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Prevalence and determinants of orthodontic malocclusions in children: a multifactorial analysis

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ABSTRACT

Aims: To determine the prevalence of orthodontic malocclusions in children and adolescents and to evaluate, through a multifactorial approach, the associations between these malocclusions and mesiodistal dimension loss, presence of dental caries, missing teeth, oral hygiene habits, and dietary behaviors.

Methods: This descriptive and cross-sectional study was conducted on 1092 children aged 4-15 years. Participants were stratified into age groups, and clinical examinations were performed to assess malocclusion type, number of missing and decayed teeth, oral hygiene indices (Gingival Index and Plaque Index), as well as individual oral hygiene and dietary habits. Normality was assessed using the Shapiro-Wilk test. Depending on the data type and distribution, Chi-square tests with Bonferroni correction, two-proportion Z tests, ANOVA with Tukey's HSD, Kruskal-Wallis with Bonferroni-adjusted Dunn, and Mann-Whitney U tests were performed. Statistical significance was set at $p<0.05$.

Results: The prevalence of orthodontic malocclusions increased significantly with age, being most common in the 10-12 and 13-15 age groups ($p<0.001$). All malocclusion types were significantly more prevalent among individuals with mesiodistal dimension loss, with class IV malocclusion observed exclusively in this group ($p<0.001$). Children with class II malocclusion had the highest mean number of missing teeth, which was significantly greater than those with no malocclusion ($p<0.001$). Similarly, the mean number of decayed teeth was significantly higher in class II and class III groups compared to those without malocclusion ($p<0.001$ and $p=0.042$, respectively). Oral hygiene and dietary habits were also significantly associated with malocclusion types. Lower tooth brushing frequency, lack of interdental cleaning, and higher consumption of acidic and sugary foods were more common among those with malocclusion ($p<0.001$). Additionally, poor oral hygiene and diet were strongly correlated with increased rates of caries ($p<0.001$) and missing teeth ($p<0.05$).

Conclusion: Orthodontic malocclusions increase progressively with age and are significantly associated with dental caries, tooth loss, inadequate oral hygiene, and unhealthy dietary habits. The implementation of multidisciplinary oral health strategies at an early age may be effective in reducing the incidence of both orthodontic anomalies and dental caries.

Keywords: Malocclusion, dental caries, tooth loss, oral hygiene, dietary habits, children

INTRODUCTION

Orthodontic malocclusions represent a common oral health issue in children and adolescents, with potential implications within functional, aesthetic, and psychosocial domains.[1] Globally, malocclusion is considered the third most prevalent oral health problem following dental caries and periodontal diseases.[2] Systematic review and meta-analyses conducted among pediatric and adolescent populations report the prevalence of class I malocclusion to be approximately 56%, class II around 31%, and class III about 11%. Large-scale studies conducted in Turkiye have yielded comparable findings, indicating a high prevalence of crowding (41%), increased overjet (34%), and crossbite (11%) anomalies.[3]

Dental caries is closely associated with different types of malocclusion. The Decayed, Missing, and Filled Teeth (DMFT) Index is a widely used epidemiological measure for quantifying dental caries experience. Evidence suggests that children aged 6 to 12 years with a high incidence of caries, as indicated by higher DMFT scores, exhibit a greater prevalence of severe malocclusions and are at increased risk of developing such conditions.[4] Similarly, individuals with high DMFT scores have been identified as belonging to a higher risk group for the development of malocclusions.[5]

Tooth loss during childhood is a critical condition that can significantly affect both masticatory function and craniofacial growth patterns. In particular, early tooth loss may adversely affect the eruption of permanent teeth, reduce arch length, and disrupt normal occlusion. Significant associations have been found between mesiodistal dimension loss resulting

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from congenital tooth agenesis or early primary tooth loss and dental malocclusions.[6,7] This condition has been specifically linked to an increased prevalence of crowding and overjet anomalies, especially in individuals with early loss of primary molars or missing deciduous teeth.[8]

Oral hygiene plays a vital role not only in maintaining periodontal health but also in the development of orthodontic problems. The literature reports a significant association between oral hygiene status and malocclusion. Higher plaque and gingival index scores have been correlated with increased severity of malocclusion.[1,9] Moreover, individual hygiene behaviors such as the frequency of tooth brushing, use of dental floss or interdental brushes, and mouthwash have been identified as key determinants in malocclusion development.[5] Consistent oral care practices may help prevent orthodontic issues associated with caries and plaque accumulation.[5,10]

Dietary habits are among the key behavioral determinants in maintaining oral health. Frequent consumption of acidic beverages and sugary snacks significantly increases the risk of both dental caries and gingivitis by promoting dental plaque accumulation. This, in turn, has been indirectly linked to the development and progression of malocclusion.[11,12]

The aim of this study is to determine the distribution of orthodontic malocclusions across different age groups and to evaluate, from a broad perspective, the relationships between these malocclusions and mesiodistal dimension loss, presence of caries and missing teeth, oral hygiene, and dietary habits. The findings are intended to provide scientific insights that support the development of multidisciplinary oral health strategies.

METHODS

Ethical Approval

This descriptive and cross-sectional study was conducted at the Faculty of Dentistry, Fırat University. The study was approved by the Fırat University Non-interventional Researches Ethics Committee (Date: 10.01.2019, Decision No: 2019/01-24). Written and verbal information about the study was provided to the parents of all participants, and written informed consent forms were obtained based on voluntary participation. Throughout the study, the ethical principles outlined in the World Medical Association (WMA) Declaration of Helsinki for medical research involving human subjects were strictly followed.

Participants

A total of 1092 children aged between 4 and 15 years participated in the study. The participants were randomly selected through clinical examination among pediatric patients who presented to the Department of Orthodontics, Faculty of Dentistry, Fırat University.

Based on developmental characteristics, the participants were divided into four age groups:

- **Group I:** 4-6 years-130 children
- **Group II:** 7-9 years-448 children
- **Group III:** 10-12 years-376 children
- **Group IV:** 13-15 years-138 children

This age-based grouping enabled a comparative analysis of oral and dental health outcomes by considering the children's physiological and behavioral developmental levels.

Data Collection Process

The data obtained through detailed anamnesis and clinical examination included demographic information (age, gender), oral hygiene habits (frequency of tooth brushing, use of dental floss or interdental brushes, use of mouthwash), and dietary behaviors (consumption of acidic beverages and sweet snacks such as chocolate and candy).

Clinical examinations were conducted by the specialist researcher Y.A., on participants who had provided informed consent. The examinations were conducted under standardized lighting conditions using a dental mirror and probe. All procedures were performed in a consistent clinical environment. During the clinical assessments, the presence of missing teeth, number of decayed teeth, status of mesiodistal dimension loss, and type of orthodontic malocclusion were recorded.

Orthodontic Classification

Orthodontic assessment was performed according to the Angle classification. Class I malocclusion was defined as the mesiobuccal cusp of the maxillary first molar being aligned with the buccal groove of the mandibular first molar. Class II malocclusion was characterized by the mesiobuccal cusp of the maxillary first molar being positioned anterior to the buccal groove of the mandibular first molar, whereas class III malocclusion was diagnosed when it was located posterior to this reference point. However, although not included in Angle's original anomaly classification, a class IV category was subsequently introduced to facilitate the categorization of cases with an asymmetric relationship, specifically class II molar relationship on one side and class III on the other, frequently accompanied by midline deviation.[13]

Oral Hygiene Assessment

Additionally, oral hygiene was evaluated using the Gingival Index (GI) and Plaque Index (PI). The GI and PI were recorded according to the criteria of Loe and Silness[14], assessing four surfaces (mesial, distal, buccal, lingual) of all index teeth on a 0-3 scale, where higher scores indicated greater GI or PI.

All index measurements were performed by the calibrated researcher Y.A. To ensure measurement reliability, repeated assessments were conducted on 10% of the sample, yielding a kappa coefficient above 0.80, which indicates strong consistency. All clinical assessments were carried out by the same researcher, thereby minimizing the impact of inter-examiner variability.

Statistical Analysis

Data analyses were performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Normality of continuous and ordinal variables was assessed using the Shapiro-Wilk test. Normally distributed data were expressed as mean±standard deviation and compared using one-way ANOVA with Tukey's HSD post-hoc test when significant; non-normally distributed or ordinal data were presented as median (minimum-maximum) and analyzed using the Kruskal-Wallis test with Bonferroni-adjusted Dunn's post-hoc test. Associations between categorical variables were evaluated using the Chi-square test with Bonferroni-adjusted residuals for post-hoc comparisons, and proportional differences between two independent groups were assessed with the two-proportion Z test. For two-group comparisons of non-normally distributed or ordinal variables, the Mann-Whitney U test was applied. Statistical significance was set at p<0.05.

RESULTS

Descriptive statistical data on variables such as the number of missing and decayed teeth by age, gingival and plaque indices, oral hygiene habits, and dietary behaviors of the individuals included in the study are presented in Table 1.

The distribution of orthodontic malocclusion types showed a statistically significant difference across all age groups (p<0.001) (Table 2). In group I, although the majority of individuals exhibited no malocclusion, class I malocclusion was the most common type among those affected. Class II and class III malocclusions were observed at lower frequencies than class I malocclusion. Groups II and III demonstrated a notable increase in the prevalence of all malocclusion types. In group IV, while malocclusion types remained present, their prevalence decreased compared to the younger age groups.

Statistically significant differences were found in the distribution of orthodontic malocclusion types between individuals with and without mesiodistal (MD) dimension loss (p<0.05) (Table 3). The prevalence of class I, II, III, and IV malocclusions was significantly higher among individuals exhibiting MD dimension loss (p<0.05). Notably, class IV malocclusion was observed exclusively in individuals with MD loss, and this association was statistically significant (z=9.660, p<0.001). In contrast, the prevalence of normal occlusion was significantly higher in individuals without MD dimension loss (*z*=-11.682, p<0.001).

Table 3. Distribution of orthodontic malocclusion types by presence of mesiodistal loss

Malocclusion type	Mesiodistal loss: Positive	Mesiodistal loss: Negative	Test statistics	p-value
No malocclusion	140 (25.8%)	338 (60.8%)	-11.682	<0.001
Class I	192 (35.4%)	140 (25.2%)	3.695	<0.001
Class II	80 (14.8%)	48 (8.6%)	3.163	0.002
Class III	46 (8.5%)	30 (5.4%)	2.018	0.044
Class IV	84 (15.5%)	0 (0%)	9.660	<0.001

Two-proportion Z tests; n (%); p<0.05 significance level

A statistically significant difference was observed in the mean number of missing teeth across different types of orthodontic

Table 1. Descriptive statistics of orthodontic, behavioral, and dietary variables in the study population

	Groups (age): Gruop I (4-6)	Gruop II (7-9)	Gruop III (10-12)	Gruop IV (13-15)
Age	5.29±0.78	8.1±0.75	10.84±0.85	13.45±0.60
Gender				
Male	68 (52.3%)	210 (46.9%)	182 (48.4%)	82 (59.4%)
Female	62 (47.7%)	238 (53.1%)	194 (51.6%)	56 (40.6%)
Missing teeth	1.03	0.94	1.22	0.78
Decayed teeth	3.60	4.59	3.31	3.36
Gingival Index	1.14	1.21	1.23	1.14
Plaque Index	1.34	1.38	1.38	1.22
Brushing frequency	0.92	1.03	1.04	1.06
Floss/interdental brush use	0.15	0.27	0.15	0.26
Mouthwash use	0.15	0.34	0.22	0.20
Acidic beverage consumption	2.68	2.87	2.96	3.26
Snack consumption	2.57	3.08	2.98	3.26

Mean±standard deviation

Table 2. Pairwise comparisons of orthodontic malocclusions types within age groups

Age groups	Malocclusion groups: No Malocclusion	Class I	Class II	Class III	Class IV	Test statistics	p-value
Group I	86 (66.2)[c]	32 (24.6)[a]	6 (4.6)[b]	0 (0)	6 (4.6)[b]	131.294	<0.001
Group II	202 (42.5)[c]	126 (26.5)[a]	52 (10.9)[b]	32 (6.7)[b]	36 (7.5)[b]	240.661	<0.001
Group III	132 (35.2)[a]	126 (33.5)[a]	56 (14.8)[b]	32 (8.5)[bc]	30 (8.0)[c]	134.113	<0.001
Group IV	54 (39.2)[a]	46 (33.3)[a]	14 (10.1)[b]	12 (8.7)[b]	12 (8.7)[b]	61.862	<0.001

Chi-square test; n (%); p<0.05 significance level
There was a statistically significant difference between the groups shown with different lowercase superscripts in the same row (p<0.001).

malocclusion (p<0.001) (**Table 4**). Individuals with class II malocclusion exhibited the highest average number of missing teeth, followed by those with class III malocclusion. Conversely, individuals with class IV malocclusion had a notably lower average number of missing teeth. Additionally, a statistically significant association was identified between the number of missing teeth and the types of orthodontic malocclusion (X^2=71.951, p<0.001).

A statistically significant difference was observed in the mean number of decayed teeth among the orthodontic malocclusion groups (p<0.001) (**Table 5**). Individuals with class II and class III malocclusions had significantly higher numbers of decayed teeth. Furthermore, a significant association was identified between categories of decayed teeth and types of malocclusion (X^2=46.052, p<0.001).

As a result of pairwise comparisons, individuals with class II malocclusion were found to have a significantly higher mean number of decayed teeth compared to those without malocclusion (p<0.001). Similarly, individuals with class III malocclusion had significantly more decayed teeth than those without malocclusion (p=0.042). No statistically significant differences were observed in the comparisons among the other malocclusion groups (p>0.05).

No statistically significant differences were observed in GI and PI between individuals with and without orthodontic malocclusion (p>0.05) (**Table 6**).

Table 6. Comparison of gingival and Plaque Index scores between individuals with and without orthodontic malocclusions

	Orthodontic malocclusion			
Variable	Negative	Positive	Test statistics	p-value
Gingival Index	1.00 (0.5-2.0)	1.00 (0.5-2.5)	143.852	0.324
Plaque Index	1.00 (0.5-2.5)	1.00 (0.5-3.0)	139.900	0.070

Mann-Whitney U test; median (minimum-maximum); p<0.05 significance level

Statistically significant differences were observed among the groups in all behavioral variables, including tooth brushing frequency, use of dental floss/interdental brushes, mouthwash use, consumption of acidic beverages, and snack consumption (p<0.001) (**Table 7**). Brushing frequency yielded the highest test statistic (H=70.332), suggesting that individuals without orthodontic malocclusion may engage in more regular oral hygiene practices. Likewise, significant differences were observed among the groups in terms of dental floss use (H=51.761) and mouthwash use (H=53.223). Furthermore, dietary behaviors such as acidic beverage (H=25.296) and snack consumption (H=25.307) varied significantly based on the type of orthodontic malocclusion.

Table 4. Distribution of missing teeth count by orthodontic malocclusion types

Malocclusion group	n (%)	Missing tooth count	Test statistics[$]	p-value[$]	Test statistics[α]	p-value[α]
No malocclusion	478 (43.55%)	0.94±1.39[a]	8.290	<0.001	71.951	<0.001
Class I	332 (30.2%)	0.93±1.34[a]				
Class II	128 (11.7%)	1.67±1.72[b]				
Class III	76 (6.9%)	1.24±2.08[ab]				
Class IV	84 (7.7%)	0.76±0.90[a]				

[$]: ANOVA, [α]: Chi-square test; Mean ± Standart Deviation; p<0.05 significance level
There was a statistically significant difference between the groups shown with different lowercase superscripts in the same column (p<0.001).

Table 5. Comparison of mean number of decayed teeth among orthodontic malocclusion types

Malocclusion group	n (%)	Tooth decay count	Test statistics[$]	p-value[$]	Test statistics[α]	p-value[α]
No malocclusion	478 (43.55%)	3.56±2.27[a]	4.843	<0.001	46.052	<0.001
Class I	332 (30.2%)	4.02±2.86[a]				
Class II	128 (11.7%)	4.42±2.18[ab]				
Class III	76 (6.9%)	4.39±1.77[ab]				
Class IV	84 (7.7%)	3.79±2.02[a]				

[$]: ANOVA, [α]: Chi-square test; mean±standard deviation; p<0.05 significance level
There was a statistically significant difference between the groups shown with different lowercase superscripts in the same column (p<0.001).

Table 7. Association between types of orthodontic malocclusions and oral hygiene & dietary habits

Variable	No malocclusion	Class I	Class II	Class III	Class IV	Test statistics	p-value
Brushing frequency	2 (0-5)[ab]	2 (0-5)[a]	1 (0-5)[b]	2 (0-5)[bc]	4 (0-5)[bc]	70.332	<0.001
Floss/interdental brush use	0 (0-4)[b]	0 (0-5)[a]	0 (0-4)[a]	0 (0-4)[ab]	0 (0-4)[a]	51.761	<0.001
Mouthwash use	0 (0-4)[b]	0 (0-4)[a]	0 (0-4)[a]	0 (0-4)[ab]	0 (0-5)[a]	53.223	<0.001
Acidic beverage consumption	4 (0-6)[a]	4 (0-5)[a]	2 (0-5)[b]	3 (0-5)[ab]	3 (0-5)[ab]	25.296	<0.001
Snack consumption	4 (0-5)[ac]	4 (0-5)[ab]	2 (0-5)[b]	3 (0-5)[bc]	4 (0-5)[a]	25.307	<0.001

Kruskal-Wallis test; median (minimum-maximum); p<0.05 significance level
There was a statistically significant difference between the groups shown with different lowercase superscripts in the same row (p<0.001).

Statistically significant differences were found in the relationship between the number of decayed teeth, oral hygiene, and dietary habits (Table 8). Brushing frequency (H=50.692, p<0.001), use of dental floss/interdental brushes (H=20.877, p<0.001), mouthwash use (H=10.429, p=0.034), consumption of acidic beverages (H=57.482, p<0.001), and snack consumption (H=31.086, p<0.001) were all significantly associated with the number of decayed teeth.

Table 8. Association between dental caries and oral hygiene & dietary habits habits

Variable	Dental caries Present	Dental caries Absent	Test statistics	p-value
Brushing frequency	2 (0-5)	2 (0-4)	50.692	<0.001
Floss/interdental brush use	0 (0-4)	0 (0-5)	20.877	<0.001
Mouthwash use	0 (0-5)	0 (0-4)	10.429	0.034
Acidic beverage consumption	4 (0-6)	4 (0-5)	57.482	<0.001
Snack consumption	4 (0-5)	4 (0-5)	31.086	<0.001

Kruskal-Wallis test; median (minimum-maksimum); p<0.05 significance level

Statistically significant differences were found between the number of missing teeth and individuals' oral hygiene and dietary habits (p<0.05) (Table 9). Brushing frequency significantly affected the number of missing teeth (H=13.961, p=0.016). Individuals with regular brushing habits had a significantly lower number of missing teeth. Similarly, the number of missing teeth was significantly lower among individuals used dental floss or interdental brushes (H=41.616, p<0.001). The frequency of mouthwash use was also associated with the number of missing teeth, showing a statistically significant difference (H=24.357, p<0.001). Regarding dietary habits, consumption of acidic beverages was found to significantly increase the number of missing teeth (H=70.633, p<0.001). Likewise, frequent snack consumption was significantly associated with tooth loss (H=44.136, p<0.001).

Table 9. Association between missing teeth and oral hygiene & dietary habits

Variable	Missing teeth Present	Missing teeth Absent	Test statistics	p-value
Brushing frequency	2 (0-5)	2 (0-5)	13.961	0.016
Floss/interdental brush use	0 (0-5)	0 (0-4)	41.616	<0.001
Mouthwash use	0 (0-5)	0 (0-4)	24.357	<0.001
Acidic beverage consumption	3 (0-5)	4 (0-6)	70.633	<0.001
Snack consumption	3 (0-5)	4 (0-5)	44.136	<0.001

Kruskal-Wallis test; median (minimum-maksimum); p<0.05 significance level

DISCUSSION

In this study, the prevalence of orthodontic anomalies in children and adolescents, along with their relationship to essential oral health parameters such as caries, plaque, and gingival indices, was evaluated. Furthermore, by analyzing the distribution of orthodontic anomalies across different age groups, the study aimed to emphasize the importance of early diagnosis and intervention based on their impact on oral health. The Angle classification traditionally includes class I, II, and III malocclusions. However, although not part of Angle's original anomaly classification, a class IV category has subsequently been introduced, as suggested by Ulgen,[13] to facilitate the identification of asymmetric cases characterized by a class II molar relationship on one side and class III on the other, often accompanied by midline deviation. In this respect, the present study aims to provide a novel contribution to the classification system.

The findings of this study indicate that the low prevalence of orthodontic anomalies in the 4-6 age group and their marked increase in the 10-12 and 13-15 age groups, along with the significant associations between these anomalies and oral health parameters such as caries, PI, and GI, are strongly consistent with findings reported in the literature. In a study by Jafari et al.,[9] it was scientifically demonstrated that as Index of Orthodontic Treatment Need scores increased, DMFT, GI, and OHI-S values also increased, indicating that more severe malocclusion is associated with poorer oral health parameters. Additionally, in a study conducted in China among the 11-14 age group, Wang et al.[15] reported a malocclusion prevalence of 72% and identified factors such as malocclusion, poor oral hygiene, and frequent consumption of sugary drinks as risk factors for caries development. Furthermore, an epidemiological study conducted in Spain emphasized that in 12 and 15-year-old adolescents, dental caries and plaque accumulation were strongly associated with malocclusion, and that the prevalence of malocclusion increased with age.[16]

In the current study, the prevalence of caries was found to be significantly higher among individuals with orthodontic anomalies. Wang et al.[15] reported a caries rate of 68.8% among individuals aged 11-14 and associated this finding with oral hygiene, diet, and genetic predisposition. Similarly, data from this study indicate a high caries rate in the same age group, with orthodontic anomalies appearing to contribute to this outcome. The difficulty in achieving proper interproximal contact and the reduced effectiveness of brushing due to malocclusion may explain this association.

According to the results of this study, class II malocclusions were found to have a particularly strong association with caries development. Similarly, the study by Bernhardt et al.[17] reported that class II malocclusions were more frequently associated with poor oral hygiene and an increased risk of caries. Consistent with these findings, studies by Alrashed et al.[18] and Bakhurji et al.[19] also indicated that malocclusions, particularly in the lower molar region, were directly linked to plaque accumulation and caries. In individuals with class II malocclusion, anterior positioning of the maxillary teeth may impede proper mouth closure, promoting mouth breathing and plaque accumulation in the posterior regions. This condition is considered a key factor contributing to the heightened risk of caries.

Oral hygiene is a crucial factor not only in maintaining periodontal health but also in preserving the functional and morphological integrity of oral tissues. In the present study, PI and GI values were found to be significantly higher in the group with orthodontic anomalies. López-Gómez et al.[20] reported that early loss of primary teeth is associated with poor oral hygiene and may predispose individuals to malocclusion by affecting jaw development. This finding is largely in agreement with the results of the current study.

In the study conducted by Mahboobi et al.,[21] high carbohydrate consumption was reported to negatively affect oral hygiene, and this condition was directly associated with the development of caries. In contrast, although the present study did not directly assess individuals' dietary habits, the poor oral hygiene observed in the presence of malocclusion and elevated caries scores suggests that a similar pathophysiological mechanism may be involved. The differences between the findings are largely attributable to variations in methodology. Mahboobi et al.[21] assessed carbohydrate consumption using survey-based direct measurements and statistically analyzed the relationship between diet and oral health with a dataset covering a broad age range. In contrast, the current study relied solely on clinical observations and objective intraoral indices. Additionally, factors such as sample size, sociodemographic differences, and environmental influences (e.g., oral hygiene education, parental supervision, and access to healthcare services) may also have contributed to the differing results.

According to the American Academy of Pediatric Dentistry, frequent consumption of sugary drinks and acidic foods increases the risk of dental caries, which may lead to premature tooth loss and indirectly contribute to the development of orthodontic anomalies.[22] Similarly, in this study, individuals who frequently consumed such beverages were found to have significantly higher rates of both caries prevalence and orthodontic anomalies.

Orthodontic anomalies that increase with age underscore the importance of initiating treatment during adolescence. In a study conducted by Patel et al.,[23] among 1290 students aged 13-15 years, 43.9% were found to have a moderate and 22.4% a severe need for orthodontic treatment, indicating that approximately 66% of the individuals were potential treatment candidates. In another study conducted by Kalantari et al.,[24] it was reported that the prevalence of malocclusion increased with age and that the need for orthodontic treatment became more pronounced, especially in individuals aged 13-15 years. These findings are consistent with the current study, which also identified a high proportion of individuals aged 13-15 as candidates for orthodontic treatment. Accelerated craniofacial growth during adolescence, combined with inadequate oral hygiene, contributes to the increased manifestation of malocclusions in this group.

The association between tooth loss and orthodontic anomalies is particularly noteworthy. Gandhi et al.[25] reported that premature loss of primary teeth, particularly in the posterior regions, may predispose individuals to jaw constriction and the development of malocclusion. Similarly, the current study found a higher prevalence of orthodontic anomalies among individuals with missing teeth.

Limitations

This study has several limitations. The cross-sectional design prevents the establishment of causal relationships. Potentially influential variables, such as participants' socioeconomic status and parental education levels, were not evaluated. All clinical evaluations were based solely on visual examination, and objective diagnostic tools such as radiographic imaging or digital model analysis were not utilized. Furthermore, the sample consisted exclusively of individuals from a specific geographic region, limiting the applicability of the findings to other populations. Future studies are recommended to address these limitations by employing multi-centered, longitudinal designs with more comprehensive methodologies.

CONCLUSION

This study revealed that orthodontic malocclusions in children and adolescents increase significantly with age and are strongly associated with various oral health parameters, including caries prevalence, tooth loss, oral hygiene status, and dietary habits. Specifically, class II and class III malocclusions were found to be significantly associated with dental caries and tooth loss. Poor oral hygiene practices and frequent consumption of acidic foods were identified as contributing factors that exacerbate these adverse outcomes. The findings suggest that preventive dentistry strategies implemented through multidisciplinary approaches beginning in early childhood may play an effective role in reducing both the incidence of orthodontic anomalies and dental caries.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Fırat University Non-interventional Researches Ethics Committee (Date: 10.01.2019, Decision No: 2019/01-24).

Informed Consent

Written and verbal information about the study was provided to the parents of all participants, and written informed consent forms were obtained based on voluntary participation.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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