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## Original Research

# Effectiveness of oral hygiene after supervised tooth-brushing education in six-year-old children at a primary school in Vietnam

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**Key words:** Children, education, information, tooth-brushing, oral health behavior.

### Abstract

**Background:** The prevalence of dental caries is very high among Vietnamese children why methods and techniques for good oral hygiene behaviours therefore is very important in caries prevention.

**Aim:** To assess oral hygiene before and after supervised tooth-brushing education in six-year-old children.

**Design:** A pilot study with a pre-post-test design was used. Forty children, six years of age, at a primary school in Hanoi, participated in the study. The modified Bass tooth-brushing method were taught. Oral hygiene, i.e. dental plaque, was assessed on each tooth surface before the tooth-brushing education and after one week.

**Results:** There was a distinct and significant improvement in tooth-brushing skills among six-year-old children of both genders after the tooth-brushing education. The rate of dental plaque was reduced by 40% after the education. An improvement in cleaning could be seen on all four tooth surfaces (buccal, lingual, mesial and distal).

**Conclusion:** School-based education in tooth-brushing technique are very effective for improving oral hygiene among six year olds.

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## INTRODUCTION

As in most Asian countries, children in Vietnam have a very high prevalence of dental caries and this has even increased during the last ten years [1]. Between 1995 and 2010, the Ministry of Health in Vietnam ran a dental and oral health care programme for children to prevent dental caries and periodontal diseases. This programme applied to the whole country for children in primary schools and included fluoride, fissure sealant, dietary counselling and oral hygiene [2]. However, as a result of the limited dental resources, the dental education programme is not sufficiently developed and widespread and it is not yet effective as a good educational routine [1].

Even if dental caries and periodontal diseases are multifactorial, it is recognised that dental plaque is an important mediating factor for these diseases [3, 4].

Efforts involving oral prevention programmes in which supervised tooth-brushing and toothpaste with fluoride for children have been shown to be effective in reducing dental caries [5-7]. When it comes to removing dental plaque, an appropriate tooth-brushing technique is the most effective way to clean bacterial plaque and debris from the tooth surfaces [4, 8]. One of the most evidence-based manual tooth-brushing methods is the modified Bass method [9], which is also included in the preventive oral care programme in Vietnam [2].

It has been previously established that it is important to create good habits at an early age to prevent caries [10] and tooth-brushing should be supported by supervision by parents or another adult [11-13]. Most oral hygiene programmes are aimed at elementary schoolchildren rather than preschool children. The supervision of tooth-brushing at school has been recommended, because some parents have less knowledge and understanding of the importance of oral hygiene techniques [11]. Moreover, a recent study highlights the importance of teachers at school educating children in improving their oral health as part of the process of oral health promotion [1].

Tooth-brushing skills have been shown to be poorer among younger children, i.e. six year olds, compared with older age groups, i.e. eight to 12 year olds [12]. A previous study assessed the effectiveness of teaching methods for tooth-brushing in preschool children and reported that children older than five years of age were able to learn and perform tooth-brushing more effectively than younger children [14]. The duration and efficiency of tooth-brushing in four- to six-year-old children has been shown to be at least three minutes, while five minutes under supervision at least once a day was extremely safe and effective [13]. Moreover, it has been recommended that tooth-brushing should be performed for a minimum of two minutes [12]. It is also important to give practical instructions to support motivation and not only oral information. Finally, regardless of the tooth-brushing method, it is important to use a methodological technique to obtain good results in oral hygiene for all tooth-sites [11].

Since the oral health care programme in Vietnam was introduced in 1995, few studies have evaluated the effect of these preventive activities. Moreover, there is a need to evaluate preventive measures for children in different age groups to distinguish the type of preventive measures that should be targeted at specific groups.

The aim of the present study was to assess and compare oral hygiene before and after school-based supervised tooth-brushing education in high-caries-risk six-year-old children in Vietnam. A further aim was to determine if there were differences between different tooth-sites regarding oral hygiene.

## **MATERIAL AND METHOD**

### *Study design*

This is a pilot study with a pre-post-test design, which aims to compare oral hygiene effects, i.e. dental plaque including debris, before and after supervised tooth-brushing education using the Bass method.

### *Study population*

The study was conducted at a primary school in Hanoi, Vietnam, in 2009. The study population was based on 1,220 pupils from the first grade to the fifth grade. The first grade consisted of five classes with more than 50 pupils in each class and a total of 267 pupils. The school has a small health care unit with a nurse in charge of health care for children. No dental health care programme had been integrated into the school at the time of this study. The study population was defined as six-year-old children. The inclusion criteria were children who had 20 primary teeth.

### *Sample*

A list of the names of all the pupils in the first grade (n=267) was given by the headmistress at the school. All 267 first-grade children were then examined by counting their teeth. As a result, 167 schoolchildren fulfilled the inclusion criteria, i.e. were six years old and had 20 primary teeth. Of the 167 six-year-old children and based on the list, a random selection were made by choosing every fourth child. In all, there were 40 participants, 22 (55%) girls and 18 (45%) boys.

### *Method*

Tooth-brushing education based on the modified Bass brushing technique (10) was given to all the pupils participating in the study and then to their families by the researcher. On the day of the examination, a dentist performed an oral clinical examination and brushed the children's teeth. This took place after lunch at the school and was regarded as the baseline. All the children were given a toothbrush and toothpaste. The children were divided into small groups, with 3-4 children in each group. The children in each group were asked about their awareness of tooth-brushing techniques and the frequency of tooth-brushing, in order to make the consultation more complete. The tooth-brushing education was performed after the children had completed the clinical oral examination and had had their teeth cleaned by the dentist, i.e. after the baseline cleaning. The children practised tooth-brushing techniques on a model; they were shown a picture of each step of the tooth-brushing procedure and given instructions by a dental nurse and the researcher. Each child was corrected step by step and practised in his or her own group with the supervision of the dental nurse. In addition to practice, the children watched and enjoyed animated films on the importance of tooth-brushing to help them feel good practical motivation. At the end of the practice, they were tested to see whether they obtained suitable results. The children were reminded to brush their teeth twice a day at home. The children's mouths were examined twice to assess cleanness, i.e. the presence of dental plaque after tooth-brushing. The first time, which was based on their actual tooth-brushing habits, was used as the

baseline. The second examination was made after the tooth-brushing education and it took place seven days later.

*Clinical examination*

Clinical examinations were used to assess cleanness, i.e. the presence of dental plaque including debris on each tooth for each child. Before the assessment was performed, the tooth surfaces in both jaws were dried and swabbed with a small cotton pellet coloured red by a solution of erythrosine (1%). The child was then told to rinse with water to clean his/her mouth until the water was clear. Four tooth surfaces, the buccal, lingual, mesial and distal surfaces on each tooth in both jaws, were assessed. The appearance of plaque on each tooth surface was assessed with scores following the plaque index (PLI) of Silness & Loe [15]. Scores of 1-3 represented plaque as well as debris, and no plaque or debris was scored as 0. The scores were also set using nominal scale rating as excellent (score 0), good (score 0.1-0.9), fair (score 1.0-1.9) and poor (score 2.0-3.0), as suggested by Silness & Loe [15]. The PLI recommended by Silness & Loe is one of the most common indices to get a clinical picture of an individual's ability to brush their teeth and it is used because it is simple to apply and easy to assess [15, 16]. The examinations were made after lunch at school so that equality and accuracy could be assured. Each child was examined by one dentist in good natural light using a dental mirror and a dental explorer.

*Ethical implications*

Before the study began, the parents and the children were informed about the study. Oral and written informed consent was obtained. The children were informed that their participation was voluntary and that they could decline participation whenever they wished without giving any reason. All the data have been treated as confidential. The headmistress of the Khuong Thuong Primary School in Hanoi approved the study. The ethical rules at the National Paediatric Hospital, Hanoi, Vietnam, relating to a local ethical review of the study design were accepted and the Helsinki Declaration was followed [17].

*Statistical methods*

The data were analysed using the EPI-INFO 6.0 program and STa-ta 8.0. The plaque scores were calculated descriptively as the total number of plaque surfaces for each individual. They are presented for each jaw and different tooth areas by gender and for the total group are also presented as a percentage. Dental plaque scores registered using a nominal scale (PLI) were calculated as the total mean value by gender and for the total population. To assess effectiveness before and after the tooth-brushing education, three main

algorithms were used in a paired t- test, McNemar's-test and  $\chi^2$  tests. A 95% level of significance ( $p < 0.05$ ) was selected for all inferential statistical tests.

**RESULTS**

The results revealed a statistically significant difference in total PLI before and after the tooth-brushing education ( $p < 0.001$ ). However, there were no statistically significant differences regarding gender. Table 1 shows the mean plaque index (PLI) before and after the tooth-brushing education according to gender and the total population.

**Table 1.** Number of participants (n) and Plaque index (mean) before and after education.

Gender	Before education		After education	p-value <sup>a)</sup>
	n	PLI (mean)	PLI (mean)	
Male	18	1.002	0.27	**
Female	22	0.794	0.19	**
Total	40	0.89	0.23	**

<sup>a)</sup> Paired t-test  
 \*\*  $p < 0.001$

Table 2 shows the total number of tooth surfaces with dental plaque in the maxilla, mandible and both jaws, before and after education. In the maxilla, there was 86% dental plaque before education and 53% after education. In the mandible, there was 78% dental plaque before education and 31% after education. For both jaws, there was a dental plaque reduction from 82% before education to 42% after education. After the education, dental plaque had been reduced by 40% in the study group.

**Table 2.** Percentage of total tooth surfaces with dental plaque in the maxilla and mandible before and after education.

Jaw	Before		After	p-value <sup>a)</sup>
	n	%	%	
Maxilla	400	86	53	*
Mandible	400	78	31	*
Total	800	82	42	**

<sup>a)</sup>  $\chi^2$  tests  
 \*  $p < 0.01$   
 \*\*  $p < 0.001$

Table 3 shows the distribution of dental plaque on each tooth surface in the maxilla and mandible in terms of gender and the total number of subjects before and after education. The result shows that the amount of dental

plaque had been reduced in both jaws for all four surfaces (buccal, lingual, mesial and distal) after education. These changes were all statistically significant ( $p < 0.001$ ) for the total population and gender.

Table 4 shows different comparisons of the effectiveness of tooth-brushing on buccal surfaces and lingual surfaces, distal surfaces and mesial surfaces in the maxilla and the mandible. The result shows that the dental plaque was reduced to a smaller degree (31%) on the buccal surfaces after the education compared with the lingual (67%) surfaces in the maxilla ( $p < 0.001$ ). However, there were no statistically significant differences between the mesial and distal surfaces in the same jaw. In the mandible, the results were similar to those in the maxilla. The dental plaque on buccal and lingual surfaces was reduced by 40% and 51% respectively before and after education ( $p < 0.001$ ). There were no statistically significant differences between the mesial and distal surfaces in the mandible

( $p > 0.05$ ).

When comparing different surfaces between the maxilla and mandible, the result indicated that dental plaque was reduced to a lesser degree on the buccal surfaces in the maxilla (31%) after education compared with the mandible (40%). This was statistically significant in terms of statistics ( $p < 0.01$ ). Dental plaque was reduced to a lesser degree on the lingual surfaces in the mandible (51%) after the education in comparison to the maxilla, where it was reduced to 67% ( $p < 0.001$ ). When comparing mesial and distal surfaces, more tooth sites were cleaner after the education; however, there were no statistically significant differences (Table 4). When comparing the effectiveness of tooth-brushing in the maxilla and mandible after education, dental plaque decreased to a lesser degree in the maxilla (33%) compared with the mandible, where it decreased by 47% after education ( $p < 0.001$ ).

**Table 3.** Distribution of dental plaque for each tooth surface in right and left jaw, in the maxilla and mandible by gender before and after education.

	Tooth surface	Right Before n (%)	Right After n (%)	p-value <sup>a)</sup>	Left Before n (%)	Left After n (%)	p-value <sup>a)</sup>
<b>Boys (n=90)</b>							
Maxilla	Buccal	77 (86)	53 (59)	**	72 (80)	51 (57)	**
	Lingual	74 (82)	10 (11)	**	63 (70)	5 (6)	**
	Mesial	53 (59)	18 (20)	**	64 (70)	13 (14)	**
	Distal	61 (68)	17 (19)	**	55 (61)	12 (13)	**
Mandible	Buccal	61 (68)	23 (26)	**	49 (54)	28 (31)	**
	Lingual	63 (70)	13 (14)	**	63 (70)	24 (27)	**
	Mesial	53 (59)	10(11)	**	58 (64)	8 (9)	**
	Distal	60 (67)	10 (11)	**	50 (56)	8 (9)	**
<b>Girls (n=110)</b>							
Maxilla	Buccal	90 (82)	56 (50)	**	88 (80)	45(40)	**
	Lingual	80 (73)	5 (5)	**	77 (70)	7 (6)	**
	Mesial	41 (37)	13 (12)	**	62 (56)	15 (14)	**
	Distal	61 (55)	11 (10)	**	41 (37)	12 (11)	**
Mandible	Buccal	60 (55)	10 (9)	**	62 (56)	10 (9)	**
	Lingual	76 (70)	10 (9)	**	77 (70)	28 (25)	**
	Mesial	35 (33)	8 (7)	**	70 (64)	14 (13)	**
	Distal	61 (55)	5 (5)	**	31 (28)	9 (8)	**
<b>All (n=200 )</b>							
Maxilla	Buccal	167 (84)	109 (55)	**	160(80)	96 (48)	**
	Lingual	154 (77)	15 (8)	**	140 (70)	12 (6)	**
	Mesial	94 (47)	31 (16)	**	126 (63)	28 (14)	**
	Distal	122 (61)	28 (14)	**	96 (48)	24 (12)	**
Mandible	Buccal	121 (61)	33 (17)	**	111 (56)	38 (19)	**
	Lingual	139 (70)	23 (12)	**	140 (70)	52 (26)	**
	Mesial	88 (44)	18 (9)	**	128 (64)	22 (11)	**
	Distal	121 (61)	15 (6)	**	81 (41)	17 (9)	**

<sup>a)</sup> McNemar's test      \*\*p < 0.001

**Table 4.** Comparison of the effectiveness of tooth-brushing between different surfaces in the maxilla, different surfaces in the mandible, between all four surfaces for the two jaws and between the two jaws before and after education.

Items	Before education n (%)	After education n (%)	Differences between before and after n (%)	p-value <sup>(a)</sup>
Buccal	327 (82)	205 (51)	122 (31)	**
Lingual	294 (74)	27 (7)	267 (67)	
Mesial	220 (55)	59 (15)	161 (40)	
Distal	218 (55)	52 (13)	166 (42)	ns
<b>Mandible (n=400)</b>				
Buccal	232 (58)	71 (18)	161 (40)	
Lingual	279 (70)	75 (19)	204 (51)	**
Mesial	216 (54)	40 (10)	176 (44)	
Distal	202 (51)	32 (8)	170 (43)	ns
<b>Buccal surface (n=400)</b>				
Maxilla	327 (82)	205 (51)	122 (31)	
Mandible	232 (58)	71 (18)	161 (40)	*
<b>Lingual surface (n=400)</b>				
Maxilla	294 (74)	27 (7)	67 (67)	
Mandible	279 (70)	75 (19)	204 (51)	**
<b>Mesial surface (n=400)</b>				
Maxilla	220 (55)	59 (15)	161 (40)	
Mandible	216 (54)	40 (10)	176 (44)	ns
<b>Distal surface (n= 400)</b>				
Maxilla	218 (55)	52 (13)	166 (42)	
Mandible	202 (51)	32 (8)	170 (43)	ns
<b>Jaw (n=400)</b>				
Maxilla	343 (86)	212 (53)	131 (33)	
Mandible	312 (78)	122 (31)	190 (47)	**

<sup>a)</sup>  $\chi^2$  tests

\*p < 0.01, \*\*p < 0.001

ns = no statistical significance

## DISCUSSION

This study was a pilot study using a pre-post-test design where interest focused primarily on comparing the effectiveness of tooth-brushing in young children before and after standardised tooth-brushing education. A second aim was to determine if there were differences between different tooth-sites regarding oral hygiene. The fact that the examination of the children's teeth was performed just a week after the educational session might make it seem less significant, but the aim was to evaluate the participants' initial perception and understanding of the information that was provided to them. The main results revealed a distinct and

significant improvement in tooth-brushing skills among six-year-old children of both genders after the supervised tooth-brushing education. The results also showed an improvement in cleaning on all four tooth surfaces (buccal, lingual, mesial and distal) in both jaws, even if there were some differences when comparing different tooth areas.

In the present study, the percentage of teeth with dental plaque in the two jaws decreased from 82% before the education to 42% after the education. This is a good result, even if plaque was still left. A recently published study has reported similar results after supervised tooth-brushing education in young children [12].

The audiovisual method included individual instructions from the dental nurse and the researcher and these instructions were frequently given during the study to help the children acquire the skills. This can be regarded as a good pedagogic tool during oral health education for children in this age group. Moreover, in addition in this age group, the development of cognitive and psychosocial training is an ongoing process [18, 19], where tooth-brushing may be one learning activity in this process. In addition, in the present study, the children appeared to absorb the knowledge quickly. Supervised tooth-brushing education appears to be very effective for this age group, as has been reported in previous studies [10, 14]. This also supports the importance of early tooth-brushing education, as well as the importance of supervision by an adult with a good knowledge of tooth-brushing techniques, which could be dental staff or teachers at the school, as well as parents.

In Vietnam, the prevalence of dental caries is very high for children and it is also influenced by different determinants such as the fluoride level in the drinking water, age, residential status, geographical location, as well as dental visits and parental education [1]. In this context, an effective tooth-brushing technique is also an important factor when it comes to preventing caries [5-7]. Moreover, another important factor is probably the use of toothpaste containing fluoride.

When comparing different tooth surfaces and the maxilla and mandible, this study also revealed an improvement in cleaning for all four surfaces compared with the situation before the education. The main results showed a greater reduction in dental plaque on the lingual surfaces of the maxilla and mandible compared with the buccal surfaces. The study also revealed that some tooth areas appeared to be more difficult for these children to brush and using the erythrosine solution appears to be a good pedagogic tool in tooth-brushing education. Using erythrosine solution also helped the children to identify jaw areas which were not brushed sufficiently in order to give instructions to brush them more effectively.

According to the method, some reflection is necessary. The study population was fairly small, which must be taken into consideration when interpreting the results. Because of the inclusion criterion of 20 primary teeth, many children were excluded. It is normal for children at six years of age to have lost some primary teeth which have been replaced by permanent teeth. However, in spite of the small number of participants, the results still provided an important message, namely the importance of education for effective tooth-brushing techniques at an early age, as this is an important mediating factor for dental caries. This is also supported by other studies [10, 12]. Moreover, the

Bass method was used as a standardised tooth-brushing technique in this study. However, regardless of technology, it appears to be important for both children and parents to have a knowledge of the removal of dental plaque and the importance of implementing tooth-brushing methodologically. The effectiveness was defined after seven days' practice and included practice both at school and at home. During the week at home, the parents of the children may have influenced the results of their children's tooth-brushing in different ways, as parents' knowledge and education may influence children's tooth-brushing habits and technique [1]. The time for evaluation of efficacy in this study was short, and more longitudinal studies is recommended in the future.

In Vietnam, as well as in other Asian countries, but also in other countries, there are large differences in oral health depending on sociodemographic and socioeconomic factors. Since parental education and knowledge of oral health can differ, it is important that there are preventive programmes in a country, including tooth-brushing (preferably combined with toothpaste with fluoride) with supervision in schools on a regular basis. This, together with parental tooth-brushing education, can maintain the effectiveness of tooth-brushing habits and produce a reduction in dental caries in young children as a result in the future.

In conclusion, individual supervised tooth-brushing education, including a methodological tooth-brushing technique, appears to be very effective when it comes to removing dental plaque and debris in six-year-old children at primary school. Pedagogic tools, such as erythrosine solution and animated films, may be a good way of motivating young children to adopt effective tooth-brushing techniques for all tooth-sites.

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