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Diastemas in primary dentition and their relationships to sex, age and dental occlusion

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*ABSTRACT. **Aim** The prevalence of interincisive and primate spaces in the primary dentition, relating them to age and sex, was studied. An analysis was made as to what extent various occlusal aspects of the arches affect the existence of spacing. **Materials and methods** A population of 267 children, 153 males and 114 females, aged 2.2 – 8.2 years, was evaluated. All were white Caucasian, apparently healthy and lacking any congenital malformations; they had complete primary dentition and no erupted permanent teeth, without existing dental malformation and not having undergone any type of orthodontic treatment. Cast models were fabricated from impressions taken of all the children. Tooth sizes and interdental spaces were measured on these models and the various occlusal aspects were noted. **Results** The prevalence of spacing was high in the primary dentition, being independent of the chronological age of each child. Spacing was more frequent in males than in females. The presence or absence of spacing was not directly related to occlusion except in cases of posterior cross-bite, where it was less frequently, and open-bites, in which spaces appeared more often than usual. **Conclusion** Spaces in the primary dentition were very common among the population studied and more frequent in male children than in females. Primate spaces were more frequent at the earliest ages, but chronological age had no influence on the presence of interincisive spacing. The lack of the spaces in the maxillary arches, typical of the primary dentition, prevailed among individuals with posterior cross-bite, contrary to what normally happens in the rest of the population.*

KEYWORDS: Diastemas, Primary dentition, Sex, Chronological age, Dental occlusion

Introduction

In newborn children, the alveolar area is covered by gum pads, the size of which is determined by various factors such as the child's degree of development at birth, weight, size of primary teeth and genetic characteristics. From the beginning, the arches are broad enough to accommodate the primary incisors, nevertheless they continue to grow during the first year of life in a sagittal and transverse manner [Moyers et al., 1976]. Maximal arch width is attained before the teeth erupt within the first six to eight months. In this period, it is rare to find inadequate growth of the dental arches that prevents the correct alignment of the incisors. Crowding is rare at this stage and there is often spacing of the teeth [Van der Linden, 1974]. Once the teeth are formed, they do not vary in size, nevertheless the dental arches may change in size because of external factors [Le Bot, 1976].

Researchers have studied different aspects of the arches in primary dentitions, for example the space available for primary teeth and the correlation between dental and arch size, trying to find out how these factors eventually affect the future development of permanent teeth. Baume [1950a] divided the primary arches into two major groups: with and without spaces. He observed that 70% of the arches had spaces and 30% did not. The spaces are essential to provide adequate accommodation for the permanent dentition. In a second paper, Baume [1950b] also reported that if diastemas do not exist the probability, which is 40% higher, is that crowding will occur in future dentition.

Sanin et al. [1970] observed that measurement of the primary dental arches and tooth size may be used

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to predict the existence of malocclusion in 82% of cases. They suggested that if they had used a larger population, they could have diagnosed crowding at ages as early as 3 or 4 years, simply by measuring the teeth and primary arches. Foster and Grundy [1986] came to a similar conclusion, when they found that they could predict, quite accurately but not with absolute precision, the crowding of the permanent dentition by considering the presence or absence of spaces in the primary dentition.

Bishara et al. [1995], however, after a longitudinal study, concluded that they could not predict the existence of a discrepancy in the permanent dentition, basing their information only on primary dentition characteristics. These authors found no statistically significant relationship between the size of the primary and permanent dentitions.

Accordingly, because of there being some differences of opinion in the literature, a further study was carried on a population of Spanish children in the primary and mixed dentitions.

Materials and methods

The child population used for the present study was obtained from three kindergartens and three local hospitals in the Spanish cities of Santiago de Compostela, Orense and Vigo. The sample comprised 267 children, 153 males and 114 females, aged between 2.2 and 8.2 years, distributed as follows: 19 were between 2 and 3 years, 64 between 3 and 4 years, 63 between 4 and 5 years, 49 between 6 and 7 years, 4 between 7 and 8 years, and 2 who were 8 years old. All were white Caucasians apparently healthy and lacking any history of congenital malformations. All children had complete primary dentitions and no erupted permanent teeth. There were no existing dental malformations and none of the children were undergoing any type of orthodontic treatment.

The study excluded any child who presented with any type of anomaly in the size, shape or number of teeth. Also excluded were any children who had teeth destroyed by extensive carious lesions or with teeth that had been heavily restored, and therefore could have affected the tooth and arch measurements.

Impressions and then cast models were taken of all the children, using fast-setting alginate and hard plaster. Spaces were measured on these models with veneer calipers, and the various occlusal aspects were noted down.

Identifying spacing. The existence of a space was defined when the interproximal surfaces of two adjacent teeth did not contact. The presence or absence of spaces was recorded in an absolute or categorical way. No measurements were made:

- *Incisors spaces (IS)* - spaces between incisors.
- *Primate spaces (PS)* - typical spaces in primary dentition between the mandibular primary canine and first primary molar, and between the maxillary second primary incisor and primary canine.

The measurements for the study were made independently in the upper and lower jaw and the spaces were expressed as follows:

- *IS maxilla* - interincisive space in the maxilla.
- *PS maxilla* - primate space in the maxilla.
- *IS mandible* - interincisive space in the mandible.
- *PS mandible* - primate space in the mandible.

Occlusal aspects registered. The various occlusal aspects assessed were:

- *Terminal plane* - straight, distal step, mesial step.
- *Canine class* - I, II, III.
- *Transverse relationship of the arches* - lateral cross-bite, unilateral cross-bite, bilateral cross-bite, scissors-bite.
- *Degree of over-bite*
  - Open-bite - when closing the molars, the front teeth did not contact.
  - Slight over-bite - when the upper incisors covered up to a third of the crown of the mandibular incisors.
  - Moderate over-bite - when the maxillary incisors covered between 1/3 and 2/3 of the crown of the mandibular incisors.
  - Deep over-bite - when the maxillary incisors cover between 2/3 and the whole of the crown of the mandibular incisors.
  - Edge to edge over-bite - when the edges of the maxillary and mandibular incisors were in contact.

Statistical methods. Once the data was collected, it was analysed statistically using Dixon's BMDP statistical program. A descriptive study was made concerning all of the variables including the mean (X), maximum (MAX) and minimum (MIN) values, standard error of the mean (SE) and standard deviation (SD). 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 BMDP 3D Test t program was used to compare means. With this program the differences between two sets of data, for example males and females, maxilla and mandible, canine class I and II, were assessed. The comparison of means was made using t=(X1–X2)/S, statistic, where S was the standard error of the difference.

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

Results

The presence of spaces in the total sample and according to sex is shown in Table 1. In the cases studied it was normal for the primary arches to have some type of spacing. The most frequent were the primate spaces of the maxilla that appeared in 77.1% of the males and 69.9% of the females. They were more frequent in males than in females, being statistically significant for all the types of spaces, except for those between maxillary incisors. Also in Table 1 the prevalence of spaces in the primary dentition is expressed in absolute value and in percentages for the total sample, and differentiating between both sexes.

The presence of spaces according to chronological age is shown in Table 2. In relation to age, only the primate spaces proved to be the most frequent and

Spaces	Sex	Nº sample	Presence of spaces Nº	%
IS maxilla	males	153	93	60.8%
	females	114	58	50.9%
PS maxilla	males	153	118	77.1%***
	females	114	79	69.9%
IS mandible	males	153	96	62.7%**
	females	114	63	55.3%
PS mandible	males	153	99	64.7%**
	females	114	62	54.4%

** = p< 0.1 *** = p<0.001 IS = incisal space PS = primate space

TABLE 1 - *Presence of spaces in the primary dental arches according to sex in a group of Spanish children.*

	IS Maxilla		PS Maxilla		IS Mandible		PS Mandible	
	No	Yes	No	Yes	No	Yes	No	Yes
X (months)	58.8	55.7	61.5	55.5**	58.0	56.4	60.9	54.5***
DS	14.0	15.2	13.8	14.7	13.7	15.4	13.7	14.9
ES	1.3	1.2	1.6	1.0	1.3	1.2	1.3	1.1
Sample size	116	151	70	197	108	159	106	161
MAX	89	100	89	100	89	100	89	100
MIN	31	26	34	26	29	26	30	26

TABLE 2 - *Mean of chronological age expressed in months belonging to the dental arches with and without spaces in the primary dentition of a population of Spanish children.*

	Total: n=267		IS Maxilla	PS Maxilla	IS Mandible	PS Mandible
TERMINAL PLANE	Straight n=198	n	110	144	113	119
		%	55.6	72.7	57.1	60.1
	Distal step n=19	n	8	12	15	10
		%	42.1	63.2	78.9	52.6
	Mesial step n=24	n	18	21	17	18
		%	75.0	87.5	70.8	75.0
	Asymmetric n=26	n	15	20	14	14
		%	57.7	76.9	53.8	53.8
CANINE CLASS	Class 1 n=173	n	100	129	94	100
		%	57.8	74.6	54.3	57.8
	Class II n=47	n	24	32	34	29
		%	51.1	68.1	72.3	61.7
	Class III n=10	n	7	9	8	9
		%	70.0	90.0	80.0	90.0
	Asymmetric n=37	n	20	27	23	23
		%	54.1	73.0	62.2	62.2
TRANSVERSAL RELATION	Absence of cross-bite n=223	n	133	171	131	133
		%	59.6	76.7	58.7	59.6
	Unilateral cross-bite n=36	n	15	22	22	22
		%	41.7	61.1	61.1	61.1
	Bilateral cross-bite n=4	n	2	2	4	3
		%	50.0	50.0	100.0	75.0
	Scissors-bite n=4	n	1	2	2	3
		%	25.0	50.0	50.0	75.0
OVER-BITE	Open-bite n=31	n	20	22	24	27
		%	64.5	71.0	77.4	87.1
	Slight over-bite n=80	n	43	58	44	45
		%	53.8	72.5	55.0	56.3
	Moderate over-bite n=69	n	45	60	44	41
		%	60.0	80.0	58.7	54.7
	Deep over-bite n=69	n	39	51	41	42
		%	56.5	73.9	59.4	60.9
	Edge to edge over-bite n=11	n	3	5	5	5
		%	27.3	45.5	45.5	45.5

***p<0.001 ** = p<0.01

TABLE 3 - *The relationship between occlusal aspects and presence of spaces in the primary dentitions of a Spanish child population.*

statistically significant among the younger children, in both arches. These results are also expressed in Table 2 where the children's mean age, with and without any type of spaces, is recorded.

The relationship between occlusal aspects and presence of spaces is given in Table 3. When relating the presence or absence of spaces to different occlusal aspects, including terminal plane, canine class, transversal relation and degree of over-bite, it was verified that in all groups the arches with spaces prevailed over those lacking them. An exception was for posterior cross-bites, where it was more frequent to find absence of incisor spaces of the maxillary arch.

Another exception to the general rule was found with respect to cases expressed as an edge to edge bite. Here the absence of primate spaces and incisor spaces was most frequent, even though statistical significance could not be demonstrated. On the other hand, in children with open bites the primate spaces were much more common than one might expect, but there was no statistical significance noted.

Discussion

Spacing is very frequently present in the primary dentition arches, aiding in the future alignment of permanent dentition as noted by Baume [1950a], who also observed that 70% of children had spaces in the primary dentition. Inamura and Sakuma [1970] stated that there exists a difference between both arches, noting that in 90.7% of primary dental spacing in children spaces were present in the maxilla, whereas 87.5% were in the mandible. El-Nofelly et al. [1988] found spaces in the primary dentition between 65% and 90% of cases, depending on which arch or which sex was considered. Gonzalez-Cuesta et al. [1995] studied the primate spaces in primary dentitions and found that 85.7% were in the maxilla and 81.5% in the mandible.

In our study, primate spaces were most frequent, especially in the maxilla, in concordance to the results obtained by Cepero et al. [1995] and Otuyemi et al. [1997], appearing in a 73.8% of the cases we have studied. However, the mandible registered 60.8%. Incisor spaces were more frequent in the mandible (59.6%) than in the maxilla (56%). In relation to sex, we observed that spaces were more frequent in male children, in agreement with El-Nofelly et al. [1988]. In our study this was statistically significant for the primate spaces in both arches and for the incisor spaces in the mandible. With reference to the chronological age of the children, both Baume [1950b] and El-Nofelly et al. [1988] found that new spaces do not appear nor do they become wider in the period following the completion of the primary dentition and the eruption of the first permanent. However, Richardson [1972] proved that they were incremental with age in 63% of the children he studied over time. The same results were obtained in a sectional study by Vaello [1987], who observed that spaces were more frequent in older age groups.

No variations were found among the different age groups in the present study while studying interincisive spaces. However, with regard to the primate spaces, it was noted that not only do they not grow with age, but, on the contrary, that the youngest patients had spaces in a greater proportion, statistically significant, thus differing completely from the authors mentioned above. An explanation could be the eventual mesial drift of the teeth in the mouth. This would coincide with an explanation, given by some authors, when referring to the diminishing of the arch depth with age in the temporary dentition period [Baume, 1950a; Borrow and White, 1952; Bonar, 1956; Moorrees and Reed, 1965].

In the present study, the arches with spaces proved to predominate over those without, in all types of occlusion, except for those individuals with posterior cross-bite, among whom the lack of interincisive diastemas in the maxillary arches was the more frequent. This coincides with the fact that this group has a tendency to present with narrow maxillary arches [Facal-García et al., 1999]. It has been proved that it is not the tooth size, but the dimension of the dental arches that has the most important influence on the presence or absence of spaces [Baume, 1950b; Tejero et al., 1991; Facal-García et al., 1999].

The children with edge to edge bites presented also with a smaller proportion of spaces. They are more frequent in children with anterior open-bite, even though the statistical significance is not relevant enough to draw a conclusion.

Finally, it is important to mention that the absence of spaces in the primary dentition not only denotes the existence of future crowding in permanent dentition, as the arches are narrower. But it also suggests a tendency towards a greater existence of other types of malocclusion, such as lateral cross-bite, although no relation is made with distal occlusion.

Conclusion

The presence of spacing was common in the primary dentition and very frequent among the Spanish population studied. Spaces in the primary dentition

occurred more often in male children than in females. Primate spaces were more frequent at the earliest ages, but chronological age had no influence on the presence of interincisive spacing. The lack of the spaces in the maxillary arches, typical of the primary dentition, prevailed among individuals with posterior cross-bites, contrary to that normally seen in the rest of the population.

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The prevalence of developmental enamel defects in permanent molars in a group of English school children

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ABSTRACT. ***Aim*** *An epidemiological study was designed to determine the prevalence of enamel defects in first permanent molars in English children of ethnic backgrounds.* ***Materials and methods*** *A population of school children aged seven years, living in the low water fluoride City of Leeds (UK) were examined for the presence of developmental enamel defects in first permanent molars. The examination criteria were based on the DDE index for screening surveys. The ethnic background to the children examined was determined by school records, name and visual assessment.* ***Results*** *The results for 307 children (154 females) showed an overall prevalence of defective enamel in first permanent molars of 14.5% and tooth prevalence of 7.2%. There were effects of gender or tooth site. There was no significant difference in prevalence between White-Caucasian (17%) or Asian-Caucasian (10%) children. The demarcated opacity was the most frequent type of defect seen, followed by diffuse opacities and hypoplasia. The occlusal and buccal surfaces were the most commonly affected.* ***Conclusion*** *As there were no significant differences in prevalence between children of different ethnic groups it was concluded that the aetiology of enamel defects in permanent molars was most likely affecting all children.*

KEYWORDS: *Dental enamel opacities, Enamel hypomineralisation*

Introduction

A marked variation in the prevalence of dental enamel defects in apparently similar populations has been reported. Researchers using the DDE index [FDI, 1982; Clarkson and O'Mullane, 1989] examined subjects in low water fluoride areas and noted prevalence as low as 9.8% [Angelillo et al., 1990] and as high as 54% [Suckling et al., 1985]. Similar wide variations in defect prevalence have also been reported using the Dean's index [Dean, 1934]. Cross comparison of the results of these various studies has been difficult because of the use of different indices, examination variability, methods of recording, different age groups, teeth used for diagnosis and whether examination of teeth was carried out under wet or dry conditions.

Wetzel and Reckel [1991] stated that there had been an increase in the occurrence of hypoplasia or hypomineralisation defects of first permanent molars (FPM) in Germany since 1978, but these authors did not state an exact prevalence. They added that there was no regional variation and relation to gender, proposing that the aetiology was not localised but systemic. These same authors excluded other aetiological factors such as amelogenesis imperfecta, tetracycline antibiotic and fluoride.

Esmark and Simonsen [1995] recorded an occurrence of idiopathic enamel hypomineralised FPM in a group of 7-year-old Danish children and concluded that the incidence of enamel defects needed further investigation related to possible environmental aetiological factors. Koch et al. [1987] had previously found severely hypomineralised enamel of FPM to be higher (15.4%) in Swedish children born in 1970 than in children born during the years before or after. This finding may indicate that there can be a specific influence on the development of enamel during a limited period of time. Other evidence from Sweden by Hammarberg et al. [1995] claimed that the prevalence of enamel defects of FPM was increasing but an exact prevalence was not mentioned in their report. Finally a study in Finland by Alaluusua et al. [1995] showed

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