Prevalence of Dental Anomalies in Various Categories of Malocclusion among Orthodontic Patients in the Kosovo Region: A Retrospective Study

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Abstract

Objectives The objective of this retrospective research was to investigate the prevalence and the association between dental anomalies and malocclusion in a subset of Kosovo's population.

Materials and Methods This retrospective descriptive study was conducted by recruiting 557 patients; 215 (38.6%) were males and 342 (61.4%) were females. The age range was from 7 to 44 years. The exclusion criteria were employed for the sample size, and 307 of 864 patients were excluded from the study. Malocclusion groups were divided through Angle's classification, and dental anomalies were defined according to the literature. Pretreatment panoramic radiographs, medical and dental history, study casts, and photographs were included to categorize malocclusion and identify dental anomalies (i.e., hypodontia, ectopic eruption, impaction, and diastema). The data were analyzed with IBM SPSS software version 16.0. The chi-squared test was utilized to calculate the frequency and percentages of malocclusion and dental anomalies. A *p*-value of 0.05 was considered statistically significant.

Results Five hundred and fifty-seven patient records from 2015 to 2020 were included. An increased prevalence of ectopic eruption (24.8%) was found in this study, whereas the least common was hypodontia (7.0%). The most common malocclusion was class I (46.9%). Vertical plane malocclusion demonstrated that 31.4% had a deep bite and 9.5% had an open bite. Most dental anomalies were significantly associated with class I malocclusion and least associated with class III malocclusion. Transverse malocclusion exhibited that 14% had anterior crossbite and 10.8% had posterior crossbite. Posterior crossbite was significantly less in the class III malocclusion group ($p = 0.019$).

Conclusion The prevalence of the selected dental anomalies was overall high in our study; 557 of 864 patients faced dental anomalies. An association was seen between malocclusion and dental anomalies in the Kosovan population, especially with class I malocclusion. Deep bite was prominent in the vertical plane malocclusion, whereas anterior crossbite was the most common finding in the transverse plane. Anterior crowding was prevalent in the maxilla and posterior crowding in the mandible.

Keywords
- malocclusion
- prevalence
- dental anomalies
- orthodontics

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Introduction

Dental anomalies are commonly observed in orthodontic patients.[1] Dental anomalies are brought about by genetic or environmental factors.[2,3] The degree of severity depends upon the type of congenital disability and morphological and structural changes in the tooth germ. Orthodontic patients face developmental anomalies more frequently than the general population.[1] Before and after birth, congenital disabilities have been notable for tooth size discrepancy, defects in the quantity and quality of teeth, position, and structural changes of teeth.[3] A genetic connection between dental anomalies and malocclusion has not been established. Early identification of dental anomalies is important for orthodontic treatment as the defects can cause aesthetic and functional changes.[4] Orthodontists must always consider dental anomalies in the orthodontic treatment plan.[5] The treatment plan modification depends upon the pretreatment diagnosis and thorough examination. Panoramic radiographs are regarded as the initial diagnostic tool for dental anomalies.[6]

A number of anomalies have been identified in referred orthodontic candidates. The rate of occurrence, the number of anomalies, and the type of anomalies are different in every population. The most prevalent were agenesis, hypodontia, impaction, hyperdontia, taurodontism, and transposition.[5,7–9] Dental anomalies are predominately associated with class II, division 2 malocclusion; therefore, a substantial genetic impact has been identified in forming this malocclusion.[3] Impaction is commonly present in class I and III malocclusions in the Turkish population.[5] In contrast, in one study in Germany, patients did not have any anomalies related to class III malocclusions and class II division 1.[10] Even though the presence of dental abnormalities has been highly reported among orthodontic patients, orthodontists do not bring this fact into consideration.[11]

The prevalence of malocclusion has been explored in a number of populations,[12,13] but no studies have been done in the region of Kosovo. In one Turkish study, malocclusion was also investigated in those referred for orthodontic care.[14] To improve public oral health, it is vital to determine the frequency and prevalence of malocclusion and the reasons for pursuing orthodontic treatment.[15]

Varied comparisons among different populations can improve orthodontic treatment planning and management. Understanding the correlation of malocclusion with developmental defects will provide avenues for new research, treatment plans, and methodologies.

As malocclusion and dental anomalies have not been investigated in the Kosovan population, this study aims to assess the frequency and prevalence of dental anomalies and malocclusion in referred orthodontic patients and show an association between them.

Materials and Methods

This retrospective epidemiological study was carried out among 557 patients aged between 7 and 44 years visiting the orthodontic specialty clinics in Kosovo. Data for the study were taken from the pretreatment diagnostic records of patients from January 2015 to January 2020. The following inclusion criteria were incorporated: archived files from 2015 to 2020, no significant medical and dental history, no extensive restorations that can hinder the identification of dental anomalies, no previous history of orthodontic treatment, Albanian patients from Kosovo, complete dental files including history, examination, orthopantomogram (OPGs), and photographs. The exclusion criteria were maxillofacial trauma, oral pathologies, and diagnosed syndromes.

After applying the exclusion criteria, the final sample consisted of 557 subjects. Out of 864 patients, 307 patients were excluded from the study. Ethical approval was not needed as it is a retrospective study with the inclusion of anonymous patient data.

The following occlusal relationships (regarding Angle's classification) were assessed during the examination of study casts: molar and canine sagittal relationships and coincidence of incisal midlines. Angle's classification was considered, and the findings were categorized into class I, II, and III malocclusion groups.[16] Patients' study models, dental files, and dental radiographs were investigated to identify the following dental anomalies: any congenitally missing teeth except third molars (hypodontia),[17] impaction (tooth that remains unerupted after complete root development),[18] ectopic eruption (tooth erupting in a different position than usual), and diastema (space between maxillary central incisors). Moreover, malocclusion in the transverse plane (upper and lower midline, anterior and posterior crossbite), malocclusion in the vertical plane (a deep bite, an open bite), and anterior and posterior crowding in both jaws were also examined. One operator made all investigations, and then they were rechecked by another orthodontic expert.

Data analysis was done by SPSS 16.0 software (SPSS Inc., Chicago, IL, United States). Descriptive statistics, along with frequency and prevalence, were performed. The chi-squared test was used to investigate whether the distribution of the patients with dental anomalies differed between the three classes of malocclusion. The level of significance for each comparison was calculated using the Bonferroni correction. The level of chi-squared test significance was set at $p \leq 0.05$.

Results

The results regarding the occlusal relationships were as follows: canine and molar sagittal relationships show that out of 557 patients, 194 (34.8%) patients had class II molar relationship, 102 (18.3%) had class III molar relationship, and 261 (46.9%) had class I molar relationship as shown in ►**Table 1**.

Table 1 Frequency of malocclusion according to Angle's classification

	Frequency	Percentage
Class I malocclusion	261	46.9
Class II malocclusion	194	34.8
Class III malocclusion	102	18.3
Total	557	100.0

Table 2 The distribution of age of the patients at the time of the study

		Mean	Standard deviation	Minimum	Maximum
Valid	Missing				
557	0	16.98	7.29	7.00	44.00

►**Table 2** presents the patient's age at the time of their examination. The mean patients' age in this sample is 16.98 ($\pm$ 7.29) years. The youngest patient was 7 years old, and the oldest patient was 44 years old.

►**Table 3** shows the results regarding malocclusion in the vertical and transversal plane, dental anomalies, and anterior and posterior crowding in the lower and upper arch. The transversal malocclusion presented that out of all patients, 63 (11.3%) patients had deviation in the upper midline, 29 (5.2%) in the lower midline, 78 (14%) had anterior crossbite, and 60 (10.8%) had posterior crossbite. The vertical plane malocclusion showed that out of all patients, 175 (31.4%) had a deep bite and 53 (9.5%) had an open bite. Three hundred three (54.4%) had anterior crowding in the mandible, and 309 (55.5%) had anterior crowding in the maxilla. Seventy-six (13.6%) patients had posterior crowding in the lower arch, and 63 (11.3%) patients had posterior crowding in the upper arch. Regarding the dental anomalies, 39 (7.0%) patients had hypodontia, 138 (24.8%) had ectopic eruptions, 52 (9.3%) had impactions, and 70 (12.6%) had diastema, as demonstrated in ►**Table 3**.

►**Table 4** shows the distribution of anomalies with malocclusion groups. The Pearson chi-squared test was performed to ascertain a relationship between dental anomalies and various malocclusion groups. Posterior crossbite was significantly lower in the class III malocclusion group compared with the other two groups of malocclusion ($p = 0.019$). Results regarding the dental anomalies show that the difference in the frequency of dental anomalies (hypodontia, impaction, and diastema) among the malocclusion groups is statistically significant, with p-values of 0.026, 0.007, and 0.016, respectively. The paired comparison exhibit that the class I group had the highest percentage of hypodontia, impaction, and diastema, whereas the class III group had the lowest percentage. The difference in the frequency of dental anomaly (ectopic eruption) among the malocclusion groups is not statistically significant. The upper arch anterior crowding frequency difference was lower in the class II malocclusion group, a finding dissimilar to the class I and III malocclusion groups ($p = 0.002$).

Moreover, ►**Fig. 1** shows the distribution of subjects with dental anomalies in each malocclusion group. Class I had the most significant dental anomalies, especially hypodontia. On the other hand, class III malocclusion had the lowest quantity of dental anomalies; the highest number was impaction in this class. Class II malocclusion had the lowest number of diastemas.

Table 3 Frequency of malocclusion in vertical and transversal plane, dental anomalies, and anterior and posterior crowding observed among orthodontic patients

Malocclusion and dental anomalies		$N = 557$ (%)
Transversal plane	Upper midline	11.3
	Lower midline	5.2
	Anterior crossbite	14
	Posterior crossbite	10.8
Vertical plane	Deep bite	31.4
	Open bite	9.5
Dental anomalies	Hypodontia	7
	Ectopic	24.8
	Impaction	9.3
	Diastema	12.6
Anterior crowding	Lower arch	54.4
	Upper arch	55.5
Posterior crowding	Lower arch	13.6
	Upper arch	11.3

Discussion

Although the literature has investigated various types of malocclusion, comparing findings among multiple populations is challenging, partly due to different methods of recording occlusal differences, age differences, the examiner's subjectivity, and specified objectives.[19] This study delivers the baseline findings to the practitioners to detect the occurrence rate of dental anomalies and malocclusion and their association in a sample of Kosovo's orthodontic patients. The correlation between malocclusion and dental anomalies has not been explored, even though dental anomalies can complicate orthodontic treatment and require a customized treatment plan. Especially the genetic basis of this correlation has not been a focus of research. In the future, we intend to focus on the phenotype–genotype correlation of malocclusion and dental anomalies to understand both coexisting prevalences thoroughly.

The methodology used in this study was inspired by studies of European countries[20,21]; hence, we will discuss our results by comparing them to close geological regions. It is established that dental anomalies are routinely noticed among individuals with malocclusion than in the general population.[3] This study demonstrated a higher occurrence of dental anomalies in female orthodontic patients, coinciding with studies conducted in Brazil, Turkey, and Saudi Arabia.[5,7,9,22–24]

Most of the patients in our study faced dental anomalies, which was higher than the findings by Uslu et al[5] and the prevalence ratio demonstrated by Thongudomporn and Freer's study.[25] Ectopic eruption was the highest in number in our study, which contrasts with the study in Saudi Arabia, where impaction (21.2%) was the common dental anomaly.[1] However, this finding was similar to a study in India where

Table 4 Distribution of dental anomalies with various malocclusion groups

		Class II		Class III		Class I			
		Count	Column N (%)	Count	Column N (%)	Count	Column N (%)	Total	*p*
Upper midline	No	169	87.1	89	87.3	236	90.4	494	0.479
	Yes	25	12.9	13	12.7	25	9.6	63	
Lower midline	No	183	94.3	98	96.1	247	94.6	528	0.803
	Yes	11	5.7	4	3.9	14	5.4	29	
Anterior crossbite	No	193[a]	99.5	27[b]	26.5	259[a]	99.2	479	0.000
	Yes	1[a]	0.5	75[b]	73.5	2[a]	0.8	78	
Posterior crossbite	No	170[a]	87.6	99[b]	97.1	228[a]	87.4	497	0.019
	Yes	24[a]	12.4	3[b]	2.9	33[a]	12.6	60	
Deep bite	No	70[a]	36.1	99[b]	97.1	213[c]	81.6	382	0.000
	Yes	124[a]	63.9	3[b]	2.9	48[c]	18.4	175	
Open bite	No	175	90.2	91	89.2	238	91.2	504	0.836
	Yes	19	9.8	11	10.8	23	8.8	53	
Hypodontia	No	188[a]	96.9	94[a,b]	92.2	236[b]	90.4	518	0.026
	Yes	6[a]	3.1	8[a,b]	7.8	25[b]	9.6	39	
Ectopic	No	156	80.4	73	71.6	190	72.8	419	0.113
	Yes	38	19.6	29	28.4	71	27.2	138	
Impaction	No	184[a]	94.8	95[a,b]	93.1	226[b]	86.6	505	0.007
	Yes	10[a]	5.2	7[a,b]	6.9	35[b]	13.4	52	
Diastema	No	177[a]	91.2	93[a,b]	91.2	217[b]	83.1	487	0.016
	Yes	17[a]	8.8	9[a,b]	8.8	44[b]	16.9	70	
Lower arch	No	86	44.3	57	55.9	111	42.5	254	0.065
	Yes	108	55.7	45	44.1	150	57.5	303	
Upper arch	No	83[a]	42.8	61[b]	59.8	104[a]	39.8	248	0.002
	Yes	111[a]	57.2	41[b]	40.2	157[a]	60.2	309	
Lower arch	No	169	87.1	87	85.3	225	86.2	481	0.906
	Yes	25	12.9	15	14.7	36	13.8	76	
Upper arch	No	174	89.7	88	86.3	232	88.9	494	0.671
	Yes	20	10.3	14	13.7	29	11.1	63	

Chi-squared test, $p \leq 0.05$.
Note: Different letters (a, b or c) indicate significant difference between the malocclusion groups regarding same dental anomaly ($p < 0.05$).

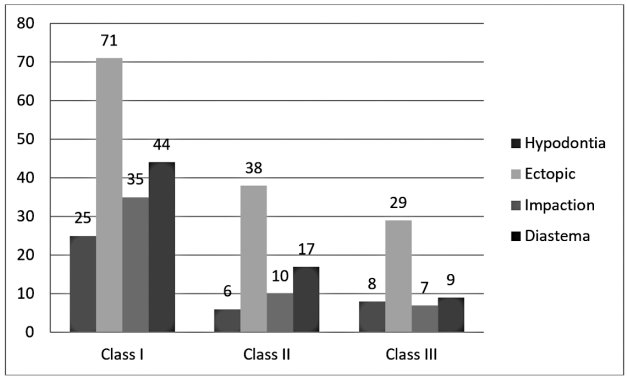

Fig. 1 Distribution of subjects with dental anomalies in each malocclusion group.

ectopic eruption was found in 51 of 200 patients.[26] The percentage of hypodontia (7%) was also low and differed from the findings by Altug-Atac and Erdem[7] and Uslu et al,[5] where hypodontia was prevalent. However, it is in accordance with the Italian and Swedish population findings, which were 7.1 and 7.4%, respectively.[27,28] It was also less than the finding by Zakaria et al, which was 19%.[29]

Concerning malocclusion, the frequency of Angle's classification of malocclusion of molars and canines was 46.9, 34.8, and 18.3%, respectively. These data are comparable to the findings of an Iranian study with molar malocclusion values of 52.0, 32.6, and 12.3%.[30] There can be slight differences between various categories of results based on differences in sample size, ethnicity, and race. Impaction was identified in increased amounts in class I malocclusion, comparable to the

Brazilian population's findings.[22] However, the findings of the same study differ regarding hypodontia as in the Brazilian study[22] hypodontia was not related to any malocclusion, whereas, in our study, it was associated with class I malocclusion. Class III malocclusion was least likely to be related to dental anomalies in our study, and this finding is identical to a study in Saudi Arabia.[1] Statistically significant results were seen with the association of malocclusion and dental anomalies, which is in contrast with the study by Basdra et al.[10] The reason could be the small sample of 88 patients in their study. Moreover, another study in Saudi Arabia found no significant association between malocclusion and dental anomalies, even though the anomalies found in their study were frequently seen in class I malocclusion.[1] A literature search produced several studies with no established correlation between dental anomalies and malocclusion; however, design faults, defining malocclusion and dental anomalies differently, and small sample size can be the reasons for no evidence of a relationship.

The main study limitations were the excluded patient records and retrospective design, which hindered the exploration of structural changes and root morphology. Moreover, a wider variety of dental anomalies was also not explored. The convenient sample size was another limitation. Even though the inclusion and exclusion criteria were applied, no probability sampling technique was utilized, that is, a random selection of patients was not utilized. A larger sample size of Kosovo's population can be truly representative of the population as a whole. A prospective study design would be even more beneficial in assessing the occurrence of dental anomalies and malocclusion.

Conclusion

Our study concluded that an association between dental anomalies and malocclusion among orthodontic patients in Kosovo's population is present. Class I malocclusion was the most frequent malocclusion, whereas ectopic eruption was the most common dental anomaly. A lack of studies in any population warrants dental pathologies to be ignored and compromise oral care. Proper measures must be taken before starting any interventional dental treatment. The pretreatment records are critical to assess and identify these anomalies before patients start their orthodontic journey. Multidisciplinary approaches will then be employed to help the patient with their orthodontic treatment. The importance of identifying these anomalies has been established in this study.

Conflict of Interest
None declared.

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