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

Pinar Kiymet Karataban¹*©, Sevgi Zorlu©, Didem Oner Ozdas²©

¹Department of Pediatric Dentistry, BAU International University, Dentistry Faculty, Batumi, Georgia; ²Department of Pediatric Dentistry, Istanbul Aydin University, Dentistry Faculty, Istanbul, Turkey

Abstract

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.

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
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 taluodontism (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).

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 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 | $p$   |
|----------------------------------|--------|-------|
|                                 | Boys   | Girls |
| Talon cusp in primary dentition  | 2 (0.8)| 3 (1.2)| 0.682 |
| Talon cusp in permanent dentition| 3 (1.1)| 6 (2.4)| 0.333 |
| Carabelli’s trait in primary dentition | 4 (1.5)| 0 (0)  | 0.124 |
| Carabelli’s trait in permanent dentition | 5 (1.9)| 4 (1.6)| 1.000 |
| Tooth agenesis                   | 18 (6.9)| 7 (2.8)| 0.049*|
| Supernumerary tooth in primary dentition | 0 (0)  | 1 (0.4)| 0.482 |
| Supernumerary tooth in permanent dentition | 2 (0.8)| 4 (1.6)| 0.444 |
| MIH                              | 33 (7.3)| 41 (9.1)| 0.251 |
| DH                              | 7 (2)  | 8 (2.3)| 0.951 |

*Fisher’s Exact Test, *Chi-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 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 nonsyndromic 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. Orodental 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.

**References**

1. Brook AH, Brook O’Donnell M, Hone A, Hart E, Hughes TE, Smith RN, et al. General and craniofacial development are complex adaptive processes influenced by diversity. Aust Dent J. 2014;59 Suppl 1:13-22. http://doi.10.1111/adj.12158 PMid:24617813

2. Al-Hashimi I, Levine MJ. Characterization of in vivo salivary-derived enamel pellicle. Arch Oral Biol. 1989;34:289-95. http://doi.10.1016/0003-9969(89)90070-8 PMid:2480770

3. Vastardis H. The genetics of human tooth agenesis: New discoveries for understanding dental anomalies. Am J Orthod Dentofacial Orthop. 2000;117:650-6. PMid:10842107

4. Thesleff I. Genetic basis of tooth development and dental defects. Acta Odontol Scand. 2000;58:191-4. http://doi.10.1080/000163500750051728 PMid:11144868

5. Atar M, Körperich EJ. Systemic disorders and their influence on the development of dental hard tissues: A literature review. J Dent. 2010;38:296-306. http://doi.10.1016/j.jdent.2009.12.001 PMid:20004698

6. Mossey PA. The heritability of malocclusion: Part 2. The influence of genetics in malocclusion. Br J Orthod. 1999;26:195-203. http://doi.10.1093/ortho/26.3.195 PMid:10532158

7. Gündüz K, Celenk P. Survey of talon cusps in the permanent dentition of a Turkish population. J Contemp Dent Pract. 2008;9:84-91. PMid:18633473

8. Garib DG, Peck S, Gomes SC. Increased occurrence of dental anomalies associated with second-premolar agenesis. Angle Orthod. 2009;79:436-41. http://doi.10.2319/021308-87.1 PMid:19413376

9. Lai PY, Seow WK. A controlled study of the association of various dental anomalies with hypodontia of permanent teeth. Pediatr Dent. 1989;11:291-6. PMid:2639323

10. Backman B, Wahlin YB. Variations in number and morphology of permanent teeth in 7-year-old Swedish children. Int J Paediatr Dent. 2001;11:11-7. http://doi.10.1046/j.1365-263x.2001.00205.x PMid:11309867

11. Seow WK, Lai PY. Association of taurodontism with hypodontia: A controlled study. Pediatr Dent. 1989;11:214-9. PMid:2638007

12. Schalk-van der Weide Y, Steen WH, Bosman F. Taurodontism and length of teeth in patients with oligodontia. J Oral Rehabil. 1993;20:401-12. http://doi.10.1111/j.1365-2842.1993.tb01624.x PMid:8350175

13. Ely NJ, Sherriff M, Cobourne MT. Dental transposition as a disorder of genetic origin. Eur J Orthod. 2006;28:145-51. http://doi.10.1093/ejo/jci092 PMid:16373452

14. Shimizu T, Takahide M. Prevalence and genetic basis of tooth agenesis. Jpn Dent Sci Rev. 2009;45:52-8. http://doi.org/10.1016/j.jdsr.2008.12.001

15. Topkara A, Sari Z. Prevalence and distribution of hypodontia in a Turkish orthodontic patient population: Results from a large academic cohort. Eur J Paediatr Dent. 2011;12:123-7. PMid:21668285

16. O’Dowling IB, McNamara TG. Congenital absence of permanent teeth among Irish school-children. J Ir Dent Assoc. 1990;36:136-8. PMid:2098447

17. Relling S. Hypodontia of permanent teeth in Danish school children. Scand J Dent Res. 1980;88:365-9. PMid:6928530

18. Albashaireh ZS, Khader YS. The prevalence and pattern of hypodontia of the permanent teeth and crown size and shape deformity affecting upper lateral incisors in a sample of Jordanian dental patients. Community Dent Health. 2006;23:239-43.

19. Nordgarden H, Jensen JL, Storhaug K. Reported prevalence of congenitally missing teeth in two Norwegian counties. Community Dent Health. 2002;19:258-61. PMid:12489841

20. Bergström K. An orthopantomographic study of hypodontia, supernumeraries and other anomalies in school children between the ages of 8-9 years. An epidemiological study. Swed Dent J. 1977;1:145-57.
21. Rose JS. A survey of congenitally missing teeth, excluding third molars in 6000 orthodontic patients. Dent Pract Dent Rec. 1966;17:107-14. PMid:5223809

22. Shethri SA. The prevalence of the Carabelli cusp in selected Saudi population. J Dent Sci. 2011;2:13-6.

23. Altug-Atac AT, Erdem D. Prevalence and distribution of dental anomalies in orthodontic patients. Am J Orthod Dentofacial Orthop. 2007;131:510-4. http://doi.10.1016/j.ajodo.2005.06.027 PMid:17418718

24. Muller TP, Hill IN, Petersen AC, Blayney JR. A survey of congenitally missing permanent teeth. J Am Dent Assoc. 1970;81:101-7. http://doi.10.1016/j.ajodo.2005.06.027 PMid:17418718

25. Gomes RR, Habckost CD, Junqueira LG, Leite AF, Figueiredo PT, Paula LM, et al. Taurodontism in Brazilian patients with tooth agenesis and first and second-degree relatives: A case–control study. Arch Oral Biol. 2012;57:1062-9. http://doi.10.1016/j.archoralbio.2012.04.006 PMid:22647425