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The Prevalence of Dental Disease in the Children of Tianjin, China —Comparison of Tianjin (central and suburban areas) with Japan—

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Summary

Dental health checkups of children were conducted in Tianjin, China (central and suburban areas of the city). The prevalence of dental disease in Tianjin was compared with that in Japan as reported in a 1999 survey report. The following results were obtained.

1. There was no marked difference in the prevalence of dental disease between central and suburban areas of Tianjin.
2. The caries incidence ratio and the average number of decayed teeth per child were significantly higher in Tianjin than in Japan, but the treated teeth rate was significantly lower in Tianjin than in Japan. This indicates that the treatment of dental caries is not sufficient in China.
3. Dental caries tended to be more severe among Japanese than Chinese children. As the economy develops and living conditions change in China, dental caries may become more prevalent there, coming to resemble Japan's present condition. Follow-up surveys are needed.

Introduction

Since the People's Republic of China reformed its stance and opened the country to foreigners, foreign capital has been entering the country, triggering rapid economic growth. Beijing, Shanghai, Chongqing and Tianjin are 4 major cities, and have exhibited notable economic growth. Changes in the types and availability of foodstuff are particularly marked in these urban areas, due to opening of a number of food-related shops operating on the basis of foreign capital¹⁾. Such changes in avail-

able foodstuff may significantly affect the degree of dental caries and the oral hygiene of Chinese children^{2,3}.

Pediatric dentistry has recently advanced markedly in China, and reports have begun to be published concerning the oral hygiene of Chinese children⁴⁻¹⁰.

For instance, the results of oral health surveys in Beijing and Shanghai have been published in recent years, and these reports have pointed out a shortage of dentists involved in oral hygiene and the treatment of caries. They indicate the necessity of improving the citizens' knowledge about and recognition of these issues, and establishing effective health measures¹¹⁻¹³.

To our knowledge, there has not been a report of recent surveys of the prevalence of dental disease in Tianjin. Tianjin, located in the east of Hebei Province, has a population of one million and an area of 1.3 million m². It is a general industrial city (manufacturing chemicals, machinery, and other goods) in northern China. Tianjin seems to have problems similar to those seen in Beijing and Shanghai, and there seems to be a need to investigate its present status and devise appropriate measures for this city.

We conducted dental health checkups in both central and suburban areas of Tianjin to gain an understanding of the present status of oral disease in China and to contribute to establishing a system for disease prophylaxis and oral cavity control. The results obtained in Tianjin were compared with the results of a previous survey of dental disease among Japanese children¹⁴.

Materials and Methods

Subjects

The subjects were 427 children (226 boys and 201 girls). Of these children, 200 (117 boys and 83 girls), aged between 3 and 5, were attending the Eighth Hongqiao District Kindergarten in the center of Tianjin (the central area group) and 227 (109 boys and 118 girls), aged between 3 and 5, were attending the Economic-Technological Development District Teda Kindergarten, a suburban area of Tianjin (the suburban group), as shown in Table 1.

Table 1 : Number of subjects

Tianjin	Age								Total
	Boys				Girls				
	3	4	5	Total	3	4	5	Total	
Central	17	27	73	117	9	22	52	83	200
Suburb	25	29	55	109	23	44	51	118	227
Total	42	56	128	226	32	66	103	201	427

Methods

Each child, lying in supine position, received checks of the oral cavity by inspection and palpation. At the same time, pictures of the oral cavity of each child were taken. The inspection record and the oral pictures thus obtained were used as data. The judgment of dental caries was made according to the criteria prepared by the Japanese Ministry of Health and Welfare (MHW).

The number of present teeth, the number of decayed teeth and the number of treated teeth were calculated. The caries incidence ratio, the caries incidence ratio of teeth, the average number of decayed teeth per child, the filled teeth rate and caries attack pattern to the MHW classification were

analyzed statistically using chi-square test and t-test.

Table 2 : Prevalence of dental caries

	Tianjin	Age			Total
		3	4	5	
Number of patients with caries	Central	20	43	116	179
	Suburb	40	62	98	200
Caries incidence ratio (%)	Central	76.9	87.8	92.8	89.5
	Suburb	83.3	84.9	92.5	88.1
Number of present teeth (tooth)	Central	517	979	2402	3898
	Suburb	958	1450	2016	4424
Number of decayed teeth (tooth)	Central	100	259	780	1139
	Suburb	210	379	721	1310
Caries incidence ratio of teeth (%)	Central	19.3	26.5	32.5	29.2
	Suburb	21.9	26.1	35.8	29.6
Mean per-child dft indices (tooth)	Central	3.9	5.3	6.2	5.7
	Suburb	4.4	5.2	6.8	5.8
Number of treated carious teeth (tooth)	Central	0	2	19	21
	Suburb	5	4	22	33
Treated teeth rate (%)	Central	0.0	0.2	0.8	0.5
	Suburb	0.5	0.3	1.2	0.7

Results

Table 2 summarizes all parameters related to the prevalence of caries examined.

1. Number and rate of children with caries

In the central area group, 179 (89.5%) of the 200 children had dental caries. When analyzed by age, caries was seen in 20 (76.9%) of the 26 children at age 3, in 43 (87.8%) of the 49 children at age 4, and in 116 (92.8%) of the 125 children at age 5.

In the suburban group, 200 (88.1%) of the 227 children had dental caries. When analyzed by age, caries was seen in 40 (83.3%) of the 48 children at age 3, in 62 (84.9%) of the 73 children at age 4, and in 98 (92.5%) of the 106 children at age 5.

Thus, in both the central area group and the suburban group, the caries incidence ratio tended to increase with age, although this difference was not significant (Fig.1).

2. Number of present teeth

In the central area group, the total number of present teeth was 3898 for the entire subjects, 517 at age 3, 979 at age 4 and 2402 at age 5.

In the suburban group, the total number of present teeth was 4,424 for the entire subjects, 958 at age 3, 1450 at age 4 and 2016 at age 5.

3. Number and rate of decayed teeth

In the central area group, the total number of decayed teeth was 1139 (29.2%). When analyzed by age, the number was 100 (19.3%) at age 3, 259 (26.5%) at age 4, and 780 (32.5%) at age 5.

In the suburban group, the total number of decayed teeth was 1310 (29.6%). When analyzed by age, it was 210 (21.9%) at age 3, 379 (26.1%) at age 4 and 721 (35.8%) at age 5.

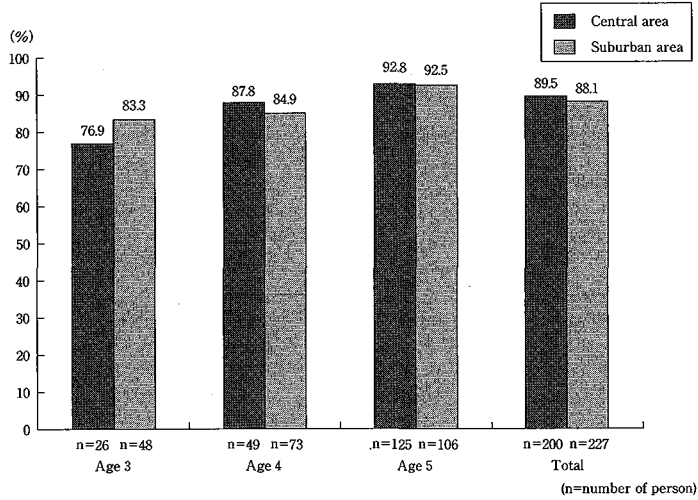


Fig.1 : Caries incidence ratio

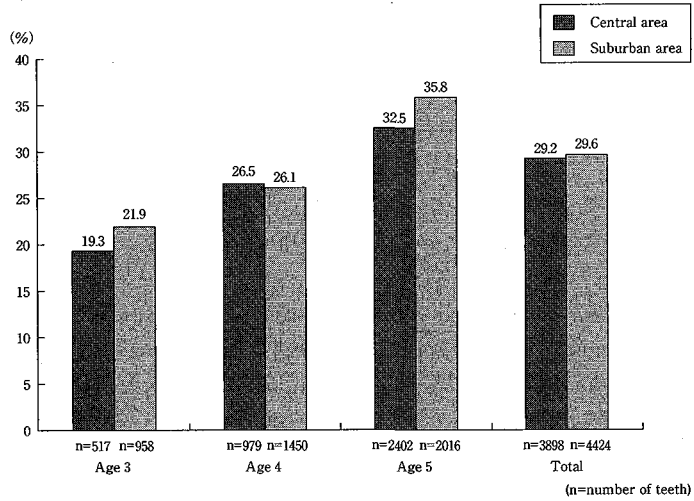


Fig.2 : Caries incidence ratio of teeth

The caries incidence ratio of teeth tended to increase with age in both the central area group and the suburban group, reaching a peak at age 5, although the difference was not significant (Fig.2).

4. The mean per-child dft indices

In the central area group, the mean per-child dft indices 5.7. It was 3.9 at age 3, 5.3 at age 4 and 6.2 at age 5.

In the suburban group, the mean per-child dft indices 5.8. It was 4.4 at age 3, 5.2 at age 4 and 6.8 at age 5.

In both the central area group and the suburban group, the mean per-child dft indices tended to increase with age. At age 4, this parameter was higher in the central area group than in the suburban group. For all subjects in the 3 year old group and the 5 year old group, this parameter was higher in the suburban group than in the central area group. None of these differences was significant (Fig.3).

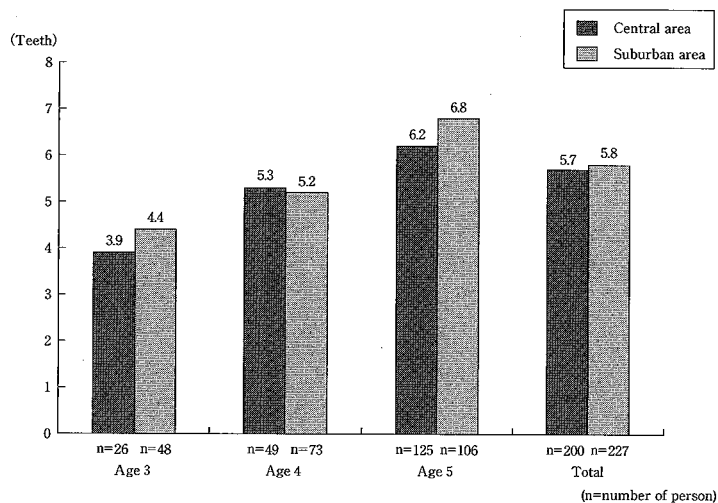


Fig.3 : Average number of carious teeth per child

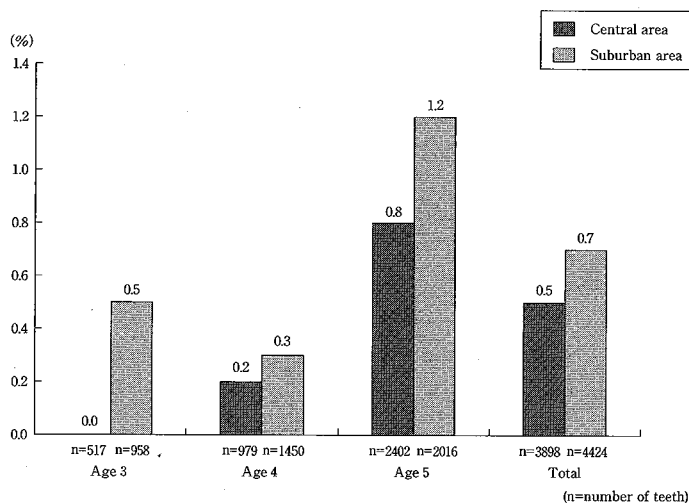


Fig.4 : Treated teeth rate

5. Number and rate of treated teeth

In the central area group, the total number of treated teeth was 21 (0.5%). It was 2 (0.2%) at age 4, 19 (0.8%) at age 5 and 0 at age 3.

In the suburban group, the total number of treated teeth was 33 (0.7%). It was 5 (0.5%) at age 3, 4 (0.3%) at age 4 and 22 (1.2%) at age 5.

The treated teeth rate tended to be higher in the suburban group than in the central area group, but the difference was not significant.

The treated teeth rate tended to increase slightly with age in both the central area group and the suburban group, although this difference was not significant (Fig.4).

6. Caries attack pattern (Table 3)

When the type of caries was analyzed in 179 children with caries from the central area group, type A caries was seen in 74 children (41.3%), type B in 82 children (45.8%) and type C2 in 23 children

Table 3 : Prevalence of each type of caries according to the Ministry of Health and Welfare classification (%)

Type	Tianjin		Age			Total
	Central	Suburb	3	4	5	
A	Central	45.0	39.5	41.4	□ *	41.3
	Suburb	50.0	30.7	25.5		32.0
B	Central	50.0	53.5	42.2	□ *	45.8
	Suburb	40.0	56.5	62.2		56.0
C 1	Central	0.0	0.0	0.0		0.0
	Suburb	0.0	0.0	0.0		0.0
C 2	Central	5.0	7.0	16.4		12.9
	Suburb	10.0	12.9	12.2		12.0

* : p<0.05

(12.9%). Type C1 was not seen at all. When analyzed by age, type A accounted for 45.0% at age 3, 39.5% at age 4 and 41.4% at age 5, while type B accounted for 50.0% at age 3, 53.5% at age 4 and 42.2% at age 5.

In analysis of the type of caries among 200 children from the suburban group, type A was seen in 32.0%, type B in 56.0% and type C2 in 12.0%. Type C1 was not seen at all. When analyzed by age, type A accounted for 50.0% at age 3, 30.7% at age 4 and 25.5% at age 5, while type B accounted for 40.0% at age 3, 56.5% at age 4 and 62.2% at age 5.

Discussion

1. Central and suburban areas

This survey was conducted in Tianjin to investigate the prevalence of dental disease in China. The survey was conducted in suburban and central areas of the city, on the grounds that regional differences can serve as an important factor determining caries¹⁵⁻¹⁷⁾, that the fluoride level in drinking water was higher in suburban areas of Tianjin than in the central area of this city, and that many mottled teeth were found in teachers and parents, over 20 years of age, and some children when a survey was previously conducted in a kindergarten in the suburban area of this city.

The mean per-child dft indices tended to be slightly higher in the suburban area than in the central area, although this difference was not significant. The treated teeth rate also tended to be slightly higher in the suburban area, although the difference was not significant. This is probably because the suburban kindergarten surveyed is located in a newly developed residential area, a district where development is more active than in any other area of Tianjin, and residents are relatively rich.

Another aim of this survey of the present status of dental disease in central and suburban areas of Tianjin was to examine differences in fluoride level of drinking water which may serve as an environmental factor possibly determining the prevalence of caries in China.

We have sampled drinking water in these areas, and these samples are now being analyzed. However, considering that neither the percentage of patients with caries nor the percentage of decayed teeth differed markedly between the central and suburban areas, we expected that no correlation would be found between the drinking water fluoride level and the prevalence of caries among deciduous teeth.

Therefore, the data from the central area were combined with the data from the suburban area when comparing the data in Tianjin with the results of the survey conducted by the Japanese Ministry of Health and Welfare.

2. Dental caries

Dental caries is a multi-factor disease, and living conditions serve as a major factor. To examine the present status of dental caries in China, we conducted dental health checkups in Tianjin, a city where living conditions were probably changing markedly due to economic progress. The data obtained in this city were compared with corresponding Japanese data. The caries incidence ratio and the caries incidence ratio of teeth among deciduous teeth were markedly higher in Tianjin than in Japan, and these differences were significant. In both Tianjin and Japan, the prevalence of caries tended to increase with age (Tables 4-1 and 4-2, Figs.5 and 6). At each age, the mean per-child dft indices in Tianjin was approximately twice that in Japan, and this difference was significant (Table 4-3, Fig.7). The treated teeth rate, on the other hand, was much lower in Tianjin than in Japan, and this difference was significant (Table 4-4, Fig.8).

Thus, the present status of dental disease in Tianjin can be characterized by a significantly higher caries incidence ratio, a significantly higher caries incidence ratio of teeth, a significantly greater the mean per-child dft indices and a significantly lower treated teeth rate, as compared with Japan.

In China, September 20 is tooth care day (this campaign began in 1989)¹⁸⁾, and oral hygiene activity is promoted on this day. The results obtained in this survey however do not reflect effects of such caries-preventing efforts.

Table 4-1 : Caries incidence ratio in Tianjin compared with Japan (%)

	Number of children	Age			Total
		3	4	5	
Japan (MHW Report, 1999)	256	36.4	41.5	64.0	47.3
Tianjin (Present survey, 2000)	427	81.1	86.1	92.6	86.6

*** : p<0.001

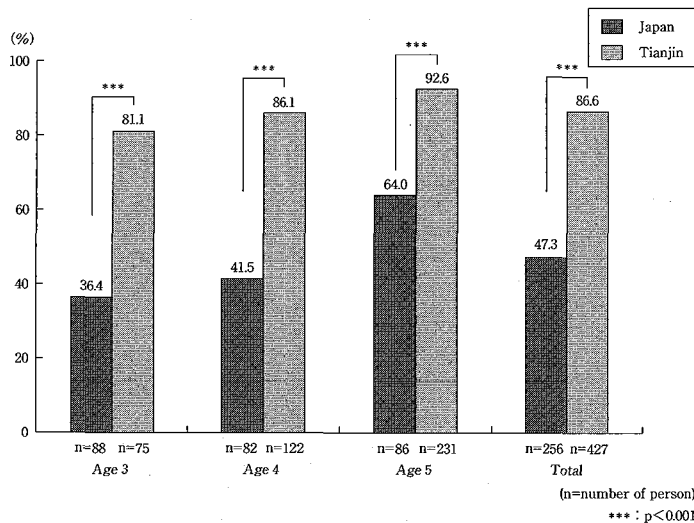


Fig.5 : Comparision of the caries incidence ratio

Table 4-2 : Caries incidence ratio in Tianjin children compared with Japanese children (%)

	Number of children	Age			Total
		3	4	5	
Japan (MHW Report, 1999)	256	10.4	12.5	19.4	14.1
Tianjin (Present survey, 2000)	427	21.0*	26.3*	34.0*	27.1*

* : p<0.05

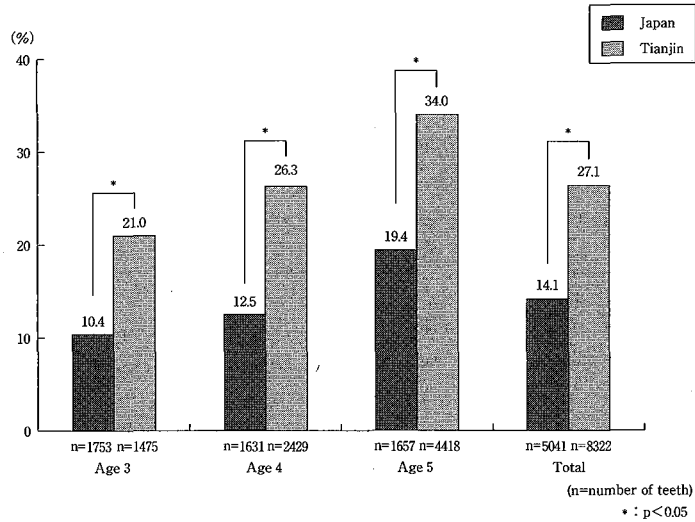


Fig.6 : Comparison of the caries incidence ratio of teeth

Table 4-3 : Mean per-child dft indices in Tianjin children compared with Japanese (Number of teeth)

	Number of children	Age			Total
		3	4	5	
Japan (MHW Report, 1999)	256	2.1	2.5	3.7	2.8
Tianjin (Present survey, 2000)	427	4.2**	5.2**	6.5**	5.3**

** : p<0.01

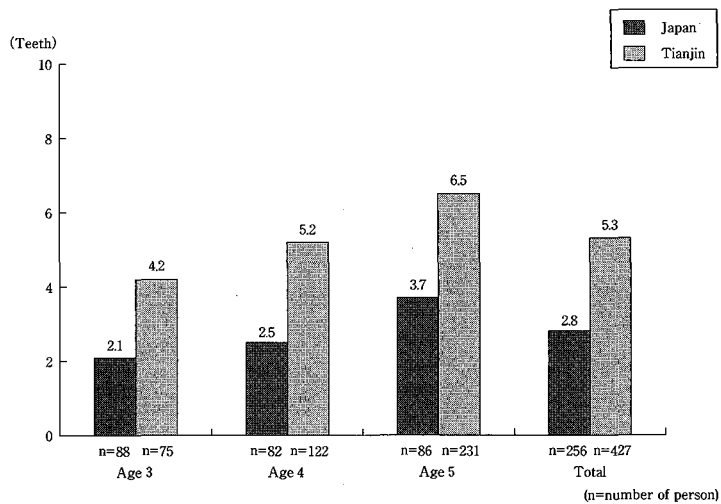
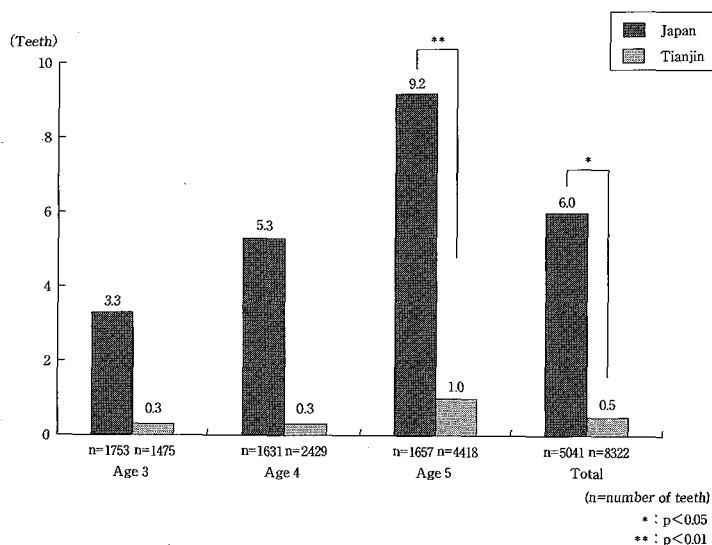


Fig.7 : Comparison of the average number of carious teeth per child

Table 4-4 : Treated teeth rate in Tianjin children compared with Japanese children (Number of teeth)

	Number of children	Age			Total
		3	4	5	
Japan (MHW Report, 1999)	256	3.3	5.3	9.2	6.0
Tianjin (Present survey, 2000)	427	0.3	0.3	1.0	0.5

* : $p < 0.05$ **Fig.8** : Comparison of treated teeth rate

3. Caries attack pattern

Deciduous caries is often multiple and it advances rapidly. Evaluation of the degree of caries in individual teeth provides only information pertaining to the present condition. So that we can guide each child based on examining whether or not the oral environment is favorable for caries and evaluating caries susceptibility and the prognosis of caries, it seems essential to investigate the caries attack pattern. We conducted this investigation and compared its results with data collected in Japan¹⁹⁾.

Because the criteria for the caries attack pattern, prepared by the Japanese Ministry of Health and Welfare, are applicable only to deciduous teeth of infants between 1 and 5 years of age, we compared the data from children at age 3 and 4 in Tianjin with the Japanese data.

The prevalence of each caries attack pattern among children at age 3 did not differ significantly between Tianjin and Japan. Among children at age 4, type A was more prevalent in Japan, while type B was more prevalent in Tianjin. Type C2 was more prevalent in Japan for children at both age 3 and 4. Thus, caries tended to be more severe in Japan than in Tianjin. In Tianjin, no 3 or 4 year old child had type C1 caries (Fig.9).

Dental caries of Chinese children will become more severe if the Chinese economy advances further, fast food and other foodstuff businesses become active under foreign capital operation, the Chinese children's habit of eating between meals becomes diverse, and living conditions in China change further, resembling the course followed by Japan²⁰⁾.

Furthermore, in Shanghai and Tianjin, there are many families in which both parents are em-

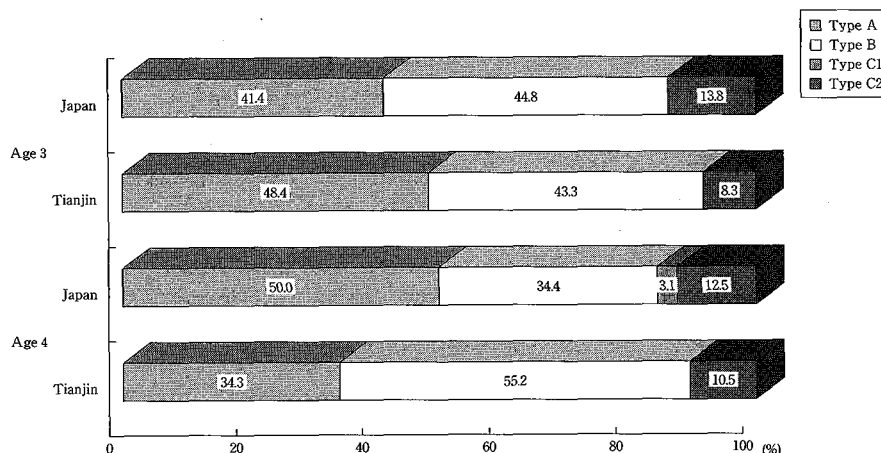


Fig.9 : Comparison of the prevalence of each type of caries according to the Ministry of Health and Welfare classification

ployed and children often take lunch and light supper at kindergarten or nursery school²¹⁾.

In Japan, the importance of instructing children about brushing after lunch or inter-meal snack at kindergarten or nursery school has been pointed out by Kozai *et al.*²²⁾ and Hinode *et al.*²³⁾. To prevent the development or exacerbation of caries, it is also necessary to advise parents and children about inter-meal snack and tooth brushing at home. The effectiveness of this advice may be enhanced if children are adequately instructed at kindergarten or nursery school as to plaque control.

4. Oral hygiene activity in China

In 1998, Japan had a population of 126000000, of which 88000 were dentists and 61000 were dental hygienists. Thus, there was one dentist per each 1430 people²⁴⁾. In contrast, the population in China was 1200000000 in 1994, of which 23000 were dentists (one dentist per 52000 people). It has recently been reported that there is one dentist per 30000 to 40000 people^{1,25)}. Also in contrast with Japan, there are no dental hygienists in China. Instead nurses play the role of dental hygienists. For these reasons, the number of dental professions who can provide oral hygienic guidance, caries-preventive guidance or caries treatment is much smaller than needed, and the Chinese government is having difficulty dealing with this situation.

Furthermore, due to the large population and wide territory, it is difficult in China to fulfill a plan of spreading prophylactic activity throughout the country, including even remote farmlands²⁶⁾.

Within the framework of oral hygienic activity, in addition to the campaign of the tooth care day mentioned above, the Chinese government set concrete goals of primary oral hygiene in 1991 covering the period until 2000 and has endeavored to promote oral health and prevention of oral diseases (Table 5).

Under the single-child policy, the concern of parents with the health of their child has changed, and the level of people's awareness of oral health has improved. Although the survey reported by Hayashi *et al.*²⁷⁾ shows a tendency of aggravation in the dental health of children in Shanghai, Saito *et al.*¹⁾ reported that the dental health of children in Shanghai tended to improve slightly.

Earlier studies suggested that there had been a delay in taking adequate measures to preserve oral health in response to sudden changes in environments (especially environments related to meals). The results of the present survey also suggest that dental health will further deteriorate un-

Table 5 : Goals of primary oral hygiene in China (to be achieved by 2000)

Goals	Poor district	District with adequate clothing and food	Rich district	Very rich district
(1) Percentage of 3 years old or older children practicing brushing	40	50	70	80
(2) Elementary and junior high school children covered by oral health programs (%)	40	60	70	80
(3) Elementary and junior high school students using officially certified toothbrushes (%)	40	60	80	90
(4) Elementary and junior high school students with treated caries (%)	20	30	40	50
(5) Caries-free deciduous teeth at age 5 and 6 (%)	30	30	30	30
(6) DMFT at age 12	<0.9	<0.9	<1.1	<1.1
(7) 15-year-old children with 3 or more periodontally healthy teeth (%)	20	40	50	60
(8) Targeted reduction in the percentage of edentulous people at age over 65 from the present percentage	5	10	15	20

less measures are taken as soon as possible.

At present, living conditions change rapidly following economic progress. Although some improvements have been made in the prevention of dental diseases, in response to warnings issued by earlier reports, it seems now urgently needed to promote elevation of people's awareness of oral environments, to improve and implement oral hygienic programs, to improve related facilities, and to deal with the shortage of dentists. This issue needs a follow-up survey.

Conclusion

Dental health checkups were conducted in Tianjin, China (central and suburban areas of the city). The prevalence of dental disease in Tianjin was compared with that in Japan reported in the 1999 survey report. The following results were obtained.

1. There was no marked difference in the prevalence of dental disease between central and suburban areas of Tianjin.
2. The caries incidence ratio and the mean per-child dft indices were significantly higher in Tianjin than in Japan, but the percentage of treated teeth was significantly lower in Tianjin than in Japan. This indicates that treatment of dental caries is not sufficient in China.
3. Dental caries tended to be more severe among Japanese than Chinese children. As the economy advances and living conditions change in China, dental caries may become more prevalent there, coming to resemble Japan's present condition. Follow-up surveys will therefore be desirable.

We presented the summary of this paper at the thirteenth assembly of the Japanese Society of Child Health, Nagano Prefecture (Matsumoto, June 30, 2001).

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抄録：中国人小児の歯科疾患実態調査

—天津（市内・郊外）および日本との比較—

内山盛嗣，齊藤珠実，岩崎 浩，中山 聡，栢本賀子，園田尚弘，村上由見子，寺本幸代，
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中国天津市（市内・郊外）での歯科検診を実施し，天津市における歯科疾患実態調査と平成11年日本人歯科疾患実態調査報告との比較・検討を行い以下の結論を得た。

1. 天津市市内と郊外における歯科疾患実態調査での明確な差は認められなかった。
2. 天津市では齲蝕罹患率，一人平均齲蝕歯数が本邦と比較して有意に高い値であったにもかかわらず，処置歯率では本邦に比較して有意に低い値を示し，齲蝕処置が行われていないという現状が把握できた。
3. 齲蝕罹患型では本邦の方が重症化傾向を示したが，今後中国の経済発展，生活環境の変化が進むにつれ，本邦と同様に中国でも重症化傾向を示していくことも考えられ，今後も追跡調査の必要性が示唆された。