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**ORIGINAL ARTICLE**

# Prevalence of Pre-eruptive Intra-Coronal Resorption in Pediatric Population: A Retrospective Analysis

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**ABSTRACT**

**Objective:** To evaluate the prevalence of pre-eruptive intra-coronal resorption (PEIR) lesions in the pediatric population. **Material and Methods:** 8341 impacted teeth were evaluated regarding PEIR lesions via panoramic radiographs of 968 patients aged 2-18 who applied between 2021 and 2022. The number of affected teeth, the number of the tooth, the degree of the lesion, the location of the defect, and the presence of ectopic position were recorded. PEIR lesions are categorized based on the thickness of the affected dentin: Grade 1 (less than 1/3), Grade 2 (between 1/3 and 2/3), and Grade 3 (more than 2/3). All analyses were performed with IBM SPSS 23.0, and p value 0.05 was considered significant. **Results:** The number of teeth with PEIR defects was 71 (0.86%), while the number of patients with PEIR defects was 58 (5.99%). Mandibular premolars (42.3%) are the most commonly defective teeth, followed by mandibular molars (39.5%). The majority of defects were classified as Grade 1. In patients with Grade 3 lesions, no more than one defect was observed. There was a significant relationship between the degree of the defect and the number of defects observed. **Conclusion:** Detecting defective teeth in pediatric patients' control radiographs is critical for early treatment. This study emphasized that the prevalence of defective teeth is high in pediatric patients, and pediatric dentists should be cautious about these defects.

**Keywords:** Pediatric Dentistry; Prevalence; Radiology.

## Introduction

Pre-eruptive intra-coronal radiolucency/resorption (PEIR) is an abnormal, well-demarcated, radiolucent area in coronal dentin tissue close to the enamel [1]. Diagnosing radiolucency in the crowns of unerupted teeth is only possible with radiographs taken during routine examinations, such as panoramic or periapical radiographs [2]. Although typically, only the dentin is affected, it has been reported that enamel may also be affected in advanced cases [3,4]. The differential diagnosis should consider internal resorptions, early stages of internal enamel pearls, turner teeth, and pre-eruptive coronal caries. In addition to radiographs taken for differential diagnosis and diagnosis, CBCT images can also be used [4].

The factor(s) that trigger the activity of dentin-resorbing clastic cells and their replacement with soft tissue, which is involved in forming PEIR lesions, is still unknown. It has been reported that these cells may be osteoclast-like giant cells originating from undifferentiated tooth follicular cells [5,6]. Seow [6] reported that the PEIR lesion formation process started immediately after crown formation was completed. After tooth eruption, the occlusal enamel remains unsupported, and as a result, the enamel collapses, and the pulp and roots are exposed to oral flora.

In the treatment of PEIR lesions, factors such as the depth of radiolucency, whether the pulp is affected or not, the condition of the periapical tissues, whether the tooth is symptomatic or not, the patient's compliance and caries risk should be considered [7].

Seow's classification [8] shows that PEIR lesions can be examined in 3 degrees. First-degree lesions are less than 1/3 of the existing dentin thickness and without risk of progression. Regular follow-up and protective applications such as fluoride and fissure sealant are recommended if the tooth erupts or after the eruption. The second degree of lesions refers to those that involve 1/3 but less than 2/3 of the existing dentin thickness. These lesions require prompt intervention to halt their progression. Fissure sealant, coronal restoration, and indirect pulp capping treatments are recommended. Grade 3 lesions involve more than 2/3 of the dentin thickness. Indirect pulp capping, pulpotomy, revascularization, and extraction treatments are recommended for grade 3 lesions that progress rapidly and cause symptoms in the patient [7].

It should be noted that the immature dentin of young teeth is a potential source of pulp inflammation. Early diagnosis and treatment of intra-coronal resorption before eruption is essential to prevent pulp involvement. Therefore, the panoramic radiographs should be scrutinized.

According to the literature, large-scale studies were found to determine the prevalence of PEIR lesions [4,8-14]. However, studies on the pediatric patient population, particularly those under 7, were insufficient. Considering the importance of early diagnosis of PEIR lesions, this study aims to evaluate the prevalence of PEIR lesions in children aged 2-18.

## Material and Methods

### Study Design

This study was approved by the local ethics committee of Lokman Hekim University, Ankara, Turkey (Project no: 2022120). Panoramic radiographs were preferred, as they show the maximum number of teeth in a single radiograph and are commonly used in clinical practice in patients with developing dentition.

### Sample Selection

Patients aged 2 to 18 who applied to Hacettepe and Lokman Hekim University Faculty of Dentistry between 2021 and 2022 and received panoramic radiographs for any reason were included in the study. The

study population consists of patients who applied for any reason and whose panoramic radiographs were taken within a year when the study was planned to be completed. The minimum sample size required for the research was 447, with a 5% margin of error and a 95% confidence level. A total of 1254 panoramic radiographs taken on the specified dates and meeting the inclusion criteria were accessed. A total of 968 panoramic radiographs were assessed after low-quality images were excluded.

Criteria for Inclusion and Exclusion

Digital panoramic radiographs of children and adolescents aged 18 and under, taken for any reason at Hacettepe University Faculty of Dentistry or Lokman Hekim University Faculty of Dentistry, were included in the study. In addition, for the panoramic radiograph to be adequately evaluated, it was required to have sufficient diagnostic quality and at least one unerupted tooth. Poor quality panoramic radiographs and radiographs of patients with dental pathology such as amelogenesis imperfecta or dentinogenesis imperfecta were excluded.

The Collection of Data

Nine hundred sixty-eight digital panoramic radiographs (444 male, 524 female) meeting the inclusion criteria were evaluated by a pediatric dentist (IMG). In all patients, the patient's age, gender, number of unerupted teeth, number of teeth with PEIR defects, which tooth/teeth had PEIR defects, location of the defect in the coronal dentin, grade of the lesion, and whether the unerupted tooth was in an ectopic position were examined and recorded. An unerupted tooth was defined as a tooth covered with bone or mucosa and located below the occlusal plane [4]. The severity of the lesion was determined by grading the mesiodistal dimension of the dentin in the tooth crown using Seow's classification [9];

- Grade 1, less than 1/3 of the existing dentin thickness;
- Grade 2, more than 1/3 but less than 2/3 of the existing dentin thickness;
- Grade 3, more than 2/3 of the existing dentin thickness.

Statistical Analysis

Descriptive statistics were presented in means (± SD) continuous variables or numbers and percentages for categorical outcomes. Whether the categorical variables differed between groups was investigated by the Chi-square test or the Fisher exact test. Cohen's kappa statistics were utilized to assess the reliability of the observer. All analyses were performed with IBM SPSS 23.0; $p < 0.05$ was considered significant.

## Results

The total number of impacted teeth in the study, which included 968 patients' panoramic radiographs, was 8274, with a mean age of 9.96 ± 3.44. While the number of teeth with PEIR defects was 71 (0.86%), the number of patients with PEIR defective teeth was 58 (5.99%).

The recorded information of teeth with PEIR defects is shown in Table 1. As a result, the most common defected teeth were mandibular premolars (42.3%), followed by mandibular molars (39.5%). The defect was primarily found in the middle (42.3%), and mesial (31%) regions and grade 1 lesions (76.1%) were frequently encountered. An example of a grade 1 lesion on the premolar tooth is presented in Figure 1.

**Table 1. Characteristics of PEIR defective teeth.**

| Variables | N | % |
|---|---|---|
| Number of Defective Teeth | | |
| 0 | 910 | 94.0 |
| 1 | 47 | 4.9 |
| 2 | 10 | 1.0 |
| 4 | 1 | 0.1 |
| Total | 71 | 100.0 |
| Defective Teeth | | |
| Maxillary Premolar | 6 | 8.4 |
| Maxillary Molar | 7 | 9.8 |
| Mandibular Premolar | 30 | 42.3 |
| Mandibular Molar | 28 | 39.5 |
| Place of Defect | | |
| Middle | 30 | 42.3 |
| Mesial | 22 | 31 |
| Distal | 12 | 16.9 |
| Middle-Mesial | 1 | 1.4 |
| Mesial-Distal | 3 | 4.2 |
| Middle-Mesial-Distal | 3 | 4.2 |
| Lesion Grade | | |
| 1 | 54 | 76.1 |
| 2 | 9 | 12.7 |
| 3 | 8 | 11.3 |
| Status of the Primary Teeth | | |
| Absent | 36 | 50.7 |
| Extracted | 2 | 2.8 |
| Filled/Decayed | 9 | 12.7 |
| Periapical Lesion (No Filling/Decay) | 9 | 12.7 |
| Filled/Decayed + Periapical Lesion | 15 | 21.1 |

**Figure 1. Grade 1 pre-eruptive intra-coronal lesion observed in the mesial region of impacted tooth number 14 in an 8-year-old male patient.**

Table 2 shows the prevalence of PEIR defects and patients with defects. The highest values in terms of both defect and patient prevalence were in the 6-12 age group. The PEIR defect in a 6-year-old patient's molar tooth is represented in Figure 2.

**Table 2. Prevalence of PEIR defective teeth and patients by age and gender group.**

| Variables | Age of 2-5 | Age of 6-12 | Age of 12 and Above | Total |
|---|---|---|---|---|
| Number of Unerupted Teeth | 1222 | 6157 | 895 | 8274 |
| Number of Defective Teeth | 5 | 60 | 6 | 71 |
| Prevalence of Teeth | 0.41% | 0.97% | 0.67% | 0.86% |
| Number of Patients | 81 | 650 | 237 | 968 |
| Number of Patients with PEIR Defect | 4 | 48 | 6 | 58 |
| Prevalence | 4.93% | 7.38% | 2.53% | 5.99% |
| Gender | | | | |
| Male | 39 | 309 | 96 | 444 |
| Female | 42 | 341 | 141 | 524 |

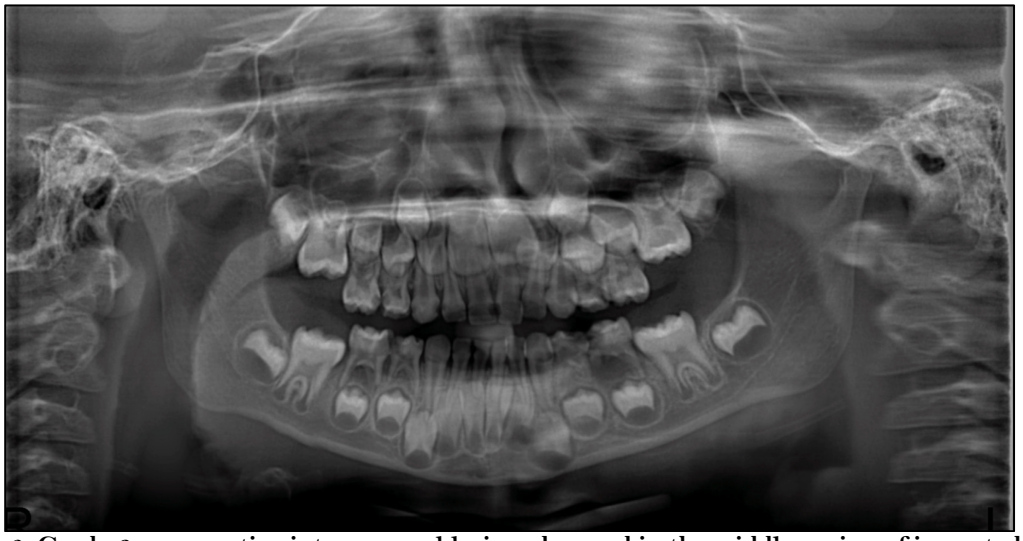

**Figure 2. Grade 3 pre-eruptive intra-coronal lesion observed in the middle region of impacted tooth number 26 in a 6-year-old female patient.**

The relationships between the number of defective teeth, the degree of defect, and the condition of the primary tooth were evaluated (Table 3). It was observed that advanced PIER defects (grades 2 and 3) were more common in missing primary teeth and primary teeth with periapical lesions in addition to caries (teeth with extraction indication). However, the available data were insufficient to determine the existence of a relationship between the status of the primary tooth and the degree of the lesion.

**Table 3. Relationship between condition of primary teeth, degree of defect, and number of defects.**

| Variables | Degree of Defect | | | Number of Defects | |
|---|---|---|---|---|---|
| | Grade 1 | Grade 2 | Grade 3 | Single Defect | More than One Defect |
| | N (%) | N (%) | N (%) | N (%) | N (%) |
| Condition of Primary Teeth | | | | | |
| Missed | 29 (71.05) | 2 (5.26) | 7 (18.42) | 32 (68.1) | 6 (25.0) |
| Filled/Caries | 2 (100.0) | 0 (0.0) | 0 (0.0) | 4 (8.5) | 5 (20.8) |
| Periapical Lesion | 9 (100.0) | 0 (0.0) | 0 (0.0) | 5 (10.6) | 4 (16.7) |
| Filled/ Caries + Periapical Lesion | 9 (60.0) | 6 (40.0) | 0 (0.0) | 6 (12.8) | 9 (37.5) |
| Number of Defects | | | | | |
| Single Defect | 34 (72.3) | 5 (10.6) | 8 (17.0) | | |
| More than One Defect | 20 (83.3) | 4 (16.7) | 0 (0.0) | | |

In patients with a single defect, the primary tooth above the defective impacted tooth was previously extracted (68.1%). In patients with more than one defect, the primary tooth is more often caries in addition to

the periapical lesion (37.5%). The chi-square test revealed a significant relationship between the status of the primary tooth and the number of defects (p=0.009).

The most common degree of defect was grade 1, both in patients with a single defect (72.3%) and in patients with more than one defect (83.3%). However, grade 3 lesions were observed only in patients with a single defect (17%). There was a significant relationship between the degree of defect and the number of defects (p=0.026). A single observer evaluated all panoramic radiographs. Intra-examiner reliability was found to be good (0.74).

## Discussion

Although the PEIR lesion is a 3000-year-old lesion, its etiology is still unknown [15]. One of the theories suggested in this regard is that PEIR defect is caused by local infection of the overlying primary tooth [16]. Our findings supported this hypothesis, as the primary teeth on the teeth with PEIR defects were either extracted or had filled/periapical lesions. This defect has never been observed in teeth growing between the roots of a healthy primary tooth. However, this theory is insufficient to explain the etiology of the PEIR defect seen in teeth that do not have primary teeth, such as molars. In the study, it was observed that there were lesions in the molar teeth on which no primary teeth were present.

Seow et al. [9] reported that local factors such as ectopic position may be an etiological factor in forming PEIR. It has been suggested that abnormal contact and pressure from the ectopic site may damage the dental follicle, resulting in dentin damage. The ectopic positions of teeth with PEIR defects were also recorded in our study, but only one tooth with a defect had an ectopic position. No relationship was found between ectopic position and PEIR defect. Another theory is that it is caused by improper mineralization of the crown of the influenced tooth. However, more research is required to confirm these theories.

In our study, in which panoramic radiographs of 968 patients were examined, PEIR defect was found in 0.86% of 8274 impacted teeth and 5.99% of patients. According to a literature review, the prevalence of patients with PEIR defects varies between 0.2 and 27.3%, and the prevalence of teeth varies between 0.2 and 3.5% [8,9,11,17]. These findings are consistent with our research. However, the overall prevalence of patients with PEIR lesions was higher than in previous studies. Because our study was conducted on pediatric patients, the presence of more impacted teeth was thought to be the cause. When the teeth erupt, the PEIR lesion can be overlooked because it is confused with the caries lesion. Therefore, early diagnosis is critical.

It was reported by Chouchene et al. [7] that the prevalence of PEIR is most common in the third molars. However, some studies have reported that the most frequently affected teeth are the mandibular first premolars, followed by the second and third molars [18]. Our study found that the defect was most common in the mandibular premolars, followed by mandibular molars. According to Yüksel et al. [19], there were more PEIR defects in maxillary third molars than in mandibular third molars, and it was suggested that the mandibular third molars had more symptoms and were extracted. However, there was no difference in the lesion prevalence between the mandibular and maxillary third molars in the study. Furthermore, when all molars are examined, mandibular molars have more defects than maxillary molars. When the literature was examined, it was observed that the maxilla had more defective teeth than the mandible [11,19], whereas in some studies, it was observed as the opposite [8,20]. There is no consensus on this topic.

Our results showed no PEIR defects in anterior and canine teeth and teeth numbered 25, 16, and 26. However, studies also report that the defect is common in canine teeth [11,19]. Al-Batayneh et al. [12] found PEIR is common in mandibular first premolars, maxillary second molars, and mandibular second premolars but

not in third molars or maxillary first premolars. Similar to this result, our study found the highest prevalence in mandibular second premolar teeth, followed by mandibular first premolar, first, and second molar teeth. It was detected very rarely in maxillary premolars and third molars. It was thought that these differences between studies may be due to the mean age of the subjects in the studies, the diversity of the studied populations, racial or geographical differences, and differences in radiological techniques.

The number of teeth affected was generally reported as a single tooth in a patient [12]. However, in some studies, it has been reported that there are cases where more than one tooth is affected, and the number of cases is significantly lower than the number of cases where only one tooth is affected [8,11,19,20]. In our study, while there were 47 patients with a single tooth defect, which supports the literature, the number of patients with two defects was limited to 10. Only one patient had four defective teeth.

The degree of PEIR defect was observed to differ in studies. Seow et al. [8] reported that most of the lesions were Grade 1, but 3% were more than one-third of the dentin thickness. However, they later reported in another study that 40% of the lesions were more than two-thirds of the dentin thickness [9]. On the other hand, Özden et al. [11] reported that 39% of the lesions were Grade 2, and 21.4% reported the presence of Grade 3 lesions with teeth with a shell-like appearance. In our study, while Grade 1 lesions constituted most cases (76,1%), 12.7% had Grade 2, and 11.3% had Grade 3 lesions.

The study only included children aged 0 to 18. The prevalence of PEIR in children under six was 4.93%. A study conducted on the population of children by Asokan et al. [13] reported that the prevalence under the age of 6 was 3.9%, supporting this result. Both studies' results were higher than those that included the adult population [4,11,21,22]. The difference was thought to be due to the elimination of the possibility that the PEIR defect could be confused with caries after its eruption in younger age groups. In the study of Asoka et al., no difference was found in terms of prevalence between the 6-9 and 10-14 age groups, which are under the age of 6 and other age groups. However, the results of our study showed that the prevalence in the 6-12 age group was 7.38%, which was significantly higher than the other age groups. The population over 12 had the lowest prevalence of 2.53%.

Treatment is recommended based on the severity of the PEIR lesion, regardless of its etiology. While follow-up is appropriate in static lesions, surgical intervention and restorative treatment of the impacted tooth are recommended in progressive lesions [9,18,23]. Early intervention and follow-up are critical for keeping these teeth healthy in the mouth. The results of this study emphasize the importance of a more sensitive radiological evaluation in the pediatric population where the defect is more prevalent.

## Conclusion

The prevalence of defective teeth is high in pediatric patients, and pediatric dentists should be cautious about these defects.

### Authors' Contributions


| | | |
|---|---|---|
| IMG | https://orcid.org/0000-0002-1647-5946 | Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Data Curation, Visualization, Supervision and Project Administration. |
| PSE | https://orcid.org/0000-0002-7568-326X | Conceptualization, Methodology, Formal Analysis, Investigation, Writing - Original Draft and Writing - Review and Editing. |
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All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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None.

## Conflict of Interest

The authors declare no conflicts of interest.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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