Distribution of different types of occlusal contacts at maximal intercuspal position in deciduous dentition

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Since there is a lack of standardization of occlusal contacts for deciduous dentition, this study assessed distribution and different types of occlusal contacts at maximal intercuspal position in children from 4 to 5 1/2 years, with normal occlusion, finding a pattern able to be used as a reference for dentists during the rehabilitation of these children, and suitable for development of the craniofacial complex.
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INTRODUCTION

Deciduous teeth must be in contact and functionally arranged to allow the development of the arches.[11]

Nakata and Wei[17] and Moura *et al.*[16] stated that the knowledge of events that characterize a transition from deciduous to mixed and permanent dentitions is essential to monitor the occlusal development.

Friel[10] was the first to determine standardization for occlusal contacts in deciduous dentition. Based in this work, Friggi[11] studied the frequency, position and types of occlusal contacts in natural deciduous teeth of children born in São Paulo, south-east region of Brazil, determining a pattern of contacts at maximal intercuspal position. Taking into account the use of a more consistent food in the northeastern of Brazil, the aim of this work was verify the regional pattern of centric contacts in deciduous dentition.

LITERATURE REVIEW

The development of a human being occurs in sequential stages, which includes dimensional and structural changes all over the body, mainly in the face.[12] Changes observed in stomatognathic system are dependent of dental development, as well as of muscular and craniofacial skeleton development.[13]

The occlusion is a biological phenomenon that results from genetical, epigenetical and environmental factors that control and affect the development and growth of the body.[10,14]

From a occlusion view point, from the birth to the complete formation of the deciduous dental arch, the following changes can be detected: increase of the number of teeth, significant increase of dimensions of the arch until two years of age, change of the morphology of the TMJ, gradual development of calcification in deciduous teeth and succeeding permanent teeth in upper and lower jaws, and increase of vertical dimension in a continuous way.[1]

Baume[3] and Ando, *et al.*[1] observed that there is a relative stability of deciduous dental arch from 3 1/2 to 5 1/2 years old. However, according to Friggi[11] the external immutability of the dental arch does not occur in the tissues of maxillae and mandible, where consistent changes can happen, like the increase of dimension, protecting tooth buds of permanents teeth during development, altering osseous trabeculate because of functional demands of muscle attachments.

The ending relationship of deciduous second molars can be in a flush terminal plane, distal step or mesial

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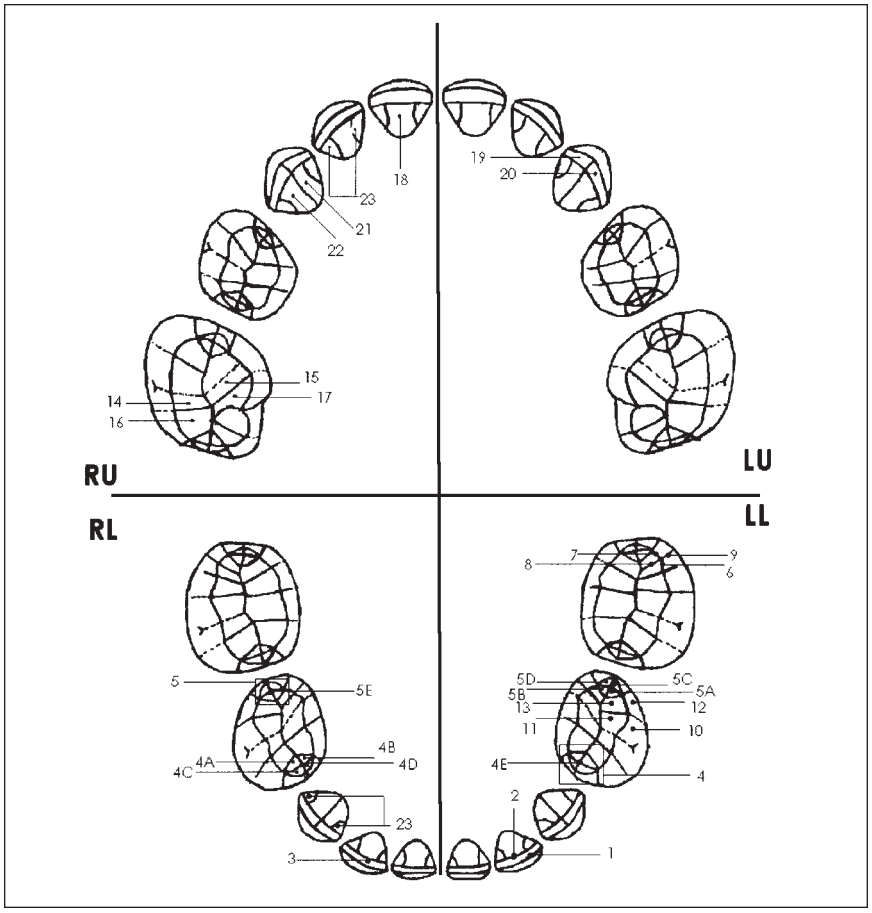


Figure 1. Occlusalgraph showing anatomic areas of dental units

1. Buccal-incisal edge
2. Lingual-incisal edge
3. Incisal border
4. Mesial marginal ridge
   - 4A disto-lingual slope
   - 4B disto-buccal slope
   - 4C mesial-lingual slope
   - 4D mesial-buccal slope
   - 4E ridge median area
5. Distal marginal ridge
   - 5A mesial-lingual slope
   - 5B mesial-buccal slope
   - 5C distal-lingual slope
   - 5D distal-buccal slope
   - 5E ridge median area
6. Mesial edge of the disto-buccal cusp
7. Distal edge of the disto-buccal cusp
8. Lingual edge of the disto-buccal cusp
9. Buccal edge of the disto-buccal cusp
10. MB slope
11. ML slope
12. DB slope
13. DL slope
14. MP slope of the enamel bridge
15. MB slope of the enamel bridge
16. DP slope of the enamel bridge
17. DB slope of the enamel bridge
18. Palatal aspect
19. Incisal-mesial border
20. Incisal-distal border
21. Mesial-palatine aspect
22. Distal-palatine aspect
23. Marginal ridges

step. The arrangement of deciduous teeth in the arch can have interdental spaces: arch type I and type II, respectively.

The spaces between upper lateral incisors and canines and between lower canines and lower deciduous first molars are called primate spaces.[3]

Ravn,[19] Burd and Moyers,[5] and Friggi[11] stated that a normal relationship between deciduous canines happens when, at maximal intercuspal position, the tip of the cusp of an upper canine is at the same vertical plane of the distal aspect of the lower canine.

Ferreira *et al.*[8] studying children born in Bahia, Brazil, from 3 to 5 1/2 years old, observed the prevalence of mesial step, relating it to factors like maxillary and mandibular growth, exclusion of cuspal interferences by chewing fibrous foods and beginning of movement of the first permanent molars.

The maximal intercuspal position, named maximal interocclusion position or central occlusion by Dawson[6] is related to the relationship between mandible and maxillae when teeth are at maximal occlusal contact.

Arnold and Frumker[2] presented five types of occlusal contacts at maximal intercuspal position in permanent dentition: (1) cusp to fossa base, (2) cusp to marginal ridge, (3) cusp to tilted plane, (4) cusp to cusp and (5) cross-bite. The type cusp to fossa base, a relation the occurs “tooth to tooth”, sometimes we do not have a touch at the innermost part of the fossa (monopodism), but a contact with slope of the cusp at two (bipodism), three (tripodism) or four points in occlusal contact.

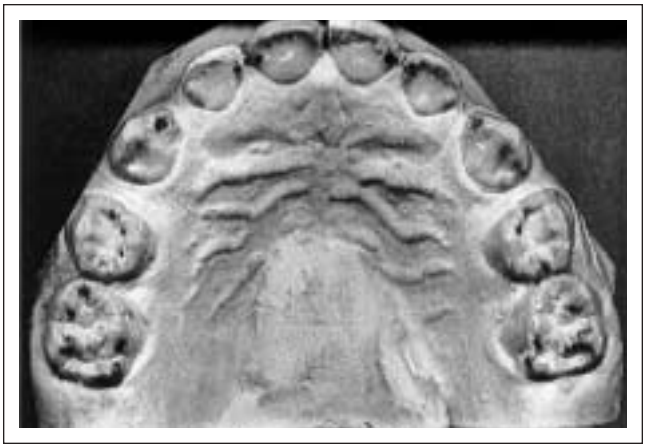


Figure 2. Photographs of upper and lower dental arches with occlusal contacts at maximal intercuspal position

Figure 3. Occlusal contacts in plaster models

Other types of contacts were described by Dawson:[6] a relation of contact between "cuspal tip to contralateral plane slope", that occurs when the cuspal tip is in a individual contact in a cuspal slope at the opposite side, and "surface to surface", a individual contact between two contralateral slopes.

Friel[10] classified the relation of contact in an ideal occlusion in four stages: occlusion of deciduous teeth after total eruption, changes before eruption of permanent incisors and molars, occlusion of new permanent teeth and changes that happen at occlusal aspects resulted of its use. To the first stage, he proposed the following types of contacts: face to face, cusp to fossa, ridge to cusp and ridge to sulcus.

Friggi[11] analyzed the occurrence and types of contacts at maximal intercuspal position in deciduous dentition, in a age group from 4 1/2 to 5 1/2 years old, and found the following results: uni-slope contact between the cusp of inferior support at the enamel bridge, bi-slope of the cusp of inferior support at the enamel bridge, support cusp slope to a slope of a contralateral marginal ridge, slopes of support cusps with two slopes of two contralateral marginal ridges, cuspal slope to contralateral inner slope and slope-to-slope.

METHODOLOGY

Thirty female and male dun-skin subjects were selected, in a age group from 4 to 5 1/2 years old, at the urban area of Feira de Santana, Bahia, Brazil, according to the following conditions: a) dental arches in agreement to the principles of normality described by Baume,[3] Foster and Hamilton[9] and Beyron:[4] ending relation between second molars in a vertical (flush terminal) plane or mesial step to the mandible, normal canine relationship, presence or not of primate spaces with a maximal over bite of 2 mm between lower and upper incisors, type I, II or mixed arches, absence of caries and malocclusion; b) subjects having pit and fissure sealant were excluded.

Having the child in the dental chair, an articulation paper was put on occlusal surfaces of the upper arch using two Müller chucks. To get the contacts, the child was asked to occlude at maximal intercuspal position (Liberman *et al.*)[15] Then, arches were photographed.

Heavy silicone rubber impression material was manipulated with an arch format, put on occlusal surfaces of the upper arch and the child was asked to

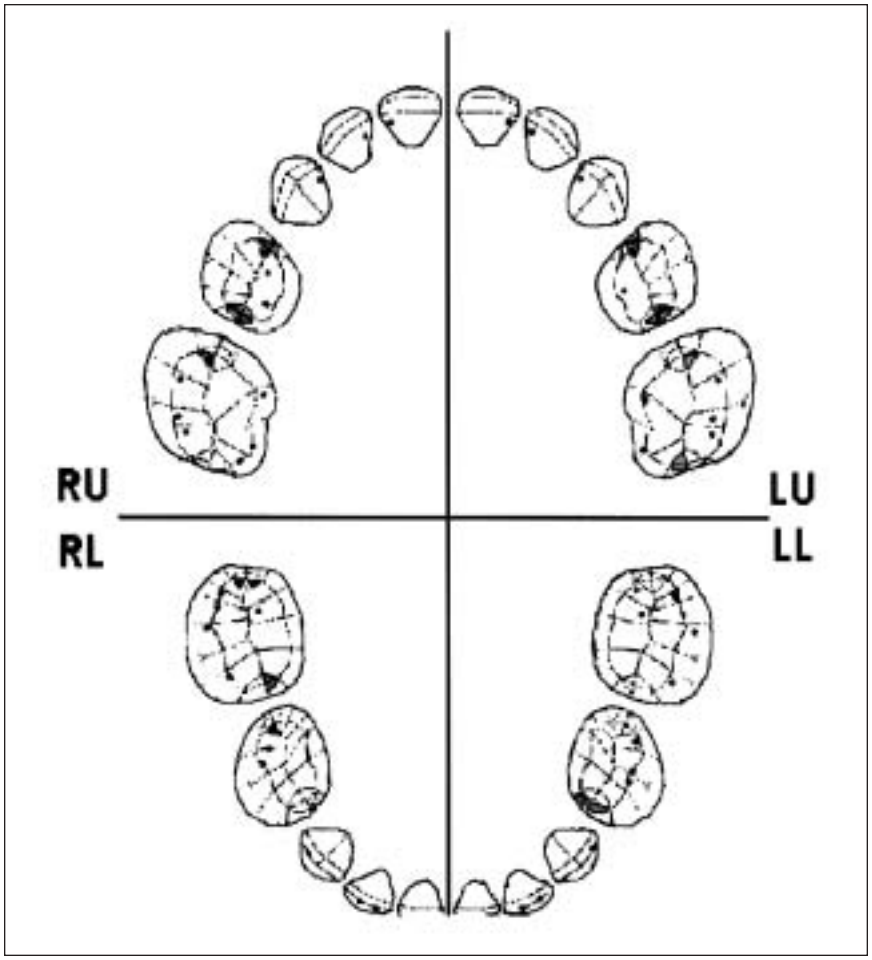


Figure 4. Individual occlusalgraph of contacts at maximal intercuspal position

occluded at maximal intercuspal position in this moment, getting the interocclusal recording. Impressions of the arches were done with light and heavy silicone for condensation. Moulds were poured with dental stone.[21]

The contacts at maximal intercuspal position were done by articulating the models with Arti-Fol carbon – "Articulating Film" 8 mm on the occlusal surfaces.

A occlusalgraph was elaborated (Figure 1) using concepts for permanent teeth as a parameter[2,4,6] according to the following types of contacts: "monopodism", "bipodism", "tripodism", "cusp to a marginal ridge", "cusp to two marginal ridges", "cusp to enamel bridge", "cusp to tilted plane", "concave palatine to edge", "marginal ridge to edge". Contacts in monopodism were considered as a relation like slope to cusp slope, according to Friggi.[11]

After analysis of contacts through photographs (Figure 2) and models (Figure 3), contact points were transferred from each subject to an individual occlusal graph (Figure 4), classifying them and filling one index card for each. Then, they were grouped in an index card that included all samples (Figure 5).

RESULTS

A equal distribution of 1170 contact points found was observed, 585 in each arch, according to the following contact patterns: "concave palatine to edge", the concave of the upper anterior tooth on the incisal edge of the lower tooth; "marginal ridge to incisal edge", the marginal ridge of the upper anterior tooth on the incisal edge of the lower tooth; "cusp to a tilted plane", cusp slope or edge of the upper tooth on cusp slope or edge of the lower teeth; "cups to a marginal ridge", cusp slope or edge on a contralateral marginal edge; "cusp to two marginal ridges", cusp slope or edge on two contralateral marginal edges; "cusp to enamel bridge", cusp slope or edge on enamel bridge (Figure 1).

Mesial step was present in 70% of the studied sample. The sample had contacts at all posterior teeth.

During the distribution of occlusal contacts of posterior teeth (Graphic 1), 461 occurred on cusp slopes (corresponding to 91.65% of contacts at lower teeth), and at upper arch the same occurred with 205 contacts (42.18%). At enamel bridge, the biggest concentration

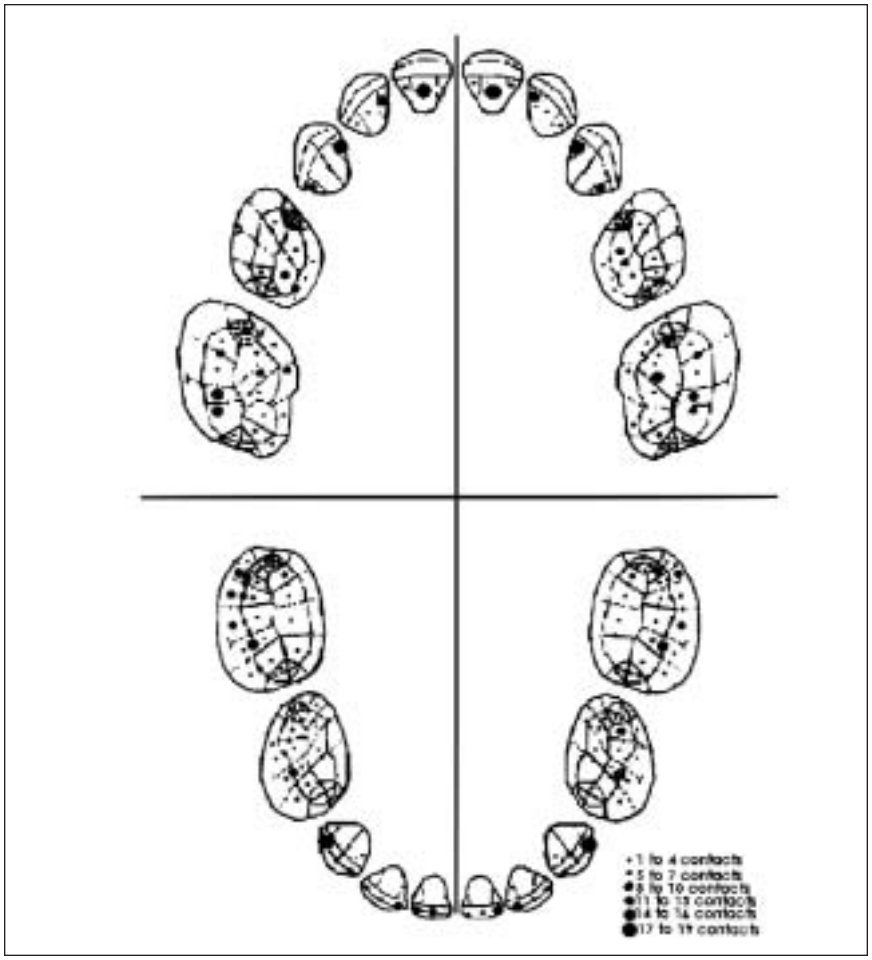


Figure 5. General occlusalgraph. Distribution of occlusal contacts at maximal intercuspal position of 30 subjects

of contacts happened, in a crescent order of frequency, at the disto-palatine, buccomesial and mesial-palatine slopes. Most contacts at marginal ridge occurred on upper teeth, with 113 contacts (74.2%).

At support cusps, 26.45% of contacts occurred on external slopes of palatine cusps of upper molars and 70.55% corresponds to buccal slopes of lower molars. Each and every lower second molars had contacts on support cusps and most of contacts of external slopes of the cusps observed on lower teeth.

The type of contact "cusp to tilted plane" was the most frequent, showing 27.86% of all contacts found (Table 1).

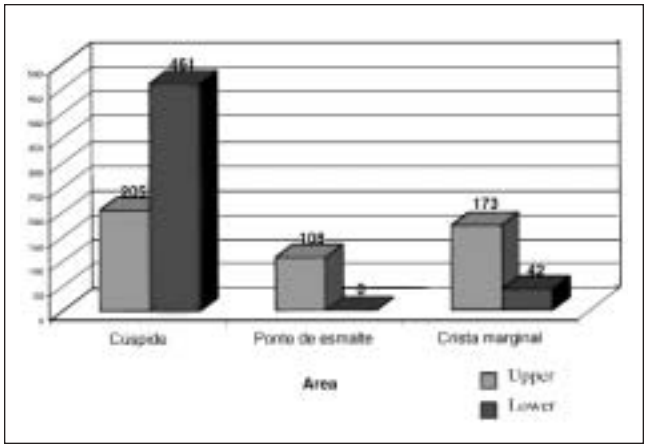
The most part of contacts on upper central incisor happened at the concave palatine (64.81%), and on lower central teeth it happened 100% at the incisal edge. The most common contact on lateral incisor was the type "marginal ridge to incisal edge". On the canine, the most common types were "marginal ridge to edge" and "ridge to external slope", when occluding with the lower first molars.

On the first molars, the most frequent contact was "cusp to marginal ridge", centralized at the distal slope of the mesial ridge on upper teeth. The contacts occurred on cusp slopes were, most of time, on the buccal edge and on palatine slope of the palatine cusp. On lower teeth, the most contacts occurred on the distal edge of the anterior buccal cusps and on disto-lingual slope of the posterior buccal cusps.

On the second molars, the most frequent contact observed was "cusp to enamel bridge". The type "cusp to marginal ridge" was more numerous on lower teeth. On upper teeth, contacts were concentrated on the buccal slope of mesial ridge and, on lower teeth, at the mesial aspect of the distal ridge. On lower teeth, cusps with the biggest number of contacts were the ones with support at buccal slopes and edges, also occurring contacts at buccal edges and slopes of lingual cusps.

About the quantity of contacts per cusp, on the first molar the monopodism contact was the most common, being the bipodism contact the most frequent on second molar. The enamel bridge was involved in most of the bi and tripodism contacts.

The canine tooth had the biggest concentration of contact type "marginal ridge to incisal edge", although lateral incisor had showed a significant percentage (37.43%).



Graphic 1. Distribution of occlusal contacts at cuspal slopes, enamel bridge and marginal ridge*

Table 1. Total distribution of contacts at upper and lower arches

Types of contacts	Quantity	%
Concave to edge	94	8,03
Ridge to edge	179	15.30
Cusp to bridge	216	18,46
Cusp to 1 ridge	272	23,25
Cusp to 2 ridges	83	7,10
Cusp to tilted plane	326	27,86
Total	**1170**	**100**

Contacts like "cusp to tilted plane" and "cusp to a ridge" had an equal distribution among posterior teeth.

DISCUSSION

Friel,[10] in 1927, studied the occlusion during the different stages and proposed patterns of occlusal contacts at maximal intercuspal position for deciduous, mixed and permanent dentition, but repeating stable relations of permanent dentition in deciduous dentition. In 1995, more than a half century later, works related to occlusion in deciduous dentition were based mainly on the rules used to classify the occlusion. So Friggi[11] did a study with children born in São Paulo, São Paulo, Brazil, with complete deciduous dentition and established a pattern of centric contacts at maximal intercuspal position.

In this work, the sample had dun-skin children, with a fibrous diet, common at the north eastern of Brazil, but types of contacts were similar to contacts found by Friggi[11], in a larger quantity because of the wear of the teeth, which is in agreement with Ehrlich and Taicher.[7] These authors considered the number of contacts not enough to establish a good occlusion, stating the importance of the localization and its consequent strength distribution.

The distribution of contacts between two slopes, also observed on canines and other anterior teeth, according to Dawson,[6] can create tangential or horizontal strengths on the support structures, which, according to Saito, *et al*.[20] must be avoided in a permanent dentition, since it can produce lateral interferences and induce tension. Otherwise, in deciduous dentition, this relation can be considered useful to maxillomandibular growth.[11]

On the upper arch, the observed contacts create strengths that promote the growth of maxillae and mandible in a transversal and posterior-anterior direction.

The predominance of mesial step in molar relation is in agreement with the hope of this study, since it is a group that uses a fibrous diet, what claim much more masticatory efforts, favoring dental wearing and a forward slide of the mandible, promoting a more adequate maxillomandibular relationship.

Not only morphological changes caused by wearing, called veneer, occurred at dental crowns, but also changes occurred in all stomatognathic system can promote the occurrence of much more contacts at maximal intercuspal position, being proved by the presence of contacts at lingual cusps of lower molars, what is in disagreement with Friggi.[11]

A increased number of contacts occurred at the lower second molar (24.49%), followed by the upper second molar (24.09%), which is in agreement with others.[7,11]

This elevated number of contacts found on second molars can be justified by the functioning of the crowns as occlusal supports against great vertical strengths created by masticatory muscles, maintaining the alveolar stability in occlusion by intercuspation.[18]

Contacts at the tip of cusps or fissure, described by Friel[10] were not found in this work, where contacts at slopes were more common, resulting in strengths that can promote a transversal growth of maxillae and mandible, also observed.[11]

The contacts "cusp to marginal ridge" on the first molar and "cusp to enamel bridge" on the second molar promote a dental stabilization in the mesial-distal direction, a important factor when permanent first molars are in eruption.

Taking account all kinds of contacts found, we can verify that they promote a mandibular stability at maximal intercuspal position.

The pattern of occlusal contacts more common in this sample (Figure 6) can be used as reference to dentists during dental rehabilitation in children, intending to guarantee a adequate development of the craniofacial complex.

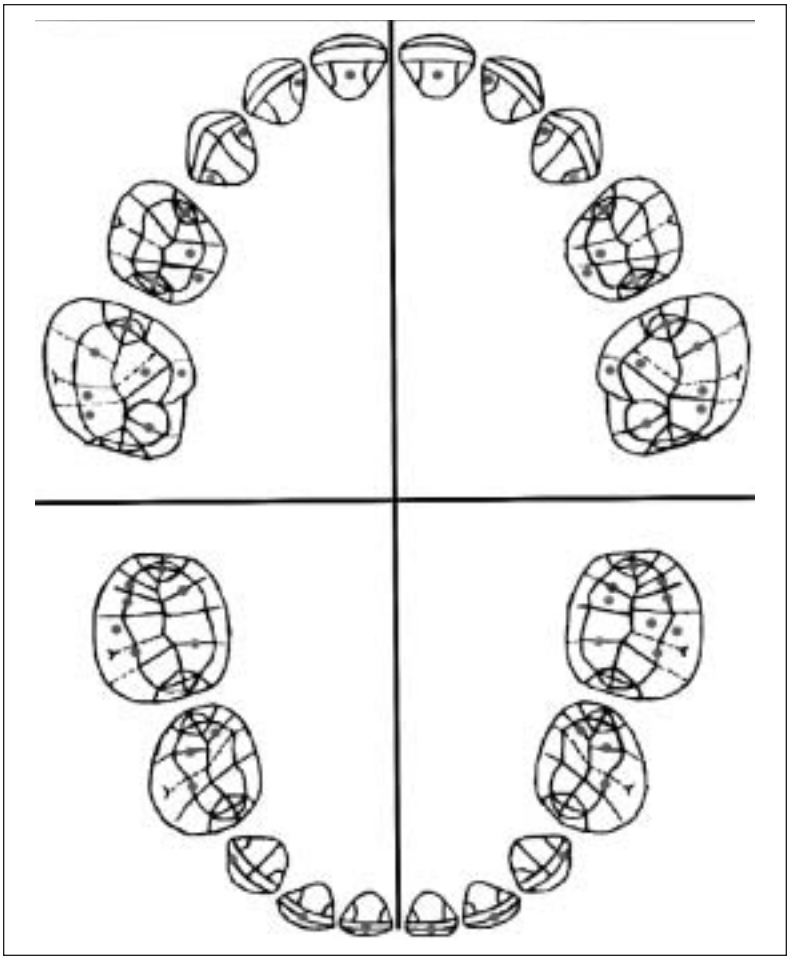


Figure 6. Occlusal contacts pattern observed in deciduous dentition

CONCLUSION

It is concluded that a great number of contacts occurred on posterior teeth, with a predominance of the following type: "slope to slope", concentrated at upper posterior teeth at distal and palatal slopes, creating strengths that promote a maxillomandibular development in a transversal and back-forward directions.

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