

Parafunctional oral habits and primary dentition characteristics in a group of preschool children from Tlaquepaque, Jalisco, Mexico.

Hábitos orales parafuncionales y características de la dentición primaria en un grupo de preescolares de Tlaquepaque, Jalisco, México.

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Abstract: The aim of this study was to evaluate the relationship between some characteristics of primary dentition, and the frequency of parafunctional oral habits, with age and sex. **Material and Methods:** A cross-sectional study was carried out in a sample of 227 preschool children. Subjects' parents or guardians were asked to sign an informed consent form. The epidemiological survey consisted of an oral examination and the application of a questionnaire (Cronbach's alpha=0.881), after calibration of a dentist (Kappa=0.932). To measure the reliability of the questionnaire, Cronbach's alpha was calculated, and for the associations, Mantel and Haenszel Square Chi-square test and likelihood ratio for contingency tables greater than 2x2 values were calculated. **Results:** Type 2 arch (72.7%), mouth breathing (26.0%) and onychophagia (17.2%) were the risk factors observed more frequently in the group under study. The type of arch was the only variable that was associated with sex ($X^2_{MH}=4.443$, $p=0.035$). **Conclusion:** A significant proportion of the subjects had at least one risk factor that may alter the development of dental occlusion; consequently, the implementation of preventive actions in this population must be considered.

Keywords: Parafunctional oral habits; child, preschool; dentition, primary; cross-sectional studies.

Resumen: Objetivo. Evaluar algunas características de la dentición primaria, así como la frecuencia de hábitos orales parafuncionales y su asociación con la edad y el sexo. **Material y Métodos:** Se llevó a cabo un estudio transversal en una muestra de 227 preescolares bajo autorización expresa de sus padres. La encuesta epidemiológica estuvo conformada por el examen bucal y la aplicación de un cuestionario (alfa de Cronbach=0,881), previa estandarización de una Cirujana Dentista (Kappa=0,932). Para medir la fiabilidad del cuestionario se calculó el valor del alfa de Cronbach y para las asociaciones la Chi cuadrada de Mantel y Haenszel y el valor de Razón de verosimilitud para tablas de contingencia mayores de 2X2. **Resultados.** La arcada tipo 2 (72,7%), la respiración bucal (26,0%) y la onicofagia (17,2%) fueron los factores de riesgo que fueron observados con mayor frecuencia en los niños. El tipo de arcada fue la única variable que estuvo asociada con el sexo ($X^2_{MH}=4,443$, $p=0,035$). **Conclusiones.** Una proporción alta de los niños encuestados presentó al menos un factor de riesgo para alterar el desarrollo de la oclusión dental, razón por la cual debe considerarse la necesidad de aplicar acciones de carácter preventivo en esta población.

Palabras Clave: Hábitos orales parafuncionales; preescolar; dentición primaria; estudios transversales.

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INTRODUCTION.

Background

Primary dentition is characterized by very specific traits, such as the type of terminal plane, canine class, primate spaces and the type of arch, which play a specific role in the development of occlusion of secondary dentition.¹⁻² During this process some parafunctional oral habits may play a role and generate unfavorable conditions for the development of occlusion depending on the strength, intensity, frequency and length of habit exposure.²⁻⁵

Characteristics of primary dentition

Primate spaces are particularly important to the change of dentition, since they help to compensate for the size difference between deciduous and permanent dentition. Additionally, they facilitate the placement of the teeth in the normal occlusion position. The mesial step and a straight terminal plane lead towards an Angle Class I occlusion, while the distal step will predispose to a Class II malocclusion, and the exaggerated mesial step will lead to a Class III malocclusion. The type of arch, according to the criteria proposed by Baume, is characterized by the presence or absence of primate and physiological spaces, thus, the type 1 arch, which presents this type of space, favors the development of a normal occlusion, while type 2 constitutes a risk factor of great importance for the development of any type of dental malocclusion because it has no space, that is, its clinical evidence is characterized by a closed arch.^{1-3,5-10}

Parafunctional oral habits

Parafunctional oral habits are one of the main causes of alterations observed in teeth and in the orofacial musculature. In addition, they play a role in some basic physiological processes such as breathing, chewing and swallowing. They can also affect the normal craniofacial and alveolar development, altering bone growth patterns, causing anterior open bite or dental protrusions, dentoalveolar protrusion and alterations in the eruption of one or more teeth. They may also cause dentoskeletal deformities, whose severity will depend on their frequency, intensity and recurrence. Parafunctional oral habits exert damaging stress in the teeth, muscles, bones and dental arches. The etiology of these habits is diverse, however, their onset and development related to a large extent to the conditions the child may be subjected

to, such as stress, frustration, exhaustion or anger, lack of parental care, domestic violence and by alterations in the emotional maturation process of the child.¹⁰⁻¹⁷

Epidemiological profile

The frequency at which the different types of terminal planes occur is highly variable, such is the case of the mesial and straight terminal plane, whose prevalence ranges from 13.1% to 74.4%, as reported by Cruz-Martínez *et al.*,¹ and Solarte.⁵ Likewise, the most frequent type of arch is type 1, ranging from 56.0% to 75.1%, without any association with sex as a variable, even though it has been observed more frequently in women.⁶⁻⁷ The prevalence of parafunctional habits is also highly variable,¹³⁻³⁰ from 5.1/100 to 86.6/100 in Spanish and Cuban children, respectively.^{4,15} Distribution by sex shows that it tends to occur more frequently in females; however, some authors have reported that the observed differences are not statistically significant, so it may occur irrespective of sex. Finger suction, object biting, nail biting (oronychophagia) and the use of pacifiers are the most frequent parafunctional habits in this population compared to cheilophagia, lip sucking and lingual protraction. Nevertheless, in the last decades, an increase in the prevalence of these habits has been observed,¹¹⁻¹⁹ since more than 18% of children under 6 years of age can present some.¹⁶ According to sex, the probability of developing these habits has changed: currently, prevalence ratios between girls and boys range from 1.7:1 to 2.2:1, even though, the differences are not statistically significant.^{12,20,23}

The aim of this study was to evaluate the frequency and distribution of parafunctional oral habits, and their association with age and sex.

MATERIALS AND METHODS.

Study design and participants

A cross-sectional descriptive study was carried out in a convenience sample of 227 children between 4 and 5 years of age, both sexes, enrolled in two preschool centers of the municipality of Tlaquepaque, Jalisco, Mexico. Twenty-five preschoolers were excluded from the study because their parents did not authorize their inclusion, or were not present on the day of the epidemiological survey, or because the preschool child refused oral examination.

Ethical and legal considerations

The study was approved by the Bioethics and Biosafety Committee of the Occlusion Dental Research Group (LIFESZ-230506), member of the Zaragoza School of Higher Studies, of the National Autonomous University of Mexico. The preschoolers' parents or guardians were asked to sign an informed consent form. The provisions of the technical standard of the Ministry of Health of Mexico (NOM013-SSA2-200635) were applied for the calibration of the examiner and the epidemiological survey, which comply with the regulations for infectious disease transmission prevention.

Calibration of the examiner

The calibration of a dentist was carried out through the direct method, measured through the calculation of absolute and relative concordances. Likewise the value of the Cohen's Kappa coefficient statistic was calculated in order to verify that these concordances were not due to chance (terminal plane Kappa=0.888, $p=0.001$, arch type Kappa=0.951, $p=0.001$, digital suction Kappa=0.841, $p=0.001$, mouth breathing Kappa=0.844, $p=0.001$, onychophagia Kappa=0.999, $p=0.001$, bruxism Kappa=0.991, $p=0.001$, atypical swallowing Kappa=0.993, $p=0.001$, pacifier use Kappa=0.994, $p=0.001$ and lip sucking Kappa=0.998, $p=0.001$).

The data collection instruments used were an epidemiological record for clinical assessment and a questionnaire that was applied to parents, whose reliability showed a Cronbach's alpha of 0.881, which proved to be a fairly homogeneous instrument in relation with its objective.

Resources

Oral examination of the preschool children was performed in a classroom during school hours by a dentist using a white LED front light (XM-L, T6-4, LED 5200LM, Cree®, USA.), disposable gloves, and a Hu-Friedy® #5 flat dental mirror without magnification. Each of the parents or guardians was given a questionnaire with a series of questions to confirm the presence of parafunctional habits of interest for the study.

Variables and clinical assessment

The parafunctional oral habits studied in the sample of preschool children were: finger sucking, lip sucking, use of pacifier or baby bottle, onychophagia, tongue-biting,

lip-biting, object-biting and mouth breathing, and their distribution by age and sex. The clinical examination was carried out in two stages: the extraoral examination, which included examination of the fingers to check for cleanliness and the presence of calluses; of the lips, to see if the upper lip covered two thirds of the incisors, if the lip closure was smooth without forcing the lower lip, if the lower lip was altered in relation to the upper one, and if it presented irritation of the skin near the lower lip; of the nose, to identify the shape of the nasal fins and observe the sealing of the lips during breathing; of the nails and cuticles of the fingers, to observe wear or bite signs, as well as possible inflammation or infection; and finally of the buccinator, orbicularis, and mentalis muscles, to determine their size and tone. The intraoral examination included the assessment of the type of step formed by the distal faces of the primary second molars and the type of arch, based on the criteria established by Baume. It also included the exploration of the position of the tongue at rest in order to identify if it had marks or scars, and the shape of the palate. The exploration of the upper incisors aimed to identify wear, fractures, diastemas and protrusion, if the lower incisors were lingualized and if they showed wear or fractures. For bruxism, an intraoral and extraoral clinical examination was performed to evaluate the presence of dental abrasion, tooth sensitivity, facial pain, hypertonicity and muscle pain, history or presence of mandibular subluxation and any history of headaches. It was considered positive when there was evidence of at least three of the signs and symptoms described above, in addition to the presence of dental abrasion, that is, when the wear of polished surfaces coincided with those of the opposite tooth at the time of the clinical examination.

Statistical methods

The statistical software SPSS version 20.0 (IBM, USA) was used for the statistical analysis. To measure the presence of parafunctional oral habits, frequencies and rates were calculated. To measure the reliability of the questionnaire, the value of Cronbach's alpha was calculated. In order to determine the association between each habit with age and sex, the Chi square value of Mantel and Haenszel was calculated because the variables were nominally measured and the data was

presented in theoretical tables; except for the analysis of the association between type of terminal plane with age and sex, as in this case Pearson's Chi square value was calculated. If the values observed in any of the cells were equal to or less than five the likelihood ratio value was also calculated. In all cases, a confidence level of 95% was considered. The tables were developed in Microsoft® Excel version 365.

Table 1. Composition of the study sample by age and sex.

		Boys		Girls		Total	
		f	%	f	%	f	%
Age	4 years	42	18.5	49	21.6	91	40.1
	5 years	73	32.2	63	27.8	136	59.9
Total		115	50.7	112	49.3	227	100.0

f: frequency.

Table 2. Percentage distribution of the behavior of parafunctional habits in the study sample.

		Frequency	Percentage
Atypical swallowing	Present	16	7.0
	Absent	211	93.0
Mouth breathing	Present	59	26.0
	Absent	168	74.0
Finger sucking	Present	5	2.2
	Absent	222	97.8
Use of pacifier/baby bottle	Present	1	0.4
	Absent	226	99.6
Onychophagia	Present	39	17.2
	Absent	188	82.8
Bruxism	Present	12	5.3
	Absent	215	94.7
Lip sucking	Present	3	1.3
	Absent	224	98.7
Total		227	100.0

Table 3. Percentage distribution of the type of arch, according to Baume's classification by age and sex.

	Type 1		Type 2	
	f	%	f	%
4 years	25	11.0	66	29.1
5 years	37	16.3	99	43.6
Both	62	27.3	165	72.7
p=0.914				
Boys	39	17.2	76	33.5
Girls	23	10.1	89	39.2
Both	62	27.3	165	72.7
p=0.035*				

f: frequency. * Statistically significant.

Table 4. Percentage distribution of terminal planes according to Baume's classification by age and sex.

	Terminal plane									
	Straight		Mesial		Distal		Mesial-exaggerated		Mixed	
	f	%	f	%	f	%	f	%	f	%
4 years	48	21.1	25	11.0	4	1.8	8	3.5	6	2.6
5 years	56	24.7	50	22.0	9	4.0	14	6.2	7	3.1
Both	104	45.8	75	33.0	13	5.7	22	9.7	13	5.7
										p=0.428
Boys	53	23.3	41	18.1	8	3.5	6	2.6	7	3.1
Girls	51	22.5	34	15.0	5	2.2	16	7.0	6	2.6
Both	104	45.8	75	33.0	13	5.7	22	9.7	13	5.7
										p=0.189

f: frequency.

Table 5. Percentage distribution of parafunctional habits in the study sample by age.

		Absent		Present	
		f	%	f	%
Atypical swallowing	4 years	83	36.6	8	3.5
	5 years	128	56.4	8	3.5
	Both	211	93.0	16	7.0
					p=0.566
Mouth breathing	4 years	64	28.2	27	11.9
	5 years	104	45.8	32	14.1
	Both	168	74.0	59	26.0
					p=0.380
Finger sucking	4 years	88	38.8	3	1.3
	5 years	134	59.0	2	0.9
	Both	222	97.8	5	2.2
					p=0.648
Use of pacifier	4 years	91	40.1	0	0.0
	5 years	135	59.5	1	0.4
	Both	226	99.6	1	0.4
					p=0.840
Onychophagia	4 years	77	33.9	14	6.2
	5 years	111	48.9	25	11.0
	Both	188	82.8	39	17.2
					p=0.684
Bruxism	4 years	87	38.3	4	1.8
	5 years	128	56.4	8	3.5
	Both	215	94.7	12	5.3
					p=0.851
Lip sucking	4 years	90	39.6	1	0.4
	5 years	134	59.0	2	0.9
	Both	224	98.7	3	1.3
					p=0.725

f: frequency.

Table 6. Percentage distribution of parafunctional habits in the study sample by sex.

		Absent		Present	
		f	%	f	%
Atypical swallowing	Boys	108	47.6	7	3.0
	Girls	103	45.4	9	4.0
	Both	211	93.0	16	7.0
p=0.754					
Mouth breathing	Boys	89	39.2	26	11.5
	Girls	179	34.8	33	14.5
	Both	168	74.0	59	26.0
p=0.306					
Finger sucking	Boys	113	49.8	2	0.9
	Girls	109	48.0	3	1.3
	Both	222	97.8	5	2.2
p=0.976					
Use of pacifier	Boys	114	50.2	1	0.4
	Girls	112	49.3	0	0.0
	Both	226	99.6	1	0.4
p=0.989					
Onychophagia	Boys	99	43.6	16	7.1
	Girls	89	39.2	23	10.1
	Both	188	82.8	39	17.2
p=0.253					
Bruxism	Boys	108	47.6	7	3.1
	Girls	107	47.1	5	2.2
	Both	215	94.7	12	5.3
p=0.803					
Lip sucking	Boys	114	50.2	1	0.4
	Girls	110	48.5	2	0.9
	Both	224	98.7	3	1.3
p=0.982					

f: frequency.

RESULTS.

A total of 227 children between 4 and 5 years old, of both sexes, enrolled in preschool education centers of the Municipality of Tlaquepaque, Jalisco, Mexico, were examined. The composition by sex showed a similar distribution of boys and girls, although not of age, since the category of 5 years olds had a greater representation compared to the 4 year-old category at a rate of 1.5:1. (Table 1)

The presence of a risk factor was observed in at least 78.9% of the study sample, and it may negatively influence the development of occlusion. Of these factors,

21.1% showed distal terminal planes, exaggerated or mixed mesial, 72.7% arch type 2, and 73.8% at least one parafunctional oral habit, with mouth breathing (26.0%) and onychophagia (17.2%) the most frequent. (Table 2)

By age, type 2 arch was the most frequent (72.7%), with a greater number of cases being observed in the 5-year-old group (43.6%), with no association between this variable and age (likelihood ratio=3.839, $p=0.428$) (Table 3). In relation to the terminal planes, mesial and straight were the most frequent (33.0% and 45.8%, respectively), with also a greater number of cases in the

5-year-old group (46.7%): no type of association was observed between the distribution of terminal planes with age (likelihood ratio=3.839, $p=0.428$). (Table 4).

The distribution of cases of parafunctional oral habits by age was found to be greater in the 5 year-old group, with mouth breathing and onychophagia the most frequent at 14.1% and 11.0%, respectively. No association was observed between any of the parafunctional habits considered in the study with age nor sex. (Table 5)

Type 2 arch was the most frequent (72.7%), with a higher number of cases in girls (39.2%) compared to boys, a difference that was statistically significant ($X^2_{MH} = 4.443$, $p=0.035$). (Table 3)

In relation to the terminal planes, mesial and straight were the most frequent (33.0% and 45.8%, respectively), with a greater number of cases of straight terminal plane, which was the most frequent (22.5%), with no association between the distribution of terminal planes and sex. (Table 4)

The distribution of cases of parafunctional oral habits by age showed a higher prevalence in girls, with mouth breathing and onychophagia being the most frequent at 14.5% and 10.1%, respectively. No association was observed in any of the cases between the different parafunctional habits considered in the study and sex. (Table 6)

DISCUSSION.

According to the results obtained from the study population, a greater frequency of type 2 arches was observed, different from the findings reported by Cruz-Martínez *et al.*,¹ Estrada *et al.*,⁴ and Solarte.⁵

This finding is relevant because type 2 arches increase the risk for children to develop some type of malocclusion, as this type of arch does not have spaces between the teeth, which will not allow for compensating for the difference in size between deciduous and permanent teeth. On the other hand, the straight terminal plane was the most frequent, followed by the mesial plane, similar to the findings reported by Estrada *et al.*,⁴ and Murrieta,⁷ but greater than that described by Cruz-Martínez *et al.*,¹ Solarte⁵ and Medrano.⁸

Its importance is that the permanent molars, when erupting, are guided towards their occlusion by the

distal surfaces of the primary second molars and the relationship between them depends entirely on the positions previously occupied by them, that is, their anteroposterior relationship and also of the mesiodistal dimensions of their crowns, which fosters a high tendency for this group of children to develop a class I molar relationship in permanent dentition.

The parafunctional habits most frequently observed in the study population were mouth breathing and nail-biting; no author has previously reported a similar finding. Mouth breathing occurred more frequently compared to the data reported by León,¹¹ Murrieta,²⁰ Solarte,⁵ Salamanca,¹² and Kasparaviciene.¹⁴ This habit usually develops as a result of allergies, hypertrophic adenoids and enlarged tonsils, which makes it a habit of adaptation that can be corrected if the factor that conditions its presence is removed.

However, this habit is rare in preschool children, so the fact that it has been the most frequent in this population may be due to the environmental pollution in the State of Jalisco, and especially in the metropolitan area in which Tlaquepaque is located.

Heavy traffic generates the dispersion of a large number of particles into the environment and into the air breathed by the children of this municipality. This is not the case with onychophagia, a habit that turned out to be the second most frequent, which is related to other factors such as nervousness, stress, insecurity or anger, usually associated with some psychological problem, and therefore its eradication turns out to be more complex. This result is similar to that described by Solarte,⁵ but lower than that reported by Murrieta²⁰ and Salamanca.¹² It is more frequent in 5-year-old children, probably because children of this age are already more aware of the environment that surrounds them and of the deficiencies and privations under which they grow-up and develop, which may be generating feelings of insecurity and fear.

Other habits, such as atypical swallowing, were less frequent compared to that reported by Shankar,¹⁰ Solarte⁵ and Estrada *et al.*,⁴ but similar to the findings of León,¹¹ Murrieta²⁰ and Salamanca.¹² The importance of atypical swallowing for the development of dental occlusion has to do with the fact that a positive relationship has been

observed between atypical swallowing and the presence of the distal step, which is unfavorable to the level of the second primary molars, as it leads to a Class II molar relationship in permanent dentition.

Bruxism was present in a lower number of cases than that reported by Salamanca.¹²

This is somewhat contradictory, considering that nail-biting was the second most common habit observed in this population, and bruxism was expected to have a similar behavior, since both habits develop under similar circumstances, that is, when the child wants to evade or avoid some condition they perceive as unsafe or dangerous. Although finger sucking was considerably lower than what was reported by León,¹¹ Murrieta²⁰ and Salamanca,¹² it must be taken into account since it is considered harmful for children over three years of age, as it can lead to the development of anterior open bite and change the growth patterns of the jaw, which are clinical conditions caused by the pressure exerted by the finger, the position of the finger and the period and intensity of the sucking.

Finally, in general terms there was no association of these habits with age and sex, illustrating that age and sex of the preschool child is not relevant, since the same predisposition to develop any of these habits was observed for all considered characteristics.

CONCLUSION.

More than one risk factor for the development of some type of malocclusion was observed in the group of children, among the most frequent ones, type 2 arch, mouth breathing and onychophagia; these last two with the possibility of being modified. However, we must

consider that the eradication of any habit in itself does not occur as a result of a conscious act to modify it, as this does not address the factors that trigger it, which makes the possibility to eliminate these habits even more difficult. However, children and their parents should be informed of the importance of modifying this behavior, with the aim of preventing the development of some type of malocclusion.

Conflict of interests: The authors declare no conflict of interest.

Ethics approval: Ethical approval Of. 017/18, by the Bioethics and Biosafety Committee of the Occlusion Dental Research Line (LIFESZ-230506), attached to the Zaragoza School of Higher Studies, of the National Autonomous University of Mexico.

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REFERENCES.

1. Cruz-Martínez I, Cisneros-Dominguez G. Detalles clínicos de la oclusión dental en niños de un círculo infantil. MEDISAN. 2017;21(7):781.
2. Wagner Y, Heinrich-Weltzien R. Occlusal characteristics in 3-year-old children--results of a birth cohort study. BMC Oral Health. 2015;15:94.
3. Dimberg L, Lennartsson B, Arnrup K, Bondemark L. Prevalence and change of malocclusions from primary to early permanent dentition: a longitudinal study. Angle Orthod. 2015;85(5):728–34.
4. Estrada Y, Estrada Y, Cubero R, López D. Factores de riesgo de maloclusiones en niños de 5 años con dentición temporal. MEDICIEGO. 2015;21(1)
5. Solarte J, Rocha Á, Agudelo AA. Perfil epidemiológico de las alteraciones de la oclusión en la población escolar del corregimiento de Genoy, municipio de Pasto, Colombia. Rev Fac Odontol Univ Antioq. 2011;23(1):111–25.
6. Murrieta-Pruneda JF, Zimbrón LA, Saavedra M, Barceló FH. Influencia de planos terminales y tipo de arcada en el desarrollo de la oclusión en la dentición permanente. Bol Med Hosp Infant Mex. 2001;58(1):21–9.
7. Murrieta-Pruneda JF, Grados B, Marques MJ, Zurita V. Características de la dentición primaria y su posible influencia en el desarrollo de la oclusión en niños de 3 a 5 años de edad.

Vertientes. 1999;2(1-2):21-6.

8. Medrano LJE, Cedillo GLS, Murrieta PJF. Prevalencia de factores de riesgo para el desarrollo de la oclusión. *Rev ADM.* 2002;59(4):128-33.
9. Corrêa-Faria P, Ramos-Jorge ML, Martins-Júnior PA, Vieira-Andrade RG, Marques LS. Malocclusion in preschool children: prevalence and determinant factors. *Eur Arch Paediatr Dent.* 2014;15(2):89-96.
10. Agarwal SS, Nehra K, Sharma M, Jayan B, Poonia A, Bhattal H. Association between breastfeeding duration, non-nutritive sucking habits and dental arch dimensions in deciduous dentition: a cross-sectional study. *Prog Orthod.* 2014;15:59.
11. Alfonso JL, Carvajal Y, Pérez N, Rodríguez O. Hábitos bucales deformantes y su posible influencia sobre el plano poslácteo en niños con dentición temporal. *MEDICIEGO.* 2014;20(2)
12. Salamanca-Torres R, Murrieta-Pruneda JF. Frecuencia de alteraciones en la oclusión en dentición primaria y su asociación con algunos hábitos bucales parafuncionales en un jardín de niños del Estado de México. *Rev Cient Odontol.* 2015;11(2):8-15.
13. Moimaz SA, Garbin AJ, Lima AM, Lolli LF, Saliba O, Garbin CA. Longitudinal study of habits leading to malocclusion development in childhood. *BMC Oral Health.* 2014;14:96.
14. Kasparaviene K, Sidlauskas A, Zasciurinskiene E, Vasiliauskas A, Juodzbaly G, Sidlauskas M, Marmaitė U. The prevalence of malocclusion and oral habits among 5-7-year-old children. *Med Sci Monit.* 2014;(20):2036-42.
15. Lopes-Freire GM, Cárdenas AB, Suarez de Deza JE, Ustrell-Torrent JM, Oliveira LB, Boj Quesada JR Jr. Exploring the association between feeding habits, non-nutritive sucking habits, and malocclusions in the deciduous dentition. *Prog Orthod.* 2016;16:35.
16. Scarpelli BB, Berger SB, Punhagui MF, Oliveira CA, Ferelle A, Oltramari-Navarro PV. Evaluation of a preventive educational program for malocclusions: 7-year study. *Braz Oral Res.* 2016;30(1):e119.
17. Warren JJ, Bishara SE. Duration of nutritive and nonnutritive sucking behaviors and their effects on the dental arches in the primary dentition. *Am J Orthod Dentofacial Orthop.* 2002;121(4):347-56.
18. Chen XX, Xia B, Ge LH, Yuan JW. [Effects of breast-feeding duration, bottle-feeding duration and oral habits on the occlusal characteristics of primary dentition] *Beijing Da Xue Xue Bao Yi Xue Ban.* 2016;48(6):1060-6.
19. Murrieta-Pruneda JF, Allendelagua RI, Pérez LE, Juárez-López LA, Linares C, Meléndez AF, Zurita V, Solleiro MG. Prevalence of non-nutritive buccal habits in a group of preschool children in Nezahualcoyotl City, Mexico (2009) *Bol Med Hosp Infant Mex.* 2011;68(1):24-30.
20. Fernandes IB, Pereira TS, de Carvalho MF, Ramos-Jorge J, Marques LS, Ramos-Jorge M. Non-nutritive sucking habits after three years of age: a case-control study. *J Indian Soc Pedod Prev Dent.* 2015;33(1):19-24.
21. Lopes Freire GM, Espasa Suarez de Deza JE, Rodrigues da Silva IC, Butini Oliveira L, Ustrell Torrent JM, Boj Quesada JR. Non-nutritive sucking habits and their effects on the occlusion in the deciduous dentition in children. *Eur J Paediatr Dent.* 2016;17(4):301-6.
22. de Vasconcelos FMN, Massoni ACLT, Heimer MV, Ferreira AMB, Katz CRT, Rosenblatt A. Non-Nutritive Sucking Habits, Anterior Open Bite and Associated Factors in Brazilian Children Aged 30-59 Months. *Braz Dent J.* 2011;22(2):140-5.
23. Aloufi SA, Jan HE, Abuhamda IS, Sayed I, Assiri AT, Samanodi HS, Alsulami AA, Alghamdi MA, Algamdi MA, Almobrki WA, Algarni SM, Wahdan AY. Meta-Analysis of Prevalence of Bad Oral Habits and Relationship with Prevalence of Malocclusion. *EC Dental Science.* 2017;11(4):111-7.
24. Cabrera TV, George Y, Martínez MR, Ramírez Y, González L. Estado de la oclusión y tratamiento selectivo en niños con dentición temporal y mixta temprana. *MEDISAN.* 2016;20(3):289-89.
25. Chamorro AF, García C, Mejía E, Viveros e, Soto L, Triana FE, Valencia C. Hábitos orales frecuentes en pacientes del área de Odontopediatría de la Universidad del Valle. *Rev CES Odont.* 2016;29(2)
26. Gomes MC, Neves ÉTB, Perazzo MF, Martins CC, Paiva SM, Granville-Garcia AF. Association between psychological factors, socio-demographic conditions, oral habits and anterior open bite in five-year-old children. *Acta Odontol Scand.* 2018;76(8):553-8.
27. Gomes MC, Pinto-Sarmiento TC, Costa EM, Martins CC, Granville-Garcia AF, Paiva SM. Impact of oral health conditions on the quality of life of preschool children and their families: a cross-sectional study. *Health Qual Life Outcomes.* 2014;12:55.
28. Alves FB, Wambier DS, Alvarez JH, da Rocha JC, Kummer TR, de Castro VC, Cabral H, Kozłowski VA Jr. Children using Day Nurseries' Facilities can be Associated with more Risk to Nonnutritive Sucking Habits. *J Contemp Dent Pract.* 2016;17(9):721-7.
29. Nihi VS, Maciel SM, Jarrus ME, Nihi FM, Salles CL, Pascotto RC, Fujimaki M. Pacifier-sucking habit duration and frequency on occlusal and myofunctional alterations in preschool children. *Braz Oral Res.* 2015;29:1-7.
30. Borrie FR, Bearn DR, Innes NP, Iheozor-Ejiofor Z. Interventions for the cessation of non-nutritive sucking habits in children. *Cochrane Database Syst Rev.* 2015;3:CD008694.