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Original Article

Behavior During Tooth Brushing in the Home Environment in Preterm and Full-Term Infants

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Abstract

Objective: To evaluate the behavior during toothbrushing of preterm and full-term infants through maternal report. **Material and Methods:** This study is based on secondary data collected from dental records of infants aged 12-38 months. The collected data of demographic and socioeconomic status, prematurity, tooth brushing habit and infant behavior during toothbrushing were tabulated using the SPSS-21.0 software and analyzed using descriptive and inferential statistics, carried out by the Chi-square, Fisher's exact or maximum likelihood ratio statistical tests, with significant level of 5%. **Results:** The types of infant behavior during toothbrushing were: *cooperative*, *participative*, *resistant*, *inflexible* and *independent*. Variables maternal education, family income and frequency of day care attendance showed significant differences regarding the infant's behavior (p=0.031, 0.033 and 0.004, respectively). No significant differences were found between infant's behavior during toothbrushing and maternal occupation/study (p=0.301), primiparity (p=0.109), infant's gender (p=0,233), prematurity (p=0,479), weight/gestational age ratio (p=0.231), toothbrushing before bed (p=0.83), dental biofilm (p=0,189) and presence of caries or extensive dental changes (p=0.566). **Conclusion:** There was no evidence that there is a difference in the behavior during toothbrushing of preterm and full term infants. Collaborative behavior was influenced by socioeconomic factors such as higher maternal schooling and family income, and in infants who attended day care.

Keywords: Child Behavior; Toothbrushing; Infant; Premature Birth; Dental Caries.

Introduction

Dental caries is a highly prevalent disease in children [1], presenting several variables that may influence its establishment, such as child's behavior, oral hygiene, nutritional habits and socioeconomic status [2]. Regardless of severity, dental caries associated with socioeconomic factors, such as low maternal schooling and family income, has the potential to impact quality of life related to the oral health of preschool children, which makes it necessary to carry out guidelines as a preventive measure [3].

Since dental caries is a multifactorial disease, actions should not be limited to treating only the end result of the process, but also to identify and interfere with factors that, if left unchanged, may lead to the recurrence of the disease. One of the strategies to control caries is the inhibition of dental plaque development, which is a structured and functionally organized biofilm [4]. In this regard, the beginning of toothbrushing practice has been considered the most determinant factor for early childhood caries, which highlights the role of oral hygiene instruction [5,6], especially when there is nocturnal feeding [7] and high sugar consumption, since sucrose is the substrate for the oral microbiota [2]. Likewise, it was demonstrated that children aged 6-60 months have higher chance of developing caries when presenting poor oral hygiene, frequency of bottle consumption equal to or greater than three times a day and time of use over five months [8].

The adoption of coherent behavioral habits in childhood begins at home with parents, especially with the mother, who plays a significant role in the lifestyle, especially with regard to the oral health of children [9]. An evaluation of the knowledge and behavior of mothers of pre-school children found that most had inadequate knowledge about oral hygiene habits [10]. A constant relationship of low maternal education, low toothbrushing frequency and presence of neighborhood that allows access to cariogenic foods with the presence of dental caries in childhood has also been shown [11].

The difficulties to perform the procedures for the mechanical control of dental biofilm can be generated both by the required persistence of parents in this task and by the lack of cooperation of children aged 6, 12, 18 and 24 months. The colonization of the oral cavity of infants by streptococci mutans and lactobacilli at 24 months is greater when mothers did not persist with toothbrushing and when the infant did not cooperate in this process [12].

A qualitative study exploring barriers and facilitators of the dental brushing routine involving primiparous mothers whose children aged 24-30 month verified that the non-collaborative behavior of infants constituted one of the barriers reported by mothers to prevent the establishment of a toothbrushing routine of twice a day. On the other hand, as mothers felt self-confident, the success rate was greater in this process [13]. In order to achieve this success, it was shown that the parents' social perception about toothbrushing, reflected by their conception of the frequency with which the majority of the parents brushed the teeth of their children, positively influenced the toothbrushing of their own children, resulting in frequency higher than the average [14]. In addition, children in the age group from 18 to 30 months presented a positive reaction when family

members were brushing their own teeth, expressing interest and requesting to brush their teeth as well [15].

The task of parents to obtain cooperation from children for brushing becomes particularly important in a population that may present risks to the behavioral and cognitive development, as in the case of preterm infants, in which their anatomical-physiological immaturity predisposes them to several challenges for survival. The lower the birth weight and gestational age, the greater the impairments of neurobehavioral development of preterm infants [16,17]. Self-regulation disorders such as increased tension and irritability have been observed in preterm infants compared to full-term infants [18]. Problems related to toothbrushing in the preschool period were also more commonly reported in preterm infants [19]. In addition, prematurity is accompanied by several medical complications in the neonatal period, which may adversely affect the development of oral structures, especially in dental enamel and predisposition to the development of carious lesions [20], so that preterm infants require special attention in dental caries prevention strategies, involving collaboration among health professionals [19].

Therefore, it is necessary to analyze the oral hygiene habits and the behavior of patients, seeking to modify them, aiming to improve their health status, so that they succeed in the control and prevention of oral diseases [21]. Thus, the aim of the present study was to evaluate the behavior during toothbrushing of preterm and full-term infants through maternal report.

Material and Methods

Ethical Aspects

Ethical standards in research with human beings according to the letter of Helsinki have been applied. This study was approved by the Ethics Research Committee (CAAE: 45236415.8.0000.5060).

Study Design and Data Collection

This is a study with secondary data regarding the mothers' answers in the dental records of infants followed in the Extension Project "Strategies for the Promotion of Oral Health for Infants", linked to the Department of Pediatric Dentistry, Federal University of Espírito Santo, conducted in the period from March 2013 to July 2015. During this period, 147 infants were treated for preventive and restorative dental procedures.

A pilot study was conducted with 38 mothers of 24-month-old infants with the aim of assessing the comprehension of items in clinical records, checking the time needed to obtain the answers and establishing the types of collaboration during toothbrushing. The evaluation of these levels was carried out through a qualitative study that involved the question "How is the behavior of your baby during toothbrushing?" Mothers were encouraged to freely express themselves on the subject, and responses were recorded by tape recorder and transcribed in full. Categories were established based on content analysis [22]. The infant's behavior during toothbrushing, extracted

from the mothers' reports, presented the following types: *cooperative*, when the infant allowed the adult to perform the dental brushing; *participatory*, when the infant brushed first and then allowed the adult to brush his teeth, or vice versa; *resistant*, when the adult could only partially brush due to the difficulty in dealing with the infant's resistance; *inflexible*, when the infant was reluctant to the point of not allowing the approach, requiring physical restraint so that the adult could perform the brushing; and *independent*, when the infant did not allow the adult to brush, but performed brushing himself. The first two types (*cooperative* and *participatory*) were considered as "collaborative" infants for the dental brushing procedure performed by an adult at home, and the others (*resistant*, *inflexible* and *independent*) were classified as "non-collaborative".

As inclusion criteria, all 147 medical records of preterm and full-term infants that were included in the extension project were selected. Exclusion criteria were records of infants under 12 months of age. Thus, there were a total of 101 medical records in the age range from 12 to 38 months. Prematurity was considered as gestational age less than 37 weeks [23]. Prematurity classification according to gestational age was as follows: extreme preterm (<30 weeks), very premature (30 to 33 weeks and six days) and late preterm (34 to 36 weeks and six days). According to birth weight: extremely low birth weight infant (<1,000 g), very low birth weight infant (1,000 to 1,499 g) and low birth weight infant (1,500 to 2,499 g) [24].

The clinical record items used included demographic and socioeconomic data such as maternal schooling, mother's work / study, work / study hours, family income and primiparity. Maternal schooling was classified by the Brazilian education system corresponding to incomplete elementary school, complete elementary school, incomplete high school, complete high school, incomplete higher education and complete higher education. Family income was evaluated according to the minimum wage determined by the Brazilian government.

Regarding the infant, data obtained were gender, prematurity according to gestational age, birth weight, length of stay at NICU, lactation during sleep, sugar use, day care attendance, dental biofilm [25] and presence of carious lesions with dentin exposure or extensive dental changes. The weight-to-gestational age ratio was classified based on weight and gestational age data [24]. Regarding tooth brushing, variables were frequency, initial age of brushing, person who performed toothbrushing, practice of brushing before bed and infant's behavior during toothbrushing.

Statistical Analysis

Data were tabulated using the SPSS software (Statistical Package for the Social Sciences) version 21.0, analyzed through descriptive and inferential statistics, which were performed by the Chi-square, Fisher's Exact statistical tests (when the exposure variable admitted two categories) or Maximum Likelihood Ratio (cases of more than two categories). Categorical variables were statistically tested to verify whether or not the infant's behavior during brushing, evaluated at two levels (collaborative and non-collaborative), was independent. For the comparison of the metric variables between these two groups, after the application of the Kolmogorov-Smirnov normality test,

variables were compared by means of the t-test for means when the distribution was adequate for the Gauss model, or by the Mann-Whitney test, considering significance level of 5%.

Results

Table 1 shows data related to the sample characterization, according to demographic and socioeconomic data. It could be observed that the majority of mothers presented schooling related to high school (50.5%) and family income of up to two minimum wages (67.3%).

Table 1. Sample characterization according to demographic and socioeconomic data.

Variables	n	%
Maternal schooling		
Elementary School	34	33.7
High School	51	50.5
Ensino Superior	16	15.8
Work/Study		
Yes	50	49.5
No	51	50.5
Working/Study hours		
Full time	32	31.7
Part-time, sporadic or by scale	18	17.8
Do not work outside the home	51	50.5
Family income in minimum wages (Brazil)*		
Up to 2 minimum wages	68	67.3
More than 2 wages to 5 minimum wages	33	32.7
Primiparity		
Yes	47	46.5
No	54	53.5
Total	101	100.0

*Minimum wage in Brazil (in Reais): R$ 678,00 (2013); R$ 724,00 (2014); R$ 788,00 (2015); Minimum wage in Brazil (converted into dollars): US$ 333.99 (2013); US$ 303.94 (2014); US$ 299.16 (2015).

Table 2 shows the characteristics of infants participating in the study. It was observed that for the majority of infants, breastfeeding or bottle-feeding was still performed during sleep (75.2%) and sugar use was part of the daily routine (86.1%).

Table 2. Sample characterization according to data related to the infant.

Variables	n	%
Sex		
Male	57	56.4
Female	44	43.6
Prematurity according to gestacional age		
Extreme preterm NB – <30 weeks	13	12.9
Very premature NB – 30-33 weeks and 6 days	22	21.8
Late preterm NB – 34 a 36 weeks and 6 days	26	25.7
Full term NB – 37 weeks or more	40	39.6
Birth weight		
<1500 grams	18	17.8
1500 a <2500 grams	38	37.6

2500 grams or more	28	27.7
Unknown	17	16.8
Length of stay in NICU		
Did not stay in the hospital	40	39.6
Up to 15 days	21	20.8
More than 15 days	40	39.6
Breastfeeding during sleep		
Yes	76	75.2
No	25	24.8
Sugar use		
Yes	87	86.1
No	14	13.9
Frequency of daycare attendance		
Yes	43	42.6
No	58	57.4
Total	101	100.0

The majority of mothers reported toothbrushing frequency of two or more times a day (80.2%), although the toothbrushing habit before bed was less frequent (46.5%). In most cases, toothbrushing was performed by the mother (88.1%), only 3% of toothbrushing was performed by the father and 8.9% by another person, which included the infant himself (6.9%) or the grandmother (2%). The initial age of toothbrushing ranged from 3 to 24 months, with mean of 12.68 (standard deviation 5.77). Clinical examination revealed the presence of dental biofilm in 61 infants (60.4%). The majority of infants (n = 70, 69.3%) did not present teeth affected by carious process. Considering the carious lesions with dentin exposure and extensive dental changes that could cause dentin sensitivity, 31 (30.7%) presented this condition.

Data on the types of behavior of infants during toothbrushing performed at home are presented in Figure 1. Most of infants showed to be of the cooperative type. The types of *cooperative* and *participatory* behavior, considered as a "collaborative" infant for the dental brushing procedure performed by an adult at home, were identified in 59 cases (58.4%), and the other types (*resistant, inflexible* and *independent*), classified as "non-cooperative", corresponded to 42 cases (41.6%).
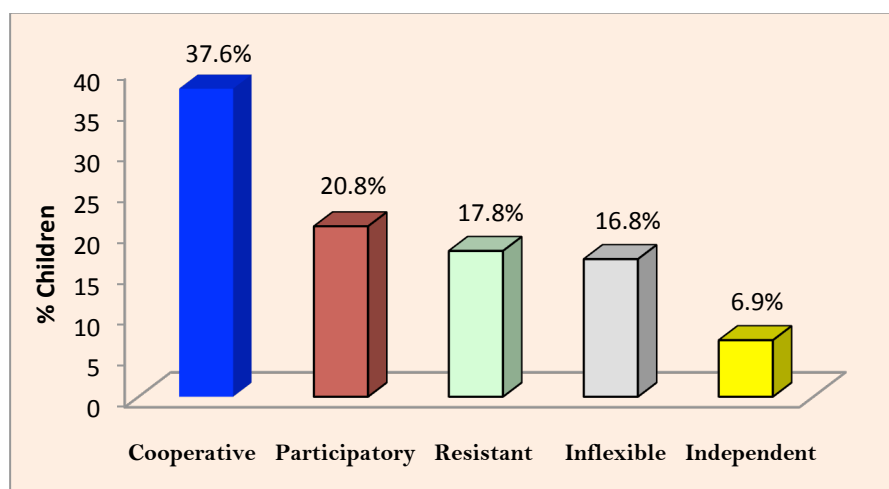

Figure 1. Types of behavior presented by infants during toothbrushing, as reported by mothers.

Collaborative behavior was associated with higher maternal schooling, considering complete high school or higher education (74.6%), with statistically significant difference (p = 0.031). Non-collaborative behavior was more frequent when the family income was up to two minimum wages (78.6%, p = 0.033). There was no statistically significant difference between variables mother's work / study (p = 0.301) and primiparity (p = 0.109), which results are shown in Table 3.

Table 3. Sample distribution regarding the infant's behavior during toothbrushing and association with demographic and socioeconomic data.

| Variables | Infant's Behavior | | | | p-value |
| | Collaborative | | Non-collaborative | | |
	n	%	n	%	
Maternal schooling					
Elementary school	15	25.4	19	45.2	
High school / higher education	44	74.6	23	54.8	0.031
Work/study					
Yes	31	52.5	19	45.2	
No	28	47.5	23	54.8	0.301
Family income in minimum wages (Brazil)					
Up to 2 MW	35	59.3	33	78.6	
More than 2 to 5 MW	24	40.7	9	21.4	0.033
Primiparity					
Yes	31	52.5	16	38.1	
No	28	47.5	26	61.9	0.109
Total	59	100.0	42	100.0	

*Minimum wage in Brazil (in Reais): R$ 678,00 (2013); R$ 724,00 (2014); R$ 788,00 (2015); Minimum wage in Brazil (converted into dollars): US$ 333.99 (2013); US$ 303.94 (2014); US$ 299.16 (2015).

Variables related to the infant and toothbrushing and their association with the collaborative and non-collaborative behavior of the infant during toothbrushing were investigated. Variable frequency of day care attendance showed a statistically significant association with the infant's behavior during toothbrushing (54.2% in the collaborative group attended day care and 26.2% in the non-collaborative group, p = 0.004). No significant differences were found with variables sex (p = 0.233), prematurity (p = 0,479), toothbrushing before bed (p = 0.83), presence of dental biofilm (p = 0.189) and presence of carious lesions or extensive dental alterations (P = 0.566), which results can be seen in Table 4.

Table 4. Sample distribution regarding the infant's behavior during toothbrushing and association with categorical variables related to the infant and to toothbrushing.

| Variables | Infant's Behavior | | | | p-value |
| | Collaborative | | Non collaborative | | |
	n	%	n	%	
Sex					
Male	31	52.5	26	61.9	0.233
Female	28	47.5	16	38.1	
Prematurity according to gestational age					
Preterm NB (<37 weeks)	35	59.3	26	61.9	0.479
Full term NB	24	40.7	16	38.1	
Toothbrushing before bed					
Yes	29	49.2	18	42.9	
No	17	28.8	20	47.6	0.083*
Sometimes	13	22.0	4	9.5	

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Presence of dental biofilm

Yes	33	55.9	28	66.7	0.189
No	26	44.1	14	33.3	

Presence of carious lesions or extensive dental changes

Yes	18	30.5	13	31.0	0.566
No	41	69.5	29	69.0	

Frequency of day care attendance

Yes	32	54.2	11	26.2	0.004
No	27	45.8	31	73.8	
Total	59	100.0	42	100.0	

*Maximum Likelihood Ratio.

The comparison of metric variables gestational age, length of stay at NICU and initial age of toothbrushing between groups (collaborative and non-collaborative) was performed by the Mann-Whitney test and can be seen in Table 5. No statistically significant differences were found.

Table 5. Sample distribution regarding the infant's behavior during toothbrushing and comparison with metric variables gestational age, length of stay at NICU and initial age of toothbrushing.

Variables	Infant's Behavior	n	Median	Mean	SD	p-value
Gestacional age (weeks)	Collaborative	59	35.50	34.96	4.08	0.521
	Non collaborative	42	35.45	34.48	3.83	
Time at NICU (days)	Collaborative	34	21.50	32.18	29.28	0.695
	Non collaborative	27	33.00	37.59	31.28	
Inicial age of tooth brushing (months)	Collaborative	59	12.00	12.42	5.38	0.710
	Non collaborative	42	12.00	13.05	6.34	

SD: Standard deviation.

Discussion

This study aimed to explore the behavior during toothbrushing of preterm and full- term infants aged 12-38 months. Premature birth corresponds worldwide to 15 million per year, which is the reason for the inclusion of this group to identify its peculiarities [23]. Children born preterm may present cognitive and neurobehavioral impairment, especially those with low birth weight and gestational age [16,17], and self-regulation problems [18], which leads us to infer that they may also be more resistant to accepting oral hygiene procedures, when compared with full-term children [19].

Data analyzed corresponded to the evaluation of the answers of mothers of infants contained in dental records and by the oral clinical examination. It was found that it was a population at risk for the development of dental caries, considering that the majority consumed sugar and bottle and breastfeeding was also performed during sleep. Many mothers reported that toothbrushing was performed before the infant slept, but they maintained the habit of bottle feeding or breastfeeding at night. The relationship of these factors with the development of dental caries has been demonstrated in literature, with emphasis on the importance of toothbrushing in dental biofilm control for caries prevention [2,5-7]. Many mothers are unaware of the role of bottle-feeding for the infant to fall asleep in the occurrence of early childhood caries when toothbrushing is not performed [10,12].

Despite the risk factors, most infants in the present study were caries-free. These results seem to be related to the fact that toothbrushing was performed by the majority at least twice a day, with mean initial age of brushing of 12.68 months, which has shown the awareness to introduce this habit. The age of approximately six months represents a crucial moment for the colonization of streptococcus mutans and lactobacilli, which is when the first teeth erupt, which is usually associated with weaning and the introduction of solid foods; therefore, prevention of the introduction of sugary beverages and foods and oral hygiene are aimed at preventing the establishment of streptococcus mutans in the biofilm [12]. On the other hand, considering the young age of children, caries was detected in 30.7%, which shows the difficulties found by parents for controlling the risk factors [8,10,12].

The evaluation of the infant's behavior during toothbrushing showed that the *cooperative* type was the most frequent, followed by the *participatory* behavior, which demonstrated the positive interaction obtained by the adult to be successful in the introduction of the brushing habit, which composed the "collaborative" group for the accomplishment of toothbrushing in the home environment. As for the *resistant* type, due to the difficulty found, the adult did not succeed, performing brushing only on some teeth, during a short period of time in which the child allowed; the *inflexible* type, when the infant presented body reluctance and did not accept the approach with the brush, the mothers' report was about the need for physical restraint to achieve toothbrushing; the last type, *independent*, the infant did not allow the adult to brush, but he himself performed the brushing. In this case, although mothers consider that brushing was performed, the recommendation is that this procedure should be performed by an adult [13]. These last three types have been included in the "non-cooperative" group. One of the barriers pointed out in literature to establish the routine of brushing in young children was precisely the non-cooperative behavior of the infant, common in the studied age group [12-13], while the mother's self-confidence [13] and the model represented by the visualization of the toothbrushing routine of parents had a positive effect on the establishment of this habit [15].

Most of the infants in this study showed collaborative behavior during toothbrushing, being carried out mainly by the mother, who plays a crucial role in the education of children [9]. As preschool children do not yet have the motor and cognitive skills needed to brush their teeth at an adequate level of hygiene, this task is the responsibility of parents [13].

In this study, a statistically significant association was observed between infant's behavior during toothbrushing and variables maternal educational level and family income. The results showed that non-collaborative behavior was more frequent when the mother had lower schooling and low family income. These results agree with other studies in which factors such as maternal schooling and family income influenced infant's behavior during toothbrushing [10,11].

There was no significant association between infant's behavior during toothbrushing and prematurity, gestational weight / age, gestational age (in weeks) and length of hospital stay at NICU (in days), which differs from literature, which refers to the existence of toothbrushing problems in

preterm infants [19]. This lack of association may have occurred due to the small number of preterm infants considered to be more vulnerable to neurobehavioral impairment [16].

Variable frequency of day care attendance was statistically associated with behavior during toothbrushing. Infants who did not attend day care institutions mostly had non-collaborative behavior during the process of oral hygiene, a fact that may be related to the insertion of habits that occurs in day care centers. This finding agrees with the results of a study that concluded that for children attending day care centers, there was a positive change in behavior regarding food, oral and body hygiene [26].

Variable presence of dental biofilm was not statistically associated with infant's behavior during toothbrushing. This result differs from another study that related positive behavior during brushing with lower presence of dental plaque [27]. The presence of carious lesions with dentin exposure and extensive dental changes did not present statistically significant association with behavior during dental brushing. This finding disagrees with literature, which reports that enamel hypoplasia may lead to greater dentin sensitivity, which would result in a more negative behavior during dental brushing [28].

The implementation of continuing education programs directed to parents or guardians aiming at the promotion of oral health has demonstrated that modifications in oral hygiene habits are more easily accepted by them than changes in habits related to diet [29]. Parents who find it difficult to establish behaviors favorable to oral health should receive special attention from health professionals [6], aiming at awareness and training to increase their self-confidence.

One of the limitations of the present study is the use of secondary data presented in records filled over the years by extension project trainees. As a way to minimize potential errors in this process, the project coordinator trained trainees and maintained control over the correct completion of the clinical file, avoiding incomplete items.

Conclusion

The types of behavior presented by infants during toothbrushing performed at home were identified as *cooperative*, *participatory*, *resistant*, *inflexible* and *independent*. The first two types were the "collaborative" group for the procedure, which represented the majority of infants. The behavior during toothbrushing did not present difference between preterm and full-term infants. The collaborative type was influenced by infants attending day care centers and socioeconomic factors such as higher maternal schooling and family income.

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