

Original Article

## **Evaluation of school-based dental health activities including fluoride mouth-rinsing in Hiraizumi, Japan**

**Satoko Ohara<sup>1)</sup>, Yoko Kawaguchi<sup>2)</sup>, Kayoko Shinada<sup>2)</sup> and Yoshiyuki Sasaki<sup>1)</sup>**

*1) Department of Preventive Dentistry and Public Health, Faculty of Dentistry,*

*2) Oral Health Promotion, Department of International Health Development, Division of Public Health, Graduate School, Tokyo Medical and Dental University*

**School-based dental health activities conducted in Hiraizumi over the past 20 years have remarkably improved the dental health status of schoolchildren. For example, DMFT index of 12-year-old children decreased to 1.5 in 1998, one-half that of the national average. School dental health activities, which were focused on dental health education, resulted in an increase of filled teeth rates, a decrease in the number of missing teeth, and a decline in incisor caries (1979-1986). In addition, the introduction of a school-based fluoride mouth-rinsing program (1986 - ) showed a positive effect on the prevention of dental caries; a significant decrease was observed in the overall prevalence of dental caries, particularly in the molars.**

**In Japan it seems advantageous to promote the dental health of schoolchildren by school-based programs that combine dental health examination, dental health education and fluoride mouth-rinsing program. Especially, to prevent dental caries in the mandibular first molars more effectively, it is recommended to start fluoride mouth-rinsing at age 5.**

**Key words:** School-based dental health program, Dental health education, Fluoride mouth-rinsing, Caries prevention

### **Introduction**

The school-based dental health program in Japan has a history of about 70 years, beginning from the time when the School Dentist Law was legislated in 1931. At present, approximately 40,000 school dentists are contributing to improving the dental health of children attending elementary and junior high schools.

The mean number of DMFT (DMFT; decayed, missing, filled teeth) in Japanese schoolchildren has gradually decreased since 1975<sup>1</sup>, but the decreasing rates are not sufficient when compared internationally. Many industrialized countries have already achieved the WHO dental health goal of “no more than 3 DMF teeth at 12 years of age by the year 2000”<sup>2</sup> (Table I). In Japan the national survey in 1993 reported that the mean number of DMF teeth for 12-year-old children was 3.6<sup>1</sup>.

Most of the permanent teeth erupt in children during their elementary and junior high school years; i.e. between ages 6 and 14, when dental caries develop most frequently<sup>1</sup>. Therefore, school-based dental health programs should focus on the prevention of dental caries in the permanent teeth.

In this study, we reviewed the dental health activities carried out in schools in Hiraizumi over the past 20 years to determine which factors were most effective in preventing dental caries in the permanent teeth. Based upon our findings, we would like to propose a recommendation regarding desirable school-based dental health activities in Japan.

---

Address for Corresponding Author: Satoko Ohara  
Dept. of Preventive Dentistry and Public Health, Faculty of  
Dentistry, Tokyo Medical and Dental University 1-5-45 Yushima,  
Bunkyo-ku, Tokyo 113-8549 Japan.  
Tel. 81-3-5803-5477 Fax. 81-3-5803-0194

### Materials and Methods

The town of Hiraizumi is located in the southern part of Iwate Prefecture and has a population of about 10,000. Schools for young children comprise two nurseries, one kindergarten, two elementary schools and one junior high school. Dental facilities comprise one public clinic and one private clinic.

Subjects in this study were children attending the elementary and junior high schools in Hiraizumi (Table II). Data were collected for the following years: 1979, when town support for community dental health activities was started; 1986, when a school-based fluoride mouth-rinsing program was initiated; 1993, when the children first participated in the fluoride mouth-rinsing

program from age 5 turned age 12; and 1998, when the most recent data were obtained.

Since 1979, we provided the dental health education to schoolchildren, parents, teachers and preschool children. We taught the importance of the teeth, restriction of sweets and oral hygiene. We also taught the effects of fluoride on the prevention of dental caries. We provided instruction on an individual basis to the children at the time of their dental health examinations. In 1986, a school-based fluoride mouth-rinsing program was funded by the local government. Weekly fluoride mouth-rinsing of 0.2% NaF solution were provided for children 5 year of age and above in the day nurseries and kindergarten and elementary schools. In Hiraizumi, almost all 5-year-old children attend either day nurseries or kindergarten. Children, whose parents gave written approval, participated in the program. Children, whose parents did not consent, were given a plain water rinse. However there were only 2 children who did not participate fluoride program in the 12 years period from 1986 to 1998.

Each year dental health examinations using dental mirrors and explorers were conducted in April or May. The school dentists in Hiraizumi and the staff of the University cooperated to conduct these examinations. Before the examination, calibration was carried out for defining diagnostic criteria.

Dental caries data were collected and analyzed according to the age of the subjects. Statistical analyses were performed by t-test,  $\chi^2$  test and one-way analysis of variance, using HALBAU software. The level of significance was set to 0.05. When a statistically significant treatment effect was found by one-way analysis

Table I. 12-years-old children DMFT index (WHO)

	DMFT index (year)
USA	4.0 (1965-67) → 1.4 (1991)
UK	4.7 (1973) → 1.4 (1993)
France	3.5 (1975) → 2.1 (1993)
Germany	6.0 (1973) → 2.5-2.6 (1994)
Denmark	6.4 (1978) → 1.3 (1994)
Finland	7.5 (1975) → 1.2 (1994)
Norway	8.4 (1973) → 2.1 (1993)
Sweden	6.3 (1977) → 1.4 (1995)
Netherlands	6.5-8.2 (1973) → 2.1 (1993)
Australia	4.8 (1977) → 1.1 (1993)
New Zealand	6.0 (1973) → 1.5 (1993)
Singapore	3.0 (1970) → 1.0 (1994)
Japan	5.9 (1975) → 3.6 (1993)

Table II. Number of Subjects

Age	1979			1986			1993			1998		
	male	female	total									
6	59	74	133	85	80	165	51	53	104	35	48	83
7	46	65	111	78	73	151	55	60	115	41	37	78
8	77	52	129	58	56	114	63	41	104	48	37	85
9	48	62	110	77	71	148	73	57	130	53	39	92
10	68	58	126	73	83	156	68	65	133	58	48	106
11	69	51	120	79	61	140	59	70	129	49	56	105
12	57	54	111	62	66	128	78	55	133	54	59	113
13	42	48	90	64	75	139	86	80	166	66	42	108
14	62	68	130	53	58	111	77	72	149	74	60	134
total	528	532	1060	629	623	1252	610	553	1163	478	426	904

of variance, a Scheffe's post hoc test was applied.

Following items were analyzed.

- I. Prevalence of dental caries (permanent teeth)
- II. DMFT index; mean number of decayed, missing, filled permanent teeth
- III. Changing pattern of DMFT index on 12-year-old children for the past 20 years.
- IV. DMFT rates by tooth type on 12-year-old children
- V. DMFT rates for the mandibular first molar
- VI. DMFS rates for the mandibular first molar in 12-year-old children (DMFS; decayed, missing, filled permanent teeth surface)

## Results

### I. Prevalence of dental caries (permanent teeth)

The prevalence of dental caries in the children according to age is shown in Fig. 1 for 1979, 1986, 1993 and 1998; the results of statistical analysis of this data are shown in Table III. In 1986, the prevalence of dental caries decreased in 8 through 11-year-old chil-

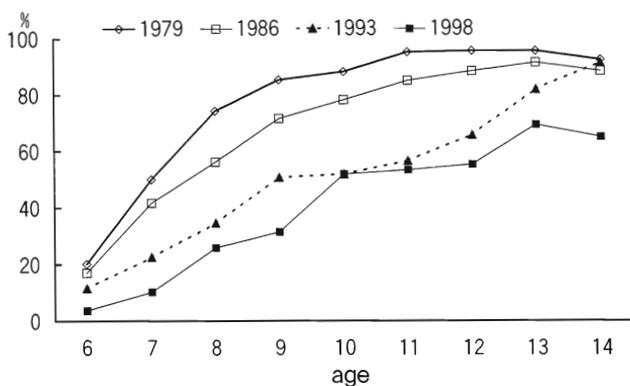


Fig 1. Prevalence of dental caries.

Table III. Statistical analysis of prevalence of dental caries

age	79-86	79-93	79-98	86-93	86-98	93-98
6	n. s.	n. s.	***	n. s.	***	n. s.
7	n. s.	***	***	**	***	***
8	**	***	***	**	***	n. s.
9	**	***	***	**	***	***
10	*	***	***	***	***	n. s.
11	**	***	***	**	***	n. s.
12	n. s.	***	***	***	***	n. s.
13	n. s.	***	***	*	***	*
14	n. s.	n. s.	***	n. s.	***	***

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

dren significantly in comparison to prevalence of dental caries in 1979. The 1979 and 1986 groups had no experience of fluoride mouth-rinsing. In 1993, significant decreases in the prevalence of dental caries were observed in 7- through 12-year-old children (who in 1993 started fluoride mouth-rinsing at age 5) and in 13-year-olds (who in 1993 started fluoride mouth-rinsing at age 6) in comparison to rates seen in 1986. This decrease was not observed in 14-year-old children (who in 1993 started fluoride mouth-rinsing at age 7). Between 1993 and 1998, the prevalence of dental caries in the 7-, 9-, 13- and 14-year-old children (who in 1998 started fluoride mouth-rinsing at age 5) were significantly decreased.

### II. DMFT index

DMFT index according to age is shown in Fig. 2-a, 2-b, 2-c, and 2-d for 1979, 1986, 1993 and 1998, and the results of statistical analysis are shown in Table IV. The caries reduction rates during the first 7 years, from 1979 to 1986, were 28.1% for elementary school pupils (6 to 11 years of age) and 12.2% for junior high school students (12 to 14 years). During the following 7 years, from 1986 to 1993, the caries reduction rates increased to 44.1% in 6- to 11-year-olds and to 41.5% in 12- to 14-year-old children.

In 1979, the number of missing teeth in 14-year-old children was 0.2 on average. After 1986, the children with missing teeth were found only rarely. The filled teeth ratio (FT/DFT × 100%) in elementary school children was 54.8%, 80.2%, 80.6% and 84.1% in 1979, 1986, 1993 and 1998, respectively, showing an increase over time. The same tendency was observed among junior high school students: 54.8% (1979), 64.5% (1986), 79.8% (1993) and 88.3% (1998).

### III. Changing pattern of DMFT index in 12-year-old children

The DMFT index in 12-year-old children decreased in Hiraizumi from 5.3 (1979) to 4.5 (1986), showing a 15.7% decline in dental caries over a 7-year period (Fig. 3). However, in the following 7-year period, marked by the start of fluoride mouth-rinsing program, it decreased remarkably from 4.5 (1986) to 2.1 (1993), with a 53.1% decline. In a year-by-year comparison, a significant difference in DMFT indexes was observed only between 1992 (3.0) and 1993 (2.1). The 12-year-old children in 1992 started fluoride mouth-rinsing at age 6 and those in 1993 started at age 5.

As DMFT index in 12-year-old children had been recorded by Japanese school health survey since

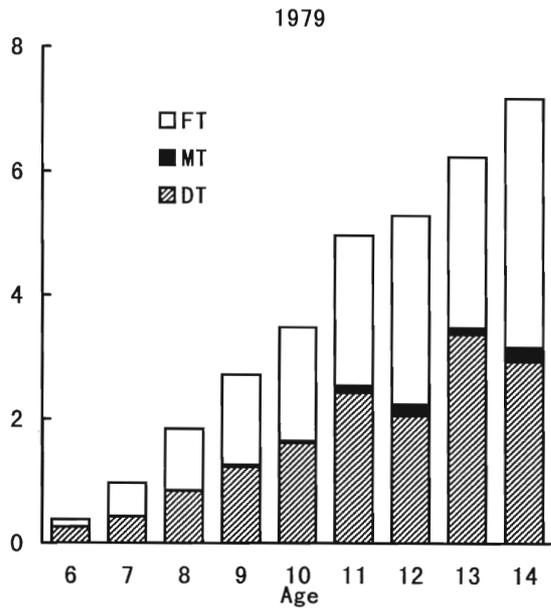


Fig 2-a. DMFT index.

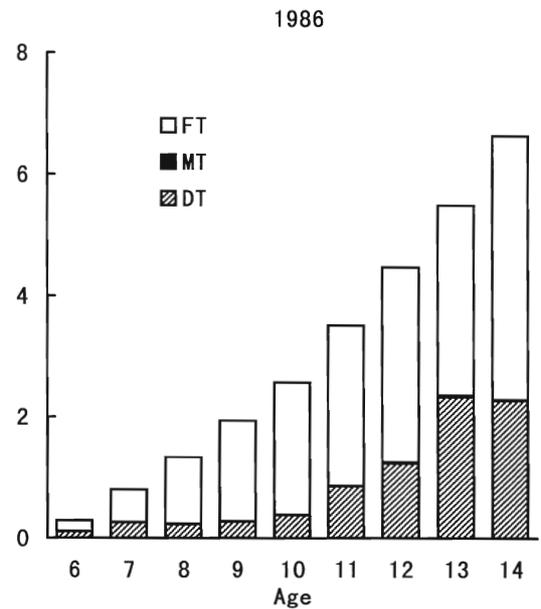


Fig 2-b. DMFT index.

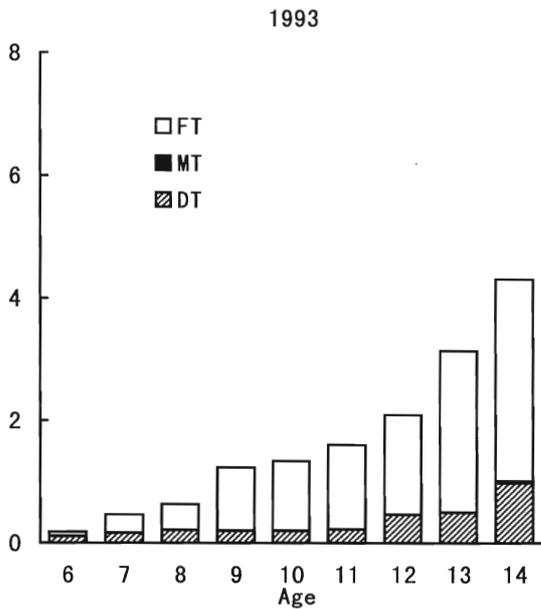


Fig 2-c. DMFT index.

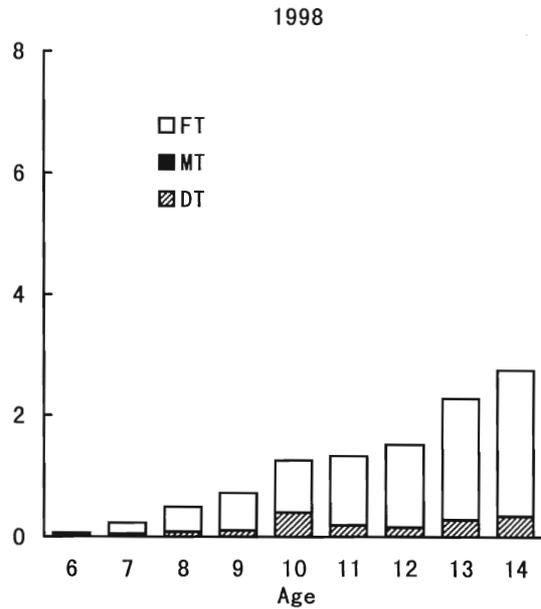


Fig 2-d. DMFT index.

1984, we were able to analyze annual changes among 12-year-old children. According to the Ministry of Education survey of school health, the national average DMFT index decreased from 4.8 (1984) to 3.1 (1998), showing a 35.4% decline in dental caries over the 14-year period. The DMFT index in Hiraizumi decreased from 5.2 (1984) to 1.5 (1998), showing a

71.2% decline over the same 14-year period.

In the year-by-year comparison of the DMFT index of the 12-year-old children in Hiraizumi with the national index average, there were no significant differences from 1984 through 1989. However, the Hiraizumi average was significantly lower than the national average from 1990 through 1998. The WHO goal of

“no more than 3 DMF teeth by the year 2000 for 12-year-olds” was achieved in Hiraizumi by 1992.

IV. DMFT rates by tooth type in 12-year-old children

The DMFT rates according to tooth type in 12-year-old children are shown in Fig. 4 and the results of statistical analysis are shown in Table V.

When comparing data for the first 7 years between 1979 and 1986, significant decreases were found for the maxillary and mandibular central and lateral incisors. Comparison of the data for the following 7 years between 1986 and 1993, revealed more significant decreases in DMFT rates for central and lateral incisors, first and second premolars, first and second molars in the maxillary and first and second molars in

the mandibular. Over the next 5 years from 1993 to 1998, significant decreases were also found for the mandibular first and second molars.

V. DMFT rates for the mandibular first molar

The DMFT rates for the mandibular first molar are shown for three groups in Fig. 5. The first group comprised children born in 1972 and had no experience of fluoride mouth-rinsing. The second group comprised children born in 1979 and had started the rinsing at age 6. The third group comprised children born in 1980 and had started the rinsing at age 5. Table VI shows the results of statistical analysis of these three groups.

DMFT rates for the mandibular first molar of the second group (born in 1979) were lower than those of the first group (born in 1972), except among children at age 6, and the differences for 7- through 12-year-old children were significant. DMFT rates in the third group (born in 1980) were lower than in the second group (born in 1979) for 6- through 12-year-old children, and these differences were all significant.

When compared with the baseline data of school-children born in 1972 who had no experience of the fluoride mouth-rinsing, the rates of decline in caries among 12-year-old children was 12.3% for children born in 1979 (who started the fluoride mouth-rinsing at age 6), and 33.7% for those born in 1980 (who started the rinsing at age 5).

Table IV. Statistical analysis of DMFT index

age	79-86	79-93	79-98	86-93	86-98	93-98
6	n. s.	n. s.	***	n. s.	n. s.	n. s.
7	n. s.	**	***	n. s.	**	n. s.
8	*	***	***	n. s.	**	n. s.
9	***	***	***	**	***	n. s.
10	***	***	***	***	***	n. s.
11	***	***	***	***	***	n. s.
12	n. s.	***	***	***	***	n. s.
13	n. s.	***	***	***	***	n. s.
14	n. s.	***	***	***	***	**

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

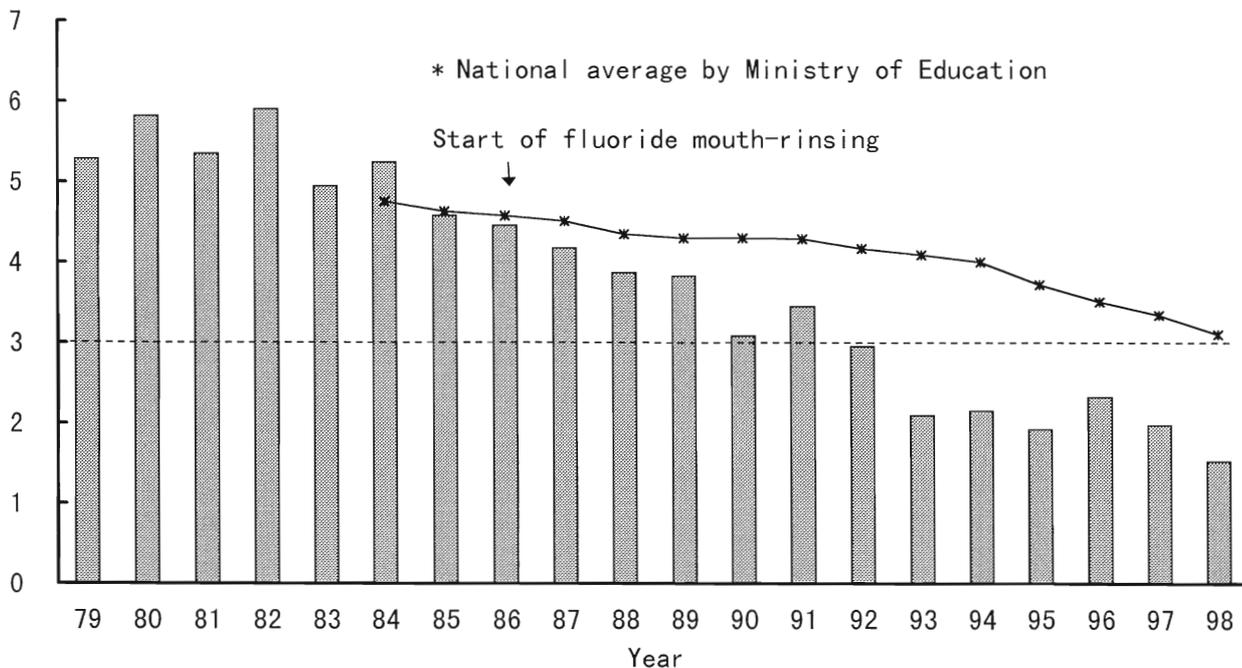


Fig 3. Changing pattern of DMFT index in 12-year-old children.

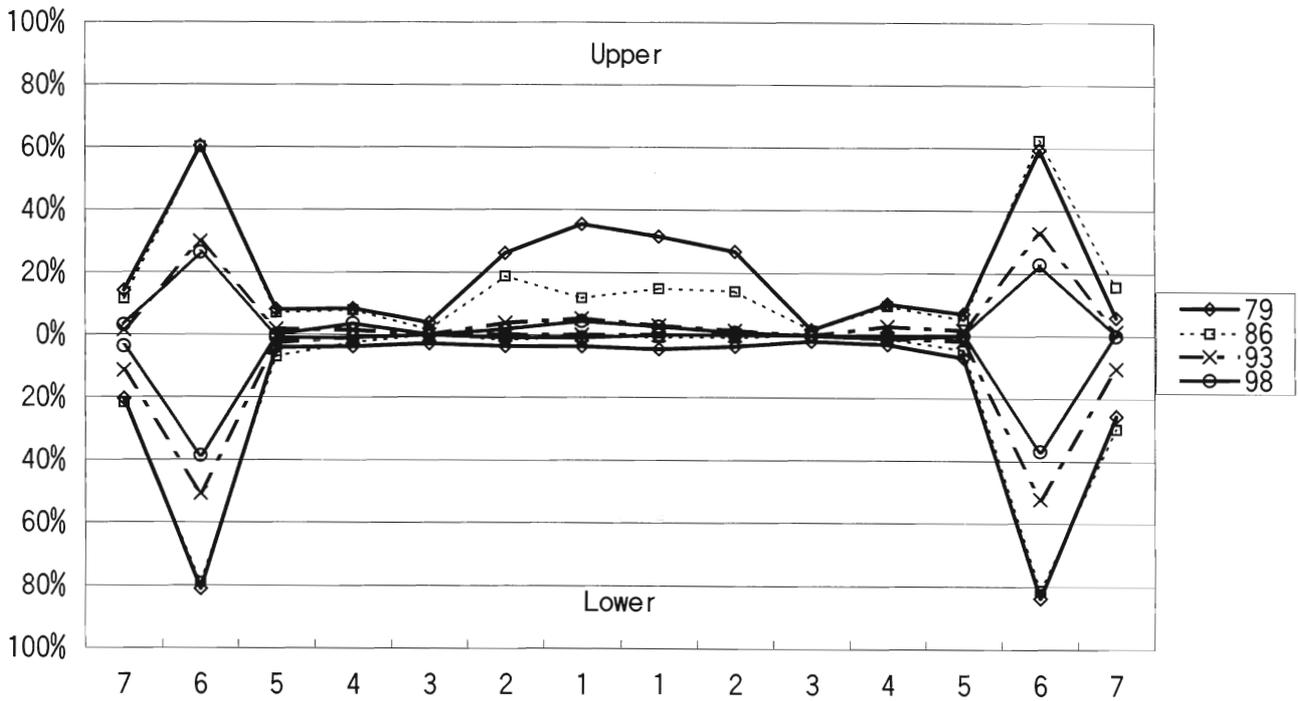


Fig 4. DMFT rates by tooth type in 12-year-old children.

Table V. Statistical analysis of DMFT rates by tooth type in 12-year-old children (Left and right teeth are combined)

	7	6	5	4	3	2	1
79-86	n. s.	**	***				
79-93	**	***	***	***	*	***	***
79-98	**	***	***	***	*	***	***
86-93	***	***	*	***	n. s.	***	***
86-98	***	***	***	***	n. s.	***	***
93-98	n. s.						

	7	6	5	4	3	2	1
79-86	n. s.	*	*				
79-93	**	***	n. s.	n. s.	n. s.	**	**
79-98	***	***	**	n. s.	n. s.	*	*
86-93	***	***	n. s.				
86-98	***	***	**	n. s.	n. s.	n. s.	n. s.
93-98	**	**	n. s.				

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

VI. DMFS rates for the mandibular first molar in 12-year-old children

The DMFS rates of the mandibular first molar in 12-year-old children are shown in Table VII for 1986, 1992 and 1993. In 1986, 12-year-old children did not receive fluoride mouth-rinsing; those in 1992 started the rinsing at age 6; and those in 1993 started the rinsing at age 5. The results of statistical analysis of this data are

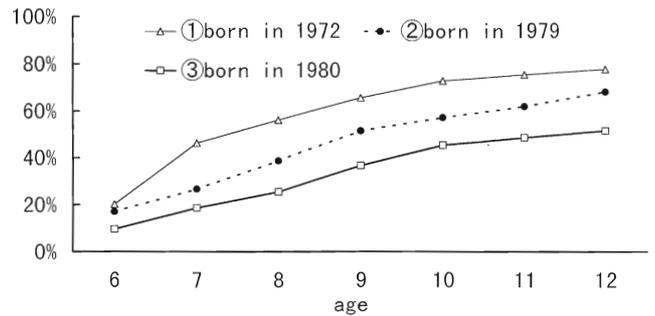


Fig 5. DMFT rates for the mandibular first molar.

Table VI. Statistical analysis of DMFT rates for the mandibular first molar

age	①-②	①-③	②-③
6	n. s.	**	*
7	***	***	*
8	***	***	***
9	***	***	***
10	***	***	***
11	***	***	**
12	**	***	***

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

- ①born in 1972
- ②born in 1979
- ③born in 1980

shown in Table VIII.

The DMFS rates declined significantly in the occlusal and buccal surfaces from 1986 to 1992. Further, from 1992 to 1993, DMFS rates declined significantly in the occlusal, lingual, mesial and distal surfaces.

Compared with the baseline data of 12-year-old children in 1986 who did not experience the rinsing, the DMFS reduction rate for the mandibular first molar occlusal caries was 17.3% for those in 1992 (who started the rinsing at age 6) and 38.7% for those in 1993 (who started at age 5).

### Discussion

In this study we analyzed the prevalence of dental caries in the permanent teeth of elementary pupils and junior high school students in Hiraizumi for 20 years from an epidemiological point of view. In particular, the effects on the prevalence of dental caries that could be attributed to dental health program were investigated.

Before starting fluoride mouth-rinsing, the DMFT index of 12-year-old children in Hiraizumi indicated that their dental caries incidence to be at nearly the same level as the national average. Thus, even if national decline of dental caries incidence in Japanese children is considered, fluoride mouth-rinsing had a great influence on caries prevention.

**Table VII.** DMFT rates for the mandibular first molar on 12-year-old children (%)

surface	1986	1992	1993
occlusal	79.8	66.0	48.9
buccal	24.6	17.8	14.2
lingual	3.1	2.1	0
mesial	9.4	6.4	0.4
distal	4.3	2.5	0

**Table VIII.** Statistical analysis of DMFT rates for the mandibular first molar on 12-year-old children

surface	86—92	86—93	92—93
occlusal	***	***	***
buccal	*	**	n. s.
lingual	n. s.	***	*
mesial	n. s.	***	***
distal	n. s.	***	**

\*  $p < 0.05$  \*\*  $p < 0.01$  \*\*\*  $p < 0.001$

Dental health education in Hiraizumi targeted to schoolchildren, parents, teachers and infants enhanced their awareness of the importance of dental health. For this reason, schoolchildren might be receptive to dental treatment. Further, an intensive dental treatment program that was conducted during the summer vacation of the first 4 years (1979–1983) might have had an influence on the decrease in the number of decayed and missing teeth and increase in the number of filled teeth. It was also revealed that school dental health activities that focused on health education in such matters as tooth brushing instruction and the restriction of sweets did not have so much effect on the prevention of dental caries<sup>3,4</sup>. However, dental health education and fluoride mouth-rinsing in combination showed a remarkable decrease in the prevalence of dental caries among the school-age children. Fluoride mouth-rinsing starting at age 5 apparently resulted in more effective dental caries prevention than starting at age 6. The results of the analysis for the prevalence of dental caries, the number of DMF teeth in 12-year-old children, the DMFT rates and DMFS rates of the mandibular first molar, all supported this. According to the DMFT rates by tooth type in 12-year-old children, it was suggested that dental caries of the incisors could be decreased by dental health education<sup>5</sup>. Incisors can be cleaned easily by good tooth brushing, but dental caries in the molars, most of which are occlusal pits and fissure caries, could hardly be decreased by plaque control. Dental health education and fluoride mouth-rinsing in combination could effect a decrease in dental caries of not only the incisors but also the molars.

Application of fluoride from time of tooth eruption has been shown to be effective for caries prevention<sup>6</sup>. In Hiraizumi, eruption rates of the mandibular first molars in schoolchildren did not differ much from year to year. The average eruption rates were about 15% for 5-year-old children and 75% for 6-year-olds, respectively. Thus, about 85% of the mandibular first molars can receive the fluoride effect from just after eruption, if the fluoride mouth-rinsing is started at age 5, but only about 25% of molars can receive that initial benefit, if mouth-rinsing is started at age 6. This could be the reason for the big differences in caries rates seen based on the age at initial fluoride mouth-rinsing.

Fluoride is usually considered effective on smooth surface caries and not so much on fissure caries<sup>7</sup>. The results of this study, however, suggest that fluoride mouth-rinsing had a preventive effect not only on smooth surface caries of the incisor but also on fissure

caries of the molars.

In our study, it was demonstrated that fluoride mouth-rinsing started at age 5 was very effective on prevention for dental caries in the permanent teeth. Wei et al<sup>8</sup>, however, reported that fluorosis could occur, supposed if 1.8% of 5-year-olds who swallow the entire rinsing solution at every mouth-rinsing session. Accordingly, WHO<sup>9</sup> stated in 1994 that, "Following correct rinsing, only a minimum amount of fluoride is retained and swallowed. Though the amount retained dose not cause fluorosis in a preschool child, it might contribute to the risk of fluorosis, depending upon the total amount of fluoride being ingested daily. Therefore, mouth-rinses are not recommended for children below the age of 6."

In Hiraizumi, prior to the start of fluoride mouth-rinsing program, the children were made to practice rinsing with water until they could do it properly. Thus, it should not be supposed that the children swallow the entire fluoride solution every time. After fluoride mouth-rinsing, 10 to 12% of fluoride may remain in the mouth of 4- and 5-year-old children<sup>10</sup>. In 5-year-old children rinsing with 5 ml of 0.2% NaF solution, about 0.5 mg fluoride per week might remain in the mouth, or 0.07 mg per day. The 5 ml-daily dose is about one-seventh of the 0.5 mg, recommended by the ADA<sup>11</sup> for 3- to 6-year-old children living in areas with less than 0.3 ppm of fluorine in the drinking water. Moreover, fluorine from general intake routes, such as fluoridated water, fluoride tablets and fluoridated food, are not available in Japan; thus, fluorosis is not expected to be a problem. That is, there is no apparent reason in Japan to keep 5-year-old children out from fluoride mouth-rinsing. Moreover, the results of this study supported that fluoride mouth-rinsing started at age 5 was remarkably more effective in preventing dental caries than started at age 6. Therefore, fluoride mouth-rinsing should be recommended for 5-year-old children in Japan. Nowjack-Raymer et al<sup>12</sup> reported that no statistically significant differences existed in the prevalence or severity of fluorosis among children who began the fluoride mouth-rinsing at age 5, 6, or 7. Consequently they concluded the safety of school-based fluoride mouth-rinsing in the communities with fluoride-deficient water supplies.

Although the number of children in Japan participating in fluoride mouth-rinsing programs like Hiraizumi is increasing, it was still only 1% of the total children<sup>13</sup>. For effective caries prevention among school-age children, we recommend a combination dental health education and fluoride mouth-rinsing program in the

widely established school-based dental health programs in Japan.

Of course, the results of this study do not exclude the dental caries prevention effects of dental health education. Providing individual health instruction during the dental health examinations as well as dental health education for school children, parents and teachers for 7 years, might have enhanced the oral health consciousness in a substantial fraction of the population, helping them recognize importance of caries prevention and accept the school-based fluoride mouth-rinsing program in Hiraizumi.

In Japan, school-based dental health activities are focused mainly on dental health education, and they do not reduce remarkably the general prevalence of dental caries, DMFT or dental caries of the first molar. Although the rate of dental caries is decreasing among schoolchildren in Japan, it is still as much as twice of that in the other industrialized countries. As the rate of dental caries is particularly high for the first molar, prevention of such dental caries is important. The preventive procedures for the permanent teeth caries are topical fluoride usage, such as fluoride mouth-rinsing<sup>7,14-18</sup>, topical application of fluoride<sup>19</sup> and brushing with fluoridated toothpaste<sup>20</sup>, as well as treatment with pits and fissure sealant<sup>21</sup>. Most of the permanent teeth erupt in children during their elementary and junior high school years; i.e. between ages 6 and 14, when dental caries develop most frequently. School-based fluoride mouth-rinsing program offers the benefit of fluoride to all the children including high risk children. The cost of school-based fluoride mouth-rinsing program per person per year is about 300 yen (3US dollars). On the other hand the cost of topical application of fluoride or treatment with pits and fissure sealant cost are about 2000-5000 yen (20-50US dollars) per once. The method of fluoride mouth-rinsing is very simple and it needs only several minutes. Heidemann J, et al.<sup>22</sup> and Karjalainen S, et al.<sup>18</sup> reported that unsupervised use of fluoridated toothpaste may not be a sufficient substitute for school-based fluoride mouth-rinsing program. Therefore among these approaches, the school-based fluoride mouth-rinsing program seems to be the best when effectiveness, reliability, economics and convenience are taken into account.

The usual dental health examination by a school dentist and the resulting written recommendations for receiving dental treatment may make school-based dental health programs "one-sided" and "top heavy". In our Hiraizumi program, children encouraged to view

their own caries and gingivitis using hand mirrors, so they willingly visited dental clinics to receive treatments. Although such a combined dental health examination and education program requires considerable resources in terms of personnel, time, and facilities, it seems as effective as individual health instruction in the clinical settings.

In Japan it seems advantageous to promote the oral health of our schoolchildren by school-based programs that combine dental health examination, dental health education and fluoride mouth-rinsing program.

### Acknowledgments

The authors wish to express their gratefulness to the residents of Hiraizumi, especially to two present school dentists Drs. Junichi Kanazawa and Koichi Oyama, as well as to the former school dentist Dr. Akihiko Tanaka. The authors also wish to thank all staff members of the Dept. of Preventive Dentistry and Public Health, Faculty of Dentistry, Tokyo Medical and Dental University, and Prof. Masami Yonemitsu and Dr. Tosiki Moriya, Dept. of Preventive Dentistry, Faculty of Dentistry, Iwate Medical University.

### References

- Dental Health Division of Health Policy Bureau/Ministry of Health and Welfare Japan. Report on the survey of dental disease (1993). Tokyo : Koku Hoken Kyokai, 1995
- Department of Noncommunicable Diseases Surveillance /Oral Health. WHO Oral Health Country/Area Profile Programme : <http://www.whocollab.od.mah.se/index.html>
- Yonemitsu Y, Kawaguchi Y, Ohara S, et al. Evaluation of community dental health activities in Hiraizumi-cho ( Iwate prefecture). (in Japanese, English abstract). *J Dent Health* 1982; 32 : 359-369.
- Yonemitsu Y, Kawaguchi Y, Ohara S, et al. Evaluation of school dental health activities in Hiraizumi primary school, Iwate prefecture. (in Japanese, English abstract). *J Stomatol Soc Jpn* 1992 ; 59 :562-570
- Tsutsui A, Kobayashi S, Nogami S, et al. Comparing the prevalence of dental caries among school children who were given tooth brushing instructions and those who rinse their mouths with fluoride in a school dental health program. (in Japanese, English abstract). *J Dent Health* 1983 ; 33 : 79-88.
- Horowitz HS, Creighton WE, McLendon BJ. The effect on human dental caries of weekly oral rinsing with a sodium fluoride mouthwash, *Archs Oral Biol.*, 15 ; 609-616, 1971.
- Leske GS, Ripa LW, Sposato A. Posttreatment benefits in a school-based fluoride mouthrinsing program. *Clin Prev Dent* 1985 ; 7(3) : 4-7.
- Wei SH, Kanellis MJ. Fluoride retention after sodium fluoride mouthrinsing by preschool children. *J Am Dent Assoc* 1983 ; 106 : 626-9.
- WHO: Fluoride and oral health, report of a WHO expert committee on oral health status and fluoride. WHO Technical Report Series 846, Geneva, 1994.
- Kobayashi S, et al. Fluoride mouthrinsing proficiency of preschool-aged children AAPHD, in Orlando Florida 1996 ; Sep : 25-27.
- ADA. New fluoride guidelines proposed. *J Am Dent Assoc* 1994 ; 125 : 366.
- Nowjack-Raymer R, Selwitz R, Kingman A, et al. The prevalence of dental fluorosis in a school-based program of fluoride mouthrinsing, fluoride tablets, and both procedures combined. *J Public Health Dent* 1995; 55: 165-70
- Kobayashi S, Yano M, Hirakawa T, et al. The status of fluoride mouthrinse programs in Japan: a national survey. *Int Dent J* 1994 ; 44 : 641-7.
- Ando Y, Yagi M, Sasaki T, et al. A longitudinal study in caries prevalence in 12-year-olds in areas with or without fluoride mouthrinsing program. (in Japanese, English abstract). *J Dent Health* 1995 ; 45 : 440-7.
- Birkeland JM, Troll P. Caries-preventive fluoride mouthrinses. *Caries Res* 1978 ; 12 (Suppl. 1) : 38-51.
- Kishi H, Kobayashi S. Post-treatment benefits in 20-year-old adults from participation in a fluoride mouth rinsing program for 11 years. (in Japanese, English abstract). *J Dent Health* 1992; 42 : 359-70.
- Leverett DH, Sveen OB, Jensen OE. Weekly rinsing with a fluoride mouthrinse in an unfluoridated community: results after seven years. *J Public Health* 1985 ; 45(2) : 95-100.
- Karjalainen S, Eriksson A, Ruokola M, et al. Caries development after substitution of supervised fluoride rinses and toothbrushings by unsupervised use of fluoride toothpaste. *Community Dent Oral Epidemiol* 1994 ; 22 : 421-4.
- Iizuka Y, Higaki M, Ikeda M, et al. Comparison of three topical fluoride agents I. a one year experience. (in Japanese, English abstract). *J Dent Health* 1971 ; 21 : 1-6.
- Niwa T, Baba K, Niwa M. A study on caries prevention effects of dentifrices containing sodium monofluorophosphate, sodium monofluorophosphate plus dextranase, and sodium monofluorophosphate plus sodium phosphate. *J Dent Health* 1975 ; 25 : 30-52.
- Yoshihara A, Kobayashi S, Sakuma S, et al. Efficient application of school-based sealant program in low risk children under the fluoride mouth rinsing program. *J Dent Health* 42. 490-491, 1992.
- Heidmann J, Poulsen S, Arnbjerg D, et al. Caries development after termination of a fluoride rinsing program. *Community Dent Oral Epidemiol* 1992; 20: 118-21.