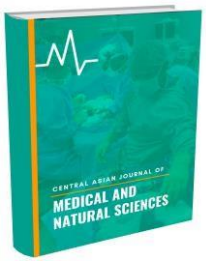

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*Article*

# An Investigation on Poor Oral Hygiene Practices Effect on Dental Caries and Malocclusion Rates Among Teenagers Attending Southern Iraqi Secondary Schools

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**Abstract:** Among the prevalent oral conditions affecting adolescents are caries and malocclusion deformity. This study examined the impact of variables including bad dental practices on teenage caries in order to investigate the relationship between malocclusion deformity and caries prevalence. The research subjects for this study were 184 teenagers, aged 11 to 14, who were enrolled in four secondary schools in Nasiriyah, southern Iraq, during the 2018–2019 academic year. These teenagers' basic information was gathered using questionnaires. By doing an on-site examination, malocclusion and caries were examined. We also investigated their bad dental habits. Following the acquisition of data, multivariate analysis was conducted using the chi-square test, logistic regression, Mann-Whitney U test, and Kruskal-Wallis H test. In this region, among teenagers aged 11-14, the frequency of malocclusion was found to be 26.63%, while the caries rate was 60.68%. The four bad oral behaviors that affected malocclusion in teenagers were biting, mandibular protrusion, lateral chewing, and mouth breathing. Malocclusion, poor dental hygiene, and frequent use of sugary drinks were all found to be independent risk factors for dental caries in teenagers and to be positively correlated with the caries rate. In adolescents, malocclusion and harmful oral practices were independent risk factors for dental caries.

**Keywords:** teenagers dental caries, malocclusion abnormalities, poor dental hygiene practices, oral bad habits, southern Iraqi secondary schools

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## 1. Introduction

Oral health is receiving increasing attention as health education grows and living standards rise. Like other organ diseases, oral diseases have a major effect on a patient's physiology and psyche [1]. Tooth decay, often known as dental caries, is a common oral illness brought on by oral microorganisms. Dental plaques, germs, and the oral environment are examples of pathogenic factors [2]. An imbalance in the oral flora is the root cause of caries, an endogenous illness. It is mostly created when the oral flora breaks down the mineral components of tooth enamel, resulting in varying degrees of damage to the teeth's hard structures.

Severe lesions not only cause oral pain or tooth loss, but they can also result in a number of grave consequences include dental periapical and pulp diseases [3], [4]. The goal of caries prevention is adolescents.

The oral cavity is home to the second-largest microbial colony in the body [5]. Therefore, the balance between health and disease in the body and system depends critically on the quantity and quality of different bacteria present in the mouth cavity. The typical oral

cavity's microbiome can contain a wide range of microorganisms, including viruses, bacteria, fungus, protozoa, and archaea. Every type of microbe has a distinct function, and among the various.

Interaction between the microbes and the host can communicate to keep the body stable and healthy. When the oral microbiome's homeostasis is disrupted, some strains will multiply uncontrollably, leading to the development of oral illnesses such gingivitis and periodontitis as well as oral cancer [6]. One common oral condition brought on by the out-of-balance proliferation of oral bacteria is dental caries. Some academics think that the presence of germs is necessary for dental caries to occur. During their growth phase, some bacteria, including Streptococcus, create biofilms that are very sticky due to their rich polysaccharide content. To create dental plaque, other types of cariogenic bacteria adsorb on the membrane's surface. Furthermore, there may be other risk factors for caries, such as poor dental hygiene practices, education, living standards, and orthodontics [7], [8]. According to a longitudinal cohort study by Warren et al. [9] the high incidence of dental caries in adolescents and the impact of the mother on the adolescent were linked to educational achievement, brushing frequency, household water fluoride concentrations, and 100% juice consumption. Hu et al. (2018) [10] used a multi-stage, stratified, randomized cross-sectional study to determine the risk factors for caries, which included women, older age groups, excessive glucose intake, and inadequate dental care. Another cross-sectional study by Giugliano et al. 2018 [11] discovered that while food habits and how often teeth were cleaned were not substantially linked to dental caries, parental education and posterior crossbite were. Patients with malocclusion deformities experience considerable physical and psychological effects. In addition to impacting early children's maxillofacial development, it also has an impact on dental health, function, and attractiveness; the effects become more noticeable as age increases [12].

According to clinical research, there is a relationship between caries and malocclusion, and the caries rate and some specific malocclusions are highly correlated [13]. To far, there is a paucity of domestic research reports on the potential impact of untreated malocclusion on teenagers' dental health-related quality of life, and there is no uniform clinical data to support the idea that malocclusion is a separate risk factor for caries. Thus, this study investigated the relationship between, from the viewpoint of adolescents, particular correlation between dental caries and malocclusion using both offline and online surveys and questionnaires. The development and occurrence of teenage caries can be effectively prevented by removing the causes of bad habits at an early age and eliminating bad habits that have already been acquired.

The peak growth and development period for adolescents is between the ages of 11 and 14. Human bones and muscles undergo a number of major alterations during the prime time of growth and development. However, the majority of orthodontic professionals still feel that children between the ages of 11 and 14 are the ideal candidates for orthodontic treatment.

The majority of orthodontic patients are still children and teenagers in the third fast growth and development period, known as the rapid growth and development period. The teeth erupt more quickly during this time because the alveolar bone and jaws are actively growing and rebuilding, with significant room for future expansion. Selecting this age range for orthodontic treatment might accelerate tooth movement while simultaneously promoting the growth of the jaw. Shorter orthodontic treatment times result in superior outcomes that can be doubled with half the effort. Consequently, by being aware of the traits and patterns of the growth and development of teenagers between the ages of 11 and 14, one may make the most of the circumstances and actively prevent and treat malocclusion deformities, which is helpful in getting positive treatment outcomes. In order to investigate the relationship between malocclusion, poor oral hygiene practices, and caries,

this study employed surveys targeted at adolescents between the ages of 11 and 14, gathered a sizable sample size, and performed a thorough scientific statistical analysis of the survey data. The aim of this study was to produce clinical data support for the public health and overall health of society, as well as a foundation for prevention and decision-making for the prevention of dental caries and oral health of the general population.

## 2. Materials and Methods

### *2.1. Research Subjects*

Teenagers enrolling in four different high schools for the 2012–2013 academic year were chosen for this study. Every member of the sample came from an urban setting. During the intermission, 200 surveys were distributed in total. There were multiple questions on the questionnaire, and information confidentiality was assured. The participants' personal information was unaffected by the questionnaire.

Among, the purpose of the questioning was to look at genetic variables and bad dental habits. To investigate malocclusion deformities and caries, a field investigation approach was employed. Every individual gave their consent to be surveyed.

Data from questionnaires was then gathered to be sorted. The fact that the questionnaire's effective response rate exceeded 92% suggests that it was of high quality. The study documented several bad oral habits, such as biting items, lateral chewing, mandibular extension, tongue and lip habits, and mouth breathing.

### *2.2. Inclusion and Exclusion Criteria*

The following conditions had to be met in order for a participant to be considered for inclusion: (1) they had to be between the ages of 11 and 14; (2) they had to be of both genders; (3) they couldn't have any physical disabilities; and (4) they couldn't have any systemic disorders.

These were the conditions for exclusion: (I) Participants who were receiving orthodontic treatment now or in the past; (II) Participants who did not fully complete the questionnaire or who did not cooperate with the dentist to finish the examination; and (III) Participants who withdrew from the investigation during its duration. Every participant completed informed permission forms and was informed about the study, as were their families.

On-site examinations were performed for cavities and malocclusion deformities. Malocclusion deformity was diagnosed using angle classification. Among the participants under investigation, several forms of malocclusion deformity and molar relationships (neutral, distal, close) were noted. Any of the following signs—deep overbite, anterior crossbite, crowded teeth, closing breakers, open bite, deep coverage, posterior crossbite, and clavicle occlusion—were considered to be indicative of a malocclusion deformity in the participants. When participants had any of the following conditions, caries was suspected: (1) apparent cavities or enamel damage in the space between teeth or on their smooth surface; (2) easily noticeable lesions lubricating the cavernous floor or wall; and (3) the existence of a filling in a tooth. (4) caries was present in the tooth; (5) caries was absent.

### *2.3. Quality Control*

Following data collection, teenagers were matched based on similar parent education stages, financial standing, and race all that for the caries deficiency index and dental aesthetic index (17). Based on these comparisons, all subjects' males and females were categorized into four groups: group A had both tooth decay and malocclusion; group B had

tooth decay but no malocclusion; group C had malocclusion but no tooth decay; and group D did not have either condition.

The impact of malocclusion that occurs on caries occurrence was examined, and the severity of caries in group A with various malocclusion types was investigated. WeChat was used to remotely monitor the individuals' health behaviors and food, among other variable aspects connected to caries, and to record this data.

The impact of misalignment on cavities occurrence was examined, and the severity of decay in group A with various malocclusion types was investigated. WeChat was used to remotely monitor the individuals' health behaviors and food, among other variable aspects connected to caries, and to record this data.

*2.4. Statistical Analysis*

This study's data were compiled using Excel 2010 and examined using SPSS 19.0. Two independent samples were rank sum tested using the Mann-Whitney U test. Several samples were compared using the Kruskal-Wallis H test. The $\chi 2$ test was used to determine whether two or more variables were correlated. The statistical significance of the difference was shown by the test levels of $\alpha$=0.05 and P<0.05.

## 3. Results

General information of the research subjects 200 questionnaires was given out at random to teenagers in 4 schools for this study; 184 of the recovered questionnaires were valid. As a result, 92% of patients recovered effectively. This The study included 184 adolescents, between the ages of 11 and 14 years. They were all urban residents, including 106 males and 78 females in (Figure 1).

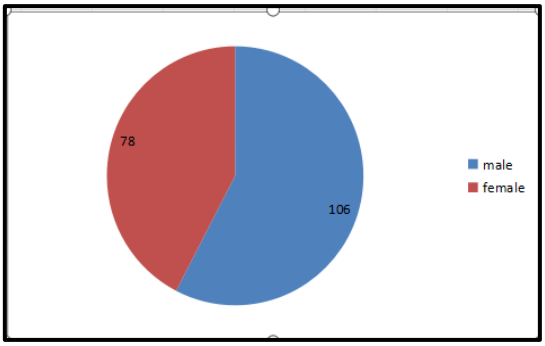


**Figure 1**. Distribution of participants male & female number

The study of the educational level of fathers found that the educational level of fathers was mainly university graduates (78%), and the educational level of mothers was mainly university graduates (57%), as shown in (Figure 2).

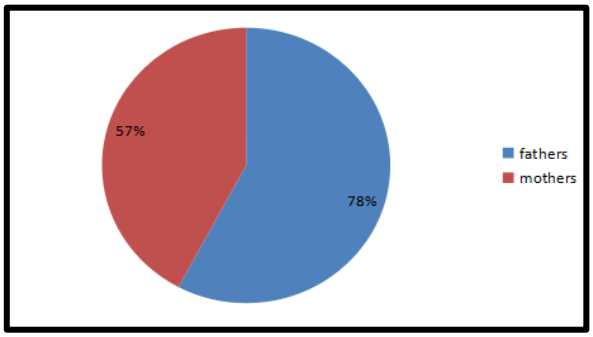


**Figure 2**. Distribution of university graduate educational level of father & mother of participants

*3.1. Examination of Malocclusion and Caries in Adolescents*

Of the 184 teenagers, 112 (65 men and 47 females) had caries (Figure 3). So, the caries rate was 60.86% also, 49 cases of malocclusion found in all, with a prevalence rate of 26.63% and 21 male and 28 female cases. Figure 4 illustrates the division of subjects into 28 cases of angle class I (57.14%), 14 cases of angle class II (28.57%), and 7 cases of angle class III (14.28%) based on the composition of malocclusion.

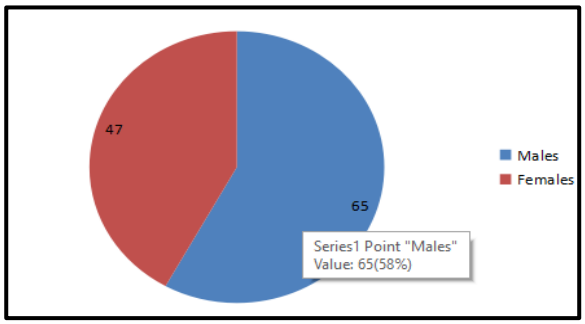


**Figure 3**. Number of participants male & female have caries

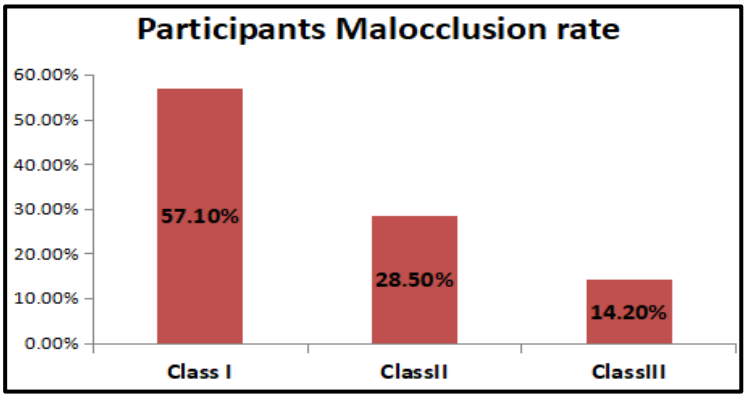


**Figure 4**. Distribution of participants malocclusion rate

Correlation between bad oral habits, anterior malocclusion, and caries as indicated in Table 1, the chi-square test was used to assess the gender registrations, parents' educational attainment, and the oral habits of teenagers. The independent variable was anterior malocclusion, and the dependent variable was caries. The findings indicated that dental trauma, malocclusion, poor oral hygiene practices, parents' educational attainment, and frequent consumption of sugary drinks were risk factors for adolescent caries. Adolescents with poor dental hygiene, tooth damage, malocclusion, and a frequent use of sugary drinks had an increased risk of developing caries. Furthermore, teenage dental caries may be influenced by the educational attainment of parents.

Teenage dental caries was considered the dependent variable, and for the multivariate logistic regression analysis on dental caries, the associated factors with significant differences ($P<0.05$) in the chi-square test were chosen as independent variables (Table 1). The findings demonstrated the significant role that poor dental hygiene, malocclusion, and frequent use of sugary drinks had in promoting dental caries in teenagers.

**Table 1**. Chi-square test findings for dental caries in teenagers between the ages of 11 and 14

| Factors | Group | Dental caries | | Non-dental caries | | $\chi^2$ | P |
|---|---|---|---|---|---|---|---|
| | | Number of cases | Proportion (%) | Number of cases | Proportion (%) | | |
| Gender | Male | 65 | 58% | 39 | 54.2% | 1.152 | 0.215 |
| | Female | 47 | 42% | 33 | 45.8% | | |
| Parent's university graduates' educational level | Father | 69 | 75% | 23 | 25% | 3.261 | 0.039 |
| | Mother | 66 | 71.7% | 26 | 28.3% | | |
| Bad oral habits | Present | 24 | 13% | 17 | 9.3% | 6.118 | 0.001 |
| | None present | 88 | 47.9% | 55 | 29.8% | | |
| Tooth trauma | – | 5 | 2.7% | 2 | 1.1% | 11.361 | 0.604 |
| Malocclusion deformity | – | 23 | 41.3% | 26 | 58.7% | 9.131 | 0.021 |
| Sweets regularly eaten | – | 76 | 41.3% | 108 | 58.8% | 6.231 | 0.319 |
| Frequent having sweet drinks | – | 98 | 53.2% | 86 | 46,8% | 6.322 | 0.023 |

*3.2. Relationship Between Different Risk Factors and Caries in Adolescents*

The data in this study did not conform to the normal distribution. After grouping of the patients, the Mann-Whitney U test was used to analyze the overall difference between malocclusion and caries, and the heterogeneity was calculated. The results are shown in Table 3.

The results showed that the average rank of malocclusion in adolescents with caries was 23.15, and the average rank of malocclusion12.83 in adolescents who were not carers. The incidence of malocclusion and the distribution of poor oral hygiene practices were significantly different between teenagers with caries and those without ($P<0.05$), according to the results of the Mann-Whitney U test.

*3.3. Relationship Between Bad Oral Habits, Malocclusion, and Caries Prevalence in Adolescents*

According to whether the subjects had caries and malocclusion, 49 teenagers were split into two groups: group A consisted of 23 cases of caries and malocclusion, whereas group B included 26 cases of malocclusion without caries. Among the oral habits were biting, mandibular extension, lateral chewing, mouth breathing, tongue and lip habits. 12 instances had tongue habits, 29 cases had lip habits, 58 cases showed biting, 11 cases showed mandibular extension, 36 cases showed lateral chewing, and 91 cases showed mouth breathing out of a total of 184 teenagers.

Six percent of the cases involved tongue-lip sucking, three percent involved biting, nine percent involved mandibular protrusion, forty percent involved unilateral chewing, thirty-six percent involved two different types of bad habits, and four percent involved three or more bad habits. In most caries instances, lip habits and unilateral chewing were

present. It was examined how poor dental hygiene practices and malocclusion are related. The findings revealed that there were 34 cases of tongue habits (3.91%), 59 cases of lip sucking habit (7.44%), 39 cases of biting (4.92%), 27 cases of mandibular protrusion (3.40%), 96 cases of partial chewing (12.11%), 84 cases of oral respiration (45.6%) figure 5. Also, 13 adolescents with two types of bad habits (7.1 %), and 4 adolescents with three or more bad habits (2.1%). There was a statistically significant ($P<0.05$) increase in the likelihood of malocclusion in adolescents who bit, advanced their mandible, chewed laterally, and breathed through their mouths.

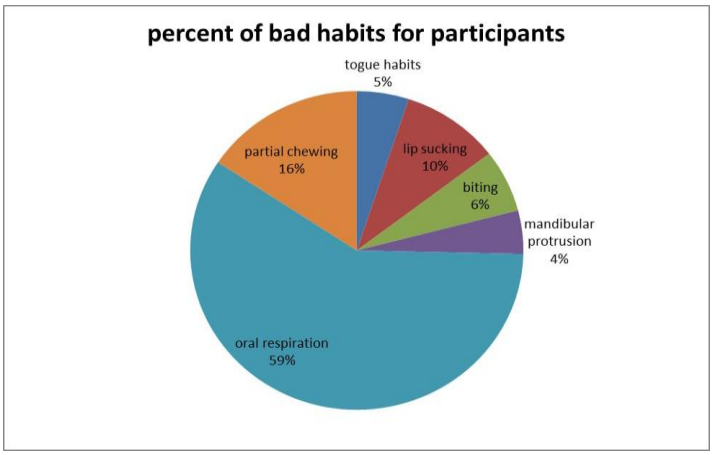


**Figure 5**. Percent of bad habits distribution between participants

## 4. Discussion

Caries is a prevalent, long-term infectious illness of the mouth cavities, most commonly brought on by bacterial infections that originate inside. It is possible to argue that caries is only caused by microbial activity. Dental plaques, germs, nutrition, and oral environment are only a few of the variables that contribute to caries [14]. Diseased alterations in the hard tissue of the teeth typically accompany caries. Both the enamel and Patients' dentine is typically characterized by organic breakdown and mineral demineralization. Changes in the color and form of dental hard tissue can be seen clinically [15]. Early caries is characterized by a loss in tooth transparency, chalky enamel, demineralization of the lesion's hard tissue, precipitation of pigment, and a yellowish-brown local color. Enamel and dentin degrade and loosen as the disease progresses, eventually turning into caries cavities [16]. There are three theories regarding the etiology of dental caries.

**Table 2**. Results of caries in adolescents aged 11 to 14 as determined by linear regression analysis

| Factors | Partial regression coefficient | Wald | P | OR | 95% CI OR |
|---|---|---|---|---|---|
| Father's educational level | 0.042 | 1.941 | 0.021 | 2.981 | 0.619–2.712 |
| Mother's educational level | 0.031 | 1.141 | 0.061 | 2.021 | 1.179–1.312 |
| Bad oral habits | 0.136 | 0.031 | 0.001 | 2.312 | 0.712–0.291 |
| Malocclusion deformity | 0.313 | 0.021 | 0.017 | 1.519 | 2.173–1.214 |
| Frequent consumption of sugary drinks | 0.292 | 0.051 | 0.031 | 1.124 | 0.719–1.026 |

*OR, odds ratio; CI, confidence interval*

**Table 3**. Mann-Whitney U test findings indicating the presence of caries

| Original hypothesis | Test | P | Decision maker |
|---|---|---|---|
| The distribution of malocclusion is consistent across caries subtypes. | Mann-Whitney U | 0.017 | Reject original assumptions |
| The distribution of bad dental practices is consistent across caries categories. | Mann-Whitney U | 0.012 | Reject original assumptions |
| Caries types show a similar pattern of sugary drink intakes. | Mann-Whitney U | 0.011 | Reject original assumptions |

Protein dissolution theory, protein dissolution-chelation theory, and chemical bacteriology. According to chemical bacteriology, oral proteolytic enzymes break down organic materials to induce tooth defects, and bacteria on the surface of teeth interact with carbohydrates in the oral cavity to produce acids and demineralize inorganic compounds in the dental hard tissue. According to the proteolysis theory, bacteria infiltrate the tooth channel, microorganisms enter the tooth through the enamel organic pathway, and proteolytic enzymes in the oral cavity first break down the local organic matter in the tooth.

Protein dissolution-chelation theory suggests dental caries is caused by the microbial breakdown of organic materials on the tooth surface, which releases a variety of chelating agents and dissolves hydroxyapatite crystals [17], [18]. Although the exact causes of caries remain unknown, the interaction of bacteria, nutrition, and host is generally accepted. Malocclusion deformity is the term used to describe abnormalities of the teeth, jaw, or craniofacial region that result from the interaction of acquired environmental variables and congenital genetic factors [19].

Like dental caries, another widespread oral condition is malocclusion. Malocclusion's complicated etiology is linked to environmental variables other than genetic ones. It's unknown if malocclusion will lead to a rise in caries cases. The incidence of caries and the prevalence of malocclusion vary throughout age groups due to variations in geography, drinking water, and other factors.

The study's findings demonstrated that malocclusion was common among teenagers in this area between the ages of 11 and 14 was 26.63%, and the caries rate was 60.86% greater than that of other domestic and international locations [15], [20]. Oral habits have an impact on occlusion development as well.

Anterior open occlusion, for instance, can result from finger sucking [14]. Thus, we examined the connection between the incidence of malocclusion and poor oral hygiene. Adolescents who bit, extended their jaws, chewed laterally, or breathed through their mouths were more likely to experience malocclusion than other adolescents ($P<0.05$), according to the findings. The "quadruple factor theory" proposes that there is a four-fold association between dental caries prevalence and malocclusion. These factors are bacteria, diet, time, and the host. According to this study, up to 23.15% of patients with malocclusion had dental caries. The results of the Mann-Whitney U and logistic regression analyses indicated a significant difference ($P<0.05$) between dental caries and malocclusion. Feldens et al.'s cross-sectional study (2015) [21] supported the opinion as well. The collection of plaque, which is difficult to clean, may be the cause.

Dentition accumulation may develop from malocclusion deformity. Dental caries is eventually caused by poor oral hygiene. Caries can also result from bad dental habits and a regular intake of sugar-filled beverages.

The process is comparable to chemical bacteriology in that poor oral hygiene practices promote the growth of bacteria, which in turn causes caries. However, it was discovered that there was no significant correlation between caries and gender, area, parents' educational attainment, or dental trauma [21].

He et al. [10] identified caries risk variables, such as women, older age groups, excessive carbohydrate intake, and insufficient dental care, using a multistage, stratified, and randomized cross-sectional analysis. This study supports the findings we found in our investigation, which showed that higher sugar intake in food and drink raises caries rates.

In conclusion, the study's findings showed that the factors promoting teenage malocclusion were biting, mandibular extension, lateral chewing, and mouth breathing. Furthermore, there is a substantial positive correlation between the caries rate and the three independent risk factors for dental caries in adolescents: poor oral hygiene, frequent consumption of sugary drinks, and malocclusion. As a result, the following anti-caries work for youth can concentrate on the aforementioned elements in order to help youth effectively prevent and break unhealthy habits at an early age. and prevent the development of caries. The following anti-caries work for youth can concentrate on the aforementioned elements in order to help youth effectively prevent and break unhealthy habits at an early age. and prevent the development of caries.

## 5. Conclusion

The frequency of malocclusion and caries in teenagers in this location was found to be high, according to this study, which examined the link between malocclusion, poor oral hygiene practices, and caries in adolescents aged 11 to 14 years. Malocclusion is linked to bad oral habits. Malocclusion is more common in adolescents who bite, protrude their mandibles, chew just on one side, and breathe through their mouths.

Three factors were associated with a higher caries rate: frequent drinking of sugary drinks, poor dental hygiene, and malocclusion. Gender, location, parents' educational attainment, and the caries rate, however, did not appear to be significantly correlated.

This study offers clinical recommendations for the region's teenage population's oral health and hygiene as well as a foundation for decision-making regarding the prevention of caries and teenage oral health. However, there are Future research needs to examine the impact of various malocclusion types on the caries rate among adolescents, as it is currently not being done.

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