ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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The Frequency of Pre-Eruptive Intracoronal Resorption in Impacted Teeth with Complete Bone Retention: A Cone-Beam Computed Tomography Study: Cross-Sectional Study

Tam Kemik Retansiyonlu Gömülü Dişlerde Preerüptif İntrakoronal Rezorpsiyon Sıklığı: Konik Işınlı Bilgisayarlı Tomografi Çalışması: Kesitsel Araştırma

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This study was presented as an oral presentation at 1st International Turkish Japanese Dental Congress, June 24-26, 2021, Ankara, Türkiye.

ABSTRACT Objective: The aim of this study was to investigate the frequency of pre-eruptive intracoronal resorptions (PIR) and to determine whether PIR differs according to age and gender in impacted teeth with full bone retention. **Material and Methods:** A total of 2,434 permanent teeth from 2,365 (1,293 females, 1,072 males) patients between the ages of 18-89 were evaluated in the study. Semi-impacted teeth in eruption process, impacted teeth with jaw pathologies, primary teeth with full bone retention, mesiodens, and supernumerary impacted teeth were not included in the study. Descriptive statistics (mean, standard deviation) were calculated for all parameters in the study. The chi-square test was used to determine the relationships between categorical variables. $p<0.05$ was considered significant. **Results:** A total of 276 impacted teeth with bone retention were observed in 207 of 2,365 patients. PIR lesions (6 molars, 4 canines, 1 incisor, 1 premolar) were detected in 12 (4.3%) of the examined impacted teeth. Seven of them were in the maxilla and 5 were in the mandible. Five of the patients with PIR were male and 7 were female ($p>0.05$) and their mean age was 54.3 (28-75) years. **Conclusion:** The frequency of PIR in impacted teeth with complete bone retention was 4.3%, and it was most common in molar teeth. If the resorbed impacted tooth is likely to erupt, it should be followed up with restorative or endodontic treatment and tried to be kept in the mouth.

Keywords: Pre-eruptive intracoronal resorption;
impacted tooth;
cone beam computed tomography

ÖZET Amaç: Bu çalışmanın amacı, tam kemik retansiyonlu gömülü dişlerde preerüptif intrakoronal rezorpsiyon (PIR) sıklığını araştırmak ve PIR'ın yaş ve cinsiyete göre farklılık gösterip göstermediğini belirlemektir. **Gereç ve Yöntemler:** Çalışmada, 18-89 yaş arası 2.365 hastadan (1.293 kadın, 1.072 erkek) toplam 2.434 daimî diş değerlendirildi. Sürme sürecindeki yarı gömülü dişler, çene patolojileri olan gömülü dişler, tam kemik retansiyonlu süt dişleri, mesiodensler ve süpernümerer gömülü dişler çalışmaya dâhil edilmedi. Çalışmadaki tüm parametreler için tanımlayıcı istatistikler (ortalama, standart sapma) hesaplandı. Kategorik değişkenler arasındaki ilişkileri belirlemek için ki-kare testi kullanıldı. $p<0,05$ anlamlı kabul edildi. **Bulgular:** Çalışmamızda 2.365 hastanın 207'sinde kemik retansiyonlu toplam 276 gömülü diş görüldü. İncelenen gömülü dişlerin 12'sinde (%4,3) PIR lezyonları (6 molar, 4 kanin, 1 kesici, 1 premolar) tespit edildi. Bunlardan 7'si maksillada, 5'i mandibulada idi. PIR'lı hastaların 5'i erkek, 7'si kadın ($p>0,05$) ve ortalama yaşları 54,3 (28-75) yıl idi. **Sonuç:** Tam kemik retansiyonu olan gömülü dişlerde PIR sıklığı %4,3 olup, en sık molar dişlerde görülmüştür. Eğer rezorbe olan gömülü dişin sürme olasılığı varsa restoratif veya endodontik tedavi ile takip edilmeli ve ağızda tutulmaya çalışılmalıdır.

Anahtar Kelimeler: Preerüptif intrakoronal rezorpsiyon;
gömülü diş;
konik ışınlı bilgisayarlı tomografi

Pre-eruptive intracoronal resorption (PIR), exhibits a caries-like radiolucency and, unlike caries, is not associated with the oral microbial flora.[1] In the past, such resorptions seen in unerupted teeth were thought to be dental caries or caries-like lesions and were defined as "intra-follicular caries" and "pre-

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eruptive caries". It is also called "idiopathic coronal resorption".[2] Cariogenic microorganisms are not found in PIR lesions, which are radiologically resembling tooth caries.[3] In impacted teeth, they appear as well-defined radiolucency within the coronal dentin tissue. The size of the PIR can reach more than two-thirds of the dentin and has been reported to include enamel in advanced cases.[4]

The etiology of this condition, which is seen in unerupted teeth, still remains unclear.[5] O'Neal et al. stated that these radiolucencies seen in impacted teeth may develop due to apical infection of the primary tooth, hypoplasia due to enamel-dentin developmental anomaly, or inclusion of uncalcified enamel matrix.[2] PIR is usually asymptomatic and diagnosed during routine radiological examination, and early diagnosis can prevent tooth loss.[3] In the treatment of PIR, it is recommended to surgically expose and restore the unerupted tooth.[6] Tooth removal is anohter option and it has been suggested to evaluate with a multidisciplinary team.[7]

Although PIR is frequently observed in unerupted permanent teeth, it can also be seen in primary teeth.[8] The prevalence of PIR is 0.7% to 27.3% depending on whether the tooth or individual is considered as an unit.[9,10] Intraoral, panoramic imaging and cone-beam computed tomography (CBCT) were used for radiographic examination of PIR lesions in the studies.[3] The frequency of PIR may differ according to the radiographic technique used, whether the teeth examined are permanent or primary teeth. In addition, the frequency may increase if the third molars are included in the study.[10] It is reported that generally only one tooth is affected by PIR and these teeth are premolars and molars.[1]

In addition to providing high resolution and superposition-free imaging of CBCT; multiplanar cross-sectional imaging is superior to panoramic imaging in the diagnosis of PIR.[9,11] Because PIR lesions are rare, studies are generally in the form of a case series or a single case report.[1-3,6,9,12] The aim of this study was to determine the frequency of PIR in impacted teeth with complete bone retention, to determine whether PIR differs according to age and gender.[1,2]

MATERIAL AND METHODS

STUDY DESIGN AND SAMPLE

This study was performed in Necmettin Erbakan University Faculty of Dentistry, Department of Dentomaxillofacial Radiology and was done in accordance with the principles defined in the Declaration of Helsinki, including all revisions. Ethical approval was received from the Ethical Committee of Necmettin Erbakan University Faculty of Dentistry (date: March 25, 2021; no: 2021/03-41).

A total of 2,365 CBCT images undertaken from patients who visited our faculty between 2018-2021 years were retrospectively analyzed. CBCT images of individuals under the age of 18, semi-impacted teeth in eruption process, CBCT records with jaw pathologies associated with impacted teeth, CBCT images with artifacts, deciduous teeth with complete bone retention, mesiodens, supernumerary and supplemental impacted teeth and syndromic patients were not included in the study. The CBCT images of patients having at least one impacted tooth were included in this study. A tooth was defined as impacted if it was completely covered with bone. The presence of PIR in impacted permanent teeth with complete bone retention was recorded.

RADILOGICAL EXAMINATION

The radiolucency observed in the coronal region of the impacted tooth detected in the examinations made in coronal, axial, and sagittal sections was defined as PIR (Figure 1, Figure 2). All assessments were done by using i-Dixel software (J Morita MFG Corp., Kyoto, Japan) on a flat-screen monitor by the same examiner. The intraobserver reliability for determining PIR defects showed complete agreement with a Kappa reliability coefficient of 1.0. 2.66 GHz Intel Xeon computer with 3.25GB RAM and Windows XPTM Professional operating system processor and 27″Dell U2711HTM monitor (U2711HTM; Dell, Round Rock, TX, USA) was used. CBCT images were obtained by using 3D Accuitomo 170 device (J Morita MFG Corp. Kyoto, Japan) which operated at 90 kVp and 5 mA, 17.5 seconds rotation time, voxel size 0.25 mm, 100x100 mm field of view according to the manufacturer's recommendation protocol.

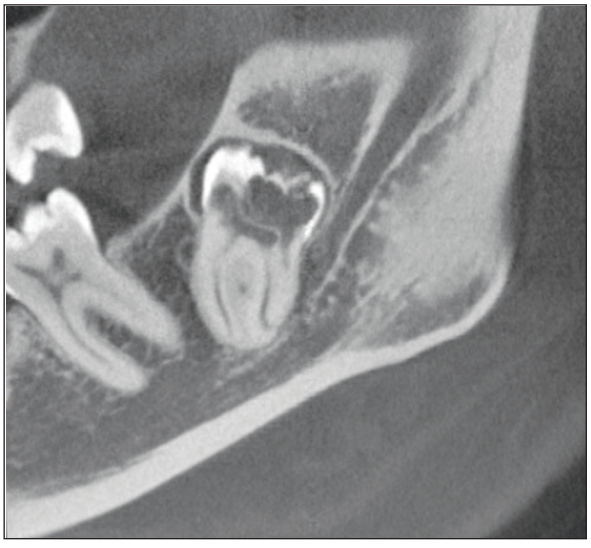

FIGURE 1: Sagittal cone-beam computed tomography section of impacted mandibular third molar with pre-eruptive intracoronal resorption.

FIGURE 2: Axial cone-beam computed tomography section of impacted mandibular canine with pre-eruptive intracoronal resorption.

STATISTICAL ANALYSIS

SPSS v.21 (IBM Corp., Armonk, NY, USA) program was used to analyze the data. Descriptive statistics (mean, standard deviation) were calculated for all parameters in the study. Mann-Whitney U test was applied to test relationship between age and PIR. The chi-square test was used to determine the relationships between categorical variables, and it was considered significant at the $p<0.05$ level.

RESULTS

The CBCT records of 2,365 patients (1,293 females, 1,072 males) between the ages of 18-89 were analyzed. A total of 2,434 teeth were evaluated in the study. The mean age of the patients was 45±16 years (43±16 for women, 47±16 for men). A total of 276 impacted teeth with complete bone retention were observed in 207 of 2,365 patients. 156 of impacted teeth with bone retention were located in maxilla and 120 of them were located in mandible.

PIR lesions (6 molars, 4 canines, 1 incisor, 1 premolar) were detected in 12 (4.3%) of the examined impacted teeth and 11 of the patients (5.3%). Seven of PIRs were in the maxilla and 5 were in the mandible. Five of the patients with PIR were male and 6 were female ($p>0.05$) and their mean age was 54.3 (28-75) years. There was no relationship between age and PIR ($p>0.05$). The distribution of teeth with PIR according to age and gender was given in Table 1.

DISCUSSION

Many hypotheses regarding the occurrence of PIR in impacted teeth have been reported in the literature. It has been reported that exposure to abnormal local pressure due to ectopic eruption of teeth may cause this condition.[11] Additionally, infection of primary teeth, local developmental mineralization defects and

TABLE 1: The distribution of teeth with PIR according to age and gender.

Tooth number	Age of patient	Gender of patient
13	45	Female
28	43	Male
21	69	Female
48	65	Female
38	46	Male
38	28	Female
48	57	Female
43	37	Male
15	45	Male
48	75	Male
13	71	Female
23	71	Female

PIR: Pre-eruptive intracoronal resorption.

viral infections (herpes zoster) may also lead to PIR.[10,11] Özdede and Dere reported that osteoclast, mature fragmented lamellar bone tissue, and mature odontogenic epithelium were seen in the histopathological examination performed after the extraction of the tooth with PIR.[3] CBCT, which is used with high success in morphological examinations of teeth, is also useful for early diagnosis of resorptions in impacted teeth. In this study, it was aimed to determine the frequency of PIR in impacted teeth with full bone retention and to evaluate its relationship with age, gender, and location.

The frequency of PIR reported in the literature is observed in a wide range (0.7% to 27.3%).[9,10] It has been reported that the frequency of PIR may vary according to the radiographic technique used, the age range in the study, and the dentition stage.[3] In a study conducted by Yildiz et al. from the Turkish population in 2021, coronal resorption of impacted permanent teeth was investigated on 3,405 panoramic radiographs.[5] Impacted teeth were detected in 622 individuals; coronal resorption was observed in 4.2% of these individuals. In that study, there was no relationship between gender and coronal resorption; an increase in incidence with age has been reported. Our study was similarly conducted with the Turkish population, and the frequency of coronal resorption was 4.3%. There was no relationship between age and gender and coronal resorption. Considering the limited sample size in this study, it should be kept in mind that the relationship between age and gender and PIR may be relatively misleading. However, the mean age of individuals with resorption is 54.3 (28-75) and it can be seen in younger individuals, it is seen that the individuals with PIR were in the advanced age group (Table 1). The mechanism of PIR seen in impacted teeth is unclear and various opinions have been reported on this issue. One of them was the prolonged pre-eruptive period.[5] This situation may be related to the long duration of impaction of the tooth with advancing age.

In their study comparing panoramic imaging and CBCT, Demirtas et al. reported that fewer PIRs were detected with panoramic imaging.[13] PIR examinations can be overlooked or underestimated in panoramic radiographs due to distortions especially in the anterior region and maxillary premolar region.[14] Therefore, the examinations in our study were performed on CBCT sections. However, radiation exposure should be considered especially in pediatric patients.[3]

Demirtas et al. reported the frequency of PIR was 3.5% in their CBCT study in 1,384 impacted teeth.[11] The researchers reported that they observed the PIR most frequently in the third molar teeth consistent with the results of the present study. PIR was detected more in molar and canine teeth (6 molars, 4 canines, 1 incisor, 1 premolar) in this study in accordance with Yildiz et al. and Uzun et al.[5,10] The reason for this may be due to the fact that the teeth with the highest impaction rate are the third molars and canines.

Although most of the PIR studies have detected only one lesion in an individual there are also studies reporting that there is more than one lesion in an individual.[10-16] In this study, 2 PIR lesions were detected in only 1 patient. Previous studies in the literature have not found a relationship between PIR and gender, as we found. In this study, a total of 12 PIRs were detected from 11 patients, and 6 patients were female and 5 patients were male ($p>0.05$).[4,14,16]

Although PIR is seen in both jaws, it has been reported that it is more common in the maxilla in most of the studies.[10,14] This study showed that 7 of 12 PIR lesions were seen in the maxilla and 5 of them were in the mandible. This results contradicts with Seow et al. which stated that PIR was most commonly observed in mandibular first molars. This difference has been attributed to the racial and geographical differences.[10,16]

The limitation of our study is the relatively small number of data. Semi-impacted teeth and/or impacted teeth in eruption process were not included in this study. This was a retrospective radiological study and clinical or histological examination was not performed. Since the radiolucency observed in semi-impacted teeth is at risk of being confused with tooth caries since they are opened to the oral environment, and precise distinctions between tooth caries and intracoronal resorption can only be made by histological methods, an examination was carried out on impacted teeth with full bone retention that were not

opened into the oral cavity. Thus, the possibility of caries lesion of intracoronal radiolucency not exposed to the oral environment in CBCT sections could be excluded. Since impacted teeth with full bone retention are seen much less frequently than semi-impacted teeth or impacted teeth in eruption stage, our sample size remained relatively low. Although there are various cases reported on this subject in the literature, there is not enough data on its frequency. CBCT files of 2,365 patients were reviewed, but the sample was relatively small because our inclusion criteria were narrow.

CONCLUSION

The frequency of PIR in impacted teeth with complete bone retention was 4.3%, and it was most common in third molar teeth, regardless of age and gender. Since impacted teeth are generally asymptomatic and can be detected incidentally, radiographic examination of patients is crucial for diagnosing the PIR before it reaches the pulp tissue.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Melek Taşsöker;* ***Design:*** *Melek Taşsöker;* ***Control/Supervision:*** *Melek Taşsöker;* ***Data Collection and/or Processing:*** *Melek Taşsöker, Fatma Yüce;* ***Analysis and/or Interpretation:*** *Melek Taşsöker, Fatma Yüce;* ***Literature Review:*** *Melek Taşsöker, Fatma Yüce;* ***Writing the Article:*** *Melek Taşsöker, Fatma Yüce;* ***Critical Review:*** *Melek Taşsöker, Fatma Yüce.*

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