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Pre-eruptive intracoronal dentine radiolucencies in the permanent dentition of Jordanian children

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Abstract

Purpose To determine the prevalence of pre-eruptive intracoronal dentine radiolucencies (PEIR) and subject factors or dental conditions associated with PEIR from orthopantograms (OPGs) in unerupted permanent teeth of children.

Methods OPGs were evaluated for 1,571 subjects (807 males, 764 females) with mean age (8.72 ± 2.5) years. Unerupted permanent teeth prior to emergence into the oral cavity were assessed. The Chi square test was used to determine statistical differences between the group showing and the group not showing the defect with regards to sex, stage of dental development, presence of developmental anomalies, and condition of primary predecessor teeth.

Results Prevalence was (8.1 %) by subject and (0.62 %) by teeth. All subjects showed only one affected tooth per subject with no significant gender differences. The highest prevalence was in mandibular first premolars (3.02 %). Most defects were noted in the mixed dentition stage (89.06 %), mainly in the mandible (79.7 %) as single lesions at a mesial location intracoronally, and a size of less than one-third of dentine thickness in (50 %). Among all variables examined, PEIR defects were significantly associated with mixed dentition stage ($p = 0.000$) and decayed/filled primary predecessor teeth ($p = 0.028$).

Conclusions PEIR defects occur at a significant prevalence rate in unerupted teeth. Increased awareness and careful radiographic examination of unerupted teeth may improve early detection and treatment of PEIR defects in children.

Keywords Pre-eruptive · Intracoronal · Radiolucency · Resorption · Radiograph

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Introduction

Pre-eruptive intracoronal dentine radiolucency/resorption (PEIR) is a term used to describe an anomaly presenting as an abnormal, well-circumscribed, radiolucent area, occurring within the coronal dentinal tissue close to the enamel–dentine junction of unerupted teeth (Brooks 1988; Rutar 1997; Seow et al. 1999a). These defects have been reported as early as 1941 (Skillen 1941). Since then, several case reports in permanent teeth described these defects, however, only one case report has been described in primary teeth (Seow and Hackley 1996); most probably due to the fact that radiographs are not routinely used prior to tooth eruption. To date, four large scale studies have been conducted to determine the prevalence of this condition; two studies were conducted in Australia (Seow et al. 1999a, b), one in Malaysia (Nik and Abdul Rahman 2003), and the other in Turkey (Özden and Acikgoz 2009). Prevalence of pre-eruptive intracoronal resorptive defects reported in the literature is shown in (Table 1).

Three main explanations of the aetiology and diagnosis of PEIR defects have been proposed in the literature. These include (1) an acquired pathological condition occurring after coronal development due to chronic apical inflammation of primary teeth, dental caries or coronal resorption (Muhler 1957; Rankow et al. 1986; Ignelzi et al. 1990); (2)

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Table 1 Prevalence of pre-eruptive intracoronal resorptive defects reported in the literature

Author/year	Type of study	Type of radiographs	Age of subjects (years)	No. of radiographs	No. of unerupted teeth	Prevalence	
						Subject	Tooth
Seow et al. (1999a)	Prospective	Bitewings	6–10	1,959	9,919	126 (6 %)	163 (2 %)
Seow et al. (1999b)	Prospective	Panoramic	3.5–25	1,281	11,767	42 (3 %)	57 (0.5 %)
Nik and Abdul Rahman (2003)	Retrospective	Panoramic	Below 20	1,007	14,554	275 (27.3 %)	309 (2.1 %)
Özden and Acikgoz (2009)	Retrospective	Panoramic	14–73	9,570	2,922	27 (1.55 %)	28 (0.95 %)
Al-Batayneh et al. (current study)	Prospective	Panoramic	6–15	1,571	20,788	128 (8.1 %)	128 (0.62 %)

a localised developmental mineralisation defect of dentine with or without an accompanying enamel defect during crown formation, (Grundy et al. 1984; Ignelzi et al. 1990) and; (3) resorption superimposed on existing developmental defects (Savage et al. 1998).

Quite possibly, most of the theories may be correct and may have been accurate explanations in each particular case cited. However, only one of the theories, the possibility of pre-eruptive caries without exposure to the oral environment, is highly suspicious and rejected according to the commonly known caries pathophysiology and little histopathological and microbiological evidence exists to support this (Ignelzi et al. 1990). Also, chronic apical inflammation of primary teeth is unlikely since PEIR defects have been highly reported in teeth that do not have primary predecessors. Therefore, the pathophysiology of these lesions may be explained by histologic evidence of normal vascular or inflammatory resorptive cells (multinucleate cells, osteoclasts and other chronic inflammatory cells) as suggested by previous case reports (Blackwood 1958; Grundy et al. 1984; Brooks 1986). The resorptive cells invade into the protective dental epithelium of an unerupted permanent tooth crown which is already disrupted by some mechanism. The lesion becomes radiographically evident after crown development, and therefore, the defect cannot be the result of an intrinsic mineralisation defect. Ideally, an accurate diagnosis can be made with histological examination (Seow and Hackley 1996).

Triggering factors for the resorption are still unknown. The only dental anomaly reported to be associated with these defects was ectopic position of the unerupted permanent tooth bud itself or the tooth bud adjacent to it; this was found in 14.3–28 % of the cases (Seow et al. 1999a; Özden and Acikgoz 2009). It was proposed that pressure resulting from an abnormal tooth position may result in local damage to the protective layer of the tooth and the resorptive cells could easily invade the dentinal layer of the tooth and initiate the dentine resorption (Seow et al. 1999a). Özden and Acikgoz (2009) were the first to report PEIR defects in maxillary supernumerary teeth with a prevalence of 1.4 %.

The clinical significance of these lesions lies in the fact that they have been hypothesised to constitute a large proportion of occult caries (hidden caries) often diagnosed as large carious lesions in radiographs of clinically sound, erupted permanent teeth of children and young adults. Therefore, it has been suggested that all unerupted, developing teeth on radiographs be screened and examined for PEIR defects (Seow 2000). This will allow early diagnosis of lesions that start as PEIR defects prior to eruption of the affected tooth, moreover, assessment of the rate of progression of a lesion should be considered through periodic intervals depending on the lesion size at the time of detection. Treatment options for these defects are mainly to observe and delay restoration until eruption, to surgically expose and restore the developing tooth prior to eruption, or in some cases to extract the tooth (Counihan and O'Connell 2012).

As there are not many large scale prevalence studies published worldwide, this study aimed to determine the prevalence of PEIR defects, and associated subject factors or dental conditions that might be associated with the defects and have a role in their aetiology in a large sample of orthopantomographs (OPG) of Jordanian children and adolescents ranging between 6 and 15 years of age.

Materials and methods

Ethical approval

This study was approved by the Institutional Review Board (IRB) at Jordan University of Science and Technology grant 203/2010. Written informed consent to participate in the study was obtained from all study subjects and signed by their parents.

Sample selection

In this cross-sectional study, standard orthopantomographs (OPG) were employed as they are commonly taken in clinical practice for patients with developing dentition, and show the maximum number of teeth in a single radiograph. All radiographs were taken as standard OPG radiographs with standardised criteria by the same technician, poor quality radiographs were excluded. Only unerupted permanent teeth which had not emerged into the oral cavity were assessed for PEIR defects through the OPG radiographs. All the subjects were children aged between 6 and 15 years who attended the Undergraduate and Postgraduate Paediatric Dentistry and Orthodontic Clinics at the Faculty of Dentistry, Jordan University of Science and Technology for the purpose of dental examination and treatment.

Subject inclusion criteria included: age less than 15 years, presence of at least one unerupted tooth upon clinical examination, and absence of any developmental anomalies of enamel or dentine mineralisation. All patients with amelogenesis imperfecta, dentinogenesis imperfecta, and hypophosphatemic rickets were excluded from the study. Furthermore, radiographs of poor diagnostic quality were also excluded. The incisor teeth were excluded from examination due to lack of definition of these teeth in the anterior regions of the OPGs. Also, linear radiolucencies on mandibular molars that resemble buccal grooves were not recorded as PEIR defects.

Clinical examination

A full history and clinical examination was performed for the patients by the same examiner and the following data were recorded: age, gender, medical history, stage of dentition (primary, mixed, or permanent). A panoramic radiograph was taken based on indications including assessment of dental growth and development, presence/absence of teeth and other anomalies, or orthodontic diagnosis and treatment planning.

Presence of specific dental conditions and developmental anomalies were also recorded and these included: fluorosis, enamel hypoplasia, crown abnormality, submerged primary molar, ectopically positioned teeth and their number, supernumerary teeth, missing teeth, molar incisor hypomineralisation, decayed and filled teeth, and endodontically treated teeth.

Radiographic examination

OPG radiographs used in this study were taken at the Postgraduate Dental Hospital, Jordan University of Science and Technology. They were taken as standard orthopantomographs (OPG radiographs). All radiographs were digitalised using a digital camera (Cyber-shot® DSC-W50, Sony, Japan). An LCD viewing monitor was used to examine the radiographs (HP S2031 20″, Hewlett-Packard, USA).

For calibration and reproducibility purposes, the investigator was trained to diagnose PEIR defects using OPGs which were not part of the study, and were assessed twice. The intra-examiner correlation coefficient was measured to express intra-examiner variability using reliability analysis-scale (Kappa). The intra-examiner agreement for identifying PEIR lesions showed good reliability with reliability coefficient Kappa of 0.9.

An unerupted tooth was defined as one that was covered by bone and/or mucosa and below the occlusal plane. All radiographs were examined by the same examiner and the following data were recorded per OPG radiograph/patient:

1. Number of unerupted teeth.
2. Number of teeth showing PEIR defects.
3. Number of PEIR defects in each patient: one, two or more.
4. Teeth affected with respect to the jaw and side.
5. Location of the defect in the coronal dentine: mesial, central, and distal aspects of the dentine in the crown.
6. Relative size of the lesion with regard to the mesio-distal dimension of the dentine in the tooth's crown; this was divided into three grades:
    a. Grade 1: less than one-third of the dentine thickness.
    b. Grade 2: between one-third and two-thirds of the dentine thickness.
    c. Grade 3: more than two-thirds of dentine thickness.
7. Condition of the primary tooth (if present) preceding the unerupted permanent tooth with a diagnosed PEIR defect, including:
    a. Missing.
    b. Sound.
    c. Decayed and/or filled (not pulp treated)
    d. Endodontically/pulp treated.
    e. Periapically infected.
8. Ectopic position of unerupted permanent teeth: all teeth positions were assessed. A tooth was considered ectopically positioned if its long axis or crown position was deviated from the normal (axial) on the radiograph. The assessment of ectopic position was performed using the clinical judgment and agreement of a paediatric dentist and an oral and maxillofacial radiologist.

Statistical methods

The data were entered manually into a Microsoft excel data sheet (Microsoft Excel, Office® 2007) in a computer. Statistical analysis was performed using Statistical Package for the Social Science (SPSS version 15.0) for Windows (SPSS Inc., Chicago, III). Mean and standard deviation were calculated for age of the subjects studied. The subjects were divided into two groups, one which showed PEIR defects, and the other group where these defects were absent. The Chi-square test was used to determine statistical differences between the two groups with regards to gender, stage of dental development, presence of specific dental conditions and developmental anomalies. The same test was also applied to determine statistical differences within the PEIR groups with regard to any association with the condition of the primary predecessor tooth. The level of significance was set at $p \leq 0.05$.

Results

Demography and prevalence of pre-eruptive intracoronal resorptive defects (subject and tooth prevalence)

A total of 1,571 individuals participated in the study and matched the inclusion criteria; there were nearly equal numbers of males and females who had at least one unerupted tooth. The mean age of the patients was (8.72 ± 2.5) years (range 6–15 years), (Table 2).

There were 128 subjects who had only one tooth with a PEIR defect per subject, giving a subject prevalence of 8.1 %. A total number of 20,788 unerupted teeth were examined and there were 128 teeth showing the defect; yielding an overall tooth prevalence of 0.62 %. Of the 128 subjects with PEIR defects, 66 (8.2 %) were males and 62 (8.1 %) were females. The difference between genders was not statistically significant ($p = 0.519$). The prevalence of PEIR in each tooth type was assessed by dividing the number of affected teeth by the total number of unerupted teeth examined in each tooth type, (Table 3).

For patients who were examined at the primary dentition stage, there were 13 (10.16 %) subjects with PEIR defect compared to 114 (89.06 %) subjects in the mixed dentition and to 1 (0.78 %) subject in the permanent dentition. The differences between the groups were statistically significant ($p = 0.000$), (Table 4).

Table 2 Age (years) descriptive statistics of subjects with pre-eruptive intracoronal resorptive defects according to gender of subjects

Gender	Number (%)	Mean age ± SD
Female	764 (48.6)	8.76 ± 2.59
Male	807 (51.4)	8.68 ± 2.41
Total	1,571 (100)	8.72 ± 2.50

Table 3 Tooth prevalence of pre-eruptive intracoronal resorptive (PEIR) defects according to jaw

Tooth	Number of unerupted teeth	Number (%) of PEIR defects lesions
Mx 3rd M	425	0 (0)
Mx 2nd M	2,622	20 (0.76)
Mx 1st M	462	3 (0.65)
Mx 2nd PM	2,331	1 (0.04)
Mx 1st PM	2,009	0 (0)
Mx C	2,669	2 (0.08)
Mn C	2,311	6 (0.26)
Mn 1st PM	2,217	67 (3.02)
Mn 2nd PM	2,395	17 (0.71)
Mn 1st M	393	4 (1.02)
Mn 2nd M	2,462	8 (0.33)
Mn 3rd M	492	0 (0)
Total	20,788	128 (0.62)

All teeth indicated are permanent teeth

Mx maxillary, *Mn* mandibular, *C* canine, *PM* premolar, *M* molar

Table 4 Prevalence of pre-eruptive intracoronal resorptive (PEIR) defects in relation to dentition stage

Dentition stage	Subjects without PEIR defects	Subject with PEIR defects (%)	*p* value
Primary	183	13 (10.16)	0.000*
Mixed	1,079	114 (89.06)	
Permanent	181	1 (0.78)	
Total (subjects)	1,443	128 (100)	

* Significant, $p < 0.05$

Pre-eruptive intracoronal resorptive defects and the medical condition of subjects

The prevalence of medical conditions in the sample was low (2.29 %), these included: asthma, epilepsy, cardiovascular diseases, allergy, and others. Of the 128 subjects with PEIR defects, none of the subjects had any medical condition.

Location of pre-eruptive intracoronal resorptive defects

Most of the affected teeth were located in the lower jaw and were observed more on the right side, (Table 5) and (Figs. 1, 2, 3). All lesions diagnosed were single lesions (one lesion per crown); the common locations in the crown were mesial and central, followed by distal aspects, (Table 6).

Table 5 Location of pre-eruptive intracoronal resorptive defects according to jaw and side

Jaw	Right	Left	Total (%)
Maxilla	21/5,197	5/5,321	26 (20.3 %)
Mandible	72/5,203	30/5,067	102 (79.7 %)
Total (%)	93 (72.66 %)	35 (27.34 %)	128

Fig. 1 Grade 1 pre-eruptive intracoronal resorptive defect located in the distal aspect of unerupted right mandibular second premolar crown

Fig. 2 Grade 2 pre-eruptive intracoronal resorptive defect located in the mesial aspect of unerupted right mandibular first premolar crown

Size of pre-eruptive intracoronal resorptive defects

All defects within the crown were found adjacent to the enamel–dentine junction, 50 % of the lesions extended to less than one-third of dentine thickness, (Table 7), and (Figs. 1, 2, 3).

Pre-eruptive intracoronal resorptive defects and general condition of the dentition

Among all developmental and acquired dental anomalies examined (Table 8), PEIR defects were only significantly associated with the presence of decayed or filled teeth ($p = 0.028$). PEIR defects were not significantly higher in subjects with ectopically positioned teeth, on the contrary, they were significantly associated with absence of ectopically positioned permanent teeth ($p = 0.017$). There was only one case of a PEIR defect among 77 cases with ectopically positioned teeth. Moreover, PEIR defects were significantly associated with non-endodontically treated primary predecessors ($p = 0.04$).

Fig. 3 Grade 3 pre-eruptive intracoronal resorptive defect located in the central aspect of unerupted left mandibular first premolar crown

Table 6 Location of coronal pre-eruptive intracoronal resorptive defects

Tooth	Mesial	Central	Distal	Total
Third molar	0	0	0	0
Second molar	13	11	4	28
First molar	2	3	2	7
Second premolar	6	8	4	18
First premolar	40	27	0	67
Canine	2	1	5	8
Total (%)	63 (49.2 %)	50 (39.1 %)	15 (11.7 %)	128 (100 %)

Pre-eruptive intracoronal resorptive defects and presence of predecessor primary teeth

The majority (72.7 %) of PEIR defects were present in permanent teeth with predecessor primary teeth, and (27.3 %) without a primary predecessor (1st and 2nd permanent molars). The most commonly affected teeth with predecessor primary teeth were mandibular right first premolar (55.78 %), mandibular left second premolar (10.58 %), mandibular right second premolar (9.62 %), and mandibular left first premolar (8.65 %).

Table 7 Size of pre-eruptive intracoronal resorptive defects

Tooth	<1/3 relative dentine thickness	Between 1/3 and 2/3 relative dentine thickness	>2/3 relative dentine thickness	Total
Third molar	0	0	0	0
Second molar	17	7	4	28
First molar	3	4	0	7
Second premolar	8	10	0	18
First premolar	35	21	11	67
Canine	1	2	5	8
Total (%)	64 (50 %)	44 (34.4 %)	20 (15.6 %)	128 (100 %)

Table 8 Distribution of pre-eruptive intracoronal resorptive (PEIR) defects in relation to dentition condition

Condition of the dentition [*n* (prevalence %)]	No. of PEIR defects in subjects with the condition	No. of PEIR defects in subjects without the condition	*p* value
Fluorosis 1 (0.06 %)	0	128	1.000
Enamel hypoplasia 7 (0.44 %)	0	128	1.000
Crown abnormality 46 (2.92 %)	4	124	0.785
Submerged primary molar 23 (1.46 %)	2	126	0.711
Ectopically positioned permanent teeth 77 (4.9 %)	1	127	0.017*
Supernumerary tooth 11 (0.7 %)	0	128	1.000
Missing tooth 96 (6.11 %)	10	118	0.438
Molar incisor hypomineralisation 40 (2.54 %)	6	122	0.133
Decayed/filled teeth 1,440 (91.66 %)	124	4	0.028*
Endodontically treated teeth 438 (27.88 %)	21	107	0.040*
Rarifying osteitis 177 (11.26 %)	10	118	0.059
Internal resorption 230 (14.64 %)	22	106	0.116

* Significant, $p < 0.05$

Discussion

Although PEIR defects have been recognised as a clinical finding for more than 70 years, most of the dental literature related to these defects is in the form of case reports. This study is one of a few studies which evaluated the prevalence and associated subject and dental factors of PEIR defects. PEIR defects can be overlooked by clinicians in spite of ease of diagnosis upon careful radiographic inspection of unerupted teeth.

In this study, a population consisting of 1,571 patients with 20,788 unerupted teeth was examined for presence of PEIR defects from OPG radiographs. The present study results were within the range reported by previous studies for both the subject (8.1 %) and tooth (0.62 %) prevalence of PEIR defects. Previous studies on OPGs reported (1.55–27.3 %) subject prevalence, and (0.5–2.1 %) tooth prevalence. Insignificant differences found in prevalence of PEIR defects between genders in this study were similar to findings in previous studies (Seow et al. 1999a; Nik and Abdul Rahman 2003; Özden and Acikgoz 2009).

The reason for the difference in prevalence between studies in (Table 1) is likely to be due to differences in radiographic definition of various unerupted teeth between studies that used OPGs and others that used bitewing radiographs. The maxillary molar and premolar crowns of unerupted teeth are usually not as well defined in both panoramic and bitewing radiographs when compared to their mandibular counterparts, and defects in these teeth may have been missed (Seow et al. 1999a, b; Nik and Abdul Rahman 2003; Özden and Acikgoz 2009).

In the present study sample, the most commonly affected teeth, indicated in (Table 3), were similar tooth groups (mostly premolars and molars) but differed in their jaw location and prevalence from those reported in previous studies (Seow et al. 1999a, b; Nik and Abdul Rahman 2003; Özden and Acikgoz 2009). This difference might be a result of the radiographic techniques used, mean age of the samples studied, or unknown local factors.

Most studies found that usually a single tooth was affected with PEIR in an individual, although others reported more than one affected tooth. None of the previous studies have suggested any explanation for this finding in certain patients, or have associated it with certain dental anomalies (Walton 1980; Wood and Crozier 1985; Seow et al. 1999b; Nik and Abdul Rahman 2003; Hata et al. 2007). All subjects in this study had only one affected tooth, this probably suggests local aetiologic factors while the presence of more defects within the same individual may suggest a systemic factor, however, this would not exclude the role of local aetiologic factors.

Seow et al. (1999b) did not report any associations of PEIR defects with medical conditions. The small

percentage of medical conditions in the present study sample was not representative enough to predict an association of PEIR defects with any medical condition; and this justifies the need for further studies in this aspect.

The significant presence of PEIR defects in the mixed dentition stage of subjects (89.06 %) in this study can be explained by a greater number of subjects in the mixed dentition among other groups, (Table 4). Also, since a greater number of unerupted teeth can bee seen on the OPG radiograph in the mixed dentition stage, and a longer time that elapses since the permanent teeth start forming until they erupt would allow for these defects to develop and be more prevalent in the mixed dentition stage. In the permanent dentition, fewer teeth remain unerupted, and any PEIR defects, when present, can be missed after the tooth erupts into the oral cavity and get contaminated by the oral flora and then cannot be distinguished from dental caries.

Most PEIR defects in this study were found in the mandible (Table 5) which was similar to what had been reported by Seow et al. (1999a, b). On the other hand, Nik and Abdul Rahman (2003) and Özden and Acikgoz (2009) found these defects to be located more in the maxilla. These differences might be due to the influence of the radiographic technique used, population studied, or other unknown factors.

The most common location of the lesions inside the crown varied in different studies, some reported central aspects (Seow et al. 1999a; Özden and Acikgoz 2009), or mesial aspects (Seow et al. 1999b; Nik and Abdul Rahman 2003). However, in this study, all PEIR defects were single lesions mostly located in the mesial followed by central and distal aspect of the crown (Table 6).

In this study, all lesions were localised just beneath the enamel–dentine junction and 50 % extended to less than one-third of dentine thickness (Table 7), comparable to previous studies which reported that (85 %) and (55 %) of defects were less than one-third of the dentine thickness, respectively (Seow et al. 1999b; Nik and Abdul Rahman 2003). However, Özden and Acikgoz (2009) reported that the majority (39.3 %) of defects were within two-thirds of the dentine thickness, and 21.4 % of lesions affecting the enamel in addition to the dentine where the crowns of affected teeth had a shell-like appearance on OPG radiographs. This was attributed to the older mean age of the subjects compared to other studies, which permitted a longer time for progression of the defects. In another study, 40 % of the defects extended to more than two-thirds of the thickness of the coronal dentine as reported by Seow et al. (1999b).

Local factors are mostly considered to be important in the aetiology of PEIR defects although the triggering factors are still unknown. In the present study, conflicting results were found; a highly significant association was found between decayed/filled primary teeth and presence of PEIR defects ($p = 0.028$) suggesting an association with caries presence in the subject, while non-endodontically treated teeth were associated with more PEIR defects ($p = 0.04$) suggesting that pulpal treatment of affected primary teeth does not increase the risk of these lesions.

Contrary to what has been speculated in the literature, there was no significant presence of PEIR defects in cases with ectopic teeth. There is no explanation to this study finding except that the ectopically erupted teeth here had no relation with the protective covering of adjacent unerupted teeth; in other words, the deviated axis of the ectopic teeth was actually away from the adjacent unerupted teeth. The theory that an ectopically positioned tooth is one of the triggering factors for PEIR defects still does not explain the presence of PEIR defects in teeth with normal axial inclination in the jaws and in teeth which do not have ectopically positioned neighbouring teeth. As results regarding this issue are contradictory, further investigation of effects of ectopic eruption on PEIR defects is needed.

The majority of PEIR defects in this study were present in permanent teeth with predecessor primary teeth (premolars). However, most previous studies reported them in teeth with no primary predecessors; namely, the first and second permanent molar teeth (Wood and Crozier 1985; Seow et al. 1999a, b; Nik and Abdul Rahman 2003; Özden and Acikgoz 2009). Again this may be due to the difference in age groups included in the different studies or due to the condition of the primary predecessor which could play a factor in the aetiology.

From a practical standpoint, however, the cause of the lesion is not nearly as important as its timely diagnosis and treatment. Careful radiographic examination of unerupted teeth in a patient is important (Kjær et al. 2012). Radiographic examination of such lesions should indicate invasiveness. Large lesions should be treated soon before they reach the pulp, mostly by surgical exposure of the defect if the tooth is to be preserved. Prognosis in the treatment of these cases has been documented in the literature with good success rates. Regardless of the cause of the defect, the dentist must choose the best treatment option that suits each case separately. Different treatment options were mentioned in the dental literature varying from restoration before eruption, restoration after eruption and extraction (Seow 1998; Seow et al. 1999a, b; Kupietzky 1999; Moskovitz and Holan 2004; Davidovich et al. 2005; Klambani et al. 2005).

Conclusion

In conclusion, PEIR defects in permanent teeth may be detected from OPG radiographs. Prevalence rate was 8.1 %

by subject 0.62 % by teeth examined and all subjects showed only one affected tooth per subject with no significant gender differences. The highest prevalence was noted in mandibular first premolars. The majority of defects were seen in the mixed dentition, mainly in the mandible, and manifested as single lesions at a mesial location intracoronally, with a size less than one-third of dentine thickness. There was a strong association between PEIR and decayed or filled primary predecessor teeth. A careful inspection during radiographic examination of unerupted teeth is recommended in order for early diagnosis and treatment.

Conflict of interest The authors declare that they have no conflict of interest.

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