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Application of Templates in Deciduous Denture Analysis

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Abstract

Introduction: Recently, diagrams have been developed in order to analyze normality and malocclusion in the deciduous dentition.

Aim: The aim of this study is to apply the diagrams developed by Long in 59 cast models of normal dentitions (group A) and 139 abnormal (group B), in order to evaluate its clinical efficacy before the known clinical criteria, which characterizes normal occlusion and malocclusion.

Methods: Group A, with 118 casts of patients with normal occlusion, was stratified in 42 models of superior arches and 36 of lower ones of type I of Baume; 17 superior casts and 23 lower ones of arches of type II. Group B, with 278 casts with different types of malocclusions, was composed of 78 upper arches and 75 lower ones of type I; 61 upper arches and 64 lower ones of type II. The total of 396 casts were examined.

Results: The Kappa test between diagrams and clinical criteria demonstrated low concordance between diagnosis of normality and abnormality of the dentition, regardless of the type of arch evaluated. The diagrams disagree in 78% of the cases clinically diagnosed as normal and in 20% of those with morphological errors.

Conclusions: The proposed diagrams do not apply to the primary dentition evaluation.

Key Words: *Deciduous dentition; Morphologic analysis; Normal occlusion; Deciduous occlusion; Malocclusion*

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Introduction and Literature Review

The diagnosis of normal deciduous occlusion and eventual morphological deviations depends on clinical criteria, several of them based on the evaluation of the relationship between dental arches. Thus, it is important to observe the terminal relation of the second deciduous molars; the positioning of the canines; the horizontal and vertical incisions between the incisors; the presence or absence of spacing, gyro version or dental crowding [6,15,17,21].

However, some of these factors, such as occasionally increased overbite and overjet and presence of crowding, may be considered normal for certain stages of development and should not be treated [24,26].

On the other hand, deciduous dentition can be influenced by intervening factors in the morphology of the arches and, if early multidisciplinary approaches are instituted, with the participation of other health professionals (phonoaudiologist, otorhinolaryngology's, psychologist, etc.), orthopedic interventions/orthodontic, which would only occur, depending on the case, in the mixed dentition stage [2,13,16,25].

Excessive overbite and Angle Class II malocclusions are monitored and treated at a later stage of occlusal development at the end of the mixed dentition [3,23,28]. Increased overextensions and open bites can be reduced with control of oral habits, while treatment of occlusal aspects can be postponed to a more developed stage of tooth maturation and facial growth [11,20,22,25]. Therefore, whatever the clinical situation, it is necessary to establish parameters that subsidize the appropriate diagnosis, to be planned the correct treatment, at the right time.'

From the point of view of the deciduous dentition and its aspects of normality, several forms of dental arches were described to characterize it [1,7,21,30]. However, for some reason, for the most part, whatever system was adopted, the practical and systematized application of parameters for the analysis was never disseminated in the daily clinical routine, although its adoption was recommended [15].

A few years ago, an electronic computer generated jig system was developed to determine the ideal dental positions in the deciduous dentition, within the range considered normal [17]. This system was applied in dental arches with bad occlusions, and solutions were suggested for possible corrections of the detected problems. It was recommended that when the tooth point is aligned with the contour of the elliptical arch, it will be in a normal arc position. Otherwise, the evaluation will guide the orthodontic diagnosis and, consequently, the respective treatment [18]. The templates were superimposed on 30 pairs of deciduous dental arches according to the type of arch (I or II of Baume) to verify the buccolingual positioning of each tooth. The results showed that 60% of the maxillary teeth were vestibular zed in relation to the ideal position, while in the mandible 50% of the teeth presented good positioning. It was concluded that the templates were of simple clinical application and could be very useful in the early determination of problems in the deciduous dentition [29].

Considering physiologically the stability of the deciduous dentition, the need to know normality patterns, the importance of early diagnosis of malocclusion with a multifactorial etiology and the scientific contribution to prove the researched methods, it was proposed to verify the applicability of Long's [17] in normal and altered deciduous denture models, in order to determine its acuity and to evaluate its clinical efficiency, in light of the known clinical criteria that characterize normal occlusion and malocclusion.

Material and Methods

Formation of the sample

A total of 1,500 children were evaluated for the selection of 198 Brazilian, Caucasian, aged 3 to 6 years old, of both genders, with intact and complete deciduous dental arches, without interproximal or occlusal caries; divided into two groups, characterized by standard study models, stratified according to Table 1, according to the type of upper and lower arch, Baume's arch type [4] and normal or abnormality of dental occlusion; determined by Long's clinical criteria [17] . The presence of any partially or totally erupted permanent tooth and any previous orthodontic treatment represented a diagnostic criterion of exclusion of the child in the research.

Diagnostic criteria for group A - normal dentures

Group A consisted of 59 children with normal deciduous dentures and the sample of 118 models obtained was defined according to Table 1 , according to the criteria of Long [17], mentioned below:

- Spacing of deciduous arches: primitive or generalized spaces (arch type I) or without spacing (arch type II);
- Terminal relationship of the second deciduous molars in a straight plane or mesial step to the mandible;

- Normal canine relation, with the apex of the upper canine in the same vertical plane of the distal surface of the lower canine, in centric occlusion [12];
- horizontal trespass ratio: normal, positive incisors ratio with horizontal overpass not exceeding 2mm between upper and lower incisors [12];
- Relationship of vertical trespass: the edges of the lower central incisors contacting the palates of the upper central incisors, in centric occlusion, not exceeding half of their clinical crowns [12].

	oclusão	arcos de Baume		total de crianças
		Tipo I	Tipo II	
maxila	normal (grupo A)	42	17	59
	alterada (grupo B)	78	61	139
	total	**120**	**78**	**198**
mandibula	normal (grupo A)	36	23	59
	alterada (grupo B)	75	64	139
	total	**111**	**87**	**198**

Quadro 1: *Composicao da amostra.*

Diagnostic criteria for group A - normal dentures

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- Relationship of vertical trespass: the edges of the lower central incisors contacting the palates of the upper central incisors, in centric occlusion, not exceeding half of their clinical crowns [12].

Diagnostic criteria for group B - altered dentures

Group B consisted of 139 children with morphological changes due to various occlusion problems, for example: anterior open bite, functional unilateral posterior crossbite, bilateral posterior cross bite, anterior crossbite, Angle Class II canine relation, Angle Class III anteroposterior relationship. Cases with Class I canine relationship, with deep overbite, increased overjet and dental crowding were considered malocclusion, according to clinical normality patterns [17]. Of the 139 children, 278 models were obtained, stratified according to Table 1 .

Obtaining plaster models

All models were obtained in a standard manner, with correctly trimmed bases (Figure 1,2).

Application of templates

- In the gypsum models, pencils were marked with points on the occlusal surfaces of the posterior and incisal teeth of the anterior teeth;
- The template corresponding to the upper and/or lower arch type (I or II of Baume) was selected;

- The template was applied on the model, coinciding the base line in the disto-vestibular cusps of the second deciduous molars, to establish the molar distance (DM), trying to center the perpendicular to the base line, so that it passed through the interincisive point;
- Simultaneously, the curve corresponding to the shape of the arc for this DM should have all the points referring to the deciduous teeth coinciding on the selected curve (Figure 3);

Figure 1: *Modelos de estudo – vista frontal.*

Figure 2: *Modelos de estudo – vistas oclusais (superior e inferior).*

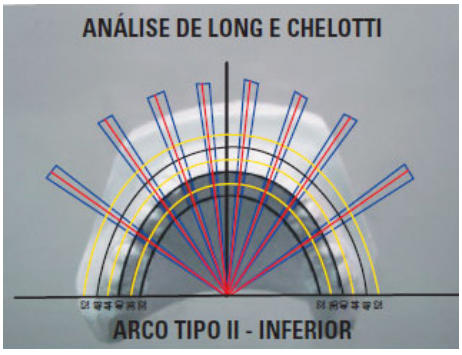

Figure 3: *Aplicacao do gabarito [18] sobre modelo de arco Tipo II inferior, normal.*

- If any representative tooth point did not coincide with the normality curve, it would be considered outside the normality pattern (Figure 4).

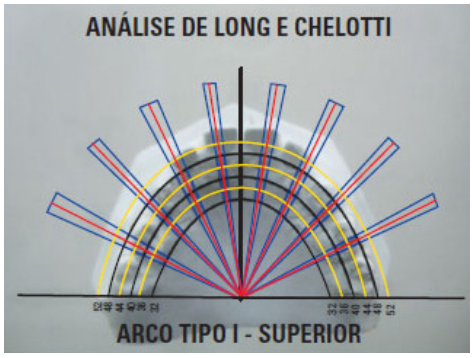

Figure 4: *Aplicacao do gabarito [18] sobre modelo de arco Tipo I superior, alterado.*

Analysis and interpretation of data

The Kappa index provided the level of agreement between the two diagnostic methods of malocclusion: feedback and clinical criteria. To assess the accuracy of the template in the diagnosis of malocclusion in the light of clinical criteria, the following values were applied: sensitivity (S), specificity (E), positive predictive value (NPV), negative predictive value false-positive (FP) and false-negative (FN).

Results

All the results were considered significant for a probability of significance of less than 5% ($p < 0.05$). There is, therefore, at least 95% confidence in the conclusions presented. The Tables 1 and 2 refer to the medium and descriptive measures of individual molars distances found in all the investigated models.

distância molar	medidas descritivas				
	mínimo	máximo	mediana	média	desvio
superior	40,0	52,0	46,0	45,9	2,2
inferior	36,0	47,0	42,0	41,6	2,2

Table 1: *Medidas descritivas da distancia molar das criancas.*

The results presented in Table 2 and Tables 3 to 6 show a low agreement between diagnosis of normality and abnormality of the denture, according to the model and clinical criteria, regardless of the type of arch evaluated.

distância molar (mm)	oclusão		total
	normal	alterada	
superior			
40	1 (1,7)	1 (0,7)	2
41	0 (0,0)	1 (0,7)	1
42	2 (3,4)	5 (3,6)	7
43	2 (3,4)	6 (4,3)	8
44	14 (23,7)	33 (23,7)	47
45	10 (16,9)	15 (10,8)	25
46	11 (18,6)	21 (15,1)	32
47	3 (5,1)	12 (8,6)	15
48	13 (22,0)	32 (23,0)	45
49	1 (1,7)	8 (5,8)	9
50	1 (1,7)	2 (1,4)	3
51	1 (1,7)	2 (1,4)	3
52	0 (0,0)	1 (0,7)	1
total	**59 (100,0)**	**139 (100,0)**	**198**
inferior			
36	1 (1,7)	0 (0,0)	1
37	1 (1,7)	2 (1,4)	3
38	3 (5,1)	13 (9,4)	16
39	7 (11,9)	4 (2,9)	11
40	20 (33,9)	29 (20,9)	49
41	4 (6,8)	11 (7,9)	15
42	12 (20,3)	20 (14,4)	32
43	3 (5,1)	14 (10,1)	17
44	7 (11,9)	36 (25,9)	43
45	1 (1,7)	3 (2,2)	4
46	0 (0,0)	6 (4,3)	6
47	0 (0,0)	1 (0,7)	1
total	**59 (100,0)**	**139 (100,0)**	**198**

Table 2: *Medidas descritivas das distancias molares dos arcos dentarios das criancas.*

critérios clínicos	gabarito arco Tipo I superior				total
	normal		alterado		
	n	%	n	%	
normal	8	19,0	34	81,0	42
alterada	10	12,8	68	87,2	78
total	18	15,0	102	85,0	120
resultado do teste de Kappa					
estimativa = 0,072			p = 0,362		

Table 3: *Resultado do teste de concordancia de Kappa para diagnostic entre as variaveis "Gabarito e Criterios Clinicon" no arco Tipo I superior.*

critérios clínicos	gabarito arco Tipo II superior				total
	normal		alterado		
	n	%	n	%	
normal	3	17,6	14	82,4	17
alterada	7	11,5	54	88,5	61
total	10	12,8	68	87,2	78
resultado do teste de Kappa					
estimativa = 0,072			p = 0,501		

Table 4: *Resultado do teste de concordancia de Kappa para diagnostic entre as variaveis "Gabarito e Criterios Clinicon" no arco Tipo II superior.*

critérios clínicos	gabarito arco Tipo I inferior				total
	normal		alterado		
	n	%	n	%	
normal	9	25,0	27	75,0	36
alterada	15	20,0	60	80,0	75
total	24	21,6	87	78,4	111
resultado do teste de Kappa					
estimativa = 0,055			p = 0,549		

Table 5: *Resultado do teste de concordancia de Kappa para diagnostic entre as variaveis "Gabarito e Criterios Clinicon" no arco Tipo I inferior.*

critérios clínicos	gabarito arco Tipo II inferior				total
	normal		alterado		
	n	%	n	%	
normal	5	21,7	18	78,3	23
alterada	5	7,8	59	92,2	64
total	10	11,5	77	88,5	87
resultado do teste de Kappa					
estimativa = 0,170			p = 0,072		

Table 6: *Resultado do teste de concordancia de Kappa para diagnostico entre as variaveis "Gabarito e Criterios Clinicos" no arco Tipo II inferior.*

The Table 3 shows feedback acuity measures in the light of clinical, revealing that the results are not favorable for feedback.

arco de Baume	níveis	teste	resultado
maxila	Tipo I	sensibilidade	87,2
		especificidade	19,0
		valor predito positivo	66,7
		valor predito negativo	44,4
		falso-positivo	33,3
		falso-negativo	55,6
	Tipo II	sensibilidade	88,5
		especificidade	17,6
		valor predito positivo	79,4
		valor predito negativo	30,0
		falso-positivo	20,6
		falso-negativo	70,0
mandíbula	Tipo I	sensibilidade	80,0
		especificidade	25,0
		valor predito positivo	69,0
		valor predito negativo	37,5
		falso-positivo	31,0
		falso-negativo	62,5
	Tipo II	sensibilidade	92,2
		especificidade	21,7
		valor predito positivo	76,6
		valor predito negativo	50,0
		falso-positivo	23,4
		falso-negativo	50,0

Quadro 3: *Resultados dos testes diagnosticos dos arcos superiors ou inferiores e tipos de arcos de Baume.*

Discussion

Long 17 evaluated 80 study models of children with normal deciduous dentures for the elaboration of the 4 jigs (2 upper and 2 lower for Baume type I and II arches). Each template has 6 ellipses, with molar distances (DM) ranging from 4 in 4 mm (32, 36, 40, 44, 48, 52), totaling 24 ellipses to represent the size and shape of the decimal arcs. These measures seem to be insufficient because, through the results obtained in the present study, it was verified that there are several models with DM intermediate to those described (Table 2). It could be suggested to place other intermediate curves between these measures; perhaps, the creation of 1-in-1mm measuring jigs, in order to determine exactly the position of the tooth in its alveolus. However, there is not yet any orthodontic, orthopedic or removable device that can place the teeth mill metrically in their intra-alveolar positions, both in the buccolingual and mesiodistal directions. The author of the research consulted [17] agrees that dental arches must have teeth aligned and level in their intra-alveolar positions, without gyrosurgery and without vestibular or lingual inclinations, in the deciduous stage, short and transient stage, which, according to Silva Filho., *et al*. [26], should not be analyzed only in its intra-arc aspect.

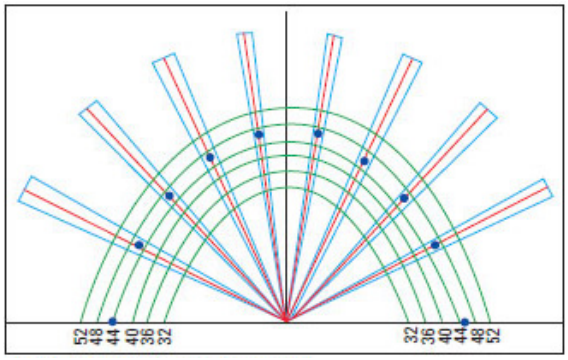

Figure 5: *Modelo do gabarito aplicado [17].*

The data of this research revealed the elliptical shape of the deciduous arches in all the 396 models studied (59 children with normal occlusion and 139 children with different occlusions), representing sufficient dental arch variability to evaluate the applicability of the tested templates according to statistical analysis preliminary. Silva Filho., *et al*. [27] also commented that the isolated analysis of the superior model is important when it shows us that the form is triangular and not parabolic, denouncing maxillary atresia, which can lead to cross bites.

The first parameter suggested to position the template was the straight line corresponding to the measured molar distance. Templates developed for the permanent denture, such as BeGole and Lyew [5] and Interlandi [14], suggested the reference of the anterior curvature to determine the shape of the human dental arch. The length of the arch was shortened, as the templates fell short of previous curvatures, evidencing, in many cases, vestibularization of the anterior teeth, as also determined by Zannet., *et al*. [29]

This justifies the large number in this study of dental arches diagnosed as normal by clinical criteria and as altered by Long's templates. The findings of Carrea [7] also showed limitations in their diagrams, by defining the measurements on each side of the equilateral triangle at 28, 30, 32 and 34 mm.

After positioning the line referring to the DM, long [17] it was recommended to match the perpendicular to the interincisive point, and from there, all points of the template should hide the points marked on the teeth, which should be aligned and level for the diagnosis of well positioned deciduous teeth. However, intra-arcuate aspects such as gyro surgery and mesiodistal or buccolingual tooth movement at this stage of the denture can be considered normal and reversible, since even at the time of the exfoliation of the first deciduous teeth, these present momentary individual mobility and alterations ". Jigs would not be required to evaluate individual dental positions or even determine individual bow shapes. At this stage of development of the dentition, the relationship of the upper arch occluding with the lower one determines the diagnosis of malocclusion.

Other authors have studied the geometric shape of dental arches, using buccal occlusal points, similar to those applied here, to position their templates [5,8,9,10]. However, it was found in the present study that the distobuccal points of the deciduous second molars referenced to overlap their templates are more lingual and narrow the dental arch at the extremities. This leads to the false impression that the second deciduous molar is inclined to lingual, which does not occur most of the time. False-negative results could suggest unnecessary corrections, since Long [17] indicated normality only when all the points overlapped.

The sample population and the parameters of normality suggested by the authors who proposed to study the morphology of deciduous dental arches may not have been applied to the great variety of forms found in this phase.

The data of this study revealed, regardless of the type of arch evaluated, superior or inferior, false-negative result superior to false-positive. The sensitivity and specificity of the template should also be emphasized, and in all cases high sensitivity and low specificity

were observed. This result showed that the template has a high capacity to identify malocclusions in known populations and a poor ability to identify normal occlusions in populations known to be normal. False-positive values diagnosed with the template would not indicate corrections of malocclusions and false-negative values would suggest to the professional the initiative of informing parents and the population about the high incidence of malocclusions and, thus, alerting them to the need for their correction.

The phase of deciduous dentures constitutes a rapid transitory stage and the teeth begin their exfoliation process around the age of 5 to 6 years, initiating the process of movement in the alveolus. In addition, patients begin their development by practicing vicious oral habits, which can be removed in the first years of life (3 to 4) and the dental position can be improved physiologically. It can be considered, then, that templates analyze only non-determinant intra articular aspects in this stage of the denture, being ancillary in the clinical diagnosis.

Conclusion

From the sample studied and according to the methodology adopted, it can be concluded that:

- Clinical criteria that identify a normal occlusion when evaluating the deciduous dentures were more efficient than the templates tested, since the templates disagreed with the normal clinical diagnosis in 78% of the cases;
- Of the cases studied, 80% who had morphological errors by the clinical diagnosis agreed with the diagnosis by the template, there was a divergence of results in 20% of the cases;
- The results were not favorable to the clinical use of the templates proposed to diagnose the normality or abnormality of the deciduous dentition.

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