DOI: https://doi.org/10.54617/adoklinikbilimler.1376924

Original Research Article

The Evaluation of Occlusion Characteristic and Deleterious Oral Habits in 3- to 5-year-old Children

3-5 Yaş Arasındaki Çocuklarda Okluzyon Özellikleri ve Zararlı Ağız Alışkanlıklarının Değerlendirilmesi

Nagehan Aktaş[1], Zeliha Hatipoğlu Palaz[2], Neşe Akal[3]

ABSTRACT

Aim: Malocclusion is a prevalent public health concern, impacting craniofacial growth and development, and significantly affecting the quality of life of children in terms of oral health. This study investigated the prevalence of malocclusion in children aged 3 to 5 years, aiming to understand its occlusal characteristics, deleterious oral habits, correlations, and their parents' attitudes toward malocclusion.

Materials and Method: This cross-sectional study included 275 children aged 3-5 and their parents. The occlusion characteristics of the children participating in the study, including the relationship of the primary molar and canine teeth, overjet, crossbite, deep bite and anterior open bite, were evaluated and recorded by a researcher. A 7-item questionnaire was administered to the parents to collect sociodemographic data and oral health habits of the children's parents. The chi-square test was used for statistical assessment of results.

Results: The results revealed that 40.7% of the children had malocclusion during their primary dentition period. It was found that the most common malocclusion was deep bite (15.7%) and harmful oral habits, especially bruxism (16.3%), were commonly observed among children in the researched age group.

Conclusion: The results of this study will play an important role in shaping future oral health planning, especially regarding malocclusions seen in the primary dentition. It is thought that the findings from the study will guide strategies to improve oral health and preventive measures.

Keywords: Child; Deleterious oral habits; Malocclusion; Primary dentition

ÖZET

Amaç: Malokluzyon, kraniyofasiyal büyüme ve gelişmeyi ve ağız sağlığı açısından çocukların yaşam kalitesini önemli ölçüde etkileyen yaygın bir halk sağlığı sorunudur. Bu çalışma, 3-5 yaş arası çocuklarda malokluzyonun yaygınlığını araştırarak malokluzyonun özelliklerini, zararlı ağız alışkanlıklarını, korelasyonlarını ve ebeveynlerinin maloklüzyon sorununa yönelik tutumlarını anlamayı amaçlamaktadır.

Gereç ve Yöntem: Bu kesitsel çalışmaya 3-5 yaş arasındaki 275 çocuk ve onların ebeveynleri dahil edilmiştir. Çalışmaya katılan çocukların süt molar ve kanin dişlerinin ilişkisi, overjet, çapraz kapanış, derin kapanış ve anterior açık kapanış dahil olmak üzere okluzyon özellikleri bir araştırmacı tarafından değerlendirilerek kayıt altına alınmıştır. Çocukların ebeveynlerinin sosyodemografik verileri ve ağız sağlığıyla ilgili alışkanlıklarını toplamak için ebeveynlere 7 maddelik bir anket uygulanmıştır. İstatistik analizi Ki-kare testi kullanılarak yapılmıştır.

Bulgular: Çalışmanın sonuçları çocukların %40.7'sinin süt dişlenme döneminde malokluzyona sahip olduğunu ortaya koymuştur. En yaygın görülen malokluzyonun derin kapanış olduğu (%15.7) ve başta bruksizm (%16.3) olmak üzere zararlı ağız alışkanlıklarının araştırılan yaş grubundaki çocuklar arasında yaygın olarak gözlemlendiği bulunmuştur.

Sonuç: Bu çalışmanın sonuçları, özellikle süt dişlenme döneminde görülen malokluzyonlarla ilgili olarak gelecekteki ağız sağlığı planlamasının şekillendirilmesinde önemli bir rol oynayacaktır. Çalışmadan elde edilen bulguların, ağız sağlığını ve önleyici tedbirleri geliştirmeye yönelik stratejilere rehberlik edeceği düşünülmektedir.

Anahtar Kelimeler: Çocuk; Malokluzyon; Süt dentisyon; Zararlı ağız alışkanlıkları

Makale gönderiliş tarihi: 16.10.2023; Yayına kabul tarihi: 5.02.2024

İletişim:Dr. Nagehan AKTAŞ
Gazi University, Faculty of Dentistry, Department of Pediatric Dentistry Bişkek Cd.(8.Cd.) 1.Sk. No:8 06490 Emek, Ankara, Turkiye
E-mail: nagehanduygu@gmail.com
[1] Asst.Prof., Gazi University, Faculty of Dentistry, Department of Pediatric Dentistry, Ankara, Türkiye
[2] Research Assistant, Gazi University, Faculty of Dentistry, Department of Pediatric Dentistry, Ankara, Türkiye
[3] Prof., Gazi University, Faculty of Dentistry, Department of Pediatric Dentistry, Ankara, Türkiye

INTRODUCTION

Malocclusion is a prevalent public health problem and can significantly affect children's quality of life related to oral health by causing problems such as chewing function, speech articulation, aesthetic appearance, and psychological problems.[1,2] A recent systematic review reported that the worldwide prevalence of malocclusion among children and adolescents was around 56%, and the prevalence score did not change from primary to permanent dentition.[3]

Malocclusion has a multifactorial etiology and can be affected by genetic and environmental factors.[4] Environmental factors such as nutritive sucking habits, which includes breastfeeding and bottle-feeding, and non-nutritive sucking habits, which includes pacifiers and digit sucking, may contribute to the increased prevalence of malocclusion.[5,6] Malocclusion observed in primary dentition is a risk factor for the future need for orthodontic treatment in permanent dentition. Therefore, comprehending the prevalence of malocclusion and its associated factors during primary dentition development is crucial to mitigate its impact on permanent dentition and enable timely interventions.[7]

During childhood, a critical phase of growth and development occurs wherein the bone structures are highly malleable, and physiological habits act as stimuli for the normal growth of the jaw, encompassing functions such as speech, swallowing, and chewing. Deleterious habits, including tongue thrusting, mouth breathing, and bruxism can negatively impact dental structure. Deleterious oral habits, albeit with minimal impact on overall child health, exert a notable influence on dental positioning, inter-arch relationships, and the natural growth of jaws, as well as the functioning of orofacial musculature.[8,9] These habits may play a role in the etiology of malocclusions, disrupting the balance in muscle strength and causing alterations in the normal functional aesthetics of the entire stomatognathic apparatus. It is imperative to address these reflex activities, as neglecting to do so could impede the potential for correction, hindering optimal oral and dental development in the long run.[10]

There are few studies on the association of deleterious oral habits with dental malocclusion in primary dentition.[7-9] This study aimed to determine the occlusal characteristics of primary dentition and investigate the prevalence of deleterious oral habits and their relationship to dental malocclusion in patients aged 3 to 5 years.

MATERIALS AND METHOD

Study design and participants

This cross-sectional study was conducted in compliance to the Declaration of Helsinki between January and June 2019. This study was approved by the Institutional Review Board of the Faculty of Dentistry at Gazi University (application number: 19.03/4). All 3- to 5-year-old children who applied to the first examination Department of Pediatric Dentistry, Gazi University were invited to the study. Children with permanent teeth, previous orthodontic treatment history or currently undergoing treatment, craniofacial anomalies or syndromes, difficulty in cooperating, and serious systemic diseases were excluded from this study.

Sample size calculation was carried out based on the number of patient population obtained from last year's data of the data automation system. According to the previous year's data, 625 children (between 3–5-year-old) were examined in the year. It was envisaged to include at least 150 cases in the study so that the study could have at least 80% power with a 5% error level and 2.5% sampling error using an analysis of variance (ANOVA) model.

Written consent was obtained from each child's parent/guardian before conducting the study.

Questionnaire Survey

A questionnaire was developed based on a prior study[11] and pretested. Parents, guided by a dentist (Z.H.P.), completed the questionnaire, which encompassed two primary sections:

Part I: General information: This section encompassed inquiries about the child's age, gender, parental educational level, the child's dental visit history, frequency of dental clinic visits, past orthodontic consultations, and the parent's perspective on malocclusion issues.

Table 1. Types of malocclusion and related diagnostic criteria

	Types	**Diagnosis criteria**
The Sagittal Relationship of the Second Primary Molars	Flush terminal plane	The distal surfaces of the maxillary and mandibular second primary molars were in the same vertical plane.
	Distal step	The distal surface of the mandibular second primary molar lay distal to that of the maxillary second primary molar.
	Mesial step	The distal surface of the mandibular second primary molar lay mesial to that of the maxillary second primary molar.
		**The sagittal relationship of the primary molars was recorded as distal or mesial step if the flush terminal plane was on one side and the distal or mesial step was on the other side.*
The Sagittal Relationship of the Primary Canines	Class I	The distal surface of the mandibular primary canine lay mesial to the cusp tip of the maxillary primary canine.
	Class II	The mesial surface of the mandibular primary canine lay distal to the cusp tip of the maxillary primary canine.
	Class III	The mandibular primary canine is further mesially positioned than the maxillary primary canine.
		**The sagittal relationship of the primary canines was recorded as class II or III if class I was on one side and class II or III was on the other side.*
Sagittal Anomalies	Anterior crossbite	It was diagnosed when any upper primary incisor or canine was positioned inside the lingual surfaces of the lower front teeth.
	Edge-to-edge incisor relationship	It was diagnosed when upper and lower incisal edges met edge-to-edge.
	Increased overjet	It was diagnosed when the distance between the incisal edge of the most protruded upper primary incisor and labial surface of the corresponding lower primary incisor was > 4mm.
Vertical Anomalies	Deep overbite	It was diagnosed when the coverage of the lower incisors by the most protruded upper primary incisor was more than half.
	Anterior open bite	It was diagnosed if no vertical overlap was found between the upper and lower primary incisors when the posterior teeth were in contact.
Transversal Anomalies	Posterior crossbite	It was diagnosed when any lower primary posterior tooth was placed buccal to the upper primary molars. Both unilateral and bilateral posterior crossbites were recorded.
	Scissor bite	It was diagnosed if one or more maxillary molars were occluded buccally to the buccal surfaces of the mandibular molars.
	Midline deviation	It was diagnosed if the midline of the mandibular primary incisors had a deviation 2 mm from that of the maxillary primary incisors.

Part II: Deleterious oral habits of the child: This section involved questions about specific deleterious oral habits exhibited by the child, including tongue-thrusting, mouth-breathing, bruxism, mandibular prognathism, lip-biting, and finger-sucking.

Oral Examination

The clinical examination of participants was conducted by a single examiner (N.A.), who received prior training from an experienced pediatric dentist (N.Akal) before commencing the study. A graded periodontal probe was utilized during the oral examination. The classification of various malocclusions was meticulously documented, and the diagnostic criteria for each malocclusion type were drawn from previous studies[12] as shown in Table 1.

Statistical Analyses

Data were analyzed with IBM SPSS V23 (IBM Corp., Armonk, NY, USA). Pearson Chi-Square Test was used to compare categorical variables according to groups, and adjustment for multiple comparisons were made with Bonferroni correction. Analysis results were presented as frequency (percentage) for categorical variables. The statistical significance level was set as $p<0.05$.

RESULTS

360 patients applied to the first examination clinic for evaluation. After considering the exclusion criteria, 275 children were included in the study. Descriptive analyses of participants' demographic characteristics and dental visiting experience were presented in Table 2. One or more anomalies were observed in 112 (40.7 %) children.

The prevalence of occlusal characteristics among children is shown in Table 3. Regarding secondary primary molar relationships, most of the children had flush terminal plane (91.3%) followed by mesial terminal plane (4.7%) and distal terminal plane (4%) in the examined population. The result showed that the most prevalent canine relation was Class I, which was present in 89.5%, followed by Class III (5.8%) and Class II (4.7%) canine relation. Statistically significant prevalence was present in class II canine relationships in 5-year-old children ($p<0.05$).

Table 2. Descriptive analyses of demographic characteristics and dental visiting experience of participants.

	Number (n)	Percentage (%)
Gender		
Female	137	49.8
Male	138	50.2
Age		
3	23	8.4
4	113	41.0
5	139	50.6
Parental education level		
High school and below	198	72.0
Undergraduate	71	25.8
Graduate and above	6	2.2
Frequency of visiting dental clinic		
Never	34	12.3
Only when needed	226	82.2
Half a year	15	5.5
Orthodontic consultation history		
Yes	50	18.2
No	225	81.8
Parental attitude toward the problem of malocclusion		
Pay positive attention	251	91.3
Not concerned	24	8.7

Table 3. The prevalence of occlusal characteristics

	Age				
	Age 3 (Year) n (%)	**Age 4 (Year) n (%)**	**Age 5 (Year) n (%)**	**Total n (%)**	**p***
Molar relationship					
Flush terminal plane	22 (95.7)	102 (90.3)	127 (91.4)	251 (91.3)	0.877
Mesial step	1 (4.3)	6 (5.3)	6 (4.3)	13 (4.7)	
Distal step	0 (0)	5 (4.4)	6 (4.3)	11 (4.0)	
Canine relationship					
Normal (class I)	22 (95.7)	102 (90.3)	122 (87.8)	246 (89.5)	0.035
Distal (class II)	1 (4.3)ab	1 (0.9)b	11 (7.9)a	13 (4.7)	
Mesial (class III)	0 (0)	10 (8.8)	6 (4.3)	16 (5.8)	
Sagittal Anomalies					
Anterior crossbite	0 (0)	2 (11.1)	8 (27.6)	10 (3.7)	0.077
Edge-to-edge	0 (0)	9 (50)	14 (48.3)	23 (8.4)	
Increased overjet	3 (100)	7 (38.9)	7 (24.1)	17 (6.1)	
Vertical Anomalies					
Open bite	0 (0)	5 (18.5)	3 (15.8)	8 (2.9)	0.579
Deep bite	5 (100)	22 (81.5)	16 (84.2)	43 (15.7)	
Transversal anomalies	0 (0)	0 (0)	0 (0)		
Scissor bite					
Posterior crossbite	0 (0)	3 (30)	5 (71.4)	0 (0)	0.104
Midline deviation	2 (100)	7 (70)	2 (28.6)	8 (2.9)	
				11 (4.0)	

* Pearson Chi-Square Test; a-b: There is no difference between groups with the same letter.

The prevalent malocclusion in the sagittal direction was identified as the edge-to-edge incisor relationship, accounting for 8.4% of cases. In comparison, the most prevalent malocclusions in the vertical and transverse directions were deep bite (15.7%) and midline deviation (4%), respectively. Notably, deep bite emerged as the most common malocclusion among children in the primary dentition. Additionally, the prevalence of posterior crossbite, anterior crossbite, and anterior open bite was noted at 2.9%, 3.7%, and 2.9%, respectively. Scissor bite was not observed in any patient.

Table 4. The prevalence of deleterious oral habits

	Age				p*
	Age 3 (Year) n (%)	**Age 4 (Year) n (%)**	**Age 5 (Year) n (%)**	**Total n (%)**	
Oral habits~					
None	20 (87)	75 (66.4)	91 (65.5)	186 (68)	0.003
Mouth-breathing	0 (0)a	1 (0.9)a	11 (7.9)b	12 (4.4)	
Lip-biting	0 (0)	4 (3.5)	8 (5.8)	12 (4.4)	
Bruxism	1 (4.3)	23 (20.4)	21 (15.1)	45 (16.3)	
Finger-sucking	2 (8.7)	4 (3.5)	12 (8.6)	18 (6.5)	
Tongue thrusting	0 (0)	5 (4.4)	0 (0)	5 (1.8)	
Mandibular prognathism	0 (0)	2 (1.8)	8 (5.8)	10 (3.6)	

* Pearson Chi-Square Test; a-b: There is no difference between groups with the same letter. ~; multiple response

Table 5. The relationship between deleterious oral habits and malocclusion

	Oral Habits ~							
	None n (%)	Mouth-breathing n (%)	Lip-biting n (%)	Bruxism n (%)	Finger-sucking n (%)	Tongue thrusting n (%)	Mandibular Prognathism n (%)	p*
Sagittal Anomalies								
Anterior crossbite	5 (18.5)	0 (0)	1 (33.3)	0 (0)	1 (11.1)	0 (0)	3 (75)	0.370
Edge-to-edge	13 (48.1)	0 (0)	1 (33.3)	5 (55.6)	4 (44.4)	1 (50)	1 (25)	
Increased overjet	9 (33.3)	1 (100)	1 (33.3)	4 (44.4)	4 (44.4)	1 (50)	0 (0)	
Vertical Anomalies								
Open Bite	3 (10.3)	0 (0)	0 (0)	2 (15.4)	2 (33.3)	1 (33.3)	1 (50)	0.441
Deep Bite	26 (89.7)	1 (100)	0 (0)	11 (84.6)	4 (66.7)	2 (66.7)	1 (50)	
Transversal anomalies								
Scissor bite	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.290
Posterior crossbite	6 (46.2)	0 (0)	2 (66.7)	0 (0)	0 (0)	0 (0)	0 (0)	
Posterior crossbite	7 (53.8)	0 (0)	1 (33.3)	3 (100)	0 (0)	0 (0)	0 (0)	

* Pearson Chi-Square Test; ~; multiple response

Children had a high prevalence of deleterious oral habits (37%). Bruxism (16.3%) was the most common habit observed, while fewer children engaged were in finger-sucking (6.5%), lip-biting (4.4%), mouth-breathing (4.4%), mandibular prognathism (3.6%), tongue-thrusting (1.8) (Table 4). The prevalence of mouth breathing in children aged 5 years was statistically significantly higher compared to children in other age groups ($p<0.05$). The relationship between deleterious oral habits and malocclusion is shown in Table 5. No statistically significant associations were found between malocclusion and sociodemographic factors.

DISCUSSION

Any abnormal environmental factors or pathologies that disrupt the natural development of occlusion should be addressed and eliminate potential irregularities and malpositions in the developing dentofacial complex through early treatments, known as preventive and interceptive orthodontic interventions.[13] With these treatments, it is possible to reduce or even eliminate the severity of malocclusion, thereby promoting optimal occlusal development. Close monitoring of children with malocclusion during their early years allows for timely intervention and appropriate orthodontic management to minimize the impact of malocclusion on the developing permanent dentition.[14] Therefore, this study was conducted to investigate the prevalence of malocclusion in the primary dentition period (3-5 years old) in Turkish children and to emphasize the necessity of understanding its etiology and associated factors for timely intervention and effective preventive strategies.

The majority of orthodontic patients are children, underscoring the crucial role of parental awareness in early treatment for malocclusion.[13,15] This sentiment is supported by the American Association of Orthodontists, which recommends the optimal timing for a child's initial orthodontic assessment to be at the age of 7 years, emphasizing the significance of early intervention in orthodontic care.[16] In the present study, 87.6% of the 275 children visited the dental clinic for examination or existing problems with their teeth. Although 91.3% of parents have a positive attitude towards the malocclusion problem in their children, 81.8% of the children included in the study did not have a history of orthodontic consultation. Alsaggaf *et al*.[15] and Alnaafa *et al*.[17] reported that 28.5% and 22.5% of parents are aware that a child's first orthodontic screening should start at age 7. In our study, although most parents showed positive attitudes towards their children's malocclusion, only 18.2% of the patients had an orthodontic examination, possibly due to parents not being aware of the need to seek orthodontic consultation at an early age.

Our findings revealed that 40.7% of the children aged 3-5 in the studied population exhibited malocclusion. The prevalence of malocclusion in primary dentition has been observed to vary considerably

among different countries. According to the literature, the prevalence of malocclusion in primary dentition was 61.6% of 4-year-olds and 58.4% of 5-year-old children in Germany18; 32.5% in children aged 3-5 years in Brazil19; 68.3% of the 3-to-5-year-old-children in China.[7] In various studies conducted in different countries, distinctive diagnostic criteria may be employed, reflecting the absence of a universally acknowledged definition for malocclusion concerning primary dentition. In alignment with analogous research, this study refrained from categorizing molar and canine relationships as malocclusion. It is essential to note that the present study offers valuable insights into occlusal traits observed in preschool children in Ankara, representing the initial examination of occlusal conditions among preschool children in a university clinic. Consequently, the findings of this study hold potential utility regarding potential occlusal conditions among preschool-aged children. Although comparable to other studies, this prevalence emphasizes the necessity of early orthodontic assessment and intervention during the critical developmental stages.

Foster and Hamilton[20] comprehensively assessed diverse occlusal conditions in the primary dentition. They defined normal occlusion by specific characteristics, including spaces between anterior teeth, primate spaces, minimal or absent overjet and overbite, and a flush plane with distal surfaces of second deciduous molars aligned on the same plane. Baume[21], in his examination of primary molar relationships, identified and classified three primary types: flush terminal plane, distal step, and mesial step. The normal molar relationship in primary dentition was flush until the eruption of the permanent first molar. The terminal plane plays a pivotal role in occlusal development, given that the posterior surface of the distal root of the primary second molar guides the eruption pathway for the first permanent molar.[22] The flush terminal plane (91.3%) was highly prevalent in our study. This is followed by the mesial step (4.7%) and the distal step (4%). In a study conducted by Yilmaz *et al*.,[23] the flush terminal relationship was found to be the most prevalent primary molar relationship among Turkish children aged 3 to 6 years, with a notable rate of 88.3%. Similar results have been reported in previous study.[24]

Discussing other types of malocclusions, 89.5% of children had a bilateral class I canine relationship, and the other studies reported a higher prevalence of class I canine relationships, at least over 75%.[8,25] The present study identified deep bite as the predominant malocclusion type in primary dentition, a finding consistent with prior studies by Zhou *et al*.[26], and Lin *et al*.[7]. On the other hand, Davidopoulo *et al*.[27] reported a higher prevalence of increased overbite in their study. The variations in our findings compared to previous studies could be attributed to differing methodologies. For instance, the definition of increased overjet varied; in our study, it was based on the coverage of lower incisors by the most protruded upper primary incisor being more than half, whereas other studies defined it as over 2 mm. These methodological differences underscore the importance of a standardized approach to ensure consistent and comparable results across studies.

An oral habit in infancy and early childhood is normal and considered abnormal over 3 years of age.[9] At the age of 3 years, the primary teeth completely erupt and establish their occlusal relationship, which lasts for 6 years until the first permanent tooth begins to erupt in the oral cavity.[8] The overall prevalence of deleterious oral habits (one or more than one in a single child) in this study was found to be 32%, which is in accordance with the studies reported by Dhull *et al*.[9] (36%), Rajchanovska and Zafirova-Ivanovska[28] (35.9%) and Omer and Abuaffan[29] (30%). However, this prevalence appears lower than the findings documented by Lin *et al*.[7] (56.1%) in a study involving Chinese preschool children. In contrast, Onyeaso and Sote[30] observed a notably lower prevalence of oral habits (13.14%) among Nigerian preschool children. This considerable variability in oral habit prevalence may be attributed, at least in part, to variations in the assessment of distinct oral habits across diverse age groups and the utilization of differing methodological approaches. Nonetheless, it is imperative to acknowledge the potential influence of cultural and environmental factors on the manifestation of oral habits.

In our investigation, bruxism emerged as the most prevalent deleterious habit (16.3%), a finding consistent with comparable studies.[7,9] It's imperative to delve into the cause-effect relationship between these habits and malocclusions, as understanding

this relationship is pivotal for effective interventions and optimal treatment outcomes. Our study did not establish a significant correlation between deleterious oral habits and malocclusion in children aged 3 to 5. This result may be explained by the habit's frequency and duration and the perilabial muscle's force.

Several limitations were identified in this study. The questionnaire was used to determine the presence or absence of deleterious oral habits. Although other studies detected oral habits by the self-reported questionnaires completed by parents, it is important to acknowledge that the validity of such data might be susceptible to recall bias or misinterpretation. Notably, the assessment did not evaluate each deleterious habit's intensity, duration, and frequency. Furthermore, employing an orthodontic treatment necessity index is advisable to enhance diagnostic accuracy in identifying malocclusions. As a cross-sectional study, it cannot establish the temporal relationship between deleterious habits and the onset of malocclusions. To gain a comprehensive understanding of malocclusion development and its intricate relationship with various factors, it is imperative that future research adopts a longitudinal approach. The generalizability of the findings is restricted, given that the study's population primarily consisted of children seeking care at at a Pediatric Dentistry Clinic. Extrapolating these results to the broader pediatric patient population should be undertaken cautiously.

Nonetheless, this study is a valuable contribution to the extant body of literature. It offers crucial insights for epidemiologists and clinicians, enhancing their understanding of malocclusion prevalence among preschool children in Turkey. The implications of these findings are far-reaching and will play a pivotal role in shaping future oral healthcare planning, particularly concerning malocclusions in the deciduous dentition. The knowledge gleaned from this study will guide informed strategies to enhance oral health and preventive measures in this specific age group.

CONCLUSION

In conclusion, this study provides valuable information regarding the prevalence and characteristics of malocclusion in primary dentition in a group of Turkish children aged 3-5 years. Early identification of malocclusion and associated risk factors, as well as timely orthodontic intervention and parent education, are crucial for optimal occlusal development and overall oral health during primary and permanent dentition.

REFERENCES

1. Masood Y, Masood M, Zainul NN, Araby NB, Hussain SF, Newton T. Impact of malocclusion on oral health related quality of life in young people. Health Qual Life Outcomes 2013;11:25.

2. Amr-Rey O, Sánchez-Delgado P, Salvador-Palmer R, Cibrián R, Paredes-Gallardo V. Association between malocclusion and articulation of phonemes in early childhood. Angle Orthod 2022;92:505-11.

3. Lombardo G, Vena F, Negri P, Pagano S, Barilotti C, Paglia L, *et al*. Worldwide prevalence of malocclusion in the different stages of dentition: A systematic review and meta-analysis. Eur J Paediatr Dent 2020;21:115-22.

4. Santana LG, Flores-Mir C, Iglesias-Linares A, Pithon MM, Marques LS. Influence of heritability on occlusal traits: a systematic review of studies in twins. Prog Orthod 2020;21:29.

5. Romero CC, Scavone-Junior H, Garib DG, Cotrim-Ferreira FA, Ferreira RI. Breastfeeding and non-nutritive sucking patterns related to the prevalence of anterior open bite in primary dentition. J Appl Oral Sci 2011;19:161-8.

6. D'Onofrio L. Oral dysfunction as a cause of malocclusion. Orthod Craniofac Res 2019;22:43-8.

7. Lin L, Chen W, Zhong D, Cai X, Chen J, Huang F. Prevalence and Associated Factors of Malocclusion among Preschool Children in Huizhou, China: A Cross-Sectional Study. Healthcare (Basel) 2023;11:1050.

8. Farsi NM, Salama FS. Sucking habits in Saudi children: prevalence, contributing factors and effects on the primary dentition. Pediatr Dent 1997;19:28-33.

9. Dhull K, Verma T, Dutta B. Prevalence of Deleterious Oral Habits among 3- to 5-year-old Preschool Children in Bhubaneswar, Odisha, India. Int J Clin Pediatr Dent 2018;11:210-3.

10. Rodríguez-Olivos LHG, Chacón-Uscamaita PR, Quinto-Argote AG, Pumahualcca G, Pérez-Vargas LF. Deleterious oral habits related to vertical, transverse and sagittal dental malocclusion in pediatric patients. BMC Oral Health 2022;22:88.

11. Roscoe MG, da Silva Bonifacio SV, da Silva TB, Pingueiro JM, Lemos MM, Feres MF. Association of Breastfeeding Duration, Nonnutritive Sucking Habits, and Malocclusion. Int J Clin Pediatr Dent 2018;11:18-22.

12. Zhou X, Zhang Y, Wang Y, Zhang H, Chen L, Liu Y. Prevalence of Malocclusion in 3- to 5-Year-Old Children in Shanghai, China. Int J Environ Res Public Health 2017;14:328.

13. Aldweesh AH, Ben Gassem AA, AlShehri BM, AlTowaijri AA, Albarakati SF. Parents' Awareness of Early Orthodontic Consultation: A Cross-Sectional Study. Int J Environ Res Public Health 2022;19:1800.

14. Rapeepattana S, Suntornlohanakul S, Thearmontree A. Orthodontic treatment needs of children with high caries using Index for Preventive and Interceptive Orthodontic Needs (IPION). Eur Arch Paediatr Dent 2019;20:351-8.

15. Alsaggaf DH, Alqarni MZ, Barayan SA, Assaggaf AA, Alansari RA. Parents' Awareness of Malocclusion and Orthodontic Consultation for Their Children: A Cross-Sectional Study. Children (Basel) 2022;9:1974.

16. American Association of Orthodontics [Internet]. St. Louis Missouri: The Association. The First Visit. Available online: https://www3.aaoinfo.org/blog/parent-s-guide-post/first-visit/ (accessed on 10 September 2023).

17. Alnaafa M, Altamimi Y, Alajlan S, Alateeq N, Almarshedi A, Alsaleh M, *et al*. The parental awareness regarding early orthodontic treatment in Hail city. Int Med J 2020;27:220–3.

18. Berneburg M, Zeyher C, Merkle T, Möller M, Schaupp E, Göz G. Orthodontic findings in 4- to 6-year-old kindergarten children from southwest Germany. J Orofac Orthop 2010;71:174-86.

19. Corrêa-Faria P, Ramos-Jorge ML, Martins-Júnior PA, Vieira-Andrade RG, Marques LS. Malocclusion in preschool children: prevalence and determinant factors. Eur Arch Paediatr Dent. 2014;15:89-96.

20. Foster TD, Hamilton MC. Occlusion in the primary dentition. Study of children at 2 and one-half to 3 years of age. Br Dent J 1969;126:76-9.

21. Baume LJ. Developmental and diagnostic aspects of the primary dentition. Int Dent J 1959;9:349–66.

22. Anu V, Pavani B, Pavani D, Liana BJ, Lubna FA, Saikrishna YV. Distribution of School Children Based on the Type of Terminal Plane in Primary Dentition: A Study among 3- to 5-year-old Children in Chennai, Tamil Nadu, India. Int J Clin Pediatr Dent 2020;13:136-7.

23. Yilmaz Y, Gürbüz T, Simşek S, Dalmiş A. Primary canine and molar relationships in centric occlusion in three to six year-old Turkish children: a cross-sectional study. J Contemp Dent Pract 2006;7:59-66.

24. Sharma K, Bihani T, Kumar V. Prevalence of Malocclusion in Primary Dentition in Southeast Part of Haryana, India: A Cross-sectional Study. Int J Clin Pediatr Dent 2021;14:757-61.

25. Khan R, Singh N, Govil S, Tandon S. Occlusion and occlusal characteristics of primary dentition in North Indian children of East Lucknow region. Eur Arch Paediatr Dent 2014;15:293-9.

26. Zhou Z, Liu F, Shen S, Shang L, Shang L, Wang X. Prevalence of and factors affecting malocclusion in primary dentition among children in Xi'an, China. BMC Oral Health 2016;16:91.

27. Davidopoulou S, Arapostathis K, Berdouses ED, Kavvadia K, Oulis C. Occlusal features of 5-year-old Greek children: a cross-sectional national study. BMC Oral Health. 2022;22:281.

28. Rajchanovska D, Zafirova-Ivanovska B. Oral habits among pre-elementary children in Bitola. Prilozi 2012;33:157-69.

29. Omer MI, Abuaffan AH. Prevalence of oral habits and its effect in primary dentition among Sudanese preschool children in Khartoum city. Indian J Dent Educ 2015;8:57-62.

30. Onyeaso CO, Sote EO. Prevalence of oral habits in 563 Nigerian preschool children age 3-5 years Niger Postgrad Med J 2001;8:193-5.