Frequency of alveolar bone loss adjacent to proximal caries in the primary molars and healing due to restoration of the teeth

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Abstract

The frequency of alveolar bone loss adjacent to extensive proximal caries, and the effect of dental restorations on alveolar bone loss and healthy alveolar bone were examined in human primary molars. Proximal caries, contact loss, mesial drift and the presence of alveolar bone loss were recorded from 190 bite-wing radiographs from 60 boys and 46 girls. Proximal caries was evident in 297 quadrants. In 63.0% of quadrants, both primary molars had proximal caries. Contact loss was evident in 38.4% of the quadrants with proximal caries. Bone loss was found in 12.1% of the quadrants with proximal caries or 31.6% of those with contact loss. Analysis of variance for the presence of bone loss indicated statistically significant values ($P < 0.05$) for one or two teeth with caries by quadrant, the presence or absence of contact loss, and age. A second examination was available for 41 children. Among these, eight out of the 36 bone defects disclosed at the first examination were present. At the second examination, after tooth restoration, healing of five bone defects was evident. These findings indicate a connection between the presence and treatment of extensive proximal caries and alveolar bone health in the primary dentition. (Pediatr Dent 14:30–33, 1992)

Introduction

Periodontal disease in children has been described as being limited to gingivitis.[1, 2] However, evidence of more advanced forms of periodontal disease in the primary dentition has been reported in clinical and radiographic studies.[3–8] Extensive proximal caries, which facilitates food impaction and plaque retention in the interdental areas, has been described as one of the possible etiologic factors of alveolar bone loss, both in the primary and permanent dentition.[8–11] Alveolar bone loss is not present in every case of extensive proximal caries in the primary dentition.[8] However, the ratio of bone loss to the presence of extensive proximal caries, and the possible healing effect of comprehensive dental treatment on interdental alveolar bone loss adjacent to extensive proximal caries, remain unclear. The purposes of the present study were to describe, in the primary human dentition:

1. The frequency of abnormal interdental alveolar bone loss adjacent to primary molars with proximal caries with relation to contact loss and mesial drift, and
2. The effect of restoration of carious proximal surfaces on healthy alveolar bone and on existing interdental alveolar bone loss adjacent to extensive proximal caries.

Materials and Methods

The dental records of 300 patients from a pediatric dentistry clinic were chosen randomly for examination. From these, pretreatment bite-wing radiographs were selected based on the following criteria: presence of the primary molars, minimal evidence of distortion, minimal overlap between tooth surfaces, a clear image of the alveolar bone area between the primary molars, and evidence of caries in at least one of the adjacent proximal surfaces of the primary molars. In the radiographs that met these criteria, the following parameters were recorded:

1. Caries presence in the adjacent proximal surfaces of the primary molars
2. Contact loss due to caries between the primary molars
3. Mesial drift of the primary molars due to contact loss: mesial drift was noted in quadrants in which obvious overlap was evident between an imaginary line, which was drawn to complete the missing tooth surface and the adjacent primary molar, or between two imaginary lines in quadrants with proximal caries in both primary molars (Figure, next page)
4. The presence of interdental alveolar bone loss: interdental alveolar bone loss was considered to be present in cases in which the distance from the CEJ to the interdental alveolar bone crest was 3 mm or more[12] and loss of cortical and interdental alveolar bone clearly was evident.

The presence of alveolar bone loss also was recorded in posttreatment bite-wing radiographs which were selected based on the following criteria: the need to have a pretreatment radiograph match, presence of the primary molars, minimal evidence of distortion, minimal overlap between tooth surfaces, a clear image of the alveolar bone area between the primary molars, evidence of comprehensive dental treatment, and no caries in the adjacent proximal surfaces of the primary molars. In cases for which more than one pair of posttreatment

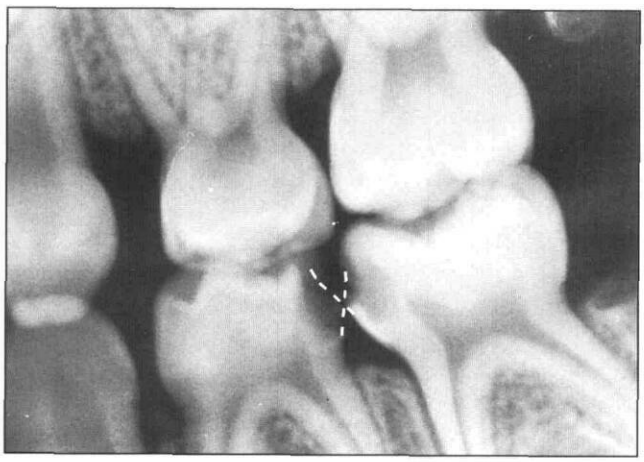

Figure. Radiograph in which extensive proximal caries, contact loss, and mesial drift are evident. Mesial drift is revealed by the overlapping of the dotted lines which replace the missing proximal surfaces. The alveolar bone between the primary molars appears to be normal.

radiographs were available, the last one that met the criteria was utilized.

The significance of the difference between means was examined with the Student's *t*-test (StatView™, BrainPower Inc.). Analysis of variance (ANOVA) was utilized to examine: the presence of contact loss with consideration of gender, the number of primary molars with caries by quadrant and arch (StatView); the prevalence of alveolar bone loss with consideration of age, gender, number of primary molars with caries by quadrant, contact loss, and arch (SPSS, version 9.0). A level of $P < 0.05$ was regarded as statistically significant.

One hundred and ninety pretreatment bite-wing radiographs from 106 children (60 boys and 46 girls, Table 1) met the requested criteria. No significant difference in age (Student's *t*-test, $t = 0.99$, $P > 0.05$) was found between boys (5.5 years ± 1.3) and girls (5.8 years ± 1.7).

In the selected radiographs, at least one primary molar was affected by proximal caries in a total of 297 quadrants: 131 maxillary and 166 mandibular (Table 2); 164 in boys and 133 in girls (Table 3); in 63% of the quadrants (N = 187) both primary molars had proximal caries. Contact loss due to caries was evident in 38.4% (N = 114) of all the quadrants with proximal caries. The ANOVA for the presence of contact loss with consideration of number of quadrants with one (N = 29) or two molars (N = 85) with caries, for the maxilla (N = 39) and the mandible (N = 75) and for boys (N = 67) and girls (N = 47), was statistically significant ($P < 0.05$) for the number of molars with caries per quadrant and arch. Mesial drift was evident in 81.6% (N = 93) of the quadrants with contact loss (51 in boys and 42 in girls).

In 21 children, alveolar bone loss was found in 36 quadrants (Table 4, next page). In all the quadrants with alveolar bone loss contact loss also was evident, and in 94.4% (N = 34) of them mesial drift also was present. Among the 21 children with bone loss, 38.1% (N = 8) had > 1 quadrant affected. Therefore, 63.9% (N = 23) of the quadrants with bone loss were present in children who had bone loss in >1 quadrant (Table 4). The presence of alveolar bone loss by gender, number of quadrants with caries, contact loss, arch affected, and number of teeth with caries by quadrant is presented in Table 5 (next page). The distribution and prevalence of quadrants with bone loss by age is presented in Table 6. ANOVA for the presence of bone loss with consideration of age, gender, number of primary molars with caries by quadrant, contact loss, and arch indicated statistically significant differences ($P < 0.05$) for one or two teeth with

Table 1. Distribution of children with selected pretreatment radiographs

Age (years)	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*Totals*
Males (N)	—	16	18	16	4	5	—	1	60
Females (N)	2	12	9	7	8	6	1	1	46
Total									106

Table 2. Numbers of quadrants affected with caries on the first and second primary molars only, and in both, by quadrant

	*Quadrant**				
	UL	*UR*	*LL*	*LR*	*Totals*
First molar only	22	21	26	27	96
Second molar only	4	3	3	4	14
Both molars	43	38	54	52	187
Totals	69	62	83	83	297

*UL = upper left, UR = upper right, LL = lower left, LR = lower right.

Table 3. Numbers of quadrants affected with caries on the first and second primary molars only, and in both, by gender of child

	Gender		
	Male	*Female*	*Total*
First molar only	54	42	96
Second molar only	7	7	14
Both molars	103	84	187
Totals	164	133	297

Table 4. Distribution of quadrants with alveolar bone loss by the number of children and gender

	Female Number of:		*Male* Number of:	
	Children	*Quadrants*	*Children*	*Quadrants*
One quadrant per child	7	7	6	6
Two quadrants per child	1	2	2	4
Three quadrants per child	—	—	3	9
Four quadrants per child	2	8	—	—
Totals	10	17	11	19
Mean		1.7		1.7
SD		1.25		1.25

Table 5. Frequency of alveolar bone loss by the presence of proximal caries, gender, arch, number, and type of teeth affected

	Quadrants with Bone Loss	
	N	*%*
Boys with proximal caries (N = 60)	10	16.7
Girls with proximal caries (N = 46)	11	23.9
Quadrants with contact loss in boys (N = 67)	19	28.3
Quadrants with contact loss in girls (N = 47)	17	36.2
Maxillary quadrants with caries (N = 131)	16	12.2
Mandibular quadrants with caries (N = 166)	20	12.0
Maxillary quadrants with contact loss (N = 39)	16	41.0*
Mandibular quadrants with contact loss (N = 75)	20	26.7*
Quadrants with caries in first primary only (N = 96)	5	5.2†
Quadrants with caries in second primary only (N = 14)	1	7.1†
Quadrants with caries in both molars (N = 187)	30	16.0†

*,†Statistically significant difference, ANOVA $P < 0.05$.

Table 6. Distribution of quadrants with interdental alveolar bone loss among quadrants with proximal caries in primary molars by age

*Age :**	*3–4*	*5*	*6*	*7*	*8*	*9–10*	*All*
Quadrants							
With bone loss	1	7	16	4	8	—	36
Total quadrants	84	78	75	23	27	6	293†
% with bone loss	1.2	9.0	21.3	17.4	29.6	—	12.1‡

* In years.

† For four quadrants no age was available.

‡ Statistically significant, ANOVA $P < 0.05$.

caries by quadrant, the presence or absence of contact loss and age.

Seventy-five posttreatment radiographs from 41 children met the requested criteria. No significant differences in age (Student's *t*-test, $t = 0.64$, $P > 0.05$) or gender distribution were found between the children with one examination (58.5% boys, 5.5 years ± 1.5) and those with two examinations (53.7% boys, 5.7 years ± 1.6). The follow-up period ranged from 6 to 37 months (16.8 months ± 7.1), and it was similar (Student's *t*-test, $t = 1.07$, $P > 0.05$) in males (15.7 months ± 5.5) and females (18.2 months ± 8.8). Among the children with two examinations, 110 quadrants with caries were identified in 75 pretreatment radiographs. In 7.2% of these quadrants (N = 8) abnormal alveolar bone resorption was evident. Examination of the corresponding 75 posttreatment radiographs revealed that in five quadrants there was evidence of healing of the alveolar crest after restoration of the teeth; one was treated with one filling and a crown, one with a crown and three with two fillings. In the remaining three cases, the alveolar defect was similar at both examinations. In one quadrant in which the bone height was considered normal at the first examination, there was evidence of bone loss at the second examination, after being treated with a disto-occlusal amalgam restoration in the maxillary first primary molar and a preformed crown on the adjacent second molar.

Discussion

The usefulness of unstandardized radiographs in the diagnosis of alveolar bone loss has been

demonstrated in previous studies.[8, 13, 14] In addition, the use of clear and strict criteria for selection of radiographs and for the diagnosis of abnormal alveolar bone resorption in the present study, reduced the possibility for mistake in the diagnosis of bone loss. In a previous study,[8] the number of quadrants with alveolar bone loss per se and adjacent to stainless steel crowns were higher in the maxilla than in the mandible. In the present study, the prevalence of bone loss among the quadrants with caries was similar in both arches (12.0 and 12.2%, respectively). On the other hand, when considering that the number of quadrants with contact loss was higher in the mandible (N = 75) than in the maxilla (N = 39), a higher per cent of quadrants with alveolar bone loss was found among the quadrants with contact loss in the maxilla (41.0%) than in the mandible (26.6%). However, this difference had no statistically significant effect on the presence of abnormal bone resorption (ANOVA, $P > 0.05$).

The present findings that 63.9% (N = 23) of the quadrants with abnormal alveolar bone resorption were present in children with >1 quadrant affected (Table 4) support a previous assumption[8] that some children have a high susceptibility to develop alveolar bone loss. The reasons for this phenomenon remain unclear and should be the subject of future studies.

Open contacts and overhang of restorations in the permanent dentition are considered as plaque retention factors which may predispose to osseous defects.[9–11, 15, 16] In addition, gingival inflammation and abnormal alveolar bone resorption have been described adjacent to extensive proximal caries and to stainless steel crowns in the primary dentition, especially when inadequate crown crimp, length, contour and position, and/or cement remaining in the gingival sulcus are observed.[8, 17–20] On the other hand, adequate proximal contour of restorations may not be harmful to the periodontal tissues of the primary and permanent teeth[9–11, 15, 17, 21] and may even promote healing of alveolar bone defects.[10, 11, 15] The present study further indicates the connection between extensive proximal caries which facilitates plaque retention and alveolar bone loss in the primary dentition.

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1. Magnusson BO, Matsson L, Modéer T: Gingivitis and perioontal disease in children, in Pedodontics. A Systematic Approach. BO Magnusson ed. Copenhagen: Munskgaard, 1981, pp, 141–59.
2. Walker JD, Mackenzie IE: Periodontal diseases in children and adolescents. In Pediatric Dentistry. Scientific Foundations and Clinical Practice. RE Stewart, TK Barber, KC Troutman, SHY Wei eds. St. Louis: CV Mosby Co, 1982, pp 623–39.
3. Jamison HC: Prevalence of periodontal disease of the deciduous teeth. J Am Dent Assoc 66:207–15, 1963.
4. Goepferd SJ: Advanced alveolar bone loss in the primary dentition. A case report. J Periodontol 52:753–57, 1981.
5. Ngan PWH, Tsai CC, Sweeney E: Advanced periodontitis in the primary dentition: a case report. Pediatr Dent 7:255–58,1985.
6. Mandell RL, Siegal MD, Umland E: Localized juvenile periodontitis of the primary dentition. ASDC J Dent Child 53:193–96, 1986.
7. Sweeney EA, Alcoforado GAP, Nyman S, Slots J: Prevalence and microbiology of localized prepubertal periodontitis. Oral Microbiol Immunol 2:65–70, 1987.
8. Bimstein E, Delaney JE, Sweeney EA: Radiographic assessment of the alveolar bone in children and adolescents. Pediatr Dent 10:199–204, 1988.
9. Glickman I: Food impaction, habit and other local factors in the etiology of periodontal disease, in Clinical Periodontology. Philadelphia: WB Saunders, 1972, pp 344–64.
10. Beadreau D: Periodontal considerations in restorative dentistry in Periodontal Therapy. HM Goldman, DW Cohen eds. St. Louis: CV Mosby, 1980, pp 1112–20.
11. Lindhe J: The cause related phase of periodontal therapy. Removal of plaque retention factors. In Textbook of Clinical Periodontology. Copenhagen: Munksgaard, 1984, pp 347–48.
12. Bimstein E, Soskolne AW: A radiographic study of interproximal alveolar bone crest between the primary molars in children. ASDC J Dent Child 55:348–50, 1988.
13. Marshal-Day CD, Stephens RG, Quigley LF Jr: Periodontal disease: prevalence and incidence. J Periodontol 26:185–203, 1955.
14. Selikowitz HS, Sheiham A, Albert D, Williams GM: Retrospective longitudinal study of the rate of alveolar bone loss in humans using bite-wing radiographs. J Clin Periodontol, 8:431–38, 1981.
15. Glickman I: Restorative-Periodontal interrelationships, in Clinical Periodontology. Glickman ed. Philadelphia: WB Saunders, 1972, pp 890–927.
16. Eid M: Relationship between overhanging amalgam restorations and periodontal disease. Quintessence Int 18:775–81, 1987.
17. Webber DL: Gingival health following placement of stainless steel crowns. J Dent Child 41:186–89, 1974.
18. Myers DR: A clinical study of the response of the gingival tissue surrounding stainless steel crowns. ASDC J Dent Child 42:33–36, 1975.
19. Ashraphi MH, Durr DP, Duncan WK: Inter-relationship between stainless steel crown, plaque accumulation and gingival health. American Academy of Pedodontics — Annual Meeting Reports, Research Abstract R-26, 1981.
20. Machen E, Rapp R, Baumhammers A, Zullo T: The effect of stainless steel crowns on gingival tissue. American Academy of Pedodontics — Annual Meeting Reports, Research Abstract R-27, 1981.
21. Guelmann M, Matsson L, Bimstein E: Periodontal health at first permanent molars adjacent to primary molar stainless steel crowns. J Clin Periodontol, 15:531–33, 1988.