Experience of dental caries and its effects on early dental occlusion: a descriptive study

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Summary
Experience of dental caries and its effects on early dental occlusion: a descriptive study.
Aim. ***Describe the occurrence of dental caries in a sample of pre-school children and school children, aged 3 and 12, and study the possible association between caries and malocclusion.***
Methods. ***We selected and analyzed the medical records of a sample of 588 patients who had their first dental examination at the Pediatric Dentistry Unit, Department of Oral and Maxillofacial Sciences of Policlinico Umberto I, "Sapienza" University of Rome.***
Results. ***In the sample, 55.4% of the children had no decayed deciduous elements, while 44.6% had at least one decayed deciduous element. The prevalence of decayed permanent teeth was 10.2%, while 89.8% had no decayed permanent teeth. In the sample, 9.4% of the children showed advanced carious lesions, that needed tooth extraction and 6.6% needed a space maintainer for post-extractive interceptive treatment. In the sample, 26.7% of the examined patients had increased overjet, while 3.7% had decreased overjet and 25.4% of the sample had an increased overbite, 11, 2% had reduced overbite values. A percentage over 10% of the sample had an anterior openbite in centric occlusion. The prevalence of posterior crossbite among entire samples was 19.8%.***
Conclusions. ***Although the incidence of caries disease was high in the selected samples, the study did not show a statistically significant association between caries and clinical orthodontic abnormalities, except for the association between the midline deviation and the severe carious diseases, necessitating extraction.***

Key words: malocclusion, caries, early childhood caries.

Introduction

The specific aims of the present study were to describe the occurrence of dental caries in a sample of preschool children and school children, aged 3 and 12, and to study the possible association between caries and malocclusion. Many industrialised countries have experienced a decline in dental caries prevalence among children over the past decades. This trend of caries reduction may be ascribed to several factors of which the most important are improved oral hygiene, a more sensible approach to sugar consumption, effective use of fluorides, and school-based preventive programmes. However, dental caries remains a major public health problem in most industrialized countries, especially for those countries where preventive programmes have not been established (1).
Dental caries is an infective transmittable bacterial disease characterised by a multi factorial pathology (2). The main players in the aetiology of this disease are: cariogenic bacteria, fermentable carbohydrates, a susceptible tooth and host and time. The Early Childhood Caries (ECC) is a severe form of caries, defined in 2004 by the American Academy of Pediatric Dentistry, which affects children of 2-5 years of age and which is characterized by precise topographical and clinical parameters. The decay pattern of ECC is characteristic and pathognomonic of the condition. The four maxillary incisors are most often affected. The lower primary incisors are intact and the primary cuspids can be occasionally affected. In very severe cases the mandibular incisors are also affected. The primary canines most of the times remain unaffected as the disease progression halts prior to the eruption of these teeth. ECC has been given a number of different names including nursing bottle syndrome, milk bottle syndrome, baby bottle caries, and baby bottle tooth decay. The term "baby bottle tooth decay" is easily understood by parents and therefore is useful in a programme that educates them about this condition. However, children who never use a bottle may still develop the disease. Early childhood caries is a relatively new term that describes rampant caries in infants and toddlers (3,4). Johnston and Messer classifies ECC into 3 patterns: 1) developmental defects; 2) smooth surface lesions; 3) rampant caries. Verkamp and Weerheijm use 4 stages to classify the ECC: initial, damaged, deep and traumatic lesions.
Dental elements conservation is an important condition to harmonic development of dental arches. Several studies refer that caries is one of the most important cause of space loss and arch change with an alteration of the normal oc-

clusion. There is a general agreement that premature loss of primary teeth usually results in loss of arch space (6,8). Northway and Wainright reported that even without the premature loss of primary teeth, arch length was shown to be reduced due to the breakdown of dental structures from caries. However, only caries which become severe have a significant effect on dental arch circumference (9).
As caries prevention programmes are effective in reducing caries risk and as caries and loss of tooth structure in the primary teeth is associated with loss of tooth structure in the primary teeth is associated with loss of space in the dental arch, children who had received an effective caries prevention programme at the primary dentition should have less crowding than children who had not experienced such a programme. Nevertheless, there is no study to test the effect of caries prevention programme started in the primary dentition on crowding in the permanent dentition. Early loss of deciduous teeth may compromise the "harmonic state" of the dental arches which comes from the balanced evolution of maxillary growth and dentitional change.
In fact the treatment of dental caries (5) is often reduced to the extraction of infected deciduous elements; this radical treatment plan is partly due to the severity of the problem, in part to the poor compliance of the young patients. Northway (10) has carried out studies on the early extraction of deciduous molars. The rear arch dimensions vary if the loss affects only one or both deciduous molars. The loss, in the lower arch, ranges from 3 mm in the exfoliation of the deciduous first molar to 4 mm in the absence of the second deciduous molar, or both. Clinch and Healy correlate the age of the dental exfoliation with the amount of space lost.
Early extractions of deciduous molars performed before the age of 6, that's to say before the eruption of the first permanent molar, leads to the loss of up to 7 mm in 25% of cases, and with smaller losses in the remaining 75%. The loss is more marked in the upper arch. If the tooth extraction is performed after the eruption of the first molar, the loss of the space is less, being found in 1/3 of cases in the maxillary arch and in ¼ in the mandibular arch.
Park (11) conducted a study to assess the effects of the extraction of the mandibular first deciduous molar after the eruption of the first permanent molar and did not detect any statistically significant difference between the extracted side and the unaffected side (P = 0,33). Therefore, the premature loss of a first deciduous mandibular molar, in the case of Class I molar relationship, has a limited influence on the space for the eruption of permanent teeth.
It is therefore essential to devise a treatment plan to early care of decidous teeth, which represent the best space maintainers or, if the assessment is too late, it is essential to use an orthodontic appliance for "maintenance of space" (12). This term refers to the set of preventive treatments studied to avoid unwanted mesial movements of all teeth, including permanent molars, due to the early loss of a deciduous tooth in order to maintain the space needed for the proper eruption of unchanged permanent teeth.
The early extraction of deciduous elements is, however, the most common cause of malocclusion because it leads to the loss of the incisal guide (if front teeth are involved), to myofunctional alterations, to underdevelopment of premaxilla and to changes in the vertical dimension, and it is also a factor causing the loss of space for permanent elements, resulting in crowding of teeth. Crowding can be separated on the basis of aetiology into three categories: primary, secondary and tertiary. Primary crowding refers to the discrepancy between jaw size and teeth dimension that is mainly determined genetically. Secondary crowding refers to the crowding that is caused mainly by environmental factors. The premature loss of decidous teeth is the most common contributing factor. Other factors include interproximal caries and fillings with improper contact points (6). Tertiary crowding refers to crowding that occurs during the adolescent and post-adolescent period (7).
A correct maintainance (13) of the space can be obtained with the use of orthodontic devices.

Materials and Methods

We selected and analyzed the medical records of a sample of 588 patients who had their first dental examination at the Department of Oral and Maxillofacial Sciences, Pediatric Dentistry Unit, "Sapienza" University of Rome.
The following parameters were considered: molar class, overjet, overbite, as well as the presence of factors such as dental crowding, crossbite, deflected midline and the presence of decayed, deciduous or permanent teeth. The

Table 1 - Frequency distribution of decayed deciduous teeth.

Valid	Frequency	Percent	Valid percent	Cumulative percent
0	325	55,4	55,4	55,4
1	65	11,1	11,1	66,4
2	51	8,7	8,7	75,1
3	37	6,3	6,3	81,4
4	24	4,1	4,1	85,5
5	25	4,3	4,3	89,8
6	30	5,1	5,1	94,9
7	24	4,1	4,1	99,0
8	2	,3	,3	99,3
9	2	,3	,3	99,7
10	2	,3	,3	100,0
Total	587	100,0	100,0	

average age of the sample and the prevalence of sex and nationality were also evaluated.
The data were collected in a Microsoft Excel program table and prepared for statistical analysis. The latter was divided into several phases. In a first descriptive phase, the prevalence of sex, the average age, the nationality, and the percentage of decayed permanent and deciduous elements of the sample were assessed.
The prevalence of orthodontic-specific parameters, such as the molar class, the upper and lower crowding, increased or decreased overjets and overbites, crossbites and the midline deviation were then examined.
The following associations were then studied:
- caries and occlusal changes;
- caries and deviation of the midline;
- ECC (Early Childhood Caries) and occlusal changes.

To assess the statistical significance of these associations we used Pearson chi-square test, also known as the goodness of fit, a nonparametric test which is used in the presence of nominal variables. The test was considered significant when $p < 0.05$.

Results

Overall, clinical records of 588 patients, aged 3 to 12 , have been selected and assessed.
Analysis of the data showed that the percentage of males (50.9%) was higher than the percentage of females (49.1%), 93.4% coming from the European Union. The average age of the samples was 8 years. In the sample, 55.4% had no decayed deciduous elements, while 44.6% had at least one decayed deciduous element (Table 1).
In the sample the prevalence of decayed permanent teeth was 10.2%, while 89.8% had no decayed permanent teeth. In a sub-sample made of children who had at least one permanent tooth, the percentage of children with at least one decayed permanent teeth was 12.7% (Table 2).
In the sample, 9.4% of the children showed advanced carious lesions, that needed tooth extraction (Fig. 1) and 6.6% needed a space maintainer for post-extractive interceptive treatment (Fig. 2). The prevalence of ECC was 27.4% of the sample (Table 3).

Table 2 - Frequency distribution of decayed permanent teeth.

Valid	Frequency	Percent	Valid percent	Cumulative percent
0	414	87,3	87,3	87,3
≥1	60	12,7	12,7	100,0
Total	474	100,0	100,0	

Table 3 - Distribution of Early Childhood Caries (ECC).

Valid	Frequency	Percent	Valid percent	Cumulative percent
Absent	82	72,6	72,6	72,6
Present	31	27,4	27,4	100,0
Total	113	100,0	100,0	

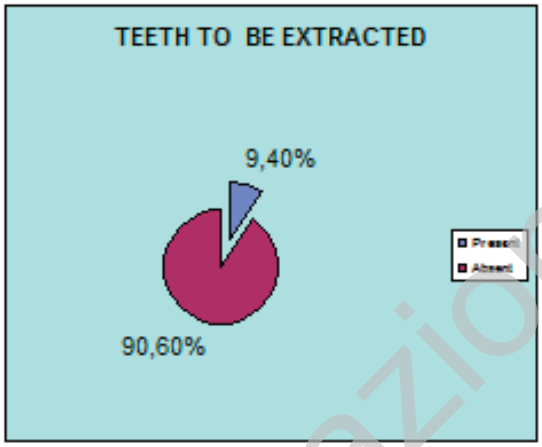

Figure 1 - Prevalence of advanced carious lesions that needed tooth extraction.

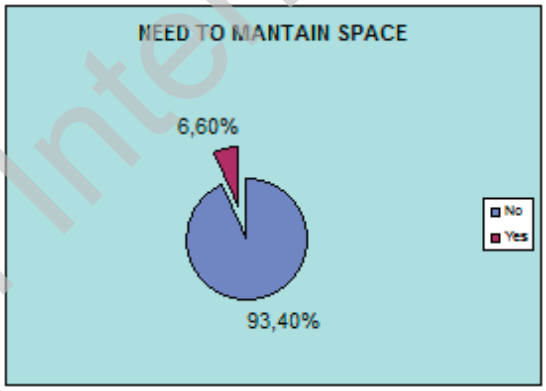

Figure 2 - Prevalence of need for a post-extraction space maintainer.

Specific malocclusions were analyzed: 48.9% of patients had a right first molar class, 22.8% a right second molar class, 8.7% had a third right molar class. While in 19.3% of the samples, the right molar class was not detectable because of the non-eruption of the first permanent molars (Table 4). As to the left molar class the data collected were as follows: 47.9% first class, 24.9% second class, 7.7% third class and 19.3% was not detectable (Table 5).
The upper and lower dental crowding was present in 12.4% (Table 6) of the sample and, specifically, 7.0% had an upper crowding (Fig. 3) and 9.9% a lower crowding (Fig. 4).
In the examined patients, 26.7% had increased overjet, while 3.7% had decreased overjet (Table 7).
In the sample, 25.4% had an increased overbite, 11, 2% had reduced overbite values (Fig. 5). A percentage over 10% of the samples had an anterior openbite in centric occlusion (Table 8).
The prevalence of posterior crossbites among entire samples was 19.8% (Table 9). In addition, the 8.3% had a deviation of the median line (Table 10).
The association between caries disease, in both deciduous and permanent teeth, and the onset of occlusal alterations, was not statistically significant in the selected samples ($p > 0.05$). However, the association between the

Table 4 - Right molar class.

		Right molar class			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	First	287	48,9	49,1	49,1
	Second	134	22,8	22,9	72,0
	Third	51	8,7	8,7	80,7
	Undetectable	113	19,3	19,3	100,0
	Subtotal	585	99,7	100,0	
Missing	System	2	,3		
Total	587	100,0			

Table 5 - Left molar class.

		Left molar class			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	First	281	47,9	48,0	48,0
	Second	146	24,9	25,0	73,0
	Third	45	7,7	7,7	80,7
	Undetectable	113	19,3	19,3	100,0
	Subtotal	585	99,7	100,0	
Missing	System	2	,3		
Total	587	100,0			

Table 6 - Distribution of crowding.

	Crowding			
Valid	Frequency	Percent	Valid percent	Cumulative percent
No	514	87,6	87,6	87,6
Yes	73	12,4	12,4	100,0
Total	587	100,0	100,0	

deviation of the midline and the carious disease is statistically significant when the latter is so severe to require the extraction of the affected tooth (P = 0.007).
The ECC was statistically significantly associated with a normal overjet and overbite (p = 0.001) (Table 11).
Furthermore, only 2.6% of patients with ECC had anterior crossbites while 92.3% had neither front nor rear crossbites.

Discussion

Studies on the prevalence of malocclusion were carried out in various parts of the world.
In this study, thanks to a descriptive statistical analysis, it was possible to assess the prevalence of various forms of altered occlusion, in a group of children aged between 3 and 12.
Most of the subjects had a first molar class, while the third molar class was less frequent (less than 10%). These data are similar to those reported by Savannah (14) (Tables 4 and 5).
Table 6 shows that just over 10% of the subjects had upper or lower dental crowding; while in literature other studies (20) show that in the patients that had not received a caries prevention programme, the arch perimeter is smaller and subsequently more crowding than in the patients underwent to a preventive programme. This could be explained by loss of arch perimeter as a result of interprox-

Table 7 - Overjet distribution.

Valid	Overjet	Frequency	Percent	Valid percent	Cumulative percent
	No	408	69,5	69,5	69,5
	Increased	157	26,7	26,7	96,3
	Decreased	22	3,7	3,7	100,0
	Total	587	100,0	100,0	

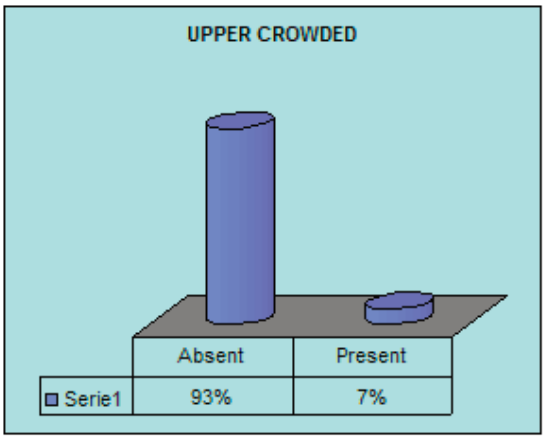

Figure 3 - Prevalence of crowding in the upper dental arch.

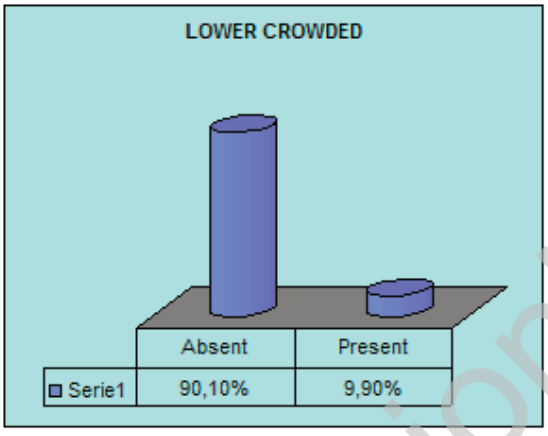

Figure 4 - Prevalence of crowding in the lower dental arch.

Table 8 - Openbite distribution.

		Openbite			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	Absent	524	89,3	89,3	89,3
	Present	63	10,7	10,7	100,0
	Total	587	100,0	100,0	

imal caries and premature extraction of the deciduous teeth which was greater in the patients without caries preventive programme.

The crowding in the lower arch was slightly more frequent than in the upper one (Figs. 3 and 4), while in Legovic's study (21) the space loss after premature extraction of deciduous teeth or after breakdown of dental structures from caries was greater in the upper arch compared to that in the lower arch.

The prevalence of posterior crossbites among entire samples was 19.8%, much higher than what was reported by Brunelle et al.(15). The prevalence of front openbites was also found higher. 26.7% of the sample had an increased

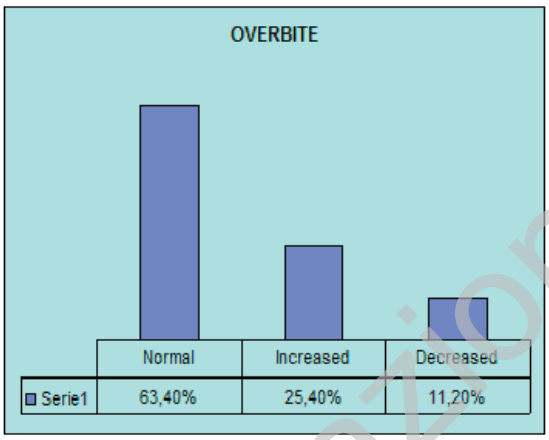

Figure 5 - Prevalence of overbite alterations.

Table 9 - Crossbite distribution.

		Crossbite			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	Absent	471	80,2	80,2	80,2
	Present	116	19,8	19,8	100,0
	Total	587	100,0	100,0	

overjet and approximately 25.4% had an increased overbite, in agreement with the results reported by Martins and Lima (16). Besides, Table 12 shows that less than 10% of the sample had deviations of the median line.

Prevalence of carious disease

Although many authors agreed to record a decreasing of caries in industrialized countries, data reported in this study show a high prevalence of caries disease.

Campus et al (17) report a caries prevalence in Italian children of approximately 22% at the age of 4 and about 44% at the age of 12. In our study the percentage of subjects with at least one decayed deciduous tooth is 44.6%.

The prevalence of children with decayed permanent elements in the entire sample is 10.2%, however, in a subsample of children who had at least a permanent element in the arch is equal to 12.7%.

The prevalence of children with so severely decayed teeth to require the extraction of the element was also quite high. The carious disease did not appear to be associated with alterations of occlusal characteristics and with deviations of the median line except where the pathology was so serious to require the dental extraction.

The prevalence of ECC is equal to 27.4% of the sample. This prevalence is higher than what reported in the literature; this data is attributable to our UOC pre-selected population. The prevalence of ECC occurs between 1% and 12% in industrialized countries and about 70% in developing countries populations (16). The study also does not show a statistically significant association between caries and clinical orthodontic abnormalities, except for the association between the midline deviation and the extraction of a deciduous element (p =. 07).

Table 10 - Distribution of deviation of midline.

		Midline			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	Non phatological	538	91,7	91,7	91,7
	Phatological	49	8,3	8,3	100,0
	Total	587	100,0	100,0	

Table 11 - Association between overjet/overbite and ECC (Early Childhood Caries).

		overjet					
		no		increased		decresed	
		Count	Column N, %	Count	Column N, %	Count	Column N, %
ECC	absent	371	90,9%	156	99,4%	21	95,5%
	present	37	9,1%	1	,6%	1	4,5%
		overbite					
		no		increased		decresed	
		Count	Column N, %	Count	Column N, %	Count	Column N, %
ECC	absent	335	90,1%	148	99,3%	65	98,5%
	present	37	9,9%	1	,7%	1	1,5%

Conclusion

Considering the high incidence of caries disease in the selected samples, 44.6% for deciduous teeth and 12.7% for permanent teeth, we think we should boost the oral health campaign among children, in order to achieve the new world trends that are recording a significant reduction in the incidence of caries in children.
Although this study has not achieved significant results from a statistical point of view regarding the association between caries disease and the onset of malocclusions, we agree with the international literature (18)(19) on the importance of interceptive orthodontic treatment in order to maintain the space for permanent teeth unchanged, both in the case of early extractions and of significant interproximal caries. (17)

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