

Original Research

Malocclusion in primary dentition: a cross-sectional study in a Lisbon population



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ARTICLE INFO

Article history:

Received 20 April 2022

Accepted 23 February 2023

Available online 30 March 2023

Keywords:

Behaviors

Deciduous dentition

Malocclusion

Prevalence

ABSTRACT

Objectives: To study the prevalence of malocclusion in deciduous dentition and its associated factors.

Methods: The target population consisted of children between 3 and 5 years old who attended four kindergartens in Alvalade, Lisbon. Data was collected through a questionnaire to parents and an intraoral examination of children. The questionnaire collected sociodemographic and non-nutritive sucking habits information. The intraoral examination collected data about the child's occlusion and dental caries.

Results: The sample included 89 children. The prevalence of malocclusion was 83.9%, and the most prevalent types were crowding (44.8%) and distocclusion (41.4%). Most of the children (68.2%) had non-nutritive sucking habits, of which using a pacifier was the most frequent (81.6%). The habit of using a pacifier after three years of age was reported by 67.8% of the participants. The variables statistically associated with malocclusion ($p < 0.05$) were age, mother's education level, non-nutritive sucking habits, use of pacifiers and thumb sucking, and caries in primary teeth.

Conclusions: The prevalence of malocclusion and non-nutritive sucking habits was high. Early diagnosis and intervention are important to avoid serious malocclusion problems and structural and functional changes. (Rev Port Estomatol Med Dent Cir Maxilofac. 2022;64(1):28-34)

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<http://doi.org/10.24873/j.rpemd.2023.03.1048>

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Má oclusão na dentição decídua: um estudo transversal numa população do concelho de Lisboa

R E S U M O

Palavras-chave:

Comportamentos
Dentição decídua
Má-oclusão
Prevalência

Objetivos: Estudar a prevalência de má oclusão na dentição decídua e os seus fatores associados.

Métodos: A população-alvo foi constituída por crianças com idades compreendidas entre os 3 e os 5 anos que frequentavam quatro jardins de infância de Alvalade/Lisboa. A recolha de dados foi realizada através de um questionário aos pais e de um exame intraoral às crianças. O questionário permitiu a obtenção de informação sociodemográfica e dos hábitos de sucção não-nutritivos. O exame intraoral possibilitou a recolha de dados relativos à oclusão da criança e de cárie dentária.

Resultados: A amostra foi constituída por 89 crianças. Obteve-se uma prevalência de má-oclusão de 83,9%, sendo os tipos mais prevalentes o apinhamento (44,8%) e a distocclusão (41,4%). A maioria das crianças (68,2%) apresentava hábitos de sucção não-nutritivos, sendo o uso de chupeta o mais frequente (81,6%). O hábito de usar chupeta após os três anos verificou-se em 67,8% dos participantes. As variáveis estatisticamente associadas à má oclusão ($p < 0,05$) foram a idade, o nível de instrução da mãe, a presença de hábitos de sucção, o uso de chupeta e chuchar no dedo, e a presença de cárie em dentes decíduos.

Conclusões: A prevalência de má oclusão e de hábitos de sucção não-nutritivos foi elevada. Assim, o diagnóstico e a intervenção precoces são importantes de modo a evitar alterações estruturais e funcionais graves que perdurem. (Rev Port Estomatol Med Dent Cir Maxilofac. 2022;64(1):28-34)

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Introduction

The word “malocclusion” comes from Latin, meaning “bad bite.” It is used to describe teeth that do not fit together properly.¹ Malocclusion is a highly prevalent,² multifactorial condition associated with developmental, genetic, hereditary, and behavioral factors.^{3,4} It negatively impacts the individual’s quality of life, being considered a public health problem.⁵

However, malocclusion is not just a single condition; it encompasses a set of oral conditions that can affect an individual’s oral health. In 1964, Björk et al.⁶ classified malocclusions into dentition anomalies, occlusion anomalies, and spacing conditions. Dentition anomalies include those related to teeth (supernumerary teeth, aplasia, and tooth malformations), eruption (ectopic, hindered, arrested transposition, and persistent deciduous teeth), and tooth alignment (rotated teeth, inversion of incisors, and tipping). Occlusal anomalies are further divided into the following: sagittal, including extreme maxillary overjet, mandibular overjet, distal molar occlusion (distocclusion), and mesial molar occlusion (mesiocclusion); vertical, including frontal open bite, lateral open bite, and frontal deep bite; and transverse, including crossbite and scissors bite. Finally, spacing conditions consist of crowding and spacing (diastema) situations.

Some types of malocclusion have a greater tendency to persist during dentition development and the transition to permanent dentition, such as distocclusion⁷ and mesiocclusion.⁸ On the other hand, other types of malocclusion may undergo spontaneous corrections during the child’s develop-

ment, namely, anterior open bite and posterior crossbite.⁷ Nonetheless, several studies indicate that having a malocclusion in the primary dentition is a determining factor for having it in the permanent dentition, increasing the likelihood of needing orthodontic treatment.⁹⁻¹¹ Studies on the prevalence of malocclusion in Portuguese children populations are scarce but have shown a considerable prevalence of these oral conditions in the primary dentition.^{12,13}

Since malocclusion can be related to some oral behaviors, namely non-nutritive sucking habits,^{14,15} early diagnosis and intervention are essential for its control. Knowing the distribution and factors associated with malocclusion in the primary dentition will help understand the disease at those ages and plan and implement preventive measures. The present study aims to contribute to the knowledge of malocclusion in the Portuguese preschool population’s primary dentition. Its objectives are as follows: 1) To study the prevalence of malocclusion in the primary dentition of a Portuguese population; 2) To characterize non-nutritive sucking habits in the same population; 3) To relate sociodemographic factors, dental caries, and non-nutritive sucking habits with the presence of malocclusion in the primary dentition.

Material and methods

A cross-sectional study was carried out as part of a larger project, which was approved by the ethics committee of the Fac-

ulty of Dental Medicine of the University of Lisbon. The target population consisted of preschool-aged children who attended four kindergartens in Alvalade, Lisbon, during the school year of 2017/2018. The study sample was non-probabilistic and included a private institution, a public institution, and two social solidarity private institutions (IPSSs). All participating institutions authorized the study and data collection on their premises. The study included all children from the selected institutions aged between 3 and 5 years old whose parents or legal guardians gave their consent and who verbally agreed to participate. Children who were under or had undergone orthodontic/orthopedic treatment and those with at least one permanent tooth were excluded.

Data was collected through a questionnaire and an intraoral examination. The questionnaire was developed for the study based on a literature review.^{3,5,7,16} Before its application in the study, the questionnaire was evaluated by a panel of four experts in oral-health epidemiological studies experienced in the study area and was then pre-tested in a few parents of preschool children. The questionnaire was applied to the children's parents or legal guardians and collected sociodemographic data and information on non-nutritive sucking habits.

The intraoral examination included an assessment of occlusal characteristics and diagnosis of malocclusion according to the criteria defined by Björk et al.⁶ for the primary dentition and by the Fédération Dentaire Internationale in 1973, as adapted by Zhou et al.¹⁶ The occlusal evaluation was performed in the position of maximum intercuspation, and measurements were performed with an accuracy within 0.5 mm using a graduated periodontal probe. Based on the occlusal measurements, malocclusion was classified as sagittal (mesioocclusion, edge-to-edge, or distocclusion) or vertical (deep overbite or open bite). Transverse malocclusions were evaluated and classified into posterior crossbite, posterior scissors bite, and crowding. Finally, dental caries were assessed according to the International Caries Detection and Assessment System II (ICDAS II).¹⁷ All intraoral examinations were conducted by the same trained investigator (dentist) in the kindergarten facilities using natural and artificial lighting, a periodontal probe, and an intraoral mirror.

Statistical analysis was performed using SPSS – Statistical Package for Social Sciences, version 25 (IBM Corp., 2017). It included descriptive statistics and inferential analysis using the chi-squared test ($\alpha=0.05$). Malocclusion prevalence estimation considered all children with at least one of the situations described above. When a study participant had information missing due to an unanswered question or the impossibility of performing the corresponding procedures, the remaining variables collected were still considered for the statistical analysis. Thus, the “n” may differ between the collected variables.

Results

The sample included 89 children (Figure 1), corresponding to a participation rate of 75.4%. Table 1 shows the sample's distribution by sociodemographic variables, dental caries, and non-nutritive sucking habits. Non-nutritive sucking habits

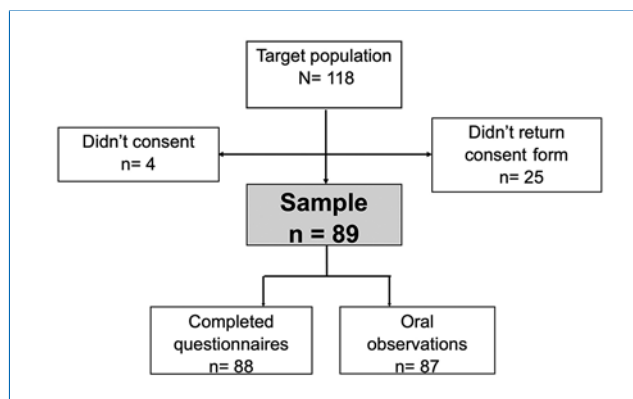


Figure 1. Study population and sample.

Table 1. Distribution of the sample by sociodemographic variables and non-nutritive sucking habits.

	n	%
Sex (n=89)		
Feminine	48	53.9
Masculine	41	46.1
Age (n=89)		
3 years	38	42.7
4 years	37	41.6
5 years	14	15.7
Mother's education level (n=85)		
Not superior	17	20.0
Superior	68	80.0
Type of Kindergarten (n=89)		
Public	26	29.2
Private	11	12.4
Social solidarity private institutions (IPSS)	52	58.4
Caries in the primary dentition (n=87)		
No	77	89.5
Yes	10	11.5
Non-nutritive sucking habit (n=88)		
No	28	31.8
Yes	60	68.2
Pacifier use after the age of 3 (n=87)		
No	16	18.4
Yes	71	81.6
Thumb-sucking (n=87)		
No	77	89.5
Yes	10	11.5

were somewhat frequent, with 68.2% of children having at least one.

Malocclusion prevalence in the primary dentition was 83.9% (n=73). The most frequent type of malocclusion was crowding, followed by distocclusion. No cases of edge-to-edge or posterior scissors bites were observed (Figure 2). The mean overbite was 1.7 mm (sd=2.5), and the mean overjet was 2.9 mm (sd=2.1).

Table 2 relates the types of malocclusion with sociodemographic factors, dental caries, and non-nutritive sucking hab-

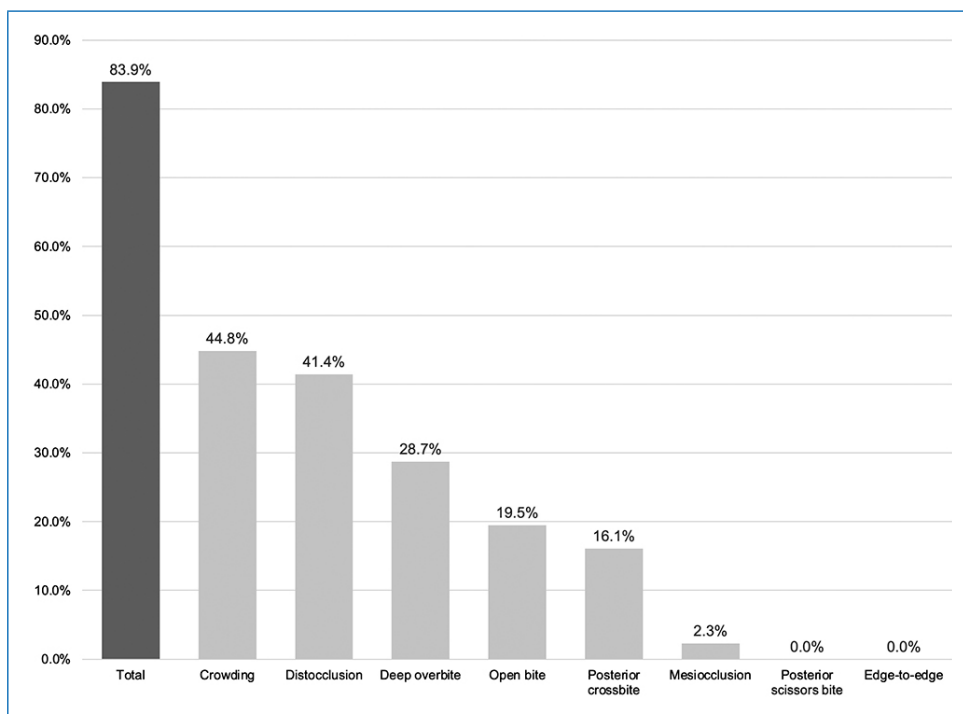


Figure 2. Prevalence of malocclusion (total and by type) (n=87).

	MO		DO		PCB		Cr		OpB		DOvB		Total	
	%	p	%	p	%	p	%	p	%	p	%	p	%	p
Sex														
Feminine	2.2		41.3		15.2		43.5		19.6		28.3		82.6	
Masculine	2.4	1.0	41.5	1.0	17.1	1.0	46.3	0.8	19.5	1.0	29.3	1.0	85.4	0.8
Age														
3 years	0.0		59.5		24.3		51.4		24.3		21.6		94.6	
4 years	5.6	0.2	36.1	0.002	13.9	0.1	44.4	0.4	19.4	0.4	41.7	0.07	86.1	<0.001
5 years	0.0		7.1		0.0		28.6		7.1		14.3		50.1	
Mother's education level														
Not superior	0.0		25.0		6.3		18.8	0.01	6.3		37.5		75.0	
Superior	1.5		44.8	0.2	19.4	0.3	53.7		22.4	0.2	26.9	0.5	86.6	0.5
Type of kindergarten														
Public	7.7		23.1		7.7		26.9		15.4		38.5		73.1	
IPSS	0.0	0.1	48.0	0.08	18.0	0.3	54.0	0.08	22.0	0.9	22.0	0.3	86.0	0.1
Private	0.0		54.5		27.3		45.5		18.2		36.4		100.0	
Caries in primary dentition														
No	2.6		45.5	0.04	16.9	0.7	45.5	1.0	20.8	0.7	29.9	0.7	84.4	1.0
yes	0.0	1.0	10.0		10.0		40.0		10.0		20.0		80.0	
Non-nutritive sucking habits														
No	3.7		33.3	0.3	14.8	1.0	48.1	0.8	3.7	0.02	44.4	0.04	85.2	1.0
Yes	1.7	1.0	45.8		16.9		44.1		27.1		22.0		84.7	
Pacifier use after 3 years old														
No	1.7		32.8	0.01	15.5	0.8	43.1	0.5	5.2	0.001	36.2	0.02	79.3	0.05
Yes	3.7		63.0		18.5		51.9		51.9		11.1		96.3	
Thumb-sucking														
No	1.3		42.7		14.7		49.3		16.0		32.0		85.3	
Yes	10.0	0.2	40.0	1.0	30.0	0.4	20.0	0.1	50.0	0.02	0.0	0.06	80.0	1.0

MO – mesiocclusion; DO – distocclusion; PCB – posterior crossbite; Cr – crowding; OpB – open bite; DOvB – deep overbite; IPSS – social solidarity private institutions. p values indicated in bold have statistically significant differences (p<0.05).

its. Statistically significant associations were found between age and the presence of distocclusion ($p=0.002$) and malocclusion ($p<0.001$). A higher mother's level of education was associated with a higher percentage of crowding ($p=0.01$). Caries were most frequent in children with distocclusion ($p=0.04$). Pacifier use after the age of three was more frequently associated with distocclusion ($p=0.01$) and open bite ($p=0.001$) and inversely related to deep overbite ($p=0.02$). The thumb-sucking habit was associated with open bite ($p=0.02$).

Discussion

Malocclusion is a worldwide public health problem and, for this reason, has been widely studied over the years.^{2-4,9,11,18} Most of the studies include permanent or mixed dentitions, and the studies on primary dentition usually focus on the repercussions of oral health-related behaviors in one particular kind of malocclusion. Some situations of malocclusion in the primary dentition spontaneously regress with the transition to the permanent dentition,⁷ but others remain, requiring therapeutic intervention. Thus, early detection and intervention in harmful behaviors are extremely important for preventing severe situations.

In the present study, "malocclusion" was defined as the presence of at least one type of malocclusion, which resulted in a very high prevalence (83.9%). The literature also reports generally high malocclusion prevalence values in the primary dentition, varying between a minimum of 53% and a maximum of 81.4%.^{7,13,16,19,20} This wide range may be related to different criteria used to classify malocclusion and to the influence of environmental factors and different cultural and behavioral patterns of the studied populations.

The literature reports the anterior open bite as the most frequent type of malocclusion.^{3,21} Contrarily, the most frequent type of malocclusion in the present study was crowding (44.8%), followed by distocclusion (41.4%) and deep overbite (28.7%). A similar study also reported crowding as the most frequent type of malocclusion, with a prevalence of 23%.¹⁸ Another study²² observed an 11.1% prevalence of crowding in the primary dentition in one or both dental arches but stated that crowding in this dentition does not determine malocclusion, contrary to crowding in a mixed or permanent dentition.

Regarding distocclusion, it was highly frequent in some studies^{16,18,20} and rarely found in others.^{23,24} In turn, the literature reveals a high prevalence of deep overbite.^{13,3}

In the present study, older children generally showed a lower prevalence of malocclusion, with decreasing values from three to four years old and, with greater relevance, from four to five years old. This result agrees with the reported self-correcting tendency of some types of malocclusion.²⁵ This natural correction may be associated with correcting behaviors such as pacifier use and other non-nutritive sucking habits. A study found that after removing the pacifier habit in 4-year-old children, the frequency of malocclusion and changes in breathing and speech decreased significantly.¹⁵ Healthcare professionals who follow preschool-aged children should consider this natural correction while bearing in mind that early intervention in these habits is essential.

Campos et al.²⁶ did not find a statistically significant association between malocclusion and the mother's level of education. The present study only found this association in crowding, with a higher prevalence of crowding among children whose mothers had a higher education level. The mother's educational level is most likely a confounding variable since there seems to be no biological or physiological explanation for this relationship. On the other hand, the relation between malocclusion prevalence in the primary dentition and socioeconomic factors has dissimilar results in the literature.²⁷ Some studies found no association between these variables,²⁸ others found a higher prevalence of malocclusion in the most disadvantaged socioeconomic levels,²⁹ and others an inverse association.¹⁹ The differences between these studies' results can be explained by several factors, such as methodological differences or cultural characteristics of the populations studied.

The present study found a significant association between the presence of dental caries and distocclusion. A study in Chinese children¹⁶ and another in Tanzania also described this significant association.³⁰

Non-nutritive sucking habits were frequent in this study. According to Tomita,²⁵ using a pacifier after three years of age becomes a childish regression behavior with the potential to generate occlusion anomalies. Anterior open bite and posterior crossbite are the types of malocclusion most commonly associated with prolonged oral habits.¹⁸ In the present study, there was an influence of non-nutritive sucking habits on children's occlusion, indicating that these habits were directly associated with the presence of anterior open bite and, on the other hand, indirectly associated with the presence of deep overbite. Other authors also found an association between non-nutritive sucking habits, such as using pacifiers or digital or object sucking, and the presence of some form of malocclusion.^{3,4,25,26}

Although oral habits can convey a sense of security and comfort, an early diagnosis and timely correction of these harmful habits are important to prevent them from significantly impacting occlusion, thus causing more serious and costly situations and decreasing the child's quality of life. Therefore, early implementation of oral-health promotion measures is essential, ideally in the final period of pregnancy and during the first year of life. Healthcare professionals who care for children of these ages, namely family doctors, pediatricians, nurses, oral hygienists, and dentists, should be involved in promoting and educating the parents. In cases where non-nutritive sucking habits persist after four years of age, the protocol proposed by Shah et al.³¹ could be applied, including psychological therapies, non-orthodontic interventions, and, in more severe cases, orthodontic interventions.

The present study has some limitations regarding the sample's characteristics and small size. However, given the scarce data on malocclusion in the primary dentition in the Portuguese population, this study contributes to the knowledge of malocclusion prevalence and its associated factors. More studies are needed in larger and more representative populations, where other factors possibly associated with malocclusion in the primary dentition can be studied.

Conclusions

The prevalence of malocclusion in the primary dentition was high, with the most common type of malocclusion being crowding, followed by distocclusion and deep overbite. The child's age and the mother's education level were associated with the presence of malocclusion, with a trend to decrease as age increases and the mother's level of education decreases. In general, non-nutritive sucking habits revealed a direct association with a higher prevalence of malocclusion.

Conflict of interest

The authors have no conflicts of interest to declare.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed their work center protocols on access to patient data and for its publication.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Carolina Pimenta: Validation, Formal analysis, Data curation, Writing – original draft. **Carina Esperancinha:** Conceptualization, Methodology, Validation, Resources, Data curation, Investigation, Writing – review & editing. **Sônia Mendes:** Conceptualization, Methodology, Validation, Supervision, Writing – review & editing. **Mário Bernardo:** Conceptualization, Methodology, Validation, Supervision, Writing – review & editing.

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REFERENCES

- American Association of Orthodontists. AAO Glossary of Orthodontic Terms. Available from: <https://aaoinfo.org/resources/glossary-of-orthodontic-terms/> Accessed 22 February, 2023.
- Dhar V, Jain A, Van-Dyke TE, Kohli A. Prevalence of gingival diseases, malocclusion and fluorosis in school-going children of rural areas in Udaipur district. *J Indian Soc Pedod Prev Dent.* 2007;25:103-5.
- Heimer MV, Katz CR, Rosenblatt A. Non-nutritive sucking habits, dental malocclusions, and facial morphology in Brazilian children: a longitudinal study. *Eur J Orthod.* 2008;30:580-5.
- Macho V, Andrade D, Areias C, Norton A, Coelho A, Macedo P. Prevalência de hábitos orais deletérios e de anomalias oclusais numa população dos 3 aos 13 anos. *Rev Port Estomatol Med Dent Cir Maxilofac.* 2012;53:143-7.
- Moreira AF, Pinto LS, Pinto KVA, Côrreia PG, Jeziorski SAZ, Velasque KS, et al. Impacto da má oclusão na dentição decídua e permanente na qualidade de vida de crianças e adolescentes: revisão de literatura. *Rev Bras Odontol.* 2015;72:70-5.
- Björk A, Krebs A, Solow B. A method for epidemiological registration of malocclusion. *Acta Odontol Scand.* 1964;22:27-41.
- Dimberg L, Lennartsson B, Söderfeldt B, Bondemark L. Malocclusions in children at 3 and 7 years of age: a longitudinal study. *Eur J Orthod.* 2013; 35:131-137.
- Antonini A, Marinelli A, Baroni G, Franchi L, Defraia E. Class II Malocclusion with Maxillary Protrusion from the Deciduous Through the Mixed Dentition: A Longitudinal Study. *Angle Orthod.* 2005;75:980-6.
- Bishara SE, Khadivi P, Jakobsen JR. Changes in tooth size-arch length relationships from the deciduous to the permanent dentition: a longitudinal study. *Am J Orthod Dentofacial Orthop.* 1995;108:607-13.
- Onyeaso CO, Isiekwe MC. Occlusal changes from primary to mixed dentitions in Nigerian children. *Angle Orthod.* 2008;78:64-9.
- Peres KG, Peres MA, Thomson WM, Broadbent J, Hallal PC, Menezes AB. Deciduous-dentition malocclusion predicts orthodontic treatment needs later: findings from a population-based birth cohort study. *Am J Orthod Dentofacial Orthop.* 2015;147:492-8.
- Silva MJ, Ferreira AC, Silva CS, Teixeira ME, Valente CA. O estado de saúde oral de crianças em idade pré-escolar e escolar de uma área urbana. *Nascer e Crescer.* 2009;18:78-84.
- Gafaniz IL. Prevalência de maloclusão em dentição decídua em crianças dos 3 aos 6 anos. Dissertação de Mestrado. Almadá: Instituto Superior de Ciências da Saúde Egas Moniz, 2015.
- Moraes RB, Knorst JK, Pfeifer ABR, Vargas-Ferreira F, Ardenghi TM. Pathways to anterior open bite after changing of pacifier sucking habit in preschool children: A cohort study. *Int J Paediatr Dent.* 2021;31:278-84.
- Sommarino S, Possobon RF, Boni RC, et al. Multidisciplinary Evaluation of Pacifier Removal on Oro-Dentofacial Structures: A Controlled Clinical Trial. *Front Pediatr.* 2021;9:703695.
- Zhou Z, Liu F, Shen S, Shang L, Wang X. Prevalence of and factors affecting malocclusion in primary dentition among children in Xi'an, China. *BMC Oral Health.* 2016;16:91.
- Topping GVA, Pitts NB. Clinical visual caries detection. *Monogr Oral Sci.* 2009;21:15-41.
- Massuia JM. Prevalência e fatores associados à má oclusão na dentição decídua em crianças de Pedra Preta, MT. Dissertação para obtenção do Título de Mestre em Saúde Coletiva. Londrina: Universidade Estadual de Londrina, 2010.
- Normando TS, Barroso RF, Normando D. Influence of the socioeconomic status on the prevalence of malocclusion in the primary dentition. *Dental Press J Orthod.* 2015;20:74-8.
- Costa-Nobre. Prevalência e fatores associados à má oclusão na dentição decídua: SB Brasil 2010. Dissertação de Mestrado. Piracicaba: Faculdade de Odontologia de Piracicaba da Universidade Estadual de Campinas, 2017.
- Chevitarese AB, Della Valle D, Moreira TC. Prevalence of malocclusion in 4-6 year old Brazilian children. *J Clin Pediatr Dent.* 2002;27:81-5.
- Silva Filho OG, Rego MV, Silva PR, Silva FP, Ozawa T. Relação intra-arco na dentadura decídua normal: diastemas,

- ausência de diastemas e apinhamento. *J Bras Ortodon Ortop Facial*. 2002;7:501-9.
23. Ferreira RI, Barreira AK, Soares CD, Alves AC. Prevalência de características da oclusão normal na dentição decídua. *Pesqui Odontol Bras*. 2001;15:23-8.
 24. Kataoka DY, Scavone Jr H, Vellini-Ferreira F, Cotrim-Ferreira FA, Sato V. Estudo do relacionamento ântero-posterior entre os arcos dentários decíduos, de crianças nipo-brasileiras, dos dois aos seis anos de idade. *Rev Dent Press Ortodon Ortop Facial*. 2006;11:83-92.
 25. Tomita NE, Bijella VT, Franco LJ. Relação entre hábitos bucais e má oclusão em pré-escolares. *Rev Saúde Pública*. 2000;34:299-303.
 26. Campos FL, Vazquez FL, Cortellazzi KL, Guerra LM, Ambrosano GMB, Meneghim MC, *et al*. A má oclusão e sua associação com variáveis socioeconômicas, hábitos e cuidados em crianças de cinco anos de idade. *Rev Odontol UNESP*. 2013;42:160-6.
 27. Elhiny OA, Yazid MA, Radwan E. The relationship between socioeconomic class and malocclusion or poor oral health, and the quality of life. A review. *Curr Sci Int*. 2019;8:535-9.
 28. Sousa RV, Pinto-Monteiro AK, Martins CC, Granville-Garcia AF, Paiva SM. Malocclusion and socioeconomic indicators in primary dentition. *Braz Oral Res*. 2014;28:54-60.
 29. Machado JIAG, Andrade NS, Silva RNC, Rego MVNN, MouraLFAD, MouraWL, *et al*. Is low income associated with malocclusion in primary dentition among preschoolers?. *Pesqui Bras Odontopediatria Clín Integr*. 2020;20:e4923.
 30. Mtaya M, Brudvik P, Astrøm AN. Prevalence of malocclusion and its relationship with sociodemographic factors, dental caries, and oral hygiene in 12- to 14-year-old Tanzanian schoolchildren. *Eur J Orthod*. 2009;31:467-76.
 31. Shah R, Ashley P, Amlani M, Noar J. Non-nutritive sucking habits in a child: A clinical protocol to their prevention and management. *J Orthod*. 2021;48:410-6.