SCHOOLCHILDREN'S TOOTH BRUSHING CHARACTERISTICS AND ORAL HYGIENE HABITS ASSESSED WITH VIDEO-RECORDED SESSIONS AT SCHOOL AND A QUESTIONNAIRE

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ABSTRACT

Tooth brushing habits become established during the first years of childhood and last throughout lifetime. To assess tooth-brushing characteristics, the procedure was videotaped at school and a questionnaire on oral hygiene knowledge, attitudes and practices was completed. A total 146 5- to 8-year-old low-SES schoolchildren from Bogotá participated. The median total tooth brushing time was 115 sec (75% Q3-178sec; 25% Q1-83sec). The median time the toothbrush was in the child's mouth was 89sec (75% Q3-145sec; 25% Q1-65sec). Most children brushed their maxillary (97%), mandibular (95%), anterior (96%) and posterior (81%) teeth. The surfaces most often brushed were the buccal-anterior-maxillary (96%) and mandibular (94%) surfaces. The amount of toothpaste dispensed was 2/3 of toothbrush head in 51% of children. Most children spat (93%), used the mirror (78%), and rinsed their mouth (72%). The majority (97%) was confident that the toothbrushing session was effective. The questionnaire revealed the following: none of the children brush their teeth at school; only 34% is supervised by an adult during the tooth brushing procedure, and only 30% brush twice a day. The study shows overall positive findings of tooth brushing while being observed, in terms of time and use of toothpaste. These results, together with the poor oral-health status and toothbrushing habits reported at home, highly recommend incorporating daily-supervised school-based tooth brushing sessions with fluoride toothpaste.

Keywords: *toothbrushing - child - videotape recording*

CARACTERÍSTICAS DEL CEPILLADO Y HÁBITOS DE HIGIENE EN NIÑOS ESCOLARES. VALORACIÓN POR MEDIO DE VIDEO-GRABACIONES Y CUESTIONARIO

RESUMEN

Los hábitos de cepillado dental se establecen durante los primeros años de la infancia y duran para toda la vida. Para valorar las características del cepillado dental, se hicieron video-grabaciones del procedimiento en el colegio y se completó un cuestionario sobre conocimientos, actitudes y prácticas de la higiene oral. En total participaron 146 escolares entre los 5 y 8 años de edad, de estrato socio-económico bajo de Bogotá. Se encontró una mediana de tiempo total de cepillado de 115 segundos (75% Q3-178seg; 25% Q1-83seg) y, una mediana de tiempo de permanencia del cepillo dental en boca de 89 segundos (75% Q3-145sec; 25% Q1-65sec). La mayoría de los niños cepilló sus dientes maxilares (97%), mandibulares (95%), anteriores (96%) y, posteriores (81%). Las superficies que cepillaron con mayor frecuencia fueron las vestíbulo-anteriores superiores (96%) e inferiores (94%). La cantidad de crema dental dispensada fue de 2/3 de la cabeza del cepillo en el 51% de los niños. La mayoría escupió (93%), usó el espejo (78%) y, enjuagó su boca (72%). Casi todos los niños (97%) sintieron confianza de que su sesión de cepillado fue efectiva. El cuestionario reveló que ningún niño cepilla sus dientes en el colegio; tan solo un 34% es supervisado por un adulto y, solo el 30% se cepillan dos veces al día. El estudio muestra en general hallazgos positivos del cepillado dental cuando los niños están siendo observados, en términos de tiempo y uso de crema dental. Estos resultados, unidos al reporte de salud oral e higiene oral deficientes en casa, recomiendan de manera importante, incorporar sesiones diarias de cepillado dental supervisado en el colegio usando crema dental fluorada.

Palabras clave: *cepillado dental - niños - grabación en video*

INTRODUCTION

Caries is the result of an imbalance between dental substance and the surrounding dental plaque, and can therefore be prevented and/or controlled through oral hygiene that removes bacterial plaque suitably[1-3]. Tooth brushing with fluoridated toothpaste is considered an effective preventive tool to control the dental caries process[4]. Tooth brushing habits are established during the first years of childhood and usually last throughout life[5]. There are several indicators that characterize the quality of tooth brushing, such as the index of bacterial

plaque[6] and gingival index[7]. A more direct way to assess tooth brushing is videotaping the child's tooth brushing, as it may offer more information about the quality of oral hygiene[8]. This technique allows for the assessment of aspects such as time, brushing teeth vs. playing with the toothbrush, surfaces that are being brushed, etc. Rugg-Gunn and Mcgregor[8] were pioneers in using videotapes of tooth brushing. Within their most important findings, they found that 5-year-old children only brushed 25% of the areas. Subsequently, Honkala et al.[9] assessed children's tooth brushing techniques by using the same technique during a school day with a mobile unit. Furthermore, Zeedyk et al.[10] used 1-day tooth brushing videotaping of 2.5-year old children at their homes through homemade recordings, with the cooperation and intervention of the parents. They found that even though the average length of the tooth brushing sessions was more than two minutes (142 s), the brush tended to be in the child's mouth for less than half of that time.

Universidad El Bosque was leading a preventive program in a group of economically deprived 5- to 8-year-old schoolchildren in Bogotá[11]; in this population (n=152) the prevalence of caries experience was 44.8%; the DMF-S was 6.3 (±3.5) and on average the students had 22.73 (±12.23) surfaces with caries lesions according to ICDAS criteria[12]. With the Cariogram® caries risk evaluation[13], 32% of the subjects were classified at high and 42% at very high risk[11]. Children's oral hygiene habits were unknown.

The aim of this study was to describe the tooth brushing characteristics and oral hygiene habits of high caries experience and risk in 5- to 8-year-old schoolchildren through school-based video-recorded tooth brushing sessions and a questionnaire.

MATERIALS AND METHODS

The sample consisted of 152 5- to 8-year-old children from three public economically deprived schools in the municipality of Usaquén in Bogotá, taking part in a caries prevention project and already having reported caries prevalence[11]. All (100%) children were included. Six children that did not attend school on the days of the videotaping sessions or those in whom it was difficult to observe the teeth during the videotaping were to be excluded (final sample n=146). The study obtained ethical approval from the Ethical Board at Universidad El Bosque, and included informed consent from the children´s caregivers. The study session with the children included an oral hygiene questionnaire and videorecording of a tooth brushing session as described below.

Oral hygiene questionnaire

A 9-item questionnaire on knowledge of oral hygiene, attitudes and practices was conducted (Table 1). The questions used were previously assessed for reliability of internal consistency and item analyses[14]. The questionnaire included: seven categorical questions in Likert format; one multiple-choice question; and one dichotomized (yes/no) question. Before the tooth brushing session, one operator (SM) read the questions to the child and filled in her/his answers on the form.

Videotaping of tooth brushing session

The videotaping of the scholchildren's tooth brushing session was planned following previous reported experiences conducted at the school[8-10], with the difference that in the present study, the child was aware of being filmed during tooth brushing, and was filmed after previous standardization of position of the operator.

Other operators (LFE, IKQ, MM) greeted the child and provided him/her with a plastic cup, a toothbrush (Colgate™) and toothpaste (Colgate™- 1450 ppm). The child was then given verbal instructions to "Brush the best you can". To obtain video of the children brushing their teeth, a restroom with a wall mirror and sink was selected at each school. The videotaping was conducted by one of three trained operators (AG, AM, VS). The operator with the video camera was located in each restroom diagonally to the wall mirror, one meter from the child. The three video cameras used in the study were the following: Two Sony Handicam™ C CD-TRV308 and a Panasonic™ NV-v2-14**.** The operator was in complete silence and started filming when the child initiated the tooth brushing session (application of toothpaste or start of tooth brushing), and continued filming until the child finished by saying out loud "I'm done" or after no more action was seen and the child answered "yes" after being asked if he/she was finished. Afterwards the child was asked if he/she felt confident that the session had been effective in achieving clean teeth.

Table 1: Questionnaire on Oral Hygiene.

Questions	Items		Answer					
			Total n = 146		Females n = 78		Males n = 68	
			n	%	n	%	n	%
1. Is plaque removal the most important of toothbrushing?	A	Yes	115	78.7	63	80.8	52	76.5
	B	No	31	21.3	15	19.2	16	23.5
2. Who taught you how to brush your teeth?	A	Your doctor	2	1.4	2	2.6	0	0
	B	Your dentist	26	17.8	15	19.2	11	16.2
	C	Your teacher	1	0.7	1	1.3	0	0
	D	Tv/Radio	0	0	0	0	0	0
	E	You	37	25.3	14	17.9	23	33.8
	F	Your caregiver	80	54.8	46	59.0	34	50.0
3. Do your parents assist you brushing your teeth?	A	Always	49	33.6	27	34.7	22	32.5
	B	Almost always	6	4.1	4	5.1	2	2.9
	C	I don´t know	2	1.4	0	0	2	2.9
	D	Almost never	2	1.4	2	2.6	0	0
	E	Never	80	54.7	40	51.2	40	58.8
	ND	Non-determinable	7	4.8	5	6.4	2	2.9
4. Do you use toothpaste to brush your teeth?	A	Always	128	88.3	70	89.8	58	85.3
	B	Almost always	4	2.3	2	2.6	2	2.9
	C	I don´t know	0	0	0	0	0	0
	D	Almost never	5	3.3	3	3.8	2	2.9
	E	Never	9	6.1	3	3.8	6	8.9
5. Do you stand up in front of the mirror to brush your teeth?	A	Always	104	71.3	53	67.9	51	75.0
	B	Almost always	10	6.8	6	7.7	4	5.9
	C	I don´t know	0	0	0	0	0	0
	D	Almost never	1	0.7	0	0	1	1.5
	E	Never	25	17.1	15	19.2	10	14.7
	ND	Non-determinable	6	4.1	4	5.2	2	2.9
6. Do you brush your teeth at night before going to sleep?	A	Always	134	91.8	71	91.0	63	92.6
	B	Almost always	8	5.4	4	5.1	4	5.9
	C	I don´t know	0	0	0	0	0	0
	D	Almost never	1	0.7	1	1.3	0	0
	E	Never	3	2.1	2	2.6	1	1.5
7. Do you brush your teeth in the morning before going out?	A	Always	33	22.6	19	24.4	14	20.6
	B	Almost always	12	8.2	6	7.7	6	8.8
	C	I don´t know	0	0	0	0	0	0
	D	Almost never	5	3.4	3	3.8	2	2.9
	E	Never	95	65.1	50	64.1	45	66.2
	ND	Non-determinable	1	0.7	0	0	1	1.5
8. Do you brush your teeth at school?	A	Always	0	0	0	0	0	0
	B	Almost always	0	0	0	0	0	0
	C	I don´t know	0	0	0	0	0	0
	D	Almost never	0	0	0	0	0	0
	E	Never	146	100.0	78	100.0	68	100.0
9. Are you happy with your teeth?	A	Totally in agreement	96	65.7	56	71.7	40	58.8
	B	In agreement	12	8.2	8	10.3	4	5.9
	C	Neutral	1	0.7	1	1.3	0	0
	D	In disagreement	2	1.4	0	0	2	2.9
	E	Totally in disagreement	33	22.6	12	15.4	21	30.9
	ND	Non-determinable	2	1.4	1	1.3	1	1.5

Tooth brushing video assessment

The operators standardized tooth-brushing assessment (starting point of tooth brushing, use of the chronometer etc.) in the videotapes by scoring 15 videos during the pilot phase. KENKO (KK 1025) chronometers were used to time the sessions in seconds. The time measurements conducted were: 1) total session time (time the brush enters the mouth until it is removed for the last time) and 2) amount of time the brush was inside the mouth and the child was most probably brushing. Further, it was observed and categorized whether the child brushed different zones of the dentition (buccal, occlusal and lingual surfaces) both in the upper jaw and lower jaw and in the anterior or posterior teeth. Based on the video record the amount of toothpaste used was categorized as none, one-third of the toothbrush, two-thirds of the toothbrush, or the entire head of the toothbrush, which was approximately 15 mm in length.

Table 2: Sample distribution by gender and age.

Gender / Age	Females		Males		Total	
	n	%	n	%	n	%
5 years old	11	7.5	8	5.5	19	13.0
6 years old	18	12.3	21	14.4	39	26.7
7 years old	29	19.9	12	8.2	41	28.1
8 years old	20	13.7	27	18.5	47	32.2
Total	*78*	*53.4*	*68*	*46.6*	*146*	*100.0*

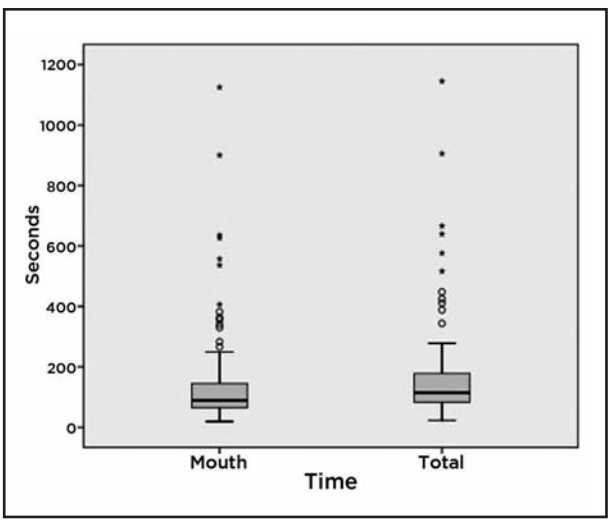

Fig. 1: Medians of total tooth brushing session and toothbrush in the mouth. While the tooth brushing-session time median length was 114.5, the time median length the toothbrush was inside the child's mouth was 89 seconds.

Three further observations were made from the video including: 1) whether the child looked at him/herself in the mirror while toothbrushing; 2) whether the child rinsed his/her mouth with water after brushing and 3) whether the child spat after brushing. Finally, children were asked if they felt confident that the tooth brushing session was effective.

Statistical Analysis

Data were entered into an EXCEL spreadsheet and exported to SAS version 9.1 for analysis. Descriptive statistics were used to determine in terms of time the median, first and second quartiles: 1) total session time and 2) amount of time the brush was inside the mouth and the child was brushing. Gender differences for all the variables were explored using the Student's t-test ($p < 0.05$). Frequency tables and descriptive statistics were generated for the responses to the questionnaire, for the four locations of tooth brushing (anterior, posterior, mandibular arch, maxillary arch), and for whether the child looked at him/herself in the mirror while tooth brushing, rinsed his/her mouth with water after brushing and spat after toothbrushing.

RESULTS

The final sample included 146 subjects (53% female and 47% male) with an age distribution showing a similar percentage distribution for the 6, 7, and 8 years old (Table 2). Six children were excluded: 2 because they did not attend school on the videotaping-session days and 4 because it was not possible to observe their teeth during videotaping.

Tooth brushing session

Fig. 1 shows that the median length of time of the tooth brushing session was 114.5 sec (25% quartile: 83 sec, 75% quartile 178 sec), while the median length of time the toothbrush was inside the child's mouth was 89 sec (25% quarti1e: 65 sec, 75% quartile: 145 sec). There was no significant difference ($p>0.05$) between males and females for the mean total session time (117 vs. 113 sec) and the amount of time the brush was inside the mouth and the child was brushing (95.5 vs. 89 sec).

The difference between brushing right and left posterior sides was lower than 10%, so data were merged for further analyses. Table 3 shows that the

surfaces most often brushed were the buccal anterior surfaces (maxillary: 98.6%; mandibular: 89.7%), followed by the occlusal mandibular surfaces (80.8%). The palatal/lingual surfaces were brushed by less than 1/5 of the children. There was a tendency to a higher percentage of girls than boys brushing selected surfaces, although it was not statistically significant (p>0.05).

Regarding the use of toothpaste, Fig. 2 shows that about 1/2 of the children (51.4%) dispensed an amount equivalent to 2/3 of the head of the toothbrush.

Table 4 shows that about 1/5 of children (21.9%) did not use the mirror at any time during the session; more than 2/3 (71.9%) rinsed their mouth afterwards and in 11 cases (7.5%) the children did not spit at any time.

Finally, most of the children (96.6%) were confident that the tooth brushing session was effective, with no significant difference between males (94.9%) and females (98.5%) (Student´s t test; p>0.05).

Oral hygiene questionnaire

Table 1 shows the results of the questionnaire. Seventy-nine percent of the children (80.8% of females and 76.5% of males) agreed that removing plaque is the most important part of brushing teeth. About half the children (54.8%; 59% of females and 50% of males) reported that their caregiver was the person who taught them how to brush their teeth and only 17.8% (19.2% of females and 16.2% of males) said their dentist or hygienist taught them. Regarding oral health practices, only 1/3 of the children (33.6%; 34.7% of females and 32.5% of males) said their parents always assisted them during toothbrushing. The majority (88.3%) answered that they always or always used toothpaste. More than 2/3 of the children (71.3%; 67.9% of females and 75% of males) said they stood in front of a mirror to brush their teeth. Most of the children (91.8%; 91% of females and 92.6% of males) said they always brush their teeth before going to sleep, while only around 1/5 (22.6%; 24.4% of females and 20.6% of males) said they always brush their teeth in the morning and none brush their teeth at school. Finally, regarding attitudes, about two thirds of the children (65.7%; 71.7% of females and 58.8% of males) agreed that they were happy with their teeth. There was no significant difference between genders (Student´s t test; p>0.05).

Table 3: Frequency of children brushing specified zones.

Surfaces		Frequency	
		n	%
Buccal	Maxillary Posterior	104	71.2
	Mandibular Posterior	108	74.0
	Maxillary Anterior	144	98.6
	Mandibular Anterior	131	89.7
Occlusal	Maxillary	99	67.8
	Mandibular	118	80.8
	Maxillary Posterior	18	12.3
Palatal/ Lingual	Mandibular Posterior	19	13.0
	Maxillary Anterior	23	15.7
	Mandibular Anterior	22	15.1

Table 4: Frecuency of three different behaviors during toothbrushing.

Behavior	Yes		No	
	n	%	n	%
The child looked at him/herself in the mirror during toothbrushing	114	78.1	32	21.9
The child rinsed his/her mouth after toothbrushing	105	71.9	41	28.1
The child spit after toothbrushing	135	92.5	11	7.5

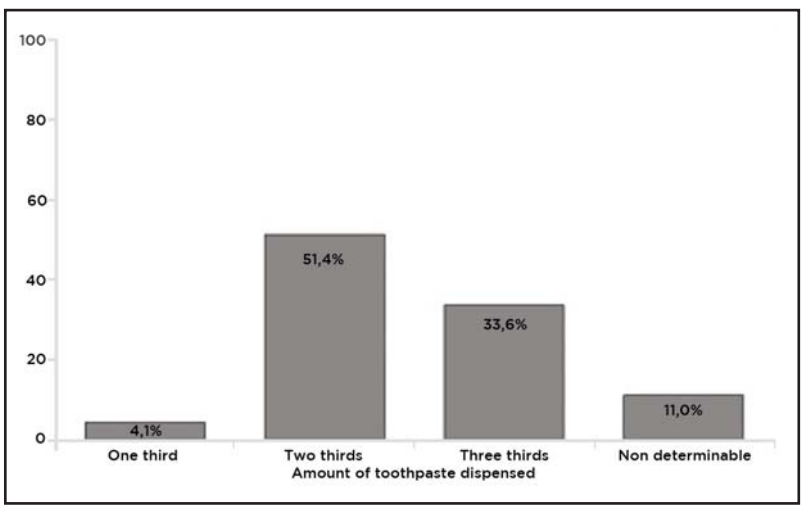

Fig. 2: Frequency of children using different amounts of toothpaste. About half of the children dispensed an amount equivalent to 2/3 of the head of the toothbrush.

DISCUSSION

This study describes the tooth brushing characteristics of schoolchildren through video-recorded sessions and a questionnaire. Children were aware of being filmed and the videotaping was conducted at school. This modality differs from other studies assessing tooth brushing through videotapes where children did not know they were being observed[8-10] and the procedure was performed at home with commonly used aids[8,10]. We decided to conduct the study at schools to take advantage of the collaboration logistics already implemented by the university at these schools. Furthermore, we wanted children to be aware that their tooth brushing process was being assessed, simulating a supervised procedure. It could be argued that this could certainly have influenced some aspects of the tooth brushing procedure, such as duration, use of toothpaste and amount of toothpaste, specific zones brushed, etc. This can be confirmed by the fact that they report poor oral health status in terms of caries experience and caries risk and by the results of the questionnaire, showing that only 30% reported brushing their teeth twice a day (68% once a day and 2% never).

Caries lesions in children about eight years of age have been reported to occur most frequently on occlusal surfaces of molars[15,16]. This has been related to the duration of the eruption of around 15 to 27 months [17] thus favoring occlusal plaque stagnation and caries initiation with a fast progression rate[7,18]. The analyses of the video-recorded tooth brushing sessions showed that the majority brushed the occlusal surfaces of both maxillary and mandibular teeth (67.8% and 80.8%). This a positive finding that may be complemented with training children in specific plaque removal focusing on these erupting molars, as advised in the Nexø method (Nexø Public Dental Health Service)[19].

Three minutes has been established as the overall recommended tooth brushing time[20] and one minute as the overall lower limit, beyond which little improvement in plaque removal has been associated[21]. In the current study the median tooth brushing time was almost two minutes, lower than recommended. Nevertheless, it should be taken into account that the so-called recommended value does not ensure that the session time corresponds to actions associated with plaque removal or if it also includes playing with the toothbrush outside the mouth, etc. In this sense, the videotapes allowed for a more reliable data; and when only the time the toothbrush was inside the mouth was calculated, the median was one minute and a half.

Zeedyk et al.[10] conducted a similar study at home where tooth brushing practices of parents and toddlers (31-33 months old) were assessed in 34 children, by the same observation method of video-recorded sessions and with parents aware of being filmed. In their study, all sessions lasted for at least 60 s and in the current sample, 95% of sessions lasted at least 60 s. Our results showed length of time the toothbrush was in the mouth to be 2.3 times higher (mean: 140.3 s; SD 149.2 s) than theirs, and furthermore, while they reported that 60% of the total session time the toothbrush was outside the mouth, in this study this value only corresponded to 12%. However, these differences should be viewed in the light of comparing two different age groups, where the toddlers have lower intellectual development[22]. As for the proportion of time the anterior and posterior teeth were brushed, while they report it to be equal, in this study the children took almost two thirds of time brushing the anterior teeth and thus left only one third for the posterior teeth. This could be due to the fact that children may think anterior teeth are most important because they are related to the smile[23].

There were some difficulties in evaluating the videos; for example sometimes they sealed their lips while the toothbrush was inside the mouth, making it difficult to assess where they were brushing their teeth. This is not reported in other similar studies[8-10].

Although this study was performed in a school setting, where the children were aware of observation among a population with limited resources and characteristics that are very different from those populations in developed countries[8-10], the results were satisfactory. In addition, it would be interesting to assess plaque levels, both before and after the filming, to infer in a more objectively the quality of the mechanical plaque removal.

The implementation of daily supervised tooth brushing with fluoride toothpaste at school could be achieved in most of this population, both one

daily additional mechanical plaque removal and an additional topical application of fluoride toothpaste, with a probable higher quality of the procedure. This preventive approach may be an inexpensive, effective way to control the development and progression of dental caries at the individual level[24-26]. Video-recorded tooth brushing sessions in schoolchildren have added useful information to a questionnaire on toothbrushing habits. By being aware of being video-recorded, children's tooth brushing characteristics showed positive results in terms of time, sites being brushed and toothpaste use. This observation technique may be used as a pedagogical tool to improve tooth brushing by means of feedback sessions at the individual level.

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