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Original article

Investigating prevalence of dental anomalies in Eastern Province of Saudi Arabia through digital orthopantomogram

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ABSTRACT

Objective: The aim of this study was to investigate the prevalence of dental anomalies in the Eastern Province of Saudi Arabia using the digital Orthopantomography (OPG).
Methods: A retrospective radiographic study was performed in which digital OPGs of 1189 subjects, ages ranging between 7 and 65 years were reviewed, and 1104 fulfilled inclusion criteria. Statistical analysis was performed. The OPGs were reviewed for congenitally missing teeth, impactions, ectopic eruption, supernumerary teeth, odontomas, dilacerations, taurodontism, dens in dente, gemination and fusion.
Results: OPGs of 1104 patients with mean age 35.32 ± 16.63 were included. The total prevalence of developmental anomalies in this study was 36.3% (401/1104). Male and female subjects with anomalies were 133 (33.2%) and 268 (66.8%) respectively. The prevalence of dilacerated teeth 300 (30.2%), congenitally missing teeth was 246 (24.7%), supernumerary teeth 18 (1.8%), talon cusp and taurodontism were seen in one patient each 1 (0.1%). Of these, a total of 15 (1.5%) anomalies were noted in pediatric patients.
Conclusions: Dilaceration was the most prevalent anomaly (30.2%) in the studied sample followed by congenitally missing teeth (23.4%). Talon cusp, concrescence/fusion, and taurodontism were the least prevalent anomalies.

1. Introduction

Developmental dental anomalies are vital league of dental pathology. Anomalies are relatively common, and previous studies showed that 36.7–40.3% of the study subjects displayed at least one dental anomaly (Patil et al., 2013; Uslu et al., 2009). Susceptible variations from the colour, shape, size, number and degree of development of teeth are seen in such anomalies (Ártun et al., 2009). Although genetic and environmental factors must be accounted for, the etiology of most anomalies remains unknown (Uslu et al., 2009).

Teeth abnormalities are classified according to variation in shape, size, number, in addition to structure (Brook, 2009; Pedreira et al., 2016; Saberi and Ebrahimipour, 2016). Abnormality frequency and the level of expression can provide an imperative proof for genetic and phylogeny research in different population groups. It should also provide understanding of the differences and the potential of occurrence amid and within populations. While the overall incidence of each of these anomalies may be small in the dental clinic or community, their existence may pose a management problem for patients or hinder treatment options in some instances. Careful and correct diagnosis simplifies and eliminates complications in the treatment regimen. Several studies of dental anomalies had been conducted in different regions of Saudi Arabia but not in the Eastern Province (Afify and Zawawi, 2012; Aljazi Hussain and Abdullah Mohammad, 2010; Ghaznawi et al., 1999; Osuji and Hardie, 2002; Salem, 1989; Al-Jabaa and Aldrees, 2013; Alyami et al., 2020). These studies reported the prevalence of selected dental abnormalities, especially those associated with malocclusion or developed orthodontic problems.

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Hence this study aimed to raise awareness of dental practitioners about the rate of occurrence of various types of dental anomalies in the Eastern Province using an affordable radiographic imaging method.

2. Materials and methods

A retrospective radiographic study was performed in which digital OPGs of 1189 subjects, who visited the Dental Hospital (DH) during the period 2012–2019, with ages ranging between 7 and 65 years. Patients are usually screened in the diagnosis clinics and referred to other clinics according to their treatment plan and OPGs are routinely taken at first visit for patients attending dental screening clinics. The exclusion criterion comprised of patients who had one or more of the following: incomplete patients' data, patients with syndromic disorder, hereditary condition, cases of cleft lip and palate, trauma, or jaw fracture that may affect development of permanent dentition. After exempting the above patients, all other patients were included in the study. Out of the 1189 subjects, 1104 subjects met the inclusion criteria. The OPGs were reviewed for congenitally missing teeth, impactions, ectopic eruption, supernumerary teeth, odontoma, dilacerations, taurodontism, dens in dente, gemination and fusion, and any additional unusual disorders that can be assessed or diagnosed using OPGs.

The digital OPGs of included patients were examined in a convincing method under good illumination, standard screen brightness and resolution. Standardization between two (MB and AT) qualified experienced examiners was conducted to eliminate inter-examiner discrepancies. The value of alpha 0.79 suggested acceptable level of inter-examiner reliability. The study was reviewed and approved by the Research Ethical Committee at the College of Dentistry, Imam Abdulrahman bin Faisal University, Saudi Arabia (EA: 2016019).

2.1. Statistical analysis

Data was analysed using statistical package software system, version 20 (SPSS 20.0®) (SPSS Inc, Chicago, Illinois, United States), and age of the patients was presented as Mean ± Standard deviation. Frequencies and percentages were calculated for presentation of all categorical variables including age-groups, gender, nationality and dental anomalies. Chi-square test was applied to compare the proportions of dental anomalies between genders, nationality, and tooth classifications. Univariate and Multivariate logistics regression analysis was performed to investigate if presence of one type of anomaly can be predicted by the presence of other anomalies and demographic variables. P-value ≤ 0.05 was considered statistically significant result.

3. Results

The study comprised a total sample of 1104 patients with an age range of 7–65 years and 455 (41.2%) were males and 649 (58.8%) were female patients. Out of the total sample size, 838 (75.9%) were Saudi nationals and 266 (24.1%) were Non-Saudis (Table 1). In all OPGs examined, at least one dental anomaly was observed in 401 (36.3%) subjects. The distribution of anomalies by gender was 133 males (33.2%) and 268 females (66.8%). The distribution of anomaly by nationality were 290 (72.3%) Saudi nationals and 111 Non-Saudis (27.7%) Figure 1.

Among 401(36.3%) overall subjects with anomalies, 79(20%) of the patients had more than one type of anomaly, out of which 67 (85%) had two types, 10 (13%) had three types and 2 (3%) had four types of anomalies. Table 2 depicts the association of anomalies with age, gender, and nationality. Age was found to be non-significant between patients having one type of anomaly and more than one type of anomaly (p – 0.246). Females were more likely 55 (21%) to have more than 1 type of anomaly as compared to males but the association was statistically non-significant (p- 0.328). Likewise, Saudi nationals were more likely to have more than 1 type of anomaly 59 (20%) but insignificantly associated (p - 0.355).

The total anomalies recorded were 993. Of these dilaceration was reported in 300 (30.2%) OPGs and was the most common anomaly noted. In addition, 73.3% of dilacerations were noted in OPGs of female patients. Table 3 depicts the gender and nationality distribution of different developmental anomalies. Mandibular 3rd molars had highest number of dilacerations (21%) followed by mandibular 2nd molars and maxillary 2nd premolar (9% each); and the least occurrence was noted in mandibular incisors (0.7%). Fig. 2 showing the actual radiographs of different types of anomalies recorded.

The second reported anomaly with a prevalence rate of 246 (24.77%) was congenitally missing teeth, which was higher in

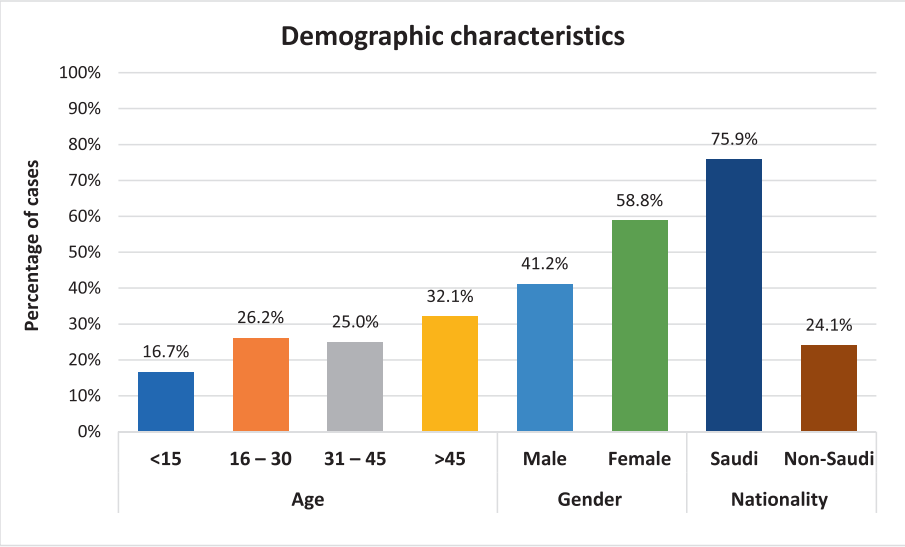

Fig. 1. Demographic characteristics.

Fig. 2. Showing Different types of Anomalies with the Tooth Number/position.

Table 1
Demographic data.

Demographic parameters		Frequency	Percentage
Age	<15	90	16.7
	16–30	141	26.2
	31–45	135	25.0
	>45	173	32.1
Gender	Male	455	41.2
	Female	649	58.8
Nationality	Saudi	838	75.9
	Non-Saudi	266	24.1

female patients (58.9%). The mandibular second premolars were the most commonly missing teeth (7%) followed by maxillary permanent first premolars (2.5%) and lateral incisors (2%).

Further, the fused roots had a prevalence of 176 (17.7%) with more predominance in females (83%). The prevalence of other dental anomalies in the descending order were as follows: Rotation (11%), Hypercementosis (6.8%), Microdontia (1.9%), Supernumerary tooth (1.8%), Ectopic enamel (1.4%), Peg shaped lateral (1.2%), Bifid Roots, Hypodontia, Ectopic Eruption (0.6% each), Transposition (0.3%), Dens invaginatus and dens evaginates (0.2%), Talon Cusp, Concrescence/Fusion and Taurodontism (0.1% each).

Results showed that the distribution of dental anomalies in females was higher (682 anomalies (68.7%)) compared to males (311 anomalies (31.3%)). The anomalies that exhibited almost equal prevalence and distribution among both genders were supernumerary tooth and peg shaped laterals incisors.

Table 4 shows the distribution of dental anomalies by location in jaws. The most commonly affected area, the maxillary molar region, exhibited 359 dental anomalies (36.2%), followed by the mandibular molar region with 287 anomalies (28.9%), both maxillary and mandibular premolars region exhibited 95 (9.6%) anomalies each, the maxillary anterior region (canine and incisors) 136 (13.7%) anomalies and least anomalies were recorded in mandibular anterior region, 21 (2.1%) anomalies.

Dilaceration was the most occurrence anomaly among all types. Multivariate logistic regression showed that the presence of dilaceration can be predicted by the presence of Congenital Missing teeth, fused roots , and rotation . Further, none of the demographical variable and other types of anomalies were significant predictors (Table 5).

4. Discussion

This study of prevalence of tooth anomalies is the first to be carried out in the Eastern Province of Saudi Arabia. The total prevalence of developmental anomalies in this study was 36.3% (401 out of 1104) which is comparable with findings of studies in the Western and Southern Regions that reported prevalence of 45.1% and 37.8% (Vani et al., 2016), respectively. In a similar study con-

Table 2
Anomalies with age, gender, and nationality.

Demographic Variables		One Anomaly	More than 1 Type of Anomalies	p-value
Age		29.76 ± 17.34	26.99 ± 12.96	0.246
Gender	Male	109(82%)	24(18%)	0.328
	Female	213(79%)	55(21%)	
Nationality	Saudi	231(80%)	59(20%)	0.355
	Non-Saudi	91(82%)	20(18%)	

Table 3
Gender & nationality distributions of dental anomalies.

Dental Anomalies	Total	Gender		Nationality	
		Male	Female	Saudi	Non-Saudi
Dilaceration	300	80 (26.7)	220 (73.3)**	231 (77.0)*	69 (23.0)
Congenital Missing	246	101 (41.1)	145 (58.9)*	214 (87.0)**	32 (13.0)
Fused roots	176	30 (17.0)	146 (83.0)**	118 (67.0)*	58 (33.0)
Rotation	110	36 (32.7)	74 (67.3)*	102 (92.7)**	8 (7.3)
Hypercementosis	68	29 (42.6)	39 (57.4)*	31 (45.6)	37 (54.4)
Microdontia	19	4 (21.1)	15 (78.9)**	13 (68.4)*	6 (31.6)
Supernumerary tooth	18	10 (55.6)	8 (44.4)	9 (50.0)	9 (50.0)
Enamel Pearl	14	6 (42.9)	8 (57.1)*	10 (71.4)*	4 (28.6)
Peg shaped lateral	12	6 (50.0)	6 (50.0)	6 (50.0)	6 (50.0)
Delayed eruption	8	3 (37.5)	5 (62.5)*	7 (87.5)**	1 (12.5)
Bifid Roots	6	0 (0)	6 (100)	3 (50.0)	3 (50.0)
Ectopic Eruption	6	0 (0)	6 (100)	5 (83.3)*	1 (16.7)
Transposition	3	1 (33.3)	2 (66.7)	3 (100)	0 (0)
Dens In Dente/dens evaginates	2	0 (0)	2 (100)	1 (50.0)	1 (50.0)
Concrescence/Fusion	2	2 (100)	0 (0)	2 (100)	0 (0)
Hypodontia	1	1 (100)	0 (0)	0 (0)	1 (100)
Talon Cusp	1	1 (100)	0 (0)	1 (100)	0 (0)
Taurodontism	1	1 (100)	0 (0)	0 (0)	1 (100)
Macrodontia	0	0 (0)	0 (0)	0 (0)	0 (0)
Total	**993**	**311**	**682**	**756**	**237**

**Shows significantly higher proportion at $p < 0.01$, *Shows significantly higher proportion at $p < 0.05$.

Table 4
Frequency of Dental anomalies according to Jaw-wise tooth classification.

	Maxilla				Mandible		
Dental Anomalies	Molars	Premolars	Canines	incisor	Molars	Premolar	Incisor
Dilaceration	77 (25.7)	42 (14.0)	18 (6.0)	16 (5.3)	108 (36.0)	36 (12.0)	3 (1.0)
Congenital Missing	119 (48.4)	10 (4.1)	4 (1.6)	7 (2.8)	86 (35)	18 (7.3)	2 (0.8)
Fused roots	129 (73.3)	3 (1.7)	0 (0)	0 (0)	42 (23.9)	1 (0.6)	1 (0.6)
Rotation	5 (4.5)	27 (24.5)	45 (40.9)	11 (10)	0 (0)	14 (12.7)	8 (7.3)
Hypercementosis	10 (14.7)	4 (5.9)	4 (5.9)	0 (0)	29 (42.6)	16 (23.5)	5 (7.4)
Microdontia	11 (57.9)	0 (0)	0 (0)	4 (21.1)	4 (21.1)	0 (0)	0 (0)
Supernumerary tooth	1 (5.6)	2 (11.1)	2 (11.1)	7 (38.9)	0 (0)	6 (33.3)	0 (0)
Peg laterals	0 (0)	1 (8.3)	1 (8.3)	0 (0)	8 (66.7)	1 (8.3)	1 (8.3)
Delayed eruption	0 (0)	1 (12.5)	0 (0)	4 (50.0)	0 (0)	2 (25.0)	1 (12.5)
Ectopic Eruption	0 (0)	4 (66.7)	2 (33.3)	0 (0)	0 (0)	0 (0)	0 (0)
Bifid Roots	0 (0)	1 (16.7)	1 (16.7)	2 (33.3)	2 (33.3)	0 (0)	0 (0)
Enamel Pearl	7 (50)	0 (0)	1 (7)	0 (0)	6 (43)	0 (0)	0 (0)
Transposition	0 (0)	0 (0)	1 (33.3)	2 (66.7)	0 (0)	0 (0)	0 (0)
Dens In Dente/dens evaginates	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)
Concrescence/Fusion	0 (0)	0 (0)	1 (50.0)	0 (0)	0 (0)	1 (50.0)	0 (0)
Hypodontia	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Talon Cusp	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)
Taurodontism	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Macrodontia	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	**359**	**95**	**80**	**56**	**287**	**95**	**21**

Table 5
Multivariate logistic regression showing presence of dilaceration can be predicted with by the presence of Congenital Missing, Fused roots and Rotation.

Anomaly Type	OR	95%CI	P-value
Congenital Missing	0.019	0.001–0.270	0.003*
Fused roots	0.146	0.026–0.805	0.027*
Rotation	0.187	0.040–0.879	0.034*

*Show significance at 0.05 level of significance.

ducted on Iranian population, a similar prevalence of 47.5% (Dalili et al., 2012) was found. However, higher prevalence (56.9%) was reported in Brazilian population(Goncalves-Filho et al., 2014) a lower prevalence was found in Odisha state in India (Goutham et al., 2017). These differences could be attributed to the regional and racial variations of the studied population.

No association was found between the anomaly's distribution and gender and other authors also have reported the same (Ranta, 1972; Lourenco Ribeiro et al., 2003). No significant association was also found between nationality and presence of anomaly. It is interesting that root dilaceration was the most prevalent dental anomaly in our study (30.2%) in accordance with international studies in Brazil (14.01%) (Goncalves-Filho et al., 2014), India (46.7%) (Goutham et al., 2017) and Iran (62%) (Standerwick, 2014). In contrast, other regional-based studies published significantly lower rate of dilaceration prevalence in the Kingdom's Southern (7.2%) (Vani et al., 2016) and 1.1% Western provinces. Root dilaceration refers to angulation or a sharp curve in the root that is assumed to occur as a result of trauma. The high level of prevalence rate of root dilaceration in our study could be related to low reporting of trauma in childhood, lack of regular dental check-ups, absence of reporting of teeth anomalies by the clinicians or simply due to genetic causes (Standerwick, 2014). Mandibular third molars had the highest number of dilacerations (21%) followed by mandibular 2nd molars and maxillary 2nd pre-

molars (9% each), and the least occurrence was noted in mandibular incisors (0.7%). Our findings were consistent with a study reported from Turkey where the root dilaceration was observed at significantly lower rates in the anterior region than in the premolar and molar regions (Gürbüz et al., 2019). In contrast to a study from the Kingdom's Jazan (Southern) region which reported mandibular first premolars (2.4%) as the most common tooth to be affected by part dilaceration (Vani et al., 2016).

Failure of teeth to form (congenitally missing teeth) is one of the common dental anomalies with a prevalence range of 1.6 to 45.7% (Dhanrajani, 2002; Neville et al., 2015; Sheikhi et al., 2012; Silva Meza, 2003). Our study showed a prevalence of 24.77% congenitally missing permanent teeth and significantly higher occurrence in female patients (58.9%) which is consistent with findings reported by previous studies (al-Emran, 1990; Kathariya et al., 2013; Yassin, 2016). Mandibular second premolars (7%) were the most frequently missing teeth, followed by maxillary permanent first premolars (2.5%) and lateral incisors (2%).

Fused roots were the second most common anomaly, 176 (17.7%) with more predominance in females 146 (83%). They were most seen in the maxillary 3rd and 2nd molars (44.8% and 23.8% respectively) followed by mandibular 3rd molars (18.2%), mandibular 2nd molars (5.0%), and maxillary 1st molars (4.5%). In a study conducted among the Latin American sub-population, it was reported that 43.2% of maxillary molars showed radicular fusion (Marcano-Caldera et al., 2019). The term "fused root" is defined as two or more roots joined together by deposits formed through the course of an individual's life or as a result of an alteration in the development of the Hertwig's epithelial root sheath close to the furcation of multi-rooted teeth (Gao et al., 2006; Martins et al., 2016; Zhang et al., 2014). Root fusion and root grooves have been associated with very complex root canal structures and prior knowledge of potential anatomical differences is crucial to the success of conventional or surgical endodontic treatment (Chai and Thong, 2004; Ordinola-Zapata et al., 2017).

Rotation is another frequently occurring positional anomaly due to multifactorial aetiology which involves both pre and post-eruptive disturbances (Yilmaz et al., 2005). Results related to prevalence of rotated teeth varied and were widely debated (Dalili et al., 2012; Vani et al., 2016). In the present study, 11.0% of patients showed teeth rotation, of which mandibular canines with the most common (27.3%) followed by maxillary first premolars (17.3%), maxillary canines (13.6%), mandibular second premolars (11.8%), and mandibular molars did not show any kind of rotations. In comparison, with this study, the prevalence of rotation was found to be consistent, 10.24% by (Gupta et al., 2011) and 13.2% by (Kathariya et al., 2013). The prevalence of rotation in this study was also unswerving with the study of prevalence of anomalies in adult population of Jazan in the Kingdom (20.2%) (Vani et al., 2016).

Hypercementosis is the increase in cementum deposition on the root surface resulting in an abnormal root shape, frequently a bulbous tip at the root apex. Hypercementosis may be solitary, involve multiple teeth, or appear as a generalized process. In a study of more than 22,000 affected teeth, the mandibular molars were affected most frequently, followed by the mandibular and maxillary second premolars, then the mandibular first premolars (Dhanrajani, 2002). The results of the current study were consistent with the earlier published literatures wherein 44% of hypercementosis were recorded in mandibular molars followed by mandibular premolars (24%) and maxillary molars (15%).

The term microdontia is applied when the teeth are smaller than normal. The prevalence of microdontia was 1.9%, making it the fifth most prevalent anomaly in this study, consistently with globally reported rates ranging from 1 to 2.6% (Goutham et al., 2017; Gupta et al., 2011; Patil et al., 2013). Further, the rate in this study is close to reported rate in the Kingdom, 2.3% (Yassin, 2016). Microdontia were more common in female patients and the most commonly reported tooth was maxillary 3rd molars (42%) followed by Maxillary lateral incisors (16%).

Supernumerary tooth was the succeeding prominent anomaly with the prevalence rate of 1.8%. A supernumerary tooth is defined as any tooth or odontogenic structure developed from tooth germ exceeding the usual number for any given dental arch area (Omer et al., 2010). Of the 18 supernumerary teeth reported, mesiodens was the most common supernumerary tooth with similar rates in males (1%) and females (1.3%). In permanent dentition, supernumerary teeth occur frequently in the anterior region as mesiodens (Ersin et al., 2004; Lara et al., 2013). Previous reports showed that the prevalence range of supernumerary teeth was between 0.1 and 3.8% of the population (Bäckman and Wahlin, 2001; Luten, 1967). The current result (1.8%) is consistent with what (Fardi et al., 2011) reported in which the prevalence of supernumerary teeth was also 1.8%. At times there could be developmental disturbance in the differentiation of the Hertwig's epithelial root sheath resulting in a malformed root or bifid root in a single rooted tooth. In this study, 6 (0.6%) cases of bifid roots were noted in a sample of 993 anomalies where in 2 (0.2%) cases each were seen in maxillary central incisors and mandibular first premolar, followed by a single case in Maxillary canine and 2nd premolar. Regarding the bifid roots in maxillary canine, till date only three cases have been documented in medical literature published from Kingdom of Saudi Arabia (Al-Zoubi et al., 2018; Rahmatulla and Wyne, 1993). This will be the fourth reported case of bifid roots in maxillary canine in Saudi Arabia.

Ectopic enamel pearls refer to the presence of enamel in unusual locations, mainly the tooth root. The most widely known are enamel pearls. These are hemispheric structures that may consist entirely of enamel or contain underlying dentin and pulp tissue. Most enamel pearls project from the surface of the root and are thought to arise from a localized bulging of the odontoblastic layer. Enamel pearls have a predilection for molars and are rarely associated with premolars, canines or incisors. Sutalo et al. (1989), studied a sample of 7,388 extracted teeth and detected enamel pearls in 1.6% of the sample, which was consistent (1.4%) with the present study, but much lesser than the Kingdom's published literature which had documented a prevalence of 4.28% (Al-Zoubi et al., 2018).

A peg shaped tooth is defined as 'an undersized, tapered, maxillary lateral incisor' which is mesio-distally deficient. Individuals with malformed lateral incisors often display diastema. In the Kingdom's Jizan province, Salem G. reported that peg-shaped lateral incisors were reported in about 0.37% of the studied sample, while Al-Emran reported a high prevalence rate (4%) (al-Emran, 1990). Horowitz investigated the prevalence of peg-shaped lateral incisors to account for 0.8% of the anomalies. In a similar approach, we found the prevalence of peg shaped laterals incisors to be 1.2%.

Positional anomaly such as ectopic eruption arises because of changes in the pattern of the eruption. The prevalence of such teeth in the present study was noted to be 6 (0.6%). Ectopic teeth eruption was common in maxillary first premolar 3 (50%) followed by maxillary canine 2 (33.3%) and maxillary second premolar 1 (2.0%). An interesting finding noticed during the radiograph assessment was that many cases with tooth rotation were associated with ectopic eruption of adjacent teeth. Further, all 6 cases of ectopic eruption were noted in females. Prevalence of ectopic eruption was previously reported between 0.3% and 7.9% (Patil et al., 2013; Gupta et al, 2011). In this analysis, the ectopic tooth eruption has been a close match to the research of Afify and Zawawi (2012), which has shown that the ectopic eruption in Saudi Arabian population was 0.7%. The most common ectopically erupted tooth in this study was maxillary first premolar and canine which was sim-

ilar to the findings recorded by Gupta et al but contrary to Afify et al (Afify and Zawawi, 2012; Gupta et al., 2011). Which stated third molars and mandibular premolars to be most ectopically erupting tooth.

Transposition of the teeth is an unusual eruption involving permanent dentition (incidence of 0.3–0.4%) and is seen more often in the maxilla (Yilmaz et al., 2005). Transposition can occur with other abnormalities, such as aplasia, lateral peg-shaped incisors and retention of deciduous teeth (Ely et al., 2006). The current study showed 3 (0.3%) teeth with transpositions which was consistent with (Vani et al., 2016). It showed more predilection to occur in females and in maxillary anterior region.

The prevalence of dens invaginatus and dens evaginates was found in just two teeth (0.2%). Best of our knowledge, there are no data to correlate these individual findings in the published literature from the Kingdom of Saudi Arabia.

The prevalence of talon cusp varies from less than 1% to 8% in permanent teeth, with a higher frequency in males than females (Aguiló et al., 1999). In this study, the prevalence of talon cusp was 1.0%, with a higher prevalence in males and in maxillary lateral incisors.

The prevalence of fusion may vary from 0.5 to 5% depending on geographical, racial or genetic factors (Kapdan et al., 2012). The prevalence of fusion in the present study was 1.0%. The current findings are consistent with the results reported by (Dash et al., 2004; Whittington and Durward, 1996).

The prevalence of taurodontism (1%) was lower than that observed in the Kingdom of Saudi Arabia by Ghaznawi et al. (Ghaznawi et al., 1999; Vani et al., 2016). None of the patients showed concrescence and gemination in this study.

5. Conclusion

The current study shows that dental anomalies are present in 33.9% of the studied population. Anomalies were more prevalent in female subjects. Root dilaceration is remarkably prevalent and its presence is correlated with other dental anomalies. It is likely that varying prevalence and distribution in Saudi or other populations could be attributed to sample selection, and geographic location of selected patients, which advocates racial and genetic differences. Despite the variation in prevalence of anomalies reported in this study, their presence may constitute aesthetic and functional challenges to the patient. Early detection of anomalies in dental development can lead to significant reduction of future dental complications.

5.1. Strength and limitation

Our results have shown differences and varying prevalence in comparison to previous published literature. These may be attributed to the sample selection, the research methodology employed, and the geographic location of patients studied, which advocate racial and genetic differences which in turn may have contributed to the varying dissimilarities.

Additional research for causation or development of dental anomaly in adult patients in the region is recommended to generate the awareness and prevent the associated dental problems. This study has several strengths. This is the first original study on dental anomalies in the Eastern province of Saudi Arabia. A large subject cohort was included over the course of a seven-year period. In addition, a large number of developmental anomalies were included for identification, broadening the scope of this research. Standardization between two qualified experienced examiners was conducted to eliminate inter-examiner discrepancies. Later, a qualified experienced Radiologist reviewed all the radiographs to disregard inter-examiner discrepancies.

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CRediT authorship contribution statement

Jehan ALHumaid: Conceptualization, Methodology, Software, Writing - original draft. **Maryam Buholayka:** Validation. **Arishiya Thapasum:** Conceptualization, Methodology, Software, Validation, Writing - original draft. **Muhanad Alhareky:** Writing - review & editing. **Maha Abdelsalam:** Writing - review & editing. **Amr Boghsan:** Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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