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ORIGINAL ARTICLE / ARAŞTIRMA MAKALESİ

Tooth Number Anomalies and Ectopic Eruption in a Group of Pediatric Dental Patients

Pedodonti Hastalarında Diş Sayı Anomalilerinin ve Ektopik Diş Sürmesinin Değerlendirilmesi

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ABSTRACT

Objective: This retrospective study aimed to evaluate the frequency and distribution of tooth number anomalies and ectopic eruption in a group of pediatric dental patients.

Matherial and Methods: The CBCT images of pediatric dental patients (6-14-year-old) taken between 2016-2022 were selected from the archive of Marmara University, Faculty of Dentistry. The CBCT images taken with Planmeca Promax 3D Mid (Planmeca Oy, Helsinki, Finland, 2012) were retrospectively re-examined to determine the frequency and distribution of the ectopic tooth, hypodontia, hyperdontia, mesiodens, or other. Descriptive statistics were used for evaluating the registered data. Pearson's Chi-squared and Fisher exact tests were used for the statistical analysis. Data were statistically analyzed at $p<0.05$ significance level.

Results: Of the 511 pediatric dental patients aged between 6-14-year-old (10.9±2.63), 246 were girls and 265 were boys. Hyperdontia was the most frequently observed number anomaly (12.7%), followed by Hypodontia (9.2%). The frequency of ectopic teeth was 4,9%. The prevalence of hyperdontia was significantly higher in boys ($p=0.033$).

Conclusions: Tooth number anomalies require a detailed radiologic examination and careful treatment planning since those anomalies may lead to or complicate the orthodontic treatment. Based on our findings, it was concluded that high-quality CBCT examinations provided detailed evaluation, revealed a high prevalence of tooth number anomalies and gave information about the current demographic trends.

Keywords: Hypodontia, Hyperdontia, Cone-Beam CT, Tooth number anomaly.

ÖZ

Amaç: Bu retrospektif çalışmada bir grup pedodonti hastasında diş sayı anomalilerinin sıklığı ve dağılımlarının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: Marmara Üniversitesi Diş Hekimliği Fakültesi arşivinden Planmeca Promax 3D Mid (Planmeca Oy, Helsinki, Finlandiya, 2012) ile 2016-2020 yıllarında çekilmiş 6-14 yaşlar arasındaki çocuk hastalara ait konik ışınlı bilgisayarlı tomografi (KIBT) görüntüleri yeniden incelenmiş ve retrospektif olarak hipodonti, hiperdonti, meziodens, ektopik dişlerin sıklığı ve dağılımı değerlendirilmiştir. Betimleyici istatistiksel analiz, Pearson ki-kare ve Fischer kesin olasılık testleri kullanılmıştır.

Bulgular: Pedodonti hastalarının 246'sını kız ve 265'ini erkek hastalar oluşturmuştur (n=511). Hiperdontinin (% 12.7) en sık rastlanan diş sayı anomalisi olduğu ve bunu hipodontinin (%9.2) takip ettiği belirlenmiştir. Ektopik dişlerin görülme sıklığı % 4.9 olarak kaydedilmiştir. Hiperdonti prevalansının erkek çocuklarda istatistiksel olarak anlamlı şekilde yüksek olduğu saptanmıştır ($p=0.033$).

Sonuçlar: Diş sayı anomalileri ortodontik tedavi gerektirebileceğinden detaylı radyolojik inceleme ve dikkatli bir tedavi planlaması gerektirmektedir. Çalışmanın bulguları yüksek kaliteli KIBT görüntülerinin detaylı değerlendirme imkanı vererek diş sayı anomalilerindeki yüksek prevalansı ortaya çıkarmış ve güncel demografik eğilimler hakkında bilgi vermiştir.

Anahtar Kelimeler: Hipodonti, Hiperdonti, Diş Sayı Anomalisi, Konik Işınlı Bilgisayarlı Tomografi.

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INTRODUCTION

Developmental dental anomalies may be manifested as deviations in the number, form, size and position of teeth. In addition to specific genes, some environmental factors in the prenatal or postnatal period also play a role in the development of these anomalies. Whilst changes in tooth number, shape and size may happen during the disruption of initiation and morphogenetic dental development stages; ectopic eruption or the rotation and impaction of teeth may originate from developmental disturbances in the eruption pattern of the permanent dentition (Gupta et al., 2011; Cantekin et al., 2014; Dindar and Atay, 2022).

Variations of tooth number anomalies consist of missing teeth and supernumerary teeth which are also known as hyperdontia (White and Pharoah, 2009). Congenital missing teeth are classified as hypodontia (absence of one to six teeth), oligodontia (absence of more than six teeth) and anodontia (complete absence of teeth), (Arte, 2001). Previous studies conducted in different populations revealed that the prevalence of hypodontia varies between 2.63 % to 11.2 % (Polder et al.,2004; Chuny et al.,2008; Dindar and Atay, 2022).

Supernumerary teeth are developed as a result of excessive dental lamina in the jaws that can appear as more than one tooth and are morphologically normal or abnormal (White and Pharoah, 2009). The most common type of supernumerary teeth is mesiodens which is located in the anterior maxillary region and may cause the following problems: delay or impaction of tooth eruption, delayed or abnormal root development or dilacerations; displaced or rotated teeth; root resorption of adjacent teeth; crowding, abnormal diastema; formation of cyst and eruption into the nasal cavity. Mesiodens may be asymptomatic and can be incidentally detected during the radiologic examination. Although its etiology is not fully known, theory suggests that the formation of mesiodens is due to the hyperactivity of the dental laminate and its remnants or palatal offshoots of the active dental lamina generate an extra tooth bud resulting in mesiodens (Çolak et al., 2013).

Most cases of supernumerary teeth are asymptomatic and usually found during routine clinical or radiological examinations (Goyal et al.,2012; Amasyalı et al., 2018). An ectopic eruption can appear in the nasal cavity, maxillary sinus as well as mandibular symphysis. Ectopic teeth can be seen in deciduous or permanent teeth and they can also be supernumerary. The etiology of ectopic eruption includes developmental disturbances i.e., cleft palate and displaced teeth due to trauma or cysts, infection, genetic factors, crowding and changes in the density of bone (Al Muhim et al., 2019).

Due to the clinical complications of position anomalies, the presence of any variation in size, shape and tooth number may require different dental disciplines, i.e., pediatric dentistry, orthodontics, restorative dentistry and oral surgery (Brook et al.,2014; Cantekin et al., 2014). Several studies from different populations showed various prevalence, and it has been shown that early diagnosis of developmental dental anomalies is of great importance for treatment planning, optimal patient management and prevention of future clinical complications. (Polder et al., 2004; Ezodini et al., 2007; Chuny et al., 2008; Gupta et al., 2011; Gabriella et al., 2012; Cobourne and Sharpe, 2013; Çolak et al.,2013; Patil et al.,2013; Karadaş et al., 2014; Lagana et al.,2017; Amasyalı et al.,2018; Sedjini and Çerkezi, 2018).

Previous studies mostly used two-dimensional panoramic images to assess the frequency of dental anomalies (Ezodini et al., 2007; Cobourne and Sharpe, 2013; Çolak et al., 2013; Karadaş et al., 2014; Lagana et al., 2017). Yet, two-dimensional imaging may pose some limitations, such as overlapping and superimpositions. The high diagnostic capacity of Cone-Beam Computed Tomography (CBCT) in the evaluation of the dentomaxillofacial region has been stated in several studies (Suzuki et all.,Oenning et all.,Gumru et al.). Thus, the purpose of this study was to evaluate the current trends in the prevalence of tooth number anomalies in a group of Turkish children with a detailed anatomical three-dimensional retrospective radiologic examination.

MATERIALS AND METHODS

The study protocol was approved by the Clinical Research Ethics Committee, Marmara University, Faculty of Dentistry (Project no:2019-342). This retrospective study was performed by analysing CBCT archives of pediatric dental patients ranging from 6 to 14 years who were referred to the Marmara University, Faculty of Dentistry with different oral and dental complaints. Exclusion criteria were; CBCTs of patients under fixed orthodontic treatment, cleft palate, any type of syndrome, traumatic injuries, or jaw fractures that affected the natural eruption of teeth. Permanent teeth were included in the study, except for the third molar and primary teeth.

The CBCT images (DICOM “Digital Imaging and Communications in Medicine”) of pediatric patients taken

with Planmeca Promax 3D Mid (Planmeca, Oy, Helsinki, Finland) between January 2016-January 2020 were randomly selected from the archive of the Department of Dentomaxillofacial Radiology.

Two experienced specialists (one pediatric dentist and one dentomaxillofacial radiologist analysed the CBCT images synchronously with the same medical monitor (NEC MD242C2 24-inch monitor, 1920×1200 resolution, Hiliex Advanced Medical) in a dimly lit room. All images were re-assessed by two evaluators (a pediatric dentist(IOK) and a dentomaxillofacial radiologist(BDK)). All the samples were evaluated simultaneously and separately and a consensus was reached. In cases of failure of consensus after discussions, a second was asked to dentomaxillofacial radiologist(SY) perform the third evaluation, and further discussions were conducted to reach the final consensus. This was a retrospective study. Patients were not exposed or subjected to additional radiation.

The CBCT the images with optimum diagnostic quality were re-assessed to determine the prevalence and distribution of the ectopic teeth “the eruption of the tooth in an improper direction”, hypodontia “absence of one to six teeth”, oligodontia “absence of more than six teeth”, mesiodontia “extra tooth localised between the upper incisors” and other hyperdontia “an increased number of teeth” (White SC and Pharoah MJ,2009).

Statiscal Analysis

Statistical analysis was performed with the Windows XP-Excel Statistical Package and SPSS 25 for Windows (SPSS Inc., Chicago, IL, USA). The statistical analysis was descriptive. The frequencies of anomalies that are detected are calculated for gender, age, number and localization. The Pearson Chi-squared and Fischer’s exact tests determined the potential differences in the distribution of dental anomalies when stratified by gender. A p-value of < 0.05 was considered statistically significant.

RESULTS

A total of 1100 CBCT images were re-examined, and 511 were deemed to fit the criteria of high diagnostic quality of this study.

The mean age of pediatric dental patients was 10.9±2.63 years. The subgroup consisted of 246 girls (48.1%) and 265 boys (51.9%).

Of the pediatric dental patients, 24.3 % had at least one tooth number anomaly. Tooth number anomalies and ectopic eruption distribution of the study population were presented in Figure 1.

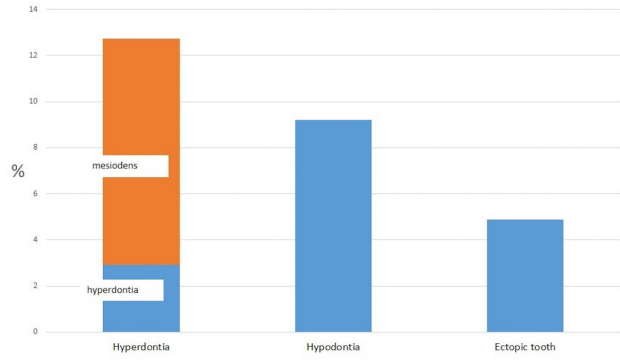

Figure 1: Distribution of tooth number anomalies in the study population.

Hyperdontia (Figure 2) was the most frequent dental anomaly. Of the patients, 12.7% showed hyperdontia whereas 9.2% showed hypodontia.

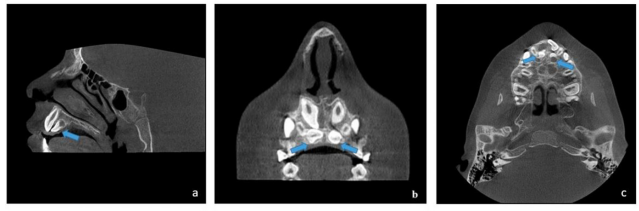

Figure 2. The sagital(a), axial(b) and coronal(c) slices of CBCT show an impacted and palatal placed two mesiodens (supernumerary teeth)

Of the hyperdontia cases, mesiodens (Figure 3) were the predominant one (9.8 %).

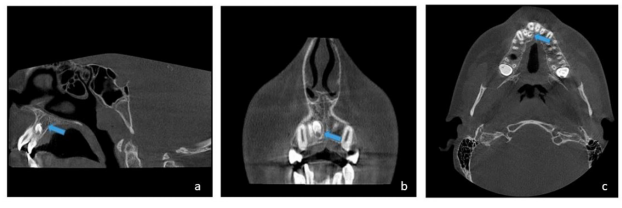

Figure 3. The sagıtal(a), coronal(b) and axial(c) slices of CBCT show an impacted and inverted mesiodens.

Hypodontia (9.2 %), and ectopic tooth (Figure 4), (4.9 %), were seen as less common.

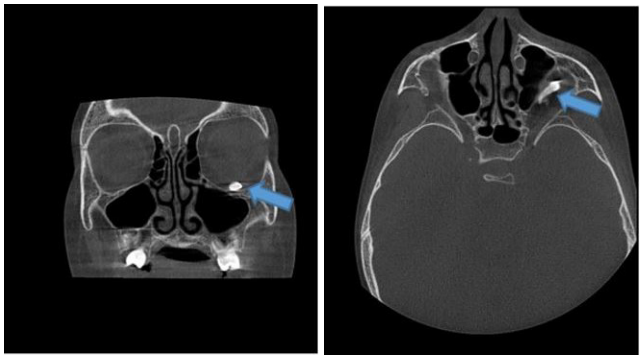

Figure 4. The coronal and sagıtal slices of CBCT show an ectopic tooth in the orbital cavity.

When the total number anomalies were compared according to gender, it was seen that hyperdontia and particularly mesiodens were higher in boys than girls, and these differences were found to be statistically significant (p=0.033), (Table 1).

Table 1. The distribution of tooth number anomalies and ectopic teeth by gender.

	Girls n (%)	Boys n (%)	Total N (%)	p
Hyperdontia	23(9.3)	42(15.8)	65(12.7)	**0.033***
Hypodontia	19(7.72)	28(10.5)	47 (9.2)	0.28
Ectopic tooth	14(5.69)	11(4.15)	25(4.9)	0.53
Total	246	265	511	

*Chi-square test p<0,05

DISCUSSION

Dental anomalies occur during the morpho-differentiation or histo-differentiation stages of dental development (Hattab et al.,1995). These anomalies may often cause various oral and dental complications and require a multidisciplinary approach to their treatment. Thus, early diagnosis of tooth number anomalies allows a less complex treatment planning and the optimal dental management of the young patient may be provided with less difficulty (Bodrumlu and Şenyurt Tazegül, 2022).

Numerous studies have investigated the frequencies of various dental anomalies. The prevalence of developmental dental anomalies widely ranged from 5.6 to 74.7 %, (Polder et al., 2004; Ezodini et al., 2007; Chuny et al., 2008; Gupta et al., 2011; Gabriella et al., 2012; Cobourne and Sharpe, 2013; Çolak et al. ,2013; Patil et al.,2013; Karadaş et al., 2014; Almaz and Sönmez, 2017; Lagana et al., 2017; Amasyalı et al., 2018; Sedjini and Çerkezi, 2018). The different results from those studies might have arisen due to different prevalences in various populations, suggesting the influence of genetic and environmental factors. These differences may reflect variations in race or sample selection, the methodology applied as well as the inclusion or diagnostic criteria and differences in definitions of the dental anomalies (Almaz and Sönmez, 2017; Baron et al.,2018).

Supernumerary teeth were recorded as the most frequent developmental dental anomalies in the maxillary anterior region (Gupta et al., 2011; Shokri et al., 2014; Vani et al.,2016; Baron et al., 2018). The incidence of hyperdontia in the present study was 12.7%, compared to 6.76 % in Iranian (Shokri et al., 2014), 2.4% in Indian (Gupta et al.,2011), 1.9% in Swedish (Backman and Wahlin, 2001), 1.27% in French (Baron et al.,2018), 1.0% in Saudi Arabian (Vani et al., 2016), 1.0% in Greek (Pallikaraki et al., 2019) studies. The prevalence rates of hyperdontia in the present study were much greater than those reported by the aforementioned studies. Their findings varied according to differences in the methodology of the study such as the evaluation of conventional panoramic images and the race or age of the population. It was thought that the radiological method and characteristics of the examined patients in those studies influenced the prevalence rates of tooth number anomalies. In addition to that, the evaluation of the images of orthodontic patients solely and/or the examination of 2D radiographic images (i.e. panoramic images) might most particularly have had impacts on the outcomes of previous studies. Since orthodontic patients are more complex cases, their radiological images do not represent the entire population. This study attempted to overcome the methodological drawbacks of previous studies on the investigation of dental anomalies. To be informed about the frequencies and distribution of tooth number anomalies, the present CBCT study retrospectively analysed the images of pediatric dental patients excluding the complex orthodontic cases. In addition to that, the higher diagnostic capacity of CBCT might be the reason for the more frequent detection of tooth number anomalies. In a previous Japanese study, Suzuki et al. indicated that impacted supernumerary teeth and disorders of tooth eruption were the most common reasons for pediatric CBCT referral (Suzuki et al.,2006). Similarly, in a Turkish pediatric CBCT referral study, Gumru et al. (2021) reported that the most common CBCT indication was impacted teeth, bone pathology and followed by dental anomalies (Gumru et al., 2021).

To date, conflicting results regarding the correlation between gender and the frequency of hyperdontia have been reported (Ezodini et al., 2007; Gupta et al.,2011; Çolak et al.,2013). This study showed a statistically significant difference between girls and boys with hyperdontia and mesiodens and that finding was in line with the study of Çolak et al. (Çolak et al., 2013).

Congenitally missing teeth which are not located in the oral cavity and are not visible on a radiograph are one of the most common developmental problems in children. It is thought to be caused by discomfort in the early stages of dental development. A combination of genetic and environmental factors can cause missing teeth. Hypodontia can also occur as an isolated condition (non-syndromic hypodontia) or be associated with a systemic disorder or syndrome (syndromic hypodontia), (Soni et al.,2018). Sejdini et al. investigated the prevalence of dental anomalies with OPTGs in the Macedonian population; reported the prevalence of hypodontia as 3.46% and the prevalence of hyperdontia as 0.76% (Sedjini and Çerkezi, 2018). In a previous dental anomaly study, examining the subpopulation of the North-East of Turkey, Karadas et al. evaluated the panoramic radiography images of 2722 patients and reported that 3.67% had hypodontia, 0.96% had hyperdontia and 0.21% had oligodontia (Karadas et al, 2014). In the present study, non-syndromic hypodontia and oligodontia cases were included. Contrary to Swedish, Indian and Saudi Arabian studies (Backman and Wahlin 2001, Gupta et al., 2011, Vani et al., 2016), in which congenitally missing teeth had a higher prevalence than hyperdontia, in the present study hypodontia was the second most common anomaly (9.2%) and our incidence was slightly higher than the Swedish and Italian populations, which were 7.4% and 7.1%, respectively (Backman and Wahlin 2001, Lagana et al.2017).

In an earlier study, Ericson and Kurol stated that conventional periapical images could localise approximately ¾ of ectopic canines (Ericson and Kurol 1986). It was noted that ectopic teeth that were not detected on panoramic radiographs come into view in areas such as the orbital cavity and condyle in the present CBCT study. Initially, OPTG diagnosed hypodontia cases may later be diagnosed as ectopic eruption on CBCT examination. For the exact localization, CBCT is essential for such cases, particularly in overlapping incisors (Sharma et al., 2015). The advantages of three-dimensional CBCT over traditional panoramic images include high image quality without geometrical distortion or any overlapping of anatomical structures in the environment and a multi-dimensional view (Sharma et al., 2015).

CBCT evaluations are currently used for various diagnostic tasks in pediatric dentistry, and the limitation of the Field of View (FOV) to a specially required region of interest has been emphasised and recommended by the radioprotection guidelines in dentistry. Gümrü et al classified the pediatric CBCT indications according to an adaptation of the European DIMITRA project recommendations. They pointed out that when the CBCT evaluation is required in pediatric dental patients, the European DIMITRA multicenter and multidisciplinary project recommendations should be respected and the most appropriate FOV should be chosen to prevent unnecessary radiation exposure (Oenning et al., 2018, Gumru et al., 2021). This study assessed the prevalence of tooth-number anomalies in standardised CBCT images with the same FOV sizes. Therefore, FOV-restricted images were excluded. Thus, the number of examined CBCT images dropped to 511 out of 1100. Due to the retrospective design, clinical information was collected from the database therefore it was not synchronous with the CBCT re-examination and that was the limitation of the present study.

CONCLUSION

It is critical to know that supernumerary teeth may cause many complications such as the eruption of delays, root resorption in adjacent teeth and diastemas. Early diagnosis allows optimal patient management, treatment planning and also an intervention at an appropriate time to prevent complications as well as possible major interventions. This study evaluated the radiologic images of 6-14 year-old non-orthodontic pediatric dental patients. Based on the findings of this study, high-quality CBCT examinations provided detailed evaluation and revealed a higher prevalence of tooth number anomalies. The findings of this study have given information about the current demographic trends and it was concluded that some cases require detailed three-dimensional evaluation due to the higher frequency of the presence of tooth number anomalies. Yet, the risks of ionising radiation in children should always should always be taken into consideration.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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