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Orthodontic Status Assessment of Bulgarian Children Aged 3 to 6 Years

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Abstract

Introduction: The importance of oral health prevention cannot be overstated and encompasses general oral health as well as orthodontic care. The occlusion observed in the primary dentition can serve as an indicator for the future occlusion in the permanent dentition. If certain occlusal discrepancies present in the primary dentition are not addressed appropriately or timely, they may persist into the mixed or permanent dentition.

The **aim** of the study was to assess the orthodontic status of preschool children.

Material and methods: The study included 200 children aged 3 to 6. The children underwent an orthodontic clinical examination with a standard dental examination set and a periodontal probe graduated in mm. The occlusion of the children was analyzed by evaluating the following parameters: molar relationship, canine relationship, and presence of physiological spaces.

Results: A flush terminal plane and a Class I canine relationship are prevalent among most children studied. Most children also exhibit spaced dentition or primate spaces.

Conclusion: Our findings suggest favorable occlusal characteristics and a higher likelihood of achieving correct occlusion in their permanent dentition.

Keywords:

malocclusion, orthodontic status, molar relationship, canine relationship, spaced and closed dentition, primate space.

Introduction

The Dental home is defined as a continuous relationship between the dentist and the patient,

encompassing all aspects of oral health care and providing continuous, comprehensive, accessible, coordinated, and family-oriented care (1).

Maintaining the esthetic and functional integrity of primary dentition is crucial (2). Oral health prevention is of paramount importance and includes both general oral health and orthodontic health (2).

The American Academy of Orthodontics advises an orthodontic check-up for children by age 7, based on two main reasons (3). First, a specialist orthodontist can assess whether the child is at risk for developing malocclusion or bite issues. Second, many dental problems are easier to treat in their early stages,

particularly when children's natural growth processes are at their most dynamic (3).

Dental and skeletal anomalies are also often found in younger preschool children (4). Malocclusions in early childhood can be attributed to genetic factors or acquired through harmful habits of the child or changes in the primary dentition (5). The occlusion of primary teeth can predict that of permanent teeth, and incorrect jaw relationships may persist into mixed or permanent teeth if not managed properly (6). Besides aiding chewing, primary teeth help maintain occlusion and space for permanent teeth (7).

Occlusion analysis of primary teeth should evaluate dental relationships in all three planes (8). The relationship between the distal surfaces of the maxillary and mandibular second primary molars is an important factor affecting the future occlusion of the permanent dentition (7). The mesio-distal relationship between the distal surfaces of the upper and lower second primary molars is called the terminal plane (9-11). The position of the terminal plane is important because it determines the future occlusion in the permanent dentition since the posterior surface of the primary second molar also guides the position and direction of the eruption of the first permanent molar (12). Thus, the terminal plane relationship in the primary dentition is used to predict the future molar relationship in the permanent dentition (13). Skeletal growth patterns are affected by dental adjustment mechanisms. A distal step in primary dentition may be associated with skeletal imbalances, potentially resulting in Class II malocclusion in permanent dentition (14). Proffit observed that class III malocclusion occurs less frequently than class II malocclusion (15). Children with a mesial step relationship at an early age may have an increased likelihood of developing class III malocclusion (15).

Several authors report different incidences of malocclusions in preschool age. According to some authors, their incidence is exceptionally high – 83.9% (11). According to other publications, a flush terminal plane occurs in over 70% of the primary dentition (16, 17). Data from other authors differ and range from 21% to almost 90% (18-20).

Physiological diastemas and tremas are usually present in the primary dentition and are prognostically favorable signs regarding the arrangement of permanent incisors. The prevalence of diastemas and tremas varies among different groups of children between 42 and 98% (21, 22). The gaps often occur either between all anterior teeth or mesial to the maxillary canine and distal to the mandibular canine (the so-called “primate spaces”) (23). The lack of these spaces in the primary dentition (non-spaced dentition) expresses a disproportion between the size of the jaws and teeth (24).

Due to the presence of various malocclusions in the primary dentition, we decided to evaluate the orthodontic characteristics and specifics in children between 3 and 6 years of age in order to be able to analyze the incorrect occlusal relationships.

The **aim** of the study was to assess the orthodontic status of preschool children.

Material and methods:

The study included 200 children aged 3 to 6 years who met the following criteria: healthy children without common diseases, who visited a private dental office for a routine preventive examination, children without dental complaints, children with a complete primary dentition, children without missing primary teeth. Children with severely carious dentition and extensive carious lesions on the mesial and distal tooth surfaces, children with existing permanent teeth, children with harmful habits, or undergoing early orthodontic treatment were excluded from the study. After receiving written informed consent from the parents and guaranteeing the confidentiality of the information, the children had an orthodontic clinical examination using a standard dental examination set and a periodontal probe graduated in millimeters. All examinations were performed by a single clinician - a specialist orthodontist. The occlusion analysis was conducted in a maximum intercuspidation.

The occlusion of the children was analyzed by evaluating the following parameters (Figure 1):

- Molar relationship:
    - Flush terminal plane (FTP): The distal surfaces of the upper and lower second primary molars are aligned vertically in central occlusion.
    - Distal step: The distal surface of the lower second primary molar is positioned more

distally compared to the upper in central occlusion.
- Mesial step: The distal surface of the lower second primary molar is positioned more mesially compared to the upper in central occlusion.

- Canine relationship:
  - class I – the cusp tip of the upper primary canine aligns with the distal surface of the lower primary canine;
  - class II – the cuspid of the upper primary canine is mesial to the distal surface of the lower canine;
  - class III – the cusp of the upper primary canine is positioned distal to the distal surface of the lower canine.
- Presence of physiological spaces:
  - everywhere: spaces between all frontal teeth – spaced dentition;
  - primate space: spaces mesial to the maxillary primary canine and distal to the mandibular primary canine;
  - no presence of physiological spaces – closed dentition.

The data were analyzed and compared using SPSS version 22 (SPSS Inc., IL, USA).

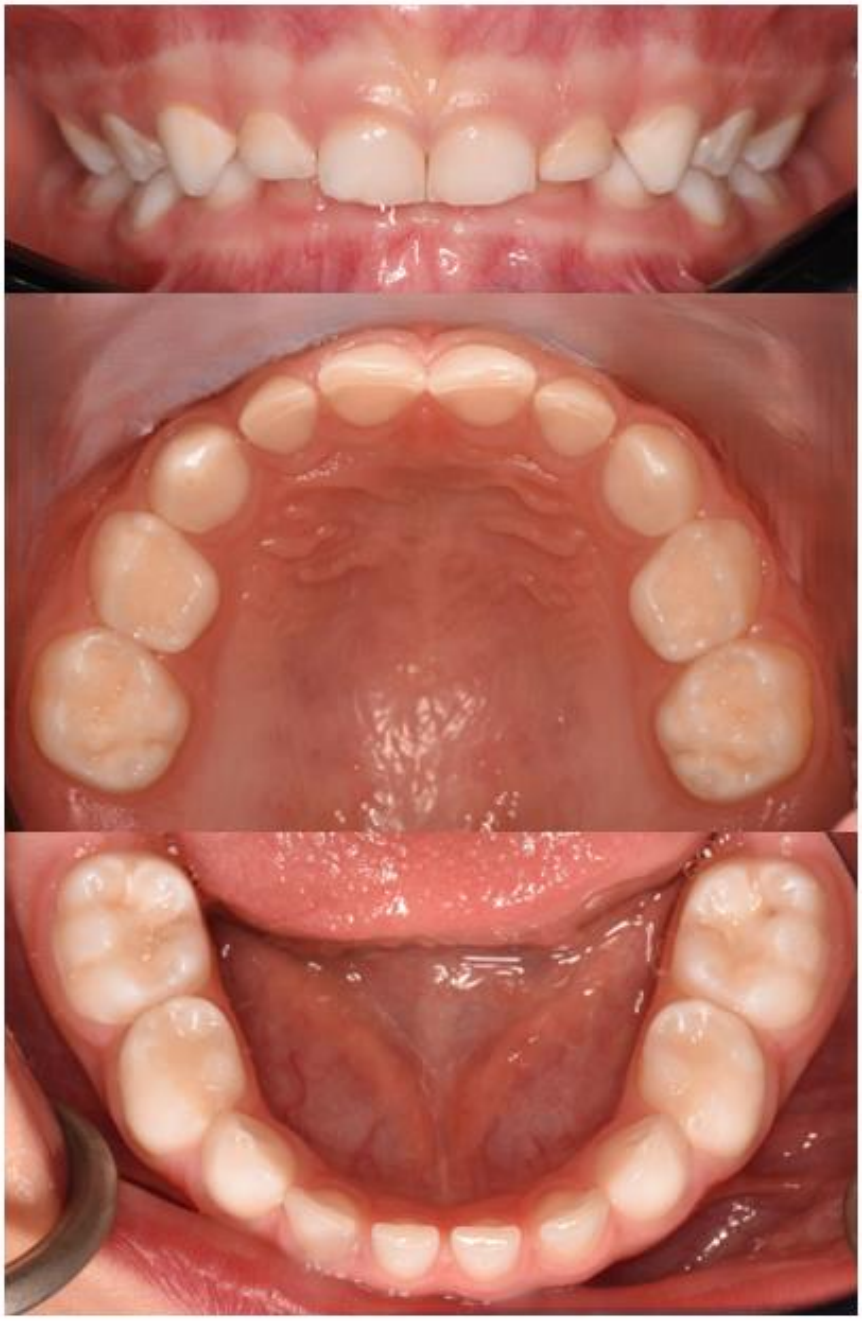

Figure 1. A child with primary dentition and physiological spaces between the teeth.

Results:

Table 1 shows the distribution of study participants by gender and age.

Table 1. Age and gender of the children

Age / Gender	3 years	4 years	5 years	6 years	Total
Male	17	30	26	16	89
Female	15	34	34	28	111
Total	32	64	60	44	200
Chi-square test	$X^2 = 2.322$, p=0.508				

Table 2 presents the molar relationship in the primary dentition.

Table 2. Molar relationship

Age / Molar relationship	3 years	4 years	5 years	6 years	Total
Bilateral FTP	68.8%	65.6%	75%	84.1%	73%
Bilateral mesial step	9.4%	21.9%	11.7%	11.4%	14.5%
Bilateral distal step	12.5%	6.3%	5%	2.3%	6%
FTP and mesial step	6.3%	3.1%	1.7%	2.3%	3%
FTP and distal step	3.1%	3.1%	3.1%	0%	1.5%
Mesial and distal step	0%	1.6%	5%	0%	2%
Chi-square test	$X^2 = 15.401$, p=0.423				

The data show that the bilateral flush terminal plane is the most common in all age groups – 73%. The least common are the different relationships on the left and right side of the dentition. The second most common of the equal bilateral molar relationships is the mesial step (14.5%), and the least common is the bilateral distal step (6%).

Table 3 presents the canine relationship in the primary dentition.

Table 3. Canine relationship

Frequency / Canine relationship	Total
I Class	71%
II Class	17.5%
III Class	11.5%
Chi-square test	$X^2 = 128.770$, p=0.000

The table shows that the frequency of occurrence of the I class canine relationship is 71%, followed by the II class – 17.5%. The least common is the III class canine relationship.

Table 4 presents the presence of physiological prosthodontics and "primate space" in the maxilla and mandible in the primary dentition.

Table 4. Spaces in the upper and lower jaw

Frequency / Spaces	Upper jaw		Lower jaw	
	N	%	N	%
Closed dentition	22	11%	25	12.5%
Primate space	71	35.5%	55	27.5%
Spaced dentition	107	53.5%	120	60%
Chi-square test	$X^2 = 54.610$, p=0.000		$X^2 = 70.750$, p=0.000	

The data show that in the most significant percentage of cases in both the upper and lower jaws, the teeth have physiological spaces in the front everywhere. Primate space occurs more often in the upper jaw. Dentition without spaces between the teeth occurs rarely – in about 11 – 12.5% of cases.

Discussion:

In Bulgaria, there is a lack of information on the occlusal status of preschool children and primary dentition. Our study estimates the frequency of the most common orthodontic problems in children from 3 to 6 years of age. In orthodontics, it is essential to detect all deviations from the correct occlusion early in order to prevent the problem from worsening in the permanent dentition (17, 25). The standard molar ratio of the primary teeth is the flush terminal plane (26). Our results showed that the most common molar relationship was the FTP in the primary molar relationship in all studied children (73%) regardless of age (Table 2). The data align with similar findings from other colleagues. In Iran, this type of molar relationship is also the most common among young children, with a prevalence of 82.75% (4). Most studies support the notion that this is the most prevalent type of occlusion in preschool children, with various authors reporting a prevalence ranging from 69% to 88% (16, 17). Another research group reported a high frequency of mesial step in the primary dentition, nearly 44% (12). These results do not coincide with ours, which found a much lower prevalence of mesial step - 14.5% (Table 2).

The ratio of the terminal plane is used as a starting point for determining the future interocclusal ratio of the permanent first molars. The position of the first permanent molars is influenced by the ratio of primary teeth, as their eruption path follows the distal surface of the root and crown of the second primary molar (6). Children with a FTP in the primary dentition often develop class I Angle occlusion in their permanent dentition, and children with a distal step develop class II Angle occlusion (27). We found the lowest prevalence of distal step in the primary dentition – only 6%. In Brazil, other colleagues found that the mesial step was more common in children aged 2 to 5 years than the FTP and distal step (28). Other authors reported 10.25% distal step and only 6% mesial step (4). In children with distal step in the primary dentition, it is recommended to start treatment of the occlusion at an earlier stage since the chances of self-correction are low (29, 30). Among the participants in our study, this was a small number of children – only 6% (Table 2). It should be noted that racial differences in occlusion are observed, which may contribute to the different incidence of molar ratios and canine ratios in different ethnic and racial groups, for example, the incidence of class III occlusion, open bite in the front and the presence of diastema is higher in African Americans than in Caucasians and Asians (31, 32).

In our study, we analyzed the canine relationship among the children and found the following distributions: 71% had a Class I relationship, 17.5% had a Class II relationship, and 11.5% had a Class III relationship (Table

3). Other research has reported similar findings (33, 34), while some authors documented an even higher prevalence of Class I relationships, reaching nearly 88% (16). According to Kumar, the prevalence in his study was 61% for Class III, 27% for Class I, and 12% for Class II (35). Consistent with our results, other researchers found that 75% of children with primary dentition exhibited a Class I canine relationship (36). Interestingly, some studies reported no cases of Class III canine relationships at all (37).

The data also revealed a significant correlation between the flush terminal plane and Class I canine relationships (34), which is supported by our findings (tables 2 and 3). Spaces between teeth are a common feature in primary dentition and represent an important characteristic, indicating favorable occlusion development in permanent dentition (22). These spaces frequently occur between all the front primary teeth. A lack of spacing in the dentition increases the risk of developing carious lesions in proximal areas and contributes to potential crowding in permanent dentition (22, 38). Our study found that nearly 90% of children had either primate spaces or physiological spaces between all their anterior teeth (table 4). Most studies indicate that spaced teeth are present in over 90% of children with primary dentition (39, 40). The occurrence of interdental spaces is affected by various factors such as ethnicity, gender, and jaw structure (22). Primate spaces are typically found more frequently in the maxilla (41), which aligns with our data (Table 4).

Our study indicates that orthodontic issues can be identified early in childhood, highlighting the need for early prevention. Contemporary literature on children's oral health highlights the critical role of parents in preventing various oral diseases (42). Therefore, motivating and educating parents and caregivers about the significance of maintaining their young children's oral health is essential.

Conclusion: A flush terminal plane and a Class I canine relationship are prevalent among the majority of the children studied. Most children also exhibit spaced dentition or primate spaces. These findings suggest favorable occlusal characteristics and a higher likelihood of achieving correct occlusion in their permanent dentition.

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