



Clinical and Radiographical Evaluation of Non-syndromic Dental Anomalies in Turkish Children

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Abstract

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AIM: The aim of this study was to investigate the frequency and distribution of non-syndromic developmental dental anomalies in Turkish children in different age groups.

SUBJECTS AND METHODS: A sample of 516 children aged 3–17 years who attended the Pediatric Dentistry Department of Istanbul Aydin University were evaluated clinically and radiographically for the existence of any structural, shape, and number anomalies of the developing dentition, and the most prevalent anomalies were compared according to gender and age groups.

RESULTS: The most observed dental anomaly was Molar Incisor Hypomineralization (MIH) and tooth agenesis by a percentage of 14.3% and 4.8%, respectively. The incidence of MIH was higher in 7–8 and 9–10 years of age groups. There were no anomalies detected in 361 (70%) of the patients; meanwhile, only one anomaly was observed in 110 (21.3%), two different anomalies at the same time were observed in 33 (6.4%), and more than two anomalies were observed in 12 (2.3%) in the study group.

STATISTICS: The statistical analysis of the results was obtained using the IBM SPSS Statistics 22 (IBM SPSS, Inc USA) program. $p < 0.05$ was considered to be statistically significant.

CONCLUSION: Although there are no known systemic disturbances, at least, one dental anomaly was observed in 21.3% of the children. The most observed anomalies were MIH and tooth agenesis. An increase in the MIH prevalence throughout the world may lead to the suggestion that more investigations should be made on environmental predisposing factors. Besides, there might be common genetic factors and genes (PAX9, AXIN2, MSX1) affecting both tooth development and tumor formation which may be a potential risk marker for future cancer development.

Introduction

Dental development is a complex adaptive system that regulates the initiation and morphogenesis of tooth germs by a series of interactions between genetic, epigenetic, and environmental factors that determine tooth number, location, type, size, and morphology [1].

The developing tooth bud is sensitive to a wide range of systemic disturbances, and particularly, the enamel is unable to recover once it is damaged [2]. Investigations have already shown that both genetic and environmental disturbances during the morphodifferentiation stage of development may cause abnormalities in tooth shape, size, and structure, and several genes are described to be associated with early tooth morphogenesis [3], [4].

Dental anomalies may occur in combination with systemic disorders and syndromes such as hypophosphatemia, cystic fibrosis, and leukemia, and they are even considered to be markers of underlying genetic disorders [5]. A single genetic defect may result in different phenotypic expressions, including such various

traits as tooth agenesis, microdontia, ectopic tooth position, and delayed development of different teeth [6].

Detailed investigation of dental anomalies is essential for the early diagnosis and treatment of possible malocclusions, cosmetic deformities, and problems of the developing dentition. For the differential diagnosis of these anomalies, radiographic evaluation should not be avoided in addition to clinical examination [7]. Early diagnosis and a thorough treatment plan might eliminate the disadvantages of these congenital dental disorders as well as the risk of orofacial developmental problems.

Therefore, the objective of this study is to investigate the frequency and distribution of different types of developmental dental anomalies in both the deciduous and permanent teeth in Turkish children and compare differences between genders in different age groups.

Subjects and Methods

This study is conducted among 516 children aged between 3 and 17 who attended Istanbul Aydin

University Pediatric Dentistry Department for dental examination and check-up from June 2014 to January 2015. The informed consent for the clinical and radiographical examination was obtained from the parents or legal guardians. The subjects then were clinically examined and radiographically evaluated with orthopantomography (OPTG) radiographs to evaluate the existence of any dental anomalies. Children with any systemic disease, syndrome, or mental retardation or with incomplete records, history of extraction of any tooth or history of endodontic treatment or trauma, or previous history of orthodontic treatment, were excluded from the study. The clinical examinations were made according to the WHO criteria. The radiographs were taken in the department of radiology by the same technician with Veraviewepocs 2D, J.Morita Corp., XH-550 with a CCD sensor.

The developmental anomalies were evaluated as follows.

1. Structural anomalies; such as molar incisor hypomineralization (MIH), amelogenesis imperfecta (AI), and dentinogenesis imperfecta (DI) in both deciduous and permanent teeth,
2. Number anomalies such as hypodontia (tooth agenesis), oligodontia, and hyperdontia and
3. Shape anomalies such as fusion, gemination, Talon cusp, Cusp of Carabelli, peg-shaped teeth, microdontia, and macrodontia.
4. Tooth agenesis was diagnosed when there was no sign of crown calcification on the radiograph and no evidence or history of loss due to orthodontic treatment, caries, periodontal disease, or trauma. Microdontia of the maxillary lateral incisors: When the mesiodistal width of the crown is less than that of the opposing mandibular lateral incisor [8].

The statistical analysis of the results was obtained using IBM SPSS Statistics 22 (IBM SPSS, Inc USA) program. The descriptive statistics (mean, standard deviation, and frequency) were used to determine the frequencies and the statistical data were compared using Chi-square, Fisher's Exact Chi-square, Continuity Yates, and Fisher Freeman Halton tests. $p < 0.05$ was considered to be statistically significant.

The ethical approval was obtained from the Ethical Committee for Clinical Investigations of İstanbul Aydin University Faculty of Dentistry (Approval Protocol Number: B.30.2.AYD.0.00.00.480.2/002)

Results

A total number of 516 children was evaluated in this investigation. Two hundred and sixty-two (50.8%) were girls and 254 (49.2%) were boys. The mean age

of the study group was 8.27 ± 3.21 . When classified according to the age groups, 66 children (12.8%) were 4 years or under; 105 (20.3%) were 5–6 years; 109 (21.1%) were 7–8 years; 97 (18.8%) were 9–10 years; 71 (13.8%) were 11–12; and 68 (13.2%) were 13 years or older.

There were no anomalies detected in 361 (70%) of the patients; meanwhile, only one anomaly was observed 110 (21.3%), two different anomalies at the same time were observed in 33 (6.4%), and more than two anomalies were observed in 12 (2.3%) in the study group.

The most prevalent anomaly determined was MIH with a percentage of 14,3% which was followed by tooth agenesis with 4,8%. The most rarely observed anomalies were DI, AI, and taurodontism (0.19%). Talon cusp on permanent teeth was observed in 14 (2.7%) children. Carabelli's trait was observed in 13 children as 4 on primary and 9 on permanent teeth (Table 1).

Table 1: The distribution of the type of the anomalies according to the number of children with percentage

Type of anomaly	n	%
Talon cusp	14	2.7
Carabelli's trait	13	2.5
Tooth agenesis	25	4.8
Supernumerary teeth (Mesiodens)	7	1.4
MIH	74	14.3
DIH	15	2.9
Odontoma	2	0.4
Taurodontism	1	0.2
Amelogenesis imperfecta	1	0.2
Fusion	1	0.2
Gemination	1	0.2
Microdontia	1	0.2

Tooth agenesis was observed in the mandibular and maxillary second premolars and maxillary laterals in 25 children with 4.8% by percentage. Supernumerary teeth were observed in seven children as mesiodens (1.4%).

Hypomineralization was the most prominent developmental abnormality with 14.3% by percentage in our investigation as noted in both primary and permanent dentitions. The distribution was 74 (14.3%) in permanent dentition and 15 children (2.9%) in the primary dentition. Although the term MIH refers to molar and incisor hypomineralization, the hypomineralized teeth were mostly molars. When compared according to gender, boys were observed to be affected more ($n = 49$) than girls ($n = 38$), but the difference was not statistically significant (Figure 2).

Comparison of the age groups according to statistical analysis has revealed that the prevalence of MIH was lower in age 6 or less group ($p = 0.044$; $p < 0.05$) and 13+ group which was statistically significant when compared to the age 7–8 group ($p = 0.016$; $p < 0.05$), 9–10 group ($p = 0.001$; $p < 0.01$), and age 11–12 group ($p = 0.001$; $p < 0.01$), respectively. The MIH prevalence was highest in the ages 9–10 group compared to the other groups (Figure 1).

The second most prevalent dental anomaly was tooth agenesis which was more observed as

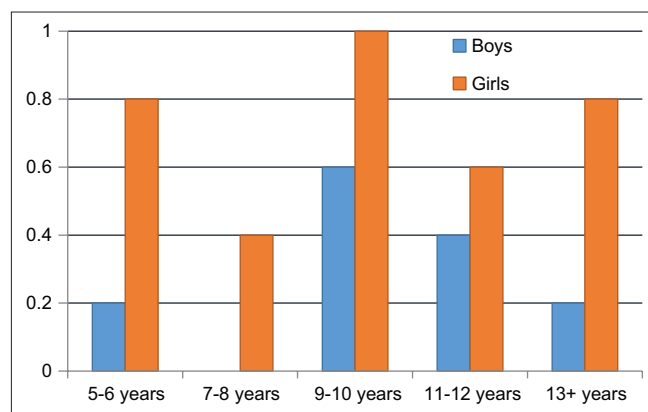


Figure 1: The distribution of tooth agenesis according to gender and age groups by percentage

the absence of mandibular second molars and then maxillary laterals, respectively.

When compared according to genders, tooth agenesis was observed more in girls (6,9%) than in boys (2,8%), which was also statistically significant. ($p = 0.049$; $P < 0.05$) (Table 2).

Table 2: Distribution of dental anomalies according to gender

Type of anomaly	Gender		p
	Girls n (%)	Boys n (%)	
¹ Talon cusp in primary dentition	2 (0.8)	3 (1.2)	0.682
¹ Talon cusp in permanent dentition	3 (1.1)	6 (2.4)	0.333
¹ Carabelli's trait in primary dentition	4 (1.5)	0 (0)	0.124
¹ Carabelli's trait in permanent dentition	5 (1.9)	4 (1.6)	1.000
Tooth agenesis	18 (6.9)	7 (2.8)	0.049*
² Supernumerary tooth in primary dentition	0 (0)	1 (0.4)	0.492
² Supernumerary tooth in permanent dentition	2 (0.8)	4 (1.6)	0.444
³ MIH	33 (7.3)	41 (9.1)	0.251
³ DIH	7 (2)	8 (2.3)	0.951

¹Fisher's Exact Test, ²Chi-square Test. * $p < 0.05$.

Furthermore, according to the age groups, in the age, 9–10 group congenitally missing teeth were observed more in number compared to the 7–8 years of the age group which was also statistically significant ($p = 0.039$; $p < 0.05$) (Figure 1).

The prevalence of Talon Cusp and Cusp of Carabelli showed no statistically significant difference when compared according to gender for both in the primary and permanent dentition. ($p > 0.05$).

Discussion

Tooth agenesis is the most common and clearly diagnosed dental anomaly in the literature and it affects permanent teeth more frequently. Tooth agenesis might appear related to a syndrome or as an isolated trait. Many dental anomalies have also been reported to be associated with tooth agenesis, including small tooth size, peg-shaped upper lateral incisor [9], [10], taurodontism, dental transposition, and double formation [11], [12], [13].

As the third molar is the most frequently affected tooth, excluding the third molar the reported

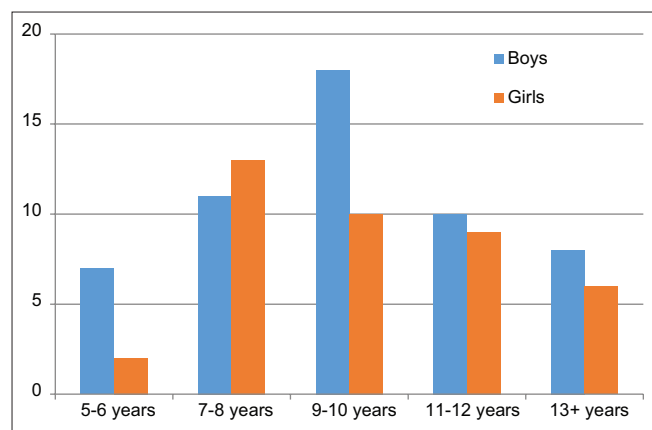


Figure 2: The distribution of MIH according to gender and age groups by number

prevalence rates vary according to the population. The prevalence of dental agenesis varied from 1.4% in Japanese [14] to 11.3% in the Irish population and 2.8% in the Turkish [15] to 11.3% in the Irish population [16]. In our study, the prevalence of tooth agenesis is 4.8% higher than previous data, which may indicate a need for further investigation of different regions of Turkey.

In most reports, the prevalence of dental agenesis in females was always higher than in males; however, Rølling [17] and Albashaireh and Khader [18] reported that there was no significant difference based on sex. The prevalence of dental agenesis in females was 1.01 times [17] to 1.64 times [9] higher than in males. In our study, the prevalence of tooth agenesis was observed 2.46 times higher in females.

The types of teeth reported missing varied in different ethnic groups. In Europeans, the mandibular second premolar was most frequently absent, followed by the maxillary lateral incisor and second premolars [17], [19], [20], [21].

In the Malaysian, Turkish, and American populations, the most frequently missing tooth was the maxillary lateral incisor; and, in Chinese, it was the mandibular central and lateral incisors absence of maxillary central incisor, canine, first molar, and second molar was rare. The prevalence of oligodontia, referring to the absence of more than six teeth, varied from 0% [12] to 0.43% [22] of the population [23], [24]. In our study, the most frequently missing teeth were mandibular second premolars. Unilateral occurrence of hypodontia is more common than bilateral occurrence. In the case of missing two or more teeth, however, symmetrical hypodontia is predominant; in our study, unilateral occurrence of hypodontia was more common as well [9], [12].

Taurodontism is more frequent in non-syndromic familial tooth agenesis. Individuals in families with second premolar and molar oligodontia are more likely to have taurodontism, even individuals with complete dentition. This association could define a subphenotype for future genetic studies of dental development. In our study, out of 25 hypodontia cases, only one was associated with taurodontism [25].

Carabelli's trait may be observed as a tubercle, cuspule, or a groove on the palatal surface of maxillary permanent molars or maxillary second deciduous molars. It includes a variety of expressions that range from complete absence to pits, grooves, tubercles, cusplet, or cusps. The prevalence of the Carabelli structure was reported as 57.6% bilateral, while of 91.2% in the first maxillary molars and 86.4% in the second molars. In our study Carabelli's trait was observed in nine children on permanent molars; and four children on deciduous molars unilaterally.

Conclusion

The prevalence of dental anomalies may vary between various populations. Orodontal anomalies are important factors for the treatment plan and prognosis of the oral health of the growing children. Besides, there might be common genetic factors affecting both tooth development and several tumor formation. Affected by PAX9, AXIN2, and MSX1 genes hypodontia has the potential of becoming a risk marker for future cancer development. Prospective studies are needed to clarify the mechanism in future. Dentists will be in the first line taking care of not only the health of maxillofacial part but also the whole body in the future. Besides clinical examination, OPTG is of critical importance for the diagnosis and management of these variations. Prevalence studies might reveal useful data prospectively for future genetical or cellular-based clinical researches in different populations.

With the results of this present research, useful data for the prevalence of dental anomalies in the Turkish pediatric population may be obtained for future studies.

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