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Prevalence of Dental Anomalies in Kundrathur Population–A Radiographic Retrospective Study

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Abstract

The aim of this article was to evaluate the prevalence of various dental developmental anomalies in the suburban population in and around Kundrathur using digital orthopantomograms. A total of 1664 digital orthopantomograms were used to ascertain the predominance of any specific dental anomalies, in which 750 OPGs fulfilled the inclusion criteria and those orthopantomograms were viewed quadrant-wise to detect the anomalies. The results show mean distribution of mean age as 29.62± 9.60 with 372 (49.6%) males and 378 (50.4%) females. The frequency distribution of tooth anomalies along study population was estimated and talon's cusp was more prevalent (52.9%) followed by impacted molar (48.4%) and canine (5.1%). It is suggested that many studies with better sample size in various age groups and taking into consideration of clinical and familial history are needed in future to specifically determine the aetiology of various evolutional and morphological developmental dental anomalies.

Keywords: Developmental anomalies, orthopantomograms, taurodontism, malocclusion

Full length article *Corresponding Author, e-mail: bounikarao@gmail.com

1. Introduction

Dental anomalies are a diverse group of deformities in the formation of teeth. The term means 'irregularity' or different from normal. Any disturbance to the epithelium and mesenchyme can specifically modify the normal odontogenesis which may lead to the developmental anomalies of the teeth. It is usually congenital malformations, which can occur either as an isolated finding or as a part of some syndromes. But, unlike common oral diseases associated to tooth and other oral tissues, dental anomalies casts least occurrence and are found only during the routine dental check-up, regarding which the patient might be unaware, but it can impart issues during treatment phase. Complete ignorance of these dental anomalies might lead to improper occlusion, aesthetic and functional problem along with its secondary problems, that makes the clinical management complicated [1].

The present study was conducted to evaluate the prevalence of dental developmental anomalies using archived digital panoramic radiographs of the patients referred to the Department of Radiology, Madha Dental College and Hospital.

2. Materials and methods

The study was conducted with 1896 archived digital orthopantomograph (OPGs) which were taken in the department of Radiology, Madha Dental College and Hospital, Kundrathur (Chennai). The inclusion criterion was all the OPGs taken between the period May 2016 to May 2019 and above the age of 16 years. Exclusion criteria are as follows, images showing low quality were excluded as it might not give proper diagnostic significance, and radiographs with obscured anterior teeth that interrupt the findings in the anterior region were excluded from the study. Patients under fixed orthodontic treatment, cleft palate, any types of bone diseases, trauma to the jaw that affects the normal eruption of permanent teeth, crown restorations, and caries or root canal treatment that interfere with the detection of some anomalies such as taurodontism were excluded. OPGs showing alteration in the normal bone architecture or any missing teeth, the patient's records were checked for any pathological condition, having fracture of the jaw, hereditary diseases or syndromes affecting the jaw, and if patient had a history of permanent teeth extraction that OPG were excluded from the study. OPGs which do not help to differentiate between concrescence due to superimposition of roots in the adjacent teeth were excluded from our study. Patients who presented with hereditary

conditions or syndromes that could cause dental anomaly, such as Down's syndrome or cleidocranial dysostosis were also excluded. 1896 panoramic radiographs were analysed and 1664 OPGs that satisfied the above criteria were selected for the study. This sample capsulated both sexes between the age group of 16 to 70 years of age. Approval was provided by the institutional ethical committee for performing this study. (MDCH/ICE/2018/14). All panoramic radiographs were taken using digital panoramic machine Planmeca Pro Max X-ray unit (Planmeca Oy., Helsinki, Finland), and the magnification factor was 1.2. The exposure parameters were standardized according to the manufacturers and it ranged between 60-70 kvp and 8-12 mA. Computerized screening of the collected images of the digital OPGs were viewed in a HP laptop with windows 8.1 pro version and Intel (R) core (TM) i3-4005U processor. Using Microsoft office picture manager application, the images are viewed and the images are magnified if required. Patients' dental records were also used to confirm a few diagnoses.

All the radiographs were analyzed by the same investigator, and were limited to evaluating 50 radiographs per day with a minimum interval of 12 hours between each session. Around 1664 digital OPGs were analyzed in which 750 OPGs showed anomalies. Further, the OPG's were screened based on the diagnostic criteria presented in the textbook of Oral radiology: principles and interpretation by White & Pharoah. The radiographs were examined for shape anomalies, number anomalies, structural anomalies and positional anomalies and OPGs with edentulous spaces were also rejected by referring to the concerned patient's records.

The criteria followed for assessment of each group of anomalies are mentioned as follows-*(Table - 1).* Data was entered into an excel sheet and sent for statistical analysis. It was performed using Statistical Package for Social Sciences software (SPSS version 23, USA 2012). A normality test was done and it was found that all variables were normally distributed. Depending upon the nature of the data, appropriate statistical tests were chosen, p-value of < 0.05 was considered to be significant. Frequency distribution in terms of relative frequency for Talon's cusp, Impacted molar, Impacted canine, Taurodontism, Peg laterals, Localized Microdontia, Anodontia, Dilaceration, Supernumerary tooth, and supernumerary root were presented as graph and tables for Maxillary right, Maxillary left, Mandibular right and Mandibular left quadrant separately. Association between dental anomalies with each of them was performed using Pearson Chi-square association.

3. Results and Discussions

Several studies have been performed in different parts of the world to determine the prevalence of dental anomalies, the purpose of the study might differ in accordance with their preference and the method recruited to analyze the prevalence also differs. In all those studies, panoramic radiographs were found to be the most essential aid in analyzing the prevalence of developmental anomalies as it covers the entire arch, few studies have been performed only with the radiographs but clinical findings are also essential in diagnosis. Hence, in the present study, we have included the dental records of the patients also. OPGs showing dental anomalies were given in figure 1, 2, 3. The results show the mean distribution of age as minimum of 16 years and a maximum of 76 years with a mean age of 29.62±9.60, there were 372 (49.60%) males and 378 (50.40%) females. There was no statistically significant difference in gender distribution among the study population (p=0.827).

The frequency distribution of teeth anomalies among the study population was estimated and prevalence of talon's cusp was 397 (52.9%), it has been reported in the literature that the range of prevalence of talon's cusp is between 0.06 % and 40.8 % [12]. Guttal et al., [7] showed 2.40% of dens evaginatus and 4.28% of talons cusp. Balasubramanya Goutham et al., [5] showed 0.37% of talons cusp. FE Ardakani et al., [16] showed 1.2% of prevalence and all were men but, in the present study, there is no such sex predilection. Impaction was seen in 363 (48.4%), the percentage prevalence is similar to the studies conducted by Aldhorae, Khalid A., et al., [4] (14%–47%) and Abbas, et al [11] (44.76%). Present study showed mandibular third molars were affected more when compared to the maxillary third molars.

In the present study, crown dilaceration was nil, whereas root dilaceration was 141 (18.8%) with female predilection 59.6%. The prevalence of microdontia ranges from 0.8% to 8.4% in Neville et al., [13]. In Gonclaves-filho et al [15] the prevalence of microdontia was 9.14% of total anomalies with the majority of the peg-shaped lateral incisor. The study conducted by Vibhute et al., [16] showed 7.7% of prevalence of microdontia and 4.1% of microdontia in Walid Samir Salem et al., [17]. In the present study prevalence of localized microdontia (mostly in maxillary third molars) was reported in 38 (5.1%) and peg laterals 102 (13.6%) and showed no macrodontia. Vibhute et al., [16] showed 3.1% of macrodontia. In all the previous study and present study, the prevalence of macrodontia is relatively rare.

Gonçalves Filho, et al., [15] (2014) showed taurodontism as the most prevalent dental anomaly with 27.19%. The present study showed 71 (9.5%) of prevalence and with male predominance. The different results in different studies may be due to racial differences or differences in the type, method, and place of study. Santosh et al., [1] showed 3.1% of canine impaction with male predominance. The present study showed canine impaction as 38 (5.1%) and no gender predilection. HTu ̈rkkahramanet al [18] have stated that the prevalence of supernumerary teeth varies between 0.1% and 3.8% in the Caucasian population both in the primary and the permanent dentition which was similar to the present results supernumerary teeth -15 (2.0%). The prevalence of supernumerary roots was 9 (1.2%), in that mandibular first and second premolars were affected commonly which coincides with Balasubramanya Goutham et al., [5] (0.83%) and Guttal et al., [7] (2%).

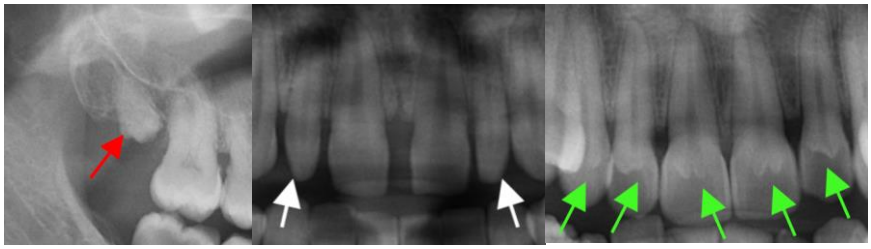


Figure 1: OPG showing localized microdontia 18 (red arrow), peg laterals 12,22 (white arrow), Talon's cusp in 11,12,13,21,22 (green arrow).

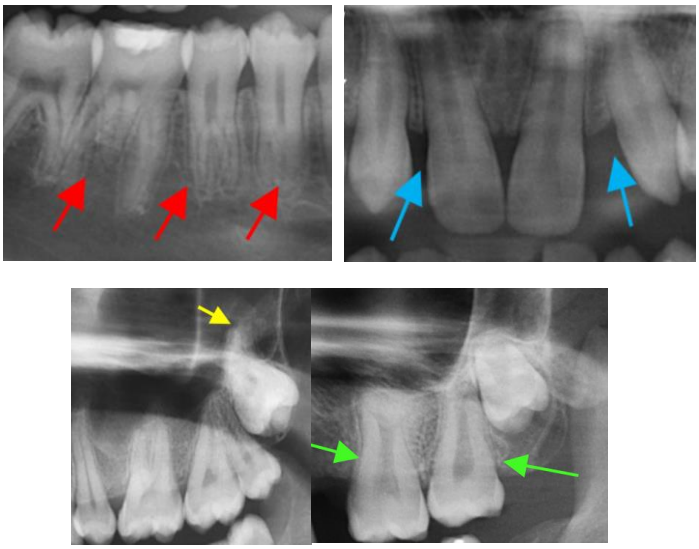


Figure 2: OPG showing supernumerary root in 46,45,44 (red arrow), anodontia 12,22. (blue arrow), distomolar in 28 region (yellow arrow), taurodont maxillary molar 26,27 (green arrow)

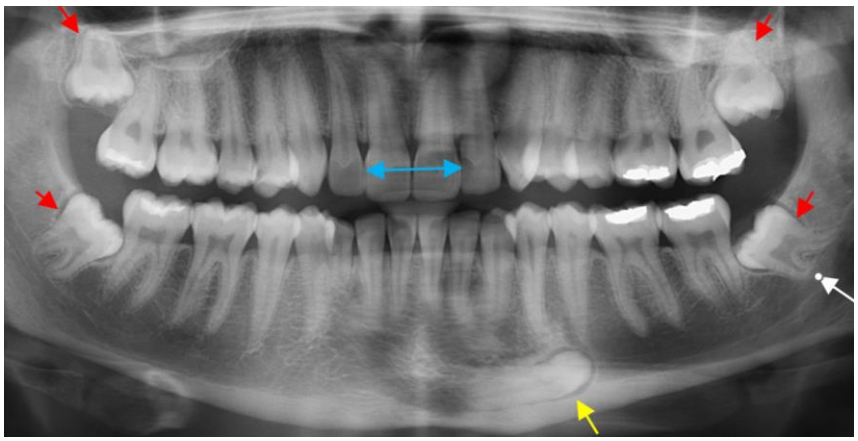


Figure 3: OPG showing impacted molars 18,28,38,48 (red arrow), impacted mandibular canine (yellow arrow), Talon's cusp in 12,22 (blue arrow) and root dilaceration in 38(white arrow)

Table 1: The criteria followed for assessment of each group of anomalies are mentioned as follows:

Type of Anomaly	Dental anomaly	Description of Radiographic appearance
SIZE		
Only gross deviation in the size is easily perceptible by radiological judgment was accepted.	Macrodontia	When size of the tooth/teeth is larger than that of the usual size it is considered macrodontia
	Microdontia	When size of the tooth/teeth is smaller than that of the usual size it is considered microdontia
	Peg laterals	It is exhibited in the radiograph as mesial and distal margins tapered together to form a peg/ conical-shaped crown with narrow pulpal space.
SHAPE		
Crown anomalies	Fusion	Both fusion and gemination, radiographically appear as double teeth that are larger than the normally appearing teeth. Only depending on the tooth count, it is concluded whether it belongs to fusion or gemination.
	Gemination	
	Dense in dent	The appearance radiograph of the invagination as a radiolucent pocket surrounded by a radio-opaque enamel border.
	Dens Evaginatus	Radiographically it appears as a radio-opaque horn-like structure seen on the coronal portion of the tooth, especially on the occlusal portion.
	Talon's cusp	Radiographically it appears like a normal tooth, with radio-opaque enamel and dentin with or without extension of pulpal tissue into the V-shaped structure superimposed over the normal image of the crown.
Root anomalies	Taurodontism	To assess taurdontism, we followed the criteria of Shiffman and Chanannel. According to these criteria, a tooth is considered as taurodont if the distance from the highest point of the floor (B) to the lowest point of the roof of the chamber (A) to divided by the distance from A to the root apex is equal to or greater than 0.2 and when the distance from B to the CEJ is greater than 2.5 mm.
	Dilaceration	Dilaceration is an abnormal bend in the root but it can be anywhere along the length of the tooth. Only the mesial and distal angulations are evident on the radiographs, buccal and lingual angulations cannot be appreciated.
	Enamel Pearl	Radiographically it appears as a hemispherical dense radio-opacity projecting from the root surface.
	Supernumerary root	Exhibited in radiographs as extra roots in a normal single-rooted or double-rooted tooth. The size and shape of the extra root is almost the same size and shape of the normal root present.
	Concrescence	Radiographic examination can throw a diagnostic dilemma to differentiate concrescence with superimposition of two closely approximated root for which additional procedure at different angulations may be required.60 OPGs which do not help to differentiate between concrescence and superimposition of roots in the adjacent teeth were excluded from our study.
NUMBER		
Number anomalies were established by counting the teeth present in the radiograph.	Anodontia	Radiographically anodontia can be determined by checking the tooth number and the space available for the tooth which is absent.
	Supernumerary teeth	Tooth number can be counted to ensure the presence of the supernumerary tooth, if there is presence of an extra tooth then, it is classified according to the morphology and shape.
STRUCTURE		
Structural deformities can only be determined with the help of radiographs.	Amelogenesis imperfecta	Imaging signs of amelogenesis imperfecta include a thin radio-opaque layer of enamel, a square crown, loss of cuspal architecture, open contact, and anterior teeth showing a picket fence appearance.
	Dentenogenesis imperfecta (DI)	Radiographically, the teeth exhibit obliteration of the pulp chamber, bell-shaped crowns, thin short roots, and periapical bone rarefaction.
ERUPTION		
A tooth was considered to be impacted based on the age mentioned in the radiograph.	Impacted	Radiographically it appears as a tooth present within the bone, depending on its position, morphology, and sight it was further segregated into canine impaction and molar impaction.

Table 2: Distribution of dental anomalies based on gender among study population

Characteristics	Total	Male (%)	Female (%)	χ^2 value (association)	p value
Size anomalies					
Localized Microdontia	38	19 (50)	19 (50)	0.003	1.000
Peg Laterals	102	45 (44.1)	57 (55.9)	1.419	0.243
Shape anomalies					
Fusion	1	0	1 (100)	0.985	1.000
Talon's Cusp	397	201 (50.6)	196 (49.4)	0.358	0.559
Taurodontism	71	44(61.9)	27 (38.1)	4.802	0.034*
Dilaceration	141	57 (40.4)	84 (59.6)	5.847	0.019*
Supernumerary root	9	7 (77.7)	2 (22.3)	2.893	0.105
Number anomalies					
Anodontia	9	6(66.6)	3 (33.4)	1.061	0.337
Supernumerary teeth	15	7 (46.6)	8 (53.4)	0.053	1.000
Eruption anomalies					
Impacted Molar	363	181 (49.8)	182 (50.2)	0.019	0.942
Impacted Canine	38	21 (55.2)	17 (44.8)	0.514	0.509

Table 3: Association between dental anomalies among study population

Characteristics	χ^2 value (association)	p value
Impacted Molar and Impacted Canine	7.817	0.007*
Anodontia and Peg laterals	3.019	0.111
Localized Microdontia and Peg laterals	0.322	0.808
Impacted molar and Dilaceration	4.422	0.040*
Impacted canine and Dilaceration	0.835	0.522
Supernumerary teeth and supernumerary root	0.186	1.000
Taurdontism and Fusion	0.105	1.000

Table 4: Quadrant wise prevalence of anomalies:

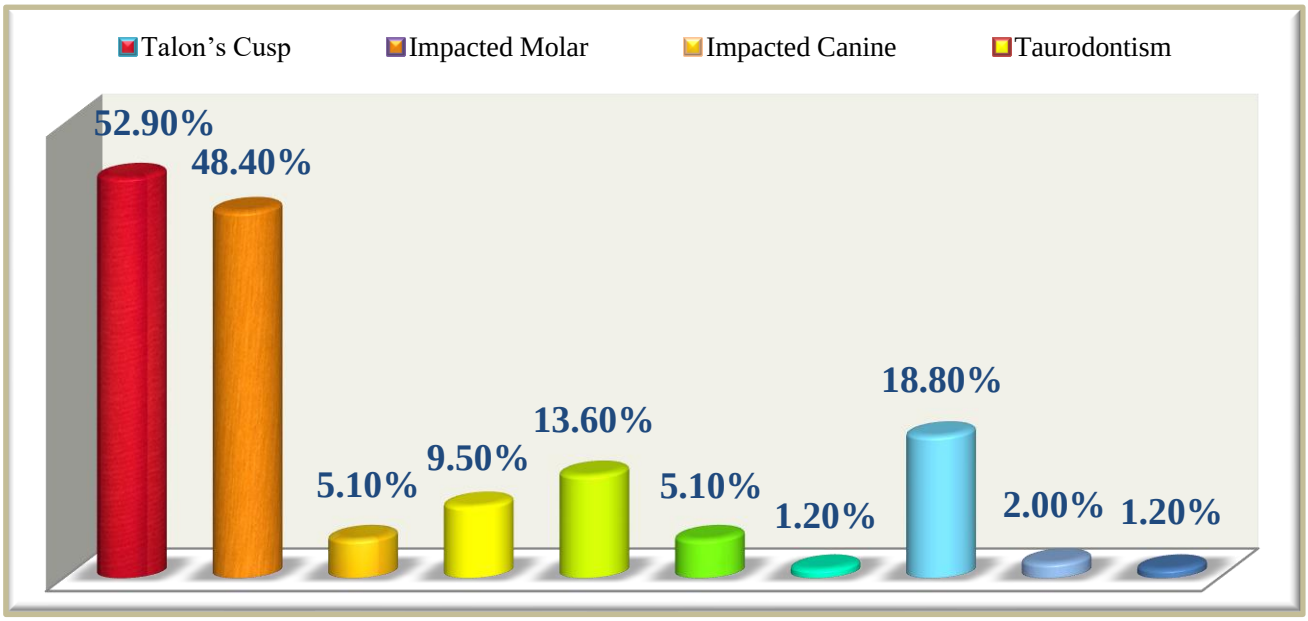
Anomaly	3rd Molar (%)				2nd Molar (%)				1st Molar (%)				2nd Premolar (%)				1st Premolar (%)				Canine (%)				Lateral Incisor (%)				Central Incisor (%)			
	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt	Mx. Rt.	Mx. Lt.	Mn. Lt.	Mn. Rt
Talon's Cusp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	10.1	0	0	28.4	31.9	0	0	34.8	34.7	0	0
Impacted Molar	21.3	23.4	30.2	28.2	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impacted Canine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.2	2.4	0.5	0.9	0	0	0	0	0	0	0	0
Taurodontism	0.1	0	0.4	0.8	1.7	1.5	5.1	5.8	1.6	1.3	1.5	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peg laterals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.4	12	0	0	0	0	0	0
Localized Microdontia	2.8	1.3	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0.1	0	0	0	0.1	0.3	0	0.1	0.1	0.1	0.3	0.4	0.1	0.1	0.4	0.4
Anodontia	0	0	0	2.3	0	0	0	0.5	0	0	0	0	0	0	0	0.5	0	0	0	1.5	0.1	0.1	0.1	0.8	0.7	0.5	0.1	0.4	0.1	0	0	0.1
Dilaceration	0.8	0.9	2.7	0	0.8	0.3	0.5	0	0.4	0	0	0	0.7	0.5	1.5	0.1	0.7	0.3	1.7	0	0.3	0.1	1.1	0	0.5	0.3	0.1	0	0.4	0.1	0.1	0
Supernumerary teeth	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.2	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supernumerary root	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0.1	0.3	0	0	0.1	0.3	0.3	0	0	0	0	0	0.1	0	0	0	0	0	0

Table 5: The most common tooth involved with the dental anomaly was also evaluated and the results are as follows

Sl. No	Anomaly	Commonly affected teeth	Percentage
1.	Localized microdontia	Maxillary right 3rd molar	2.8%
		Maxillary left 3rd molar	1.3%
2.	Peg laterals	Right lateral incisor	12.4%
		Left lateral incisor	12%
3.	Talon's cusp	Maxillary left central incisor	37.7%
		Maxillary right central incisor	34.8%
4.	Taurodontism	Mandibular right 2nd molar	5.8%
		Mandibular left 2nd molar	5.2%
5.	Dilaceration	Mandibular left 3rd molar	2.7%
		Mandibular right 3rd molar	2.3%
6.	Supernumerary root	Mandibular left 1st premolar	0.30%
		Mandibular left 2nd premolar	0.30%
		Mandibular right 1st premolar	0.30%
7.	Anodontia	Maxillary right lateral incisor	0.70%
		Maxillary left lateral incisor	0.50%
8.	Supernumerary teeth	Distomolar (Maxillary left 3rd molar - 0.40% & maxillary right 3rd molar – 0.60%)	1%
9.	Impacted molars	Mandibular left 3rd molar	30.10%
		Mandibular right 3rd molar	28.20%
		Maxillary left 3rd molar	23.40%
		Maxillary right 3rd molar	21.30%
10.	Impacted canine	Maxillary right canine	3.2%
		Maxillary left canine	2.4%

Table 6: Following tabular column is the overview of articles included in this study

Sl. No.	Author	Methods	Study population	Sample	% Prevalence of anomaly	Common anomaly
1.	Santosh, et al (2013)	Orthopantomographs (OPGs) and dental records	Indian population	4133	1519 (36.7%)	Congenitally missing teeth - 673 (16.3%)
2	Ahmed R, et al (2012)	OPGs and dental records	Western region of Saudi Arabia	878	396 (45.1%)	Congenitally missing teeth - 226 (25.7%)
3.	Salem G. (1989)	Clinical and Radiographic examination	Gizan region, Saudi Arabia	2393		Congenitally missing teeth (2.2%)
4.	Chandrika V, et al (2018)	study models and panoramic radiographs	Andhra Pradesh population	600	22.3%	Missing 3rd molars
5.	Aldhorae, Khalid A., et al. (2019)	Digital panoramic radiographs	Yemen	1675	30.61% in orthodontic and 22.96% in non-orthodontic patients	Impaction (14%–47%)
6.	Balasubramanya, et al (2017)	Panoramic radiographs and dental records	Odisha Population	1,080	35.27%	Dilaceration 46.71%
7.	Kruthika S, et al (2010)	clinical and radiographic examinations	Indian Population	20,182	350	Hyperdontia 87
8.	Arvind, et al. (2021)	Radiographs, dental casts, and clinical findings	Indian Population	4,000	331 cases (8.27%)	Hypodontia (4.7%)
9.	Saurabh K, et al. (2011)	Radiographs, dental casts, and clinical findings	Indian Population (Indore)	1123	385 (34.28%)	Rotation (10.24%)
10.	Nawar Bahjet et al (2019)	Clinical and Radiographic examination	Baghdad	600	-	Congenital missing second premolar (36.3%)
11.	Merve Erkmen, et al (2017)	Clinical and Radiographic examination	Turkey	9173	166 (1.8%)	Congenitally missing teeth (0.52%)
12.	Abbas, et al. (2014)	panoramic radiography	Hamadan City	1649	29%	Impaction (44.76%)



Graph 1: Distribution of dental anomalies among study participants

The present study showed 9 (1.2%) anodontia involving the maxillary lateral incisor as the most common. Abbas et al., [11] have examined for oligodontia but no case was reported by him. Goncalves –filho et al., [15] showed 6.28% with a female predilection. In the present study the prevalence of fusion was 1 (0.1%). Guttal et al., [7] (2010) showed 4.85% of fusion and 0.28% of gemination.

Gemination and fusion in the general population are very low at 0.19% and 0.22% respectively. No gemination was found in our study which coincides with the results of Vibhute et al [16]. The present study revealed nil dens invaginatus, this could be due to the reason that mild cases of dens invaginatus are difficult to be detected in OPGs, whereas IOPA might be helpful. Other anomalies like DI, concrescence are also rare anomalies. Saurabh K et al [9] with 0.09% prevalence of DI also reported it to be the rarest among the whole study group. Other studies like Balasubramanya Goutham et al., [5] 0.09% and Gonçalves Filho, et al., [15] 0.63% also showed very minimal prevalence, as it is difficult to identify concrescence in OPGs and very less studies have included concrescence as an evaluating criterion. *(Graph – 1: Distribution of dental anomalies among study participants).* The distribution of dental anomalies based on gender was also evaluated and it showed that taurodontism was more prevalent in males 44 (61.9%) when compared to females 27 (38.1%). Whereas, dilaceration was more in females 84 (59.6%) when compared to males 57 (40.40%). There was a statistically significant association between gender and taurodontism with a p-value of 0.034 and for dilaceration, the P value was 0.019. Other anomalies do not show any gender correlation. *(Table – 2: Distribution of dental anomalies based on gender among study population)*

The association between various dental anomalies among the study population was also evaluated and found that there was a statistically significant association between impacted molars and canines (p=0.007) and impacted molar and dilaceration showed association (p=0.040). *(Table -3: Association between dental anomalies among study population).* Quadrant-wise dental anomalies were also evaluated and the results are as follows- Among all the four quadrants localized microdontia and peg lateral was more seen in the maxillary right quadrant. Talon's cusp was seen in the maxillary left quadrant. Prevalence of taurodontism is in the mandibular both right and left quadrants. Dilacerations and supernumerary roots are most common in the mandibular left quadrant. Anodontia was seen in the mandibular right quadrant whereas supernumerary teeth did not follow any specific pattern. Among impaction, molar impaction is prevalent in the mandibular left quadrant (30.2%) and canine impaction in the maxillary right quadrant with 3.2%. *(Table – 4: Quadrant wise prevalence of anomalies).* The most common tooth involved with the dental anomaly was also evaluated and the results are as follows, *(Table - 5).* Following tabular column is the overview of articles included in this study. *(Table - 6).*

4. Conclusions

These results were similar to few studies, even though some differences were seen in certain aspects, this may be due to differences in number of samples, plane, and method of the study, as well as racial and genetic differences. Incidence in various populations can render significant information for genetic and phylogenetic studies and helps in the understanding of variations within and between the different populations under evaluation.

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