant relationship between CPITN and smoking in their study on 97 smokers and 55 nonsmokers.

The mechanism by which smoking and periodontal disease are related has not been fully elucidated. It has been said that at least 200 substances that are toxic to the biological system have been isolated from tobacco smoke. Studies have been conducted on the immunological system of periodontal tissue and the response of fibroblasts to find how these toxic substances are involved in the onset and progression of periodontal disease. It has been found that smoking acts on the biological responses of periodontal tissue and that its effect is biphasic--both suppressive and stimulatory.²⁴⁾

In the present study of Japanese factory workers, it was recognized that smoking had the most profound effect on periodontal diseases among various items related to lifestyle. It is further noted that the prevention of smoking should thus be a very important goal in any health education program if one desires to maintain optimum oral health. Our results also revealed a significant relationship between the CPITN score and the frequency of meals. However, there may be many confounding factors in the correlation between diet and oral health. Thus, further studies are warranted in this area.

The authors examined the severity of periodontal diseases and investigated its relationship to lifestyle factors. Subsequently it was shown that smoking is the one factor that most exacerbates periodontal diseases. It is suggested that to maintain oral health, health education should focus on the importance of prevention of smoking as one of its primary goals.

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