Alveolar bone loss in the primary dentition: state of the art

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Alveolar bone loss has been reported in primary teeth of healthy young children with a variable prevalence. This study aimed to review the literature on alveolar bone loss in the primary teeth of children without systemic diseases and to discuss the controversies with regard to the prevalence of this pathology in the primary dentition.

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INTRODUCTION

Periodontal diseases are infections caused by microorganisms that colonize dental surfaces at or below the gingival margin and are part of a dental biofilm. The onset is usually delayed for prolonged periods of time after initial colonization by the pathogens.[1]

In the primary dentition, periodontal diseases are usually limited to the gingival tissues.[2-4] However, deeper involvement of periodontium can be occasionally seen, and despite various reports on the relationship between periodontal diseases and systemic disorders,[3;5-8] otherwise healthy children can also present these oral diseases[9-11].

The shorter lifetime of the primary dentition is probably the reason why in general little attention is paid to periodontitis in children. In addition, the rate of periodontal destruction may be too slow in the majority of cases to cause a substantial loss of attachment within the lifetime of the primary dentition.[12]

A retrospective radiographic study of 17 patients with localized juvenile periodontitis has demonstrated that 16 of these patients presented one or more sites of alveolar bone loss in the primary dentition while none of the controls presented such bone loss in their primary teeth.[13] Besides, another retrospective study has been conducted with a larger sample (286 patients) and showed that 40% of the patients that presented localized juvenile periodontitis had had alveolar bone loss in the primary dentition[14]. For this reason, some studies have emphasized the necessity of clinical and radiographic examinations in children in order to diagnose and treat alveolar bone loss early in life.[5,7,9,15-17] However, oral health conditions of preschool children have not been documented to the same extent as school children's oral health, even with regard to the distribution and severity of periodontal disease[18].

The aim of this study is to review the literature on alveolar bone loss in the primary teeth of children without systemic diseases and to discuss the controversies with regard to the prevalence of this pathology in the primary dentition.

FACTORS INFLUENCING ALVEOLAR BONE HEIGHT IN PRIMARY TEETH

The distance from cementoenamel junction (CEJ) to the alveolar bone crest (ABC), which can be observed in bitewing radiographs, has been extensively used to determine the absence or presence of alveolar bone loss in children.[2,11,13-14,19-25] Some studies agree that any measure of this distance beyond 2 mm should be considered abnormal with regard to primary teeth.[2,14,22-23,25] Other studies, however, also consider CEJ-ABC distances between 2 and 3 mm as belonging to the normal range according to differences that can be observed with increasing age.[11,13,20-21,24] Furthermore, in the reviewed literature, only one radiographic study has reported that the normal alveolar bone height between primary molars would be a CEJ-ABC distance of 1.00±0.50 mm, or rather, distances greater than 1.5 mm would already be considered alveolar bone loss.[19]

Measures of the CEJ-ABC distance above these threshold values may indicate an early stage of periodontal disease in primary teeth and/or a tendency of the patient to develop periodontal disease. These patients should be identified as risk populations, and receive special attention with the intent to cure present incipient disease and most importantly, to establish proper measures to prevent the chronic and continuous progress that is characteristic of periodontal disease.[19]

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Since increased CEJ-ABC distance in primary teeth can also be a predisposing factor of alveolar bone loss in the permanent dentition, it is important to identify the relationship between CEJ-ABC and certain potential etiological factors.[26]

Age has been reported to be a significant variable in determining the CEJ-ABC distance,[19,24,27] which usually increases with increasing age.[15-16,19,24,27] Moreover, the increase in the CEJ-ABC distance in primary teeth is related to a combination of several other factors including facial growth and attrition.[27] The latter contributes to this increase, as it is responsible for a continuous eruption of these teeth.[19] Besides, exfoliation of primary teeth has already been reported as a physiological feature that can promote an increase in the CEJ-ABC distance, what can be considered a normal characteristic of the shedding process[2;20].

Ethnic origin[22] and caries prevalence[22-23] have also been found to contribute to alveolar bone loss. Still with regard to caries prevalence, it has been verified that proximal caries[11,15,20-21,26,28] and stainless steel crowns[20,25] appeared to have a deleterious effect on the alveolar bone. In spite of the findings of the last two studies, Einwag[29] did not find bone resorption associated with stainless steel crowns until the age of fifteen, irrespective of how long the crowns had been in place.

Interproximal restorations and lack of interproximal contact were also significantly associated with an increase in the CEJ-ABC distance.[30] Bimstein *et al*.[31] have found that there was 5 to 10 times more alveolar bone loss at sites that have inadequate restorations compared to adequately restored sites, confirming a direct relationship of marginal alveolar bone loss with inadequate amalgam restorations or crowns in primary molars.

Many factors may influence alveolar bone height in primary teeth and loss of periodontal support may occur as a physiological process during exfoliation, or as a result of proximal caries, food impaction and inadequate proximal restorations. Then, prevalence of "true" periodontitis in children may be difficult to estimate.[32]

PREVALENCE OF ALVEOLAR BONE LOSS IN PRIMARY TEETH

Periodontitis is characterized by the destruction of the periodontal fiber attachment to alveolar bone.[33] However, a small attachment loss, or apical migration of the junctional epithelium in the human primary teeth, has no clinical significance and does not necessarily denotes the presence of periodontitis, since it may be physiological.[17] For this reason, there is considerable variation in the prevalence of this pathology in children, as many studies on periodontal diseases during childhood deals with different ethnic groups, age ranges, and diagnostic criteria.[17,30] Especially with regard to age range and diagnostic criteria, there are studies that deals with children both in the primary and in the mixed dentition, as well as some of them use either radiographic or clinical parameters to diagnose periodontal alterations (Table 1).

DISCUSSION

Children and adolescents susceptible to periodontal disease may and should be identified by radiographic means as early as possible in order to prevent the advance of an otherwise possibly destructive disease.[20] Nevertheless, although radiographic bone loss may be an indication of periodontal disease, it does not discriminate between current periodontal disease and bone loss due to previous episodes of disease.[23,38] Therefore, correct diagnosis of periodontitis requires the concurrence of bleeding on probing and loss of periodontal support, although studies on the prevalence of this oral disease in children have focused only upon the accumulative destructive effect of the disease revealed by clinical measurements of loss of attachment or radiographic measurements of marginal bone loss.[32]

Periodontal research have employed a wide variety of diagnostic features including gingivitis, probing depths, clinical attachment level scores, and radiographically assessed alveolar bone loss. Quite different threshold values have also been used to define periodontal pockets as "deep" or "pathological", or to diagnose clinical attachment and alveolar bone losses[32]. These methodological discrepancies can explain some of the variations found in the reviewed literature with regard to prevalence of alveolar bone loss in the primary teeth.

Sweeney *et al*.[35] have reported the lowest prevalence of periodontitis (see Table) despite having one of the highest studied sample sizes (2264 children). This result would probably be due to methodological problems as the authors employed their own clinical judgment to diagnose radiographic alveolar bone loss, without clearly defining which parameters were employed as diagnostic criteria. On the other hand, the study of Jamison[34] has showed high prevalence of periodontitis within all age groups (see Table) as well as with regard to the whole studied population (mean total prevalence of 25.1%). These results may reflect an overestimation of the population's periodontal status as many children were probably having their primary teeth being shed (age ranged from 5 to 14 years), and the author neither exclude any tooth from the evaluation nor used radiographs that could have been used to identify bone loss sites that were due to the exfoliation process.

The variable age range of the studied populations is another important aspect to be discussed. In fact, none of the reviewed studies have really analyzed only the primary dentition, although many of them have reported.[2,13,16,23-24,38] In spite of having analyzed primary teeth, these studies usually dealt with children in the mixed dentition. Furthermore, even considering that some children were in the early mixed dentition and that their primary cuspids and molars were probably not undergoing exfoliation, mesial sites of cuspids and distal sites of second primary molars

Table 1. Prevalence of periodontitis in primary teeth according to different studies

Authors (year)	Diagnostic criteria	Age (years)	S	P	Country
Jamison (1963)[34]	Ramfjord – PDI>3	5-7 8-10 11-14	67 68 24	26.9% 25.0% 20.8%	United States
Sweeney et al. (1987)[35]	"Normal" or "reduced" height of ABC (examiner's judgment)	_	2264	0.84%	United States
Bimstein et al. (1988)[20]	QBL= CEJ-ABC between 2mm e 3mm without loss of cortical and inter-radicular bone DBL= CEJ-ABC >3mm + clear evidence of loss of cortical and inter-radicular bone	2 3 4 5 6 7 8 9 10 11 12	3 19 92 118 108 112 90 87 79 46 51	0% 0% 4.3% 3.4% 1.9% 2.6% 3.3% 1.1% 3.3% 2.1% 0%	United States
Bimstein (1992)[21]	CEJ-ABC ≥3mm + clear evidence of loss of cortical and interdental alveolar bone	3-10	106	19.8%	_
Bimstein et al. (1993a)[11]	QBL= CEJ-ABC between 2mm e 3mm and/or partial loss of LD DBL= CEJ-ABC >3mm + complete absence of LD	3 4 5 6 7 8 9 10 11 12	1 20 48 73 83 88 92 77 14 4	0% 0% 6.3% ≈15% ≈8% ≈12% ≈17% ≈13% ≈14% 0%	Israel
Bimstein et al. (1994)[22]	QBL= CEJ-ABC >2mm + partial loss of LD DBL= CEJ-ABC >2mm + complete absence of LD	5	317	QBL 8.5% DBL 2.1%	New Zealand
Sjödin & Matsson (1994)[23]	CEJ-ABC >2mm	7 8 9	1058 1470 1368	2.0% 3.1% 4.5%	Sweden
Drummond & Bimstein (1995)[28]	CEJ-ABC >2mm + complete absence of LD	4 5 6 7 8 9 10	13 26 43 31 30 18 15	0% 19.2% 27.9% 22.6% 16.7% 16.7% 42.9%	New Zealand
Matsson et al. (1995)[36]	CEJ-ABC >2mm	4-11	Vietnamese 36 Swedish 41	Vietnamese 28% Swedish 5%	Sweden
Bimstein et al. (1996)[31]	CEJ-ABC >2mm + complete absence of LD	6-9	354	26.8%	_
Carranza et al. (1998)[25]	CEJ-ABC >2mm + complete absence of LD	3 4 5 6 7 8 9 10	10 31 28 11 12 6 9 8	0% 6.4% 10.7% 0% 0% 33.3% 22.2% 0%	Mexico
Paolantonio et al. (2000)[37]	PD ≥2mm from the CEJ + radiographic confirmation (resorption of ABC)	6-14	780	2.1%	Italy

S: sample size
P: prevalence of periodontitis
PDI: periodontal disease index
CEJ-ABC: distance from the cementoenamel junction to the alveolar bone crest
QBL: questionable bone loss
DBL: definitive bone loss
LD: lamina dura
PD: probing depth

could have been influenced by the eruption of permanent lateral incisors and first molars, respectively. The table shown at the present study was constructed by discriminating all possible age years (according to data availability) and their corresponding prevalence in order to give an idea of the actual prevalence of alveolar bone loss in the primary dentition. Most of the studies, however, have evaluated few children in the ages of 3, 4 and 5 years, except for the study of Bimstein *et al.*[22] with 5-year-old New Zealand children that studied a sample of 317 children,

although the authors did mention if all the participants were in the primary dentition.

Few data exist on the prevalence of periodontitis in the primary dentition, and different assessment methods limit comparison among the available studies[32]. In addition, because of physiological changes in the dentition, data describing loss of periodontal support in primary teeth of children in the mixed dentition may not be trustworthy. Then, it would be quite interesting to carefully investigate alveolar bone loss in children actually in the primary dentition using both clinical and radiographic parameters as diagnostic criteria for identification of current disease.

CONCLUSIONS

Many features as proximal caries, defective proximal restorations, tooth exfoliation and others, can influence alveolar bone loss in the primary dentition. For this reason and because of different diagnostic criteria employed in epidemiological studies, prevalence of alveolar bone loss in primary teeth presents a wide range. Further studies with children in the primary dentition should be encouraged and would be of great importance.

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