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Dental Anomalies / *Anomalies Dentaires*

A TWO STAGE RADIOGRAPHIC STUDY OF THE PREVALENCE OF ANOMALIES ASSOCIATED WITH TOOTH NUMBER

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Introduction: Dental anomalies (DA) are a group of dental developmental disturbances which appear during tooth formation manifesting themselves as an alteration in tooth number, shape, and size. Dental anomalies of number include hypodontia, mesiodens, supernumerary tooth, and odontoma.

Objectives: To evaluate the prevalence and distribution of dental anomalies associated with tooth number in the radiographic archives of University Dental Hospital Sharjah, United Arab Emirates (UAE).

Methods: Retrospective evaluation of 2000 Orthopantomogram (OPG) images were taken between January 2015 to December 2022. The OPG showing dental anomalies of number were further investigated for the availability of Cone Beam Computerized Tomography (CBCT). Multiple logistic regression analysis was performed to assess the influence of age and gender on the presence of supernumerary teeth, $p < 0.05$ was considered as statistically significant.

Results: The prevalence of DA in relation to tooth number was 3.8% (Hypodontia 0.1%, mesiodens 0.5%, odontoma 0.9% and supernumerary teeth 2.4%) in this study. Significant difference was noted only in the prevalence of supernumerary teeth between male (1.7%) and female (3.5%) ($P=0.008$).

Conclusions: The prevalence of DA in relation to tooth number in the present study was 3.8%. Prevalence, site of occurrence and gender distribution of DA in relation to tooth number in UAE residents were similar to the population in other parts of the world.

Keywords: Dental anomalies, supernumerary tooth, odontoma, mesiodens, Cone Beam Computed Tomography

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The authors declare no conflicts of interest.

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UNE ÉTUDE RADIOGRAPHIQUE EN DEUX ÉTAPES DE LA PRÉVALENCE DES ANOMALIES ASSOCIÉES AU NOMBRE DE DENTS

Introduction: Les anomalies dentaires (AD) sont des troubles du développement dentaire qui apparaissent lors de la formation des dents et se manifestent par une altération du nombre, de la forme et de la taille des dents. Les anomalies dentaires de nombre comprennent les hypodonties, les mésiodens, les dents surnuméraires et les odontomes.

Objectifs: Évaluer la prévalence et la répartition des anomalies dentaires de nombre de dents dans les archives radiographiques de l'hôpital dentaire universitaire de Sharjah, aux Émirats Arabes Unis (EAU).

Méthodes: Une évaluation rétrospective de 2000 orthopantomogrammes (OPG) a été réalisée entre janvier 2015 et décembre 2022. Les OPG présentant des anomalies dentaires de nombre ont fait l'objet d'une étude plus approfondie afin de déterminer la disponibilité de la tomographie volumique à faisceau conique (CBCT). Une analyse de régression logistique multiple a été réalisée pour évaluer l'influence de l'âge et du sexe sur la présence de dents surnuméraires; une valeur $p < 0,05$ est considérée comme statistiquement significative.

Résultats: Dans cette étude la prévalence de l'AD de nombre était de 3,8 % (hypodontie : 0,1 %, mésiodens : 0,5 %, odontome : 0,9 % et dents surnuméraires : 2,4 %). Une différence significative a été observée uniquement dans la prévalence des dents surnuméraires entre les hommes (1,7 %) et les femmes (3,5 %) ($p= 0,008$).

Conclusions: La prévalence de l'AD de nombre dans la présente étude était de 3,8 %. La prévalence, le site d'apparition et la répartition par sexe de l'AD en fonction du nombre de dents chez les résidents des Émirats arabes unis étaient similaires à ceux observés dans d'autres régions du monde.

Mots clés: Anomalies dentaires, dent surnuméraire, odontome, mésiodens, tomodensitométrie volumique à faisceau conique

Introduction

Dental anomalies (DA) are a group of dental developmental disturbances which appear during tooth formation and could be precipitated by environmental/genetic factors, manifesting themselves as an alteration in tooth number, shape, and size [1]. Wherein, number variation includes hypodontia, mesiodens, supernumerary tooth, and odontoma. Alteration in tooth size manifest by way of macrodontia/microdontia, abnormal morphological features of the teeth include fusion, dilaceration, gemination, taurodontism, and concrescence [2]. Genetic mutation or environmental factors could interfere with the function of the HOX gene proteins and trigger an alteration in dental development resulting in dental anomalies formation [3]. Though dental anomalies remain asymptomatic their presence causes malocclusion, difficulties during root canal treatment/extraction, and at times could deviate the path of tooth eruption [4].

Epidemiology of dental anomalies is varied the reason being the difference in ethnicity, study design, and clinical and radiographic diagnostic methods used for evaluations. In a sample that included only orthodontic patients, the overall prevalence of dental anomalies was reported to be 18.7% in the Greek population, 24.4% in the Albanian sample, and 29% in subjects from Israel [5-7]. Whereas the non-orthodontic Italian population also reported an overall prevalence of 20.9% [8]. Wagner et.al reported an overall prevalence of 61.3% in the Southern Brazilian pediatric population [9]. Since the incidence of dental anomalies differs within and between different populations early diagnosis helps in proper patient management. There seems no clear evidence of the occurrences of this condition among the population living in the United Aarab Emirates (UAE).

Dental anomalies are usually diagnosed by way of clinical observation and examination augmented with routine radiography. Orthopantomogram (OPG) is a valuable tool to assess dentition and facial skeleton giving an overall impression, hence frequently used as a screening tool wherein the radiation exposure dose is approximately 0.014 mSv. A systematic review on interpreting OPG includes counting all teeth, following the contours of the mandible/maxillary sinuses, and checking image peripheries to aid in precise diagnosis [10]. Orthopantomogram resolution is not exhaustive and being able to view in 2D seems a limitation. To overcome this limitation adjunct techniques like Cone Beam Computerized Tomography (CBCT) are used when more details are required. CBCT is an extraoral imaging technology that gives a three-dimensional view of maxillomandibular skeletal and dental structures and can be used as a valuable adjunct tool to diagnose and locate dental anomalies [11].

Early diagnosis of DA seems important as certain conditions could interfere with the normal development of dentition or need special attention during dental procedures. DA like supernumerary tooth is known to cause deviation of the path of eruption of permanent teeth and sometimes associated with aesthetic issues and malocclusion [12-14]. Radiography plays an important role in detection and localization of supernumerary tooth. Hence the present study aims to evaluate the prevalence and distribution of dental anomalies associated with tooth number in the radiographic archives of University Dental Hospital Sharjah, United Arab Emirates (UAE).

Materials and Methods

This retrospective evaluation of 2000 Orthopantomogram (OPG) images taken between January 2015 to December 2022. These OPGs were evaluated for the presence of dental anomalies of number. The sample included subjects who attended University Dental Hospital Sharjah (UDHS), Sharjah for various dental treatments, wherein panoramic radiographs scans were done for routine diagnostic purposes. The sample was retrieved from the patient record management system axiUm (*USA*) and radiographic images from Sidexis software (Germany). The panoramic radiographs were obtained using Sirona Orthophos XG (Dentsply, Germany). Dental anomalies of number which include hypodontia, mesiodens, supernumerary tooth, and odontoma were examined by two examiners RA and DA. In case of doubt third examiner SS was consulted. The study was approved by the Research Ethics Committee, University of Sharjah (Reference number:REC-23-02-21-01-F). Based on previous research, a sample size of 1,875 was determined using the formula $4pq/d^2$, with $p = 0.25$ representing the prevalence of dental anomalies, $q = 0.75$ calculated as the complement of p, and $d = 0.02$ indicating the desired precision [8]. This calculated sample size was subsequently rounded up to 2,000 samples.

Inclusion Criteria

1. Age 15- 65 years
2. Gender: Male/Female

Exclusion Criteria

1. OPGs of patients with genetic syndromes/craniofacial malformations.
2. History of extractions/trauma/previous orthodontic treatment.
3. Patients undergoing fixed orthodontic treatment.
4. OPG with incomplete image and poor image quality.

The OPG showing dental anomalies of number were further investigated for the availability of CBCT. CBCT scans that were obtained using Galelios, Sirona CBCT Dental Systems (Bensheim Germany) x-ray machine (Field of View 15 cms X 24 cms). The machine was operated using SIDEXIS operating system at 85 kVp and 7 mA. Assessment of CBCT was performed directly on a 1920 X 1080 pixel and 23-inch DELL

monitor screen. The CBCT scan were analyzed for the buccal or palatal/lingual location

Statistical Analysis

The collected data were entered into a Microsoft Excel spreadsheet and analyzed using IBM SPSS Statistics, Version 22 (Armonk, NY: IBM Corp). Descriptive statistics were utilized to present the data in terms of frequency and percentage distributions. Chi Square test and fisher's exact test was used to examine the association between dental anomalies and gender. Multiple logistic regression analysis was conducted to evaluate the influence of age and gender on the presence of supernumerary teeth. A significance level of $p < 0.05$ was considered as statistically significant

Results

Age and gender distribution of the 2000 OPG scans in the present study in given in Table 1.

In this study overall prevalence of anomalies in tooth number was 3.8%. The distribution of individual anomalies includes hypodontia 0.1%, mesiodens 0.5%, odontoma 0.9% and supernumerary teeth 2.4%. Mesiodens which were single (n=7) and erupted (n=7) (Table 2).

The total number of supernumerary teeth were 47 out of 2000 OPGs. Single supernumerary tooth was observed in 32 OPGs, whereas 5 supernumerary teeth were noted in 3 OPGs. Majority of the supernumerary tooth were in the right mandible (Figure 1) (Table 3).

The prevalence of the odontoma was 0.9% seen in 18 cases, amongst the 18 cases 3 were complex odontoma and 15 compound odontoma, seen mostly in the left maxilla (Figure 2) (Table 4).

Gender wise evaluation on the prevalence indicates no significant difference (P=0.10) between the male (0.7%) and female (0.1%) in the occurrence of mesiodens (Figure 3).

Table 1. Age and gender distribution of the study subjects.

		Frequency	Percent
Age	**15 – 25 years**	333	16.7
	26 - 35 years	366	18.3
	36 - 45 years	600	30.0
	46 - 55 years	348	17.4
	56 - 65 years	353	17.7
Gender	**Male**	1265	63.2
	Female	735	36.8

Table 2. Radiographic characteristics of mesiodens

		Frequency	Percent
Mesiodense	**Absent**	1990	99.5
	Present	10	.5
Number of teeth (Mesiodense)	**1**	7	70.0
	2	3	30.0
Erupted/Unerupted (Mesiodense)	**Erupted**	7	70.0
	Unerupted	3	30.0

Table 3. Radiographic characteristics of supernumerary teeth

		Frequency	Percent
Other supernumerary teeth	**Absent**	1953	97.7
	Present	47	2.4
Number of teeth (supernumerary teeth)	**1**	32	68.1
	2	12	25.5
	5	3	6.4
Location (supernumerary teeth)	**Right Maxilla**	9	19.2
	Left Maxilla	11	23.4
	Left Mandible	9	19.2
	Right Mandible	18	37.7

Figure 1. A- An OPG showing impacted supernumerary tooth in the right maxillary canine region. B&C- Sagittal and coronal CBCT section showing lingual location of the supernumerary tooth

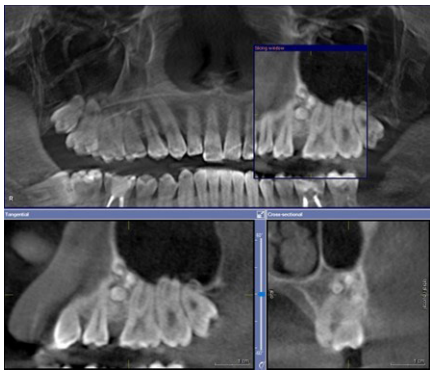

Figure 2. Multiplanar CBCT view showing compound odontoma of the maxilla.

Table 4. Radiographic characteristics odontoma

		Frequency	Percent
Odontoma	**Absent**	1982	99.1
	Present	18	0.9
Compound/Complex Odontoma	**Complex**	3	16.7
	Compound	15	83.3
Location (Odontoma)	**left mandible**	3	16.7
	left maxilla	6	33.3
	Right mandible	3	16.7
	Right maxilla	3	16.7

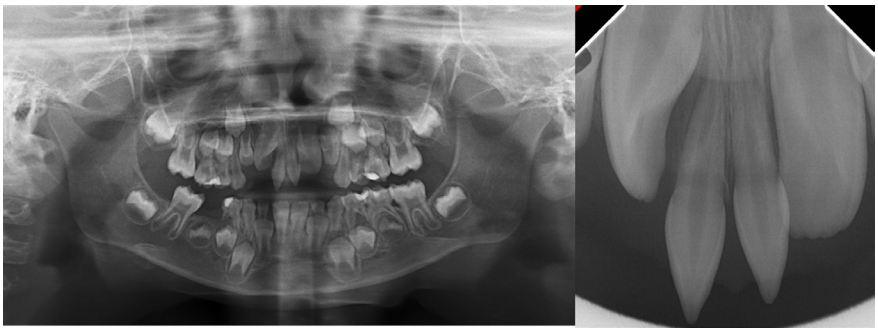

Figure 3. Panoramic radiograph showing 2 erupted mesiodense

Similarly, there was no significance (P=0.76) in the prevalence of odontoma between male (0.9%) and female (0.8%). However, significance was noted in the prevalence of supernumerary teeth between male (1.7%) and female (3.5%) population (P=0.008) (Table 5).

Among 2000 OPG examined 76 radiographs of subjects were identified with DA of number, of which 27 cases had CBCT scans accounting to 1.4% of the cases. There was no significant difference in buccal and lingual occurrence of DA of number (P=0.07) (Table 6).

Logistic regression modeling was conducted to determine the probability of subjects having supernumerary teeth. The analysis revealed that neither age nor gender exerted a significant effect on the likelihood of having supernumerary teeth (Table 7).

Table 5. Association between dental anomalies and gender among study subjects

		Gender		Total	Chi Square Value	p-value
		Male	Female			
Mesiodense	Absent	1256(99.3%)	734(99.9%)	1990(99.5%)	-	0.10(NS)#
	Present	9(0.7%)	1(0.1%)	10(0.5%)		
Number of teeth	1	6(66.7%)	1(100.0%)	7(70.0%)	-	1.00(NS)#
	2	3(33.3%)	0(0.0%)	3(30.0%)		
Erupted/ Unerupted	Erupted	3(33.3%)	0(0.0%)	3(30.0%)	-	1.00(NS) #
	Unerupted	6(66.7%)	1(100.0%)	7(70.0%)		
Odontoma	Absent	1253(99.1%)	729(99.2%)	1982(99.1%)	0.09	0.76(NS) ##
	Present	12(0.9%)	6(0.8%)	18(0.9%)		
Compound /Complex	Compound	9(75.0%)	6(100.0%)	15(83.3%)	-	0.52(NS) #
	Complex	3(25.0%)	0(0.0%)	3(16.7%)		
Location	Left Mandible	0(0.0%)	3(50.0%)	3(16.7%)	-	0.07 (NS) #
	Left Maxilla	6(50.0%)	0(0.0%)	6(33.3%)		
	Right Mandible	3(25.0%)	3(50.0%)	6(33.3%)		
	Right Maxilla	3(25.0%)	0(0.0%)	3(16.7%)		
Other supernumerary teeth	Absent	1244(98.3%)	709(96.5%)	1953(97.7%)	7.14	0.008*##
	Present	21(1.7%)	26(3.5%)	47(2.4%)		
Number of teeth	1	9(42.9%)	23(88.5%)	32(68.1%)	-	0.002*#
	2	9(42.9%)	3(11.5%)	12(25.5%)		
	5	3(14.3%)	0(0.0%)	3(6.4%)		
Location	Right Maxilla	3(14.3%)	6(23.1%)	9(19.1%)	-	0.07(NS) #

 # Fisher's Exact Test
**p<0.05 Statistically Significant,*

Chi Square Test
p>0.05 Non-Significant, NS

Table 6. Gender wise distribution of CBCT scan and observed dental anomalies among study subjects

CBCT scans	CBCT	Gender		Total	Chi Square Value	p-value
		Male	Female			
	Absent	1256(99.3%)	717(97.6%)	1973(98.7%)	10.54	0.001*##
	Present	9(0.7%)	18(2.4%)	27(1.4%)		
	Buccal	3(33.3%)	5(27.8%)	8(29.6%)	-	0.07(NS) #
	Distal	0(0.0%)	3(16.7%)	3(11.1%)		
	Lingual	6(66.7%)	10(55.6%)	16(59.3%)		

Fisher's Exact Test ## Chi Square Test
*p<0.05 Statistically Significant, p>0.05 Non-Significant, NS

Table 7. Logistic regression to determine the likelihood of other supernumerary teeth based on age and gender.

	B	S.E.	Wald	df	p-value	Odds Ratio	95% C.I.for Odds Ratio	
							Lower	Upper
Age			6.97	4.00	0.14(NS)			
Age (1)	0.22	0.41	0.31	1.00	0.58(NS)	1.25	0.57	2.77
Age (2)	-0.48	0.42	1.27	1.00	0.26(NS)	0.62	0.27	1.42
Age (3)	-0.46	0.53	0.78	1.00	0.38(NS)	0.63	0.23	1.76
Age (4)	-1.19	0.66	3.22	1.00	0.07(NS)	0.30	0.08	1.12
Gender (1)	0.59	0.31	3.69	1.00	0.06(NS)	1.81	0.99	3.32
Constant	-3.71	0.36	104.12	1.00	<0.001*	0.02		

**p<0.05 Statistically significant, p>0.05 Non Significant, NS*
Variables: Age , Gender. -2 log likelihood =430.99, Cox and snell R 2 = 0.007, Nagelkerke R 2 = 0.036, Model Chi square(5) = 14.46 p = 0.01

Discussion

Dental anomalies (DA) tend to occur due to environmental and genetic factors, which affect differentiation process during odontogenesis. This leads to change in the number and size of dentition [15]. Besides leading to change in the number and size DA, which can be developmental or congenital can also affect the shape, eruption and exfoliation pattern of teeth [13, 16]. DA of number such as supernumerary teeth have been associated with tooth impaction, ectopic eruption, delays in eruption, dental spacing and crowding [17]. Whereas anomalies of number such as hypodontia have been known to have adverse impact on quality of life in terms of esthetics and function [18]. DA such as odontoma can case delay in eruption of teeth and retention of deciduous teeth [19]. Several clinical and radiographic studies have been conducted to investigate the prevalence of DA of number [20-22]. However, there is only one study like the present study which used primary OPG and a secondary CBCT analysis [23].

A supernumerary tooth occurring in the midline of the palate between the maxillary central incisors is termed as mesiodens [24]. Various investigations have reported a prevalence rate ranging from 0.15% to 1.9% [24]. In the present study the prevalence was 0.5%. In one of the recently published studies the mesiodens were commonly found in the males when compared to females with a ratio of 1.78:1 favoring males [24]. However, presently no significant gender difference in the occurrence of the mesiodens was observed. Singhal et al [25] reported single mesiodens in 78.09% of their sample, similar finding was observed in the present study wherein single mesiodens was detected in 70% of the cases and two mesiodens in remaining 30%. In the present report majority (70%) of mesiodens were erupted. Likewise, observation (erupted 83.11%) was spotted in the study by Singhal et al [25].

Prevalence of supernumerary teeth were found to be 2.4% in the present sample. Studies have revealed that the prevalence of supernumerary teeth ranges from 0.1% to 3.8% [20]. We observed that the prevalence of supernumerary teeth was significantly higher in females when compared to males. However, contrasting results were observed in a study by McBeain

and Miloro conducted in the Unites States of America [26]. The difference in the results could be due the nature of the study conducted by McBeain and Miloro which was clinical, and ours was solely a radiographic study. Presently there was no significant difference in the site of occurrence of supernumerary teeth, similar result was observed in a study conducted in the United Arab Emirates by Almuheiri and Duarte [27]. Research has indicated that supernumerary tooth typically doesn't show symptoms, so regular clinical check-ups and X-ray assessments are necessary in such instances. However, these supernumerary teeth could cause symptoms and pose a risk of harming neighboring teeth, necessitating treatment [21, 32, 33].

OPG and intraoral radiographs are commonly used for radiographic evaluation of supernumerary tooth. However, owing to anatomical superimposition associated with OPG and intraoral radiographs CBCT is often used to accurately localize unerupted supernumerary tooth [34]. In the present study 27(1.4%) cases of DA of number had CBCT scans.

The prevalence of the odontoma in this study was 0.9%. Research from Taiwan hospital reported a prevalence of 1.25% for odontomas [28]. In the present investigation majority of the odontomas were compound type. Comparable results were found in a Turkish study with 63.6% of the cases of odontoma being compound type [29]. In this report there was no significant difference in the occurrence of odontoma between male and female subjects. Likewise, findings were observed in a recently published clinic-radiographic study by DeColibus et al in the United States of America [30]. Investigations have revealed compound odontomas were commonly observed in the anterior region (66.6%), whereas complex odontomas were observed in the molar region (50.0%) [31]. However, in the present research there was no significant difference in the site of occurrence probably due to fewer number of odontoma cases.

Conclusion

The prevalence of DA in relation to tooth number in the present study was 3.8%. Prevalence, site of occurrence and gender distribution of DA in relation to tooth number in UAE residents were similar to the population in other parts of the world.

Study limitation and future recommendations

A significant drawback of the current study is the absence of clinical data. Incorporating clinical information would enhance the credibility of the study. Subsequent research endeavors could be designed to incorporate both clinical and radiographic findings for a more comprehensive analysis.

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