DENTAL MATURATION IN PATIENTS WITH DENTAL AGENESIS

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ABSTRACT

Background: Dental agenesis is the most common developmental anomaly in humans, frequently associated with disorders in dental development and maturation.

Aim: The purpose of this study is to determine variations in dental maturation in a group of Venezuelan children with dental agenesis.

Design: 1,188 panoramic radiographs, from healthy patients ages 5 to 12 years old were studied for agenesis of permanent teeth, excluding third molars. Dental maturation was assessed by relative eruption and root formation according to Nolla, comparing children affected with dental agenesis to a stratified control group selected from the same population, excluding subjects with premature loss of primary teeth. Descriptive analysis, as well as differences between means (Student t test, ANOVA p=0.05) were performed.

Results: Prevalence of dental agenesis was 5.6%, (mean 1.64) with a female: male ratio of 1.44:1. The second mandibular premolars (35.19%), followed by the lateral maxillary incisors (30,55%) were most affected. Delayed dental eruption was observed in the dental agenesis group, with statistical significance only for the first eruption stages of the early mixed dentition. Root formation was delayed in up to 2 Nolla stages, with statistical significance for the maxillary lateral incisor and second premolar in most stages, as well as for complete coronal and apex formation for several teeth.

Conclusion: Dental maturation was delayed in children with dental agenesis, with variable significance for relative eruption and root formation for different teeth and ages.

INTRODUCTION

Dental agenesis is the most common developmental anomaly in humans, frequently associated with disorders in dental development and maturation. (1,2) Although occasionally caused by environmental factors, genetic factors with a marked degree of penetrance play a major role in dental agenesis. Different inheritance patters as well as involved genes have been identified. (1-3) Prevalence of dental agenesis worldwide varies from 0.3% to 36.5% with differences between genders and ethnic groups (4, 5). Little data regarding dental agenesis in Latina American populations has been published. (6 - 11)

Several studies have evidenced that dental development and eruption may be altered in individuals with dental agenesis. (6, 12 - 18)

Garn et al. in 1963 (12, 14) observed significant delay in tooth formation and eruption in a radiographic study comparing individuals with 3rd molar agenesis with a control group in North American samples. On the other hand, Bailit et al. in 1967 (13) observed that clinical dental eruption was delayed in 177 children with dental agenesis, although these differences were not significant when compared with eruption data from Japan.

The number of teeth affected by agenesis may also influence delays in dental development. Rune y Sarnäs (15) studied tooth size and formation in 91 Swedish children with four or more missing teeth. Tooth formation was found to be delayed in relation to chronological age as well as compared to norms described by Haavikko. Also, Schalk van der Weide y Cols (16) studied 216 individuals from the Nederlands with six or more missing teeth, using dental development stages proposed by Demirjian. These researchers found significant tendency for delay in tooth formation when comparing their sample to data from the Nijmegen Growth Study.

Lozada e Infante (6) used Demirjian's stages to compare dental development in 56 Colombian children with dental agenesis with a control group. They found a tendency for delayed tooth formation, although this was not statistically significant.

Uslenghi S, et al.(17) compared radiographic development of permanent teeth in a group of 135 children from the with agenesis of one or more permanent teeth to a matched group, using Haavikko's method. They found that tooth formation in children with hypodontia was significantly delayed. Ruiz-Maelin y Cols. (18) studied a sample composed by 139 white and non-white patients from the United Kingdom using the before mentioned methods (Demirjian, Haavikko). They found significant delay in dental age was found in the dental agenesis group when compared to a control group. This study found no evidence to suggest that sex or ethnicity has an effect in the delay in dental age for agenesis patients.

The purpose of this study is to determine variations in dental maturation in a group of Venezuelan children with dental agenesis.

DESIGN

The design was a retrospective, cross-sectional study of dental panoramic radiographs and dental records, taken for routine examination at the peadiatric dentistry postgraduate program university clinic (Group A) and a private paediatric dentistry practice (Group B). A total of 1,188 good quality panoramic radiographs, from healthy patients ages 5 to 12 years old were studied for agenesis of permanent teeth, excluding third molars. Radiographs with distortion or poor quality images were excluded. Children with syndromes, systemic diseases or premature loss of primary teeth were excluded. Selected radiographs were converted into digital images and downloaded. All radiographs were analyzed by one observer (ACM).

Dental agenesis was classified according to gender and affected tooth. Dental maturation was assessed by relative eruption (1= oclusal surface covered by bone, 2= oclusal surface breaks through alveolar bone cest, 3= oclusal surface reaches oclusal plane) and root formation according to Nolla's (19) proposed stages (0 to 10 including decimals 0.2, 0.5, 0.7 for mid-stages). Children affected with dental agenesis were compared to a control group selected from the same population, including 229 radiographs, stratified by age and gender to complete at least 3 controls for each study individual. 28 radiographs were randomly selected, including subjects from each age group, to test for intra-examiner agreement using Cohen's kappa. Descriptive analysis, as well as differences between means (ANOVA p=0.05) were performed.

This study was approved by the Research and Ethics Committees of the Universidad Central de Venezuela Dental School (N° 0101-2010) and received partial funding from the Counsel for Scientific and Humanistic Development CDCH-UCV (PI-10-7973-2011/1).

RESULTS

Cohen's kappa ststistic demonstrated an intraexaminer agreement of 0.77 for eruption stages and 0.68 for Nolla's tooth formation stages. 66 healthy children presented with dental agenesis; 37 patients had 1 missing tooth, 23 had 2 missing teeth, 2 had 3 missing teeth and 3 had 4 missing teeth. Only 1 patient had 7 missing teeth. Prevalence of dental agenesis was 5.6%, (mean 1.64) with a female: male ratio of 1.44:1. The second mandibular premolars (35.19%), followed by the lateral maxillary incisors (30,55%) were most affected teeth. (Fig. 1).

18 patients with dental agenesis that presented premature loss of primary molars were excluded from the study group in order to avoid any variation that could derive from this loss and should not be attributed to variations associated with dental agenesis.

Delayed dental eruption was observed in the dental agenesis group, with statistical significance only for the first eruption stages of the early mixed dentition. Root formation was delayed in up to 2 Nolla stages, with statistical significance for the maxillary lateral incisor and second premolar in most stages, as well as for complete coronal and apex formation for several teeth. (Table I, Table II, Fig 2, Fig 3)

Fig. 1. Distribution of teeth affected by dental agenesis

Table I. Means for tooth eruption distributed by age

Age	group	21	22	23	24	25	26	27	31	32	33	34	35	36	37
5,00 - 5,99	control	1,03	1,00	1,00	1,00	1,00	1,76	1,00	2,21	1,27	1,00	1,00	1,00	1,88	1,00
	agenesis	1,33	1,00	1,00	1,00	1,00	1,50	1,00	2,50	1,67	1,00	1,00	1,00	1,50	1,00
6,00 - 6,99	control	1,58	1,06	1,00	1,00	1,00	2,29	1,06	2,68	1,71	1,00	1,00	1,00	2,35	1,00
	agenesis	1,50	1,00	1,00	1,00	1,00	1,63	1,00	1,75	1,63	1,00	1,00	1,00	1,88	1,25
7,00 - 7,99	control	2,53	1,48	1,00	1,00	1,00	2,78	1,00	2,90	2,33	1,00	1,00	1,00	2,85	1,00
	agenesis	2,45	1,55	1,00	1,00	1,00	2,64	1,00	2,82	2,27	1,18	1,00	1,25	2,45	1,00
8,00 - 8,99	control	2,86	2,39	1,03	1,08	1,03	2,89	1,00	3,00	2,83	1,08	1,06	1,00	2,97	1,00
	agenesis	2,86	2,50	1,00	1,00	1,00	2,86	1,00	3,00	2,86	1,00	1,00	1,00	2,43	1,29
9,00 - 9,99	control	2,97	2,90	1,20	1,40	1,17	3,00	1,00	3,00	3,00	1,57	1,40	1,13	3,00	1,00
	agenesis	2,60	2,00	1,20	1,40	1,00	3,00	1,00	3,00	2,80	1,80	1,60	1,00	3,00	1,00
10,00 - 10,99	control	3,00	3,00	1,28	1,91	1,34	3,00	1,19	3,00	3,00	2,22	1,81	1,28	3,00	1,19
	agenesis	3,00	3,00	1,43	2,57	1,29	2,71	1,29	2,71	3,00	2,29	2,29	1,50	2,71	1,29
11,00 - 11,99	control	3,00	3,00	1,96	2,58	1,96	3,00	1,62	3,00	3,00	2,46	2,54	1,96	3,00	1,65
	agenesis	3,00	2,00	2,00	1,67	1,00	2,33	1,67	2,33	2,33	2,00	2,33	1,67	2,33	1,67

Fig. 2 Mean differences for eruption stages

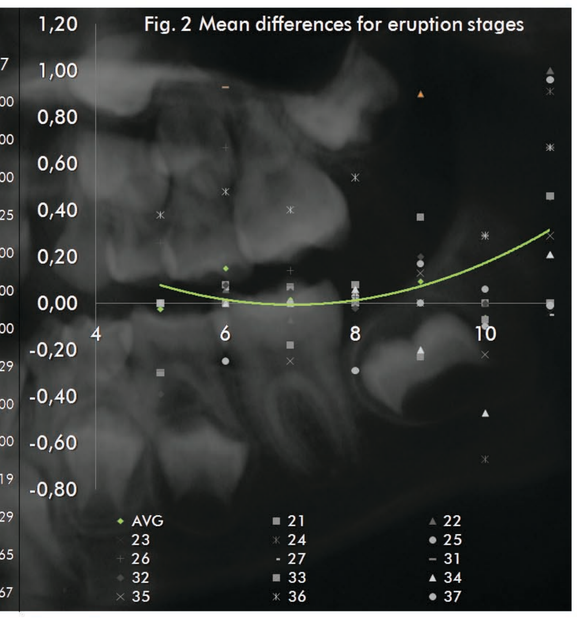
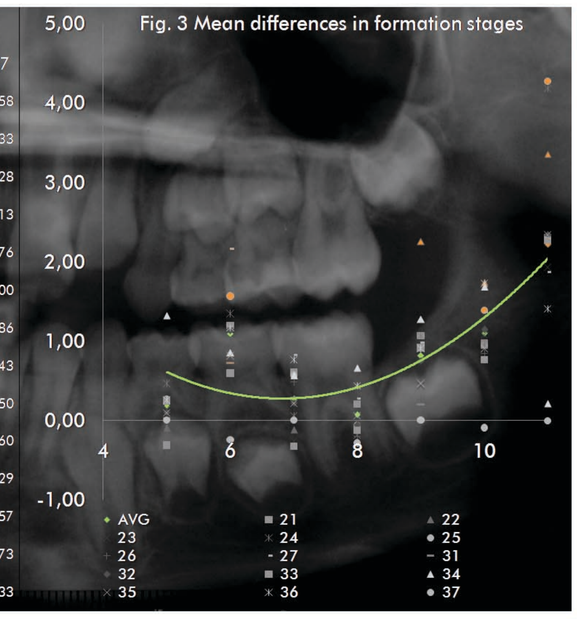


Table II. Means for tooth formation (Nolla) distributed by age

Age	Group	21	22	23	24	25	26	27	31	32	33	34	35	36	37
5,00 - 5,99	control	6,68	6,06	5,81	5,13	4,06	7,13	3,58	7,52	6,94	5,90	5,19	4,29	7,42	3,58
	agenesis	7,00	6,17	5,67	4,67	3,80	7,33	3,33	7,50	6,83	5,67	4,67	3,50	7,33	3,33
6,00 - 6,99	control	7,19	6,63	6,03	5,72	4,69	8,03	4,66	8,22	7,63	6,22	5,78	5,16	7,94	4,28
	agenesis	6,00	5,00	4,88	4,38	3,13	6,88	2,50	7,50	6,50	5,63	4,63	3,83	7,13	3,13
7,00 - 7,99	control	8,20	7,51	6,73	6,05	5,56	8,76	4,63	9,10	8,59	6,85	6,15	5,56	8,76	4,76
	agenesis	8,45	7,64	7,00	6,00	5,00	8,27	3,82	8,82	8,36	7,18	5,80	4,71	8,55	4,00
8,00 - 8,99	control	9,06	8,44	7,47	6,81	6,33	9,22	5,69	9,50	9,08	7,58	6,89	6,39	9,33	5,86
	agenesis	8,86	8,00	7,57	7,00	6,40	9,43	5,43	9,57	9,14	7,71	6,57	5,83	9,29	5,43
9,00 - 9,99	control	9,66	9,25	8,03	7,66	7,13	9,66	6,38	10,00	9,75	8,31	7,81	7,16	9,66	6,50
	agenesis	8,60	7,00	7,60	6,60	5,25	9,40	5,40	9,80	9,00	7,40	7,20	6,50	9,20	5,60
10,00 - 10,99	control	9,94	9,74	8,65	8,23	7,81	9,84	6,94	10,00	10,00	8,61	8,48	7,94	9,90	7,29
	agenesis	9,00	8,00	7,57	7,29	6,43	9,00	5,57	9,00	8,86	7,86	7,43	6,67	9,00	5,57
11,00 - 11,99	control	9,96	9,85	8,92	8,85	8,27	9,96	7,54	10,00	10,00	8,92	9,04	8,35	10,00	7,73
	agenesis	7,67	6,50	7,00	4,67	4,00	7,67	5,67	7,67	7,67	6,67	7,33	6,67	7,67	6,33

Fig. 3 Mean differences in formation stages



CONCLUSION

Prevalence of dental agenesis in this Venezuelan sample (5.66%) is similar to that reported in other populations. 91% presented with one or two missing teeth being the mandibular second premolar and the maxillary lateral incisor most frequently affected. Females were more affected than males (1.44:1).

Dental maturation was delayed in children with dental agenesis, although variations were evident between individuals.

Eruption was delayed for the early stages of mixed dentition, with statistical significance for the mandibular central incisor, maxillary first molar and maxillary lateral incisor.

Tooth formation had a tendency to be delayed, with statistical significance at most ages for the maxillary lateral incisor and maxillary second premolar; also for the late stages of root completion and apex formation for most teeth.

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