

Association between infant feeding duration and the terminal relationships of the primary second molars

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Abstract

Aim: This study was developed to assess the effect of prolonged bottle feeding and breastfeeding on the anteroposterior relationship of the dental arches in 3-6-year-old children attending preschools in the eastern zone of São Paulo city. **Methods:** The association between infant feeding duration (artificial and natural) and occlusal characteristics were evaluated in 485 children at the stage of complete primary dentition, who attended municipal preschools in the eastern zone of São Paulo city. The information related to types and duration of child breastfeeding was investigated by means of questionnaires filled out by parents/guardians. The occlusal characteristics corresponding to the terminal relationships of the primary second molars were classified as vertical plane (VP), mesial step (MS) and distal step (DS). Logistic regression analysis ($p < 0.05$) was applied. **Results:** Considering the right and left sides, DS was diagnosed in 9.7% of the cases, MS in 14.2% and VP in 76.1%, without significant differences between sides and genders. The association between the presence of DS and the age of bottle-feeding and breastfeeding cessation was significantly high ($p < 0.001$). The older the child when bottle-feeding ceased (3-4 years old) and the shorter the breastfeeding duration (<3 months), the greater the chances of the child presenting DS. **Conclusions:** Breastfeeding duration is one of the factors that could influence the development of DS because the longer the breastfeeding duration, the higher the percentage of children who were not bottle fed, ranging from 5.8% (among children who interrupted breastfeeding before the age of 3 months) to 63.8% (after 12 months of age).

Keywords: bottle feeding, breastfeeding, malocclusion, epidemiology.

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Introduction

There are several factors that could lead to malocclusion in primary dentition. In general, these factors may be genetic or environmental, for example, such as nonnutritive sucking habits - finger and pacifier-sucking¹⁻³. The key to determining the etiology of malocclusions is to assess the preponderant effect of each factor in particular.

Nowadays, there has been emphasis on the importance of breastfeeding, since mother's milk is the best diet from a nutritional point of view, reinforcing

the child's immunological system against infectious and allergic diseases. Furthermore, the act of breast sucking produces adequate development of the masticatory system structures, providing balance of the internal and external muscular contention forces⁴⁻⁷. Lower prevalence and severity of malocclusions in breastfed children, in comparison with those that were bottle fed, have been reported⁸.

The association between nonnutritive sucking habits and the development of malocclusions in the primary dentition has been mentioned in previous investigations^{1-3,5}. However, few studies have addressed the influence of bottle feeding on occlusal characteristics. Thus, the aim of this epidemiological study was to assess the effect of prolonged bottle feeding and breastfeeding on the anteroposterior relationship of the dental arches in children aged 3 to 6 years attending to public preschools in the eastern zone of São Paulo city.

Material and methods

This cross-sectional study was conducted in agreement with the Brazilian National Council Health's Resolution Act 196/96.

The sample consisted of children of both genders aged 3 to 6 years from three public preschools located in the eastern zone of São Paulo, SP, Brazil. The total number of children assessed was 984, and 499 were excluded for not meeting the inclusion criteria: informed consent form signed by the parents/guardians; adequately filled out questionnaires on sucking habits; complete primary dentition, without erupted permanent teeth or teeth in the process of eruption; absence of extensive caries lesions or loss of coronal structure, which would compromise occlusion; absence of early primary tooth loss; absence of any type of trauma; absence of visual and/or mental and/or hearing deficiencies; and no history of orthodontic and/or speech treatment. The children who were assessed did not show characteristics suggestive of cleft lip and palate fissures or any other anomalies that could contribute to the establishment of malocclusions. Therefore, the final sample was composed of 485 children, being 248 girls and 237 boys.

Information on the types and duration of infant feeding and the data about their general health were investigated by means of questionnaires filled out by the parents/guardians. The clinical examinations were performed by a calibrated dentist who was blind to the questionnaire data. The aim of examiner calibration was to explain the main doubts with regard to the clinical data and standardize the method of assessment and registering the information for each individual. The data obtained from calibration were submitted to Kappa statistics (k) for reproducibility analysis. A k index higher than 0.81 was obtained, indicating good intraexaminer agreement.

The clinical examinations were performed in the school environment, using disposable wooden spatulas, under a suitably directed source of artificial lighting. The children remained comfortably seated while clinical records were filled

out. During the examinations the child was asked to perform maximum mouth opening and then to bite in maximum intercuspation (MI) to collect the clinical data.

To classify the relationships of the distal surfaces of primary second molars the criteria proposed by Baume were applied⁹: 1. vertical plane (VP) – the distal surfaces of the primary second molars coincide in the same vertical plane; 2. mesial step (MS) – the distal surface of the mandibular primary second molar is located in a more mesial direction in relation to the distal surface of the maxillary primary second molar; 3. distal step (DS) – the distal surface of mandibular primary second molar is located in a more distal direction in relation to the distal surface of the maxillary primary second molar.

After clinical assessments and collection of information based on the above-mentioned inclusion criteria, the children were divided into two major groups:

- Group according to the age of interrupting bottle feeding, which was divided into four sub-groups: no bottle feeding habit; bottle feeding interrupted by the age of 2 years; bottle feeding interrupted between the ages of 3 and 4 years; bottle feeding interrupted between the ages of 5 and 6 years.

- Group according to the age of interrupting breastfeeding, which was divided into six sub-groups: not breastfed; breastfeeding for less than 3 months of age; breastfeeding interrupted between 3 and 6 months of age; breastfeeding interrupted between 6 and 9 months of age; breastfeeding interrupted between 9 and 12 months of age; and over than 12 months of age.

Initially, the frequency of the data with reference to breast and bottle feeding, age and gender were calculated. Next, the prevalence of the relationships of the distal surfaces of the primary second molars was obtained, in the complete sample and according to the study group. Logistic regression analysis was applied to identify the factors related to breastfeeding and bottle feeding durations that could influence on the development of the relationships of the distal surfaces of the primary second molars. The level of significance was set at 5%.

Two regression models were constructed simultaneously, one for the presence of DS and the other for the presence of MS, using the group that presented VP as a reference. The co-variables used in the models were: age of bottle feeding cessation/interruption – the reference group did not have the habit; age of breastfeeding interruption – the reference group was the one that interrupted the habit after 12 months of age; gender – the reference group was composed by boys; and side – the reference group was the right side. The odds ratio (OR) was estimated based on the co-variables that showed significant association with the types of relationships of the distal surfaces of the primary second molars.

Results

Considering the complete sample, the distribution according to chronological age in years was as follows: 13.9%

Table 1. Distribution of the relationships of the distal surfaces of the primary second molars, expressed in number (n) and percentage (%), according to side and gender.

Relationships of the distal surfaces of the primary second molars	Side				Gender				Total Sample	
	right		left		Boys		Girls		n	%
	n	%	n	%	n	%	n	%		
VP	366	75.5	372	76.7	358	75.5	380	76.6	738	76.1
DS	54	11.1	40	8.3	46	9.7	48	9.7	94	9.7
MS	65	13.4	73	15.1	70	14.8	68	13.7	138	14.2
Total	485	100.0	485	100.0	474	100.0	496	100.0	970	100.0

Vertical plane (VP), mesial step (MS) and distal step (DS).

Table 2. Distribution of the relationships of the distal surfaces of the primary second molars according to the age when bottle feeding was interrupted.

Relationships of the distal surfaces of the primary second molars	Age when bottle feeding was interrupted (years)				Total Sample
	Without the habit	Up to 2 years	Between 3 and 4 years	Between 5 and 6 years	
	%	%	%	%	
VP	79.6	78.7	70.7	76.7	76.1
DS	4.8	10.0	13.9	7.0	9.7
MS	15.6	11.3	15.4	16.3	14.2
Total	100.0	100.0	100.0	100.0	100.0

Vertical plane (VP), mesial step (MS) and distal step (DS).

for children aged 3; 37.7% for those aged 4; 37.1% for those aged 5; and 11.3% for children aged 6 years. The percentage of boys (48.9 %) was very close to that of girls (51.1%).

Distribution of the sample according to the bottle feeding duration showed 25.8% for children without the habit; 32% for children who interrupted the habit at the age of 2; 33.3% interrupted it between the ages of 3 and 4, and 8.9% between the ages of 5 and 6 years. Whereas, distribution of the sample according to the breastfeeding duration showed 7% for children who were not breastfed; 21.2% for children who interrupted it below the age of 3 months; 23.9% interrupted breastfeeding between 3 and 6 months of age; 8.7% between the ages of 6 and 9 months; 6.8% between the ages of 9 and 12 months; 30.7% over the age of 12 months, and 1.7% referred to the parents/guardians who did not remember the age when breastfeeding was interrupted. Figure 1 shows the

distribution of the sample according to the bottle feeding duration in the breastfeeding subgroups.

The distribution of the sample according to prevalence of the relationships of the distal surfaces of the primary second molars in age groups presented the following sequence: at the age of 3, 79.1% showed VP; 5.2%, DS and 15.7%, MS. At the age of 4, 73.8% showed VP; 10.9%, DS and 15.3%, MS. At the age of 5, 76.1% had VP; 10.6% had DS and 13.3% had MS. At the age of 6, the respective values were of 80% for VP; 8.2% for DS and 11.8% for MS. Table 1 shows the distribution of the terminal relationships of the primary second molars according to side and gender. It can be observed the distributions of the three characteristics are relatively balanced according to the two above-mentioned factors.

Table 2 shows the frequency of the terminal relationships

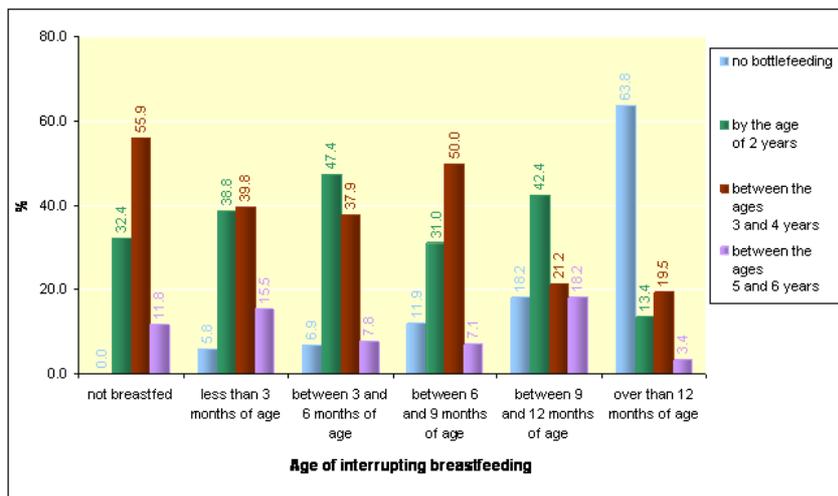


Fig.1. Distribution of the sample according to the bottle feeding duration in the breastfeeding subgroups.

Table 3. Distribution of the relationships of the distal surfaces of the primary second molars according to the age when breastfeeding was interrupted.

Relationships of the distal surfaces of the primary second molars	Age when breastfeeding was interrupted (months)						Total Sample
	Not breastfed	under 3	Between 3 and 6	Between 6 and 9	Between 9 and 12	over 12 months	
VP	75.0	73.8	69.4	72.6	84.9	80.9	76.1
DS	13.2	15.1	13.8	10.7	1.5	4.0	9.7
MS	11.8	11.2	16.8	16.7	13.6	15.1	14.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Vertical plane (VP), mesial step (MS) and distal step (DS).

of the primary second molars in the sub-groups according to the age when bottle feeding was interrupted. From the group without the habit up to the interval between 3 and 4 years of age, the relationship of VP showed successively lower percentage values; the inverse situation occurred with DS. Table 3 shows the frequency of the relationships of the distal surfaces of the primary second molars in sub-groups with reference to the age when breastfeeding was interrupted. Considering the children who were breastfed, the relationship in DS showed successively lower prevalence. The percentage value 1.5 is pointed out for children who interrupted breastfeeding between the ages of 6 and 9 months of life.

The logistic regression models are shown in Tables 4 and 5 with respect to the possible associations between the analyzed co-variables studied and the types of the relationships of the distal surfaces of the primary second molars.

Discussion

Evaluation of the relationships between the distal surfaces of primary second molars is relevant because it is one of the important parameters in establishing occlusion of the permanent first molars⁹. It is known that the terminal relationship of primary second molars seems to be the first factor that could determine or influence the future relationship between the permanent molars and the subsequent stages in the development of occlusion. Therefore, the goals of this study were to assess the prevalence of different terminal relationships of dental arches in primary

dentition in a group of children from municipals preschools in the eastern zone of São Paulo city and to study the association between the type of infant feeding (breast and artificial) and the development of these terminal relationships. There is a lack of studies related to these variables which also consider specific feeding durations. This study provides scientific evidence that clearly demonstrates the association between longer periods of breastfeeding and lower prevalence of distal step in primary dentition.

The results of prevalence of the types of relationships of the distal surfaces of the primary second molars are close to those found in a previous study¹⁰ in terms of percentage and sequence of predominance. When compared with other studies¹¹, our results were the same in sequence of predominance, but differed in their percentages. On the other hand, our results disagree with those of other authors¹² who observed a predominance of terminal relationship of primary second molars in MS. These divergences might have occurred due to the differences in methodology which involved the sample group and the age group of the children who were examined.

As regards the side of the dental arch and gender, no differences in distribution of terminal relationship of primary second molars were verified, which is in agreement with several other studies¹⁰⁻¹¹. Children at the age of 3 were those who showed the highest percentage of MS, and the 6-year-olds showed a lower percentage. The percentage of children with DS was lower than that of children with MS at all ages, in agreement with several authors¹¹.

In the present study, it was found that the longer

Table 4. Logistic regression model of the relationships of the distal surfaces of the primary second molars and the age when breastfeeding and bottle feeding were interrupted.

Comparisons	DS/VP		MS/VP	
	Odds ratio	p-Value	Odds ratio	p-Value
Age when bottle feeding was interrupted				
Up to 2 years/without habit	2.11	0.035	0.73	0.215
Between 3 and 4 years/without habit	3.26	0.000	1.11	0.645
Between 5 and 6 years/without habit	1.51	0.430	1.08	0.817
Age when breastfeeding was interrupted				
Between 9 and 12 months/after 12 months	0.36	0.329	0.86	0.704
Between 6 and 9 months/after 12 months	2.96	0.019	1.23	0.542
Between 3 and 6 months/after 12 months	3.99	0.000	1.30	0.281
Less than 3 months/after 12 months	4.10	0.000	0.81	0.447
Not breastfed/after 12 months	3.54	0.007	0.84	0.673

Vertical plane (VP), mesial step (MS) and distal step (DS).

Table 5. Logistic regression model for the relationships of the distal surfaces of the primary second molars and all studied co-variables.

Comparisons	DS/VP		MS/VP	
	Odds ratio	p-Value	Odds ratio	p-Value
Age when bottle feeding was interrupted				
Up to 2 years/without habit	0.88	0.772	0.64	0.141
Between 3 and 4 years/without habit	1.41	0.399	0.97	0.921
Between 5 and 6 years/without habit	0.60	0.382	1.09	0.829
Age when breastfeeding was interrupted				
Between 9 and 12 months/after 12 months	0.39	0.375	0.96	0.930
Between 6 and 9 months/after 12 months	2.74	0.046	1.33	0.435
Between 3 and 9 months/after 12 months	4.01	0.001	1.49	0.172
Less than 3 months/after 12 months	4.05	0.001	0.92	0.786
Not breastfed/after 12 months	3.26	0.025	0.94	0.884
Gender				
girls/boys	0.99	0.963	0.93	0.704
Side				
Left/right	0.72	0.145	1.10	0.594

Vertical plane (VP), mesial step (MS) and distal step (DS).

the breastfeeding duration, the higher the percentage of children who did not have the bottle feeding habit, and the older the child when breastfeeding was interrupted, the lower the chances of presenting DS. This result reaffirms the literature^{7,13} because there is greater prevalence of malocclusions in children who received only artificial or mixed feeding. Furthermore, the increase in breastfeeding duration is related to the reduced occurrence of undesirable habits in children from 3 to 6 years of age¹².

According to the logistic regression models, it was evident that the longer the child was bottle fed, the greater the chances of presenting distal step, and this relationship is not self-corrected with the natural development of occlusion. Therefore, in many cases, orthopedic and/or early orthodontic intervention will be needed. Moreover, the longer the breastfeeding duration, the lower the chances of developing DS between the primary second molars. Children who were not breastfed or who were breastfed for less than 3 months presented 3 or 4 times greater chances, respectively, of developing distal steps in comparison with the children who were breastfed for more than 12 months (Table 5). When the latter model was adjusted, only the age at which breastfeeding was interrupted presented significance, and the age whose bottle feeding was interrupted became irrelevant. Therefore, it is suggested that the duration of breastfeeding has a preponderant influence on the occurrence of distal step.

Considering the prevalence of distal step based on the results of this study, there was no significant difference between children who stopped breastfeeding between 9 to 12 months and those who were older than 12 months when breastfeeding ceased. Scavone et al.⁴ reported that breastfeeding beyond 9 months of age was significantly associated to a lower prevalence of non-nutritional sucking habits. Considering that these habits have been associated with malocclusions in the primary dentition⁴, our results corroborate those of Scavone et al.⁴ in that breastfeeding for

over 9 months of age has marked beneficial and meaningful consequences on occlusion and avoidance of non-nutritional sucking habits.

Based on the results of this research, it may be suggested that the longer the duration of breastfeeding, the lower the possibility of the child using a bottle for a long period. Furthermore, the shorter the breastfeeding duration, the greater the chances of the child developing distal step. In fact, the duration of breastfeeding seems to have a marked influence on the development of the distal step.

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