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IMPACTED MAXILLARY CANINES AND THEIR ASSOCIATION WITH CONGENITALLY ABSENT TEETH AND OTHER IMPACTIONS

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Abstract

Introduction: As a result of numerous studies, dental anomalies associated with impacted maxillary canines (IMC) have been obtained. The most common such dental developmental anomaly is congenitally missing teeth (CMT) or aplasia. The ethnic specificity in their occurrence has been proven.

Material and methods: To evaluate this association in our area, we conducted a cross-sectional study of 104 patients with IMC, proven by orthopantomographic imaging, in the northern part of the Republic of North Macedonia. The data analysis was performed in the statistical program Statistica.

Results and discussion: No association of IMC with their associated anomalies such as aplasia or other impactions was found. Female patients with IMC more often than males have an anomaly such as aplasia – 11 (19,64%) vs 4 (8,33%). This described difference in the distribution of patients with and without aplasia, depending on their gender, was not sufficient for statistical significance (p=0,1).

Conclusion: Further studies are needed to reflect the true ethnic specificity of the occurrence of the association of IMC with the agenesis of permanent teeth in the territory of our country.

Keywords: impacted maxillary canines, aplasia, associated dental anomalies.

Introduction

Dental anomalies occur through a complex interaction of genetic, epigenetic, and environmental factors during the process of morpho-differentiation and histo-differentiation of teeth development [1]. Malocclusions, as a dental anomaly, are not a pathological condition. One of these malocclusions is impaction. This dental anomaly is asymptomatic and once diagnosed, patients usually do not agree to any treatment [2].

The impaction that is the subject of this study is that of the permanent maxillary canines. It causes marked aesthetic disorders. The etiology of impacted maxillary canines (IMC) is multicausal. Since 1994, the theory of polygenic-multifactorial inheritance by Peck has been advocated. The fact that a group of genes is responsible is undeniable.

These genes are also responsible for the occurrence of other dental anomalies. These other anomalies are: reduced crown of the second lateral incisor, congenital absence of the upper lateral incisors, congenital absence of one or both lower second premolars, infraocclusion or ankylosis of the second deciduous molar and distal angulation of the second lower premolar. IMC can also occur due to the presence of local factors such as long path of canine eruption (22 mm), retention of deciduous canines, supernumerary teeth, odontomas, pathological lesions (cysts), early trauma to the maxilla, cleft palate, ankylosing spondylitis and cleidocranial dysplasia [3].

Furthermore, impacted maxillary canines have different prevalence depending on ethnicity. Namely, a higher prevalence of IMC was found in an isolated Jewish community, where it was 4,9%[4].

A high prevalence of impacted maxillary canines was also determined in a cohort study in the city of Ramadi, where it was 4,6%[5].

In the Israeli population, Brin et al. found a frequency of 4,5% [6], while in the American population the prevalence is 1,5% [7].

Associated dental anomalies have been obtained as a result of numerous studies. One such association is a positive correlation between displaced upper canines and the small dimensions of the lateral incisors [8,9].

On the other hand, anomalies of the second maxillary incisors have more variations, depending on the genetic expression, starting from the reduced width of the crown, their hypoplasia, up to their aplasia. Very often in research, although not the subject of our research, agenesis of the second premolar with microdontia of the lateral maxillary incisors has been shown as an associated dental anomaly. Baccetti in 1998, based on research results, concluded that 18% of patients with agenesis of the second premolars have microdontia of the maxillary lateral incisors [10].

Aplasia occurs sporadically or hereditary (inherited). The tooth is congenitally absent, i.e. aplasia, only if the absence of mineralization of the tooth crown is confirmed on panoramic radiography. Congenital missing teeth (CMT) is the most frequent developmental anomaly. In impacted maxillary canines, the most common associated dental developmental anomaly is congenitally missing teeth (CMT) or aplasia. More recent research confirms that this anomaly, aplasia, has had a higher prevalence in recent decades.

The most common congenitally absent lower second premolars are represented by 23,34% of the total CMT. The age at which the absence of premolars is determined with certainty is 10 years. The hereditary absence of individual teeth is a mutation of the genes responsible for the lack of individual teeth, which are: PAX9 and MSX1.

In addition to the hereditary factor, the socio-economic factor has also been determined as influential in the congenital absence of teeth, because in communities with low socio-economic status (SES), which have more caries, dental infections and local inflammations act as an etiological factor [11].

The prevalence of CMT varies among the races studied. In particular, in South Korea, the upper lateral incisors are most frequently absent, as are those in China and Japan, suggesting a racial characteristic of this anomaly. Of great importance is the conclusion in the same study that impacted canines, specifically palato-dislocated maxillary canines (PIC), are an associated dental anomaly of second premolar agenesis [12].

With the knowledge of significant associations between individual dental anomalies, it is possible to detect the potential risk of developing other dental anomalies with early diagnosis of a dental developmental anomaly. Family trees were also examined in a study by Prinnen and Arte, which determined that aplasia as an anomaly and IMC are under the same genetic control [13].

The aim of our study is to test the association of IMC with other dental anomalies such as congenitally absent teeth or so-called aplasia, as well as with other impactions.

Material and methods

A cross-sectional study was conducted among individuals aged 10 to 69 years, who underwent radiographic orthopantomogram imaging for diagnostic purposes in dental clinics in the northern part of our country, the Republic of Macedonia, and all of them had a finding of IMC. Representativeness was ensured by a simple random sample of a total of 104 respondents who agreed to participate in the study.

Statistical analysis of the data obtained during the investigation has been realized on the basis of the statistical program Statistica for Windows 8.0. Computer analysis comprised adequate statistical methodologies: frequency distribution (absolute and relative representation), for demonstration of qualitative signs, i.e. parameters, as well as descriptive methods (measures for central tendencies – cut off, mean and modus), for demonstration of median and typical data values.

Determination of the association, i.e. relationship of some variables and the occurrence of impacted maxillary canines and quantification of that relationship, has been made by usage of non-parametric methods (Chi-square test of homogeneity with C – coefficient of contingency) and the parametric methods (Linear correlation – Pearson's coefficient). For testing the significance of difference among some analyzed

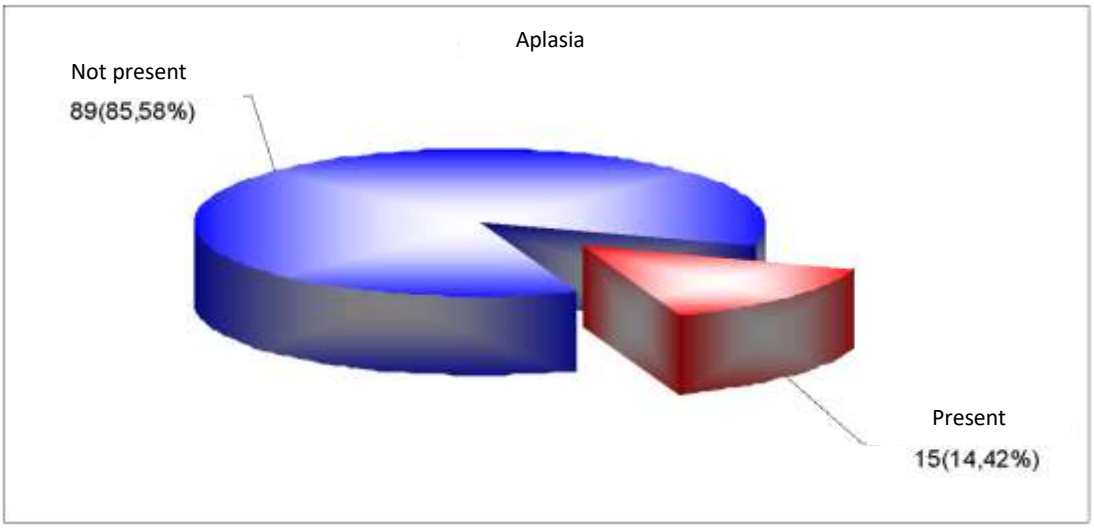
parameters were used, depending on the type and distribution of the data, parametric (t-test for independent samples), and non-parametric tests for independent samples (Mann-Whitney U test, Kolmogorov-Smirnov test for two samples, Fisher exact test). The value of $p<0,05$ was taken as a level of significance, while for the high significant value was taken $p<0,01$.

Results

Out of a total of 104 respondents with registered IMC, 15 of them (14,42%) also had other dental anomalies such as aplasia of individual teeth in the permanent dentition (Table 1, Picture 1).

Table 1. Distribution of respondents in terms of the presence of aplasia.

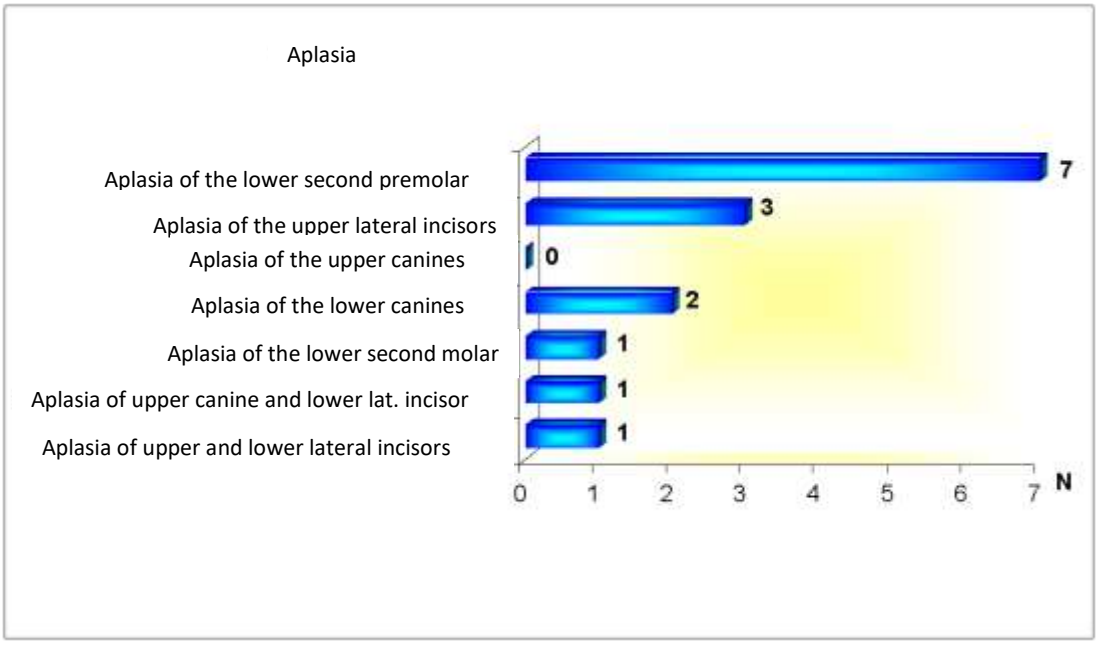
Aplasia	**n (%)**
Not present	89 (85,58)
Present	15 (14,42)



Picture 1. Graphical representation of the respondents in terms of the presence of aplasia.

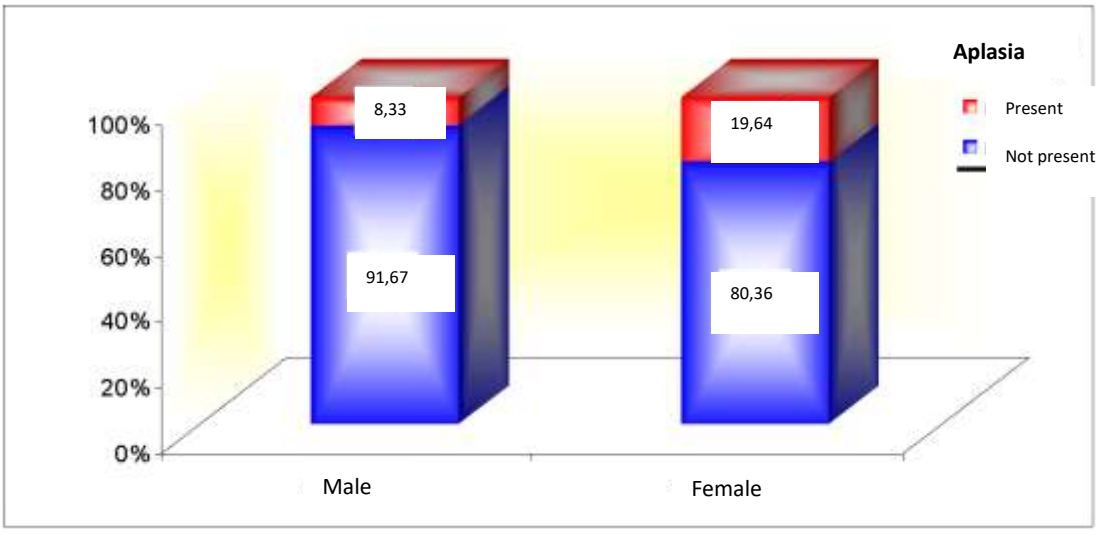
In the group of 15 patients with IMC and aplasia of certain teeth, 7 had aplasia of the lower second premolar, 3 had aplasia of the upper lateral incisors, and 2 had aplasia of the lower canines.

Aplasia of the lower second molars was recorded in one patient, aplasia of the upper canine and lower lateral incisor in one patient, and aplasia of the upper and lower lateral incisor in one patient (Picture 2).



Picture 2. Graphical representation of the respondents in terms of localization of aplasia.

Female patients more often than males have an anomaly such as aplasia – 11 (19,64%) vs 4 (8,33%). This described difference in the distribution of patients with and without aplasia with IMC, depending on their gender, was not sufficient for statistical significance (p=0,1) (Picture 3).



Picture 3. Graphical representation of aplasia depending on the gender of the respondents.

In the group of 4 male patients with aplasia, in one patient aplasia was localized on the lower second premolar, in one on the upper lateral incisors, in one on the upper canine and lower lateral incisor, and in one patient aplasia of the upper and lower lateral incisor was detected. In the group of 11 female patients with aplasia, in 6 patients aplasia was present on the lower second premolar, 2 patients had aplasia of the upper lateral incisors, and 2 on the lower canines.

Aplasia of the lower second molars was registered in one patient. No statistically significant difference in the localization of aplasia was confirmed depending on the gender of the subjects. (Table 2).

Table 2. Localization of aplasia depending on the gender of the respondents.

aplasia– localization	**Gender**		**p-value**
	Male	**Female**	
aplasia of the lower second premolar	1	6	0,28 ns
aplasia of upper lateral incisors	1	2	
aplasia of lower canines	0	2	
aplasia of lower second molars	0	1	
aplasia of the upper canine and lower lateral incisor	1	0	
aplasia of the upper and lower lateral incisors	1	0	
Total	4	11	

p (Fisher exact, two tailed test)

In 4 (3,85%) patients, in addition to IMC, there is another type of impaction. Three patients have an impacted lower canine, and one patient has an impacted upper lateral incisor. (Table 3).

Table 3. Distribution of respondents in relation to another type of impaction.

Other impactions present	**n (%)**
Not present	100 (96,15)
Impacted lower canine	3 (2,88)
Impacted upper lateral incisor	1 (0,96)

Other impactions are present in 2 male patients (one patient with an impacted lower canine, one with an impacted upper lateral incisor), and in 2 female patients, both with an impacted lower canine. (Table 4).

Table 4. Other impacts on respondents depending on their gender.

Other impactions present	**Gender**		**p-value**
	Male	**Female**	
Not present	46 (95,83)	54 (96,43)	not present vs present 1,0 ns
Impacted lower canine	1 (2,08)	2 (3,57)	
Impacted upper lateral incisor	1 (2,08)	0	
Total	48	56	

p (Fisher exact, two tailed test)

Discussion

According to the guidance theory of Backer et al., the distal surfaces of the upper lateral incisors are guides in the eruption of the permanent canines. This theory stems from the findings in studies, where IMC are associated with the wedge shape of the lateral incisors, with their reduced mesio-distal diameter or with their congenital absence. The association is approximately 50% [14].

In some studies, no association has been found between agenesis of the maxillary lateral incisors and IMC. An example of this are studies conducted in Mexico, as well as in Latin Americans in general, where no association has been found between these two dental anomalies [15].

The phenomenon of presence and absence of association can only be explained by ethnic differences. In some ethnic groups, the association is present and in others, it is absent. For example, in the study by Garib, palato-dislocated maxillary canines (PIC) are an associated dental anomaly of second premolar agenesis. Thus, these dental anomalies are the product of the same genetic mechanism [16].

The fact that the human dentition is specific to certain nations is also evidenced by the results of research. Manual standardized measurements were made among northern Chinese, North Americans of European descent, modern British of European descent, and Romano-British.

They came to certain conclusions regarding some racial characteristics of the dentition among these four ethnic communities. Namely, it was shown that the Chinese have the largest teeth overall, and the Romano-British have the smallest mesio-distal diameter of the tooth crowns. Modern British have the largest central incisors, and Americans have the largest first and second molars. They also came to the conclusion that those teeth which rudiments were formed earlier have smaller variations in the mesio-distal diameter.

The conclusion of the study is that illness and poor nutrition in childhood cause large variations in the characteristics of the dentition [17]. The most significantly associated dental anomalies according to previous studies are: dislocated maxillary canines (when the canines do not follow the normal eruption path), and transposition (when two teeth switch places) as well as agenesis of lateral incisors with dislocated maxillary canines [10].

Aplasia of the second premolar, small dimensions of the maxillary lateral incisor, infraocclusion of the second primary molar, enamel hypoplasia and PIC are different manifestations of a syndrome with incomplete penetration and variable expression. In fact, palato-dislocated maxillary canines (PIC) show a significant association with all types of dental anomalies, with the exception of ectopically erupted first molars and supernumerary teeth, which indicates their common genetic origin [16].

With the knowledge of the association between individual dental anomalies, it is possible to detect the potential risk of developing other dental anomalies through early diagnosis of a dental developmental anomaly. This avoids unnecessary costs for their repair as well as the additional trauma that is inevitable in the process.

Conclusion

Of the total number of subjects in this study with IMC findings, 14,42% had aplasia, of which the most common aplasia was that of the lower second premolar with a percentage of 6.73%. The second type of aplasia in terms of frequency of occurrence was that of the maxillary lateral incisors and occurred in only three cases. Female patients more often than males have an anomaly such as aplasia – 11 (19,64%) vs 4 (8,33%).

This described difference in the distribution of patients with IMC with and without aplasia, depending on their gender, did not prove to be sufficient for statistical significance (p=0.1). In this study, it was found that in addition to IMC, the subjects can also show impactions on other teeth, namely on the lower canines, as well as on the upper lateral incisors.

Their total percentage is only 3,84%. Further research is more than needed. Since dental anomalies are transmitted generationally, it is possible with the early examination of the child, to take an anamnesis from the parents for the presence of dental anomalies in the family, and thus to make a projection for expected dental anomalies in the child and to bring their consequences within acceptable limits.

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