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Changing use and knowledge of fluoride toothpaste by schoolchildren, parents and schoolteachers in Beijing, China

Min Liu, Ling Zhu and BoXue Zhang
Beijing, China

Poul Erik Petersen
Geneva, Switzerland

Objective: To assess the oral hygiene practices, current use of and knowledge about fluoride toothpaste among schoolchildren, parents, and schoolteachers; to describe the attitudes of parents and schoolteachers in relation to improving schoolchildren's oral health. **Design:** Cross-sectional study. **Participants:** 1,557 schoolchildren, 1,132 parents, and 352 schoolteachers were recruited by multistage stratified sampling procedure in a district of Beijing, China. **Methods:** Self-completed questionnaire. **Results:** The percentage of schoolchildren, parents, and schoolteachers who actually used fluoride toothpaste was 88%, 86%, and 87%, respectively, and 74-78% of the respondent groups brushed their teeth twice a day or more. 64% of schoolchildren, 73% of parents, and 74% of schoolteachers confirmed the caries preventive effect of fluoride toothpaste. Toothpaste recommended by oral health professional organisations was preferred by respondents - particularly by schoolchildren - when purchasing toothpaste (86%). 93% of parents and 56% of schoolteachers recognised their important role in promoting children's oral health; however, their lack of knowledge seemed to be a major obstacle in fulfilling this role. **Conclusions:** The use of fluoride toothpaste in Beijing appears to have increased during the past decade. In addition to mass communication comprehensive school-based oral health programmes are needed to continuously promote the use of fluoride toothpaste among schoolchildren.

Key words: Dental caries, fluoride toothpaste, oral health behaviour, school oral health

During the past two decades, many industrialised countries have experienced a dramatic decline in the prevalence and severity of dental caries among children and adolescents[1-4]. Although the reasons for this are complex, the consensus view is that the greater availability of fluoride through automatic fluoridation (i.e. water, salt, milk) and an increasing use of fluoride toothpastes are the most significant factors for improved control of dental caries[5-7]. A recent systematic review revealed that daily use of fluoride toothpaste may reduce the DMFT 3-year increment by 25% [8]. WHO continues to emphasise as an important public health measure the need to strengthen the effective use of fluoride for the prevention of dental caries in the 21st century, and highly recommends the introduction of affordable fluoride toothpastes in developing countries[9-11]. In China, the dental caries experience in primary teeth is high while children show relatively low and less severe dental caries patterns in their permanent teeth[11]. However, an increasing level of caries in permanent teeth has been observed recently in some areas of China partly because of the growing consumption of sugars and inadequate exposure to fluoride[12,13]. The availability and use of dental services in China are rather limited[13-18] and professionally applied fluoride would thus have minimal public health impact. Promoting oral self-care capacity and the

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use of fluoride toothpaste is therefore an appropriate strategy for the control of dental caries in China.

Previous studies showed that the use of fluoride toothpaste among Chinese children and adolescents was relatively low, particularly in rural areas[13,18,19]. Chinese society has changed rapidly during the past decade and fluoride toothpastes are now more commonly available on the market, especially in urban areas. In addition, oral health education programmes, such as the 'Love Teeth Day' mass campaign[20,21], have been implemented at province and community levels throughout the country since 1989, and the regular use of fluoride toothpaste is highly recommended by these programmes. However, no recent data are available which could elucidate the changing use of fluoride toothpaste in children and adolescents. In a life cycle perspective, childhood and adolescence are crucial periods for the development of health practices. Both parents and schoolteachers have a great potential to influence this process. As a platform, school can provide both a supportive environment for promoting oral health and important networks to the local community and families[22]. Thus, the objectives of the present study were to describe the oral hygiene practices, current use and knowledge of fluoride toothpaste among schoolchildren, parents and schoolteachers, and to describe the attitudes of parents and schoolteachers in relation to improving schoolchildren's oral health. The results may be helpful in the orientation of school oral health programmes towards promoting healthy lifestyles.

Study population and methods

Study population

This investigation took place in Haidian district, Beijing in January 2004. Schoolchildren were recruited by a multistage stratified sampling procedure. Three strata consisting of primary schools (grades 4 to 6), secondary schools (grades 7 to 9), and high schools were identified based on the actual education system of China. Schools within each stratum were chosen through a probability sampling procedure (proportional to size) and schoolchildren were then chosen by simple random sampling within each sampled school. All schoolteachers responsible for training of the sampled schoolchildren were selected together with the mother or father of these schoolchildren. In all, 1,557 schoolchildren (response rate 87%, mean age ± SD: 13±2.1 yrs), 1,132 parents (response rate 64%, mean age ± SD: 37±9.2 yrs), and 352 schoolteachers (response rate 89%, mean age ± SD: 52±23.0 yrs) participated in the study.

Questionnaires

For each respondent group, a self-administered structured questionnaire was used to collect information about oral self-care practices, use of toothpaste, consumer preferences, fluoride knowledge, and dental visiting habits. The wording of the questions was identical to provide valid comparisons of the responses given by schoolchildren, parents and schoolteachers. Items addressing attitudes towards promoting schoolchildren's oral health were included in the questionnaires for parents and schoolteachers. The participants were asked to provide the brand name of the toothpaste used at time of the study. Whether or not the reported toothpaste contained fluoride was collected through information available from the manufacturer or the market and the result was recorded as 'actual use'. Furthermore, the participants were asked to report the type of toothpaste (fluoridated, non-fluoridated, do not know) currently being used and the answers were recorded as 'self-reported use'. The highly structured questionnaires were tested and validated prior to the study. The present study received ethical approval from the Education Commission of Haidian District, Beijing city.

Statistical analysis

Data from the questionnaires were processed and analysed by means of the Statistical Package for the Social Sciences (SPSS 14.0). Description and analysis of the data were carried out by frequency distributions. Bivariate frequency distributions were computed and the differences in proportions were evaluated by the Chi-square test. The measurement of fluoride knowledge was based on seven component items. Cronbach's Alpha was used to evaluate the internal reliability of these items and the results for schoolchildren, parents, and schoolteachers were 0.83, 0.78, and 0.77, respectively. A correct answer to a statement on fluoride knowledge was coded as a 1 and an incorrect answer as a 0. Composite variables of fluoride knowledge were then constructed based on additive indices and the scales were subsequently categorised into three levels according to empirical distributions: low level (scores 0-2); middle level (scores 3-5); and high level (scores 6-7). Spearman correlation coefficients confirmed moderate to strong associations between the final composite variables and the original component variables.

Results

Toothbrushing practices

The responses of primary, secondary, and high school students with regard to tooth brushing practices, use of fluoride toothpaste, fluoride knowledge, and consumer preferences were combined since no substantial differences were found. *Table 1* summarises the toothbrushing habits of schoolchildren, parents and schoolteachers. The vast majority of the respondents reported having brushed their teeth every day during the past week and

Table 1 The distribution (%) of schoolchildren, parents and schoolteachers with different tooth brushing practices

	Schoolchildren	Parents	Schoolteachers
Tooth brushing everyday during the past week	95	98	99
Frequency of tooth brushing yesterday			
No brushing	1	1	1
Once	24	23	22
2 times or more	74	76	78
Try carefully to brush all surfaces of every tooth	82	87	83
Post-brushing behaviour			
Rinsing with beaker and much water	78	83	81
Rinsing with beaker but little water	17	14	16
Rinsing without beaker	6	3	3
Amount of toothpaste used for brushing (fraction of the head of toothbrush)			
Less than 1/4	6	7	9
1/4-1/3	22	22	28
1/2	30	33	28
More than 1/2	29	25	24
Full head of a toothbrush	13	13	12

Table 2 The percentages of respondents who used different types of toothpaste by "actual use" and "self-reported use"

	Schoolchildren	Parents	Schoolteachers
Actual type of toothpaste			
Fluoridated	88	86	87
Non-fluoridated	6	8	7
Uncertain	6	6	7
Self-reported type of toothpaste			
Fluoridated	52	66***	53
Non-fluoridated	11	19	18
Don't know	37	15	29
Use of fluoride toothpaste correctly reported	52	69***	54

*** $p<0.001$

three quarters of these claimed to have brushed their teeth two times or more on the previous day. Most of the respondents answered that they tried carefully to clean every tooth surface and that they rinsed their mouth with a large amount of water from a beaker after brushing. Rinsing the mouth without a beaker after tooth brushing was indicated by very few persons only. The amount of toothpaste used each time varied markedly among all the respondents.

Use of fluoride toothpaste

Nearly 90% of the schoolchildren, parents and schoolteachers actually used fluoride toothpaste and these percentages were much higher than the self-reported use (*Table 2*). Nearly half of the schoolchildren and schoolteachers were not able to judge correctly whether their toothpaste contained fluoride; the likelihood of a correct answer was somewhat higher for parents (69%, $p<0.001$).

Fluoride knowledge

Most schoolchildren, parents and schoolteachers claimed that they had heard about the concept of fluoride toothpaste (*Table 3*); however, only one third of them confirmed the statement that "fluoride toothpaste is a kind of toothpaste which contains fluoride". Two thirds of schoolchildren and three fourths of parents and schoolteachers reported that brushing the teeth with fluoride toothpaste can prevent dental caries, and similar figures were found for the item that fluoride toothpaste can strengthen resistance of tooth surfaces. Meanwhile, the statement "fluoride toothpaste can reverse early-stage caries" was confirmed by less than half of the respondents. Around 60-70% of the respondents reported that a proper amount of fluoride is helpful, whereas an excess amount of fluoride may be harmful to dental health. About half of the parents and four out of ten schoolteachers answered that the amount of fluoride toothpaste should be less than pea-size for children 3-7 years of age. The differences of

Table 3 The percentages of participants who responded differently to statements on fluoride knowledge and the distribution (%) of participants by additive index of fluoride knowledge level

		Schoolchildren	Parents	Schoolteachers
Heard about the word 'fluoride toothpaste'	Yes	81	92	97***
Fluoride toothpaste is a kind of toothpaste which contains fluoride	Right	26	38	38***
	Wrong	30	26	24
	Do not know	44	36	38
Tooth brushing with fluoride toothpaste can prevent caries	Right	64	72	73***
	Wrong	6	8	5
	Do not know	30	20	22
Tooth brushing with fluoride toothpaste can reverse early-stage caries	Right	48	50***	43
	Wrong	14	21	22
	Do not know	38	29	35
Tooth brushing with fluoride toothpaste can strengthen resistance of tooth surfaces	Right	65	74	76***
	Wrong	5	6	3
	Do not know	30	20	21
Proper amount of fluoride is helpful, but excess amount of fluoride may be harmful to health	Right	58	64	68**
	Wrong	9	9	6
	Do not know	33	27	26
The amount of fluoride toothpaste should be less than pea-size for 3-7 year old children	Right	--	48**	42
	Wrong	--	11	8
	Do not know	--	41	50
Fluoride knowledge level				
Low (score 0-2)		31***	23	24
Medium (score 3-5)		41	45	47
High (score 6-7)		28	32	29

*** $p<0.001$

fluoride knowledge among schoolchildren, parents and schoolteachers are also shown in *Table 3*, and the additive index on the level of fluoride knowledge confirmed that schoolchildren scored somewhat lower than did parents and schoolteachers.

Sources of fluoride information

With regard to sources of fluoride information, mass media were most frequently reported by all respondents, oral health education programmes being the second most often reported (*Table 4*). One fifth of the schoolchildren had learned about fluoride from their parents. The percentages of primary school students and secondary school students whose knowledge of fluoride derived from dentists were much higher than those of high school students ($p<0.001$). Oral health education included in the school curriculum was reported by one sixth of schoolchildren (*Table 5*). High school students (20%) had more often received fluoride information from teachers than had primary and secondary school students ($p<0.01$). About half of the schoolchildren wished to know how to prevent dental disease effectively and how to promote oral health in school; this attitude was particularly frequent among primary school students (74%).

Attitudes towards promoting schoolchildren's oral health

The percentage of parents who recognised that they have an important role in promoting children's oral health was 93%; however, 32% of parents felt that they had not done their best. Lack of knowledge (46%) was frequently reported by parents as an obstacle in promoting children's oral health. In all, 56% of schoolteachers thought that they were important in promoting schoolchildren's oral health while 66% did not want to recommend that schoolchildren use fluoride toothpaste, as their knowledge in this regard was insufficient.

Table 4 The percentages of respondents who reported certain sources of fluoride information (more than one response allowed)

	Schoolchildren				Parents	Schoolteachers
	Primary school	Secondary school	High school	Total		
Mass media	65	75	77***	72	76	78
Oral health education programme	58	58	61	58	60	60
Dentist	40***	40	26	37	33	17
Parents	22	22	16	21	--	1
Friends or relatives	25	35**	30	31	34	32

** p<0.01 *** p<0.001 Indicate differences among primary, secondary, and high school children

Table 5 The percentages of schoolchildren who have gained oral health information from school according to type of school

	Primary school	Secondary school	High school	Total
Have oral health education classes	18	16	13	16
Teachers have told me about fluoride	11	12	20**	13
Want to know how to protect teeth in school	74***	52	32	54

** p<0.01 *** p<0.001

Table 6 The percentages of schoolchildren, parents and schoolteachers who considered different factors when buying toothpaste (more than one response allowed)

	Schoolchildren	Parents	Schoolteachers	Total
Toothpaste recommended by professional organisations	86***	77	73	81
Taste	74	73	81**	74
Brand	73***	66	71	70
Effects advertised by the toothpaste factories	66	66	62	65
Whether it contains fluoride or not	58	61***	46	58
Price	42	49**	45	45

** p<0.01 *** p<0.001 Indicate differences among schoolchildren, parents, and schoolteachers.

Table 7 The percentages of respondents using fluoride toothpaste and having a high level of fluoride knowledge according to whether they were concerned that toothpaste contains fluoride (Yes) or not (No)

	Schoolchildren		Parents		Schoolteachers	
	Yes	No	Yes	No	Yes	No
Use of fluoride toothpaste	88	89	89**	82	85	89
High knowledge level about fluoride	35***	17	37***	22	37**	22

** p<0.01 *** p<0.001 Indicate differences within respondent groups

Consumer preferences

Toothpaste recommended by professional oral health organisations was most frequently considered by schoolchildren and parents when purchasing toothpaste and it was the second most common consideration among schoolteachers (*Table 6*). Whether or not the toothpaste contained fluoride was of less concern to all respondents than the taste, brand, or commercial advertisements of the toothpaste. In addition, nearly half of the respondents took into account the price of toothpaste. The consumer concern as to whether the toothpaste contains fluoride was positively associated with fluoride knowledge level, but did not relate to actual use of fluoride toothpaste (*Table 7*). Moreover, the use of fluoride toothpaste was irrespective of the fluoride knowledge level for the three groups.

Table 8 The percentages of schoolchildren, parents and schoolteachers who visited a dentist during the past year and the reasons for last dental visit

	Schoolchildren				Parents	Schoolteachers
	Primary school	Secondary school	High school	Total		
Have seen a dentist during the past year	53†††	52	33	49***	42	32
The reason for the last dental visit (only for dental visitors)						
Problems/need for care	50	51	65†	59	71	84***
Dental check-up	50†	49	35	41***	29	16

† p<0.05 ††† p<0.001 Indicate differences among primary, secondary, and high school children;
* p<0.05 *** p<0.001 Indicate differences among schoolchildren, parents, and schoolteachers.

Table 9 The distribution (percentage) of participants by level of fluoride knowledge and use of fluoride toothpaste according to whether or not they saw a dentist during the past year

	Saw a dentist during past year or not					
	Schoolchildren		Parents		Schoolteachers	
	Yes	No	Yes	No	Yes	No
Fluoride knowledge level						
Low	24	36***	20	26	23	24
Middle	45	39	41	48	45	48
High	31	25	39***	26	32	28
Use of fluoride toothpaste						
Yes	89	87	88	85	85	87
No	4	7	6	9	8	6
Uncertain	7	6	6	6	7	7

*** p<0.001 Indicates differences within respondent groups

Dental visiting habits

The answers to questions on dental attendance and the reasons for the last dental visit of the respondents are summarised in *Table 8*. The percentage of individuals who claimed to have seen a dentist during the previous year was somewhat higher in schoolchildren than in parents and schoolteachers. Experience of dental symptoms rather than a check-up was a prominent reason for the last dental visit. Relatively more schoolchildren went to see a dentist for a check-up while parents and schoolteachers often sought a dentist because of problems. Dental visits and dental check-ups were more often reported by primary and secondary school students than by high school students. With the exception of schoolteachers, respondents who visited a dentist during the past year seemed to have higher level of fluoride knowledge. However, the use of fluoride toothpaste was not associated with dental visiting habits in the three groups (*Table 9*).

Discussion

The aim of the study was to describe the current use of and knowledge about fluoride toothpaste among schoolchildren, parents and schoolteachers, and to assist in the formulation of appropriate strategies for the continuous promotion of the use of fluoride toothpaste targeted at schoolchildren in China. School-based oral health promotion programmes have been introduced in certain urban communities in China over the past years[23,24]. Notably, such a programme had not yet been established in the present study area and these programmes are still greatly needed in most communities throughout the country. The participants were strictly sampled by proportional sampling procedures and the response rates for the three study groups were high. The validity of the questionnaires was evaluated in pre-tests and by an expert panel of public oral health researchers prior to the investigation[25]. The Cronbach's Alpha values indicated that the internal consistencies of items within the three questionnaires were satisfactory[25]. Overall, the present study may give an overview of the use of and knowledge about fluoride toothpaste among schoolchildren, parents, and schoolteachers in an urban community in China, even though the present data are not representative in purely statistical terms.

In light of previous studies[13,15,17,18,26], growing proportions of urban Chinese appear to have adopted healthy lifestyles in terms of regular oral hygiene practices. A major finding of the present study is that substantially more schoolchildren used fluoride toothpaste compared with previous studies[13,18,19,26,27]. The use of fluoride

toothpaste by 12-year-old children as reported in the present study was 90%, which was more than twice the level (38%) found for children of the same age group living in Beijing in 1995[13]. The use of fluoride toothpaste by parents and schoolteachers was also greater than observed in earlier studies of schoolteachers and middle-aged adults living in urban areas of China[15,17,26,27]. This trend may relate to several factors. Firstly, more fluoride toothpastes have been made available on the market during the past decade, especially in urban areas. The second reason for the greater use of fluoride toothpaste observed may relate to different data collection methods. Previous studies[13,15,17-19,26,27] were based on declared use of fluoride toothpaste rather than actual use of verified fluoride toothpastes. The latter approach, applied in the present study, may have provided data with less information bias, which may be helpful to explain why the self-reported use of fluoride toothpaste in the present study was very similar to the finding (48%, age group 11-15 yrs) of a survey[19] conducted in 2003 in eight main cities of China, including Beijing.

According to the actual results most of the participants were not particularly clear about the concept of fluoride toothpaste and a high proportion of them did not know whether their toothpaste actually contained fluoride. Thirdly, the implementation of oral health education programmes has increased over time in China. In urban areas this is due particularly to the launch in 1989 of the annual 'Love Teeth Day' campaign[20,21]. The greater use of fluoride toothpaste and the fact that significant proportions of schoolchildren, parents, and schoolteachers reported having gained information about fluoride from oral health education programmes may reflect a positive impact of these programmes. Remarkably, only a few respondents indicated having obtained fluoride information from a dentist. This, however, corresponds to their low utilisation of dental services and the symptoms-oriented dental visiting habits.

The availability of fluoride toothpaste on the market may be an important reason for its greater use in China. People were apparently not significantly motivated by health concerns while buying toothpaste as they seldom considered the content of fluoride. Toothpastes recommended by professional oral health organisations were preferred. The accreditation of products by professional oral health organisations, informing about the clinical effect of fluoride toothpaste, may contribute to effective promotion of the use of fluoride toothpaste. Meanwhile, several domestic products are labelled fluoride toothpaste but have none or little efficacious fluoride content[28] and establishment of appropriate quality assurance mechanisms is urgently needed.

Mass media and large scale oral health education programmes may be powerful in health communication. Based on the present study, knowledge about fluoride must be continuously improved among schoolchildren, parents, and schoolteachers. The majority of parents recognised their responsibilities in promoting their children's oral health. However, lack of knowledge restricts their function and the involvement of parents in translation of information to children was low. Most importantly, the dissemination of oral health messages in school was also poor and about half of the schoolteachers did not sufficiently understand their role in promoting children's oral health. Children spend considerable time in school and health education may target children at an age when their health habits are being formed. Only a few schoolchildren had received information from teachers about the benefits of fluoride even though most of them were eager to know more about how to prevent dental disease and how to promote oral health in school. Both schoolteachers and parents have a great potential to influence the oral health behaviour of children[22]. Comprehensive school-based oral health programmes are greatly needed and will provide a unique context for promoting the use of fluoride toothpaste. Moreover, when the Health Promoting Schools approach is applied the target population may include not only schoolchildren but also parents and schoolteachers[22]. The parents and schoolteachers, however, need proper training and practical support in health education from dentists experienced in public health, and should also be provided with relevant educational material.

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Correspondence to: Dr. Ling Zhu, Peking University, School and Hospital of Stomatology, Department of Preventive Dentistry, Beijing, China. Email: zhuling@ncoh.cn