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Evaluation of the Prevalence of Dental Anomalies Among Children Through Panoramic Radiographs for Five Years in Ahvaz, Iran

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Abstract

Background: Malocclusions, cosmetic problems, some problems linked to tooth extraction and root canal treatment, and other diseases of the mouth and teeth can occur as a result of dental anomalies (DAs).

Objectives: The present research was conducted to determine the prevalence of DAs through panoramic radiographs of children in Ahvaz, Iran, in five years (2018 - 2022).

Methods: In this descriptive-cross-sectional study, 1000 panoramic radiographs were selected from the archives of the Radiology Department of Ahvaz Dental School and other radiology centers of the city related to children in the age group of 5 - 12 years. A pediatric dental assistant and a pediatric dental specialist evaluated them for the presence of DAs based on Lam's (2014) criteria and definitions. The frequency of DAs was reported based on numbers and percentages. Finally, the raw results were analyzed using the chi-square test and Student's *t*-test at the significance level of $\alpha = 0.05$ by SPSS software version 25.

Results: The results showed that only 150 (15%) patients had at least one DA and 850 (85%) had no DAs. Most DAs were related to dental missing (4.2%), dental transposition (2.9%), and ectopic growth (2.2%). The frequency of dental missing (71.4% vs. 28.6%) and dental transposition (72.4% vs. 27.6%) in boys were significantly higher than in girls. The frequency of DAs missing teeth in the lower jaw (61.9%) was significantly more than in the upper jaw (38.1%).

Conclusions: Anomalies of missing teeth, transposition, and ectopic growths are among the most common anomalies in Ahvaz children, but the anomalies of microdontia, tooth displacement, dens evaginates, and dentinogenesis imperfect were rare DAs among them. As the prevalence of DAs in Ahvaz children is estimated to be high, early diagnosis and treatment of this complication are suggested as a means to prevent complications.

Keywords: Dental Anomalies, Children, Panoramic Radiographs, Dental Tissue Deviations, Ahvaz

1. Background

The difference in the pattern of the dental system of people of different societies is significant for dentists. Dental anomalies (DAs) include differences in tooth morphology, position, number, or related pathologies, the presence of which causes disturbances in tooth growth, formation of jaw arch, or occurrence of malocclusion. Dental anomalies include dental changes based on number (agenesis, missing and extra teeth), size (microdontia, microdontia), morphology (tarantism, fusion, gemination, dilation, dens in dent, dens evagination), growth pattern (ectopic, delayed growth, growth early, displacement), structures or pathological processes (periapical lesions, pathological analyzes, and cysts) (1). Diagnosis (pre-eruptive caries, amelogenesis imperfecta, and odontogenesis imperfecta) during DAs is essential because of their role in causing orthodontic and maxillofacial anomalies (2, 3). In the absence of treatment, DAs lead to malocclusions, cosmetic problems, and problems during tooth extraction and root canal procedures and lay the foundation for other dental diseases (2).

Imaging plays an essential role in the diagnosis of oral and dental health treatment for adults and children. Panoramic radiographs are prescribed for patients due to their appropriate acceptance by the patient, their non-invasive nature, and the preparation of clinical data (4). Radiographs are used to observe pathologies in the mouth, jaw, and face, as well as

evaluate dental development and treatment plans. Panoramic radiographs are helpful in screening DAs, evaluating dental development, and planning treatment (3).

Some research has been performed about the prevalence of DAs in different societies (5-8). There is no doubt that the results of research conducted in specific societies can only be generalized in those societies, and each society should report its particular results. The differences can be justified and explained through genetic factors as well as racial and environmental differences in each society (7).

Evaluating cases such as the prevalence of DAs in both sexes and different age groups is essential to increase the awareness of researchers and professionals (9). The results of these studies can help the therapist in the early stages of anomaly diagnosis. Dental anomalie prevalence in Iranian society can play an essential role in guiding radiologists and pediatricians on how to prioritize diagnoses as a result of a lack of domestic studies. Evaluating the epidemiology aspects of these problems, the nature of these anomalies, and their etiology will help to understand the patterns of the disease, reduce the discomfort caused by the disease (morbidity), and treat and manage them in time.

2. Objectives

The main goal of this research was to determine the prevalence of DAs through the evaluation of panoramic radiographs available in Ahvaz radiology centers between 2018 and 2022. The studied DAs included extra teeth, congenital absence of teeth, impacted teeth, odontoma, radicular cyst, fusion, gemination, ectopic growth, and previous caries.

3. Methods

The present research was conducted using descriptive and cross-sectional methods in which 1000 panoramic radiographs were selected from the archives of the radiology department of Ahvaz Dental School and other radiology centers of the city related to children in the age group of 5 - 12 years. According to Lam (2014), two people were evaluated for DAs using the criteria and definitions provided by pediatric dental assistants and pediatric dental specialists (10).

The evaluated variables in the present study included age, sex, type of jaw, and type of DAs. DAs in the present study are divided based on the number of teeth (lack of teeth or extra teeth), tooth size (macrodontia or microdontia), growth pattern (dental recession, tooth displacement, transposition or ectopic growth), morphology (tarantism, gemination, fusion, dilaceration, dens in dent or dens evaginates) and structure (amelogenesis imperfecta or dentinogenesis imperfecta).

Dens evaginatus is a cusp-like projection of enamel on the tooth crown while dens invaginatus is an inversion or enfolding of enamel into the crown, sometimes extending beyond the CEJ or into the root (10, 11). Dens evaginatus is usually found in the central groove or on the lingual ridge of the buccal cusp of a molar or premolar tooth. Most often, the mandibular premolar teeth are involved bilaterally. This extra cusp or tubercle is composed of enamel and dentin, and in many instances pulp tissue as well. This particular anomaly occurs in less than 5% of the population, most commonly in Native American, Asian, and aboriginal racial groups. Exposure and necrosis of the pulp can result from cuspal wear or fracture. As discussed, dens evaginatus is an external outcropping of tooth structure in contrast to dens invaginatus, an internal involution of tooth structure (10, 11).

SPSS software (statistical package for social sciences) version 25 was used for data analysis. In the descriptive field, frequency and percentage indicators were used to report the prevalence of each of the DAs in general and separately by jaw and sex. In addition, mean and standard deviation indicators were used to report age in people with and without DAs. In the inferential field, the chi-square test was utilized to compare the frequency of DAs separately for each anomaly (DA) or, in general, according to the type of jaw and gender of the patients. Moreover, the Student's *t*-test was applied to compare the average age in groups with and without DAs. Both statistical tests were used at a significance level of $\alpha = 0.05$.

4. Results

A total of 1000 panoramic radiographs were examined, among which 150 (15%) had at least one dental anomaly and 850 (85%) had no anomalies. Among DAs, missing (4.2%), transposition (2.9%), and ectop (2.2%) were the most common DAs in this study. After that, supernumerary (1.2%), taurodontism (0.8%) and fusion (0.7%) were ranked respectively. The frequency of displacement and dentinogenesis imperfecta in the present study was zero. Table 1 shows the prevalence of DAs by gender, revealing that the prevalence of missing in the boys' group (71.4%) was significantly higher than in the girls' group (28.6%) ($P < 0.001$). In addition, the prevalence of transposition in the boys' group (72.4%) was significantly higher than in the girls' group (27.6%) ($P < 0.001$). The prevalence of DAs by jaw (upper and

lower) can be seen in Table 2. The results of this study showed that the prevalence of missing DA- in the lower jaw (61.9%) was significantly higher than in the upper jaw (38.1%) ($P < 0.05$). In addition, all the cases (100%) related to some DAs, including supernumerary ($P < 0.001$) and dens in dent ($P < 0.05$), were observed significantly more in the upper jaw than in the lower jaw. On the other hand, the prevalence of DA-dilacerations in the lower jaw (100%) was significantly higher than in the upper jaw (0%) ($P < 0.05$). Further, no significant difference was observed in other classifications of DAs between the two groups ($P < 0.05$). The average age of the participants in the study was (8.0 ± 2.59) years. The results obtained in none of the groups showed a significant relationship between age and type of anomaly ($P < 0.05$) (Table 3).

The incidence of radiolucency in boys and girls was similar. Out of 10 observed radiolucency, five people (50%) were boys and five people (50%) were girls. In addition, the frequency of observing this pathology in the upper and lower jaws was the same (five upper jaws and five lower jaws). The age of people in whom radiolucency was observed (7.20 ± 3.97) was lower than the age of other people (8.00 ± 2.95). However, this difference was not significant ($P < 0.05$) (Table 4).

Table 4. The Frequency of Radiolucency Status Based on Sex and Age of Children [a]

Variables	Frequency of Radiolucency Status		P
	Yes	No	
Sex			> 0.05
Boy	5 (50)	424 (42.7)	
Girl	5 (50)	568 (57.3)	
Age	7.30 ± 2.97	8.2 ± 0.95	> 0.05

[z] Abbreviations: S.D; standard deviation, P; P-value for statistical analysis; N, number.

[a] Values are expressed as No. (%) or mean ± SD.

5. Discussion

Out of 1000 panoramic radiographs, at least one dental anomaly was observed in 150 (15%) patients, and the prevalence of DAs was 15%. The highest prevalence of DAs was related to missing teeth (4.2%), tooth displacement (2.9%), ectopic growths (2.2%), extra teeth (1.2%), tarodontism (0.8%), fusion (0.7%), dens in dent (0.6%), amelogenesis imperfecta (0.6%), microdentia, gemination, dilaceration (0.4%), dental impaction (0.3%), macrodentia and dens evaginatus (0.1%). In addition, there was no simultaneous case of displacement and dentigenesis imperfecta in the samples.

Similar to the present study, other studies have been conducted that have different results. Arya et al. surveyed the prevalence of DAs through the evaluation of archived panoramic radiographs in a private radiology center in Bushehr, Iran. The findings of the mentioned study showed that out of all 4962 radiographs, 18.40% had at least one dental anomaly, and the anomalies were dens in dent (10.3%), absence of teeth (3.35%), and impingement (2.64%) had the highest prevalence (12). In Khodadadi et al., the frequency of jaw lesions in panoramic radiographs of 5 - 12-year-old children living in the north of the country showed that 18.8% of all 1000 panoramic images had evidence of jaw lesions (13). In another study, Namdar et al. evaluated 510 panoramic images of patients referred to a private practice in Sari, Iran, and reported the frequency of DAs as 26.65%. In this study, the highest finding was related to the impacted tooth (19.6%), and the lowest finding was related to dilacerations (0.39%) of the tooth root (14). Mohan et al. examined 581 panoramic radiographs of American patients with an age range of 6-19 years, and the results showed that 74% of patients had at least one case of DA (15). In the study of 1200 panoramic images of orthodontic patients with an age range of 7 - 17 years in Greek people by Pallikaraki et al., the prevalence of DAs was observed in 16.92% of people. In addition, in the mentioned research, oligodontia was the most common type of anomaly (6.4%), and the extra tooth was the least common (1%) (16). Wagner et al. evaluated the frequency of DAs in 512 young people and showed that 61.3% of the cases had at least one type of DA. In addition, the most common DAs in the research mentioned above included radicular dilacerations (38.1%), permanent tooth agenesis (29.3%), extra teeth (6.4%), and impacted teeth (6.4%) (17).

Baron et al. also evaluated the prevalence of DAs in 551 French patients' candidates for orthodontic treatments and showed that 45.7% of cases had at least one type of DA, and tarodontism (15.06%) and ectopic growths (11.43%) were the most common types of DA (18). Moreover, the prevalence of DA in 1050 panoramic images of Australian children by Dang et al. was evaluated and showed that 5.14% of patients had at least one type of DA, and agenesis was recorded in 4.28%, impaction in 0.6%, and extra teeth in 0.28% of the samples (19). Yassin investigated the prevalence of DAs among 1252 Saudi children and showed that 25.39% had DA. In the mentioned research, some DAs, including hypodontia (9.7%) and hypodontia (3.5%), were in the next categories after DAs related to the number of teeth.

Table 3. Investigating the Average Age of Children with Anomalies in Different Anomaly Groups [a]

Variables	DAs		Age	P
DA-Number	Missing	Yes	8.26 ± 2.54	> 0.05
		No	7.99 ± 2.59	
	Supernumerary	Yes	7.16 ± 2.51	> 0.05
		No	8.01 ± 2.59	
DA-Size	Macrodontia	Yes	12.0 ± 2.59	> 0.05
		No	7.99 ± 2.59	
	Microdontia	Yes	7.5 ± 2.08	> 0.05
		No	8.0 ± 2.59	
DA-pattern of growth	Impaction	Yes	6.66 ± 3.05	> 0.05
		No	8.0 ± 2.59	
	Displacement	Yes	-	> 0.05
		No	8.0 ± 2.59	
	Transposition	Yes	8.3 ± 2.60	> 0.05
		No	7.99 ± 2.59	
	Ectop	Yes	7.0 ± 2.52	> 0.05
		No	8.02 ± 2.58	
DA-morphology	Taurodontism	Yes	7.87 ± 2.74	> 0.05
		No	8.0 ± 2.59	
	Gemination	Yes	7.00 ± 2.58	> 0.05
		No	8.00 ± 2.59	
	Fusion	Yes	8.71 ± 1.97	> 0.05
		No	7.99 ± 2.60	
	Dilaceration	Yes	7.50 ± 3.69	> 0.05
		No	8.0 ± 2.59	
	Dens in dent	Yes	8.66 ± 2.73	> 0.05
		No	8.0 ± 2.59	
	Dens evaginatus	Yes	10.0 ± 2.59	> 0.05
		No	7.97 ± 2.59	
DA-structure	Amelogenesis imperfec	Yes	8.83 ± 3.92	> 0.05
		No	7.99 ± 2.58	
	Dentingenesis imperfecta	Yes	-	> 0.05
		No	8.00 ± 2.59	
	Pre.fruptive carries	Yes	10.0 ± 1.73	> 0.05
		No	7.99 ± 2.59	

[z] Abbreviations: DAs, dental anomalies; DA, dental anomaly; P, P-value for statistical analysis.

[a] Values are expressed as mean ± SD.

The findings of the mentioned study showed that the rarest DAs were dentinogenesis imperfecta (20). In another study, the prevalence of DAs among Brazilian children aged 5 - 12 by de Marsillac et al. was reported as 11.72% and the prevalence of anodontia and extra teeth were estimated as 4.63% and 3.31%, respectively (21). Furthermore, the prevalence of DAs for the predominantly black pediatric population in the United States included 4.4% for congenitally absent teeth, 1.49% for supernumerary teeth, 0.26% for dentinogenesis imperfecta, 0.44% for odontoma, 0.22% for germination, and 0.12% for fusion (22). In another study on American children with an age range of 3 - 9 years by Ignelzi et al., 2.4% of patients had extra teeth, 7.8% had permanent tooth loss, 9.1% had ectopic growths, 0.1% had facial radiolucencies, and 0.1% had facial radiopacities (23). On the other hand, in Ezoddini et al., the prevalence of DAs in 480 people referred to Yazd Faculty of Dentistry, Iran, was estimated as 40.8%, and the most common DAs were dilaceration, missing teeth, and transposition (24). Haghanifar and Rokouei reported the prevalence of DAs in 8018 individuals who referred to private clinics as 28.06% (25). In Lagana et al., 4706 people aged 8 to 12 years were referred to a radiology center in Rome, Italy,

and the prevalence of DAs was also reported at 20.8% (26).

The reason for the difference in the findings of various studies could be related to the condition of the evaluated radiographs, not considering the hidden teeth and the evaluation method of DAs in different studies. However, the results of studies describing the prevalence of DAs are not comparable. In other words, the differences between the desired statistical communities in terms of age, race, population size, and other things, as well as differences in radiographic criteria, cause differences in the results. The difference in panoramic devices and the difference in the radiation angle of the device are also other factors that result in different results (27). In some studies, deciduous tooth samples are not separated from permanent tooth samples, which is also influential in the difference in the prevalence of DAs. In general, the three influential factors are genetic, individual, and study factors in the results of related research influencing people from different countries (18, 28).

The findings of the present research showed that three common types of DAs included missing teeth (4.2%), dental transposition (2.9%), and ectopic growths (2.2%). Congenital missing teeth are a state in which teeth have not erupted and cannot be seen in radiography. As a rare condition, this phenomenon is of particular importance due to its effect on the chewing system as well as on the beauty of the person in terms of psychological effects, especially in the anterior areas (29). The etiology of dental transposition has been evaluated in some research, and various hypotheses, such as canine migration due to the presence of mechanical obstacles or displacement of dental appendages, have been proposed in this regard (30, 31). On the other hand, genetic etiology has also been reported for this complication (32). Trauma to deciduous teeth has also been proposed as one of the possible causes of dental transposition (33).

The type of anomaly ranked third in the present study was ectopic growths. The prevalence of ectopic growth in previous research has been different from 0.7% to 7.9% (7, 8). Yassin reported that the prevalence of this anomaly in Saudi Arabian children was 2.3% (20). According to the present research, the rarest DAs were related to macrodentia (0.3%) and dens evaginatus (0.1% each), while no cases of displacement and dentigenesis imperfecta were seen in the samples. Baradaran Nakhjavani et al., in the investigation of Iranian samples, did not observe any cases of extra tooth anomalies, transposition, and fusion, and these findings are different from the results of the present research (34). In addition, Bruce et al. identified dens in dent anomaly in only one person in examining the prevalence of DAs in young American and black patients (22). In Yassin's research on Saudi Arabian samples, the rarest anomalies included dentinogenesis imperfecta (0.3%) and amelogenesis imperfecta (only one case) (20). In the study of Baron et al. on French samples, no case of dens evaginatus was observed (18).

According to this research, the frequency of missing teeth (71.4% vs. 28.6%), dental transposition (72.4% vs. 27.6%), and total DAs (59.2% vs. 40.8%) were higher in boys than girls. In other DAs, no significant differences were observed between the two groups. In some studies, the prevalence of DAs was higher in boys (19, 24, 35), and at the same time, the prevalence of DAs in girls was reported to be higher than in boys in some studies (28, 36).

In the present study, there were no significant differences regarding age in the groups with and without different DAs. In Bayati et al., which evaluated the panoramic radiographs of Iranian patients, there was no significant relationship between DA type and age (37).

In general, the prevalence of DAs in the lower jaw is significantly higher than in the upper jaw (52.3% vs. 47.6%), and the prevalence of missing anomalies in the lower jaw (61.9%) is significantly higher than in the upper jaw (38.1%) was reported. On the other hand, supernumerary and dens in dent anomalies in the upper jaw were significantly more than in the lower jaw, and dilacerations were observed only in the lower jaw. Goya et al. reported the highest number of anomalies involving teeth in the lower jaw and also reported a higher and significant prevalence of missing incisor teeth in the lower jaw (18.82%) in investigating the prevalence of hypodontia of permanent teeth in patients of Japanese race (6). On the other hand, Bayati et al., in a study on Iranian society, observed a significant relationship between the type of anomaly and the involved jaw (37), which is somewhat consistent with the results of the present study.

5.1. Limitations

As in some similar studies in the past, in the present study, the researchers were not able to separate the deciduous tooth samples from the permanent type samples, which was one of the limitations of the present study. In addition, considering that the demographic factors in the present study are not the same as those in other similar studies, the reasons for the difference in

the prevalence of DAs in this study from other similar studies cannot be readily determined.

5.2. Conclusions

Based on the findings, only 150 (15%) patients had at least one DA, and 850 (85%) had no DA. Anomalies of missing teeth, transposition, and ectopic growths are common DAs in Ahvaz children, but anomalies of microdontia, tooth displacement, dens evaginates, and dentinogenesis imperfections were rare DAs in them. The frequency of tooth loss, tooth transposition, and total DAs were higher in boys than in girls, while in other DAs, no significant differences were observed between the two groups. In general, the prevalence of DAs in the lower jaw was significantly higher than in the upper jaw, and the prevalence of missing anomalies in the lower jaw was significantly higher than in the upper jaw. On the other hand, supernumerary anomalies and dens in a dent in the upper jaw were significantly more than in the lower jaw, and dilacerations were observed only in the lower jaw. In the present study, no significant differences were observed regarding age in the groups with and without different DAs. Considering that DAs can cause many problems in terms of function and beauty for patients, it is necessary to plan and take effective measures for their timely diagnosis, prevention, and treatment in the studied communities. Routine examinations through panoramic radiographs following the initial clinical examination can be helpful in patients, especially children. All dentists and specialists are encouraged to prescribe panoramic radiography for children due to its valuable role in diagnosing ADs and pathologies.

Footnotes

Authors' Contribution: M.R. A. and S.A., writing original draft, writing review &amp, editing; M.K.; supervision, investigation, methodology and project administration.

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References

1. Chauhan RB, Shah TV, Shah DH, Gohil TJ, Oza AD, Jajal B, et al. An overview of image processing for dental diagnosis. *Innov Emerg Techno*. 2023;**10**. https://doi.org/10.1142/s2737599423300015.
2. Abdulrahman BI, Aldahmash AM, Alghamdi HH, Alghamdi AH, Hamad TAB, Ruished AF. Prevalence of Dental Anomalies among Patients Visiting the Riyadh Elm University Clinics. *Ann Dental Specialty*. 2023;**11**(2):40-5. https://doi.org/10.51847/4wajSjZRu8.
3. Prado HV, Soares ECB, Carneiro NCR, Vilar ICO, Abreu LG, Borges-Oliveira AC. Dental anomalies in individuals with osteogenesis imperfecta: a systematic review and meta-analysis of prevalence and comparative studies. *J Appl Oral Sci*. 2023;**31**. e20230040. [PubMed ID: 37672427]. [PubMed Central ID: PMC10506791]. https://doi.org/10.1590/1678-7757-2023-0040.
4. Bekiroglu N, Mete S, Ozbay G, Yalcinkaya S, Kargul B. Evaluation of panoramic radiographs taken from 1,056 Turkish children. *Niger J Clin Pract*. 2015;**18**(1):8-12. [PubMed ID: 25511336]. https://doi.org/10.4103/1119-3077.146965.
5. A. LHumaid J, Buholayka M, Thapasum A, Alhareky M, Abdelsalam M, Bughsan A. Investigating prevalence of dental anomalies in Eastern Province of Saudi Arabia through digital orthopantomogram. *Saudi J Biol Sci*. 2021;**28**(5):2900-6. [PubMed ID: 34025167]. [PubMed Central ID: PMC8117041]. https://doi.org/10.1016/j.sjbs.2021.02.023.
6. Goya HA, Tanaka S, Maeda T, Akimoto Y. An orthopantomographic study of hypodontia in permanent teeth of Japanese pediatric patients. *J Oral Sci*. 2008;**50**(2):143-50. [PubMed ID: 18587203]. https://doi.org/10.2334/josnusd.50.143.
7. Gupta SK, Saxena P, Jain S, Jain D. Prevalence and distribution of selected developmental dental anomalies in an Indian population. *J Oral Sci*. 2011;**53**(2):231-8. [PubMed ID: 21712629]. https://doi.org/10.2334/josnusd.53.231.
8. Patil S, Doni B, Kaswan S, Rahman F. Prevalence of dental anomalies in Indian population. *J Clin Exp Dent*. 2013;**5**(4):e183-6. [PubMed ID: 24455078]. [PubMed Central ID: PMC3892239]. https://doi.org/10.4317/jced.51119.
9. Xiao J, Luo J, Ly-Mapes O, Wu TT, Dye T, Al Jallad N, et al. Assessing a Smartphone App (AICaries) That Uses Artificial Intelligence to Detect Dental Caries in Children and Provides Interactive Oral Health Education: Protocol for a Design and Usability Testing Study. *JMIR Res Protoc*. 2021;**10**(10). e32921. [PubMed ID: 34529582]. [PubMed Central ID: PMC8571694]. https://doi.org/10.2196/32921.
10. Lam EW. Dental Anomalies. In: White WC, Pharoah MJ, editors. *Oral radiology principles and interpretations*. Maryland Heights, Missouri: Mosby; 2014. p. 582-611. https://doi.org/10.1016/b978-0-323-09633-1.00031-6.
11. Neville BW, Damm DD, Allen CM, Chi AC. *Oral and maxillofacial pathology*. Amsterdam, Netherlands: Elsevier Health Sciences; 2023.
12. Arya N, Rafie A, Tahmasebi R, Akheshteh V, Salmani E. [Evaluating the Prevalence of Dental Anomalies through Panoramic Radiographs in a Sample of Iranian Population During 2016 to 2020]. *J Mashhad Dental Sch*. 2023;**47**(4):388-400. Persian. https://doi.org/10.22038/jmds.2023.69968.2253.
13. Khodadadi N, Hamzeh M, Abesi F, Khafri S. [Frequency of Jaw Lesions in Panoramic Radiography of Children in North of Iran]. *J*

Mazandaran Univ Med Sci. 2023;**32**(216):174-8. Persian.

14. Namdar P, Shiva A, Hadian H, Mousavi J, Shahidi B. [The frequency of Accidental Dental Abnormalities and pathologic finding in panoramic radiography of orthodontic patients]. *J Res Dental Sci*. 2022;**19**(4):346-54. Persian. https://doi.org/10.52547/jrds.19.4.346.
15. Mohan R, Puranik CP, Kaci P, Moore T, Katechia B, Schulman GS, et al. Prescription of panoramic radiographs in children using age-based prevalence of dental anomalies and pathologies. *Int J Paediatr Dent*. 2024;**34**(2):125-34. [PubMed ID: 37330621]. https://doi.org/10.1111/ipd.13095.
16. Pallikaraki G, Sifakakis I, Gizani S, Makou M, Mitsea A. Developmental dental anomalies assessed by panoramic radiographs in a Greek orthodontic population sample. *Eur Arch Paediatr Dent*. 2020;**21**(2):223-8. [PubMed ID: 31494863]. https://doi.org/10.1007/s40368-019-00476-y.
17. Wagner VP, Arrue T, Hilgert E, Arus NA, Da Silveira HLD, Martins MD, et al. Prevalence and distribution of dental anomalies in a paediatric population based on panoramic radiographs analysis. *Eur J Paediatr Dent*. 2020;**21**(4):292-8. [PubMed ID: 33337905]. https://doi.org/10.23804/ejpd.2020.21.04.7.
18. Baron C, Houchmand-Cuny M, Enkel B, Lopez-Cazaux S. Prevalence of dental anomalies in French orthodontic patients: A retrospective study. *Arch Pediatr*. 2018;**25**(7):426-30. [PubMed ID: 30249487]. https://doi.org/10.1016/j.arcped.2018.07.002.
19. Dang HQ, Constantine S, Anderson PJ. The prevalence of dental anomalies in an Australian population. *Aust Dent J*. 2017;**62**(2):161-4. [PubMed ID: 27471093]. https://doi.org/10.1111/adj.12443.
20. Yassin SM. Prevalence and distribution of selected dental anomalies among saudi children in Abha, Saudi Arabia. *J Clin Exp Dent*. 2016;**8**(5):e485-90. [PubMed ID: 27957258]. [PubMed Central ID: PMC5149079]. https://doi.org/10.4317/jced.52870.
21. de Marsillac M W, Andrade MR, Fonseca Rde O, Marcal SL, Santos VL. Dental anomalies in panoramic radiographs of pediatric patients. *Gen Dent*. 2013;**61**(7):e29-33. [PubMed ID: 24192746].
22. Bruce C, Manning-Cox G, Stanback-Fryer C, Banks K, Gilliam M. A radiographic survey of dental anomalies in Black pediatric patients. *Nda j*. 1994;**45**(1):6-13. [PubMed ID: 9594056].
23. Ignelzi MJ, Fields HW, Vann WJ. Screening panoramic radiographs in children: prevalence data and implications. *Pediatr Dent*. 1989;**11**(4):279-85. [PubMed ID: 2639321].
24. Ezoddini AF, Sheikhha MH, Ahmadi H. Prevalence of dental developmental anomalies: a radiographic study. *Community Dent Health*. 2007;**24**(3):140-4. [PubMed ID: 17958073].
25. Haghanifar S, Rokouei M. Radiographic evaluation of the mental foramen in a selected Iranian population. *Indian J Dent Res*. 2009;**20**(2):150-2. [PubMed ID: 19553713]. https://doi.org/10.4103/0970-9290.52886.
26. Lagana G, Venza N, Borzabadi-Farahani A, Fabi F, Danesi C, Cozza P. Dental anomalies: prevalence and associations between them in a large sample of non-orthodontic subjects, a cross-sectional study. *BMC Oral Health*. 2017;**17**(1):62. [PubMed ID: 28284207]. [PubMed Central ID: PMC5346249]. https://doi.org/10.1186/s12903-017-0352-y.
27. Swapna LA, AlMegbil NT, Almutlaq AO, Koppolu P. Occurrence of the Elongated Styloid Process on Digital Panoramic Radiographs in the Riyadh Population. *Radiol Res Pract*. 2021;**2021**:6097795. [PubMed ID: 34804609]. [PubMed Central ID: PMC8601818]. https://doi.org/10.1155/2021/6097795.
28. Ghabanchi J, Haghnegahdar AA, Khodadazadeh SH, Haghnegahdar S. A radiographic and clinical survey of dental anomalies in patients referring to Shiraz dental school. *J Dent*. 2009;**10**(Supplement 2009):26-31.
29. Dean JA, Avery DR, McDonald RET. *Dentistry for the Child and Adolescen*. Boston: Mosby; 2011.
30. Amin N, Parker K, Bacon V, Stephens S, Chia M. Dental transpositions: An update for clinicians. *Prim Dent J*. 2024;**13**(1):74-9. [PubMed ID: 38520194]. https://doi.org/10.1177/20501684241230777.
31. Shoaib A, Ahmed B. Tooth Agenesis in Human Population: Treatment Considerations in Subjects with Tooth Agenesis. *Pakistan J Med Res*. 2023;**62**(2):92-9.
32. Irish JD. Tooth transposition prevalence and type among sub-Saharan Africans. *Am J Hum Biol*. 2020;**32**(2). e23329. [PubMed ID: 31566823]. https://doi.org/10.1002/ajhb.23329.
33. Eshgian N, Al-Talib T, Nelson S, Abubakr NH. Prevalence of hyperdontia, hypodontia, and concomitant hypo-hyperdontia. *J Dent Sci*. 2021;**16**(2):713-7. [PubMed ID: 33854723]. [PubMed Central ID: PMC8025189]. https://doi.org/10.1016/j.jds.2020.09.005.
34. Nakhjavani Y, Jafari A, Arabkhani H. Prevalence of Permanent Dental Anomalies among Patient. *Iran J Pediatric Dent*. 2014;**10**(1):29-36. https://doi.org/10.29252/ijpd.10.1.29.
35. Ghaznawi HI, Daas H, Salako NO. A clinical and radiographic survey of selected dental anomalies and conditions in a Saudi Arabian population. *Saudi Dent J*. 1999;**11**(1):8-13.
36. Bilge NH, Yesiltepe S, Torenek Agirman K, Caglayan F, Bilge OM. Investigation of prevalence of dental anomalies by using digital panoramic radiographs. *Folia Morphol (Warsz)*. 2018;**77**(2):323-8. [PubMed ID: 28933802]. https://doi.org/10.5603/FM.a2017.0087.
37. Bayati S, Shams N, Dadollahi Sarab M, Khosravi N, Khani M, Amiri F, et al. [Rate of incidental findings of pathology and dental anomalies in pediatric patients: a radiographic study]. *Jundishapur Scientific Med J*. 2016;**15**(2):139-46. Persian.

Table 1. The Prevalence of Dental Anomalies (Das) in Children Based on Sex [a]

Variables	DAs														
DA-Number	DA-Size		DA- Pattern of Growth				DA- Morphology						DA- Structure		
Missing	Supernumerary	Macrodontia	Microdontia	Impaction	Displacement	Transposition	Ectop	Taurodontism	Gemination	Fusion	Dilaceration	Dens in Dent	Dens Evaginatus	Amelogenesis Imperfecta	Dentingenesis Imperfecta	Pre.Er car
Sex																
Male	30 (71.4)	7 (58.3)	0 (0)	2 (50)	1 (33.3)	0 (0)	21 (72.4)	9 (40.9)	4 (50)	2 (50)	5 (71.4)	2 (50 %)	2 (33.3)	1 (100)	2 (33.3)	0
Female	12 (28.6)	5 (41.7)	1 (100)	2 (50)	2 (66.7)	0 (0)	8 (27.6)	13 (59.1)	4 (50)	2 (50)	2 (28.6)	2 (50 %)	4 (66.7)	0 (0)	4 (66.7)	0
Total	42 (4.2)	12 (1.25)	1 (0.1)	4 (0.4)	3 (0.3)	0 (0)	29 (2.9)	22 (2.2)	8 (0.8)	4 (0.4)	7 (0.7)	4 (0.4)	6 (0.6)	1 (0.1)	6 (0.6)	0
P	< 0.001	> 0.05	> 0.05	> 0.05	> 0.05	-	< 0.001	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	

[z] Abbreviations: Das, dental anomalies; P, P-value for statistical analysis.

[a] Values are expressed as No. (%).

Table 2. The Prevalence of Dental Anomalies (Das) in Children Based on Upper and Lower Jaw [a]

Variables	DAs																
	DA-Number		DA-Size		DA- Pattern of Growth			DA- Morphology								DA- Structure	
	Missing	Supernumerary	Macrodontia	Microdontia	Impaction	Displacement	Transposition	Ectop	Taurodontism	Gemination	Fusion	Dilaceration	Dens in Dent	Dens Evaginatus	Amelogenesis Imperfecta	Dentingenesis Imperfecta	Pre. C
Upper/Lower Jaw																	
Upper	16 (38.1)	12 (100)	1 (100)	4 (100)	1 (33.3)	0 (0.0)	13 (44.8)	10 (45.5)	2 (25)	3 (75)	6 (85.7)	0 (0.0)	6 (100)	1 (100)	3 (50)	0 (0 .0)	0
Lower	26 (61.9)	0 (0.0)	0 (0.0)	0 (0.0)	2 (66.7)	0 (0.0)	16 (54.2)	12 (54.5)	6 (75)	1 (25)	1 (14.3)	4 (100)	0 (0.0)	0 (0.0)	3 (50)	0 (0.0)	3
Total	42 (4.2)	12 (1.25)	1 (0.1)	4 (0.4)	3 (0.3)	0 (0.0)	29 (2.9)	22 (2.2)	8 (0.8)	4 (0.4)	7 (0.7)	4 (0.4)	6 (0.6)	1 (0.1)	6 (0.6)	0 (0)	3
P	< 0.05	< 0.001	> 0.05	> 0.05	> 0.05	-	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	< 0.05	< 0.05	> 0.05	> 0.05	-	>

[z] Abbreviations: Das, dental anomalies; DA, dental anomaly; P, P-value for statistical analysis.

[a] Values are expressed as No. (%).