



Prevalence of Dental Anomalies in a Sample of Turkish Children: A Retrospective Study

Bir Grup Türk Çocuğunda Dental Anomalilerin Sıklığının Değerlendirilmesi: Retrospektif Çalışma

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ABSTRACT

Objective: The aim of this study was to determine the prevalence of dental anomalies in Turkish children aged 2-14 years by panoramic radiographies. The most common dental anomaly, the frequency of multiple dental anomalies and gender differences were further evaluated.

Methods: Two thousand and thirty panoramic radiographies were scanned by two experts in a dimly illuminated environment. Anomalies were recorded in the Excel table under six main groups and 21 subgroups: size, number, position, texture, shape and eruption anomalies. A chi-square test was used to analyze the data at $p<0.05$.

Results: The mean age of the patients evaluated was 9.52 ± 2.68 years, and the gender distribution was balanced. It was found that germ deficiency (8.3%) was the most prevalent anomaly. The most common type of anomaly was number anomaly (11.1%) in which no statistically differences were found between females and males ($p<0.05$). The germ deficiency was more common in the mandible, whereas microdontia, taurodontism, and dilaceration were more common in the maxilla. Additionally, 116 patients (6.1%) had multiple types of anomalies simultaneously.

Conclusion: The prevalence of dental anomalies was found to be 23.7%. It is crucial for clinicians to detect these anomalies in their early stages, as they can potentially lead to a variety of clinical complications.

Keywords: Children, dental anomaly, gender, panoramic radiography, prevalence

ÖZ

Amaç: Bu çalışmanın amacı, 2-14 yaş arası Türk çocuklarında diş anomalilerinin görülme sıklığının panoramik radyograflerle belirlenmesidir. En sık görülen diş anomalisi türü, aynı anda birden fazla diş anomalisinin görülme sıklığı ve cinsiyet farklılıkları ayrıca değerlendirilmiştir.

Yöntemler: İki bin otuz adet panoramik radyografi, iki uzman tarafından loş bir ortamda taranmıştır. Anomaliler Excel tablosunda büyüklük, sayısı, konum, doku, şekil ve sürme anomalileri olmak üzere altı ana grup ve 21 alt grup olarak kaydedilmiştir. Verilerin analizinde ki-kare testi kullanılmıştır ($p<0,05$).

Bulgular: Değerlendirilen hastaların ortalama yaşı $9,52\pm2,68$ yıl olup cinsiyet dağılımının dengeli olduğu saptanmıştır. Germ eksikliğinin (%8,3) en sık görülen anomaly olduğu belirlenmiştir. En sık görülen anomaly türü sayı anomalisi (%11,1) olup, kadın ve erkekler arasında istatistiksel olarak anlamlı bir fark olmadığı saptanmıştır ($p<0,05$). Germ eksikliğinin mandibulada daha sık görüldüğü, mikrodonti, taurodontizm ve dilasasyonun ise maksillada daha sık görüldüğü belirlenmiştir. Ek olarak 116 hastada (%6,1) aynı anda birden fazla anomaly tipi görülmüştür.

Sonuç: Diş anomalilerinin görülme sıklığı %23,7 olarak bulunmuştur. Potansiyel olarak çeşitli klinik komplikasyonlara yol açabileceğinden, klinisyenlerin bu anomalileri erken evrede tespit etmesi çok önemlidir.

Anahtar Kelimeler: Çocuk, diş anomalisi, cinsiyet, panoramik radyografi, prevalans

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Introduction

Dental anomalies are deviations in tooth structure that arise from improprieties in embryonic development that take place throughout the process of odontogenesis. They may be acquired, congenital, or developmental (1). Dental anomalies can be categorized according to their quantity, form, dimensions, eruption, and structure (2). In addition to dense invaginatus, taurodontism, macrodontia, inversion, and transposition, the term “dental anomaly” encompasses an extensive variety of irregularities (3). Clinical diagnosis of these anomalies is possible via examination or radiograph. They commonly result in dental abrasions, poor aesthetics, and difficulties with mastication. Additionally, they may result in occlusal incompatibilities as a consequence of heightened caries susceptibility caused by increased plaque accumulation, tooth attrition, and fractures. Research on dental anomalies helps to ascertain their prevalence within the population and mitigates complications associated with delayed treatment through the facilitation of prompt diagnosis and optimal treatment strategizing (3).

The occurrence rate of dental anomalies exhibits variation across the populations analyzed (2,4-8). It has been reported that the prevalence of dental anomalies in the Turkish populace ranges from 1.69% to 39.2% (5,6,9). The occurrence rate of dental anomalies has been documented in several scholarly works as follows: 36.7% for the Indian population (7), 40.8% for the Iranian population (4), 45.1% for the Saudi Arabian population (8) and 17.52% for the Nigerian population (2).

By analyzing panoramic radiographies, the study aims to determine the prevalence of dental anomalies among Turkish children aged 2 to 14 years, in addition to identifying the most prevalent dental anomaly, gender differences, and the frequency of multiple dental anomalies.

Methods

Research Ethics and Design

This retrospective cross-sectional study received approval from the Hacettepe University’s Ethical Committee (approval number: 2023/13-09, date: 25.07.2023). This cross-sectional study assessed panoramic films of children aged 2 to 14 who submitted applications to the university’s pediatric dentistry department between 2021 and 2022. All panoramic films utilized in this study were captured in the radiology department of the faculty using the identical panoramic film device (Morita Veraview IC5-HD, Tokyo, Japan). Their capturing purposes varied, including root development time, caries examination, and eruption. None of the films were exposed expressly for this research.

Criteria for Inclusion and Exclusion

High-quality panoramic radiographies captured for any purpose between 2021 and 2022 were incorporated into the research. Exclusion criteria encompassed low-quality panoramic radiographies featuring artifacts, radiographs taken from patients with craniofacial defects including cleft lip and palate, patients

undergoing fixed orthodontic treatment, and patients with syndromes including ectodermal dysplasia.

The Collection of Data

Two impartial specialists assessed the radiographs using a computer monitor in a dimly illuminated environment. Each specialist assessed every patient’s radiograph. The patients’ dental anomalies, gender, and age were documented in an Excel file (Excel 2019; Microsoft Office). Amelogenesis imperfecta, germ deficiency, microdontia/macrodontia, ankylosed tooth, ectopic position, inversion, transposition, fusion-gemination, ectopic position, odontoplasia, ghost tooth, talon cusp, dilaceration, conical shaped teeth, taurodontism, dentin dysplasia, talon cusp, impacted tooth, and retained primary tooth were among the anomalies documented. The 21 anomalies mentioned can be classified into six primary categories: size (microdontia/macrodontia), number [germ deficiency (hypodontia, oligodontia), supernumerary teeth], position (ectopic position, inversion, transposition), texture (amelogenesis imperfecta, dentin dysplasia, turner tooth, odontoplasia, ghost tooth); shape (fusion-gemination, taurodontism, conical shaped teeth, dilaceration, dens invaginatus, talon cusp); and eruption (impacted tooth, retained primary tooth, eruption delay, ankylosed tooth) anomalies.

Following the evaluation of all anomalies by two experts, the radiographs that generated disagreement were reassessed, and a consensus was reached. A tooth was classified as having a talon cusp if its structure exhibited a V-shaped radiopaque structure (Figure 1) (10). Patients who exhibited five germ deficiencies or less were categorized as having hypodontia (11), while those who had six or more germ deficiencies were classified as having oligodontia (11). The determination of taurodontism was conducted in accordance with the criteria outlined by Shifman and Chanannel (12). These criteria involved the vertical expansion of the pulp chamber and its rectangular shape.

Statistical Analysis

The SPSS (version 23, SPSS, IBM) software was used to evaluate the data. Percentages were compared using chi-square tests with $p=0.05$.



Figure 1. Eleven years old patient; 11 talon cusp, 18,48 germ deficiency

Results

Incidence of Dental Anomalies

Thirty-eight patients with cleft lip palate and one patient with ectodermal dysplasia were excluded from the study, out of a total of 2030 patients whose panoramic radiographies were evaluated. Seventy of the remaining 1991 patients were omitted from the study on account of substandard quality radiographs; the radiographs of patients from 1921 were assessed. The patients who were assessed had an average age of 9.52 ± 2.68 years, and the gender distribution was balanced, with 50.4% females and 49.6% males. Table 1 presents the frequencies of the 21 anomalies that were assessed.

The most common anomaly was found to be germ deficiency (8.3%). A total of 358 patients (928 teeth) exhibited germ deficiency; among these, tooth number 18 (47.5%) was identified as the most frequently affected tooth. Subsequently, teeth numbers 28 (42.2%), 38 (35.8%), and 48 (31.8%) were inserted. Taking into account the prevalence of germ deficiencies in third molars and excluding them, germ deficiency was detected in 160 patients (364 teeth). The most frequently occurring tooth numbers with germ deficiencies were as follows: 35 (36.3%), 45 (34.4%), 22 (28.1%), and 12 (25%). The teeth with the lowest prevalence of germ deficiency (0.6%) were teeth 11, 21, 33, and 36. No deficiency was detected in tooth 46. Of the cases 0.5% involved oligodontia and 7.9% involved hypodontia.

Following germ deficiency, the most prevalent dental anomalies were impacted teeth (4%) (Figure 2), ectopic position (3.7%), and supernumerary teeth (3%) (Figure 3), in that order. Tooth number 45 (16.9%) exhibited the highest frequency of occurrence among teeth exhibiting ectopic position.

A total of 35 patients (89 teeth) exhibited taurodontic disruption, with the molars 16 and 26 being the most commonly affected (57.1%). A total of 48 patients exhibited microdontia, with the number of affected teeth being identified as 21 (31.3%) and 22 (33.1%), respectively. A total of 50 patients (2.6%) exhibited dilaceration, while 77 patients (4%) presented with impacted teeth. The teeth with the highest incidence of impaction were teeth 13 (20.8%) and 23 (15.6%), in that order. Dilaceration was most prevalent (16%) in tooth number 16.

Upon examining 21 anomalies under six headings, it was ascertained that the number anomaly was the most prevalent form of anomaly (Table 2). Eruption anomalies were considerably more prevalent in females than in males statistically. Regarding the remaining categories of anomalies, no gender disparity was observed (Table 2).

Anomalies in Primary Teeth

An anomaly associated with germ deficiency was observed in one primary tooth (number 82). An anomaly of fusion-gemination was found in one primary tooth, where fusion occurred between the supernumerary tooth and tooth number 72. Dentin dysplasia was detected in primary teeth in only three cases. After

thoroughly analyzing all the radiographs, it was determined that there was one primary tooth that was impacted, one primary tooth that was ankylosed, and two phantom teeth that were identified among the primary teeth (Table 1).

Maxilla-mandible and Gender Differences

While certain dental anomalies such as ectopic position anomalies, microdontia, taurodontism, and dilaceration were more prevalent in the maxilla, germ deficiency is more prevalent in the mandibula (Table 3). A higher incidence of impacted

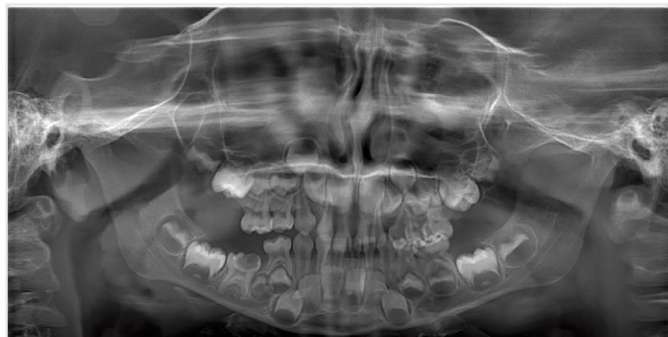


Figure 2. Four years old patient; 85 impacted primary tooth, 45 ectopic position

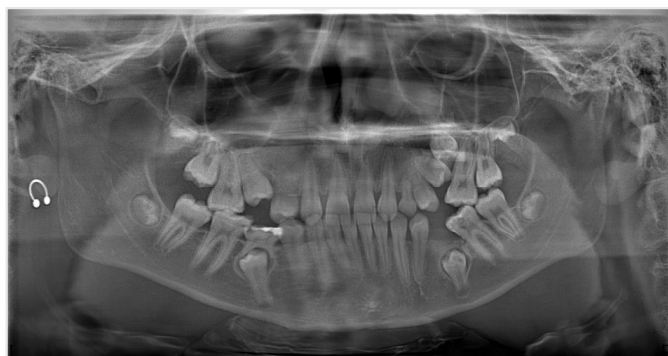


Figure 3. Thirteen years old patient; supernumerary tooth in the upper left molar region, 12,22, germ deficiency, 25,35 impacted teeth



Figure 4. Thirteen years old patient; 18,28,14,25 germ deficiency (number anomaly), 45,17 microdontia (size anomaly), 24 turner tooth (tissue anomaly), 45 ectopic position (position anomaly) and 85 retained primary tooth (eruption anomaly)

teeth ($p=0.009$) was observed in females compared to males, as indicated in Table 3.

The Frequency of Occurrence of Different Types of Anomalies Simultaneously

Figure 4 illustrates a single patient in whom five of the six categories of anomaly types were simultaneously observed. Of all evaluated patients 5.1% were found to have two distinct types of anomalies concurrently. There were 116 patients (6.1%) who presented with multiple types of anomalies simultaneously, as shown in Table 4.

Table 1. Distribution of dental anomalies as count and percentage

Dental anomalies	Total (%)	Permanent	Primary
Germ deficiency	160 (8.3)	159	1
Impacted tooth	77 (4)	76	1
Ectopic position	71 (3.7)	71	-
Supernumerary tooth	58 (3.0)	57	1
Dilaceration	50 (2.6)	50	-
Microdontia	48 (2.5)	48	-
Taurodontism	35 (1.8)	35	-
Talon cusp	34 (1.8)	34	-
Dens invaginatus	16 (0.8)	16	-
Conical shaped tooth	12 (0.6)	12	-
Fusion-gemination	11 (0.6)	10	1
Dentin dysplasia	11 (0.6)	10	3*
Retained primary tooth	5 (0.3)	-	5
Inversion	5 (0.3)	5	-
Ghost tooth	3 (0.2)	2	1
Turner tooth	2 (0.1)	2	-
Amelogenesis imperfecta	2 (0.1)	2	-
Transposition	1 (0.1)	1	-
Odontoplasia	1 (0.1)	1	-
Ankylosed tooth	1 (0.1)	-	1
Eruption delay	1 (0.1)	1	-

*Two patients have dental anomalies in both their permanent and primary teeth

Table 2. Distribution of anomaly groups as count and percentage according to genders

	Total (%)	Male (%)	Female (%)
Number anomaly	213 (11.1)	102 (10.7)	111 (11.5)
Shape anomaly	148 (7.7)	78 (8.2)	70 (7.2)
Position anomaly	86 (4.5)	44 (4.6)	42 (4.3)
Eruption anomaly	81 (4.2)	29 (3)*	52 (5.4)*
Size anomaly	48 (2.5)	21 (2.2)	27 (2.8)
Tissue anomaly	16 (0.8)	7 (0.7)	9 (0.9)
Total	455 (23.7)	219 (23)	236 (24.4)

*Reveals statistically significant difference between genders ($p<0.05$)

Discussion

The dental anomaly concept contains a wide variety of anomalies such as germ deficiency, supernumerary teeth, taurodontism, macrodontia, microdontia, dense invaginatus, fusion, gemination, inversion and transposition. Dental anomalies can lead to various complications and cause damage. Research on dental anomalies not only determines their prevalence in society but also helps reduce complications related to delayed treatment by allowing rapid diagnosis and optimal treatment planning (2,3).

Utilizing digital panoramic radiographies, the prevalence of dental anomalies in patients aged 2 to 14 years was determined. Digital panoramic radiographies are favored over other advanced imaging techniques, such as computed tomography (CT), because they permit simultaneous examination of the dentition and jaw while consuming negligible amounts of radiation and at a low cost (6). As a result, this approach was favored in this retrospective investigation due to its capacity to assess a substantial quantity of radiographs.

Upon incorporating all dental anomalies that were examined, the overall incidence of anomalies was determined to be 23.7%. Previous studies that examined different Turkish populations regarding this point have reported a range between 1.69% and 39.2% (5,6,9). The variation in these rates between studies could potentially be attributed to differences in the age groups of the patients analyzed and the range of anomaly types assessed. For instance, Buyukgoze-Dindar and Tekbas-Atay (5) evaluated the panoramic radiographies of a patient group between the ages of 12 and 60, while in the current study the population age was between 2 and 14 years old. Furthermore, comprehensive dental anomaly subgroups were evaluated in the current study in comparison to previous studies (5,6,9). It is also important to note that as the number of anomalies increases, the percentage of patients with anomalies also increases. Bilge et al. (6) evaluated a variety of dental anomalies closest to the present study by examining five main and 16 subgroups. Therefore, a similar percentage with this previous study was reported in the current study.

Anomalies of the primary teeth were also assessed in current study. It was ascertained that one participant possessed two turner teeth, four participants amounted to a total of five retained primary teeth, and one participant had one impacted primary tooth (Figure 2). An anomaly in primary teeth was identified at 0.45% in present study and this result was compatible with the previous results which ranged between 0.3-5.46% (13-15) in different Turkish populations. It is thought that this difference between the studies may be due to the difference in the age groups examined. While children between the ages of 2 and 5 were included in Kapdan et al. study (13), in current study, children aged 2-14 were included when determining primary tooth anomaly. An analysis of primary tooth studies conducted globally revealed that the occurrence rate of dental anomalies varied between 0.2% and 7.2% (16,17).

Table 3. Distribution of anomalies as count and percentage in jaws and genders

	Maxilla (%)	Mandible (%)	Male (%)	Female (%)
Germ deficiency	95 (4.9)	104 (5.4)	69 (7.2)	91 (9.4)
Taurodontism	31 (1.6)	15 (0.8)	16 (1.7)	19 (2)
Microdontia	39 (2)	16 (0.8)	21 (2.2)	27 (2.8)
Dilaceration	33 (1.7)	23 (1.2)	27 (2.8)	23 (2.4)
Impacted tooth	51 (2.7)	28 (1.5)	27 (2.8)*	50 (5.2)*
Ectopic position	41 (2.1)	35 (1.8)	37 (3.9)	(3.5)

*Reveals statistically significant difference between genders ($p < 0.05$)

Table 4. Distribution of patients with anomaly groups as count and percentage

Number of anomaly groups	Frequency (%)
0	1466 (76.3)
1	339 (17.6)
2	98 (5.1)
3	16 (0.8)
4	1 (0.1)
5	1 (0.1)
Total	1921 (100)

Anomalies involving impacted were statistically more prevalent in females than males in the present study. While some studies did not find any discernible distinction between the genders (13,15,18,19), others did mention such variations (5,20). Brook et al. (20) found that supernumerary teeth were more prevalent in males and hypodontia was more prevalent in females. Buyukgoze-Dindar and Tekbas-Atay (5) documented a statistically significant increase in the incidence of microdontia and mesiodens anomalies among females.

Size anomaly was determined to be 2.5%, while number anomaly was 11.1% in the present study. The percentages, as reported in a comprehensive study by Jain et al. (19), were 6.25% and 2%, respectively. Although size anomaly occurrences were comparable between the two investigations, number anomaly occurrence rates varied. According to Bilge et al. (6), the Turkish population exhibited a number anomaly of 17% and a size anomaly of 8.2%. Additionally, position anomaly was the most prevalent one (60.8%), according to Bilge et al. (6) In this previous study (6), the most prevalent subgroups were impacted teeth (45.5%), dilaceration (16.3%), hypodontia (13.8%), and taurodontism (11.2%). It has been noted in the literature that while the frequency of anomalies may differ between studies, the sequence of the most prevalent anomalies remains consistent (1,5,6). Furthermore, number anomaly is the most prevalent in the current study. Hypodontia (germ deficiency) and impacted teeth are, in line with findings from other research (6,19), the most prevalent forms of anomalies.

The prevalence of talon cusp was determined to be 1.8% in present research. When the studies conducted in Turkey were examined (5,9), it was seen that there were few studies examining the talon cusp anomaly and its incidence was reported as 0.02-

0.03%. It was documented that the prevalence of talon cusp among the population of Jordan was 0.55% (10). The results of the two studies are comparable; however, the age and racial composition of the groups under investigation might account for the marginal disparity between them.

In the literature, the incidence of hypodontia and oligodontia varies. They were 7.9% and 0.5%, respectively, according to present research. Bilge et al. (6) documented that the prevalence of hypodontia was 5.5%, but there was no occurrence of oligodontia. In another study conducted in Turkey, the prevalence of hypodontia was reported as 1.36% and the incidence of oligodontia was reported as 0.04% (5). Studies conducted in the Turkish population reported that the prevalence of hypodontia was between 1.5 and 6.77% (5,21). When other studies conducted around the world were examined, Olatosi et al. (2) reported the prevalence of hypodontia as 1.36%, similar to Buyukgoze-Dindar and Tekbas-Atay (5). Hypodontia was reported in 4.7% of cases by Jain et al. (19). The incidence of hypodontia has been 5.21% in the Iranian population (22) and 6.02% in the Puerto Rican (23) population. Although the characteristics of the population are different, the results are quite similar.

Each anomaly type identified in the current study was classified into six overarching categories, and the occurrence rate of multiple anomaly types concurrently was also ascertained. The study revealed that the occurrence rate for a single anomaly was 17.6%, while the occurrence rate for multiple anomalies concurrently was 6.1%. The number of studies examining the co-occurrence frequency of anomalies is exceedingly limited. The occurrence rate of a single anomaly was documented by Jain et al. (19) as 8%, whereas the occurrence rate of multiple anomalies was 0.27%. According to the findings of Bilge et al. (6), the occurrence rate of a single anomaly was 35.25%, while the occurrence rate of multiple anomalies was 3.91%. The higher frequency of multiple anomalies observed in the current study compared to other studies might be attributed to the subgroup quantity of anomalies that were assessed.

Study Limitations

There were some limitations to this study. First, since it was a retrospective study, intraoral examinations of the patients could not be performed. Furthermore, this information is lacking as the patient record archive at our institution does not contain any clinical data regarding the patients. The diagnosis of

many dental anomalies will be made easier by combining the evaluation of clinical examination and radiographic data. In particular, tissue anomalies are diagnosed based on the tissue seen radiographically, and this may cause some tissue anomalies, such as the early stages of mild amelogenesis imperfecta forms, to be overlooked. Another limitation of the study was that some dental anomalies could not be easily diagnosed with panoramic radiographies, which provide us a two-dimensional image of a three-dimensional structure. Therefore, it will be easier to make the diagnosis if you use imaging techniques like CT that offer three-dimensional examination. However, since the amount of radiation the patient would receive was taken into consideration once more and was only taken when necessary, it was believed that the hospital archive would not be sufficient for such a scan while taking CT in the pediatric patient group.

Conclusion

Dentinal anomalies are extremely prevalent and broadly distributed across populations. Based on the findings of this research, the prevalence of dental anomalies was 23.7%, with number and shape anomalies being the most prevalent. Although there was no gender difference in the incidence of dental anomalies, according to subgroups, eruption anomalies were more common in females than in males. The occurrence rate of multiple anomalies occurring concurrently is 6.1%. There was a single patient who exhibited five distinct kinds of anomalies simultaneously. In the early stages, clinicians can make more accurate diagnoses of dental anomalies by having knowledge of the categories of anomalies, their prevalence in the jaw, and the fact that they may not always manifest symptoms but can lead to a variety of clinical complications.

Ethics

Ethics Committee Approval: This retrospective cross-sectional study received approval from the Hacettepe University's Ethical Committee (approval number: 2023/13-09, date: 25.07.2023).

Informed Consent: Retrospective cross-sectional study.

Footnotes

Authorship Contributions

Concept: P.S.E., E.U.O., Design: P.S.E., E.U.O., Data Collection or Processing: P.S.E., S.K., E.U.O., Analysis or Interpretation: P.S.E., S.K., E.U.O., Literature Search: P.S.E., Writing: P.S.E., E.U.O.

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