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Original Article

Symmetry of dental agenesis in Down Syndrome children

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Abstract *Background/purpose:* Down syndrome (DS) may affect the mouth, influencing its function, feeding and hence overall health status. We aim at investigating the frequency and type of dental agenesis in a school-age DS sample, evaluating gender, laterality, upper or lower side, and mono- or bi-laterality.
Materials and methods: Oral clinical and radiological exams were performed. Forty-six (20 female and 26 male) panoramic radiographs, done when DS patients were 8—12 years old, were examined, from patients between 3 and 25 years old at the first visit.
Results: The percentage of missing teeth was compared with chi-squared test: 65% of patients presented agenesis of one or more teeth. The most frequently missing teeth were the upper left lateral incisor, the lower second premolars and the upper right lateral incisor. Usually, the absence was bilateral. There was no difference between sexes, between mandible and maxilla, either in the left or in the right side.
Conclusion: A high occurrence of dental agenesis was observed in DS patients: some teeth were mostly affected and bilateral agenesis was frequent. Due to the high prevalence of teeth agenesis in DS patients, special care is devised for correct development of oral functions and for avoidance of oral pathologies.

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Introduction

Tooth agenesis is diagnosed when teeth are not present in radiography, due to a defect in development or to the absence of embryonic tooth buds. It is the most common craniofacial anomaly in humans, with a prevalence of 4.8% excluding the third molars.[1,2] Orthopantomography may exclude other anomalies that may block tooth eruption.[3] Tooth agenesis may be single or multiple, symmetric or casual. Multiple agenesis may arise from syndromes that affect different organs deriving from the ectoderm. Agenesis of primary teeth in non-syndromic population is not frequent and similar in both sexes. The lack of primary teeth is linked to the lack of permanent teeth, recurring in 95.6% of permanent teeth.[3] However, it is also possible that primary teeth agenesis is followed by a permanent tooth, and permanent agenesis may follow the primary teeth eruption, since primary and permanent tooth originate from two different extension of the dental lamina.[4]

Trisomy 21 or Down Syndrome (DS) is a chromosomic anomaly that affects 1:1250 newborns. Various anomalies have been described in the oral district of DS patients, which may affect oral functions. Mandibular prognathism is frequent, leading to impaired occlusion, and either uni- or bilateral inverted-, open- or cross-bite. Primary tooth eruption in DS persons may be delayed up to the 12th month, while the first permanent molar starts to appear around age 8. Microdontia and tooth agenesis are frequent, and a different electrolyte balance is observed in saliva.[5] Macroglossia may be real or apparent, due to the smaller oral cavity, leading to oral respiration and salivary leakage.

Gingivitis is also frequent, hence daily oral hygiene and dentistry controls should be very careful to avoid irreversible damages and morbidity.[6] DS patients present primary medical problems that interfere with oral care[7] and a higher risk of oral health problems,[8] some of which associated to peculiar Interleukin-1 polymorphism.[9] Few studies report data on the occurrence of dental agenesis in the DS population. In DS persons, without considering the third molars, tooth agenesis is present in 25–30% to 63%,[10–17] and between 52% and 92% including the third molars.[14,17–19]

The aim of the present work is to provide data on the presence of tooth agenesis in a series of DS patients: for the first time, we'll evaluate in the same patients the frequency of agenesis taking into account gender, laterality, upper or lower position and the presence of bilateral agenesis for homologous positions, in order to reveal non-casual links and suggest possible cues for developmental studies.

Materials and methods

The data on patients were collected at Piove di Sacco Hospital, Padova, Italy. The study was performed in accordance with the Helsinki Convention on Human Rights, and was approved by the institutional ethical committee (Comitato Etico per la pratica clinica, Unità Locale Socio Sanitaria 16 Padova, permission n. 3704/U16/15. The written informed consent was obtained from parents).

Data collection started on DS patients that underwent an orthopantomography between age 8 and 12; 46 patients (20 females, 26 males) were evaluated and visited every 3–4 months. The sample was selected according to age at first visit (3–25 years, mean 11.6), that is the age reported here. Care was taken to exclude cases of traumatic or clinical avulsion of tooth. Agenesis of the third molar was not considered, due to its high presence also in normal population.

The data on occurrence of agenesis were transformed in percentages. The following two-level variables were considered: males vs. females, mandible vs. maxilla, right

Table 1 Number and percentage of missing teeth in the 4 different quadrants: upper right (A), upper left (B), lower left (C), lower right (D). For each tooth position listed in the first column, the number of missing teeth in females (F), males (M) and their sum is reported, followed by the percentage. Percentages were analyzed with chi-squared test within each quadrant, significance below 0.001 is reported in the last column (Comparisons). Different letters mark different percentages within each quadrant, the same letter identifies percentages that are not significantly different.

Position	F	M	Total	%	Comparisons
A					
17	0	0	0	0	
16	0	0	0	0	
15	2	3	5	10.9	ab
14	0	1	1	2.2	b
13	0	1	1	2.2	b
12	5	6	11	23.9	a
11	0	0	0	0	
B					
21	0	0	0	0	
22	6	8	14	30.4	c
23	1	1	2	4.3	d
24	0	1	1	2.2	d
25	4	3	7	15.2	cd
26	0	0	0	0	
27	0	0	0	0	
C					
37	0	0	0	0	
36	0	0	0	0	
35	5	7	12	26.1	e
34	0	1	1	2.2	f
33	1	0	1	2.2	f
32	3	5	8	17.4	ef
31	0	2	2	4.3	ef
D					
41	0	2	2	4.3	gh
42	1	4	5	10.9	gh
43	1	0	1	2.2	h
44	0	2	2	4.3	gh
45	6	6	12	26.1	g
46	0	0	0	0	
47	0	0	0	0	
Sum of all quadrants	20	26	88		
p					<0.001

vs. left side, and unilateral vs. bilateral agenesis. Also, the missing teeth position was analyzed. Data were processed using chi-squared test, post-hoc pairwise comparisons were performed using Marascuilo test. The level of significance was set at $p < 0.001$. All the analyses were performed using SAS® (9.2 SAS Institute Inc.).

Results

Tooth agenesis was present in 65% of our DS patients, significantly more ($p < 0.001$) than in the normal population (according to Polder and coll.:[4] 2.2%–10.1%, mean 6.1%). The distribution of missing teeth reveals that 13% of our DS patients missed one tooth, 37% two, 8.6% missed five or six teeth, 4.4% missed ten or thirteen teeth. The number of missing teeth did not differ according to gender.

Patients were then assigned to three categories: normal, hypodontia (loss of 1–6 teeth), oligodontia (more than 6 missing teeth): 35% DS subjects did not present tooth loss, 61% lacked 1 to 6 teeth and 4% lacked more than 6 teeth: these three percentages were significantly different from each other.

Table 1 shows the data clustered by sex: no difference was present between sexes, when evaluating the same tooth. However, the percentage of missing teeth was different in the various positions, marked by different letters in Table 1.

The most affected positions were 22 (in 30.4% of the sample), 35 and 45 (26.1% each) and 12 (23.9%). Less affected positions were: 32 (17.4%), 25 (15.2%), 15 (10.9%) and 42 (10.9%). Some positions were never affected: 11, 16, 17, 21, 26, 27, 36, 37, 46, 47. Our subjects did not present agenesis for both upper and lower first molars, while two persons presented bilateral agenesis of upper or lower canines. In some cases, lower central incisors were absent.

Noteworthy, agenesis was mostly bilateral for some elements. Table 2 shows that in the maxilla tooth 12 was missing in eleven patients, which also lacked 22. Bilateral agenesis for 13 and 23 was present in one patient, and one lacked only 23. One patient presented agenesis for 14 and 24, while five patients lacked 15 and 25 (two lack only 25): bilateral agenesis was mostly present for lateral incisors, and then second premolars (Fig. 1a).

Also in the mandible, some bilateral agenesis was present. While twelve patients displayed agenesis of either 35 or 45, nine of them presented bilateral agenesis of 35 and 45; two patients showed bilateral agenesis of 31 and 41, while 32–42 and 34–44 agenesis could be unilateral or bilateral (Fig. 1b).

Concerning left-right asymmetries, there was a tendency ($P = 0.0504$) for a greater loss of teeth on the left side, while no difference was present between sexes, and between maxilla and mandible.

Discussion

Dental and oral problems in DS population arise independently from mental disability, socioeconomic status or dental care,[20] and may represent secondary significant limitations.[21] On the other hand, DS patients experience more treatment complications due to their medical condition.[22]

Our data support an increased percentage of agenesis in DS population. Without considering third molars, normal population shows 2–10% agenesis, while our sample shows 65% agenesis. Also in samples of 43[18] and 98 DS patients,[12] agenesis of at least one tooth affects 63% of patients. Others found around 60% in samples of 70 and 114 DS;[15,16] 56% in 25 subjects,[17] while two studies report different values, 38.6%,[13] and 81%.[11] All papers report a higher percentage in DS patients referred to the normal population, therefore dental agenesis appears peculiar to DS patients. However, the reported percentages may vary considerably, maybe due to difference in detecting missing teeth in the different papers.

Table 2 A. Number of patients showing bilateral agenesis in the maxilla. B. Number of patients showing bilateral agenesis in the mandible.

A					
Position	22	23	24	25	Right unilateral + bilateral
12	11				**11**
13		1			**1**
14			1		**1**
15				5	**5**
Left unilateral + bilateral	**14**	**2**	**1**	**7**	

B						
Position	31	32	33	34	35	Right unilateral + bilateral
41	2					**2**
42		4				**5**
43			1			**1**
44				1		**2**
45					9	**12**
Left unilateral + bilateral	**2**	**8**	**1**	**1**	**12**	

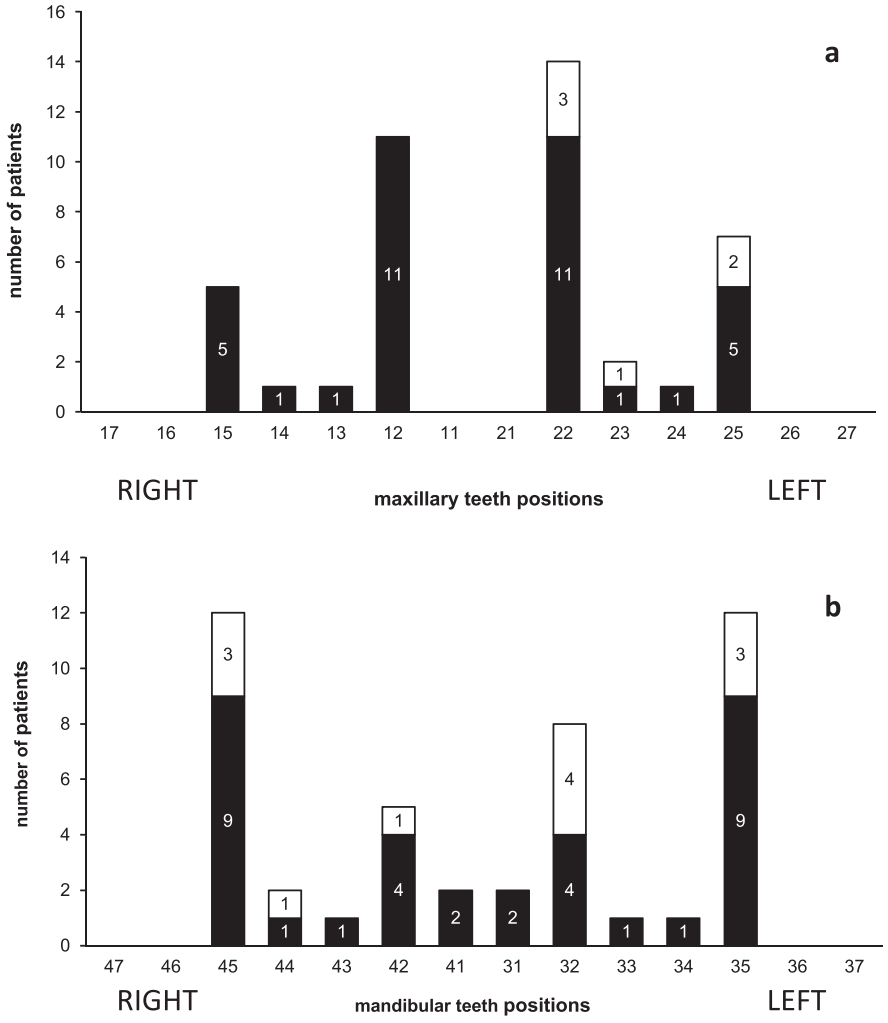

Fig. 1 **a**: Distribution of unilateral and bilateral agenesis in the maxilla. Black: bilateral agenesis, white: unilateral agenesis. Elements 12 and 22 are the most affected. **b:** Distribution of unilateral and bilateral agenesis in the mandible. Black: bilateral agenesis, white: unilateral agenesis. Elements 35 and 45 are the most affected. The number on the bars refers to the number of patients showing either bilateral or unilateral agenesis.

Our patients show no difference between sexes: this is in accordance with the majority of other studies.[12,14,16] However, in a sample of 25 DS patients (mean age 15), females were more affected,[17] while in another sample of 100 subjects, the males were more affected:[11] these two contrasting results require a cautionary interpretation, given the majority of studies finding no difference. The most affected teeth are absent in 30.4% (upper left lateral incisor), 26.1% (both lower second premolars) and 23.9% (upper right lateral incisor), while the other positions are much less affected.

In the maxilla, the lateral incisors agenesis is almost always bilateral, as for second premolars. In the mandible, bilateral agenesis is apparent for second premolars and lateral incisors.

Also other studies (see Supplementary Table 1 for a summary and Supplementary Table 2 for comparison) report that agenesis pattern affects more the lateral upper incisors, then lower second premolars and upper second premolars.[14–17] This may suggest that the most affected teeth are the last of each series, lateral incisors, second premolars and third molars.

Other studies reveal that symmetric agenesis affects positions 12–22, 15–25, 31–41, 35–45,[16] or 12–22 and 31–41,[15] and are supported also by our data. The finding that some elements are bilaterally absent points to the non-randomness of teeth absence and suggests a precise developmental defect, the mechanism of which may be linked to the syndrome itself and may be worthy of further studies.

Summarizing our findings, DS patients present a higher incidence of dental agenesis. This is in accordance with previous papers, despite some minor differences, due most probably to the statistical power or to stratification according to various criteria, including sex. Since the lack of one or more teeth may affect the development of oral structures and biomechanics of mastication, a special care for DS patient is devised for developing and preserving functionality.

Conflicts of interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jds.2018.04.003.

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