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**ASSESSMENT OF THE RELATIONSHIP OF DENTAL ANOMALIES WITH  
SKELETAL MALOCCLUSIONS AND GROWTH TYPE – REVIEW ARTICLE**

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**Abstract:** Aim of the study: Knowledge of dental and skeletal malocclusions, genetic variations, and etiological factors that lead to their occurrence is of great importance for correct diagnosis and treatment plan. The aim of this paper was to determine if there is a relationship between the prevalence, distribution, and gender dimorphism of dental anomalies with skeletal malocclusions in the sagittal direction and growth patterns.

Material and method: To realize the set goals, an electronic search of published studies on this issue was conducted through the PubMed and Google Scholar databases. The literature search was performed according to the PRISMA guidelines with the following main eligibility criteria: only studies published in English and studies conducted in human populations.

Results: Some dental anomalies preferentially associated with skeletal malocclusions have been found. The distribution in population and gender is different depending on the presence of genotype-phenotype correlation.

Conclusion: There are a small number of studies in the world literature that examined the association of dental anomalies with sagittal skeletal malocclusions and the facial growth type. These studies indicate a positive correlation between the occurrence of dental anomalies, skeletal irregularities in the sagittal direction and growth type. In order to better shed light on this problem, it is necessary to carry out further research on this topic, which would contribute to determining a more precise diagnosis and predicting the orthodontic treatment in patients with various malocclusions.

**Keywords:** dental anomalies, sagittal skeletal malocclusions, growth patterns and cephalometry.

## 1. INTRODUCTION

Knowledge of dental and skeletal malocclusions, genetic variations, and etiological factors leading to their occurrence is of great importance for proper diagnosis and treatment plan. Their recognition and treatment in time will minimize the possible harmful effects on the dentofacial complex. In most cases, anomalies in the craniofacial complex and intermaxillary relationships are accompanied by some dental anomalies, affecting function and aesthetics and making orthodontic therapy difficult. (Mercuri, Cassetta, Cavallini, Vicari, Leonardi & Barbato, 2013; Kathariya, Nikam, Chopra, Patil, Raheja & Kathariya, 2013; Sacerdoti & Baccetti, 2004).

Numerous authors have examined the prevalence of dental anomalies in different populations, concluding that differences in their prevalence are due to differences in ethnicity, diagnostic criteria, nutritional factors, and environmental factors. (Zou, Meng, Law, Rao & Zhou, 2018; Vibhute, Vibhute & Daule, 2018; Uslu, Akcam, Evirgen & Cebeci, 2009; Kuchler, Riso, Costa, Modesto & Vieira, 2008; Altug-Atac & Erdem, 2007). Depending on the severity of the malocclusion, treatment needs and priorities are determined, bypassing orthodontic protocol limitations. Orthopantomogram and cephalometric analysis in 2D remain essential tools in the final diagnosis and proper implementation of malocclusion treatment. (Jha, 2021; Sella Tunis, Sarne, Hershkovitz, Finkelstein, Pavlidi, Shapira, Davidovitch & Shpack, 2021).

Analyzing the prevalence of dental anomalies in Turkish orthodontic patients, Bilge, Yeşiltepe, Törenek Ağırman, Çağlayan & Bilge (2017) found the presence of at least one dental anomaly in 90% of respondents, and 2% had three of them. The anomaly of the position of teeth was more pronounced (60.8%) and the anomaly of the structure was the rarest (0.2%) with a predominance in the female sex. Thongudomporn & Freer (1998) analyzing the prevalence of dental anomalies in orthodontic patients determined the presence of at least one dental anomaly in

75% of the respondents. The most common anomaly was dental invaginates and the least common was hyperdontia and root dilaceration.

Examining the agenesis of the maxillary lateral incisor and its relationship with other dental anomalies, Lupinetti, Li, Feagin, MacDougall & Lamani (2022) concluded that there is a correlation between the hypodontia of the lateral incisors and the impaction of the maxillary canines, but also a strong relationship with the hypodontia of the other teeth. Mercury et al. (2013) examining dental anomalies and clinical features in patients with maxillary canine impaction found more frequent impaction of these teeth on the palatal side of the jaw compared to the buccal side, and 2.5 times higher prevalence in girls compared to boys. The authors also determined a significant association between palatally impacted canines and the occurrence of other dental anomalies such as tooth impaction, agenesis, the conical shape of the lateral incisors, and transposition. In patients with buccally impacted maxillary canines, no differences in clinical characteristics and congenital dental anomalies were determined compared to the control group, except overjet and dental agenesis.

The prevalence of dental anomalies among school children in India in relation to gender differences was investigated by Kathariya et al. (2013). In 26% of the examined children, only one dental anomaly was observed and 13.5% of the respondents had two or more dental anomalies. Tooth rotation and impaction, especially in the upper jaw, were the most frequently present anomalies, while hypodontia and microdontia were more common in girls compared to boys.

Sella Tunis et al., in 2021 studied the characteristics of dental anomalies in 2897 patients from Tel Aviv regarding the number, size, shape, position, and eruption of teeth. In 36% of the respondents, they determined the presence of at least one dental anomaly, and the most frequently missing teeth were the maxillary lateral incisor and the mandibular second premolar. Maxillary incisors and mandibular first premolars were the teeth with the most common occurrence of hyperdontia. Dental anomalies were more often present in the upper jaw, mostly in the frontal region, while in the lower jaw, they were more frequently represented in the lateral region.

Sacerdoti & Baccetti (2004), analyzing the relationship between palatally impacted canines, craniofacial characteristics, and other dental anomalies, determined a significant relationship between unilateral impaction and maxillary lateral incisor agenesis, while bilateral impaction was associated with third molar agenesis. The occurrence of other dental anomalies simultaneously with palatal impaction of maxillary canines, as well as gender differences and bilateral expression of impaction only confirm the genetic component in the etiology of this dental anomaly.

The purpose of this review paper was to determine, through the analysis of data from the available literature, whether there is a relationship between the prevalence, distribution, and sex dimorphism of dental anomalies with sagittal skeletal malocclusions and facial type growth.

## 2. MATERIAL AND METHOD

To realize the set goals, an electronic search of published studies on this issue was conducted through the PubMed and Google Scholar databases, using the following keywords and titles of medical topics: "dental anomalies", "sagittal skeletal malocclusions", "dental anomalies and sagittal skeletal malocclusions", "skeletal malocclusions and growth type", and "skeletal malocclusions and cephalometry". Published studies in the last 20 years were analyzed, except very small number of studies that are original and cited in all newer studies. The literature search was performed according to the PRISMA guidelines with the following main eligibility criteria: only studies published in English and studies conducted in human populations. Clinical studies, prospective and retrospective studies, systematic reviews and meta-analyses were of particular interest.

## 3. DISCUSSION

There are a small number of studies in the literature that examined the relationship between dental anomalies and sagittal skeletal malocclusions. (Basdra, Kiokpasoglou & Stelzig, 2000; Basdra, Kiopasoglou & Komposch, 2001; Ben-Bassat & Brin, 2003). Dwijendra, Parikh, George, Kukunuru & Chowdary (2015) determined a high prevalence of dental anomalies in patients with class II and III malocclusion, with a higher frequency in the mandibular in comparison with the maxillary dental arch. The most common anomalies were hypodontia (10.9%) and tooth rotation (18.8%).

Fernandez, Pereira, Luiz, Vieira & De Castro Costa (2018) examining the prevalence of dental anomalies in patients with different skeletal malocclusions and different growth type, determined a significant association between microdontia and class III malocclusion, and between tooth agenesis and hypo-divergent facial growth type. In the maxillary teeth, unlike the mandibular ones, a microdontic form is more often found, which can be explained by the underdevelopment of the maxilla, which is one of the characteristics of skeletal malocclusion class III. Also, in patients with a hypo-divergent growth type, a high frequency of crowding of teeth is found. It is assumed that the

short length of the arch increases the probability of agenesis, an anomaly that is associated with the hypo-divergent growth type. (Graber, Vanarsdall & Vig, 2012).

Vibhute et al. (2013) and Ben-Bassat et al. (2003) reached similar findings in their studies, which established a link between skeletal malocclusions and different teeth. Uslu et al. (2009) analyzing the representation of dental anomalies in different orthodontic malocclusions, determined the presence of at least one dental anomaly in 40.3% of the respondents. The most common was agenesis present in 21.6% of the respondents, followed by dens evaginatus (6.2%), dens invaginatus (5.0%), and impactions (2.9%). No significant correlation was observed between dental anomalies and the type of malocclusion.

In contrast, Basdra et al. (2000) found a high correlation between skeletal malocclusion class II/2 and dental anomalies. In 13.9% of patients with this malocclusion was observed maxillarylateral incisors agenesis, 7.5% was associated with a conical form of lateral incisors, while in 33.5% the impact of canines was observed. The same author, a year later, examined the link between dental anomalies and skeletal malocclusion class II/1 and class III and found a significant correlation between the presence of dental anomalies and malocclusion class III. (Basdra et al., 2001).

Drenski Balija, Aurer, Meštrović & Lapter Varga (2022) examining the prevalence of dental anomalies in Croatian orthodontic patients, registered at least one present anomaly in 24.1% of the respondents, and two or more anomalies in 1.2% of the studied group. The most frequently present anomaly was hypodontia, followed by tooth impaction. The authors found no statistically significant differences in the prevalence of dental abnormalities between males and females. In contrast, Ku, Han, Kim, Oh, Kook & Kim (2022) examining the prevalence of dental anomalies in Korean orthodontic patients with various skeletal anomalies concluded that the prevalence of dental anomalies varied depending on the type of malocclusion. The most frequently anomaly was tooth impaction, followed by microdontia, agenesis and hiperdontia. These anomalies were represented with greater frequency in class I and II malocclusion and less often in class III. In subjects with class II malocclusion, the most frequently present anomaly was dental agenesis, followed by microdontia.

Knowledge of the impact of dentofacial genetics on the diagnosis and planning of orthodontic treatment has become an integral part of modern orthodontic practice. (Trakinienė, Ryliškytė & Kiaušaitė, 2013).

#### 4. CONCLUSION

Knowing the frequency and distribution of dental anomalies in a certain population is of great importance for taking early preventive measures, as well as early orthodontic treatment in order to prevent the occurrence of later more severe disorders in the craniofacial morphology.

There are a small number of studies in the world literature that examined the association of dental anomalies with sagittal skeletal malocclusions and the facial growth type. These studies indicate a positive correlation between the occurrence of dental anomalies and skeletal irregularities in the sagittal direction. In order to better shed light on this problem, it is necessary to carry out further research on this topic, which would contribute to determining a more precise diagnosis and predicting the orthodontic treatment in patients with various malocclusions.

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