

Association between breastfeeding profile and malocclusion of children in a preventive program

Associação entre perfil de aleitamento e má oclusão de crianças em um programa preventivo

Asociación entre el perfil de lactancia y maloclusión de niños en un programa de prevención

Received: 03/18/2022 | Reviewed: 03/25/2022 | Accept: 03/31/2022 | Published: 04/07/2022

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Abstract

Purpose: To analyze the influence of the breastfeeding profile on the occlusal characteristics of the primary dentition in children participating and not participating in an educational-preventive dental program as well as its influence in these aspects. **Methods:** This cross-sectional study was carried out using a questionnaire filled in by the guardians combined with the examination of the occlusal characteristics of 400 children aged between 27 and 48 months, divided into 2 groups, 200 participants of a preventive dental program, Baby Clinic (BC), and 200 from schools from the city, not participating in a preventive dental program. The questionnaire included retrospective information on duration, type and form of breastfeeding and non-nutritive sucking habits (NNSH). Clinical evaluation of dental occlusion was also performed, using the malocclusion index recommended by the World Health Organization. Data were analyzed using the chi-square test. **Results:** In both groups, a high percentage of mothers breastfed their children (90% BC; 84.5% schools); high percentage of children had NNSH (64.5% BC; 57.5% schools), as well as a high rate of dental malocclusion (63% BC; 58% schools), the main one being anterior open bite (20.5% BC; 15% schools). In both groups, a lower occurrence of malocclusion was observed in children who were exclusively breastfed for up to six months (29.5% BC; 16.5% schools). **Conclusions:** our results indicated that children who were breastfed up to 6 months had a lower occurrence of malocclusion compared to those who were weaned early.

Keywords: Breast-feeding; Primary dentition; Malocclusion; Pacifier; Baby bottle.

Resumo

Objetivo: Analisar a influência do perfil de aleitamento sobre as características oclusais da dentição decídua em crianças participantes e não participantes de um programa odontológico educativo- preventivo, bem como sua influência nesses aspectos. **Métodos:** Este estudo transversal foi realizado por meio de um questionário preenchido pelos responsáveis combinado com o exame das características oclusais de 400 crianças com idade entre 27 e 48 meses, divididas em 2 grupos, 200 participantes de um programa odontológico preventivo, Bebê Clínica (BC), e 200 de escolas da cidade, não participantes de programa odontológico preventivo. O questionário incluiu informações retrospectivas sobre duração, tipo e forma de aleitamento e hábitos de sucção não nutritiva (HSNN). A avaliação clínica da oclusão dentária também foi realizada, utilizando-se o índice de má oclusão recomendado pela Organização Mundial da Saúde. Os dados foram analisados pelo teste do qui-quadrado. **Resultados:** Em ambos os grupos, uma alta porcentagem de mães amamentaram seus filhos (90% BC; 84,5% escolas); alto percentual de crianças apresentou HSNN (64,5% BC; 57,5% escolas), assim como uma alta taxa de má oclusão dentária (63% BC; 58% escolas), sendo a principal a mordida aberta anterior (20,5% BC; 15% escolas). Em ambos os grupos, menor ocorrência de má oclusão foi observada em crianças que receberam aleitamento materno exclusivo até os seis meses (29,5% BC; 16,5% escolas). **Conclusões:** nossos resultados indicaram que crianças que foram amamentadas até 6 meses apresentaram menor ocorrência de má oclusão em comparação com aquelas que tiveram desmame precoce.

Palavras-chave: Aleitamento materno; Dentição decídua; Má oclusão; Chupeta; Mamadeira.

Resumen

Objetivo: Analizar la influencia del perfil de lactancia en las características oclusales de la dentición primaria en niños participantes y no participantes de un programa odontológico educativo-preventivo, así como su influencia en estos aspectos. **Métodos:** Se realizó un estudio transversal usando un cuestionario que fue diligenciado por los tutores combinado con el examen de las características oclusales de 400 niños con edades entre 27 y 48 meses, divididos en 2

grupos, 200 participantes de un programa preventivo en salud bucal, Clínica del Bebe (CB), y 200 de las escuelas de la ciudad, que no participaban de ningún programa de prevención. El cuestionario incluyó información sobre duración, tipo y forma de lactancia materna y hábitos de succión no nutritivos (HSNN). También se realizó evaluación clínica de la oclusión dentaria, utilizando el índice de maloclusión recomendado por la Organización Mundial de la Salud. Los datos se analizaron mediante la prueba de chi-cuadrado. Resultados: En ambos grupos, un alto porcentaje de madres amamantó a sus hijos (90%CB; 84,5% escuelas); alto porcentaje de niños tenían HSNN (64,5%CB; 57,5% escuelas), así como una alta tasa de maloclusión dental (63%CB; 58% escuelas), siendo la principal mordida abierta anterior (20,5%CB; 15% escuelas). En ambos grupos, se observó una menor ocurrencia de maloclusión en los niños que recibieron lactancia materna exclusiva hasta los seis meses (29,5%CB; 16,5% escuelas). Conclusiones: los resultados indicaron que los niños que fueron amamantados hasta los 6 meses tuvieron una menor ocurrencia de maloclusión en comparación con aquellos que lo hicieron por menos tiempo.

Palabras clave: Lactancia materna; Diente primario; Maloclusión; Chupetes; Biberón.

1. Introduction

For more than two decades, the FOA-UNESP Baby Clinic has been developing dental actions for educational and preventive aspects in children aged 0 to 5 years, as well as explaining to parents the importance of establishing good habits for the maintenance of the child's oral health, emphasizing the importance of breastfeeding for the correct development of the child's stomatognathic system (Cunha et al., 2000), early diagnosing possible occurrences of dental malocclusions.

Breast milk is the ideal food to be given to the child in the first years of life. The World Health Organization (WHO) recommends exclusive breastfeeding during the first six months of life and partial breastfeeding up to two years old or beyond (World Health Organization, 2017). Scientific evidence is clear about the importance of breastfeeding for mothers and children (Peres et al., 2015). The breastfeeding woman benefits from protection against breast cancer, intrapartum spacing and probable protection against ovarian cancer and type 2 diabetes (Victora et al., 2016; Sattari et al., 2019). In relation to children, there is a positive impact on infant mortality outcomes, obesity, specific autoimmune diseases, allergic conditions, cancers (Greer et al., 2019, Peres et al., 2021) in addition to reduction of risk of dental malocclusion, playing a preventive role in the occurrence of malocclusions (Sum et al., 2015, Abanto et al., 2019). WHO also recommends that mothers with suspected or confirmed COVID-19 continue to breastfeed their children, since the benefits of breastfeeding substantially outweigh the potential risks of transmission (World Health Organization, 2020). Precautionary measures should be used to minimize the risk of contagion, such as washing hands with soap and water before touching the baby and wearing a mask. The baby needs close contact with the mother and must breastfeed directly. If the mother's health status does not allow for direct breastfeeding, the newborn should be fed breast milk previously expressed by the mother and without pasteurization, highlighting the potential passage of antibodies against SARS-CoV-2 through breast milk (Fernández-Carrasco et al., 2020).

Factors that interfere with the benefits of breastfeeding and that can influence the development of facial structures are the non-nutritive sucking habits (NNSH) especially pacifier and finger (Carvalho et al., 2021, Andrade et al., 2020). Longitudinal studies indicate that pacifier user's breastfeed for less time when compared to non-users, with an evident dose-response component (Aarts et al., 1990; Vogel et al., 2001, Santos et al., 2021), which may cause possible dental malocclusions. Malocclusion is considered by the World Health Organization to be the third biggest problem of oral public health, since epidemiological surveys carried out in several countries have pointed out a relevant incidence of malocclusion. This reality is present since the deciduous dentition, requiring, therefore, an early orthodontic evaluation to avoid them (Trottman et al., 1999; Tschill et al., 1997). The benefits of dental care provided since early childhood are well known in relation to the prevention of dental caries. However, there is a lack of research that studies and points out the possible advantages of this early assistance on the profile of breastfeeding and on its influence on the child's dental occlusion, requiring, therefore, its performance. Thus, the aim of the present study was to analyze the influence of breastfeeding profile on the occlusal characteristics of primary dentition, in two-four year old children who participate and do not participate in an educational-preventive dental program, as well as its influence in these aspects.

2. Methodology

This study was submitted and approved by the Ethics Committee in Local Research (Resolution #01 of 06/13/1998 of the National Health Council) of the School of Dentistry of Araçatuba, São Paulo State University, Brazil (# 89820818.0.0000.5420) in accordance with the Declaration of Helsinki, and following the Council for International Organizations of Medical Sciences (CIOMS) guidelines regarding the use of clinical records for research purposes.

This is a cross-sectional research on the profile of breastfeeding and the occurrence of malocclusions involving 400 children of both genders, aged 27 to 48 months, divided into 2 groups, 200 participants of a preventive dental program, Baby Clinic (BC), and 200 from schools in Araçatuba (Schools), a city in northwest of the state of São Paulo - Brazil with 195 thousand inhabitants, not participating in a preventive dental program. Consent for undertaking the research was obtained from the school's principals, with agreement to perform the examinations coming from the parents or guardians. Only the children from both groups (BC and schools) whose parents or guardians returned the signed permission forms were included in the study. Also, the children participating in the research should present the complete primary dentition without missing teeth and completely filled out questionnaire with no items missed. The exclusion criteria were as follows: children with absence of eruption of a deciduous tooth (delayed eruption or agenesis), dental morphological anomalies, tooth loss due to caries or dental trauma and history of orthodontic treatment.

The clinical evaluation that comprised this research was carried out jointly by two examiners (professor of research and a student). The teacher gave the student theoretical guidance on the index used in a two-hour period. The calibration between both consisted of the clinical evaluation of 20 patients in the same age group of the research, first by the professor and then by the student. After, the Kappa test was performed in relation to the inter and intra examiner evaluation. The Kappa value found in the evaluations for dental occlusion among the examiners was: 0.89. In the intra-examiner analysis, Kappa values were 0.90, which was considered adequate.

Dental occlusion

Children's dental occlusion was assessed using the malocclusion index recommended by WHO (World Health Organization, 1997) and the terminal relationship of the deciduous second molar. The criteria are as follows:

WHO index: Normal: absence of changes in occlusion; Light: when there are one or more teeth with gyroversion or slight crowding or spacing, impairing regular alignment. Posterior crossbite (uni or bi lateral), overbite or vertical overbite above 2mm; Moderate / Severe: when there is an unacceptable effect on facial appearance or a significant reduction in masticatory function or phonetic problems observed by the presence of one or more of the following conditions on the four previous incisors: 1) horizontal maxillary overlap estimated at 9mm or more , positive overjet; 2) mandibular horizontal overlap, anterior crossbite equal or greater than the size of a tooth, negative overjet; 3) open bite; 4) midline deviation estimated at 4mm or more and; 5) crowding or spacing at 4mm or more.

Terminal Molar relationship: The terminal relationship of the upper and lower deciduous second molars on both sides, was recorded in a specific file according to the criteria proposed by Baume in the following conformation (Baume, 1950) : 1) Flush terminal: the distal surfaces of the upper and lower second primary molars are in the same vertical plane in a centric occlusion; 2) Distal step: the distal surfaces of the lower primary second molar are in a posterior relationship to the distal surface of the upper second molars in centric occlusion; 3) Mesial step: the distal surfaces of the lower primary second molar are in an anterior relationship to the distal surface of the upper second molars in centric occlusion.

In the determination of the primary second molar relationship, if one side had a flush terminal plane while the other side had a distal or mesial step, which was noted as a Mixed Step. The parents of BC children were scheduled, via message, phone call or e-mail, to attend the University's Pediatric Dentistry Discipline. In this dental consultation, the research was explained and the Free and Informed Consent term was presented, to authorize the child's participation in the research; the questionnaire on the profile of breastfeeding for mothers was also applied and a clinical evaluation of the child's dental occlusion was performed. For the children of the Schools, the breastfeeding profile questionnaire was sent through their diaries and a date was scheduled for the clinical evaluation of their dental occlusions at the school itself.

Breastfeeding profile

Complementary and exclusive breastfeeding were defined according to WHO (World Health Organization, 2007). To establish the time, type and form of breastfeeding of the children participating in the research, a questionnaire was applied collecting this information and the presence of NNSH (pacifier and finger), as well as whether mothers received information in the prenatal about the importance of breastfeeding and aspects of non-nutritive sucking habits. Age, marital status and maternal education were also questioned. The questionnaire consisted of 12 objective questions. Those questionnaires with no data on breastfeeding were excluded from the analysis.

The data of questionnaire and the clinical exams were recorded in a database created using the Epi Info software, version 7.2.2.6. for Windows. Absolute and relative frequencies were calculated for each variable to describe the sample. The chi-square test was used to analyze the associations between breast-feeding duration, non-nutritive sucking habits and occlusal characteristics, at significance levels of $P < 0.05$. The results were presented in tables and graphs.

3. Results

The predominant age group of the children participating in the research was 37 to 48 months, with 76% of this age group in BC and 71.5% in schools; the overall mean was 41 months. In the mothers of these children, the overall mean age was 30 years during pregnancy, the majority of whom were married (88% in BC and 77% in Schools). As for schooling, 65% of mothers in BC completed higher education, while 46.5% in Schools.

Regarding the act of breastfeeding, a substantial proportion number of the mothers both in BC (90%) and in Schools (84.5%) indicated the willingness and attitude of wanting to breastfeed. A proportion of 52.5% of mothers from BC, reported breastfeeding their children exclusively until 6 months and 23.5% breastfed non-exclusively / complementary until 24 months or more. In Schools, these percentages were 35% and 25%, respectively. This difference between the groups was not statistically significant ($P > 0.05$). We observed a higher percentage of mothers in BC who received prenatal information about the importance of breastfeeding (73.5%). This difference in relation to mothers in the Schools group (49.5%) was statistically significant ($P < 0.05$) [Table1].

Table 1 - Percentage of mothers from Baby Clinic and Schools who breastfed and received information about breastfeeding in prenatal care.

	Breastfeeding mothers	Mothers who did not breastfeed	Received information	Received no information
Baby Clinic	90%	10%	73.5%	26.5%
Schools	84.5%	15.5%	49.5%	50.5%

Source: Authors (2022).

With regard to the breastfeeding period, a similar number was found, however, a little more favorable to children belonging to BC, with an average of exclusive breastfeeding of 4.2 months and non-exclusive of 18 months. In school children the exclusive was 3.5 months and the non-exclusive the average was 13 months.

Regarding artificial breastfeeding, children from both groups use the bottle-fed as the main means to carry it out, with a percentage equal to or greater than 90%, which started in the child's first year of life, where the average onset was around five months in BC and seven and a half months in schools; this difference between the groups (BC and schools) was not statistically significant ($P>0.05$). At the time of the survey, about 80% of these children were still receiving bottle-fed, and only 10.5% and 19%, respectively, belonging to BC and those who did not belong to it, no longer used it.

Regarding NNSH, these were found in more than half of the children evaluated in both groups (BC and schools), and the difference between the groups was not statistically significant ($P>0.05$) [Table 2]. Of these habits, the pacifier was predominant, used by 90% of children, followed by digital sucking (10%). It is noteworthy that in 90% of children the habit started in the first semester of life. On the other hand, considering the length of time of the NNSH, we found in BC that of a total of 130 children with the habit, 56 (43 %) did it beyond three years of age. This data in the Schools was very similar where of 115 children with present habit, 44 (38.3%) kept it beyond three years old.

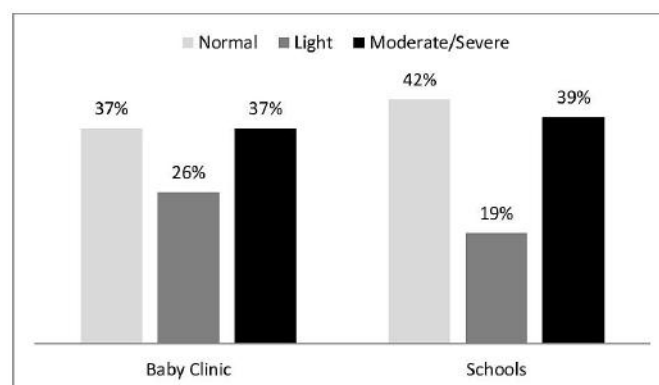
Table 2 - Percentage of children participating in the survey in relation to bottle-fed use and non-nutritive sucking habits.

	Bottle-fed use	No received bottle –fed	Never received bottle -fed	Presented NNSH	Never had NNSH
Baby Clinic	87.5%	10.5%	2%	64.5%	35.5%
Schools	80%	19%	1%	57.5%	42.5%

Source: Authors (2022).

In relation to the occurrence of malocclusion, in Figure 1 there is a total of 63% of children in BC presenting some type of malocclusion, while the occurrence of this in children in Schools was 58%; this difference was not statistically significant ($P>0.05$). The most frequent occlusal alteration in children in both groups was the anterior open bite with 20.5% in BC and 15% in Schools.

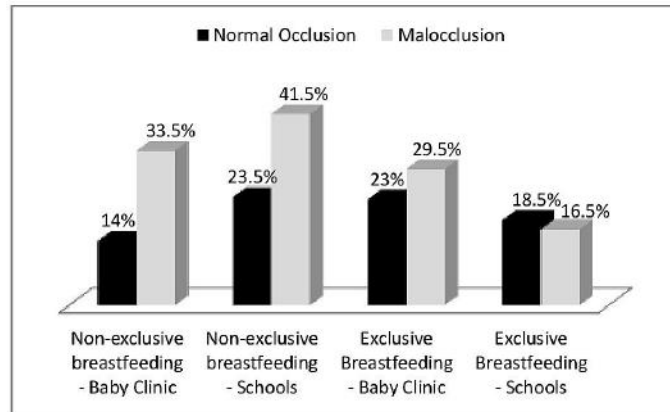
Figure 1 - Percentage of children, from both groups, in relation to the degrees of facial abnormalities.



Source: Authors (2022).

Figure 2 shows the relationship between children, up to six months of age, who received exclusive and non-exclusive breastfeeding and the influence on the occurrence of malocclusion. The difference between the groups was statistically significant in Schools ($P<0.05$) and not statistically significant in Baby Clinic ($P>0.05$).

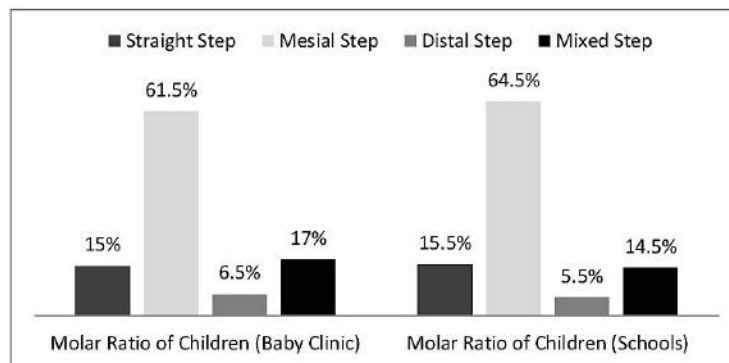
Figure 2 - Percentage of children, from both groups, in relation to exclusive or non-exclusive breastfeeding up to 6 months and the occurrence of malocclusion.



Source: Authors (2022).

Finally, the terminal relationship of the second deciduous molars was verified, with the mesial step being prevalent, both in BC (61.5%) and in Schools (64.5%), as shown in Figure 3.

Figure 3 - Percentage of the types of terminal relationship of the deciduous second molars in the children of Baby Clinic and Schools.



Source: Authors (2022).

4. Discussion

Although the growth and development of the facial bones is strongly associated with genetic factors (Enlow & Hans, 2008), it is also believed that environmental factors such as breastfeeding and oral parafunctional habits also affect facial growth (Legovic & Ostric, 1991). Our results indicated that children who were breastfed up to 6 months had a lower occurrence of malocclusion compared to those who were weaned early, emphasizing the importance of breastfeeding on the preventive role in the occurrence of malocclusions (Sum et al., 2015, Pereira et al., 2021), in addition to providing the infants with all the nutrients they need. These effects are essential for the achievement of many of the newly launched Sustainable Development Goals by 2030, being clearly relevant to the third sustainable goal, which includes maternal and child health (United Nations, 2016).

Of the children evaluated, 63% of the BC group and 58% of the School, presented any type of malocclusion, that is, anomalies regarding bone or dental structures. These results are perhaps due to the duration of exclusive breastfeeding, which was low in the two groups studied, as well as the presence of non-nutritive sucking habits in more than half of the children

(pacifier in 90% of the cases) evaluated in both groups. Regarding the duration of breastfeeding, a meta-analysis study revealed that longer duration of breastfeeding is a protective factor against nonspecific malocclusion, as well as for anterior open bite and posterior cross-bite (Peres et al., 2015). Even so, as verified in our results children in the Schools group that were exclusively breastfed until six months of age, had less malocclusions than those that were not exclusively breastfed until this age. This difference was statistically significant. On the other hand, in the BC group this difference was not statistically significant. The average of exclusive breastfeeding in the present study was below the time recommended by health agencies, which indicate 6 months. This decrease, after 120 days postpartum, which may be related to the woman's return to work, thus making it difficult to maintain exclusive breastfeeding (Haga et al., 2012; Henshaw et al., 2015; Codignole et al., 2021).

These results may support the idea that prolonged breastfeeding has a positive impact on preventing malocclusions, regardless of type. It may be explained by the effect of sucking on the skeletal and muscular development of the child's face. (Pereira et al., 2021). Children who are exclusively breastfed for a longer period are more likely to developing perioral musculature and decrease the risk of malocclusion than those who have early weaning experience (Sánchez-Molins, et al., 2010). The constant repetitive effort promotes the correct development of these muscles. As a result, the duration of natural breast-feeding has a positive effect on orofacial structures (Xiaoxian et al., 2015). Otherwise, early weaning may lead to an insufficient perioral muscular activity, which may cause negative consequences to dental occlusion (Neiva et al., 2009).

There are some intrinsic limitations of cross section study and it was hard to take into consideration of the effect of exclusive breastfeeding until the recommended period of six months as the only determinant for the future establishment of normal occlusion. Other important factors such as the early introduction of the bottle-fed and the occurrence of non-nutritive sucking habits favor dental malocclusions.

Although there was a significant difference in prenatal information received by mothers in the BC group, no significant difference was found in terms of attitudes regarding both breastfeeding habits and the introduction of artificial breastfeeding. It can be thought that this information is nowadays very accessible in different ways and in different spaces for women and not only in medical or dental health environments. The wide access to the media, programs in work environments and even in the schools of the children, can offer information about these feeding practices. It was found that at the time of the research, a high percentage of children were still using, especially the bottle-fed, artificial breastfeeding. It is known that the introduction of the bottle-fed, being easier and feasible at the moment, does not favor the harmonious development of the face structures, in addition to its use allowing the food fullness without however reaching the emotional fullness of the sucking, which may justify the child's need sucking a finger and pacifier to satisfy this deficiency (Xiaoxian et al., 2015, Carvalho et al., 2021).

In our research, another important fact was that in both groups, children over 3 years old (BC 43% and Schools 38.3%) remained with non-nutritive sucking habits. This permanence can be attributed to socio-cultural aspects and they are not always easy to remove, as emotional factors are almost always also involved in the etiological factors. These non-nutritive sucking habits and bottle feeding can lead to the occurrence of serious malocclusions such as open bite, maxillary protrusion, among others (Corrêa-Faria, et al., 2014). It is known, however, that the severity of problems arising from sucking habits also depends on their duration, frequency and intensity, in addition to individual genetic predisposition. Pacifiers and digital suction, from the orthodontic point of view, must deserve the professional attention whenever they last or manifest in children over the age of three to four years, because, according to the literature, the effects of habits existing before that age, undergo a spontaneous correction process in most cases (Feres et al., 2017; Lira et al., 2020).

At the time of eruption of the permanent first molars, their initial occlusion is dependent on the terminal plane relationship of the deciduous second molars. However, it is recognized that the relationship of the terminal faces of the deciduous second molars, who usually go into occlusion at around two and a half years of age, justifying our choice of the age

range evaluated, serves as a guide for the establishment of occlusion of the first permanent molars, and the evaluation in children can provide a prediction of the establishment of occlusion in the permanent dentition (Baume, 1950). A distal step in the primary dentition would reflect a likely skeletal imbalance, which would certainly result in a Class II malocclusion in the permanent dentition. Therefore, the two most common and normal pathways would be from a flush terminal plane to the top-to-top relationship, and subsequently a relationship in occlusion key or mesial step for the engagement of the first permanent molars (Bishara et al., 1988). The predominance, in our research of occurrence of the mesial step, was significant and can be considered a favorable finding, since it evolves more frequently to class I and less frequently to class III and II. The incidence of a Class III molar relationship in the permanent dentition is increased when there is a larger mesial step in the deciduous dentition for example, the incidence is 1% with a 1 mm mesial step and increases to 19% with a mesial step of two mm or more (Bishara et al., 1988).

5. Conclusion

Our results indicated that children who were breastfed up to 6 months had a lower occurrence of malocclusion compared to those who were weaned early. The breastfeeding profile was similar in both groups of children studied, highlighting that the weaning time was low and that the occurrence of malocclusion was high and with a similar percentage. Considering these aspects, there was no influence of children's participation in the Baby Clinic program. The results suggest the need for more accurate motivation measures, as a stimulus for longer duration of breastfeeding.

Considering that the present study was limited to some extent by the fact that many children have non-nutritive sucking habits, other studies should be carried out analyzing the association between breastfeeding and malocclusion of children who do not have habits, highlighting the importance of this topic.

Acknowledgments

The authors would like to thank CAPES (financial code #001) for the financial support.

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