

Prevalence of dental anomalies among 7- to 35-year-old people in Hamadan, Iran in 2012-2013 as observed using panoramic radiographs

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ABSTRACT

Purpose: This study was performed to evaluate the prevalence of all types and subtypes of dental anomalies among 7- to 35-year-old patients by using panoramic radiographs.

Materials and Methods: This cross-sectional study was conducted on 1649 people in Hamadan City, in 2012-2013. The prevalence of four types and 12 subtypes of dental anomalies was evaluated by two observers separately by using panoramic radiography. Dental anomalies were divided into four types: (a) shape (including fusion, taurodontism, and dens invagination); (b) number (including hypodontia, oligodontia, and hyperdontia); (c) structure (including amelogenesis imperfecta, dentinogenesis imperfecta, and dentin dysplasia); and (d) position (including displacement, impaction, and dilacerations).

Results: The reliability between the two observers was 79.56% according to the Kappa statistics. The prevalence of dental anomalies diagnosed by panoramic radiographs was 29%. Anomalies of position and number were the most common types of abnormalities, and anomalies of shape and structure were the least in both genders. Anomalies of impaction (44.76%), dilacerations (21.11%), hypodontia (15.88%), taurodontism (9.29%), and hyperdontia (6.76%) were the most common subtypes of dental anomalies. The anomalies of shape and number were more common in the age groups of 7-12 years and 13-15 years, respectively, while the anomalies of structure and position were more common among the other age groups.

Conclusion: Anomalies of tooth position were the most common type of dental anomalies, and structure anomalies were the least in this Iranian population. The frequency and type of dental anomalies vary within and between populations, confirming the role of racial factors in the prevalence of dental anomalies. (*Imaging Sci Dent* 2014; 44 : 7-13)

KEY WORDS: Anomalies; Dentition; Radiography, Panoramic; Prevalence; Iran

Introduction

Dental anomalies consist of a wide range of disorders, including changes in the number, morphology, eruption, and size of teeth.¹ The developmental anomalies of teeth are caused during tooth development, whereas the acquired

anomalies are caused after tooth development.² Anomalies of tooth structure (enamel and dentin defects) can be symptoms of syndromes.³ Some dental disorders and developmental defects of enamel may lead to a number of problems such as increased sensitivity and esthetic problems, while severe tooth decay can be prevented by the timely detection of problems and appropriate intervention.⁴ Some other dental anomalies, such as impaction, play an effective role in the etiology of different types of malocclusions.⁵ Anomalies affect the occlusion and length of the jaw arch and their identification, particularly in the anterior region in

*This study was funded by Hamadan University of Medical Sciences
Received July 26, 2013; Revised August 12, 2013; Accepted August 16, 2013

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young adults, and hence, are extremely important in the esthetic and orthodontic treatment plan.^{6,7}

Several studies have addressed the prevalence of dental anomalies; however, the results of these studies were inconsistent between and within populations. These differences are a reflection of variations in race, sampling methods, and different diagnostic criteria.⁸⁻¹¹ The genetic basis for these variations has been well demonstrated by a polygenic model of inheritance. The discontinuous distributions of tooth morphology and agenesis are explained by these polygenic traits, which can exhibit phenotypic discontinuity at the end of a continuous distribution.¹²

Previously published studies evaluated a few types or subtypes of dental anomalies among a limited and particular population. However, the current study was conducted to assess the prevalence of all types (position, number, shape, and structure) and subtypes of dental anomalies in patients referred to specialized radiology centers in Hamadan City, in the west of Iran, in 2012-2013.

Materials and Methods

Dental history and panoramic radiographs of 4,000 patients, who visited one of the clinics of maxillofacial radiology in Hamadan City, were reviewed during 2012-2013. Patients with a history of tooth extraction, orthodontic treatment, and cleft lip and palate were excluded. Finally, 1649 patients belonging to the age group of 7-35 years were enrolled. The panoramic radiographs were obtained with Cranex D (Soredex, Helsinki, Finland). The diagnostic dental anomalies were categorized into four types; a) anomalies in shape, including fusion, taurodontism, and dense invagination; b) anomalies in number, including hypodontia, oligodontia, and hyperdontia; c) anomalies of structure, including amelogenesis imperfecta, dentinogenesis imperfecta, and dentin dysplasia; and d) anomalies in location, including transposition, impaction, and dilacerations.

Shape anomalies

Fusion happens in developing teeth and may lead to the combined mass of adjacent teeth becoming one tooth. In general, the size of the interlocking crowns is large.² These teeth have two separate pulp chambers with the same single dentin surface; therefore, the number of teeth will be less than usual.¹ In the case of taurodontism, the tooth trunk is long, while the root is short. Shiffman and Chanannel¹³ developed the criteria for assessing taurodontism. Accord-

ing to their criteria, when the distance between the lowest point of the roof of pulp chamber (point A) and the highest point in the floor of pulp chamber (point B) was divided by the distance between the point A and the root apex of the longest root, the calculated value was above 0.2, or when the distance between the point B and the line that attached the cemento-enamel junction (CEJ) from the mesial to the distal end exceeded 2.5 mm, the tooth was considered to be a taurodont.¹³ In dens invagination, the enamel layer folding was the diagnostic criterion and it was more radiopaque than the surrounding tooth structure; it was seen as a reverse tear such as lucency with a radiopaque border.²

Number anomalies

With respect to the dental age and the time of tooth calcification, the absence of radiopacity of the bud was considered "missing." Missing of one or more teeth was considered hypodontia; that of more than six teeth, oligodontia; and that of one or more supplementary teeth, hyperdontia.^{1,6,7}

Structural anomalies

On the radiographs of dentinogenesis imperfect, tooth reveals normal crown size but bulbous appearance due to the narrowing of the CEJ. In this type of anomaly, the roots are short and thin, and the pulp chamber shows partial obstruction.² Amelogenesis imperfecta has three subtypes, namely hypoplastic, hypomature, and hypocalcified, with specific radiographic appearances. In this study, amelogenesis imperfecta and dentin dysplasia were evaluated irrespective of their subgroups. In dentin dysplasia type 1, the roots of all teeth have changes in form and molar roots are W-shaped or shallow. Pulp chamber is obstructed before eruption and rarefying osteitis is seen in approximately 20 % cases. In type 2, obstruction in the pulp chamber occurs and the root diameter decrease after eruption; the pulp chamber is thistle-shaped or flare-like, and a number of pulp stones are observed. In this type of anomaly, the roots demonstrates normal form and appropriate proportions.² Dentinogenesis imperfecta is an inherited group of disorders that are characterized by the formation of abnormal dentin.¹⁴

Position anomalies

According to the developmental age of the person, tooth is considered to be impacted if the eruptional pathway of

the tooth is blocked by the adjacent teeth, bone, or soft tissue, or if there is no possibility of growing and achieving a functional position, or if the non-erupted tooth root is completed. A change in the location of two adjacent teeth or eruption in an abnormal position considered as transposition. The radiographic deviation from the long axis of a tooth is considered as dilaceration.

In this study, data were collected anonymously from the patients' medical records. The data collection tool was a checklist designed by the researchers. The first part of the checklist was related to the patients' demographic characteristics. The second part of the checklist was related to the radiographic findings of the dental anomalies.

Dental anomalies were evaluated separately and independently by two observers including a radiology resident and an endodontic resident. The reliability between the two observers was estimated to be 79.56% by using the Kappa statistics, which was considered an excellent agreement. The relationship between dichotomous variables was evaluated using a chi-square test. All statistical analyses were performed at the 95% confidence level using the statistical software Stata 11 (StataCorp, College Station, TX, USA).

Results

In this study, 1,649 panoramic radiographs of the eligible patients were studied. The mean age of the subjects was 21.79 years (range: 7-35 years); 624 subjects (38%) were male, and 1,025 (62%) were female. Out of these

1,649 patients, 475 had at least one type of dental anomaly; hence, the prevalence of dental anomaly in the study population was estimated to be 29%. Among the people who had dental abnormalities, 373 subjects (78.53%) had one type of anomaly, 88 (18.53%) had two types of anomalies, and 13 (2.74%) had three types of anomalies. In one subject, four types of anomalies were detected.

The absolute and the relative frequencies along with the prevalence of the different types and subtypes of anomalies among the study population are shown in Table 1. Considering the fact that some people had more than one type of anomaly, a total of 592 dental anomalies were found in the study population. According to these results, the prevalence of the anomalies of shape, number, structure, and location was 3.58%, 8.13%, 0.30%, and 23.89%, respectively. Furthermore, in the case of shape anomalies, the incidence of taurodontism was 3.34%; in the case of number anomalies, the incidence of hypodontia was 5.70%; in the case of structure anomalies, the incidence of amelogenesis imperfecta was 0.24%; and in the case of position anomalies, the incidence of impaction was 16.07%. These were the most common subtypes of anomalies.

The number of anomalies diagnosed among the study population by the types and subtypes of anomalies is shown in Table 2. Considering the fact that some people had 2 or more anomalies, we found that the number of all anomalies diagnosed in the study population was 1,257, of which 18.54% were shape anomalies, 21.56% number anomalies, 0.40% structure anomalies, and 59.51% position anomalies.

The absolute and relative frequency distributions of the

Table 1. Absolute and relative frequency distribution and prevalence of types and subtypes of anomalies among study population

Types and subtypes of anomalies	Frequency	Percent	Prevalence (%) ^a
Shape	59	9.97	3.58
Fusion	0	0.00	0.00
Taurodontism	55	9.29	3.34
Dens invagination	4	0.68	0.24
Number	134	22.64	8.13
Hypodontia	94	15.88	5.70
Oligodontia	0	0.00	0.00
Hyperdontia	40	6.76	2.43
Structure	5	0.84	0.30
Amelogenesis imperfecta	4	0.68	0.24
Dentinogenesis imperfecta	0	0.00	0.00
Dentin dysplasia	1	0.17	0.06
Location	394	66.55	23.89
Transposition	4	0.68	0.24
Impaction	265	44.76	16.07
Root dilaceration	125	21.11	7.58
Total	592	100.00	35.90

^aPrevalence=Number of anomalies/Total population (1649)

types of anomalies by age group and gender are given in Table 3. The results indicated that the prevalence of different dental anomalies varied across age groups ($p=0.001$). Accordingly, the anomalies of shape and number were more common in the age groups of 7-12 years and 13-15 years, while the anomalies of structure and position were considerably more common among the other age groups. Furthermore, the anomalies of position and number were the most common types of abnormalities and the anomalies of shape and structure were the least in both genders.

The distribution of dental anomalies by jaw, and teeth number and side is shown in Table 4. These results suggested that more anomalies occur in the maxilla (54.42%) than in mandible. However, the distribution of dental anomalies on the left and the right sides was similar. This study revealed that dental anomalies were most commonly occurred in the mandibular and maxillary third molars on both sides. Totally, 40 people had at least one or more supplementary teeth. Totally 55 supplementary teeth were diagnosed including 29 fourth molar and 12 mesiodens. In addition, 6 supplementary teeth were diagnosed in maxilla and 8 supplementary teeth in mandible (Table 4).

Discussion

In order to evaluate the prevalence of dental anomalies among 7-35-year-old patients, we used panoramic radiographs. According to our findings, the anomalies of position and number were the most common types of abnormalities and the anomalies of shape and structure were the least common in both genders. Furthermore, the anomalies of impaction, dilacerations, hypodontia, taurodontism, and hyperdontia were among the most common subtype of dental anomalies.

According to our results, the prevalence of dental anomalies diagnosed by panoramic radiographs was approximately 29%. However, the prevalence of dental anomalies as reported by previous studies was inconsistent. The prevalence of dental anomalies was reported to be 28.34%, 73.1%, and 8.40% by Gupta et al in 2011,¹⁴ Guttal et al in 2010,¹⁵ and Ezoddini et al in 2007,¹⁶ respectively. This inconsistency between their results might be attributed to the diagnostic criteria used for identifying and classifying dental anomalies, genetic, and racial factors. Furthermore, the types of anomalies evaluated by those studies might be another reason for this inconsistency since previous studies investigated only a few types of anomalies, not all of them.

Some anomalies, like supplementary teeth, interfere with the normal eruption of other teeth. In addition, there

are some anomalies, such as the impaction of third molars, which can be diagnosed with certainty only in older age. To diagnose all types of anomalies, we considered patients in a wide age range. According to our results, the prevalence of the shape and number anomalies was higher in the younger age groups than in the elderly. This finding was similar to the results reported by Ezoddini et al.¹⁶ They indicated that taurodontism and dens invagination were limited among people less than 20 years of age. On the other hand, the prevalence of position anomalies was more common in older people. These findings could be attributed to third molar impaction. One reason for this might be that root completion occurs at 22 years of age.¹⁷ Since the anomalies of structure were observed only in five cases, we could not state the age-specific distribution of these anomalies.

The most common abnormality reported in our study was impaction (16.07%). Dalili et al,¹⁸ Ezoddini et al,¹⁶ and Ghabanchi et al¹⁹ reported the prevalence of impaction to be 16.6%, 8.3%, and 2.95% in different regions of Iran. This inconsistency might originate from the lack of third molar impaction. In the present study, apart from the third molars, there were only 98 impacted teeth. Other factors could also contribute to the lack of a single definition, clinical judgment, and professional opinion of observers regarding tooth impaction. The most commonly impacted teeth were the third mandibular molars, third maxillary molars, maxillary canines, mandibular canines, and mandibular second premolars. These findings were consistent with the results of previous investigations.^{2,20,21}

Radiographic images have been introduced as the best way to detect tooth dilacerations,² but the small buccal and lingual curvature cannot be observed on radiographs. Dilacerations have been reported as the second most common anomaly in this study (7.58%). The most prevalent teeth with dilacerations were the maxillary second premolar and lateral incisor. The prevalence of dilacerations was reported to be 15% by Ezoddini et al,¹⁶ 1.44% by Ghabanchi et al,¹⁹ and 5.6% by Dalili et al.¹⁸ This inconsistency might be attributed to the settings of these studies as well as the accuracy of the methods and the diagnostic criteria that were used.

According to our results, the prevalence of hypodontia was estimated to be 16.07%, while the results reported by previous studies were inconsistent and varied from 0.15%¹⁵ to 26.1%.⁶ This could be attributed to the fact that, in most studies, missing the third molar was not considered to be hypodontia. Further, it can be inferred that the absence of tooth buds is often controlled by genetic factors. However,

the results might be affected by environmental factors; in fact, in some studies, environmental factors were considered to be the only etiological factors.¹ Missing teeth were mostly observed in the maxillary lateral incisors; this was similar to the findings of a study by Gupta et al in 2011.¹⁴ Then, the mandibular second premolar, that of the maxillary second premolar, and the missing of the third molar in both jaws were the next most common missing teeth.

The prevalence of taurodontism was 3.34% in our study. It was reported to be 5.7% by Ezoddini et al,¹⁶ 1.03% by Ghabanchi et al,¹⁹ and 8.61% by Ghaznawi et al.²² As mentioned above, we used the Shiffman and Chanannel's criteria, while Ghabanchi used Tulensalo's criteria.²³ According to Tulensalo's criteria, if the distance between the line connecting the mesial and distal points of the CEJ to the top point of the pulp chamber floor was more than 3.5 mm, the tooth was considered as a taurodont. The difference in the criteria of taurodontism might be the main reason for this inconsistency.

The prevalence of supplementary teeth was reported to be 0.43% by Guttal et al in 2010¹⁵ among an Indian population. According to the results of two studies performed in Iran, the prevalence of supplementary teeth was estimated to be 2.4%¹⁹ and 3.5%,¹⁶ respectively. It was reported to be 2.7% by another study conducted in Thailand,⁶ while the prevalence of supplementary teeth was estimated to be 2.43% in our study. An autosomal dominant pattern with incomplete penetration in hyperdontia and certain environmental factors were reported to be the influential factors for supplementary teeth.¹ On the basis of our results, we concluded that the fourth molars, mesiodens, and mandibular premolars were the most common supplementary teeth, while in some papers, mesiodens and supplementary teeth in the premolar region have been reported to be the most common ones.^{14,21}

In this study, the prevalence of dens invagination was estimated to be 0.24%, which was considerably less than that reported by Dalili et al in 2013 (10.09%)¹⁸ and by Ghabanchi et al in 2009 (1.44%).¹⁹ One reason that could explain this inconsistency was the difference in the methods used for the diagnosis of this anomaly. In our study, only radiographic evaluation was carried out without a clinical examination; therefore, we could not detect mild dens invaginations that would only be detectable clinically.

In this study, the prevalence of transposition was 0.24%, and it was observed only in the maxillary canine and the first premolar with equal frequency on the left and right sides. This result was consistent with that of previous studies.^{6,24}

In this study, the anomalies of fusion, oligodontia, and dentinogenesis imperfecta were not detected because of the rarity of these anomalies. If the sample size were sufficiently larger, these dental anomalies might have been detected. Despite this weakness, this study had a number of strengths, given as follows: a) All types of dental anomalies that might be detected by panoramic radiographs were evaluated. b) Well-defined dynastic criteria were employed. c) A single radiographic machine was used to increase the reliability of the diagnosis.

Since the prevalence and the types of anomalies vary within and between populations, knowledge about the types of anomalies and their prevalence by age, gender, and jaw can help clinicians perform a better diagnosis of dental anomalies at early stages, particularly in the anterior region in young adults and in planning timely treatment measures.

In conclusion, positional anomalies were the most common types of dental anomalies and structural anomalies were the least in the Iranian population in our study. The frequency and the types of dental anomalies have varied among different populations analyzed, confirming the role of racial factors in the prevalence of dental anomalies.

Acknowledgments

We would like to thank the Vice-Chancellor of Research and Technology, Hamadan University of Medical Sciences, who approved this study.

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