
Original

Incidence of Caries in Cambodian Children's Immature Permanent Teeth and Effectiveness of Fluoride Application

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With the aim of preventing caries, a study consisting of oral assessment, caries prevention guidance, and fluoride application to tooth surfaces for a certain period of time was conducted, involving 321 Cambodian children aged 6 to 9 who belonged to an elementary school in Siem Reap City.

The incidence of caries in immature permanent teeth was higher and the treated tooth rate was lower than those in Japan, revealing the passive use of dental treatment services among Cambodian children. Furthermore, caries prevention rates did not support the effectiveness of localized fluoride application to prevent caries in immature permanent teeth. These results highlight the necessity of systemic fluoride application as a more effective caries-preventive approach.

Key words: Cambodian children, Caries incidence of immature permanent teeth, Fluoride application

Introduction

Excessively abundant food and diversified dietary patterns involved in economic development may lead to the development and deterioration of caries among children¹⁾. Since 2010, the authors have conducted surveys in Cambodia to examine the oral health and lifestyles of children, in order to clarify the current status and causes of caries among those who will play important roles for this country in the future and establish preventive measures.

The surveys were conducted in Siem Reap Province and the capital Phnom Penh, during which oral assessment and questionnaire surveys targeting children were carried out to examine the association between caries and living environments^{2,3)}. The results suggested the necessity of providing early caries treatment and preventive education/guidance for Cambodian children.

The preventive intervention approach, initiated in 2013, consisted of tooth-brushing guidance and localized fluoride application for lower-grade elementary school students, and the development and progression of caries in the immature permanent teeth of the same subjects, as well as the effectiveness of this approach, were time-dependently observed, as reported in this paper.

Subjects and Methods

The study was conducted with cooperation from Wat Svay Elementary School located in Siem Reap City, which had been randomly chosen for our previous study to examine the incidence of dental diseases among 12-year-old children in 2011, and readily consented again to cooperate with this. It examined the effectiveness of tooth-brushing guidance and fluoride application to tooth surfaces to motivate children to brush their teeth and prevent caries among them.

On the initiation of the study, oral assessment was conducted for 406 children aged 6 to 9 in combination with tooth-brushing guidance and fluoride application; however, in the course of the study, their number decreased due to transfer to other schools or temporary absence. The total number of children who participated in all 4 surveys was 321 (153 males and 168 females). Involving these, oral assessment was conducted during the first and fourth (final) surveys, while tooth-brushing guidance and fluoride application were continued from the first to third surveys (Table 1). The period of each survey was as follows: first: July 2013; second: January 2014; third: July 2014; and fourth: November 2014.

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Table 1 The total number of children

Age/years	6	7	8	9	Total
Male	1	46	48	58	153
Female	1	54	56	57	168
Total	2	100	104	115	321

Oral assessment was conducted, adopting the items examined in the Survey of Dental Diseases⁴⁾ by the Ministry of Health, Labour, and Welfare, and the severity of caries was classified into 4 stages. All teeth were assessed by 2 Japanese dentists based on the same criteria. For fluoride application, a fluoride gel (9,000

ppmF; Bee Brand Medico Dental, Osaka) was used.

Ethical considerations

The survey was conducted with the approval of Asahi University School of Dentistry (No. 25144, July 16, 2013) after explaining the content of the survey to the subjects and their parents and obtaining their consent.

Results

Table 2 shows the incidence of dental caries.

Table 2 The incidence of dental caries

Items	first survey			4 th survey		
	Male	Female	Total	Male	Female	Total
Gender						
Number of the subjects	153	168	321	153	168	321
Number of caries-free children	1	0	1	0	0	0
Number of surveyed teeth	3406	3800	7206	3484	3878	7362
Number of decayed teeth	1812	2006	3818	—	—	—
Proportion of children with caries(%)	99.3	100	99.7	—	—	—
Numbers of permanent teeth and those with caries	1575	1873	3448	2308	2719	5027
The total number of those with caries	399	521	920	654	808	1462
Rates of preventing caries in permanent teeth(%)	—	—	—	-62.9	-53.1	-58
Number of treated permanent teeth	8	21	29	14	24	38
Rate of treated permanent teeth(%)	2.0	3.9	3.0	2.1	2.9	2.5

1. Number and proportion of caries-free children

Among the 321 children, only 1 (0.3%) male aged 9 was caries-free at the time of the initial survey, whose 3 and 1 permanent teeth diagnosed as C1 and C2, respectively, during the final survey.

2. Number and proportion of children with caries

Among the 321 children, 320 (99.7%) were diagnosed with caries during the initial survey. The proportions of those with caries among males and females were 99.3 and 100%, respectively.

3. Numbers of permanent teeth and those with caries

The total number of permanent teeth at the time of the initial survey was 3,448: males: 1,575; and females: 1,873. The total number of those with caries was 920 (26.7%): males: 399; and females: 521.

The total number of permanent teeth at the time of the final survey was 5,027: males: 2,308; and females: 2,719. The total number of those with caries was 1,462 (29.1%): males: 654; and females: 808.

In both males and females, there was a tendency for the number of permanent teeth with caries to increase with the development of such teeth.

4. DMFT (Table 3)

The mean DMFT score at the time of the initial survey was 3.0: males: 2.7; and females: 3.2.

The mean DMFT score at the time of the final survey was 4.7: males: 4.4; and females: 4.9.

There were no sex differences during the first or final

survey, as time-dependent increases in DMFT scores were observed among both males and females.

Table 3 DMFT

Survey	First				4th			
	D	M	F	DMFT	D	M	F	DMFT
Male n=153	2.6	0.0	0.1	2.7	4.3	0.0	0.1	4.4
Female n=168	3.1	0.0	0.1	3.2	4.8	0.0	0.1	4.9
Total n=321	2.9	0.0	0.1	3.0	4.6	0.0	0.1	4.7

5. Number and rate of treated permanent teeth

The total number of treated permanent teeth at the time of the initial survey was 29 (3.0%): males: 8 (2.0%); and females: 21 (3.9%).

The total number of treated permanent teeth at the time of the final survey was 38 (2.5%): males: 14 (2.1%); and females: 24 (2.9%).

Time-dependent changes in the treated tooth rate were not observed among males or females.

6. Rates of preventing caries in permanent teeth

To evaluate the effectiveness of fluoride application, caries prevention rates^{5, 6)} were calculated by comparing the incidence of caries in permanent teeth between before (initial) and after (final survey) the application. The mean prevention rate was -58.0%, and did not support such effectiveness: males: -62.9%; and females: -53.1%.

Discussion

1. Current status of caries

The incidence of caries, DFT and DMFT scores,

and untreated tooth rates among Cambodian children were also markedly higher than those among Japanese children⁴⁾ at the time of our previous surveys^{2,3)}. In a survey on dental diseases⁷⁾ conducted in Cambodia, involving those aged 6, 12 to 13, and 15 to 17, the incidence of caries was 93.1% and DMFT score was 0.23 among 6-year-olds; these values are similar to those observed in the present study involving those aged 6 to 9.

In the present study, 3 and 1 permanent teeth of the child who was caries-free at the time of the initial survey were diagnosed as C1 and C2, respectively, during the final survey.

Based on the results of their previous surveys^{2,3)}, the authors reported the necessity of early dental treatment and preventive measures against caries for Cambodian children in consideration of age-related deterioration. In the present study, a tendency for caries to develop immediately after immature permanent tooth eruption and progress in those in whom it had already been present in their immature permanent teeth before the study was also observed, indicating the necessity of adopting preventive measures as an urgent issue.

Regarding caries treatment, a large number of major and minor dental clinics are located throughout Phnom Penh and Siem Reap Cities. Although accurate data are unavailable, the number of dental clinics is likely to be markedly higher than that of actual dentists in Cambodia; the number of certified dentists is approximately 600, including those from other countries, such as Thailand, Vietnam, Japan, and China⁹⁾. The inconsistency between these numbers suggests the possibility of uncertified dentists providing treatment, although it is also necessary to consider national policies on this issue when examining it in detail.

In the present study, treated tooth rates were markedly low, and filling was incomplete. Secondary caries and fracture were observed in a large number of treated teeth, highlighting the necessity of improving the quality of treatment, as well as enhancing awareness after treatment through preventive education and guidance.

The low treated tooth rates may also be explained by the unavailability of national health insurance programs, forcing people to use dental services at their own expense. Recent economic development is enabling them to undergo dental treatment more actively, except in remote areas, although the quality of such treatment varies among clinics, and this increases our expectations for improved medical environments to promote dental service use and consequently contribute to caries prevention.

2. Development of caries prevention systems

In order to prevent caries, it is essential to remove factors associated with their development. In our previous surveys^{2,3)}, a lack of tooth-brushing habits among the majority of Cambodian children was noted. Sweetened snacks were frequently consumed, and a large volume

of sugar was used for daily meals. Some statistical data⁸⁾ show a lower level of sugar consumption per person in Cambodia compared to Japan, but this is unlikely to represent the actual situation.

With a view to examining appropriate methods to prevent caries among Cambodian children, who frequently suffer from caries in multiple teeth, in this study, an approach combining tooth-brushing guidance and localized fluoride application was performed, and its effectiveness to prevent caries in immature permanent teeth was time-dependently evaluated based on caries prevention rates. However, the rates were negative.

As a caries-preventive effect is also achieved on some occasions by methods other than fluoride application, such as improving the matrix, arranging the time, motivating people to brush their teeth, limiting sweetened food consumption, and developing favorable dietary habits, it is inappropriate to determine its effectiveness based only on caries prevention rates⁶⁾.

The present study aimed to clarify the effectiveness of an approach to prevent caries from developing and progressing as a basis for the prevention of caries among Cambodian children; however, caries prevention rates did not support its effectiveness. In addition, caries had already developed in multiple teeth of such children in the presence of marked plaque buildup, revealing their insufficient tooth-brushing, allowing caries to develop immediately after immature permanent tooth eruption. Under these conditions, localized fluoride application is unlikely to be sufficient to prevent caries from developing and progressing.

As future perspectives, it may be necessary to organize medical environments in preparation for the development of caries prevention systems, including approaches to the Cambodian government to enable its people to freely use dental services to treat caries in multiple teeth, nurture dentists and dental hygienists to provide appropriate treatment for children, and dispatch teaching nurses to schools. It may also be important to simultaneously provide group or individualized caries prevention guidance for children. As an initial step, the provision of early caries treatment and preventive education, in addition to the enhancement of awareness of prevention, may be crucial.

Based on these results, further studies will be conducted to examine the effectiveness of water fluoridation and fluoride tablet use as methods of systemic fluoride application while appropriately considering ethical issues.

Conclusions

To provide a basis for caries prevention, a study was conducted involving lower-grade students of Wat Svay Elementary School in Siem Reap City, Cambodia. The incidence of caries in immature permanent teeth was higher and the treated tooth rate was lower than those in Japan, revealing the passive use of dental treatment services.

Caries prevention rates did not support the effectiveness of localized fluoride application to prevent caries in immature permanent teeth, highlighting the necessity of systemic fluoride application as a more effective caries-preventive approach.

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