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Mothers as facilitators of oral hygiene in early childhood

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Background. Toothbrushing twice daily is a recommended component of oral self-care soon after the eruption of primary dentition.
Aim. This study aims to investigate oral hygiene and frequency of oral cleaning in children up to 3 years, in relation to mother-related factors.
Design. A cross-sectional study of 504 children aged 12–36 months in Tehran, Iran was implemented. Mothers answered questions about their own oral self-care and their activity in their children's oral hygiene. The child's oral hygiene was assessed on the basis of visible dental plaque on the labial surfaces of the upper central incisors. Data analysis included chi-square test, analysis of variance (ANOVA) and logistic regression.
Results. Twice daily oral cleaning was reported for 5% of all children and once daily cleaning for 19% of the 12- to 15-month-old children, 18% of the 16- to 23-month-old children, and 48% of the 24- to 36-month-old children. Of the mothers, 59% stated that they lacked the skill to clean their children's teeth. Dental plaque was observed in 65–76% of the children. Clean teeth were more likely (OR = 1·7, 95% CI 1.3–2.3) in children of mothers who themselves have a higher toothbrushing frequency.
Conclusions. To improve oral hygiene in early childhood, more emphasis should be placed on mothers' own toothbrushing and their skills in their children's oral cleaning.

Introduction

Toothbrushing twice daily is a part of recommended oral self-care and should start as soon as an infant's teeth erupt[1]. This standard is met for the majority of children in several European Union countries and the USA[2–4]. In Iran, toothbrushing is reportedly practised for only 59% of 3-year-old children[5]. As young children lack the ability to clean their own teeth effectively, parents are recommended to clean their children's teeth at least until they reach school age[6–8]. Insufficient oral hygiene in terms of presence of visible plaque on anterior teeth of children has been identified as a risk marker for dental caries among young children[9–11].

Toothbrushing behaviour is learned from models as part of the socialization process[12,13]. Because parents play a key role in the family in transferring health-related habits to the children, their toothbrushing has been associated with oral cleaning frequency of their children[12,14–16], being higher in families with higher socio-economic status[15,17]. However, few studies have been conducted on these associations in early childhood.

Mothers play a vital role in raising very young children. Parents' attitudes towards their perceived ability to maintain their children's oral hygiene have been investigated[2,18], but studies including very young children are scarce.

This study investigated oral hygiene and frequency of oral cleaning among children of up to 3 years of age in relation to mother-related factors.

Materials and methods

Subjects

The sample included children aged 1 to 3 years and their mothers who visited the vaccination and child development assessment offices of public health centres in Tehran, Iran[9,19]. Vaccinations against common childhood diseases

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are administered at public health centres regardless of socio-economic status, with resulting coverage across the country ranging from 94% to 98%[20]. Calculation of sample size, based on around 60% prevalence for visible plaque, 5% error and 95% confidence interval, resulted in 369 subjects. To achieve enough children of all target ages under the present sampling circumstances, the sample size was increased to 500.

Using a list provided by the Ministry of Health and Medical Education, 18 out of 102 public health centres were randomly selected to represent the districts in Tehran[9,19]. Four working days were devoted to each health centre. On these days all target-age children, except for two whose mothers refused to take part in the study, were enrolled, resulting in 20–35 children per centre, totalling in 504 children (254 boys and 250 girls). Preceding the vaccination, mothers were first interviewed in a private room close to the vaccination room. The interview was conducted using a pretested, structured questionnaire. Following the completion of the interview, the child was examined by one examiner (S.M.).

Oral cleaning for the child

This was covered by three questions on frequency of oral cleaning for the child, cleaning device, and adult's role in oral cleaning for the child. Each mother was asked to respond to the question 'How often are your child's teeth cleaned?' with five response alternatives, later categorized as: 'More than once a day', 'Once a day', 'Less than once a day', and 'No cleaning'. Ultimately, to facilitate the final analyses, two separate dichotomies were formed: 'Twice daily' or 'Less' and 'Daily' or 'Less', to reveal factors related to oral cleaning for the child on twice-daily basis and daily basis.

The answers to the question about the cleaning device were categorized into 'Toothbrush', 'Washcloth, gauze, etc.', and 'Nothing'. Information about the adults' role in the oral care of the children was elicited by asking: 'Who performs the child's toothbrushing?' The responses were categorized as: 'The child alone', 'The child with supervision or help by adults', and 'The adults solely'.

Mother-related factors

Mother's own oral cleaning was assessed in terms of the frequency of her own toothbrushing. The answers to the question 'How often do you brush your teeth?' were categorized into: 'More than once a day', 'Once a day', and 'Less than once a day'.

Mothers' perceptions of their ability to maintain their children's oral hygiene was measured by three items[2,18] (Table 1). The responses were given on a 5-point Likert scale ranging from Strongly agree to Strongly disagree and scored as follows (in parentheses): Strongly agree (1), Agree (2), No opinion (3), Disagree (4), and Strongly disagree (5).

Socio-demographic information

An interview also sought information on the child's age and gender, and the parental level of education. The child's age was recorded on the basis of his or her birthday. Three age groups were formed for the analyses: 12–15 months

Table 1. Distributions (%) of the mothers' responses to the statements regarding perceptions of ability to maintain oral hygiene for their 1- to 3-year-old children, in Tehran. Iran (*n* = 504).

	Responses (%)				
Statements†	**Strongly agree**	**Agree**	**No opinion**	**Disagree**	**Strongly disagree**
1. I don't know how to brush or clean my child's teeth properly.	24	35	2	36	3
2. We don't have time to brush or clean our child's teeth twice a day.	3	25	0	63	9
3. We cannot make our child brush or clean his or her teeth twice a day.	7	29	7	49	8

Statistical evaluation by the chi-square test: no difference ($P > 0.05$) according to child's age or gender; according to parents' level of education, $P = 0.01$ for statement no. 1, $P = 0.02$ for no. 2, and $P = 0.06$ for no. 3.
†Selected from Pine *et al.*[2]

($n = 242$), 16–23 months ($n = 156$), and 24–36 months ($n = 106$), the two youngest groups being somewhat overrepresented due to the recommended vaccine shots at 12 and 18 months of age. Level of education was recorded separately for father and mother with a 7-point scale ranging from illiterate to doctoral degree. Parental education was defined as the highest level of either parent's education and then categorized into three levels: Low (primary school or illiterate), Moderate (diploma or high school education) and High (university education). Distribution of the children by parental level of education showed no difference between age group and gender.

Clinical examinations

Prior to the clinical dental examinations, one of the authors (S.M.), with 5 years of experience as a practicing dentist, received additional training from an experienced paediatric dentist who was the head of a university department of paediatrics[9,19]. The training ended with double examination of children, resulting into kappa value of 0.8 for recordings of dental plaque. The dental examination was carried out with the help of a headlamp and a plane dental mirror with the mother and the examiner sitting in a knee-to-knee position.

Visible dental plaque was assessed on the labial surfaces of the upper central incisors and recorded as 'No visible plaque', 'Plaque present at gingival margin only', and 'Abundant dental plaque covering more than gingival margin of the tooth'. The child's oral hygiene was determined as the maximum finding of dental plaque and later dichotomized as 'Good' (absence of visible plaque) or 'Poor' (presence of visible plaque).

Statistics applied

Evaluation of the statistical significance of the differences between the subgroups included the analysis of variance (ANOVA) for comparison of mean values and the chi-square test for frequencies. A logistic regression model served for multivariable assessment, separately for factors related to the oral cleaning for the child on (a) daily basis, (b) twice-daily basis, and (c) whether the child's oral hygiene was good. The corresponding odds ratios (OR) and their 95% confidence intervals (95% CI) were determined. Goodness of fit was assessed by means of the Hosmer–Lemeshow test. A *P*-value less than 0.05 denoted statistical significance.

Ethical consideration

The study was approved by the Ethics Committee of the School of Dentistry, Shaheed Beheshti University Medical. The mothers gave informed written consent to participate in the study. The subjects were entered into the database with a numerical code only.

Results

Child's oral hygiene

Visible dental plaque appeared on at least one upper central incisor of 65% of the 12- to 15-month-old children, 70% of the 16- to 23-month-old children, and 76% of the 24- to 36-month-old children ($P < 0.001$), with no gender difference. Fewer children aged 12 to 15 months of those parents with a moderate level of education had visible plaque (57% vs. 70–75%; $P = 0.02$). For the two older age groups, no relationship was found between the presence of visible plaque and level of parental education.

Mother-related factors

Of the mothers, 57% reported brushing their own teeth once a day and 11% more than once a day. The higher the educational level in the family, the more likely it was for mothers to report a higher brushing frequency ($P < 0.001$).

Table 1 shows responses to the three statements describing mother's perceptions of their ability towards maintaining the child's oral hygiene. Fifty-nine per cent of all mothers compared to 73% of those mothers from low educated families ($P = 0.01$) stated that they did not know how to brush or clean their children's teeth. The mothers confirmed that they had time to clean their children's teeth, since 72% of all mothers and 82% of those mothers from high educated families ($P = 0.02$) disagreed

Table 2. The frequency of oral cleaning (%) among 1- to 3-year-old children (*n* = 504) in Tehran, Iran, as a function of mother-related factors.

Mother-related factors	*n*	Frequency of oral cleaning for child (%)				*P*-value
		> 1/day	1/day	< 1/day	None	
Mothers' own toothbrushing						
> 1/day	56	13	23	16	48	
1/day	287	4	25	17	54	< 0.001
< 1/day	161	0	14	27	59	
I don't know how to brush or clean my child's teeth properly.†						
Strongly agree	121	2	18	20	60	
Agree	178	3	14	20	63	0.001
Strongly disagree and Disagree	196	5	30	20	45	
We don't have time to brush or clean our child's teeth 2/day.†						
Strongly agree and Agree	139	2	16	19	63	0.093
Strongly disagree and Disagree	364	4	24	21	51	
We cannot make our child brush or clean his or her teeth 2/day.†						
Strongly agree and Agree	186	1	17	22	60	0.011
Strongly disagree and Disagree	284	5	25	20	50	

Statistical evaluation by the chi-square test.
†Those who had 'no opinion' for the statement were excluded.

with this statement: 'We have no time to brush or clean our child's teeth twice a day'. No gender-based difference was observed.

Oral cleaning for the child

For 5% of all children, mothers reported twice-daily oral cleaning, and for 38%, no cleaning. Once-daily oral cleaning was reported for 34% of all children, for 19% of 12- to 15-month-old children, for 18% of 16- to 23-month-old children, and for 48% of 24- to 36-month-old children ($P = 0.001$). The frequency of oral cleaning for the child (Table 2) was positively associated with the mother's own toothbrushing frequency. The frequency of oral cleaning for the child was higher for the children of those mothers indicating that they know how to brush the child's teeth and that they are able to make the child brush his or her teeth twice a day ($P < 0.05$). No differences were found according to the child's gender or the parental level of education.

Among those children whose teeth were cleaned ($n = 227$), the most common cleaning device was a toothbrush (70%), followed by a washcloth or gauze (19%), and some other device (11%). Of those children for whom the use of a toothbrush was reported ($n = 160$), 35% brushed by themselves, 37% of 24- to 36-month-old children compared to 12% of 12- to 15-month-old children ($P = 0.03$), and 20% with the help or supervision of an adult. For 45% of all children an adult performed the cleaning. No gender-based differences were observed. Frequency of oral cleaning was not associated with assistance in oral cleaning or the type of cleaning device.

Factors related to daily and twice-daily oral cleaning for the child

For all children ($n = 504$), the frequency of oral cleaning on a daily basis was directly proportional to the mother's own toothbrushing frequency (OR = 1.9). When controlling for the child's socio-demographic information, the frequency of oral cleaning for the child was higher for the children of those mothers who indicated that they know how to brush their children's teeth (OR = 1.3) and that they were able to make their children brush their teeth twice a day (OR = 1.3) (Table 3). The logistic regression model indicated a good fit (Hosmer–Lemeshow, $P = 0.5$). A separate logistic regression model (Table 4) showed that the frequency of oral cleaning for the child on twice daily basis was directly proportional to the mother's own toothbrushing frequency (OR = 5.1). None of the other factors included in the model had any significant impact on twice daily oral cleaning for the child (Hosmer–Lemeshow, $P = 0.8$).

Table 3. Factors related to oral cleaning on a daily basis for 1- to 3-year-old children (*n* = 504) in Tehran, Iran, explained by logistic regression model.

Parameters in the model	Estimate of strength	Standard error	Odds ratio		*P*-value
			OR	95% CI	
Mother's toothbrushing frequency	0.633	0.171	1.9	1.3–2.6	< 0.001
I don't know how to brush or clean my child's teeth properly.†	0.233	0.090	1.3	1.1–1.5	0.009
We don't have time to brush or clean our child's teeth 2/day.†	0.034	0.120	1.0	0.8–1.3	0.775
We cannot make our child brush or clean his or her teeth 2/day.†	0.233	0.104	1.3	1.0–1.5	0.025
Child's age	0.075	0.015	1.1	1.0–1.1	0.000
Child's gender: 1 = boys, 2 = girls	0.136	0.224	1.1	0.7–1.8	0.543
Level of parental education	–0.079	0.094	0.9	0.8–1.1	0.404

Goodness of fit with Hosmer–Lemeshow test ($P = 0.5$).
†Strongly agree = 1; Strongly disagree = 5.

Table 4. Factors related to oral cleaning on a twice-daily basis for 1- to 3-year-old children (*n* = 504) in Tehran, Iran, explained by logistic regression model.

Parameters in the model	Estimate of strength	Standard error	Odds ratio		*P*-value
			OR	95% CI	
Mother's toothbrushing frequency	1.625	0.469	5.1	2.0–12.7	0.001
I don't know how to brush or clean my child's teeth properly.†	0.171	0.211	1.2	0.8–1.8	0.416
We don't have time to brush or clean our child's teeth 2/day.†	–0.100	0.304	0.9	0.5–1.6	0.741
We cannot make our child brush or clean his or her teeth 2/day.†	0.438	0.282	1.5	0.9–2.7	0.121
Child's age	0.058	0.031	1.1	1.0–1.1	0.061
Child's gender: 1 = boys, 2 = girls	–0.073	0.527	0.9	0.3–2.6	0.891
Level of parental education	0.041	0.208	1.0	0.7–1.6	0.844

Goodness of fit with Hosmer–Lemeshow test ($P = 0.8$).
†Strongly agree = 1; Strongly disagree = 5.

Factors related to the child's good oral hygiene

Table 5 shows factors related to child's good oral hygiene. Absence of dental plaque was more likely for the children of those mothers reporting a higher frequency of their own toothbrushing (OR = 1.7). Frequency of oral cleaning for the child played no clear role in achieving the good level of oral hygiene. The logistic regression model controlled for all background information and fitted the data well (Hosmer–Lemeshow, $P = 0.9$).

Discussion

The results of the present study indicate that a higher frequency of mother's own toothbrushing has an obvious impact on higher frequency of oral cleaning for the child and his or her good oral hygiene in early childhood. In addition, mothers' positive perceptions of their ability to maintain their children's oral hygiene showed association with higher frequency of oral cleaning for the child.

The frequency of oral cleaning in this child population was at very low level compared to data reported from developed countries. Toothbrushing twice daily, which is a part of the recommended oral self-care but rarely reported for our subjects, is practiced almost as a norm for 1- to 4-year-old children (85–97%) in several Nordic countries and in the USA, with the highest figure reported for Scotland[2–4]. Our findings on child's oral cleaning are, however, comparable to those reported for some Middle Eastern countries such as Jordan[21], but lower than for other countries like Poland and Hong Kong, where oral cleaning has been reported for 66% and 75% of 1- to 3-year-old children, respectively[17,22].

Table 5. Factors related to good oral hygiene (no visible plaque on upper incisors) in 1- to 3-year-old children (*n* = 504) in Tehran, Iran, as explained by a logistic regression model.

Parameters in the model	Estimate of strength	Standard error	Odds ratio		*P*-value
			OR	95% CI	
Mother's toothbrushing frequency	0.517	0.146	1.7	1.3–2.2	0.000
Frequency of oral cleaning for the child.	0.036	0.080	1.0	0.8–1.3	0.650
I don't know how to brush or clean my child's teeth properly.†	0.098	0.081	1.1	0.9–1.3	0.229
We don't have time to brush or clean our child's teeth 2/day.†	−0.123	0.102	0.9	0.7–1.1	0.227
We cannot make our child brush or clean his or her teeth 2/day.†	0.014	0.092	1.0	0.8–1.2	0.876
Child's age	−0.026	0.016	1.0	0.9–1.0	0.092
Child's gender: 1 = boys, 2 = girls	0.270	0.199	1.3	0.9–1.9	0.175
Level of parental education	−0.044	0.083	1.0	0.8–1.3	0.599

Goodness of fit with Hosmer–Lemeshow test ($P = 0.9$).
†Strongly agree = 1; Strongly disagree = 5.

It is highly recommended that adults perform oral cleaning for young children, who until approximately 6 years of age lack the dexterity and cognition needed for adequate cleaning[6–8]. Adult involvement in this child population's oral cleaning was higher than that reported for Chinese and Hong Kong children, and almost comparable to reports for Pakistani and Polish children, but lower than that reported from several Nordic countries and the USA, where majority of adults are still involved in brushing the teeth of their 4-year-old children[2,17,22].

An alarming finding was the low level of oral hygiene among these 1- to 3-year-old children; the present figures exceed those of some recent studies[10,11]. No relationship was found between the frequency of oral cleaning for the child and child's level of oral hygiene. This may be because for most children the frequency of oral cleaning was once daily or less which does not meet the recommendation. The other reason may be that the brushing was not effective in removing plaque. However, the positive relationship between the mother's own toothbrushing frequency and the child's oral hygiene was an encouraging finding. It indicates that the mothers who brush their own teeth more frequently were able to perform the oral cleaning for the child more efficaciously. This again calls for more emphasis on mothers' own oral hygiene behaviour regarding oral health promotion programmes for children during early childhood. On the other hand, ineffective plaque removal may to some extent be ameliorated by the beneficial effects of exposure to fluoride toothpaste used while toothbrushing.

Children learn oral self-care in the course of primary socialization[4]. Consequently, the oral health behaviour of both parents affects their children's oral health behaviour[4,12,13,15,23]. Mothers play a key role not only as facilitators of oral cleaning of very young children, but also as transmitters of oral health behaviour to them. For the present study, accordingly, only mothers were interviewed about their own toothbrushing. Future epidemiological research that includes the clinical examination of mothers would be useful for considering the direct assessments of various types of oral health indicators for mother and child.

Our finding that level of parental education is not associated with the child's oral cleaning frequency conflicts with some other findings[5,15,17]. Our results suggest a lack of emphasis on infants' oral health care in the whole community and among dental and medical professionals in particular. The most recently promulgated oral health programme in Iran recommends that the child's first dental visit take place after the child's second birthday[24]. In view of this recommendation, the current low rates of children's oral cleaning are easier to understand.

A few available reports show that parents' attitudes toward their perceived ability to maintain their children's oral hygiene is positively correlated with preschool-aged children's oral

cleaning frequency or oral health status[2,25]. In line with their findings, our study revealed that mothers' conceptions of maintaining children's oral hygiene were positively related to the frequency of oral cleaning for the child. However, these played no clear role in this child population's level of oral hygiene.

Regular and frequent oral cleaning in early childhood should be emphasized, and parents should receive basic instructions for performing this task. In addition, the parents' own regular toothbrushing and their active role in performing oral cleaning for their children should be encouraged.

What this paper adds

- Oral cleaning in early childhood in Iran might be insufficient regarding its inception, frequency, and adults' responsibility for it: as a result, many young children have poor oral hygiene.
- The mother's higher toothbrushing frequency has an obvious impact on the child's higher frequency of oral cleaning and better oral hygiene.

Why this paper is important to paediatric dentists

- Paediatric dentists are in a key position to facilitate non-dental-healthcare professionals, who have frequent contacts with parents of infants and toddlers, to promote oral health and hygiene in early childhood.
- Paediatric dentists also can use their expertise in dentistry to inform mothers of the importance of their own toothbrushing habits.

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