Scientific Article

The prevalence of pre-eruptive dentin radiolucencies in the permanent dentition

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Abstract

Purpose: *Although intracoronal radiolucencies in radiographs of unerupted teeth have been reported for several decades, the prevalence of this condition remains unknown. This study determined the prevalence and associated dental conditions of permanent teeth showing pre-eruptive dentin radiolucencies in bite-wing radiographs of school children attending two school dental therapy training centers.*

Methods: *There were 1959 subjects (934 males and 1025 females), each providing a set of bite-wing radiographs which showed the crowns of unerupted permanent teeth. The mean age of the children at radiographic exposure was 7.8 ± 1.79 years of age.*

Results: *126 (6%) of subjects had radiolucencies in the crowns of pre-eruptive permanent teeth. Of the 9919 teeth viewed on the radiographs, 163 (2%) were affected. There were no significant racial and gender differences in the prevalence of the defects. Of the 126 subjects with dentin radiolucencies, 93 (74%) had only 1 affected tooth compared with 31 (25%) who had two teeth affected, and 2 (2%) who had 3 affected teeth.*

Conclusions: *Within each tooth type, the highest tooth prevalence was found in the mandibular first molar (4%), followed by the mandibular first premolar (2%), the mandibular second molar (1%), mandibular second premolar (1%), maxillary first molar (1%), maxillary first premolar (1%), and maxillary second premolar (0.2%). In addition, the group with dentin radiolucencies had a high prevalence of ectopically-positioned teeth of 14% compared with only 2% in the group without the defect, suggesting that ectopic position may predispose a tooth to pre-eruptive radiolucent defects. Other common developmental and acquired dental conditions were also examined, but no significant differences were noted between groups with and without the pre-eruptive dentin radiolucencies. (Pediatr Dent 21:26–33, 1999)*

Dental radiographs of unerupted teeth occasionally show intracoronal radiolucencies within the dentin.[1] As these lesions resemble dental decay, they are often referred to as "pre-eruptive caries[2–9]". Although there have been more than 25 individual case reports[1, 2] describing more than 50 affected teeth since this condition was first described in 1941,[6] its prevalence and etiology remain largely unknown. Previous case reports were mainly in the permanent dentition,[2–24] of which the most commonly involved teeth were the premolars, and third and second molars. In the primary dentition, there has been only one case reported to date, which involved the primary mandibular second molar.[1]

Although the pathogenesis of pre-eruptive dentin radiolucencies remains unknown, many case reports have provided clinical and histological evidence that these lesions are resorptive in nature.[1, 2, 12, 14, 15, 17, 18, 21] The resorptive cells, which are likely to have originated from the surrounding bone, are thought to enter the dentin through a break in the external covering of the developing tooth. However, the etiology and factors associated with the initiation of the resorption are still unclear.

As there have been no large scale studies on pre-eruptive dentin radiolucencies, our study was conducted to determine its prevalence, and associated dental conditions in a large sample of bite-wing radiographs of school children.

Methods

Subjects

The subjects were school children attending the two school dental therapy training centers in Brisbane, Australia. Parental consent for full dental care at these clinics, including radiography, was given by approximately 75% of all children attending the schools in the catchment areas. Most children would have a set of bite-wing radiographs exposed at least once every two years.

The race and gender of each subject, and the fluoride supplementation history as provided by the

guardians on the routine personal history forms, were noted. In addition, the medical history forms were scanned for details of medical conditions present.

Records of subjects from one of the centers were further examined with respect to various details of dental examinations, such as fluorosis and other developmental enamel defects, as noted in the examination forms.

Bite-wing radiographs

Bite-wing radiographs used for the study were selected using the following criteria:

1. Permanent teeth still unerupted
2. At least the occlusal half of crown of unerupted tooth/ teeth visible
3. Optimal positioning of the teeth, i.e. minimal overlap
4. Optimal radiographic contrast.

The age of each subject at the time of radiographic exposure was noted.

TABLE 1. DEMOGRAPHY OF STUDY POPULATION

	Pre-eruptive Dentin Radiolucency		
Subjects	*Absent* *N* (%)	*Present* *N* (%)	*Total* *N* (%)
Total number	1833 (94)	126 (6)	1959 (100)
Gender			
Male	875 (48)	59 (47)	934 (48)
Female	958 (53)	67 (53)	1025 (52)
Race			
Caucasian	1587 (87)	107 (7)	1694 (87)
Asian	125 (7)	9 (7)	134 (7)
Aborigine	18 (1)	0	18 (0.9)
Others	103 (6)	10 (10)	113 (6)
Age at Radiographic Exposure*			
Mean (yrs±SD)	7.81±1.77	7.61±2.15	7.79±1.79
Range	2.92 to 14.00	3.83 to 13.00	2.92 to 14.00
Medical Condition			
Asthma	288 (16)	26 (21)	314 (16)
Epilepsy	13 (0.7)	2 (2)	15 (0.8)
CVS Condition	17 (0.9)	3 (2)	20 (1)
Allergies	122 (7)	5 (4)	127 (7)
Others	189 (10)	6 (5)	195 (10)
Total (%) with medical condition	629 (34)	42 (33)	671 (34)
Systemic fluoride			
Yes	38 (2)	4 (3)	42 (2)
No	1795 (98)	122 (97)	1917 (98)

* The majority (over 94%) were aged 6-10 years.

The bite-wing radiographs were examined for radiolucencies within the crowns of unerupted teeth by two of the authors using a standard radiographic viewer with 2X magnification. Prior to the beginning of this study, the authors were trained in diagnosis of the pre-eruptive dentin radiolucencies using previous radiographs which were not part of the present study. Preliminary testing demonstrated complete agreement of authors as to the presence/absence of defects.

At the completion of this study, cases which were considered by one author as questionable were subjected to further examination by the other authors. Only the cases considered as positive by the other authors were included.

The radiolucent lesions were noted with regard to which teeth were affected, and the locations of the defects were analyzed as to whether they were on the central, mesial, or distal aspects of the crown. In addition, the size of the defects relative to the width of dentin were also noted.

In addition to the pre-eruptive dentin radiolucencies, other dental conditions noted from the bite-wing radiographs were restored teeth, endodontically treated teeth, abscessed teeth, ectopically positioned permanent molars, and submerged primary molars.

Statistical analysis

The subjects were divided into two groups, one which showed pre-eruptive dentin radiolucencies, and another group which did not show these defects. The chi-square test (with Yates correction where necessary) and the Student's *t*-test were used to determine statistical differences between the groups.

Results

Demography of general study population

Out of 7747 individual patient records which were available, 3607 contained bite-wing radiographs. Eighty-five of these bite-wing radiographs were not of optimal radiographic quality, and were discarded. Of those remaining, 1959 sets showed the crowns of unerupted teeth and met all radiographic criteria for inclusion in the study. Each set of bite-wing radiographs was contributed by one subject.

Table 1 shows the demographic details of the 1959 subjects studied. These reflected the demography of the general clinic population. There were nearly equal numbers of males (934) and females (1025). Most of the subjects were Causasians (87%), with small percentages of Asians (7%), Australian aborigines (0.9%), and other groups such as native South Americans (6%). The mean age ± standard deviation (SD) at radiographic exposure was 7.79 ± 1.79 years.

Overall, 671 subjects had at least one medical condition, the most common of which were asthma (16%), allergies (7%), congenital cardiac defects (1%), and epilepsy (1%).

There were only a small percentage of subjects (2%) with a positive history of fluoride supplementation, as Brisbane does not have fluoride in the community water supplies (Table 1).

Comparison of demography between groups

As shown in Table 1, there were no significant differences in all the demographic variables analyzed between the group with pre-eruptive dentin radiolucencies and the group without the defects ($P>0.1$).

Prevalence of pre-eruptive dentin radiolucencies

Subject prevalence

Of the radiographs examined from 1959 subjects with suitable bite-wing radiographs, there were 126 children with at least one tooth showing pre-eruptive dentin radiolucency, giving a prevalence by subject of 6% (Table 2). There were no significant differences in subject prevalence between males and females ($P>0.1$). Of the 126 subjects with pre-eruptive dentin radiolucencies, 93 had only one tooth affected, 31 had two affected teeth, and 2 had three affected teeth.

Tooth prevalence

In contrast, of the 9919 teeth examined, only 163 showed pre-eruptive dentin radiolucencies, giving a tooth prevalence of only 2% (Table 2). There were no significant differences in tooth prevalence between males and females ($P>0.1$). The mean number of teeth affected per subject was 1.31±0.48 (median is 1, range 1 to 3).

TABLE 2. GENERAL PREVALENCE OF PRE-ERUPTIVE DENTIN RADIOLUCENT DEFECTS

	Female	*Male*	*Total*
Prevalence by subjects			
Population	*N*=1025	*N*=934	*N*=1959
No. with dentin defects	67	59	126
Percentage affected	7%	6%	6%
Prevalence by teeth			
No. of teeth examined	*N*=5150	*N*=4769	*N*=9919
No. of teeth affected	89	74	163
Percentage	2%	2%	2%

Distribution of pre-eruptive dentin radiolucencies in the permanent dentition

When each tooth group was considered separately (Fig 1), the highest prevalence of pre-eruptive dentin radiolucencies was noted in the mandibular first molar (4%), followed by the mandibular first premolar (2%), the mandibular second molar (1%), the mandibular second premolar (1%), the maxillary first premolar (1%), the maxillary first molar (1%), and the maxillary second premolar (0.2%).

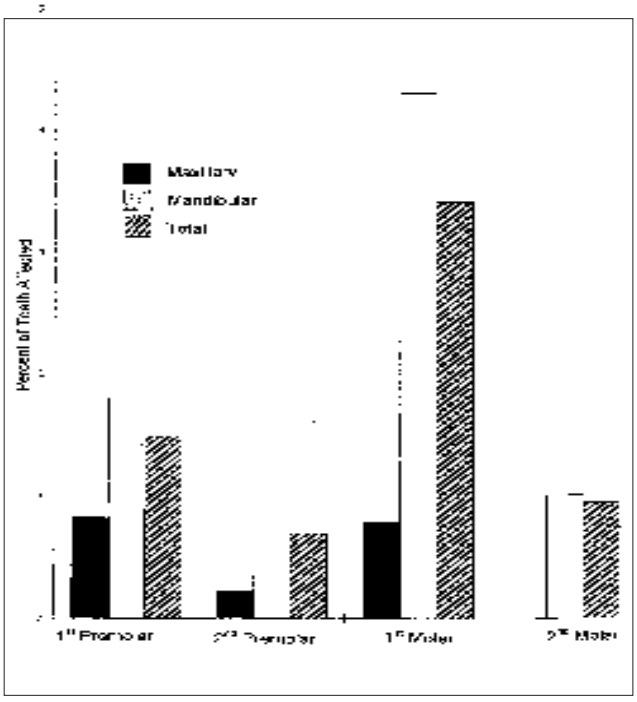

Fig 1. Distribution of pre-eruptive intracoronal resorption defects in the various tooth groups.

TABLE 3. LOCATION OF PRE-ERUPTIVE DENTIN RADIOLUCENCIES WITHIN THE CROWN

	Mesial	*Central*	*Distal*	*Mesial +Central*	*Distal +Cemtral*	*P value*
1st Permanent Molar						
Max (*N*=13)	10 (77)	2 (15)	1 (8)	0	0	*P*<0.02 (x^2=8.79, df=2)
Mand (*N*=70)	27 (39)	28 (40)	12 (17)	2 (3)	1 (1)	*P*<0.05 (x^2=7.20, df=2)
2nd Permanent Molar						
Max (*N*=0)	0	0	0	0	0	
Mand (*N*=27)	11 (41)	11 (41)	2 (8)	3 (11)	0	*P*<0.05 (x^2=6.75, df=2)
1st Premolar						
Max (*N*=6)	4 (67)	0	2 (33)	0	0	NS
Mand (*N*=29)	14 (48)	3 (10)	12 (41)	0	0	*P* >0.05 (x^2=7.10, df=2)
2nd Premolar						
Max (*N*=1)	1 (100)	0	0	0	0	
Mand (*N*=15)	5 (33)	1 (7)	9 (60)	0	0	*P*<0.05 (x^2=6.40, df=2)
Permanent Canines						
Max (*N*=2)	0	0	2 (100)	0	0	
Mand (*N*=0)	0	0	0	0	0	
Total Dentition (*N*=157)						
All Maxillary Teeth (*N*=22) (14%)	15 (68)	2 (9)	5 (23)	0	0	*P*<0.05
Mandibular Teeth (*N*=141) (86%)	57 (40)	43 (31)	35 (25)	5 (4)	1 (0.7)	(x^2=6.28, df=2)

Location of pre-eruptive dentin radiolucencies

In all the163 teeth in which pre-eruptive dentin radiolucencies were present, every one of the lesions was located in dentin, just beneath the dentino-enamel junction. Twenty-two teeth with pre-eruptive dentin radiolucent defects were located in the maxilla, in contrast to 141 located in the mandible (Table 3). Table 3 shows the intracoronal locations of these lesions with respect to whether these were mesial, central, or distal aspects. In the case of the mandibular first permanent molar, the defects were commonly located in the central (40%) and mesial (39%) aspects of the occlusal, and less commonly in the distal (17%). In addition, the majority of the defects on this tooth occured in single discrete spots with the exception of 4% which showed a combination of two separate lesions on each tooth. By contrast, in the case of the maxillary first permanent molar, the majority were found on the mesial aspects (77%), and few in the central (15%) and distal (8%).

In the case of the mandibular second permanent molar, the defects were most often seen in the mesial and central aspects of the occlusal (41% each), whereas in the mandibular first premolar, comparable percentages occurred in both mesial and distal aspects. By contrast, in the case of the mandibular second premolar, a large percentage of the defects were located in the distal aspects of the occlusal (60%).

Size of pre-eruptive dentin radiolucencies relative to dentin thickness

The sizes of the pre-eruptive radiolucencies relative to dentin width in the various groups of teeth are shown in Table 4. In the majority of teeth (139/163), the defects were less than one-third of the dentin thickness at the time of radiographic exposure. Only four teeth (3%) showed defects which were larger than two-thirds the width of dentin (Table 4).

Comparison of developmental dental conditions

Among the developmental conditions analyzed, fluorosis, isolated enamel defects, fused teeth, and submerged primary molars did not show statistically significant differences in prevalence between the group with pre-eruptive dentin radiolucencies compared with the group without defects (Table 5, *P*>0.1). By con-

TABLE 4. SIZE OF PRE-ERUPTIVE DENTIN RADIOLUCENCIES RELATIVE TO DENTIN THICKNESS

	Less than 1/3 *N (%)*	*Approx 1/3-2/3* *N (%)*	*Greater than 2/3* *N (%)*
1st Permanent Molar			
Max (*N*=13)	11 (85)	1 (8)	1 (8)
Mand (*N*=70)	61 (87)	7 (10)	2 (3)
2nd Permanent Molar			
Max (*N*=0)	0	0	0
Mand (*N*=27)	23 (85)	3 (11)	1 (4)
1st Premolar			
Max (*N*=6)	5 (83)	1 (17)	0
Mand (*N*=29)	24 (83)	5 (17)	0
2nd Premolar			
Max (*N*=1)	1 (10)	0	0
Mand (*N*=15)	13 (87)	2 (13)	0
Permanent Canine			
Max (*N*=2)	1 (50)	1 (50)	0
Mand (*N*=0)	0	0	0
All Max Teeth (*N*=22)	18 (82)	3 (14)	1 (5)
All Mand Teeth (*N*=41)	121 (86)	17 (12)	3 (2)
Total Dentition (*N*=163)	139 (85)	20 (12)	4 (3)

trast, the prevalence of ectopically positioned permanent molars appeared significantly higher in the group with pre-eruptive dentin radiolucencies compared to the one without (14% vs 2%, $P>0.0005$). Furthermore, detailed analysis of the teeth in ectopic position (Table 6) indicated that of the 13 teeth with pre-eruptive dentin radiolucencies, seven were also ectopically positioned, and two were directly adjacent to ectopically-positioned teeth. In all these teeth, the pre-eruptive dentin radiolucencies were located directly adjacent to the contacting teeth (Table 6). Fig 2 shows an ectopically erupting permanent second molar which had a large pre-eruptive dentin radiolucency, located on the cental aspect just beneath the enamel.The crown of the maxillary left first premolar also showed a large radiolucent defect on the distal aspect. As the tooth was fully erupted, it was not included in the study.

Comparison of the prevalences of dental caries and pulp conditions

As shown in Table 7, there were no significant differences in the mean number of decayed and filled teeth in the group with pre-eruptive dentin radiolucencies compared to that without the defects (5.04±3.65 vs 4.96±3.50, $P>0.1$). Similarly, the mean number of pulp-treated teeth, abscessed teeth, and teeth showing internal pulpal resorption were also not significantly different in the two groups ($P>0.1$).

Discussion

Although radiolucencies within the coronal dentin of unerupted teeth have been recognized by clinicians for more than 50 years,[1,2] there have been no previous reports regarding the prevalence of this condition. In our study, which examined un- erupted teeth on bite wing radiographs of 1959 school children, it was found that 6% of all subjects had at least one unerupted tooth showing a pre-eruptive radiolucency. Although this figure already indicates a relatively high prevalence, it is suspected that the true prevalence may be even higher if third molars were included in the study, as previous studies have indicated that pre-eruptive radiolucencies may be seen in these teeth.[2,6,7,24–26]

In our sample, the most commonly affected teeth were the mandibular first molar, followed by the mandibular first premolar, mandibular second molar, and mandibular second premolar. By contrast, significantly smaller prevalences were found in the maxillary molars and premolars, probably reflecting the fact that unerupted maxillary permanent teeth may not always appear in optimum view in bite-wing radiographs of the mixed dentition. This problem is also encountered in other radiographs such as panoramic surveys

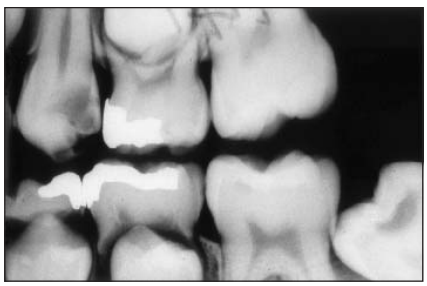

Fig 2. An ectopically erupting permanent second molar, not included in the study.

TABLE 5. DEVELOPMENTAL DENTAL CONDITIONS IN SUBJECTS

Presence of Dental Condition	•Without Defects *N*=1082	•With Defects *N*=95	*P* Value
Fluorosis	27 (6)	0	NS†
Isolated enamel defects	215 (20)	25 (26)	NS
Ectopic eruption of permanent molars	19 (2)	13 (14)	*P*<0.0005 (x^2=46.97, df= 1)
Submerged primary molars	6 (0.6)	2 (2)	NS
Fusion/crown abnormality	16 (2)	2 (2)	NS

• 1082 out of 1833 bite-wing radiographs without defects and 95 out of 126 bite-wing radiographs with the defects extended sufficiently in posterior direction to allow assessment of erupting molar position.

† NS = nonsignificant.

in which the coronal details of maxillary teeth often are not as clear as the mandibular teeth.[27]

Our results suggest that systemic factors probably play a minimal role in the etiology of the pre-eruptive dentin radiolucencies. There were no significant racial and gender differences in the prevalence of defects. Furthermore, comparison of the groups with and without the defects showed no significant differences in the prevalences of various medical conditions.

In contrast, local factors are thought to play important roles in the etiology of pre-eruptive dentin radiolucencies although the triggers are unknown. The present study found a highly significant association of ectopically positioned permanent molars with pre-eruptive dentin radiolucencies suggesting that a trigger factor for defect may be their ectopic positions. It may be hypothesized that pressure resulting from an abnormal position induces sufficient local damage to the tooth protective coverings to cause resorptive cells to enter through the tooth to reach the dentin. This hypothesis is further substantiated by our present results which showed that in the ectopically-positioned teeth that had radiolucent defects, or in teeth which were abutting ectopically-positioned teeth, the radiolucent lesions were primarily located in the parts of the teeth adjacent to the areas of direct contact pressure. Although in our series, only approximately 13% of teeth with pre-eruptive dentin radiolucencies were associated with obvious ectopic positioning, it is likely that this association may be much higher considering that many cases of ectopic positioning may persist only in a transient state, and may not be observed at the time of radiographic exposure. However, even a short period of pressure from ectopic positioning may cause sufficient damage to induce dentin defects. In addition, several previous case reports have also mentioned the presence of resorption defects in teeth showing ectopic position.[11, 13, 15, 16, 19] Of further interest are previous studies[4] which mentioned that resorption may also be induced

TABLE 6. PRESENCE OF PRE-ERUPTIVE DENTIN RADIOLUCENCE

	Surface Affected
Ectopic Tooth	*Resorption Defect in Itself*
46	*46 (mesial)*
46	*46 (mesial)*
37	*37 (mesial)*
46	*46 (mesial)*
36	*36 (mesial)*
47	*47 (mesial)*
47	*47 (central)*
Total *N*=7 (54%)	
Ectopic Tooth	*Resorption Defect in Adjacent Tooth*
46	45 (distal)
37	36 (distal)
Total *N*=2 (15%)	
Ectopic Tooth	*Resorption Defect in Distant Tooth*
14	34 (distal)
26	24 (distal)
47	37 (central)
46	36 (central)
Total *N*=4 (31%)	

TABLE 7. DENTAL CARIES AND PULP CONDITIONS IN SUBJECTS WITH AND WITHOUT PRE-ERUPTIVE DENTIN RADIOLUCENCIES

	Subjects with Intracoronal Resorption Defect N (%)	
Dental caries/pulp condition	Without Defects *N*=1082	With Defects *N*=95
Teeth with dental caries and/or fillings	5643	479
Mean no of decayed/filled teeth/subject	4.96±3.5	5.04±3.65
(Range)	(0 to 19)	(0 to 14)
Pulpotomy/Pulpectomy	255	33
Mean no/subject ± SD	0.24±0.64	0.35±0.82
Range	0 to 6	0 to 5
Abscessed teeth	251	21
Mean no/subject ± SD	0.23±0.39	0.22±0.46
Internal pulpal resorption	14	2
Mean no/subject ± SD	0.01±0.42	0.02±0.43

*Differences between the groups with and without resorption defects were all non-significant, $P > 0.1$

in teeth adjacent to ectopically positioned neighboring teeth.

It may be speculated that local inflammation is a possible initiating factor which causes loss of integrity of the protective dental epithelium, and allow resorptive cells to enter the crowns of developing teeth.[1,2] One possible source of inflammation are the primary predecessor teeth, which may contribute inflammatory foci through pulpal and apical infection.[11] The affected permanent teeth in this case would be the anterior teeth and premolars which have primary predecessors. However, the results of the present study showed that there were no correlations of abscessed and endodontically treated primary teeth with resorption defects in the succeeding permanent teeth, suggesting that endodontic inflammation of primary teeth is unlikely to be a contributory factor. Furthermore, the most commonly affected teeth include the permanent molars which do not have primary predecessors, indicating that factors other than primary teeth are involved.

The relatively high prevalence of pre-eruptive dentin radiolucencies in unerupted teeth suggests that there should be increased clinical surveillance regarding their presence on dental radiographs. Furthermore, ectopically positioned teeth, and those abutting against them, should be considered at high risk for pre-eruptive resorptive lesions. As bite-wing radiographs are routinely exposed in school-aged children[28] they provide an important radiographic screen for these defects. Panoramic and periapical radiographs are also useful for the detection of resorption defects in unerupted teeth, and these may be requested to confirm the presence of defects found on bite-wing radiographs, as well as to screen for other defects.

The clinical significance of pre-eruptive dentin radiolucencies lies mainly in the fact that the processes of destruction are usually continuous while the tooth is unerupted, and may be rapid, although clinical symptoms at the unerupted stages are usually minimal.[2,10] Upon eruption of the tooth, while the destructive processes may be halted due to the uncovering of the dental crown, dental caries may be quickly initiated through external openings. Usually, the enamel remains intact even after extensive destruction of dentin.[2] In many cases, the dentin radiolucencies remain undetected until after eruption, when the majority are diagnosed as dental decay.[9] In a few severe cases, dental pain and pulpal abscesses may be reasons for the patients seeking initial dental treatment for the affected teeth.

The management of pre-eruptive dentin radiolucencies depends largely on the extent of radiolucency at the time of initial diagnosis.[2] A rapidly progressive and large lesion in a tooth which is still unerupted should indicate immediate surgical exposure, and curettage of the defects followed by lining with calcium hydroxide and restoration with dental cements or amalgam.[1,10] If the lesion is small, and the affected tooth close to eruption, it may be possible to wait for the tooth to erupt to achieve occlusal access[9] for restoration of the defect.

Conclusions

1. The prevalence of intracoronal dentinal radiolucencies in pre-eruptive permanent teeth on bite-wing radiographs was 6% by subjects and 2% by teeth examined. The mandibular first permanent molar was the most commonly affected tooth, and the majority of subjects showed only one affected tooth each.
2. There was a strong association of ectopic position with pre-eruptive dentin radiolucencies suggesting that abnormal tooth contacts and pressure encountered in ectopic position maybe trigger factors.

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References

1. Seow WK, Hackley D: Pre-eruptive resorption of dentin in the primary and permanent dentitions: case reports and literature review. Pediatr Dent 18:67–71, 1996.
2. Seow WK. Multiple pre-eruptive intracoronal radiolucent lesions in the permanent dentition: case report. Pediatr Dent 20:195–198, 1998.
3. Coke JM, Belanger GK: Radiographic caries-like distal surface enamel defect in an unerupted second premolar. J Dent Child 48:46–49, 1981.
4. Skaff DM, Dilzell WW: Lesions resembling caries in unerupted teeth. Oral Surg Oral Med Oral Pathol 45:643–46, 1978.
5. Giunta JL, Kaplan MA: "Caries-like" dentin radiolucency of unerupted permanent tooth from developmental defects. J Pedodont 5:249–55, 1981.
6. Skillen WG: Intra-follicular caries. Ill Dent J 10:307–308, 1941.
7. Baab DA, Morton TH, Page PC: Caries and periodontitis associated with an unerupted third molar. Oral Surg Oral Med Oral Pathol 58:428–30, 1984.
8. Luten JR. Internal resorption or caries? A case report. J Dent Child 25:156–59, 1958.
9. Wood PF, Crozier DS: Radiolucent lesions resembling caries in the dentine of permanent teeth: a report of sixteen cases. Aust Dent J 30:169–73, 1985.
10. Holan G, Eidelman E, Mass S: Pre-eruptive colonal resorption of permanent teeth: report of three cases and their treatment. Pediatr Dent 16:373-76, 1994.surgical advancement of the mandible. J Oral Surg 38:543–49, 1980.
16. Rubinstein L, Wood AJ, Camm J: An ectopically impacted premolar with a radiolucent defect. J Pedodont 14:50–52, 1989.
17. Taylor NG, Gravely JF, Hume WJ: Resorption of the crown of an unerupted permanent molar. Int J Paediatr Dent 2:89–92, 1991.
18. Blackwood HJJ: Resorption of enamel and dentine in the unerupted tooth. Oral Surg Oral Med Oral Pathol 11:79–85,1958.
19. Wooden EE, Kuftinec MM: Decay of unerupted premolar. Oral Surg Oral Med Oral Pathol 38:491–92, 1974.
20. Walton JL: Dentin radiolucencies in unerupted teeth: report of two cases. ASDC J Dent Child 47:183–86, 1980.
21. O'Neal KM, Ground TG, Cohen DM: Preeruptive idiopathic coronal resorption: A case report. J Endodont 23:58–59, 1997.
22. Goldman HM: Spontaneous intermittent resorption of teeth. J Am Dent Assoc 49:522–32, 1954.
23. Grundy GE, Adkins KF: Idiopathic external coronal resorption. Case report. Aust Dent J 27: –4, 1982.
24. Browne WG: A histopathological study of resorption in some unerupted teeth. Dent Record 74:190–96, 1954.
25. Baddour HM, Tilson HB: A carious impacted third molar. Oral Surg Oral Med Oral Pathol 48:490, 1979.
26. Nickel AA, Wolske EW: Internal resorption of four bony impacted third molars. Oral Surg 49:187, 1980
27. Seow WK, Lai PY. Association of taurodontism with hypodontia: A controlled study. Pediatr Dent 11:214–19,1989.
28. Myers DR, McKnight-Hanes C, Dushkar JC, Thompson WO, Durham LC: Radiographic recommendations for the transitional dentition: comparison of general dentists and pediatric dentists. Pediatr Dent 12:217–21, 1990.