

Teenagers' oral health attitudes and behavior in Japan: comparison by sex and age group

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Abstract: We investigated sex and age group differences in attitudes to oral health among school-age children using an Oral Self-Care Appraisal (OSCA) to systematically determine changes in oral health knowledge, attitude, and behavior across developmental stages. The subjects (n = 1584) were stratified after random sampling so that each school grade analyzed contained 88 boys and 88 girls. Factor analysis was undertaken to identify a set of underlying factors, with 10 factors considered in the cross-sectional study. Our results showed that the factors toothbrushing, persistence, and sociability were more predominant in primary school children than in junior high and senior high school students. Furthermore, postponement of visiting the dentist and resignation to one's own dental cavities became more predominant in proportion to the level of school education. Girls had significantly higher scores than boys for desire to improve oral care, dental anxiety, dependency on snacks, toothbrushing, concern over number of cavities, and sociability. Together, the results indicated that the oral health care behavior of girls was better than that of boys, and that the tendency to postpone visiting the dentist and resignation to one's own dental cavities increased markedly with age. (J. Oral Sci. 50, 167-174, 2008)

Keywords: oral health attitudes/behavior; developmental stages; sex differences; factor analysis.

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Introduction

Over the past two decades, there has been a dramatic decline in dental caries in 12-year-old children in a number of industrialized nations (1-3). However, prevention of dental caries is still an important issue worldwide. On the other hand, the prevalence of gingivitis, although considered preventable by thorough plaque control, remains very high during adolescence (4,5).

For studying oral health behavior in children, it is necessary to use a questionnaire that systematically measures changes in oral health knowledge, attitudes, and behavior across developmental stages. Such information is helpful for understanding what should be taught and which behavioral changes are necessary for improvement of oral health, and also for developing strategies that could be used for educating children about good oral health habits.

Various epidemiologic studies of oral health behavior in children and adolescents have been reported from all parts of the world (6-9), and generally they have indicated that oral health behavior in girls is better than that in boys. However, oral health behavior in schoolchildren has not been fully understood, and data on aspects such as oral condition (tooth decay) and oral hygiene habits (toothbrushing and flossing) are limited. In addition, there have been few attempts to assess the general concept of oral health behavior in primary, junior high, and high school children. Moreover, although a number of studies have investigated the oral health behavior of adolescents (10-12), little is known about factors responsible for changes in oral health behavior during the development of young people.

Kawamura et al. (13) previously developed a questionnaire regarding oral self-care for junior high and senior

high school students. The test-retest reliabilities for the items in the survey were found to range from 0.40 to 0.79 (1 month apart), which is considered suitable at the clinical level. They interviewed primary school children to determine whether the subjects could understand oral self-care in order to develop a questionnaire that could be broadly modified for children in each developmental stage (from primary school to senior high school). After some minor changes and deletions, the Oral Self-Care Appraisal (OSCA) questionnaire containing 30 items was developed. In the present study, we investigated sex and age group differences in oral health behavior of school-aged children using the OSCA.

Subjects and Methods

Subjects

In collaboration with the public dental health committee of the Kamo/Higashi-Hiroshima Dental Association, four schools in and around Higashi-Hiroshima City were randomly selected, including a primary school (School A), junior high school (School B), and senior high school (School C), each located within the city, as well as another senior high school (School D) located in a nearby rural district. The principals of the schools were contacted about the proposed investigation and all agreed to administer the questionnaire to their students one week prior to an oral health check-up.

We administered the OSCA, comprising 30 items, to

students in primary School A (Grades 4-6; 10 to 12 years of age), junior high School B (Grades 7-9; 13 to 15 years of age), and senior high School C and D (Grades 10-12; 16 to 18 years of age). The distribution of the study population by sex and grade is shown in Table 1. Questionnaire recovery rates were 97.3% (614 of 631) for those administered at School A, 92.5% (558 of 603) for those at School B, 96.7% (1274 of 1318) for those at School C, and 94.2% (425 of 451) for those at School D. The total recovery rate was 95.6% (2871 of 3003).

Previous reports have indicated that, in general, school-aged girls have better oral health behavior than school-aged boys (14-16). In order to reduce the influence of extracted factors that may cause differences in boy/girl ratios, the ratio of boys to girls must be 1:1 for every grade level examined. Appropriate subjects were randomly selected to adjust the sex ratio to 1:1 by computer, neglecting subjects who incompletely answered the questionnaires. Since the sex ratio was 1:1, the 10 factors extracted were considered to have a certain degree of universality in our analyses. Furthermore, in order to utilize standard criteria according to developmental stage, the candidates were stratified by random sampling so that every school grade consisted of 88 boys and 88 girls. For the two senior high schools, 44 students for each sex and grade were selected at random from each. As a result, 1584 subjects with an equal distribution by sex and grade group were selected for analysis.

Table 1 Number of subjects by school and gender

Cross Table	Year	Boys	Girls	Total
Primary School A 614/631 = 0.973*	4	88 (97)	88 (104)	176 (201)
	5	88 (96)	88 (100)	176 (196)
	6	88 (95)	88 (122)	176 (217)
A total		264 (288)	264 (326)	528 (614)
Junior high school B 558/603 = 0.925*	7	88 (88)	88 (99)	176 (187)
	8	88 (93)	88 (92)	176 (185)
	9	88 (88)	88 (98)	176 (186)
B total		264 (269)	264 (289)	528 (558)
Senior high school C 1274/1318 = 0.967*	10	44 (181)	44 (244)	88 (425)
	11	44 (181)	44 (244)	88 (425)
	12	44 (162)	44 (262)	88 (424)
C total		132 (524)	132 (750)	264 (1274)
Senior high school D 425/451 = 0.942*	10	44 (80)	44 (71)	88 (151)
	11	44 (53)	44 (83)	88 (136)
	12	44 (67)	44 (71)	88 (138)
D total		132 (200)	132 (225)	264 (425)
Total	2871/3003 = 0.956*	792 (1281)	792 (1590)	1584 (2871)

Recovery number is shown in brackets. * Recovery rate.

Statistical analyses

Principal component factor analysis was undertaken to identify the set of underlying factors contributing to the OSCA responses, with the answers rated as follows: agree = 4, somewhat agree = 3, somewhat disagree = 2, and disagree = 1. This was followed by a promax rotation of the factors that accounted for the greatest amount of variation and computation of factor loadings for each question to identify any that exceeded 0.45 (SPSS Inc, 1999), which was used as a threshold for moderate to high loadings. An item was assigned to factor X when its absolute value of loading was more than 0.45 and it had

no loading at 0.35 or higher for another factor. Differences among school levels (primary, junior high, and senior high) for each factor score were evaluated using analysis of variance, and differences between boys and girls were evaluated using independent *t*-tests.

Results

Table 2 shows the answers by percentage for the 10 factors extracted by promax rotation. Items with a loading below 0.45 were not reported. Ten socio-psychological factors labeled desire to improve oral care (f1), dental anxiety (f2), dependency on snacks (f3), toothbrushing (f4),

Table 2 Answers to 10 factors extracted by promax rotation

Item descriptions	Agree (%)	Somewhat Agree (%)	Somewhat Disagree (%)	Disagree (%)	Factor* loading
f1. Desire to improve oral care (DIOC)					
12. I would like to learn how best to brush my teeth.	17	23	30	30	0.69
18. I feel the condition of my teeth plays an important role in daily life.	23	30	26	22	0.51
22. I want to know how to use dental floss properly.	11	15	28	46	0.69
24. I would like to use chewing gum or mouth spray to improve my breath.	19	27	25	29	0.51
28. I want to know my chances of getting cavities.	33	28	19	20	0.72
30. I feel that it is fashionable to have beautiful teeth.	27	33	21	19	0.56
f2. Dental anxiety (DA)					
15. I get nervous the day before visiting the dentist.	10	12	18	60	0.89
21. I worry about what my treatment will be like in the waiting room.	19	22	19	40	0.87
27. I feel uncomfortable when I receive my oral health checkup at school.	18	26	22	35	0.61
f3. Dependency on snacks (DOS)					
14. I often eat too many snacks to the point where I am unable to eat meals.	11	21	21	46	0.66
20. I tend to eat snacks in my free time.	15	24	30	31	0.80
26. I have many opportunities to eat snacks at home or outside.	16	28	33	23	0.83
f4. Toothbrushing (TB)					
4. I often check my teeth in a mirror after brushing.	33	27	19	21	0.70
9. I brush each of my teeth carefully.	16	33	36	15	0.73
11. I have had my dentist tell me that I brush very well.	7	9	22	63	0.66
f5. Persistence (Persist)					
17. Often when I start something I never finish it.	14	29	37	20	-0.82
23. I try to be persistent in what I do.	21	44	27	8	0.49
29. I continue doing things, even when they are difficult.	14	33	37	16	0.77
f6. Concern over number of cavities (CONC)					
1. I had many cavities when I was young.	13	30	29	28	0.76
6. I develop new cavities soon after being treated by the dentist.	7	16	29	48	0.77
f7. Expectation of fluoride's effect (EFE)					
3. I think fluoride paste is good for the gums.	11	31	33	25	0.84
8. I think fluoride treatments prevent cavities.	19	33	30	19	0.86
f8. Sociability (Soc)					
5. I feel I am a happy person.	36	36	20	8	0.78
10. I usually try to respond to a smile with a smile.	42	40	13	5	0.77
f9. Postponement of visiting the dentist (PVD)					
2. I put off going to the dentist until I have a toothache.	22	25	21	32	0.64
7. I go to the dentist when the school dentist finds a cavity in my mouth.	41	26	21	12	-0.69
f10. Resignation to own cavities (RTOC)					
13. It is possible to treat a cavity at its early stage by brushing.	19	23	27	31	0.48
19. I feel cavities are impossible to avoid.	10	16	28	46	0.77
25. Some people have teeth that decay easily.	11	13	28	48	0.73

* Principal component factor analysis using promax rotation with OSCA items.

n = 1584

Table 3 Comparison of scores of 10 factors by gender

	Boys	Girls
f1: Desire to improve oral care	-0.125	0.125

f2: Dental anxiety	-0.137	0.137

f3: Dependency on snacks	-0.149	0.149

f4: Toothbrushing	-0.146	0.146

f5: Persistence	0.050	-0.050
	*	
f6: Concern over number of cavities	-0.067	0.067
	**	
f7: Expectation of fluoride's effect	-0.011	0.011
f8: Sociability	-0.213	0.213

f9: Postponement of visiting the dentist	0.083	-0.083

f10: Resignation to own cavities	-0.005	0.005

Independent *t*-test, *: $P < 0.05$, **: $P < 0.01$, ***: $P < 0.001$

persistence (f5), concern over number of cavities (f6), expectation of effect of fluoride (f7), sociability (f8), postponement of visiting the dentist (f9), and resignation to one's own dental cavities (f10) were extracted.

Table 3 shows a comparison of the scores for f1-10 by gender. There were significant differences between the sexes for 8 factors, excluding expectation of the effect of fluoride and resignation to one's own dental cavities. The scores for desire to improve oral care, dental anxiety, dependency on snacks, toothbrushing, and sociability were higher for girls than for boys ($P < 0.001$), whereas those for persistence and postponement of visiting the dentist were higher for boys ($P < 0.05$, $P < 0.001$, respectively).

Table 4 shows a comparison of the scores for the 10 factors by grade level in boys. Toothbrushing, persistence, and sociability had higher scores for primary school boys than for boys in junior high and senior high schools ($P < 0.001$). Furthermore, postponement of visiting the dentist and resignation to one's own dental cavities became more predominant as the level of school education increased ($P < 0.001$). In contrast, there were no significant differences in scores for desire to improve oral care, dental anxiety, dependency on snacks, concern over number of cavities, or expectation of the effect of fluoride among the three levels of education.

Table 5 shows a comparison of the scores for the 10

factors by grade level in girls. Toothbrushing and persistence had higher scores in primary school girls as compared to girls in junior high and senior high schools ($P < 0.001$). Furthermore, the score for sociability for primary school girls was more predominant than for girls in junior high and senior high schools (primary school vs junior high school girls, $P < 0.001$; primary school vs senior high school girls, $P < 0.05$). In contrast, dependency on snacks, postponement of visiting the dentist, and resignation to one's own dental cavities were less prominent in primary school girls ($P < 0.001$). In addition, the score for concern over numbers of cavities was significantly higher for senior high school girls than for girls in junior high school ($P < 0.05$). There were no significant differences in scores for desire to improve oral care, dental anxiety, and expectation of the effect of fluoride among the three levels of education.

Discussion

In the present study, the obtained data were factor analyzed using promax rotation that provided an oblique solution, as opposed to varimax rotation that gives a rectangular solution. Varimax rotation is often used to obtain factors without mutual correlation, whereas oblique rotation offers solutions that recognize the relevance between mutual factors. As it is generally accepted that naturally occurring phenomena are never totally unrelated,

Table 4 Comparison of 10 factors by grade level for boys

	Grades 4-6	Grades 7-9	Grades 10-12
f1: Desire to improve oral care	-0.176	-0.199	-0.001
f2: Dental anxiety	-0.193	-0.149	-0.068
f3: Dependency on snacks	-0.144	-0.185	-0.118
f4: Toothbrushing	0.065	-0.263	-0.242
f5: Persistence	0.412	-0.122	-0.140
f6: Concern over number of cavities	0.005	-0.163	-0.044
f7: Expectation of fluoride's effect	-0.052	-0.071	-0.014
f8: Sociability	0.064	-0.444	-0.258
f9: Postponement of visiting the dentist	-0.365	0.198	0.417
f10: Resignation to own cavities	-0.241	-0.047	0.272

Independent *t*-test, *: $P < 0.05$, **: $P < 0.01$, ***: $P < 0.001$

Table 5 Comparison of 10 factors by grade level for girls

	Grades 4-6	Grades 7-9	Grades 10-12
f1: Desire to improve oral care	0.157	0.136	0.083
f2: Dental anxiety	0.062	0.127	0.222
f3: Dependency on snacks	-0.190	0.336	0.301
f4: Toothbrushing	0.536	-0.031	-0.066
f5: Persistence	0.285	-0.277	-0.159
f6: Concern over number of cavities	0.128	-0.073	0.147
f7: Expectation of fluoride's effect	0.132	-0.063	-0.035
f8: Sociability	0.391	0.039	0.208
f9: Postponement of visiting the dentist	-0.498	0.009	0.238
f10: Resignation to own cavities	-0.377	-0.043	0.436

Independent *t*-test, *: $P < 0.05$, **: $P < 0.01$, ***: $P < 0.001$

oblique rotation has been suggested to produce results that are more practical (17).

In the present study, school-aged girls had higher scores for dental anxiety than boys, but there were no significant differences with regard to school grade for both sexes. Neverlien (18) found that the levels of self-reported dental anxiety in a Norwegian adult population varied with gender and age. In another study, it was reported that women and younger subjects had higher levels of dental anxiety than men and older subjects, though the age of those subjects was higher than in the present study (19). Since there is scant information regarding oral health behavior in later adolescence, it is still unknown whether dental anxiety decreases with age. Wright (14) reported that the proportion of subjects with low dental anxiety decreased from 39.6% for 6- to 8-year-old subjects to 18.0% for those 11 to 13 years old, and then to 15.2% for 14- to 16-year-old subjects. From those results, it was suggested that the difference in dental anxiety with age was consistent with two maturational phenomena; an increased likelihood of unpleasant dental experiences resulting from direct personal experiences with increasing age, and changes in the cognitive ability of children as they age, as adolescents have an increasing ability to rationalize experiences and abstract their feelings. In the present study, even in older adolescents with a higher maturation level, the level of dental anxiety tended to increase in both boys and girls, although there were no significant differences among the three levels of education. Thus, our results also indicate that unpleasant dental experiences increase with age.

In both sexes, there was a remarkable age-related increase in scores for postponement of visiting the dentist, which was in agreement with the tendency for the increases in scores for dental anxiety and resignation to one's own dental cavities. One reason may be the control maintained by the public health dental services in Japan, which includes annual dental examinations held during school time at schools, as this might tend to restrict the development of an individual's sense of responsibility in students. Entrance to junior high school generally marks the beginning of critical developmental and transitional stages. During this period of transition into adolescence, many children develop fatalistic beliefs regarding oral diseases, along with a decrease in their individual sense of value, self-esteem, and sociability, which occurs with increasing age. The traits seen in our study are in agreement with an earlier report that utilized cluster analysis (20). Furthermore, comparisons of data from studies of western populations in the UK, Australia, Ireland, and elsewhere indicate that a higher percentage of people living in Asia put off going to the dentist until they have toothache (western, 12% vs Asia,

47%), and only a small proportion (8%) of the western subjects reported a perception of inevitability in having false teeth, whereas 33% of Asians studied held this fatalistic belief.

Pre-adolescents have been shown to brush their own teeth more often than adolescents in Japan (21). In general, dental care from the guardian (mainly mother) seems to heavily influence the toothbrushing habits of infants and primary school children (22). Fitzgerald et al. (23) reported that preferred oral health behavior associated with a medicalized model among adolescents was frequent use of chewing gum and rapid toothbrushing, while for the cosmetic model frequent use of chewing gum and breath fresheners was noted. In the present study, high school students, especially girls, tended to depend more on snacks (sweets) than pre-adolescent subjects. Cutress (24) reported that knowledge of the effects of sugar intake and use of fluoride is a predictor of prevalence for public health purposes, and that no other proven inhibitors of caries through diet are available. Caries risk is primarily caused by supplementation of diet with pure sugars, which initiate the caries process by intra-oral metabolism. Dental caries becomes a significant public health problem in populations that have per capita annual consumption of sugars that exceeds 20 kg, while fluoride as a component of the diet or when applied by other intra-oral routes exerts a significant anti-caries effect despite the availability of sugars (24).

Nakazono et al. (25) reported that four items, fluoridated water to prevent caries, fluoride supplementation to stop decay, toothbrushing and fluorinated water to stop caries, and brushing to solve gum problems, were highly beneficial preventive practices. Fluoride intake during meals or application of fluoride in the oral cavity through other means is effective against caries, irrespective of whether or not sugar is consumed. In the present study, the expectation of the effect of fluoride (F7) by the subjects involved two items: "I think fluoride treatments prevent cavities" and "I think fluoride paste is good for the gums". The results showed that expectation of the effect of fluoride was not related to knowledge about fluoride, but rather some mere expectation of its effect by the subjects. Grembowski et al. (26) have suggested that fluoride has very little effect on the gums. The respondents in this study were students in their fourth to twelfth year of public school, and the purpose of their education was to prepare them for a variety of situations, including common problems encountered in everyday life. Although research has provided a lot of information on the cause and effects of dental caries and periodontal disease, the present teenagers knew little about those issues and were doing relatively little to prevent oral health problems.

By utilizing the 10 factors of the OSCA, a better understanding of the psychosocial influences on oral health could assist efforts by schools and the community to maintain and promote lifelong healthy oral conditions. If the oral health behavior of school-aged children could be measured, intervention strategies for behavioral change used by the schools could be planned. Furthermore, it would also be possible to compare the results with the attitudes and behavior of the parents, which would provide verification of whether parents are influential role models for their children with regard to oral health behavior. In addition, a simultaneous interrelationship of oral health behavior (10 factors in the present study) and the oral health of children could be examined using linear structural relations (LISREL) analysis in the next stage.

In the present cross-sectional study, 10 scales in the OSCA were used to assess determinants of oral health attitudes and behavior of school-aged children. Factor analysis provided interpretable scales that could be used as variables. Since all of the subjects were recruited from public schools in the general area of the same city, further research is needed to determine whether similar results could be obtained from other areas and/or foreign countries, where culture, race, and/or health insurance systems differ. Nevertheless, we consider that information acquired by use of the OSCA is useful for understanding changes in oral health behavior during the development of children.

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