The diastemas in deciduous dentition: the relationship to the tooth size and the dental arches dimensions

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Tooth size and different arch parameters were studied for influence in the presence or absence of diastemas in the primary dentition. The size of teeth scarcely influences the presence or absence of diastemas, but the dental arch dimensions are closely connected with diastemas.
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INTRODUCTION

Deciduous teeth usually fit in the arches from the very moment they erupt. This is due to the fact that in the early stages the arches are already wide enough to withhold all the teeth[1] and, furthermore, these arches have a postnatal growth, obtaining the maximal arch width before the teeth erupt in the first six to eight months. In this period it is rare to find inadequate growth of the dental arches that would lead to problems in the spacing incisors.[2]

The study of the tooth size and arches dimensions is more than justified, if we consider the direct influence they maintain in establishing a correct occlusion, since they are supposed to have a certain harmonious relationship. Sometimes this does not occur due to genetic influences or environmental factors, which interfere with adequate development. The tooth size does not vary once the teeth are formed and yet the dental arches may change due to external conditions.[3]

Baume[4] was one of the first to prove that diastemas are common in primary dentition, and they are very important, since absence causes a greater probability that crowding will occur in future dentition.[5]

Sanin *et al*.[6] in 1970 observed that the measurement of the temporary dental arches and the tooth size can be used to predict the existence of malocclusion in 82% of the cases. They suggest that if they had used a larger population, they could have diagnosed crowding in ages as early as three or four years, simply by measuring the teeth and deciduous arches.

Foster and Grundy[7] come to similar conclusions in 1986 when they affirm that they can predict, quite accurately, but not with absolute precision, the crowding conditions in permanent dentition by considering the presence or absence of diastemas in primary dentition.

Bishara *et al*.[8] in 1995, concluded from a longitudinal study that they can not predict the existence of a discrepancy in permanent dentition basing the information only on deciduous dentition characteristics, since these authors do not find any relationship statistically significant between both periods.

When relating the presence or absence of diastemas in deciduous dentition with the tooth size and arch dimensions, more emphasis is put on the latter, since diastemas are more frequent in wider arches whereas, the crown size of the teeth plays a less important role.[4,9,10]

MATERIAL

The children used for this study were obtained from three kindergartens and three local hospitals belonging to the Spanish cities of Santiago de Compostela, Orense and Vigo.

The sample comprised 267 children, 153 males and 114 females, aged 2 to 8 years. All were white apparently healthy and lacking malformations; they had complete deciduous dentition and no erupted permanent teeth, without existing dental malocclusion and not having undergone any type of orthodontic treatment.

The study discarded all children that presented any type of anomaly in the size, shape or number of teeth, as well as those, who had teeth destroyed by extensive carious lesions or that had been reconstructed and therefore could alter the tooth and arch measurements.

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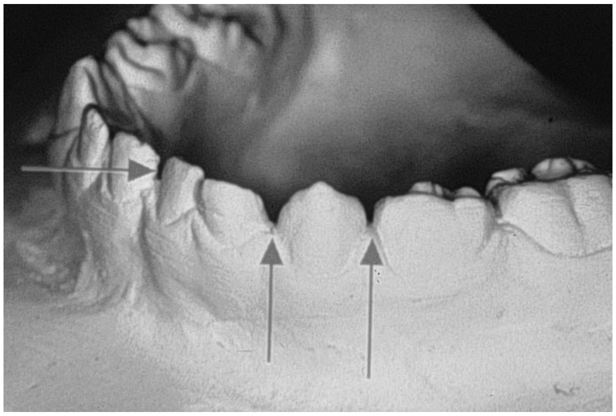

Figure 1. We defined the existence of a diastema when the interproximal surfaces of two adjacent teeth do not contact.

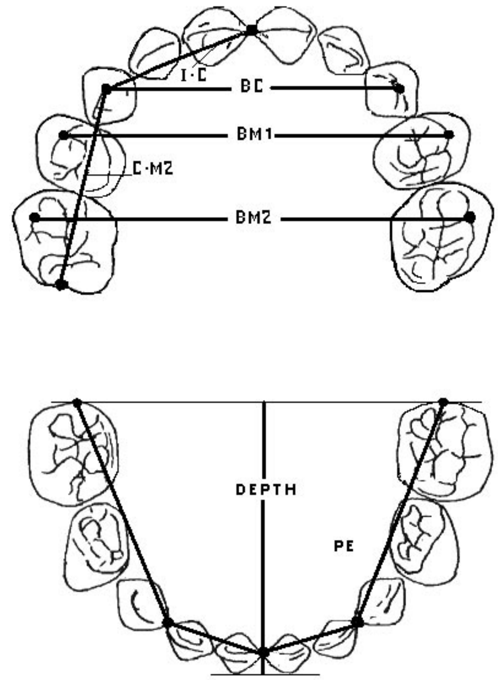

Figure 2. Dental Arches Dimensions in Deciduous Dentition. BC: Diameter between both canines. **BM1**: Diameter between both first molars. **BM2**: Diameter between both second molars. **I-C**: Anterior segment. **C-M2**: Posterior segment. **Depth**: Arch depth. **PE**: Arch perimeter.

Cast models were taken of all the children studied using fast-setting alginate and hard plaster. The diastemas were registered on these models, as well as the transversal diameters and arch perimeter, using a digital calibre (Munchmer model), capable of registering tenth millimeters, and a tridimensional compass (Korkhaus type), employing the latter only for measuring the arch depth.

METHOD

Identifying the diastemas

We defined the existence of a diastema when the interproximal surfaces of two adjacent teeth do not contact. (Figure 1) We considered the presence or absence of two distinct diastemas:

- *Incisors spaces (IS)*: Spaces between incisors.

- *Primate spaces (PS)*: Typical spaces in primary dentition between the mandibular deciduous canine and first deciduous molar and between the maxillary second deciduous incisor and deciduous canine.

The study was made independently in the upper and lower jaw, and the diastemas were expressed as follows:

IS Upper: Interincisive diastemas in the maxilla.
PS Upper: Primate diastemas in the maxilla.
IS Lower: Interincisive diastemas in the mandible.
PS Lower: Primate diastemas in the mandible.

Measurement Registration

1. Tooth Dimensions:
The maximal mesiodistal diameters of the crown of each tooth were measured. Only teeth on the left side were measured.
2. Dental Arch Dimensions: (Figure 2)
   - **Arch breadth*:*** it was measured in three levels:
     -Diameter between both canines (BC): defined as the distance between the cusp tips of both deciduous canines or between those estimated on the worn facets.
     -Diameter between both first molars (BM1): measured between the mesiobuccal cusps of the first primary molars.
     -Diameter between both second molars (BM2): measured between the mesiobuccal cusps of the second deciduous molars.
   - **Arch depth*:*** it was determined by measuring the total arch and two segments, only on the left side.
     -Total depth (Depth): measured from the buccal surface of the central incisors to the mid-point of the tangent that passes through the distal face of the second deciduous molars.
     -Anterior segment (I-C): the distance between the contact point of both incisors, or from the center point of the diastema, if no contact exists, and the canine cusp or the estimated worn facet.

-Posterior segment (C-M2): the distance between the canine cusp or its estimated worn facet, and the distal face of the deciduous second molar.

- **Arch perimeter (PE):** it is the result of adding the distance belonging to the four segments divided in the arch: from the contact point between incisors, or from the center of the diastem between them, to the distal face of the lateral incisor, and from here to the distal face of the second molar, at both sides of the arch.

STATISTICAL METHOD

A descriptive study was made concerning all the variables including the mean, maximum and minimum values, the mean ratio, standard error of the mean, standard deviation and interquartillic deviation.

A comparative analysis of the correlation between the categorical values was made using coefficient squared, and parametric tests were used for the comparative study between categorical and dimensional values (children's age in months). "Pearson's R" was used for the study of correlation coefficients.

The statistical significance was calculated based on the *p value*, considering the difference to be statistically significant when $p< 0.05$.

RESULTS

1. **Relation between the tooth size and the presence of diastemas.**

The size of the dental crowns is not directly related to the presence or absence of diastemas, specially in the maxillary region where a significant difference in the dental sizes of each arch, with or without diastemas, does not exist.

In the mandible, the incisors and canines were smaller and the arches had incisors spaces. Referring to the primate spaces, only the central incisor of the lower jaw was statistically smaller in the arches having this type of spaces. (Table I)

2. **Relation between arch dimensions and the presence of diastemas.**

On the other hand, it was observed that the upper or lower arches having diastemas of either type presented more width at every level, as well as more depth and perimeter than those lacking diastemas, existing important rates of statistical significance (Tables II and III).

DISCUSSION

Diastemas are very frequently present in the deciduous dentition arches. The authors who have studied them found that they are very frequent, and more so in the upper-jaw, and that they are also more frequent in male children.[4,9,11,12] They all agree that the presence of diastemas is desirable, since when they do not exist, there is a greater probability of future crowding.[5,7]

The objective of our research was to study the relationship between the existence/absence of diastemas and the dimensions of both the teeth and the arches during the period of complete deciduous dentition, in a sample of children between two and eight years of age, who only had the deciduous dentition stage in common. The presence of diastemas in the deciduous arch has no relationship with the chronological age of the children in our sample, as it has also been proved in another study that we are about to publish, coinciding with other authors, who observed that diastemas neither appear nor grow with age.[4,9]

During this period of complete deciduous dentition, the arch dimensions do not undergo any significant change either, regardless of the chronological age, as proved by several studies.[13-15]

Finally, changes are obviously non-existent in the tooth crowns. All this will lead us to consider our sample to be homogeneous.

As for the relationship between the presence of diastemas and the tooth and arch dimensions, the arch size seems to have a much greater influence than the tooth size. It has been proved so by Baume[4] and by Tejero *et al.*[16] for primary dentition. These authors find that diastemas are more frequent in broad arches. We have found, apart from the relationship with the arch dimensions, a certain relationship with the dental crown size in the case of the mandible interincisive diastemas, where the appearance is related to smaller incisors and canines. This relationship could not be established for the rest of the mandible teeth and all the maxillary teeth.

Our greatest discrepancies in the results are with El-Nofelly *et al.*[9] who did a study similar to ours among an Egyptian population. The number of children comprised in this sample was also similar (243 children against the 267 we have used). They found a relationship between the tooth size and the interincisive diastemas in both arches, whereas in our study there exists a relationship only in the case of the mandible canines and incisors. However, in their study there seems to be no relationship between the primate spaces and the dental or arch dimensions, while our research has proved a relationship between the primate spaces and the arch dimensions, with all the arch parameters studied, and always with high rates of statistical significance. We think that certain racial aspects might account for the differences between the two studies.

Studies on permanent dentition coincide in considering the dental arch size to be more important than

Table I. Mean and Standar Desviation of the teeth size in the primary arches, with and without diastems.

MAXILLARY

TOOTH		IS Upper No 116	IS Upper Yes 151	PS Upper No 70	PS Upper Yes 197
Central Incisor	X	6,5	6,4*	6,5	6,4
	SD	0,4	0,4	0,4	0,4
Lateral Incisor	X	5,3	5,2	5,2	5,2
	SD	0,4	0,4	0,3	0,4
Canine	X	6,7	6,6	6,7	6,7
	SD	0,4	0,4	0,4	0,4
Molar 1°	X	7,7	7,0	7,0	7,1
	SD	0,4	0,4	0,4	0,4
Molar 2°	X	8,8	8,7	8,8	8,7
	SD	0,5	0,6	0,5	0,6

MANDIBLE

TOOTH		IS Lower No 108	IS Lower Yes 159	PS Lower No 106	PS Lower Yes 161
Central Incisor	X	4,1	4,0***	4,1	4,0**
	SD	0,2	0,0	0,2	0,2
Lateral Incisor	X	4,8	4,6***	4,8	4,6
	SD	0,4	0,3	0,3	0,3
Canine	X	5,8	5,6***	5,7	5,7
	SD	0,4	0,3	0,4	0,4
Molar 1°	X	7,8	7,7	7,7	7,7
	SD	0,4	0,4	0,4	0,4
Molar 2°	X	9,8	9,7	9,8	9,7
	SD	0,5	0,5	0,5	0,5

X: Mean expressed in millimeters, SD: Standar Deviation. ***P<0,001, **P<0,01, *P<0,5
IS: Incisors Spaces, PS: Primate Spaces.

Table II. Mean of the transversal diameters in the primary dental arches with and without diastems.

MAXILLARY

		IS Upper No 116	IS Upper Yes 151	PS Upper No 70	PS Upper Yes 197
BC	X	26,7	28,3***	26	28,2***
	SD	2,1	1,8	1,9	1,9
BM1	X	33,8	35,3***	32,9	35,2***
	SD	2,7	2,1	2,6	2,1
BM2	X	39,6	40,0***	38,9	40,9***
	SD	3,0	2,3	2,8	2,5

MANDIBLE

		IS Lower No 108	IS Lower Yes 159	PS Lower No 106	PS Lower Yes 161
BC	X	21,3	22,7***	21,4	22,6***
	SD	1,3	1,5	1,4	1,5
BM1	X	27,5	28,9***	27,7	28,7***
	SD	2,1	1,7	2,0	1,9
BM2	X	33,9	35,2***	34,2	35,0**
	SD	2,0	2,1	2,1	2,1

BC: Diameter between both canines ***P<0,001, **P<0,01
BMI: Diameter between both first molars,BM2: Diameter between both second molars.
X: Mean expressed in millimeters, SD: Standar Deviation.
IS: Incisors Spaces, PS: Primate Spaces.

the tooth size, as far as crowding in permanent dentition is concerned, since they prove that crowding is not due to bigger teeth, but to smaller arches.[17]

Our study was based on the existence or non-existence of diastemas, regardless of the size, because we have used plaster models and a manual calibre and it was difficult for us to measure them. Nowadays with the help of computers we could have quantified the diastema space in millimeters, in this way the diastema variable would have become quantitative (measured in millimeters) instead of qualitative (existence or non-existence of diastemas), and the results would have been more decisive. But that is a work still to be done.

CONCLUSIONS

The presence of diastemas in primary dentition is due above all to broader arches and not to smaller teeth and, in the same way, the non-existence of diastemas must be related to smaller arches and not to bigger teeth.

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Table III. Mean of the depth, segments and perimeters expressed in mm. in the primary arches with and without diastems.

		IS Upper		PS Upper	
		No 116	Yes 151	No 70	Yes 197
Depth	X	25,8	27,0***	25,9	27,0***
	SD	1,8	1,6	1,8	1,6
I - C	X	15,6	16,8***	15,6	16,8***
	SD	0,8	1,2	0,8	1,2
C - M2	X	20,2	20,7***	20,2	20,7***
	SD	0,9	1,0	0,8	1,0
Perimeter	X	70,4	73,1***	70,4	73,0***
	SD	2,7	3,2	2,7	3,2

MAXILLARY

		IS Lower		PS Lower	
		No 108	Yes 159	No 106	Yes 161
Depth	X	23,3	23,9***	23,0	24,1***
	SD	1,5	1,6	1,4	1,6
I - C	X	12,1	12,7***	12,1	12,7***
	SD	0,7	1,0	0,8	0,9
C - M2	X	21,3	21,5***	21,1	21,6**
	SD	1,0	1,1	1,0	1,1
Perimeter	X	65,7	67,1**	65,4	67,2***
	SD	3,2	3,0	3,0	3,1

MANDIBLE

I - C: Distance between central incisors and canine
C - M2: Distance between canine and second molar.
X: Mean expressed in millimeters, SD: Standar Deviation.
IS: Incisors Spaces, PS: Primate Spaces.

***P<0,001, **P<0,01, *P<0,5

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