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THE RELATIONSHIP OF MALOCCLUSIONS WITH THE ERUPTION TIME OF PERMANENT TEETH IN CHILDREN LIVING IN DIFFERENT CLIMATIC AND GEOGRAPHICAL CONDITIONS

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This study is a fragment of the planned research work “Assessment of dental morbidity of children with regard to environmental and social aspects and the effectiveness of prevention of dental caries and periodontal diseases” (state registration 0115U000037), years 2015-2019.

Introduction. Dentofacial anomalies, with an average prevalence of 40% to 81%, are among the major dental diseases [3, 8, 12, 13, 14]. The analysis of the literature data shows that there has not been a tendency to a downward trend in this pathology in recent years. Significant increase of dentofacial anomalies, along with other factors, is associated with the negative environmental impact, the presence of somatic diseases, and climatic and geographical living conditions of children [2, 5, 6, 11, 15]. Therefore, the prevalence of dentofacial anomalies can be fully considered as one of the indicators that characterize the health status of children in a particular region.

In addition, it is known that the formation of dentofacial anomalies is significantly affected by the eruption time of permanent teeth, which is an important criterion for indicators of normal development of the dentofacial system. Deviations from the average terms of eruption of permanent teeth serve as one of the prognostic symptoms of the development of the child’s organism [4, 7].

Different internal and external factors cause the fluctuations in the time of permanent teeth eruption. Climatic, geographical, ecological, and regional peculiarities of the territory where children live have a significant impact on the term of permanent teeth eruption [1, 9, 10]. In this regard, it is important to study

the features of permanent teeth eruption for each individual region, which differ in their conditions and their relationship with the formation of dentofacial anomalies. Epidemiological studies have been devoted to evaluating the eruption time of permanent teeth in Ukraine [9]. In recent years, the issue of terms of permanent teeth eruption, the dynamics of their changes, the regional features of teeth eruption, their relationship with the physical development of children and with dentofacial anomalies have not been covered in the literature, which, in turn, causes difficulties in the choice of treatment and preventive measures. Therefore, it is important to further study the prevalence of dentofacial anomalies, to evaluate the eruption time of permanent teeth at the regional level and to assess their interconnection.

The aim of the work is to assess the relationship between malocclusions and the eruption time of permanent teeth in children living in different climatic and geographical conditions.

Material and research methods. 333 7-year-old children were examined to assess the prevalence and structure of malocclusions and the eruption time of permanent teeth. Among them, there are 110 children living in the flat terrain, 109 children living in the mountainous terrain and 114 children from the foothills. The nature of dentofacial anomalies was evaluated according to the D.A. Kalvelis classification.

Statistical processing of the research results was carried out using software packages for statistical analysis of Microsoft Excel research data, which is included in the Microsoft Office package and the Statistica program. When performing the statistical processing of the obtained data, the following methods were used: analysis of variational series – since there was Gaussian distribution in the studied groups, the obtained results are presented in the form of arithmetic mean values and their average error ($M \pm m$); assessing the estimated probability of differences in the obtained results in the compared groups using the Student t-test; correlation analysis was performed by calculating the paired and linear

correlation coefficients using the Pearson method. The difference at $p < 0.05$ was considered significant.

The purpose of statistical data processing was to determine the characteristic quantitative estimates of the studied indicators, to establish the presence or absence of correlation between the obtained indicators, as well as the influence of external factors on them. Correlation analysis was performed between the incidence of malocclusions and the number of erupted permanent teeth.

During the examination all safety measures concerning the children's health, respect for their rights, human dignity and moral and ethical standards were kept in accordance with the principles of the Helsinki Declaration, the Council of Europe Convention on Human Rights and Biomedicine and the relevant laws of Ukraine.

The results of the study and their discussion. The prevalence, structure of malocclusions and permanent teeth eruption in 7-year-old children are shown in Table 1. It was found that with the prevalence of deep (40.91 ± 4.69%) and distal occlusion (38.18 ± 4, 63%) in children living in the flat territory, only 4.2 and 4.0 teeth were erupted in the upper jaw, respectively, which is significantly less than in children who had malocclusions much less frequently. The largest number of permanent teeth that erupted in the upper jaw in the children living in the flat territory was found in case of the cross bite (5.8 teeth), and the highest number of permanent teeth that erupted in the children in the lower jaw (6.8 teeth) was observed in case of the open bite

Children living in the mountainous area also the most frequently had distal (28.44 ± 4.32%) and deep (16.51 ± 3.56%) malocclusions, in which the number of teeth that erupted in both jaws was 10.6 teeth and 10.9 teeth, respectively.

Analyzing the foothills, on average, we see an increase by one tooth in the number of erupted teeth, and a decrease in the incidence of malocclusions.

Table 1. The prevalence of malocclusions and the number of permanent

teeth that erupted in children depending on the area of residence.

Children (7-year-old)		Malocclusions									
		Distal Bite		Mesial Bite		Deep Bite		Open Bite		Cross Bite	
		the amount of teeth	%	the amount of teeth	%	the amount of teeth	%	the amount of teeth	%	the amount of teeth	%
Flat Terrain	Upper Jaw	4,0	38,18 ± 4,63	5,1	2,73 ± 1,55	4,2	40,91 ± 4,69	5,4	4,55 ± 1,99	5,8	7,27 ± 2,48
	Lower Jaw	6,2		6,6		6,1		6,8		6,5	
Mountainous Terrain	Upper Jaw	4,2	28,44 ± 4,32	4,6	5,50 ± 2,18	4,4	16,51 ± 3,56	4,8	9,17 ± 2,76	4,6	12,84 ± 3,20
	Lower Jaw	6,4		6,7		6,5		6,6		6,8	
Foothills	Upper Jaw	4,3	11,40 ± 2,98	4,7	7,02 ± 2,39	4,8	12,28 ± 3,07	5,4	4,39 ± 1.92	5,8	6,14 ± 2,25
	Lower Jaw	6,9		6,7		6,1		6,6		6,7	

It was found that in 7-year-old children (Table 2) living in the mountainous area there is a statistically significant ($p < 0.05$) inverse correlation between the proportion of permanent teeth in the upper jaw and the prevalence of distal ($r = -0.87$), mesial ($r = -0.78$), deep ($r = -0.79$), and cross ($r = -0.53$) bites.

A similar significant ($p < 0.05$) relationship was found between the proportion of permanent teeth and the prevalence of distal ($r = -0.68$), mesial ($r = -0.60$), and open ($r = -0, 75$) bites in the lower jaw. This means that the higher the prevalence of these types of malocclusions is, the less is the number of permanent teeth that erupted in 7-year-old children living in the mountainous area.

Table 2. Correlation between different malocclusions and the number of permanent teeth that erupted depending on the area of residence of 7-year-old children.

Children (7-year-old)		Malocclusions				
		Distal Bite	Mesial Bite	Deep Bite	Open Bite	Cross Bite
Mountainous Terrain	Upper Jaw	-0,87*	-0,78*	-0,79*	-0,46	-0,53*
	Lower Jaw	-0,68*	-0,60*	-0,35	-0,75*	-0,49
Foothills	Upper Jaw	-0,42	-0,63*	-0,47	-0,32	-0,55*
	Lower Jaw	-0,25	-0,31	-0,49	-0,21	-0,24
Flat Terrain	Upper Jaw	-0,45	-0,56*	-0,41	-0,62*	-0,68*
	Lower Jaw	-0,42	-0,44	-0,51*	-0,50*	-0,34
Average	Upper Jaw	-0,61*	-0,70*	-0,52*	-0,45	-0,57*
	Lower Jaw	-0,52*	-0,42	-0,48*	-0,59*	-0,44

Note. * – the correlation coefficient is significant ($p < 0,05$)

In children living in the foothills, a similar significant ($p < 0.05$) inverse correlation was found between the proportion of permanent teeth in the upper jaw and the prevalence of mesial ($r = -0.63$) bite.

Significant inverse correlations were found between the proportion of permanent teeth in the upper jaw and the prevalence of mesial ($r = -0.56$), open ($r = -0.62$) and cross ($r = -0.68$) bites in children living in the flat territory. In the lower jaw, a similar relationship was established with the prevalence of deep ($r = -0.51$) and open ($r = -0.50$) bites.

We analysed the relationship between the incidence of malocclusion and the eruption of permanent teeth in children, taking into account the article (Table 3).

The results of the analysis indicate that the higher the incidence of malocclusions is, the smaller is the number of permanent teeth that erupted.

Table 3. Correlation between different malocclusions and the number of permanent teeth that erupted depending on the area of residence of boys.

Boys (7-year-old)		Malocclusions				
		Distal Bite	Mesial Bite	Deep Bite	Open Bite	Cross Bite
Flat Terrain	Upper Jaw	-0,50	-0,47	-0,62*	-0,43	-0,69*
	Lower Jaw	-0,39	-0,58	-0,27	-0,54	-0,47
Mountainous Terrain	Upper Jaw	-0,89*	-0,76*	-0,83*	-0,79*	-0,61
	Lower Jaw	-0,67*	-0,43	-0,39	-0,77*	-0,44
Foothills	Upper Jaw	-0,34	-0,81*	-0,62*	-0,46	-0,57
	Lower Jaw	-0,46	-0,21	-0,54	-0,37	-0,28

Note. * – the correlation coefficient is significant ($p < 0,05$)

Therefore, significant ($p < 0.05$) inverse correlations between the proportion of permanent teeth in the upper jaw and the prevalence of deep ($r = -0.62$) and cross ($r = -0, 69$) bites were found in boys living in a flat terrain.

In boys living in the mountainous area, there is a significant ($p < 0.05$) inverse correlation between the proportion of permanent teeth in the upper jaw and the prevalence of distal ($r = -0.89$), mesial ($r = -0.76$), deep ($r = -0.83$) and open ($r = -0.79$) bites. A similar significant ($p < 0.05$) relationship was found between the proportion of permanent teeth and the prevalence of distal ($r = -0.67$) and open ($r = -0.77$) bites in the lower jaw

In boys living in the foothills, a significant ($p < 0.05$) inverse correlation was found between the proportion of permanent teeth in the upper jaw and the prevalence of mesial ($r = -0.81$) and deep ($r = -0.62$) bites.

It was found that with the increase in the incidence of malocclusions, a decrease in the number of permanent erupted teeth is observed (Table 4). Therefore, significant ($p < 0.05$) inverse correlations between the proportion of permanent teeth in the upper jaw and the prevalence of mesial ($r = -0.55$) and open ($r = -0, 63$) bites were found in girls living in a flat terrain. A similar significant ($p < 0.05$) relationship was found between the proportion of permanent teeth and the prevalence of distal ($r = -0.78$) and deep ($r = -0.55$) bites in the lower jaw.

Table 4. Correlation between different malocclusions and the number of permanent teeth that erupted depending on the area of residence of girls.

Girls (7-year-old)		Malocclusions				
		Distal Bite	Mesial Bite	Deep Bite	Open Bite	Cross Bite
Flat Terrain	Upper Jaw	-0,46	-0,55*	-0,40	-0,63*	-0,50
	Lower Jaw	-0,78*	-0,43	-0,55*	-0,51	-0,36
Mountainous Terrain	Upper Jaw	-0,88*	-0,83*	-0,43	-0,32	-0,51
	Lower Jaw	-0,65*	-0,84*	-0,41	-0,53	-0,47
Foothills	Upper Jaw	-0,43	-0,54*	-0,31	-0,29	-0,54*
	Lower Jaw	-0,17	-0,38	-0,41	-0,07	-0,22

Note. * – the correlation coefficient is significant ($p < 0,05$)

For girls living in the mountainous areas, there is a significant ($p < 0.05$) inverse correlation between the proportion of permanent teeth in the upper and lower jaws and the prevalence of distal ($r = -0.88$ in the upper and - 0.65 in the lower) and mesial bites ($r = -0.83$ and -0.84, respectively).

In girls living in the foothills, a similar significant ($p < 0.05$) inverse correlation was found between the proportion of permanent teeth in the upper jaw and the prevalence of mesial ($r = -0.54$) and cross ($r = -0.54$) bites.

The prevalence of dental jaw abnormalities occupies an important place among the main dental diseases [1, 4, 7]. Several authors link the significant increase of dental jaw abnormalities with the negative impact of the environment, the presence of somatic, climatic and geographical living conditions of children [1, 3, 7]. The prevalence of dental jaw abnormalities can be considered as one of the indicators characterizing the health of children in a particular region [5, 8].

The article highlights the prevalence and structure of malocclusion and terms of eruption of the permanent teeth in children living in different climatic and geographical conditions. It has been established that the prevalence of malocclusion and terms of eruption of the permanent teeth in children depends on the geographical and environmental living conditions [3, 5]. It is proved that there is a strong correlation between malocclusions and the number of erupted teeth.

It was estimated that in the case of frequency of deep bite (40,91±4,69 %) and distal occlusion (38,18±4,63 %) in children living in flat terrain region there were revealed only 4,2 and 4,0 erupted teeth, which is less comparing with children with decreased index of malocclusions frequency. The most high number of the permanent teeth, which are erupted on the upper jaw is revealed in the case of crossbite (5,8 tooth), in the case of open bite it was noticed the most high number of the permanent teeth that were erupted on the lower jaw (6,8 tooth).

In children that live in the mountainous terrain the most frequent were diagnosed distal occlusion (28,44±4,32 %) and deep bite (16,51±3,56 %). In that cases number erupted teeth on the both jaws was 10,6 tooth and 10,9 tooth.

Conclusion. The examination of children revealed that distal and deep bites were more frequently diagnosed in children living in the flat territory compared with the mountainous area and foothills. It was proved that there is a strong correlation between the number of teeth that erupted in children during the period of an early transitional bite and malocclusions. A relationship between the incidence of malocclusions and the eruption time of permanent teeth was found, taking into account the peculiarities of the residence area.

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