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ORIGINAL ARTICLE

The prevalence and distribution of anomalies of permanent teeth in 6-17-year-old children in a selected Iranian Population

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Abstract

Background: Dental anomalies can lead to malocclusion, aesthetic issues, increased caries risk, difficulties with tooth extraction and root canal treatment, and other oral diseases. Therefore, early identification of anomalies can assist the clinician in the initial stages of anomaly diagnosis. This study aimed to evaluate the frequency and prevalence of dental anomalies in a group of Iranian children aged 6-17 years.

Materials & Methods: In this cross-sectional descriptive-analytical study, 500 panoramic radiographs of children aged 6 to 17 years (272 girls and 228 boys) from the archives of the radiology department were included. Two examiners evaluated and interpreted the data, and the prevalence of dental anomalies was assessed by age group, gender, upper and lower jaws, and specific teeth. Data were analyzed using Fisher's exact test and chi-square tests (α=0.05).

Results: The overall person-based prevalence of having at least one dental anomaly was 37.6% (188 out of 500). No significant difference was observed between girls (40.1%) and boys (34.6%) ($P = 0.212$). Prevalence significantly increased with age ($P < 0.001$), peaking in the 14-17 years group. A total of 198 anomalies were detected, with tooth impaction (10.6%) and agenesis (9.0%) being the most frequent. Anomaly-based analysis revealed no significant difference in distribution between the upper (54.0%) and lower jaws (46.0%) (P=0.108). However, anomalies were significantly more concentrated in the anterior region (54.5%) than in the premolar and molar regions ($P < 0.001$).

Comments in the abstract are not fully addressed, and the abstract is shorter than the previous version.

Conclusion: Dental anomalies were observed in more than one-third of the pediatric population, with the highest frequency observed for tooth impaction and agenesis of anterior teeth.

Keywords: Dental anomalies, panoramic radiography, prevalence

Introduction

Dental anomalies refer to dental changes resulting from abnormalities during tooth formation and can be congenital, developmental, or acquired (1). Developmental types occur during tooth formation, while acquired types occur after tooth formation, and congenital types have a genetic origin (2). Dental anomalies arise from interactions among genetic, epigenetic, and environmental factors during dental development (3). These anomalies can affect a single tooth or, in a generalized manner, all teeth, and may also be seen as part of systemic diseases or syndromes (4). Additionally, they can originate from changes in the mineralized tissues, including enamel, dentin, and cementum (5). These abnormalities encompass a wide

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range of changes in the number, size, eruption pattern, position, structure, and morphology of teeth (6, 7).

Various classifications of dental anomalies have been proposed; in terms of number, these include Hypodontia and Hyperdontia. Hypodontia refers to the failure of development of one or more teeth, excluding third molars, while Hyperdontia refers to the presence of more teeth than the normal number (8, 9). Anomalies in tooth size also include Macrodontia and Microdontia. Microdontia refers to teeth that are smaller than the normal size, whereas Macrodontia refers to teeth that are larger than the normal size (8, 10). Morphological dental anomalies include Dens invagination, Talon cusp, Gemination, Fusion, and Taurodontism (8).

A detailed study of dental anomalies is very important because, although they have a lower prevalence compared to caries and periodontal diseases, their management is challenging and can lead to malocclusion, aesthetic issues, difficulties during tooth extraction and root canal treatment, as well as predisposing individuals to other oral diseases (11, 12). Additionally, anterior tooth anomalies can reduce individuals' self-esteem (13). These anomalies are usually asymptomatic; however, they may cause significant problems, including disruption in tooth eruption, periodontal issues, interference with speech and chewing, and dysfunction of the temporomandibular joint (14, 15). Recognizing anomaly types based on age, gender, and jaw prevalence can assist the clinician in early-stage anomaly diagnosis (16). The prevalence of dental anomalies varies across communities and has been reported as high as 27.7% (17-20).

The incidence and prevalence of these developmental tooth anomalies can provide valuable insights for genetic studies and help understand differences between populations (21). It is important to find and treat these developmental tooth abnormalities as soon as possible because they can affect the way your teeth look, make you more likely to get cavities, cause problems with your gums, make it hard to chew, or cause malocclusion (21). In the past, researchers examined how common dental developmental problems were across different sample groups and populations. However, this research has reported conflicting results. These differences in the data can be explained by the different sampling methods, investigations, geographic areas examined, and criteria and parameters used in the investigations (21-23).

For the diagnosis and evaluation of dental anomalies, panoramic radiographs are a very effective, non-invasive method (19) that is well tolerated by patients and provide more comprehensive information than clinical examination, as they show a wide range of jaws and teeth in greater detail (1). In this regard, they can be used to assess dental development, plan treatment, and screen for anomalies that may not be diagnosed during clinical examination (24).

In the study by Arya et al. (25), anomalies in morphology and number, particularly dens in dente and tooth agenesis, were among the most common anomalies. Additionally, the prevalence of anomalies was significantly higher in the maxilla and lateral incisors. In the study by Alanzi et al. (26), the prevalence of dental anomalies among students in Kuwait was relatively high, and some types of dental anomalies were associated with gender. The study by Drenski Balija et al. (27) also demonstrated that the prevalence of dental anomalies is gender-related, with hypodontia being the most common anomaly, followed by tooth impaction.

Since awareness of the prevalence, severity, and distribution of dental anomalies in dental arches can provide fundamental data for genetic and polygenic studies, and given the importance of the topic and the diversity of results in past studies, there is a need for

further investigations across all populations, especially within the Iranian community. Emphasis has been placed on conducting studies in this area in the pediatric population, given the importance of diagnosing these anomalies in childhood and preventing further disorders. Therefore, the present study aimed to determine the prevalence and distribution of dental anomalies in the pediatric population using panoramic radiographs.

Materials & Methods

This descriptive–analytical cross–sectional study (ethics code: IR.IAU.KHUISF.REC.1401.284) was conducted using 500 digital panoramic radiographs archived in the Department of Oral and Maxillofacial Radiology at the Faculty of Dentistry, Islamic Azad University, Isfahan Branch, Iran. The radiographs belonged to patients aged 6–17 years who attended the center between 2018 and 2021.

The inclusion criteria were: patients aged 6 to 17 years and the availability of a high-quality digital panoramic radiograph. Exclusion criteria were: a history of previous or ongoing orthodontic treatment, diagnosed craniofacial syndromes, cleft lip and/or palate, systemic diseases known to affect jaw growth and tooth development, or a history of trauma or surgery in the maxillofacial region.

All radiographs were evaluated independently by two observers (a senior dental student and an oral and maxillofacial radiologist) in a dimly lit room on a single monitor. To ensure the reliability of the diagnostic process, the inter-observer agreement was assessed on a pilot sample of 50 radiographs prior to the main evaluation. The agreement was calculated using Cohen's Kappa statistic and was found to be excellent ($\kappa = 0.891$). In the main study, when the two observers disagreed, a joint session was held to reach consensus. The presence and type of the following dental anomalies were recorded: impaction, agenesis (excluding third molars), supernumerary teeth, microdontia, Macrodontia, taurodontism, fusion, gemination, and dilaceration. For each detected anomaly, its location (maxilla/mandible and anterior/premolar/molar/molar/molar/molar region) was also registered.

Data were analyzed using IBM SPSS Statistics for Windows, Version 24.0 (Armonk, NY: IBM Corp). A dual-level analytical approach was adopted.

1. **Person-based Analysis:** To determine the overall prevalence and its association with demographic variables (age and sex), the individual patient was the unit of analysis ($N = 500$). Each patient was categorized as either having or not having at least one dental anomaly. This approach maintains the statistical independence of observations for these specific analyses.
2. **Anomaly-based Analysis:** To describe the distribution and characteristics of the anomalies themselves (e.g., frequency jaw, or tooth region), the individual anomaly was the unit of analysis ($N = 198$). This involved using all detected anomalies, including both anomalies from the 10 individuals who presented with two distinct conditions.

Descriptive statistics, including frequencies and percentages, were calculated. The Chi-square test was used to assess associations between categorical variables. A p-value of less than 0.05 was considered statistically significant.

The study protocol was approved by the Ethics Committee of Islamic Azad University, Khorasgan Branch, and conducted in accordance with relevant ethical guidelines.

Results

A total of 500 panoramic radiographs of children and adolescents aged 6–17 years were evaluated. The sample consisted of 272 females (54.4%) and 228

males (45.6%). The mean age of participants was 10.94 ± 3.19 years.

Based on age stratification, 180 individuals (36.0%) were in the 6–9-year group, 207 (41.4%) in the 10–13-year group, and 113 (22.6%) in the 14–17-year group. Of the 500 individuals studied, 188 (37.6%; 95% CI: 33.4%–41.8%) presented with at least one dental anomaly. Among these affected individuals, 178 presented with a single anomaly, while 10 exhibited two concurrent anomalies, resulting in a total of 198 recorded dental anomalies.

Regarding the 10 individuals with co-occurring anomalies, five cases involved combinations with dental impaction (impaction with agenesis [n=2], dens evaginatus [n=1], amelogenesis imperfecta [n=1], and dilaceration [n=1] additionally, two individuals presented with concurrent taurodontism and agenesis. The remaining three combinations occurred once: agenesis with Macrodontia, supernumerary tooth with gemination, and dens evaginatus with dilaceration.

In terms of individual anomaly distribution (N=500), dental impaction was the most prevalent, occurring in 53 individuals (10.6%), followed by agenesis (9.0%). Frequencies for other anomalies were as follows: Macrodontia (3.0%), supernumerary teeth (2.6%), dens evaginatus (2.6%), taurodontism (2.2%), microdontia (1.8%), dilaceration (1.8%), hypercementosis (1.2%), enamel pearl (1.0%), gemination (0.8%), supernumerary root (0.8%), ankylosis (0.8%), fusion (0.6%), amelogenesis imperfecta (0.4%), and dens invaginatus (0.4%). No instances of concrescence or dentinogenesis imperfecta were recorded (Figure 1).

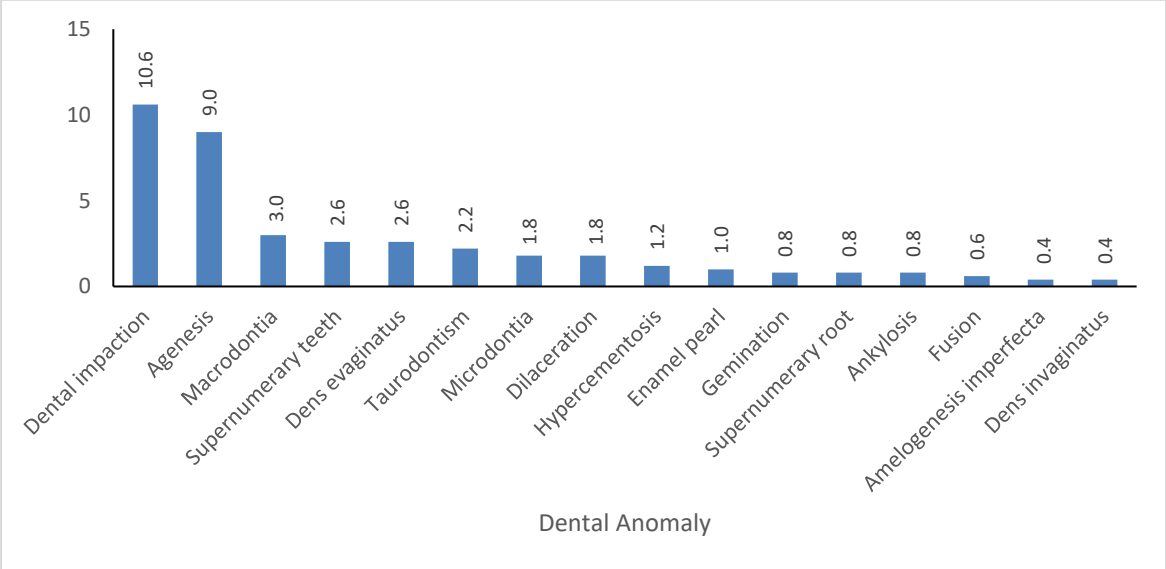

Figure 1. Distribution of dental anomaly types in the studied sample of individuals aged 6–17 years (n=500).

Dental anomalies were identified in 109 girls (40.1%) and 79 boys (34.6%) within the sample studied. No statistically significant difference was observed between the sexes in the overall prevalence of dental anomalies (χ^2 test, $P = 0.212$). Furthermore, sex-based comparisons across individual types of dental anomalies revealed no statistically significant differences (all $P > 0.05$) (Table 1).

Table 1. Distribution of dental anomalies by sex in the studied sample (n = 500)

Variable	Category	Girls (n = 272)	Boys (n = 228)	P value
Presence of a dental anomaly	No	163 (59.9)	149 (65.4)	0.212
	Yes	109 (40.1)	79 (34.6)	
Type of Anomaly	Tooth impaction	33 (12.1)	20 (8.8)	0.224†
	Tooth agenesis	26 (9.6)	19 (8.3)	0.633†
	Macrodontia	8 (2.9)	7 (3.1)	0.933†
	Supernumerary tooth	7 (2.6)	6 (2.6)	0.968†
	Dens evaginatus	8 (2.9)	5 (2.2)	0.601†
	Taurodontism	3 (1.1)	8 (3.5)	0.068‡
	Microdontia	3 (1.1)	6 (2.6)	0.312‡
	Dilaceration	7 (2.6)	2 (0.9)	0.191‡
	Hypercementosis	5 (1.8)	1 (0.4)	0.227‡
	Enamel pearl	2 (0.7)	3 (1.3)	NA
	Gemination	3 (1.1)	1 (0.4)	NA
	Supernumerary root	4 (1.5)	0 (0.0)	NA
	Ankylosis	2 (0.7)	2 (0.9)	NA
	Fusion	2 (0.7)	1 (0.4)	NA
	Amelogenesis imperfecta	2 (0.7)	0 (0.0)	NA
	Dens invaginatus	1 (0.4)	1 (0.4)	NA

Values are presented as frequency (percentage) [n (%)]. P values represent comparisons between girls and boys.

† Calculated using the chi-square test.

‡ Calculated using Fisher's exact test (used when expected cell counts were <5).

NA: Not applicable. Statistical comparison was not performed for anomalies with very low total frequency (fewer than 6 cases in the total sample) to avoid unstable estimates.

As shown in Table 3, the prevalence of dental anomalies varied significantly across age groups, with an overall increasing trend from the youngest to the oldest cohorts ($P < 0.001$). Post-hoc pairwise comparisons with Bonferroni adjustment indicated that the 6–9 years group had a significantly lower prevalence than both the 10–13 and 14–17 years groups, whereas the difference between the two older groups was not significant.

Among specific anomalies, tooth impaction demonstrated a significant age-related increase ($P < 0.001$), with Bonferroni-corrected tests confirming a significantly lower prevalence in the 6–9 years group. Significant differences were also observed for dens evaginatus ($P = 0.006$) and hypercementosis ($P = 0.010$), primarily driven by higher frequencies in the 10–13 years group.

In contrast, no significant associations with age were found for agenesis, Macrodontia, supernumerary teeth, taurodontism, microdontia, or dilaceration (all $P > 0.05$). For anomalies with fewer than 6 cases, statistical comparisons were omitted and are indicated as NA in the table.

Table 2. Distribution and prevalence of dental anomalies across different age groups in the sample studied

Variable	Category	6–9 Years (n = 180)	10–13 Years (n = 207)	14–17 Years (n = 113)	P-value
Presence of Dental Anomaly	Yes	40^{a}(22.2)	93^{b}(44.9)	55^{b}(48.7)	$<0.001^{\dagger}$
Type of Dental Anomaly	Impaction	6^{a}(3.3)	28^{b}(13.5)	19^{b}(16.8)	$<0.001^{\dagger}$
	Agenesis	14 (7.8)	19 (9.2)	12 (10.6)	$0.705^{\dagger}$
	Macrodontia	6 (3.3)	6 (2.9)	3 (2.7)	$0.941^{\dagger}$
	Supernumerary tooth	5 (2.8)	3 (1.4)	5 (4.4)	$0.256^{\ddagger}$
	Dens evaginatus	0^{a}(0.0)	8^{b}(3.9)	5^{b}(4.4)	$0.006^{\ddagger}$
	Taurodontism	3 (1.7)	7 (3.4)	1 (0.9)	$0.357^{\ddagger}$
	Microdontia	2 (1.1)	2 (1.0)	5 (4.4)	$0.074^{\ddagger}$
	Dilaceration	2 (1.1)	4 (1.9)	3 (2.7)	$0.570^{\ddagger}$
	Hypercementosis	0^{a}(0.0)	6^{b}(2.9)	0^{a}(0.0)	$0.010^{\ddagger}$
	Enamel pearl	0 (0.0)	5 (2.4)	0 (0.0)	NA
	Gemination	2 (1.1)	2 (1.0)	0 (0.0)	NA
	Supernumerary root	0 (0.0)	3 (1.4)	1 (0.9)	NA
	Ankylosis	1 (0.6)	1 (0.5)	2 (1.8)	NA
	Fusion	1 (0.6)	2 (1.0)	0 (0.0)	NA
	Amelogenesis imperfecta	0 (0.0)	1 (0.5)	1 (0.9)	NA
	Dens invaginatus	0 (0.0)	2 (1.0)	0 (0.0)	NA

Values are presented as frequency (percentage) [n (%)].

† Calculated using the chi-square test.

‡ Calculated using Fisher's exact test (used when expected cell counts were <5).

a,b: Different superscript letters in a row indicate statistically significant differences between age groups based on post-hoc Bonferroni-adjusted tests ($P < 0.05$).

NA: Not applicable. Statistical comparison was not performed for anomalies with very low total frequency (fewer than 6 cases in the total sample) to avoid unstable estimates.

The distribution of anomalies based on anatomical location was analyzed at the anomaly level ($N = 198$). As detailed in Table 3, $54.0\%(n = 107)$ of the anomalies were located in the upper jaw, while $46.0\%(n = 91)$ were in the lower jaw. This distribution did not show a statistically significant difference ($P = 0.108$).

When specific anomaly types were examined, certain conditions—such as Impaction, Macrodontia, Supernumerary tooth, Microdontia, Dilaceration, Enamel pearl, Gemination, Ankylosis, Fusion, and Dens invaginatus—were numerically more frequent in the upper jaw. In contrast, Agenesis, Dens evaginatus, Hypercementosis, and supernumerary roots were observed more often in the lower jaw. Amelogenesis imperfecta occurred with equal frequency in both jaws. However, none of these differences reached statistical significance (all $p > 0.05$).

Table 3. Distribution of dental anomalies and their specific types according to jaw location (upper vs. lower) in the studied sample (n = 198)

Variable	Category	Upper jaw	Lower jaw	P-value
Presence of a dental anomaly	Yes	107 (54.0)	91 (46.0)	0.108†
Type of dental anomaly	Impaction	29 (54.7)	24 (45.3)	0.492†
	Agenesis	22 (48.9)	23 (51.1)	0.881†
	Macrodontia	10 (66.7)	5 (33.3)	0.197†
	Supernumerary tooth	7 (53.8)	6 (46.2)	0.782†
	Dens evaginatus	5 (38.5)	8 (61.5)	0.405†
	Taurodontism	5 (45.5)	6 (54.5)	0.763†
	Microdontia	6 (66.7)	3 (33.3)	0.317‡
	Dilaceration	6 (66.7)	3 (33.3)	0.317‡
	Hypercementosis	2 (33.3)	4 (66.7)	0.414‡
	Enamel pearl	3 (60.0)	2 (40.0)	NA
	Gemination	3 (75.0)	1 (25.0)	NA
	Supernumerary root	1 (25.0)	3 (75.0)	NA
	Ankylosis	3 (75.0)	1 (25.0)	NA
	Fusion	2 (66.7)	1 (33.3)	NA
	Amelogenesis imperfecta	1 (50.0)	1 (50.0)	NA
	Dens invaginatus	2 (100.0)	0 (0.0)	NA

Data are presented as n (%).

† Calculated using the chi-square test.

‡ Calculated using Fisher's exact test (used when expected cell counts were <5).

NA: P-value not reported for anomalies with a total frequency < 6 in the studied sample due to unstable estimates and limited interpretability.

The distribution of dental anomalies across tooth groups demonstrated a statistically significant overall difference ($P < 0.001$). Anomalies were most frequently observed in anterior teeth (54.5%), followed by premolars (29.3%) and molars (16.2%).

Impaction showed significant variation among tooth groups ($P < 0.001$), with the highest proportion in anterior teeth (71.7%), followed by premolars (26.4%) and minimal occurrence in molars (1.9%). Post hoc pairwise comparisons with the Bonferroni adjustment confirmed significant differences among all three groups.

Agenesis also differed significantly across tooth groups ($P < 0.001$), being more common in anterior (51.1%) and premolar (44.4%) teeth than in molars (4.4%). However, no significant difference was observed between anterior and premolar teeth after Bonferroni correction.

Macrodontia ($P < 0.001$), supernumerary teeth ($P = 0.030$), and dens evaginatus ($P = 0.018$) showed significant differences in distribution among tooth groups. In contrast, dilaceration ($P = 0.368$) and hypercementosis ($P = 0.414$) showed no statistically significant variation.

For anomalies with very low total frequencies or zero cells across groups, statistical comparisons were not performed due to sparse data and lack of variability (NA).

Table 4. Distribution of dental anomalies according to tooth group (anterior, premolar, and molar) in the studied sample (n = 198)

Variable	Category	Anterior	Premolar	Molar	P value
Presence of Dental Anomaly	Yes	108 (54.5) [a]	58 (29.3) [b]	32 (16.2) [c]	<0.001
Type of Dental Anomaly	Impaction	38 (71.7)[a]	14 (26.4)[b]	1 (1.9)[c]	<0.001
	Agenesis	23 (51.1)[a]	20 (44.4)[a]	2 (4.4)[b]	<0.001
	Macrodontia	13 (86.7)[a]	1 (6.7)[b]	1 (6.7)[b]	<0.001
	Supernumerary tooth	9 (69.2)[a]	4 (30.8)[b]	0 (0.0)[b]	0.030
	Dens evaginatus	3 (23.1)[a]	9 (69.2)[b]	1 (7.7)[a]	0.018
	Taurodontism	0 (0.0)	0 (0.0)	11 (100.0)	NA
	Microdontia	9 (100.0)	0 (0.0)	0 (0.0)	NA
	Dilaceration	1 (11.1)	4 (44.4)	4 (44.4)	0.368
	Hypercementosis	0 (0.0)	4 (66.7)	2 (33.3)	0.414
	Enamel pearl	0 (0.0)	0 (0.0)	5 (100.0)	NA
	Gemination	3 (75.0)	1 (25.0)	0 (0.0)	NA
	Supernumerary root	0 (0.0)	1 (25.0)	3 (75.0)	NA
	Ankylosis	3 (75.0)	0 (0.0)	1 (25.0)	NA
	Fusion	3 (100.0)	0 (0.0)	0 (0.0)	NA
	Amelogenesis imperfecta	1 (50.0)	0 (0.0)	1 (50.0)	NA
	Dens invaginatus	2 (100.0)	0 (0.0)	0 (0.0)	NA

Data are presented as n (%).

† Calculated using the chi-square test.

‡ Calculated using Fisher's exact test (used when expected cell counts were <5).

a,b: Superscript letters (a–c) indicate results of post-hoc pairwise comparisons with Bonferroni adjustment. Groups sharing the same letter are not significantly different.

NA: P-value not reported due to sparse data (total frequency <6) or zero cells across groups, precluding valid statistical comparison

Discussion

The results of the present study indicated that dental anomalies were observed in 188 individuals. The most frequently observed anomalies were, in order, dental impaction, agenesis, Macrodontia, supernumerary teeth, dens evaginatus, and taurodontism.

According to the results, among the 188 individuals with dental anomalies, the prevalence of dental anomalies such as dental impaction, Macrodontia, supernumerary teeth, microdontia, dilaceration, enamel pearl, gemination, ankylosis, fusion, and dens evagination was higher in the upper jaw than in the lower jaw. Conversely, the prevalence of agenesis, dens evaginatus, hypercementosis, and additional roots was greater in the lower jaw. Amelogenesis imperfecta was observed equally in both jaws.

Panoramic radiographs are used as diagnostic tools, frequently in dentistry, in addition to bitewing and periapical radiographs. The method used to capture panoramic images differs from that for other images, such as bitewing and periapical. The detail resolution in panoramic radiographs is lower, and the overlap of oral structures is greater. Given that panoramic radiographs display oral structures in a large area and

their relative positions, they serve as diagnostic tools for abnormalities (27).

According to the results of the present study, among individuals with dental anomalies, the prevalence of anterior tooth anomalies was significantly higher than that of molar and premolar anomalies, and premolar anomalies were higher than molar anomalies. The prevalence of Macrodontia, taurodontism, microdontia, enamel pearls, and ankylosis was higher in boys than in girls. There was no significant difference in the prevalence of dental anomalies between girls and boys. In the 6-9-year age group, dental anomalies were observed less frequently, with the highest prevalence for dental agenesis, followed by dental impaction and Macrodontia. No significant differences were observed among individuals in the age ranges of 10-13 and 14-17 years, and in both categories, the most frequently observed anomalies were dental impaction, followed by agenesis and dens evaginatus.

The study by Wagner et al. (28) showed that the most common anomaly in children aged 6-12 years was diastema of permanent teeth, followed by agenesis, dental impaction, and supernumerary teeth. There was also no significant relationship between girls and boys regarding the prevalence of agenesis and dental impaction anomalies, which aligns with the results of the present study. However, regarding the most common anomaly, there was a discrepancy with the present study's results, which appears to be due to the exclusion of traumatic cases. Additionally, similar to the study by Wagner et al. (28), the highest frequency observed in the examined population was related to dental impaction and agenesis in permanent teeth, with dental impaction being more common in anterior teeth, especially in maxillary canines, and dental agenesis being more frequently observed in the lateral incisors of the upper jaw and the second premolars of the lower jaw. Palikaraki et al. (29) reported the most common dental anomalies in a group of the Greek population aged 7-17 years as oligodontia, impaction, and supernumerary teeth. Considering that oligodontia, like agenesis, involves the absence of teeth, the two common anomalies align with the present study's results regarding the lack of association between anomaly prevalence and gender.

In a study by Baron et al. (30) examining the prevalence of dental anomalies among the orthodontic patient population in France, taurodontism was found to be the most common condition, and no significant relationship was observed between gender and dental anomaly prevalence. This result contrasts with the present study, which excluded patients with a history of orthodontic treatment or those currently undergoing treatment. However, the lack of significance regarding gender was similar in both studies. Additionally, in the study by Dang et al. (24), the prevalence of dental anomalies in a population of Australian children was approximately 5%, with dental agenesis being the most frequently observed anomaly. In the present study, more than one-third of participants had dental anomalies, suggesting that the lower prevalence of dental anomalies in the Australian population may account for this discrepancy.

The study by Ajami and Talebi (31) in Mashhad on patients with cleft lip and palate found that the most common anomaly was hypodontia, followed by microdontia and root diastema, all of which were most prevalent in the anterior region. The results of the present study regarding the most frequently observed anomalies and the higher prevalence of dental agenesis and microdontia in the anterior region align with this study. However, in the present study, root diastema was observed more frequently in premolars and molars, which, based on the findings of Ajami and Talebi (31), may be attributed to the higher prevalence of root diastema in patients with cleft lip and palate compared to others and the increased observation of

this anomaly in the anterior regions of these patients. In the Yassin study (21), clinical examinations and panoramic radiographs of Saudi children demonstrated that hypodontia was the most common anomaly, while dentinogenesis imperfecta was the rarest. Considering that the hypodontia anomaly also refers to the absence of teeth (fewer than six teeth), dentinogenesis imperfecta was also one of the rarest anomalies observed in the present study. In this study, Macrodontia was more frequently observed in boys, consistent with the present findings.

In the study by Arya et al. (25), which examined the prevalence of dental anomalies in panoramic radiographs in Bushehr, 913 cases were identified with at least one dental anomaly. The anomaly "dens in dent" had a prevalence of 3.10%, dental agenesis was 3.35%, and impaction was 2.64%, respectively, indicating the highest prevalence. The lateral incisors of the left maxillary arch were identified as the most common teeth in terms of dental anomaly prevalence. Furthermore, the prevalence of anomalies was significantly higher in males compared to females.

In a study, Dagdiya et al. (32) demonstrated that the prevalence of dental anomalies is relatively low in the Indian population, suggesting that geographic location may influence their prevalence. Additionally, it is essential to identify and treat these anomalies promptly to prevent further complications.

Based on the results of the current study, the most frequently observed anomaly in the pediatric population of Isfahan was dental impaction, which aligns with findings from other studies conducted in different cities of Iran (20-23). Additionally, the most commonly affected teeth were the maxillary anterior teeth, mandibular canines, and mandibular second premolars, consistent with previous research findings (2, 11, 33, 34).

The age range of 10 to 13 years appears to be the optimal period for examining dental anomalies in children. It is recommended that this group, along with patients who have no prior history of radiographic evaluation, be assessed for dental anomalies using panoramic radiography to facilitate timely treatment interventions.

Conclusion

The prevalence of dental anomalies in the pediatric population of this study is relatively high (over 30%). Dental impaction and agenesis have the highest prevalence, with dental impaction most observed in the anterior maxillary teeth, while agenesis is more prevalent in the maxillary lateral incisors and mandibular second premolars. Overall, the highest frequency is seen in the anterior teeth. In the 6- to 9-year age group, dental anomalies are observed less frequently. There is no significant difference in the prevalence of anomalies between girls and boys, as well as between the maxilla and mandible.

Conflict of Interests: The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial, in this article

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