



RADIOGRAPHIC INVESTIGATION OF THE RELATIONSHIP BETWEEN DENTAL MALOCCLUSIONS AND DENTAL ANOMALIES ON THE TURKISH POPULATION

Türk Popülasyonu Üzerinde Dental Maloklüzyonlar ve Diş Anomalileri Arasındaki İlişkinin Radyografik Olarak İncelenmesi

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ABSTRACT

Objectives: The aim of this study was to investigate the relationship between various dental anomalies and dental malocclusions / vertical growth patterns.

Materials and Methods: The study was carried out on panoramic radiographs of 756 patients with a mean age of 15.46 ± 4.52 years. 64.6% (n=488) of the total patients were female and 35.4% (n=268) were male. The panoramic radiographs of the patients were detected for the following dental anomalies: supernumerary tooth, agenesis, transposition, microdontia, dilaceration and taurodontism. The obtained data were analyzed using chi-square or Fisher exact tests at a significance level of 5%.

Results: Impaction (14.4%) and microdontia (8.5%) were the most common anomalies. The prevalence of dental anomalies were the highest in skeletal Class III malocclusion (9.9%) and hypodivergent (11.6%) growth pattern (p<0.05).

Conclusion: The presence of an association between skeletal malocclusion/vertical growth pattern and dental anomalies was observed for tooth agenesis, impaction, transposition and taurodontism. Supernumerary tooth, microdontia and dilaceration were not significantly different among malocclusion groups.

Keywords: Dental anomalies; Dental Malocclusion; Growth Pattern.

ÖZ

Amaç: Bu çalışmanın amacı çeşitli dental anomaliler ile dental maloklüzyonlar/dikey büyüme paternleri arasındaki ilişkiyi araştırmaktır.

Gereç ve Yöntemler: Çalışma, yaş ortalaması 15,46 ± 4,52 yıl olan 756 hastanın panoramik radyografileri üzerinde yapıldı. Hastaların %64,6'sı (n=488) kadını ve %35,4'ü (n=268) erkekti. Hastaların panoramik radyografileri üzerinde aşağıda belirtilen diş anomalileri araştırıldı: süpernümerer diş, agenez, transpozisyon, mikrodonti, dilaserasyon ve taurodontizm. Elde edilen veriler Ki-kare veya Fisher exact testleri kullanılarak % 5'lik anlamlılık düzeyinde analiz edildi.

Bulgular: Gömülü diş (%14,4) ve mikrodonti (%8,5) en sık rastlanan anomalilerdi. Dental anomalilerin prevalansı iskeletsel Sınıf III maloklüzyon (%9,9) ve hipodiverjan (%11,6) büyüme paterninde en yüksekti (p<0,05).

Sonuç: Diş agenezi, gömülü diş, transpozisyon ve taurodontizm için iskeletsel maloklüzyon / dikey büyüme paterni ve dental anomaliler arasında bir ilişki olduğu gözlemlendi. Süpernümerer diş, mikrodonti ve dilaserasyon maloklüzyon grupları arasında anlamlı olarak farklı değildi.

Anahtar Kelimeler: Dental Anomali; Dental Maloklüzyon; Büyüme Paterni.

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INTRODUCTION

Dental anomalies can be caused by a number of factors, including genetic, physical, chemical, environmental, and biological factors in the developmental stage.¹⁻³ Investigation of the incidence of dental anomalies may provide important information for phylogenetic and genetic studies and may help to understand variations within and between populations.^{4, 5} Dental anomalies may also occur as part of a syndrome or disease, and detection may be important for diagnosis. For this reason, early diagnosis of dental anomalies is important from a therapeutic point of view.⁴

The number and the shape of the teeth and the anomalies in the tooth position may cause incompatibilities in maxillary and mandibular arch lengths and may prevent obtaining a proper occlusion during orthodontic treatment planning.^{5,6} Dental anomalies may also impair orthodontic treatment and other dental treatments; therefore, the presence should be investigated before treatment and should be considered during treatment planning.^{3,6,7}

In literature, the prevalence of dental anomalies has been investigated in many studies, but very few of these studies have examined the relationship between dental anomalies and malocclusions.^{1,8} Therefore, in this study, it was aimed to investigate the relationship between various anomalies (supernumerary, agenesis, transposition, microdontia, dilaceration, taurodontism) and dental malocclusions.

Dental anomalies of number are supernumerary tooth and tooth agenesis. A supernumerary tooth is defined as an extra tooth or tooth-like structure in addition to 32 permanent teeth.⁹ Tooth agenesis is defined as the congenital absence of tooth / dental germs in permanent teeth and is one of the most common tooth developmental anomalies.¹⁰

Dental transposition is defined as the displacement between two adjacent teeth in the

same half-jaw.¹¹ Microdontia is defined as smaller teeth than normal.^{12,13} Dilaceration means an abnormal twist during the development of the root.¹⁴ Taurodontism is characterized by short, uncompleted roots that are formed as a result of prolonged pulp chamber and Hertwig epithelial root sheath failure.¹⁵

The aim of this study was to determine the frequency and distribution of developmental anomalies in the permanent teeth of the Turkish orthodontic patient population with different skeletal malocclusions and vertical skeletal patterns.

MATERIALS AND METHODS

The study was carried out on panoramic radiographs of 756 patients who applied to Bolu Abant İzzet Baysal University, Faculty of Dentistry, Department of Orthodontics for orthodontic treatment between 2013 and 2018. The local ethics committee of Bolu Abant İzzet Baysal University approved the study. Patients between 12 and 25 years of age were included in this study. Patients with panoramic radiographs of bad quality, cleft lip/palate, syndromes, trauma, systemic disorders were excluded to correctly detect dental anomalies. The sample size was calculated based on a power analysis using G*Power Software version 3.1.9.2 (Universität Düsseldorf, Germany) at alpha error probability of 0.05. The power analysis showed that 273 samples were sufficient, while for more reliable results it was determined as 756.

The skeletal classification was made using ANB angle. Patients with ANB between 0-4, were classified as Class I, ANB>4 as Class II and ANB<0 as Class III.¹⁶ The patients were classified according to their vertical growth pattern using SN-GoGn angle. Patients with SN-GoGn<32 were classified as hypodivergent, SN-GoGn=32 as normal and SN-GoGn>32 as hyperdivergent.¹⁶

The panoramic radiographs of the patients were detected for the following dental

anomalies: supernumerary tooth, agenesis (with the exclusion of third molars and inclusion of hypodontia and oligodontia), transposition, microdontia, dilaceration and taurodontism. Radiographs were evaluated by an orthodontist who was blinded to the groups.

Statistical Analysis

The obtained data were analyzed with SPSS version 20.0 (Statistical Package for Social Sciences, SPSS Inc, Chicago, Ill.) using chi-square or Fisher exact tests at a significance level of 5%. The Kappa index was found to be .83 and the intra-observer correlation was found to be .84 in terms of reliability of the evaluations made.

RESULTS

64.6% (n = 488) of the total patients were female and 35.4% (n = 268) were male and the mean age was 15.46 ± 4.52 years. Table 1 shows the characterization and distribution of dental anomalies by sex. The prevalence of dental anomalies in 756 patients dental records was 26.9% (n = 203). There were significantly more dental anomalies in females (14%) than in males (12.8%) (p<0.05).

Table 1. Frequency of Dental Anomalies by Sex

Dental Anomalies	n (%)			P Value
	Females	Males	Total	
Total Of Dental Anomalies	106 (14)	97 (12.8)	203 (26.9)	0.000
Tooth Agenesis	21 (2.8)	16 (2.1)	37 (4.9)	0.310
Supernumerary	6 (1.2)	6 (0.8)	12 (1.6)	0.363
Microdontia	36 (4.8)	28 (3.7)	64 (8.5)	0.147
Impaction	48 (6.3)	61 (8.1)	109 (14.4)	0.000
Transposition	20 (2.6)	18 (2.4)	38 (5)	0.115
Dilaceration	13 (1.7)	20 (2.6)	33 (4.4)	0.002
Taurodontism	10 (1.3)	16 (2.1)	26 (3.4)	0.005

Impaction (14.4%) and microdontia (8.5%) were the most common anomalies. The most common dental anomaly was impaction, both in males (8.1%) and females (6.3%).

The teeth most affected by dental anomalies were shown in Table 2. Impaction was the most common in maxillary canines, while agenesis was the most common in maxillary inciseive.

Table 2. Most Frequent Dental Anomalies and Their Most Affected Teeth

Dental Anomalies	n (%)	Most Affected Teeth, n (%)
Toot Agenesis	37 (4.9)	Maxillary Anterior 29(3.8) Mandibular Anterior 6(0.8) Mandibular Premolar 2(0.3)
Supernumerary	12 (1,6)	Maxillary Anterior 4(0.5) Mandibular Premolar 3(0.4) Mandibular Molar 3(0.4) Maxillary Molar 2(0.3)
Microdontia	64 (8.5)	Maxillary Anterior 62(8.2) Mandibular Anterior 2(0.3)
Impaction	109 (14.4)	Maxillary Canine 40(5.3) Mandibular Premolar 26(3.4) Mandibular Canine 23(3.0) Maxillary Premolar 14(1.9) Maxillary Molar 4(0.5) Maxillary Anterior 2(0.3)
Transposition	38 (5)	Mandibular Premolar 21(2.8) Maxillary Premolar 6(0.8) Maxillary Canine 5(0.7) Mandibular Canine 3(0.4)
Dilaceration	33 (4.4)	Maxillary Anterior 14(1.9) Maxillary Premolar 9(1.2) Mandibular premolar 7(0.9) Mandibular Anterior 3(0.4)
Taurodontism	26 (3.4)	Mandibular Molar 23(3) Maxillary Premolar 3(0.4)

Table 3 shows the distribution of tooth anomalies according to skeletal malocclusions and growth patterns.

Table 3. Distribution of Dental Anomalies Among Skeletal Malocclusions and Growth Patterns

Dental Anomalies	Skeletal Malocclusion Pattern, n (%)				Growth Pattern, n (%)			
	Class I	Class II	Class III	P Value	Hyperdivergent	Hypodivergent	Normal	P Value
Total	68(9)	60(7.9)	75(9.9)	0.000	36(4.8)	88(11.6)	79(10.4)	0.000
Tooth Agenesis	13(1.7)	16(2.1)	8(1.1)	0.000	4(0.5)	13(1.7)	20(2.6)	0.000
Supernumerary	3(0.4)	2(0.3)	7(0.9)	0.454	3(0.4)	9(1.2)	0(0)	0.177
Microdontia	25(3.3)	13(1.7)	26(3.4)	0.849	6(3.8)	17(2.2)	41(5.4)	0.000
Impaction	32(4.2)	44(5.8)	33(4.4)	0.000	33(4.4)	52(6.9)	24(3.2)	0.032
Transposition	6(0.8)	17(2.2)	15(2)	0.000	15(2)	14(1.9)	9(1.2)	0.010
Dilaceration	7(0.9)	7(0.9)	19(2.5)	0.061	10(1.3)	14(1.9)	9(1.2)	0.215
Taurodontism	7(0.9)	0(0)	19(2.5)	0.002	10(1.3)	3(0.4)	13(1.7)	0.000

40.7% of the individuals in the study had Class I, 41.4% Class II, and 17.7% Class III 'malocclusion. According to the growth pattern, 22% of the patients were hypodivergans, 56.9% were normodiverts and 21.2% were hyperdivergent. The prevalence of dental anomalies were the highest in skeletal Class III malocclusion (9.9%) and hypodivergent (11.6%) growth pattern ($p < 0.05$). Tooth agenesis was significantly more prevalent in Class II (2.1%)/normodivergent (2.6%) patients, impaction was the most prevalent at Class II (5.8%)/hypodivergent (6.9%) patients. Transposition prevalence was significantly lower in Class I (0.8%) / normodivergent (1.2%) patients.

DISCUSSION

Some dental anomalies were linked to certain skeletal malocclusions, suggesting the similar genetic basics.¹⁷ The presence of dental anomalies complicates the overall dental treatment, as well as orthodontic treatment. Therewithal, the patients referring to the Department of Orthodontics may have more dental anomalies resulting in esthetic concerns. There are numerous studies in the literature investigating the prevalence in different populations¹⁸⁻²⁵ and patient groups, as well as in Turkish population.^{6,26-28} The results of these studies vary greatly due to differences in dental anomaly definitions, diagnostic criteria, environmental factors and ethnicity.²⁸ However, no previous study analyzed dental anomalies in Turkish patients with different skeletal malocclusion and growth patterns. Therefore, we aimed to investigate the prevalence of dental anomalies and their

diversities between different sagittal malocclusions and vertical growth patterns.

Thongudomporn and Freer²⁹ investigated 111 orthodontic patients for dental anomalies and indicated that 74.77% of the patients had at least one dental anomaly with the most common as invagination. In their study on 900 orthodontic patients, Uslu *et al.*⁶ found that 40.3% of patients exhibited at least one dental anomaly, with the most prevalent as agenesis (21.6%). Altug-Atac and Erdem²⁸ investigated 3043 orthodontic patients and they found that only 5.46% of the patients had dental anomalies, with the most prevalent ones as hypodontia and microdontia. Fernandez *et al.* (30) found a prevalence of 15.7% in their study that included 1047 orthodontic subjects, and impaction (14.4%) was the most prevalent dental anomaly in their study. We detected a total prevalence of 26.9% for dental anomalies in our study, with the most prevalent anomalies as impaction (14.4%) and microdontia (8.5%). The differences in these studies may be attributed to different populations and patient numbers the studies included.

While some studies did not find significant prevalence differences between sexes for dental anomalies²¹, Fernandez *et al.*³⁰ indicated that dental anomaly prevalence was greater in males than in females and impaction and fusion were significantly different between sexes. The results of our study suggested that macrodontia, impaction, dilaceration and taurodontism was significantly different between sexes and these anomalies were also more frequent in males, in accordance with the study of Fernandez *et al.*³⁰, while female patients had more dental anomalies in total (14%).

Tooth agenesis prevalence was found to be between 0.3% and 10.1%.³¹ In the present study, tooth agenesis prevalence was 4.9% and upper incisors were the most effected teeth by agenesis (3.8%), followed by lower incisors (0.8%) and lower premolars (0.3%) when the

third molars were not included. This finding was partially in accordance with the previous studies that showed the most affected teeth by agenesis are the second premolars and upper lateral incisors, respectively.^{6,21,28}

Supernumerary teeth were observed in 12 patients (1.6%), which was between the range of the previous studies (0.3%-3.8%).^{6,28,30} The most common area of supernumerary teeth in the literature was found to be the maxillary anterior site.³² The most affected teeth in this study were upper incisors (0.5%), which was in accordance with the literature.

Microdontia prevalence was found to be between 1.5% and 2% in the literature³³, while we found a prevalence of 8.5%, with the most affected teeth as upper incisors (8.2%). Proffit³⁴ indicated that size anomaly of the maxillary lateral incisor is the most prevalent anomaly. Peg-shaped lateral incisors were also counted as microdontia and were not separately investigated in this study, which could be the reason why the prevalence was relatively higher than other studies.

Impaction prevalence was 14.4% in the study of Fernandez *et al.*³⁰, which was exactly the same as we observed in the present study. Prevalence rate of canine impaction was indicated as 3.58% in a Turkish population in a previous study³⁵, which was lower than the prevalence in our study. This difference may be due to the fact that patients with impacted teeth refer to orthodontist and gather at the department of orthodontics.

The prevalence of transposition (5%) and dilaceration (4.4%) in our study were similar to those described in the literature.^{6,30} This difference can be attributed to different sample sizes and racial groups studied. A wide range of prevalence was given in the literature for taurodontism and our prevalence of taurodontism (3.4%) was within this range.^{6,36}

The genes that have an influence on skeletal malocclusion may also influence

certain dental anomaly occurrence.³⁷ When associated with skeletal malocclusion and vertical growth patterns, a higher number of anomalies were found in skeletal Class III patients and hypodivergent patients, which was in accordance with the study of Fernandez *et al.*³⁰ Class III patients had the highest rate of anomalies, followed by Class I and Class II patients. Basdra *et al.*³⁷ previously showed that Class III patients had significantly higher dental anomalies than Class II div 1 patients. While Uslu *et al.*⁶ found significant differences only for impaction and short roots and Fernandez *et al.*³⁰ for microdontia and tooth agenesis, we found multiple significant differences for anomalies among the groups. The difference could be due to the variability of patients with malocclusions.

Microdontia was associated with the skeletal Class III patients and tooth agenesis was associated with hypodivergent growth pattern previously.³⁰ According to our results, microdontia was also higher in Class III and II patients than in Class I. However, tooth agenesis was the highest in normal patients and hypodivergent patients were in the second order. In contrary to Uslu *et al.*⁶, we found a higher rate of prevalence for impaction in Class II patients, which may also be associated with malocclusion variability. Taurodontism was not detected in any Class II patients and its rate was lower in hypodivergent patients that could be attributed to specific genetic mechanisms.

CONCLUSIONS

According to the results of the present study, the presence of an association between skeletal malocclusion/vertical growth pattern and dental anomalies was observed for tooth agenesis, impaction, transposition and taurodontism. Class III patients and hypodivergent vertical patterned patients had the most dental anomalies and dental anomaly prevalence. Supernumerary tooth, microdontia and dilaceration were not significantly different among malocclusion groups.

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None declared.

Conflict of Interest

None declared.

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