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Prevalence of dental developmental anomalies: a radiographic study.

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Objectives To determine the prevalence of developmental dental anomalies in patients attending the Dental Faculty of Medical University of Yazd, Iran and the gender differences of these anomalies. ***Design*** A retrospective study based on the panoramic radiographs of 480 patients. Patients referred for panoramic radiographs were clinically examined, a detailed family history of any dental anomalies in their first and second degree relatives was obtained and finally their radiographs were studied in detail for the presence of dental anomalies. ***Results*** 40.8% of the patients had dental anomalies. The more common anomalies were dilaceration (15%), impacted teeth (8.3%) and taurodontism (7.5%) and supernumerary teeth (3.5%). Macrodontia and fusion were detected in a few radiographs (0.2%). 49.1% of male patients had dental anomalies compared to 33.8% of females. Dilaceration, taurodontism and supernumerary teeth were found to be more prevalent in men than women, whereas impacted teeth, microdontia and gemination were more frequent in women. Family history of dental anomalies was positive in 34% of the cases.. Taurodontism, gemination, dens in dente and talon cusp were specifically limited to the patients under 20 year's old, while the prevalence of other anomalies was almost the same in all groups. ***Conclusion*** Dilaceration, impaction and taurodontism were relatively common in the studied populaton. A family history of dental anomalies was positive in a third of cases.

Key words: Developmental dental anomalies, family history, panoramic radiography, prevalence.

Introduction

The factors leading to developmental abnormalities can be either genetic factors such as inheritance, metabolic and mutations or environmental factors including physical, chemical, environmental and biological factors. It is also possible that some of these anomalies are caused by a combination of both genetics and environmental factors (White and Pharoah, 2004). During recent years researchers recognized a growing number of genes that have been linked with early tooth morphogenesis. So far, all these genes have developmental regulatory functions in other organs also. The majority of them are linked with the signaling pathways transmitting interactions between cells and tissues. Mutations in several of these genes in humans have been identified as causes of dental anomalies, mainly hypodontia (Thesleff, 2000). Detailed study of these anomalies seems essential as they can lead to malocclusion, cosmetic deformities, and problems during tooth extraction or root canal treatment. In order to diagnose these anomalies, in addition to clinical observations and examinations, paraclinical investigations such as radiography are essential and play an important role in the differential diagnoses of these anomalies (White and Pharoah, 2004). Some of the evolutional growth anomalies are the following: Alteration in number of teeth, extra or supernumerary teeth, dens in dente, dilaceration, taurodentism, malformations, germination and alterations in size of teeth (Arte *et al*, 2001). These anomalies may occur in combination with other anomalies and even some of them such as taurodontism are considered to be a marker of underlying genetic disease.

The prevalence of these anomalies in different populations and ethnic groups were the subject of several studies. In 1994 Bruce *et al* examined the panoramic radiographs of Black children and found that 4.4% had congenitally missing teeth and 1.5% had supernumerary teeth. Odontomas, germination, fusion and dentinogenesis imperfecta all had less than 1% prevalence. Supernumerary teeth and odontomas was significantly higher in Blacks than in Caucasians. Ooshima *et al* (1996) conducted a survey of 905 Japanese children with primary dentitions (mean age of 4.7 years), and 745 high school students with permanent dentitions (mean age of 16.8 years), and found that microdontia and Carabelli's tubercle were more common in primary dentitions, while peg shaped teeth and talon cusps were more common in permanent dentitions. Thongudomporn and Freer (1998) reported that 74.77% of their subjects had at least one anomaly. The most prevalent anomaly was invagination, while supernumerary teeth and root dilacerations were the least frequent anomalies. Short roots and dental invagination were significantly more frequent in women than men. Later, Cholitgul and Drummond (2000) reported a 21% prevalence of jaw and dental anomalies in the panoramic radiographs of 1607 children and adolescents aged between 10 and 15 years in New Zealand. The most frequent findings were malpositioned, missing and misshaped teeth. Backman and Wahlin (2001) detected one morphological anomaly in 18% and more than one

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anomaly in 8% of the Caucasian children aged 7 years in North Sweden by clinical and radiological examination. Their data indicated that the prevalence of hypodontia, excluding the third molar was 7.4% and the prevalence of hyperdontia was 1.9%. The genetic hypothesis for the high prevalence of morphological anomalies in the population under study was not verified. These morphological anomalies such as dilacerations, impacted teeth and Taurodontism usually lead to teeth

extraction which have an effect on the arch of the mandible and alignment of the other teeth and results in teeth dysfunction. The present study was performed to determine the prevalence of evolutional and morphological growth anomalies in Yazd province of Iran and to examine the value of panoramic radiographs in detecting these anomalies.

Materials and Methods

A total of 480 cases (220 males and 260 females) were selected from the patients referred to the Oral Radiology Department of the Dental Faculty of Yazd. The patients were examined clinically followed by a panoramic radiograph which were taken by Plan meca EC Proline (Helsinky, Finland) with the maximum KVP of 80, mA=12 and Sec=18 in the Department of Oral and Maxilofacial Radiology, Yazd Sental School. The radiographic films were studied by a dentist (H. Ahmadi) by direct observational method using a view box.

Patients were divided into different age groups and each group was evaluated separately. After careful comparison we found out that the best cut-off point to evaluate the possible effect of intervention by the dental service in Iran is 20 years old. From the total of 480 patients, 250 were under 20 years old and 230 were over 20 years old.

In order to reduce radiographic misinterpretation, two oral radiologists carefully studied the findings and verified them. The diagnosis and inclusion criteria for these anomalies were made on the basis of the descriptions presented by White and Pharoah (2004). For example; macrodontia was defined when the radiograph revealed the increased size of both erupted and unerupted macrodont teeth and taurodontism was described as an extension of the rectangular pulp chamber into the elongated body of the tooth in the radiograph.

Finally, any history of dental anomalies in the patients' first and second degree relatives was carefully studied with a similar procedure to the patients.

For statistical analysis all the data were analyzed using Chi-square and Fisher exact test.

Results

Of 480 cases, in 196 patients (40.8%) at least one dental anomaly was detected,. Anomalies were found in 49.1% of males compared with 33.8% of females. Dilacerations was the most prevalent dental anomaly (15%), followed by impacted teeth (8.3%) and taurodontism (7.5%) (Table 1) Macrodontia and fusion with 0.2% prevalence were the least common anomalies. Taurodontism, dilacerations and supernumerary teeth were more common in men, while impacted teeth, microdontia and gemination were more common in women The prevalence of dental anomalies was higher in patients under 20 years compared with those over 20 years (46.8% vs. 34.4%). Taurodontism, gemination, dens in dente and talon cusp were specifically seen in patients younger than 20 years of age, while the prevalence of other anomalies was almost the same in both age groups (Table 2). A positive family history of dental anomalies was recorded in 34% of the patients (Table 3).

Discussion

Morphological dental anomalies are relatively common. These anomalies are related to genetics and environmental factors. The simultaneous occurrence of these anomalies may be genetically determined and can be associated with specific syndromes (Hattab *et al,* 1995). Molecular genetic studies have revealed that mutations in the genes of the signaling networks cause a diversity of human craniofacial anomalies (Thesleff, 1998). There have been several studies investigating the prevalence of morphological and growth dental anomalies. Different prevalences were reported in different ethnic groups. Some of these anomalies such as dental root anomalies have a specific radiographic view. Panoramic radiography is a radiological technique for producing a single image of the facial structure, including both the maxillary and mandibular dental arches and their supporting structures. It has many advantages such as; the broad coverage of teeth, low patient radiation dose, and the short development time. The early recognition of dental anomalies is important from the therapeutic point of view. In addition there are many complications with these anomalies and early detection of them is most important if such complications are to be avoided. There is a growing emphasis in developed countries for early orthodontic treatment but in Iran there is not much concern in this regard. The purpose of this study was to assess the prevalence of numerical and morphological dental anomalies in our population and to determine the need for preventive and interceptive intervention for such anomalies. In addition, our goal was to verify if there are any genetically determined different prevalences in our cases compared with other studied populations. The present data indicated that the prevalence of some dental anomalies in our population is similar to those reported in the other studies while some other studies reported different rates. For example, the prevalence of taurodontism in the present study (7.5%) was the same as in Jordan (8%) reported by Darwazeh *et al* (1998). Similarly, our data showed the prevalence of 0.8% for dens invaginatus and 0.2% for fusion and germination, which were the same as these rates (0.65% and 0.19-0.22%) in a Jordanian population (Hamasha and Almoari, 2004 and Hamasha and Al-Khateeb, 2004). As the prevalence of tauradontism in our study was also similar to the Hamasha and Al-Kateeb (2004) study, it can be concluded that the prevalence of dental anomalies in these two populations is relatively the same. One of the reasons could be the genetic similarity between two populations under study. On the other hand, in the present study the prevalence of dilacerations was 15% which is significantly higher than the incidence of 3.78% reported by Hamasha *et al* (2002) in Jordan. This lower

Table 1. Prevalence of anomalies in population under study according to gender

Type of anomaly	*Male (n=220)* *Number (Percent)*	*Female (n=260)* *Number (Percent)*	*Total (n=480)* *Number (Percent)*	*p-value*
Dilaceration	47 (21.4%)	25 (9.6%)	72 (15%)	0.000*
Impacted teeth	16 (7.3%)	24 (9.2%)	40 (8.3%)	0.268
Taurodontism	22 (10%)	14 (5.4%)	36 (7.5%)	0.056
Supernumerary teeth	11 (5%)	6 (2.3%)	17 (3.5%)	0.112
Microdontia	2 (0.9%)	10 (3.8%)	12 (2.5%)	0.040*
Gemination	4 (1.8%)	6 (2.3%)	10 (2.1%)	0.76 F
Dens in dente	2 (0.9%)	2 (0.8%)	4 (0.8%)	1 F
Talon cusp	3 (1.4%)	0	3 (0.6%)	0.096 F
Fusion	1 (0.5%)	0	1 (0.2%)	0.458 F
Macrodontia	0	1 (0.4%)	1 (0.2%)	1 F
Number of patients	108 (49.1%)	88 (33.8%)	196 (40.8%)	

*: statistically significant, F= Fisher exact test

Table 2. Prevalence of anomalies in population under study according to age

Type of anomaly	*under 20 years (n=250)*		*Above 20 years (n=230)*		*p-value*
	Number	*Percent*	*Number*	*Percent*	
Dilaceration	31	12.4	41	17.8	0.096
Impacted teeth	19	7.6	21	9.1	0.544
Taurodontism	36	14.4	0	0	0.000*
Supernumerary teeth	8	3.2	9	3.9	0.673
Microdontia	5	2	7	3	0.464
Gemination	10	4	0	0	0.002* F
Dens in dente	4	1.6	0	0	0.125 F
Talon cusp	3	1.2	0	0	0.25 F
Fusion	1	0.4	0	0	1 F
Macrodontia	0	0	1	0.4	0.479 F
Number of patients	117	46.8	79	34.3	

*: statistically significant, F= Fisher exact test

Table 3. Family history of dental anomalies in the patients.

Type of anomaly	Family history		
	Positive (n=66) Number (Percent in anomaly)	Negative (n=130) Number (Percent in anomaly)	Total (n=196) Number (Percent in total patients)
Dilaceration	16 (22.3%)	56 (77.7%)	72 (43.9%)
Impacted teeth	16 (40%)	24 (60%)	40 (20%)
Taurodontism	10 (27.7%)	26 (72.3%)	36 (19%)
Supernumerary teeth	7 (41.2%)	10 (58.8%)	17 (8.8%)
Microdontia	7 (58.3%)	5 (41.7%)	12 (7.3%)
Gemination	6 (60%)	4 (40%)	10 (5.1%)
Dens in dente	2 (50%)	2 (50%)	4 (2%)
Talon cusp	2 (66.6%)	1 (33.4%)	3 (1.5%)
Fusion	0	1	1 (0.5%)
Macrodontia	0	1	1 (0.5%)
Number of patients	66 (34%)	130 (66%)	196

rate in the above study could be due to using periapical radiographs instead of panoramic radiographs.

Taurodontism is an important finding which demands special attention during dental treatment. There have been several studies reporting the prevalence of taurodontism. Sarr *et al* (2000) performed a study in Senegal, where the prevalence of taurodontism was studied using panoramic radiographs of the first and second molars of 150 cases aged between 15 and 19 years. Taurodontism was present in 48% of their cases. The prevalence was much higher than 7.5% detected in the present study. However taurodontism was seen only in less than 20 year old patients in our study (14.4%). Schalk *et al* (1993) examined panoramic radiographs of oligodontia patients and reported that 28.9% had taurodontism, whereas the prevalence of taurodontism in normal subjects was 9.9%. Findings supported the hypothesis that taurodontism could be the result of an ectodermal defect and an evolutional presentation in oligodontia patients. The different results in different studies may arise from racial differences or differences in the type, method and place of study. Varying definitions of dental anomalies may also account for different results. Constant and Grine (2001) studied the prevalence and degree of taurodontism in mandibular permanent molars of two South African population groups (Zulus and Khoisans). The findings in Zulus were similar to those reported for modern populations, but the prevalence in Khoisons was much higher. Laatikainen *et al* (1996) studied the prevalence of taurodontism in the first and second permanent molars of identical and nonidentical twins with cleft lips and palates. In 91% of the cases, taurodontism was symmetrical, which suggests that it can have a genetic background. In the present study, of the 36 cases with taurodontism, 85% was symmetrical, suggesting a genetic background.

In the present study, the second most frequent anomaly was impaction with a prevalence of 8.3%, which can have a relationship with other anomalies as was shown by Leiferts and Jonas (2003).

In a study by Liu and Sew (1995) on Taiwanese patients, the prevalence of supernumerary teeth in men was three times more than that in women. Gabris *et al* (2001) reported a prevalence rate of 1.92% for supernumerary teeth. The most frequently supernumeries were the mesiodens followed by the lateral and central incisors. Similarly Kim and Lee (2003) reported the prevalence of 0.15%-1% for mesiodens being higher in boys than girls. The present study found that the prevalence of supernumerary teeth was 3.5%, occurring more often in males than females, and the mesiodens were the most frequently found supernumerary which agrees with previous reports.

Mavrodisz *et al* (2003) reported the prevalence of 2.5% for talon cusp in patients aged between 7 and 18 years;the prevalence in men was higher than that in women. It was concluded that early diagnosis of this anomaly is important for successful treatment, especially for placement of sealant and periodic reduction of the cusp. In the present study, the prevalence of talon cusp was 1.2% in the age group under 20 years old which is slightly lower than the above study and all of them were detected in men.

Ooshima *et al* (1996) showed that the prevalence of macrodontia, microdontia and Carabelli's tubercle were more frequent in primary teeth, while the prevalence of peg-shaped teeth was more frequent in permanent teeth. Similar results were found in the present study except that macrodontia was seen in only one case in the 20-29 years age group.

Conclusion

Our data show that the prevalence of anomalies is more frequent in patients younger than 20 years old. In fact, some of the dental anomalies such as dens in dente, dens invagination, supernumerury and so on, are extracted before the age of 20 because of orthodontic or endodontic treatment. The results of this study were similar to the results of the other studies, while some differences were seen in certain aspects, which could be due to the differences in the sample selected, method and place of study, as well as racial and genetic differences. It is felt that more studies with larger samples in different age groups and taking into consideration factors such as family history are needed in the future in order to specifically determine the causes of various evolutional and morphological dental anomalies.

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