Investigation of the Prevalence of Dental Anomalies in Third Molars Using Cone Beam Computed Tomography

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Abstract

Background: Dental anomalies are one of the problems frequently encountered during dental examinations. The aim of this study is to evaluate the frequency of dental anomalies such as transposition, ectopia, microdontia, taurodontism, dilaceration, paramolar teeth, amelogenesis imperfecta and inversion in sex and third molars.

Materials and Methods: Cone beam computed tomography (CBCT) images of 2300 patients aged between 12 and 65 years who applied to Hatay Mustafa Kemal University Faculty of Dentistry for various reasons between January 2021 and June 2024 were retrospectively evaluated. While scanning the CBCTs, the sex of the patients and the tooth in which the anomaly was present were noted. All scans were performed by three observers reaching a consensus. Descriptive statistics method was used for statistical analysis.

Results: It was observed that the rate of anomalies in all third molars was 10.8%. It was calculated that 54.8% of the individuals with these anomalies were female, 45.2% were male, and the average age was 29.8. It was observed that the most common anomaly in tooth number 18 was ectopia with a rate of 57.14%, the most common anomaly in tooth number 28 was microdontia with a rate of 36.76%, the most common anomaly in tooth number 38 was dilaceration with a rate of 43.9%, and the most common anomaly in tooth number 48 was dilaceration with a rate of 37.72%. It was determined that the most common dental anomaly in women was dilaceration with a rate of 42% and in men was dilaceration with a rate of 57%. Of the anomalies detected, 0.4% were transposition, 11.3% were ectopia, 13.8% were microdontia, 9.3% were taurodontism, 55.48% were dilaceration, 5.89% were paramolar, 2.43% were amelogenesis imperfecta, and 1.2% were inversion.

Conclusion: Dilaceration was found to be the most common dental anomaly, most commonly seen in males and in tooth number 38. After dilaceration, microdontia and ectopia are other common anomalies. It was concluded that microdontia and ectopia were most common in females and in tooth number 18.

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Keywords: Dental anomaly, dilaceration, microdontia, taurodontism, cone beam computed tomography.

Introduction

Dental anomalies are a general expression of conditions that differ from the usual anatomical structure of the teeth in color, size, shape and number. They can be genetically inherited, due to systemic diseases, trauma or local factors. Although the presence of dental anomalies sometimes does not cause problems for people, it may sometimes cause aesthetic or functional problems. Some of these are periodontal problems, malocclusion, difficulty in root canal treatment, esthetic problems and difficulty in tooth extraction. According to Neville's classification of developmental dental anomalies; number anomalies (hypodontia, hyperdontia), size anomalies (microdontia, macrodontia), shape anomalies (gemination, fusion, concrescence, accessory tubercles, dens invaginatus, ectopic enamel, taurodontism, hypersementosis, accessory roots, dilaceration), structural anomalies (amelogenesis imperfecta, dentinogenesis imperfecta, type 1 dentin dysplasia, type 2 dentin dysplasia, regional odontodysplasia) (1).

Taurodontism is a shape anomaly in which vertical expansion of the pulp chamber, apical shift of the pulp base and bifurcation, absence of narrowing at the enamelcementum alignment and shortening of the roots are observed (2). Its etiology is not known exactly. It is thought to be caused by failure of Hertwig's epithelial root sheath to close according to the normal level or by infection during tooth development. It is mostly seen in molars and premolars and less frequently in incisors (3).

Microdontia is a general term for a tooth size that is smaller than the normal size. Microdontia can be seen in a single tooth or in more than one tooth. There is a relationship with some syndromes in terms of the rate of detection of microdontia. Microdontia is frequently seen in third molar and mesiodens (3).

Dilaceration is the name given to the curvature or angulation seen in a region of the tooth. Generally, dilaceration occurs in the root. Although it has been reported that dilaceration occurs developmentally, traumas on the eruption path are an effective factor in the formation of dilaceration. Dilacerations in the root were observed more frequently in mandibular third molar (4).

Paramolar tooth means an extra tooth in number. The etiology is still not clearly defined. Today, the commonly accepted etiologic condition is hyperactivity of the dental lamina (5). Amelogenesis imperfecta occurs as a result of defects in Amelogenin (AMELX), Enamelin (ENAM), Kallikrein 4 (KLK4), Matrix Metalloproteinase 20 (MMP20) and Distal Less Homeobox 3 (DLX3) genes involved in enamel production. There are autosomal dominant (OD), autosomal recessive (OR) or X-linked subtypes (3).

The displacement of the tooth from its normal position to the neighboring teeth is called transposition. It can be seen in a single or double jaw, unilateral or bilateral. It is generally seen in the maxilla and unilaterally (6).

Inversion is the name given to eruption of the erupting tooth in the opposite direction of the normal eruption direction. It is mostly observed in third molar and supernumerary teeth (7).

Ectopic tooth anomaly is the name given to the development of the tooth in a different location in the jaw bones but outside its normal location. Ectopic eruption is frequently observed in permanent molars in the maxilla(8).

Cone beam computed tomography (CBCT) is an imaging method that offers three-dimensional imaging, has low radiation and clearly shows anatomical points without superposition (9). Panoramic radiography may not accurately show dental anomalies such as dilaceration because it gives a two-dimensional image. CBCT, on the other hand, is preferred over panoramic radiography because it offers the opportunity to examine dental anomalies in a larger area and shows them in detail without superposition of surrounding anatomical structures (10).

The aim of this study was to investigate the frequency of dental anomalies such as transposition, ectopia, microdontia, taurodontism, dilaceration, paramolar tooth, amelogenesis imperfecta and inversion in the sexes and in third molar teeth.

Materials and Methods

Between January 2021 and June 2024, CBCT images of 2300 patients aged between 12 and 65 years who were admitted to Hatay Mustafa Kemal University Faculty of Dentistry for various reasons were retrospectively analyzed. Patients with no image artifacts, no trauma to the head and neck region, no cyst tumors in the relevant regions, and any third molar teeth were included in our study. While scanning the CBST, the sex of the patients and the third molars with dental anomalies were noted. Dental anomalies of the third molars were then classified as transposition, ectopia, microdontia, dilaceration, taurodontism, paramolar tooth. amelogenesis imperfecta and inversion.

All CBCT scans were obtained on the same device (Kavo 3D Op Pro, Biberach, Germany) with the same acquisition parameters (13x15 cm FOV, 380 µm voxel size and 0.38 mm slice thickness) and the images were verified in all three dimensions by examining them in axial, coronal and sagittal planes. All scans were performed by consensus of three observers (Z.E.H, M.K., E.Ç.E). All data were saved in Microsoft Excel (Microsoft Corp., Redmond, WA, USA). All evaluations were performed on a single monitor (1,366x768 pixel liquid crystal display; Dell 14-inc.; Dell. Round Rock. Texas. USA) to ensure standardization. Screen features such as changing screen brightness and zooming were allowed to be used for clearer evaluations. Descriptive statistics method was used for statistical analysis.

Results

A total of 5292 third molar teeth were detected in 2300 CBCT images. Dental anomalies were detected in 490 of these 5292 teeth. The incidence of dental anomalies was 10.8% in all third molars, 54.8% (194 patients) were female, 45.2% (160 patients) were male, and the average age was 29.8 years.18 The most common anomaly in tooth number 18 was ectopia with a rate of 57.14%, the most common anomaly in tooth number 28

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was microdontia with a rate of 36.76%, the most common anomaly in tooth number 38 was dilaceration with a rate of 43.9%, and the most common anomaly in tooth number 48 was dilaceration with a rate of 37.72%. It was determined that

the most common dental anomaly was dilaceration with a rate of 42% in females and 57% in males. The distribution of dental anomalies according to sex is shown in Table 1.

Table 1. Distribution of dental anomaly by sex.

Dental Anomaly	Females	Males
Transposition	%50,0	%50,0
Ectopia	%50,8	%48,2
Microdontia	%63,23	%36,77
Taurodontism	%65,21	%34,79
Dilaceration	%48,29	%51,71
Paramolar	%55,17	%44,83
Amelogenesis Imperfecta	%50,0	%50,0
Inversion	%25,0	%75,0

It was observed that the most common dental anomaly accompanying all third molars was dilaceration with a rate of 55.48%, followed by microdontia with 13.8%. Microdontia and ectopic tooth anomaly were detected in 13.8% and 11.3% of third molars, respectively. These were followed by taurodontism with 9.3%, paramolar tooth with 5.89%, amelogenesis imperfecta with 2.43%, and inversion with 1.2%. The least common third molar anomaly was transposition with a rate of 0.4%. The distribution of dental anomalies according to third molars is shown in Table 2.

Discussion

Knowing the frequency of dental anomalies accompanying the third molars is an important consideration in interventions or examinations in this region. Early detection of dental anomalies provides correct treatment planning by preventing orthodontic problems that may occur in the future and reduces the complications and complexity of the treatment plan (11). Since third molars are often used as the basis for forensic age estimation, estimates based on pulp chamber width in cases of taurodontism may be misleading and should be carefully examined (12). Kuzin AV et al. (13) reported that the relationship of dilaceration in the roots of mandibular impacted third molar teeth with the mandibular nerve increases the risk of complications in surgical extractions. When ectopic teeth are closely associated with different tissues such as the maxillary sinus, they may create local foci of infection (14). Root dilacerations may lead to complications such as instrument fracture, canal obstruction, and elbow formation during endodontic treatment (15). Lambada et al. (16) concluded in their case study that third molar teeth ectopically located in the mandibular ramus constitute an etiologic factor for osteomyelitis. The aim of this study was to investigate the frequency of dental anomalies accompanying third molars.

Table 2. Distribution of dental anomalies according to third molar teeth.

Dental	#18 (n)	#28 (n)	#38 (n)	#48 (n)
Anomaly				
Transposition	%100,0	%0,0	%0,0	%0,0
Ectopia	(2) %57,14	%30,35	%0,0	%1,78
Microdontia	(32) %47,05	(17) %36,76	%7,35 (5)	(1) %8,82
Taurodontism	(32) %23,9	(25) %19,56	(3) %23,91	(0) %32,60
Dilaceration	(11) %9,52	(9) %8,79	(11) %43,95	(15) %37,72
Paramolar	(20) %27,5	(24) %37,93	(120) %13,79	(103) %20,68
Amelogenesis	%25,0	%25,0	(4) %25,0	%25,0
Imperfecta Inversion	(4) %0.0	(4) %0.0	(4) %33.3	(4) %66.66
Inversion	/00,0	/00,0	(2)	(4)

n: Number of patients

Studies calculating the prevalence of dental anomalies in different populations are available in the literature. In studies conducted in Saudi Arabia, Alhumaid et al. (17) reported that the prevalence of dental anomalies was 37.8% for all teeth. Chen et al. (18) found that the rate of dental anomalies in all teeth was 36.3%. Gupta et al. (19) found the prevalence of dental anomalies to be 34.06% in a study on the Indian population. Nemati et al. (20) reported this rate as 47.5% in their study on Iranian population. In studies conducted on the Brazilian population, Vagner et al. (21) reported a prevalence of 56.9% and Goncales et al. (22) reported a prevalence of 61.3% (21-22). In a study conducted in the Turkish population, the frequency of dental anomalies was found to be 68.9% (23). In our study, the prevalence of developmental dental anomaly was found to be 10.8% and this value was found to be lower compared to other

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studies. It is thought that the inclusion of all teeth in the study had a great effect on the prevalence of dental anomalies.

When the prevalence of each dental anomaly was investigated, Hamasha et al. (24) reported the prevalence of dilaceration as 3.78% and Alhumai et al. (17) reported this rate as 30.2%. In our study, 55.48% of third molars were found to have dilaceration anomaly. In their study, Gupta et al. (19) found the prevalence of ectopic teeth to be 7.93%, and in another study, Bilge et al. (28) concluded that the prevalence of ectopic teeth was 4.46%. In our study, the prevalence of ectopic teeth was found to be 11.3%. Nemati et al. (20) reported that the prevalence of transposition was 0.1% and Papadopoulos et al. (27) reported that this rate was 0.33%. In our study, this rate was calculated as 0.4% in accordance with Nemati et al. (20).

As a result of epidemiologic studies, the prevalence of microdontia is between 1.5-2% and is higher in women than in men (28). It has been reported that the most affected teeth are maxillary lateral teeth (29-31). Neville et al. (31) reported that the worldwide prevalence of microdontia anomaly is between 0.8-8.4% as a result of their study. Gupta et al. (19) reported this rate as 2.4%. In our study, this rate was determined as 13.8%. The reason for this higher rate compared to the literature is thought to be the calculation of microdontia seen only in third molars in our study.

In their study, Süsgün et al. (32) found that the incidence of inversion anomaly was 1.7% and it was mostly seen in posterior teeth. In our study, 1.2% inversion was found in accordance with the literature. Martínez-González et al. (33) reported that 36 patients had paramolars (26.47%) in their study on the prevalence of dental anomalies in 130 patients. In our study, the rate of detection of paramolars was 5.89%. The reason for this difference with the literature is thought to be the difference in the number of patients examined. In our study, CBCT images of 2300 patients were scanned and 490 third molars with dental anomalies were classified.

In a study by Gadhia et al. (34), the prevalence of amelogenesis imperfecta was found to be 0.03%, while in our study, the prevalence was significantly higher at 2.43%. Similarly, Saberi et al. (35) found taurodontism to be the most common shape anomaly, with a prevalence of 5.38%. In contrast, our study found the prevalence of taurodontism in third molars to be 9.3%, which is higher than what has been reported in the literature. This difference may be attributed to the specific group of teeth examined in our study.

Renugalakshmi et al. (36) observed a higher prevalence of dental anomalies in male children, while

another study by Sella Tunis et al. (37) concluded that the occurrence of dental anomalies was independent of sex and age. Our study also found sex differences in anomaly prevalence, with specific anomalies more frequently observed in males, particularly dilaceration.

CBCT is a valuable imaging method that allows dental professionals to examine not only the dental structures but also their relationship with surrounding anatomical structures in three dimensions. CBCT is particularly useful for evaluating areas like the maxillary third molar region, as it allows for examination without anatomical superimposition. This capability provides more accurate evaluations, especially in cases requiring three-dimensional assessments, such as evaluating the angle of root dilacerations and identifying taurodontism. Additionally, CBCT can help prevent complications during invasive procedures such as tooth extractions in this region (10). For these reasons, CBCT was preferred over panoramic radiography in our study.

Conclusion

In this study, the prevalence of dental anomalies in third molars was determined to be 10.8%, with a higher frequency in females (54.8%) compared to males (45.2%). Dilaceration was identified as the most common anomaly, predominantly observed in males and tooth #38.

Awareness of the prevalence and characteristics of dental anomalies in third molars is crucial for clinicians performing dental procedures in this region. CBCT is highly recommended for the accurate detection of dental anomalies due to its ability to provide detailed and comprehensive imaging without superimposition.

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Author contributions: All authors contributed to the study's conception and design. The preparation of the project was done by ECE, MK, ZEH and CAB. Data collection was done by ECE, MK, ZEH and CAB.

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Selecting patient data, evaluating images were done by ECE, MK, ZEH and CAB. Writing publications were done by MK, ZEH, ECE and CAB. Making measurements were done by ECE, MK, ZEH and CAB. The final manuscript has been read and approved by all authors.

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