Original Article

Prevalence of Dental Anomalies using Cone-beam Computed Tomography: An Institutional-based Retrospective Study

Fatima Injela Khan[1], Ashish Aggarwal[2], Nitin Upadhyay[3], Nupur Agarwal[3], KBA Kader[1], Shreya Verma[1]

[1]Post Graduate Student, Department of Oral Medicine and Radiology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India, [2]Professor and Head, Department of Oral Medicine and Radiology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India, [3]Professor, Department of Oral Medicine and Radiology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India

ABSTRACT

Background: Dental anomalies, which affect the number, size, shape, or structure of teeth, can be accurately identified using cone beam computed tomography (CBCT), a low-radiation imaging modality that aids in precise treatment planning. **Aim:** The present study was conducted with the aim to assess the prevalence of dental anomalies using CBCT. **Materials and Methods:** This retrospective observational study was conducted using 495 CBCT images to assess the prevalence of dental anomalies in different age groups and gender and also the common types anomalies. Data were analyzed using the Chi-square test to investigate potential differences in the prevalence of dental anomalies. **Results:** Of the 495 CBCT scans, 217 (43.84%) were males and 278 (56.16%) females, with a mean age of 37.68 ± 16.24 years. Patients <18 years comprised 5.25%, whereas 94.75% were ≥18 years. No significant association was found between dental anomalies and gender ($P = 0.550$) but a significant association existed with age ($P = 0.047$). The most common anomaly was impacted tooth (15.58%), followed by rotated tooth (12.32%), whereas anodontia and dentinogenesis imperfecta were the least common (0.20% each). Anomalies were categorized by shape (32.32%), position (27.28%), number (9.49%), size (3.43%), and structure (1.01%). **Conclusion:** The prevalence of dental anomalies varies across different regions and among age group and gender. The most common dental anomaly was an impacted tooth, followed by rotated tooth.

Key words: Cone beam computed tomography, Dental anomalies, Developmental disorders, Prevalence

INTRODUCTION

Dental anomalies are a set of developmental diseases affecting the teeth and can lead to a variety of irregularities in their number, size, shape, and structures.[1] Dental anomalies that occur after teeth maturation are categorized as acquired, and those that arise during the tooth development process are classed as developmental.[2]

Their prevalence varies across different geographic regions, age groups, genders, and populations, with various studies reporting differing data.[3] Dental abnormalities (DAs) can have a complicated and multivariate aetiology that is influenced by both environmental and hereditary factors.[4] Tooth development is caused by genetic factors, such as gene mutations or modifications, which can result in anomalies in tooth size, shape, quantity, and position.[2] Dental anomalies can also result from environmental causes that disturb normal tooth development, such as trauma, infections, or nutritional deficits. They may appear in one tooth, several teeth, one or both arches, or both.[5] While some are asymptomatic, others may have significant clinical effects on the person's general health.[6]

DAs can cause difficulties during dental procedures and raise the possibility of complications for patients.[1] Anomalies in teeth might interfere with normal eruption processes and lead to occlusion issues.[3] In addition, in certain patients, they may result in periodontal issues, temporomandibular joint pain, and difficulties in speaking and chewing. The dentist may face challenges in performing endodontic therapy and tooth extractions on such teeth.[7] Moreover, it may also cause an impact on patient's self-esteem and social interactions due to esthetic concerns. Therefore, dentists should have sufficient knowledge about dental anomalies.[4]

Dental anomalies are usually identified incidentally on panoramic radiographs taken during routine dental examinations.[8] When compared to intraoral radiography procedures, panoramic radiographs are a faster imaging method

Corresponding Author:
Dr. Fatima Injela Khan, Post Graduate Student, Department of Oral Medicine and Radiology, Institute of Dental Sciences, Bareilly, UP, India. Phone: 8191851165. E-mail: fatimainjelakhan23@gmail.com

that may assess a wider area at once and provide the patient a minor radiation dosage.[3] Nevertheless, the superimposition of anatomical structures in panoramic radiographs occasionally makes it impossible to evaluate the image effectively.[6] Cone-beam computed tomography (CBCT) offers a less radiation-intensive option and enhances diagnostic accuracy by providing a precise three-dimensional image of the tooth structure.[9]

As there are scarce studies cited in literature in different populations regarding the anatomic variations of teeth particularly using CBCT.[2] Their prevalence also varies in different populations and age groups.[5] Therefore, it is necessary to access them in our population and assist clinicians for proper diagnosis and further treatment planning, thus eliminating any complications. Hereafter, with this context, the current study was carried out to investigate the prevalence of various types of dental anomalies within our population using CBCT.

MATERIALS AND METHODS

The present study is an observational, descriptive study and was conducted in the Department of Oral Medicine and Radiology using 495 CBCT images. Patients of any age with either gender that were collected from the archives within the duration of 2 months were included in the study. Any syndromic conditions, history of jaw trauma, presence of any bony pathologies, patients undergoing orthodontic treatment, or scans of poor quality or those with significant artefacts affecting visibility were excluded from the present study.

The images obtained from CBCT were generated in digital imaging and communication in medicine format. Before choosing the areas that were utilized for measurement, image positioning was standardized after copying the exam file to a standard computer using CS 3D software. Multiplane reconstruction involved the visualisation of axial, sagittal, and coronal sections in all three spatial dimensions.

According to Patil *et al.* (2013)[7] all of the images were thoroughly examined to determine any probable dental anomalies, the gender and age range in which they occur, and the type of pathology. Five groups of dental anomalies were evaluated, and each category was further divided into subgroups: Abnormality in size (macrodontia and microdontia). Number anomalies (anodontia, hyperdontia, and hypodontia), shape anomalies (taurodontism, dilaceration, accessory root, fusion/gemination, and dense invaginates, dens evaginates, Talon's cusp), structural anomalies (Amelogenesis imperfecta, Dentinogenesis imperfecta, odontodysplasia), and position anomalies (impacted tooth, rotated tooth). For statistical analysis, these data were compiled in an Excel spreadsheet from Microsoft.

Statistical analysis

The Statistical Package for the Social Sciences (SPSS) program, version 16.0 (Windows version 17.0 SPSS Inc., Chicago, IL, USA), was used to analyze the data once it was entered into a Microsoft Excel spreadsheet. Calculations were performed to determine descriptive analysis, including frequency and percentage, and Chi-square test was used to investigate potential differences in the prevalence of dental anomalies based on gender and age.

RESULTS

Among the total 495 CBCT scans taken, 217 were males, and dental anomaly was found in 4.61% cases based on size, 9.68% based on number, none based on structure, 27.65% on position, and 30.88% based on shape. The number of females was 278, and among them dental anomalies were reported in 2.52% cases based on size, 9.35% based on number, 1.80% according to structure, 28.06% according to position, and 33.45% based on shape [Table 1].

On the basis of age groups, in <18 years of age the total number of anomalies according to size were reported in 11.54% cases, 7.69% based on number, none according to structure, 23.08% according to position and 19.23% based on shape, whereas the number of dental anomaly in ≥18 years of age were found as 2.99% according to size, 9.59% based on number, 1.07% according to structure, 28.14% based on position, and 33.05% according to shape [Table 1].

The dental anomaly was found based on size in 3.43% cases, 9.49% according to number, 1.01% based on structure, 27.28% based on position, and 32.32% based on shape. There was no statistically significant relationship between dental anomalies and gender (P = 0.550), whereas there was a statistically significant relationship between dental anomalies and age (P = 0.047).

Position anomalies were the most common type of anomaly (n = 138, 27.88%), and the least observed anomaly type was structural anomalies (n = 5, 1.01%). Table 1 shows the distribution of dental anomaly types by gender and age. The most common dental anomaly subtype was impacted teeth (n = 77, 15.58%) [Figure 1], and the least common subtypes of dental anomaly were

Table 1: Distribution of type of dental anomaly according to gender and age

Criteria taken	Prevalence of dental anomaly based on gender and age									
	Based on size		Based on number		Based on structure		Based on position		Based on shape	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Male	10	4.61	21	9.68	0	0.00	60	27.65	67	30.88
Female	7	2.52	26	9.35	5	1.80	78	28.06	93	33.45
Age <18 years	3	11.54	2	7.69	0	0.00	6	23.08	5	19.23
Age ≥18 years	14	2.99	45	9.59	5	1.07	132	28.14	155	33.05

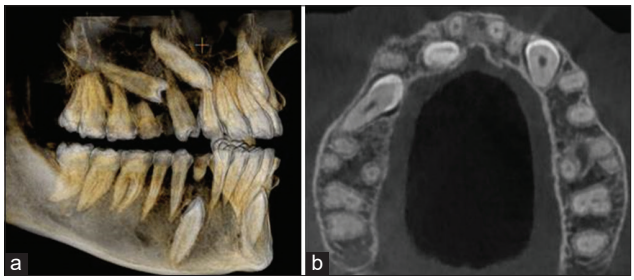

Figure 1: (a) 3-Dimensional image depicting multiple impacted teeth, (b) Axial section of Maxilla having multiple impacted teeth

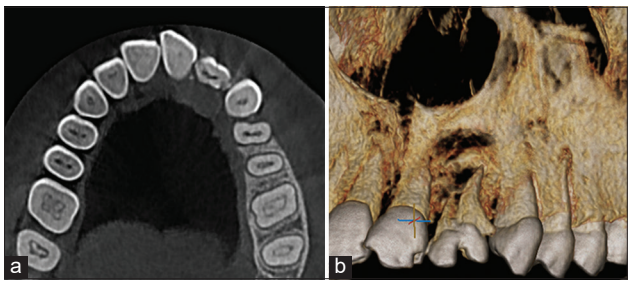

Figure 2: (a) 3-Dimensional image depicting Fusion of two teeth. (b) Axial image depicting fusion

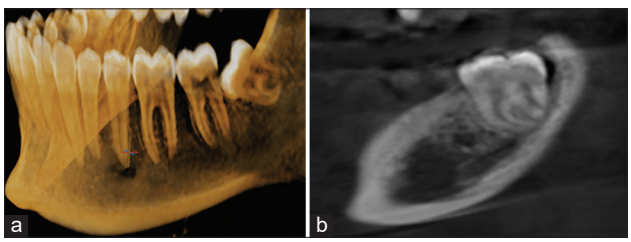

Figure 3: (a) 3-Dimensional image depicting dilacerated root. (b) Sagittal image depicting dilaceration of the mesial root

fusion/gemination [Figure 2], and accessory root (n = 3, 0.61%). Table 2 shows the distribution of dental anomaly subtypes.

Shape anomalies were observed in a total of 160 patients (n = 160, 32.32%); the most common shape anomaly subtype was dilaceration (n = 50, 10.10%) [Figure 3], and the least common shape anomaly was fusion (n = 3, 0.61%)

Number anomalies were found in 47 patients, with hyperdontia being most common (5.05%). Size anomalies included macrodontia (1.62%) and microdontia (1.82%). Shape anomalies were most frequent (32.32%), followed by position anomalies such as impacted teeth (15.56%) and rotated teeth (12.32%) [Table 2].

Table 2: Distribution of dental anomalies according to the subtype of dental anomaly

Dental anomaly type and subtype	Number	Percentage
Based on size	17	3.43
Macrodontia	8	1.62
Microdontia	9	1.82
Based on number	47	9.49
Anodontia	1	0.20
Hyperdontia	25	5.05
Hypodontia	21	4.24
Based on structure	5	1.01
Amelogenesis IM	4	0.81
Dentinogenesis IM	1	0.20
Based on position	138	27.88
Impacted	77	15.56
Rotated	61	12.32
Based on shape	160	32.32
Gemination	7	1.41
Fusion	3	0.61
Dilaceration	50	10.10
Taurodontism	28	5.66
Accesssoryroot	36	7.27
Talon cusp	6	1.21
Dens invaginatus	13	2.63
Dens evaginatus	5	1.01
Enamel pearl	12	2.42

DISCUSSION

Dental anomalies are developmental disorders affecting the number, size, shape, and structure of teeth. This retrospective study analyzed 495 CBCT scans to assess the types and prevalence of anomalies across age and gender. Of the patients, 217 (43.84%) were male and 278 (56.16%) females, with a mean age of 37.68 ± 16.24 years; 5.25% were under 18 and 94.75% were 18 or older.

Similar to the present study, Aslan and Akarslan[4] studied tooth number irregularities in 378 non-syndromic Turkish patients (240 females, 138 males; aged 7–45), comparing them to 237 patients with 546 congenitally missing teeth and 141 with 185 supernumerary teeth. Congenitally missing teeth were more common than extra teeth, with the mandibular second premolar most frequently missing (26.6%) and extra teeth most often found in the anterior maxilla (37.9%). Both anomalies were more frequent in females.

Ooshima *et al.*[5] evaluated various dental anomalies in 745 high school students (mean age 16.8 years) with permanent dentition and 905 children (mean age: 4.7 years) with primary dentition. Microdontia, macrodontia, Carabelli's tubercle, and related traits were more common in primary dentition, while peg-shaped teeth, central tubercle, and palatal accessory cusp were more prevalent in permanent dentition. The study compared the prevalence developmental anomalies in permanent teeth and primary teeth and concluded that anomalies were more common in Permanent dentition. This variation could be attributed due to the different sample sizes taken for both the dentition. In our study, we

compared the prevalence in the age groups and focused on which anomaly is the most prevalent in our population.

Another citation in literature by Goutham *et al.*[6] used panoramic radiography to assess the prevalence of DAs in the Odisha population. Dental anomalies were detected in 1080 panoramic radiographs. In order to corroborate the diagnosis, dental records were examined. Anomalies concerning tooth size, form, and position, as well as the quantity of roots (supernumerary roots) were assessed. The study's findings indicated that 35.27% of people had DAs. Dilaceration was the most common, occurring in 46.71% of cases, followed by peg laterals in 20.99%. The imaging modality employed in this study was a two-dimensional technique and differed from the three-dimensional technique, which one used in the present study. In the present study, impacted tooth was found to be most prevalent, contrasting to this study, which might be due to different sample size chosen and regional variations.

Another contrasting study was by Patil *et al.* (2013)[7] analyzed 4,133 OPGs from Indian patients aged 13–38 years (mean age 21.8) to assess dental anomalies. At least one anomaly was found in 36.7% of individuals. Congenitally missing teeth were most common (16.3%), followed by impacted teeth (15.5%), supernumerary teeth (1.2%), and microdontia (1.0%). Rare anomalies included ectopic eruption (0.7%), macrodontia and odontoma (0.2% each), and transposition (0.1%). The imaging modality utilized in their study differed from that of the present study, which employed a three-dimensional technique.

While assessing dental anomalies using CBCT, it was observed that their prevalence varies with region, age, and gender.[10] Panoramic radiographs often fail to detect these anomalies accurately, leading to diagnostic challenges.[11] CBCT, with its ability to visualize teeth in all three planes and provide detailed anatomical assessment, proves to be a superior imaging modality for early and accurate detection.[12] However, limited studies have explored the prevalence and types of dental anomalies specifically using CBCT.[13]

Further, these anomalies also pose several challenges in performing dental procedures such as periapical infections, missed canals or perforation, instrument fracture, root fractures during extractions, occlusal trauma leading to TMD disorders, movement resistance during orthodontic treatment, and anchorage problems.[14] Hence, CBCT offers a less radiation-intensive option in enhancing diagnosis accuracy and avoiding any unforeseen future complications in treatment planning.[15]

CONCLUSION

Dental anomalies can complicate dental procedures and require careful attention. CBCT should be recommended for accurate diagnosis and effective treatment planning. Larger, multicenter studies can provide broader data on anomaly patterns across populations.

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