Original Article / Özgün Araştırma

Evaluation of the Relationship Between Malocclusion and the Periodontal Health, Caries, Socio-economic Status of Children

Çocuklarda Görülen Malokluzyonlar ile Periodontal Sağlık, Diş Çürükleri ve Sosyo-ekonomik Durum Arasındaki İlişkinin Değerlendirilmesi

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Abstract

Objective: In this study, it was aimed to evaluate the relationship between malocclusions and various factors such as periodontal treatment needs, dental caries, anterior segment crowding and parental socio-economic status of 12–14 year-old children.

Materials and Methods: Classification of malocclusions of 534 patients aged 12-14 years who applied to our clinic in our study was done according to Angle malocclusion classification. Periodontal treatment requirements were assessed using community periodontal index of treatment needs (CPITN); dental caries were evaluated by decay, missing, filled teeth (DMFT). Statistical analysis was performed in SPSS Statistics Version 12.0 software package. P<0.05 was considered statistically significant.

Results: The mean DMFT score of the children in the study group was 4.318±3.14. The most common malocclusion was class 1 malocclusion (55.1%). The differences between mean DMFT scores and malocclusion classifications were not statistically significant (p>0.05). According to the CPITN, individuals with healthy periodontal disease (CPITN 0) accounted for 24.9% of patients. It was seen that only 6.4% of the patients without anterior segment crowding had CPITN 2 score. It was observed that the CPITN 0 score decreased as the anterior segment crowding increased. It was found that the correlation between CPITN scores and anterior segment crowding was statistically significant (p<0.05). However, the relationship between malocclusion classifications was not statistically significant (p>0.05). There was no statistically significant relationship between parental socio-economic status and malocclusion classifications of children (p>0.05).

Conclusion: In our study, there is no correlation between malocclusions and dental caries. However, it has been observed that the lower anterior segment crowding are detrimental to periodontal health, laying the groundwork for the development of periodontal diseases. Oral health care and early interventions (preventive and preventive programs) are thought to help prevent orthodontic problems that can occur.

Öz

Amaç: Bu çalışmada, 12-14 yaşları arasındaki çocuklarda maloklüzyonların periodontal tedavi gereksinimleri, diş çürükleri, ön segmentte yer darlığı ve ebeveynlerin sosyoekonomik durumları gibi birçok faktörle olan ilişkilerinin değerlendirilmesi amaçlanmıştır.
Gereç ve Yöntemler: Çalışmamızda, kliniğimize başvuran 12-14 yaşları arasındaki 534 sağlıklı hastanın maloklüzyonlarının sınıflandırılması Angle maloklüzyon sınıflamasına göre yapılmıştır. Periodontal tedavi gereksinimleri toplumda periodontal tedavi gereksinimi indeksi (CPITN), diş çürükleri çürük, kayıp, dolgulu dişler (DMFT) indeks değerleri kullanarak değerlendirilmiştir. İstatistiksel analizler SPSS Statistics Version 12 paket programında yapılmıştır. P<0,05 istatistiksel olarak anlamlı kabul edilmiştir.
Bulgular: Çalışma grubundaki çocukların ortalama DMFT değeri 4,318±3,14 olarak saptanmıştır. En yaygın maloklüzyonun, sınıf 1 maloklüzyon (%55,1) olduğu görülmüştür. Ortalama DMFT değeri ile maloklüzyon sınıflamalarının arasındaki farklılıklar istatistiksel olarak anlamlı bulunmamıştır (p>0,05). CPITN'e göre, sağlıklı periodonsiyuma (CPITN 0) sahip olan bireyler hastaların %24,9'unu oluşturmuştur. Ön segmentte yer darlığı olmayan hastaların sadece %6,4'ünün CPITN 2 değerine sahip oldukları görülmüştür. Ön segmentte yer darlığı artıkça CPITN 0 değerinin azaldığı gözlenmiştir. Ön segmentte yer darlığı ile CPITN değerleri arasındaki ilişkinin istatistiksel olarak anlamlı olduğu görülmüştür (p<0,05). Ancak maloklüzyon sınıflamaları arasındaki ilişki istatistiksel olarak anlamlı bulunmamıştır (p>0,05). Ailelerin sosyo-ekonomik seviyeleri ve çocukların maloklüzyon sınıflamaları arasında da istatistiksel olarak anlamlı ilişki bulunmamıştır (p>0,05).
Sonuç: Çalışmamızda, maloklüzyon ile diş çürükleri arasında ilişki görülmemiştir. Ancak, alt ön dişlerdeki çapraşıklıkların, periodontal sağlık üzerinde zararlı etkileri olduğu, periodontal hastalıkların oluşmasına zemin hazırladığı gözlenmiştir. Ağız sağlığı bakımları ve erken yaşlardaki müdahalelerin (koruyucu ve önleyici programlar) oluşabilecek ortodontik problemlerin önlenmesine yardımcı olabileceği düşünülmektedir.

Introduction

Malocclusion is defined as the absence of an association between the upper and lower arches and abnormal alignment of the teeth. It has led to an increased interest in orthodontic treatment in many countries. Malocclusion can increase the risk of dental trauma, caries, periodontal problems, and oral dysfunctions such as chewing, swallowing, and talking difficulties (1).

Many factors can affect the severity of malocclusion and the desire to receive orthodontic treatment in individuals. One of these factors is the socio-economic status of the patients/parents (2). Studies have shown that the incidence of malocclusion severity and orthodontic treatment need is high among individuals with low socio-economic status (3-5). The lack of social protection programs in the low socio-economic classes has been reported to be one of the main causes. In addition, high caries rates and the early loss of primary teeth, which may result from irregular dental visits, can cause the displacement of teeth and crowding (5,6).

One of the most common types of malocclusions that affect the aesthetic appearance, function, and quality of life of the patients is dental crowding (1). Irregularities are generally observed 40-58% in the lower incisors in retention areas, especially in individuals with poor oral hygiene habits. In these areas, plaque accumulation can increase and caries

occur, this affects periodontal health negatively (7-12). When malpositions with adverse effects are observed, orthodontic treatment should be provided to redirect occlusal forces. Consequently, occlusal trauma, which may also affect periodontal health, can be prevented.

Several epidemiological studies have been conducted in communities with different ethnic origins to evaluate the effects of malocclusion on periodontal health (1,13,14). However, there are limited studies evaluating the relationship between malocclusion and the socio-demographic factors, caries, and periodontal status of children/adolescents in Turkey (10). These studies are important for evaluating the risk of caries in patients, identifying malocclusion and patients who require early preventive orthodontic treatment, and initiating treatments. Furthermore, the findings can be applied to improve oral hygiene in communities and reduce the costs of orthodontic treatment.

With more detailed information from this study results, we expect to identify malocclusion prevalence and associated conditions of malocclusion in 12-14-years-old children. This might help in understanding maloclussion occurrence and also assist public health interventions.

This study was designed to determine the relationship between malocclusion and the periodontal treatment requirements, dental caries,

anterior segment crowding, and parental socio-economic status of 12-14 year-old children. Our hypothesis was that malocclusion was associated with these parameters.

Materials and Methods

Required approvals from the Süleyman Demirel University Faculty of Medicine Clinical Studies Ethics Council were obtained for this study (approval number: 2014/93). The patients signed an Informed Consent Form, as established by the ethical guidelines. The study population consisted of 534 healthy children (233 males, 301 females) between 12 and 14 years of age who applied to our clinic in the period of June to December, 2014. It has been noted that individuals participating in the study were selected to have no orthodontic treatment history in the past, to be individuals with no syndromes that would affect the development of craniofacial structures, to have no orthognathic surgery, and not to be disabled individuals.

To evaluate the incidence of dental caries among the children, the number of decayed, missing, and filled teeth were recorded according to the decay, missing, filled teeth (DMFT) system (15). Angle's malocclusion classification was used to assess molar relationship (16). In order to determine the relationship between socio-economic status and malocclusion classification, the self-reported monthly income levels of the families were divided into three groups: <1000₺, 1000-3000₺, and >5000₺. The lower and upper anterior segment crowding was assessed as follows: 0 - if there is no space; 1 - if only one segment is scored; 2 - if both segments are scored (17). To determine periodontal status and treatment needs, community periodontal index of treatment need (CPITN), which is recommended by the World Health Organization (WHO), was used. The highest score was recorded for each tooth according to the CPITN criteria. The highest score was selected as the CPITN score of each individual, and periodontal treatment needs were determined. The CPITN scores were set so that 0=healthy, 1=bleeding on gentle probing, 2=calculus or other plaque-retentive factors, 3=shallow pocketing of 4-5 mm, and 4=deep pockets of 6mm or more (18).

Statistical Analysis

The data were analyzed using SPSS for Windows (SPSS-Statistical Package for Social Science, Software Version 12, SPSS Inc., Chicago, IL, USA). The effects of CPITN score on crowding in the anterior segment and malocclusion classification were examined using the chi-square test. In addition, the chi-square test was used to evaluate malocclusion classification according to age, gender, socio-economic status, and DMFT scores. The Kruskal-Wallis test was used to evaluate the data obtained from the DMFT in terms of age. Student's t-test was used to analyze data on DMFT characteristics according to gender. Levels of statistical significance were set at p<0.05.

Results

In the study, 534 children between 12 and 14 years of age were evaluated. The mean age of the children was 13.01±0.04. The distribution of patients according to age was as follows: 12 years, 170 (31.8%); 13 years, 189 (35.4%); 14 years, 175 (32.8%). There was no difference in the sex distribution of all age groups.

The mean DMFT score was 4.32±3.14. In addition, 12.2% of the study group consisted of children with a DMFT score of 0. The mean DMFT scores were 3.61±2.66 for 12-year-old children, 4.46±3.06 for 13-years-old children, and 4.86±3.52 for 14-year-old children; the scores were increased with age. Although the mean DMFT score of females (4.39±3.16) was higher than that of males (4.23±3.11), the differences between gender and the mean DMFT scores were not statistically significant (p>0.05).

In the study, class 1 malocclusion (55.1%) was the most common malocclusion. Class 2 (23% class 2 div 1, 13.7% class 2 div 2) was observed in 36.7% of the children, and class 3 malocclusion was observed in 8.2% of the children. The lowest mean DMFT scores were found among children with class 2 div 2 malocclusion, whereas the highest scores were found among children with class 1 and class 3 malocclusions. Class 1, class 2 div 1, and class 2 div 2 malocclusions were more common among females than males, whereas class 3 malocclusion was more common among males. There was no statistically significant relationship between gender and malocclusion (p>0.05) (Table 1). Moreover, the relationship between age and malocclusion classification was not statistically significant (p>0.05). The differences between mean DMFT scores and malocclusion classification were not statistically significant (p>0.05) (Table 2).

The majority of children (83.14%) had low-income families (<1000₺, 1000–3000₺). In the study, 62.2% of the children with a monthly family income level of 3000" or more had class 1 malocclusion, and 2.2% had class 3 malocclusion. There was no statistically significant relationship between the socio-economic levels and malocclusion classification of children (p>0.05)

According to the CPITN, children with healthy periodontal status (CPITN 0) accounted for 24.9% of the study group. Despite the absence of calculus and iatrogenic irritation, there was bleeding (CPITN 1) in 67% of the patients during scaling, and both iatrogenic irritation and supragingival/subgingival dental plaque (CPITN 2) were observed in 8.1% of the patients. Patients with CPITN 3 and CPITN 4 were not evaluated.

Only 6.4% of the patients without anterior segment crowding had CPITN 2 score. CPITN 0 score were decreased with increasing crowding in the anterior segment. The relationship between CPITN scores and crowding was statistically significant in the anterior segment (p<0.05) (Table 3). In the study, 55.8% of children with CPITN 2 and 54.8% of those with CPITN 0 had class 1 malocclusion. It was found that only 8.67% of children with class 2 malocclusion required oral and dental care education as well as scaling. The relationship between CPITN scores and malocclusion classification was not statistically significant (p>0.05) (Table 4).

Table 1. The distrubition of malocclusion classification according to gender

Gender	Angle malocclusion classification									
	Class 1		Class 2 div 1		Class 2 div 2		Class 3		Total	
	n	%	n	%	n	%	n	%	n	%
Female	168	55.8	72	23.9	41	13.6	20	25.8	301	56.4
Male	126	54.1	51	21.9	32	13.7	24	13.5	233	43.6
Total	294	55.1	123	23	73	13.7	44	8.2	534	100

x^2: chi-square, p=0.486, div: Division

Table 2. The relationship between malocclusion classification and mean decay, missing, filled teeth scores

Malocclusion classification	n	Mean DMFT	Standard deviation	Standard error
Class 1	294	4.510[a]	3.0999	0.1808
Class 2 div 1	123	4.407[ab]	3.2538	0.2934
Class 2 div 2	73	3.274[b]	2.6628	0.3117
Class 3	44	4.523[a]	3.5666	0.5377
Total	534	4.318	3.1408	0.1359

DMFT: Decay, missing, filled teeth, div: Division

Table 3. The relationship between anterior segment crowding and community periodontal index of treatment needs scores

Anterior segment crowding	The community periodontal index of treatment needs (CPITN)								x^2
	CPITN 0		CPITN 1		CPITN 2		Total		
	n	%	n	%	n	%	n	%	
0	79	59.4	140	39.1	15	34.9	234	43.8	
1	28	21.1	100	27.9	8	18.6	136	25.5	22.114
2	26	19.5	118	33	20	46.5	164	30.7	
Total	133	24.9	358	67	43	8.1	534	100	

x^2: chi-square, p=0.000, CPITN: Community periodontal index of treatment needs

Table 4. The relationship between malocclusion classification and CPITN scores											
CPITN	**Angle malocclusion classification**										
	Class 1		**Class 2 div 1**		**Class 2 div 2**		**Class 3**		**Total**		x^2
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
CPITN 0	73	54.9	20	15	24	18	16	12	133	24.9	
CPITN 1	197	55	92	25.7	43	12	26	7.3	358	67	1.631
CPITN 2	24	55.8	11	25.6	6	14	2	4.7	43	8.1	
Total	294	55.1	123	23	73	13.7	44	8.2	534	100	

x^2: chi-square, p=0.091, div: Division, CPITN: Community periodontal index of treatment needs

Discussion

This cross-sectional study was conducted in 12–14-year-old children. Because, the eruption of permanent teeth completes nearly at the age of 13 and the clinical diagnosis of the type and extent of malocclusion is best made at this age group (17). Also, ın a study, when the patients who applied to the clinic for orthodontic treatment were compared according to their dentition periods (6-9, 10-12 and ≥13 years), it was observed that the most frequent patients were 13 years (19). Because of these reasons, we decided to evaluate the relationship between malocclusion and related various factors in children aged 12-14 years.

One of the methods widely used in epidemiological studies of malocclusions is Angle's malocclusion classification (20). In our study, according to Angle's classification, 55.1% of children had class 1 malocclusion; this result was similar to that of a study performed with 100 children (10-12 years of age) in Turkey (21). However, recent studies have shown that the most common malocclusion in adolescents is class 2 malocclusion in Turkey (22-25). Nevertheless, when the literature review was done, data on the prevalence of malocclusion are limited (26-28).

Since socio-economic differences are an important factor in Turkey, families were separated into groups according to monthly income levels, and their effects on malocclusion were examined in our study. Some studies have reported that children at low socio-economic levels have more severe malocclusions and poor oral/dental health (20,29,30). However, there are also studies that have reported that the severity and classification of malocclusion are not different based on socio-economic status (31-33). In our study, there was no statistically significant relationship between the socio-economic levels and malocclusion classification of children reform of the health care systems to provide government-subsidized treatment according to the past years has made it easier for the low-income families to benefit protective and preventive dental programs in early dentition period of their children from the public hospitals. Thus, this could contribute the prevention of malocclusion in children. If an identical study is repeated in a few years after changes to the socio-economic environment in the overall population, different results might be observed. One of the etiologic factors that can cause the space loss in the dental arch and malocclusions, both in the mixed and permanent dentition, is dental caries (31-33). Children with dental caries (DMFT>0) were almost twice as likely to have class 2-3 malocclusion compared with children without dental caries (DMFT=0) (8). On the other hand, in a study of 12-year-old children in India in 2015, no association was found between malocclusion and caries (9). In our study, the differences between mean DMFT scores and malocclusion classification were not statistically significant (p>0.05). Because, the DMFT index is inadequate when compares dental caries and malocclusion. It does not distinguish between a small, non-cavitated lesion and a large cavitated lesion with loss of tooth structure. It includes many lesions that are non-cavited and therefore can have no more effect on malocclusion. Individuals with a moderate and high risk for caries have increased the orthodontic treatment needs (34). Indeed, according to Dental Health Component, children with high DMFT scores

have increased orthodontic treatment needs (35,36). According to Dental Aesthetic Index (DAI), children between the ages of 11 and 15 with a DAI score of >35 were reported to have more dental caries than other children (37). The prevalence of severe caries (DMFT>8) was observed to increase from 10.8% to 50% when DAI scores were increased (38). The early prevention and treatment of caries will help to reduce orthodontic treatment needs.

Malocclusion is also an important factor in the etiology of periodontal disease. Irregularities in the lower anterior teeth can have adverse effects on the periodontal health of the teeth, increase plaque accumulation, and lead to periodontal diseases (39). Gingivitis was observed to be at a high level in patients with malocclusion compared with those without malocclusion (40). Conversely, in a study of children with a mean age of 12.38±0.75, there was no correlation between periodontal disease and irregularities of the teeth when oral hygiene was good (41). In another study of children aged 10-18 years, malocclusion severity was not associated with periodontal status between groups with an overjet of more than 6 mm, a deep bite of more than 6 mm, and posterior unilateral or bilateral crossbite (42). Similar to the results of these studies, there was no statistically significant relationship between CPITN scores and malocclusion classification in our study (p>0.05). Due to differences between the sample groups and the methods used, different results could be obtained when evaluating the relationship between periodontal status and malocclusion. In addition, it is possible that the CPITN measures the periodontal treatment needs of the entire jaw and masks local periodontal problems with healthy areas (10).

When the relationship between treatment needs and oral hygiene conditions (plaque, amount of calculus, gingivitis, and pocket depth) was assessed, no relationship was found (43,44). In a study in Nigeria, the association between the DAI and CPITN scores of patients with a mean age of 15.8±7.5 was not statistically significant (45). In contrast, a study in Turkey involving 836 patients between 11 and 14 years of age has reported a close relationship between treatment priority index TPI and CPITN scores (10).

Occlusal irregularities and crowding may be responsible for periodontal diseases (46). Although there was a correlation between irregularity and gingivitis scores, the amount of plaque accumulation and the degree of irregularity were not clinically significant (43). Studies have reported a correlation of malpositions in the lower arch, irregularities in the upper arch, and deep bite with CPITN scores (14,47). For teeth with occlusal irregularities, there was a significant increase in the depth of scaling every year; however, there was no significant increase in scaling depth for teeth without occlusal irregularities (48).

In this study, only 6.4% of the patients without anterior segment crowding had a CPITN score of 2. CPITN 0 scores were decreased with increasing crowding in the anterior segment. The positive relationship between the degree of irregularity and the severity of gingival inflammation may be attributed to the bad oral hygiene of the patients, which can lead to dental plaque formation and cause the onset of periodontal inflammation. Nevertheless, crowding would not contribute to gingivitis if the individual has good oral hygiene (46).

Conclusion

In the study, periodontal status was associated with anterior segment crowding but not malocclusion classification. However, malocclusion could cause an increase in plaque retention. In addition, ıt was concluded from the present study that malocclusion had no significant effect on dental caries and parental socio-economic status. Thus, the hypothesis of the present study was rejected.

Patients with malocclusion should be evaluated so as to facilitate oral health by minimizing inaccessible areas in the oral cavity. Assessment of the orthodontic treatment needs of children should be based not only on the severity of malocclusion features but also on the dentition period, and the age group of the children. Further studies involving large populations are necessary in different age groups, which requires increased attention regarding to prevent maloclussion.

Ethics

Ethics Committee Approval: Süleyman Demirel University Faculty of Medicine Clinical Studies Ethics Council (approval number: 2014/93).

Informed Consent: All patients included were informed about the study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.Ö., Concept: E.Ö., Ç.K., Design: E.Ö., Ç.K., Data Collection or Processing: E.Ö., Analysis or Interpretation: E.Ö., Literature Search: E.Ö., Writing: E.Ö., Ç.K.

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