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Evaluation of Orthodontic Treatment Needs and Dental Aesthetic Appearance of Individuals with Periodontal Disease According to DAI, ICON, IOTN Indices

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ABSTRACT

Objective: Malocclusion is a condition that negatively affects individuals' quality of life and is characterized by deviations in the ideal alignment of the teeth. Orthodontic anomalies and periodontal diseases can interact with each other. This study aims to evaluate the need for orthodontic treatment in individuals with periodontal disease.

Materials and Methods: The study included 150 patients who presented with periodontal disease complaints at the Department of Periodontology, Faculty of Dentistry, Atatürk University. Participants' periodontal status was assessed using the bleeding index, pocket depth, and DMFT index. Orthodontic treatment need was determined using the ICON (Index of Complexity, Outcome and Need), DAI (Dental Aesthetic Index), and IOTN (Index of Orthodontic Treatment Need) indices.

Results: Among the patients, 36.7% were classified as having severe malocclusion according to the ICON index, 60.7% according to the DAI index, and 38.6% according to the IOTN index. Additionally, gingivitis was detected in 82.7% of the participants. A statistically significant correlation was found between age and bleeding index, DMFT, DAI, and IOTN indices, as well as between DMFT and ICON indices ($p<0.05$).

Conclusion: Orthodontic problems were found to be prevalent among patients seeking periodontal treatment. This finding highlights the importance of considering orthodontic evaluation alongside periodontal health and underscores the need to raise awareness in society regarding this relationship.

Keywords: Index of orthodontic treatment need, Malocclusion, Periodontal diseases.

Periodontal Hastalığı Olan Bireylerde Ortodontik Tedavi İhtiyacının ve Diş Estetik Görünümünün DAI, ICON, IOTN İndekslerine Göre Değerlendirilmesi

ÖZ

Amaç: Maloklüzyon, bireylerin yaşam kalitesini olumsuz etkileyen ve dişlerin ideal dizilimden sapmasıyla karakterize edilen bir durumdur. Ortodontik anomaliler ve periodontal hastalıklar karşılıklı etkileşim gösterebilir. Bu çalışmada, periodontal hastalığı olan bireylerde ortodontik tedavi ihtiyacının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: Çalışmaya, Atatürk Üniversitesi Diş Hekimliği Fakültesi Periodontoloji Anabilim Dalı'na periodontal hastalık şikayetiyle başvuran 150 hasta dahil edildi. Katılımcıların periodontal durumu; kanama indeksi, cep derinliği ve DMFT indeksi ile değerlendirildi. Ortodontik tedavi ihtiyacı ise ICON (Index of Complexity, Outcome and Need), DAI (Dental Aesthetic Index) ve IOTN (Index of Orthodontic Treatment Need) indeksleri kullanılarak belirlendi.

Bulgular: Hastaların %36,7'si ICON, %60,7'si DAI ve %38,6'sı IOTN indeksine göre şiddetli maloklüzyon grubunda yer aldı. Ayrıca, %82,7'sinde gingivitis saptandı. Yaş ile kanama indeksi, DMFT, DAI ve IOTN indeksleri arasında ve DMFT ile ICON arasında istatistiksel olarak anlamlı korelasyon bulundu ($p<0.05$).

Sonuç: Periodontal tedaviye başvuran hastalarda ortodontik problemlerin yaygın olduğu tespit edilmiştir. Bu bulgu, ortodontik değerlendirme ve periodontal sağlığın birlikte ele alınmasının önemini vurgulamakta, toplumun bu konuda bilinçlendirilmesi gerektiğini göstermektedir.

Anahtar Kelimeler: Ortodontik tedavi ihtiyacı indeksi, Maloklüzyon, Periodontal hastalıklar.

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INTRODUCTION

While the World Health Organization (WHO) defines health as ‘a state of complete physical, social and mental well-being, not merely the absence of disease or infirmity’, if malocclusion prevents the individual from being peaceful due to psychosocial (dentofacial aesthetics or impairment of self-esteem) or physical reasons (functional impairment), the individual cannot be considered healthy (Bellot-Arcis et al., 2012). Malocclusion can be defined as the deviations of the teeth located in the upper and lower jaw bone from the ideal both within the jaw in which they are located and mutually (between the jaws), being located outside the arch, being cramped and / or crowded (Ülgen, 2001). Together with genetic and environmental factors, malocclusions can affect the development and appearance of the jaw and facial area. Malocclusions can be seen as an important public health problem because they negatively affect the social and psychological well-being and quality of life of individuals.

Orthodontics is the branch of science that analyses the dental, maxillofacial and facial system and makes diagnosis and treatment planning by taking into account growth and development (Gülyurt, 1984). The aim of this treatment is to provide a permanent and balanced occlusal relationship and harmonious facial aesthetics (Hassan, 2006). Orthodontic malocclusions were first studied by Angle in 1899 (Angle, 1899). Many studies have been conducted on malocclusions, their prevalence, treatment needs and/or priorities (Ackerman & Proffit, 1969; Angle, 1899; Frankel, 1951; Gravely & Johnson, 1974; Katz, 1978).

The need for orthodontic treatment has been an important factor in the development of orthodontic indices (Hamdan, 2004). These indices have been developed to be used in classification according to the level of treatment need, in the post-treatment follow-up process and in various epidemiological studies (Kazancı & Ceylan, 2010).

Periodontology is a branch of science that studies the surrounding tissues of the tooth, the diseases of these tissues and their treatment methods (Ansari et al., 2018; Hoffman, 1966). Periodontal health is defined as the absence of inflammatory periodontal disease and/or clinical signs of these diseases (Tonetti & Sanz, 2019). Gingivitis is the mildest course and is caused by microbial dental plaque (Newman et al., 2011), while periodontitis is the state of advanced periodontal destruction (Kinane, 2001).

Patients presenting to the clinic for orthodontic treatment do not always have ideal periodontal health. These patients have many periodontal problems ranging from mild to severe (Uludağ & Çağla, 2014). Periodontal problems may occur during and after orthodontic treatment (Murakami et al., 1989), and an existing orthodontic problem may cause periodontal problems without treatment (El-Mangoury et al., 1987). Malocclusions may cause individuals to be unable to establish adequate oral hygiene, no matter

how much attention they pay to their oral hygiene. In this case, periodontal problems may occur, sometimes with or without being aware of the malocclusion.

In our study, we aimed to determine whether there is a relationship between the need for orthodontic treatment and periodontal problems of patients who applied to the clinic for the treatment of periodontal problems.

MATERIALS AND METHODS

Study type

This study was conducted in the clinic of the Department of Periodontology, Clinical Sciences Division, Faculty of Dentistry, Atatürk University, through patient evaluations during December 2024 and January-February 2025.

Study group

Our study was carried out on 150 patients who applied to Atatürk University Faculty of Dentistry, Department of Periodontology for the treatment of periodontal problems.

As inclusion criteria;

- Not having orthodontic treatment,
- Not having any systemic disease,
- Not having undergone any periodontal treatment,
- To have received oral hygiene training,
- Having a daily tooth brushing habit was determined.

Dependent and independent variables

ICON, DAI, IOTN, DMFT, periodontal disease, bleeding index and pocket depth records were obtained from each patient before starting periodontal treatment.

Procedures

Indices used in our study;

Index of Complexity, Outcome and Need (ICON): It is an index developed by Daniels and Richmond (Daniels & Richmond, 2000) to evaluate treatment difficulty, need and results.

Index of Orthodontic Treatment Need (IOTN): The index developed by Brook and Shaw (Brook & Shaw, 1989) is a combination of the Swedish (Linder-Aronson, 1974) and SCAN (Evans & Shaw, 1987) indices.

Dental Aesthetic Index (DAI): Cons et al. (Cons et al., 1989) It is an orthodontic index based on socially aesthetic perception.

DMFT Index (Decayed, Missing, and Filled Permanent Teeth): It is defined as the total number of decayed, missing, and filled teeth (Petersen et al., 2005).

Periodontal Disease: As a result of clinical examination by the periodontologist, the disease present in individuals will be determined. e.g. gingivitis, periodontitis

Bleeding Index: It is the index formed by evaluating the bleeding that occurs as a result of gingival probing with the help of periodontal probe.

Age: The chronological age of the individuals will be taken as basis.

Statistical analysis

Statistical analyses were performed with IBM SPSS 20 statistical analysis programme. Data were presented as mean, standard deviation, median, minimum, maximum, percentage and number. In the comparison of two quantitative variables, Pearson correlation was used if the normal distribution condition was met and Spearman correlation test was used if not. Statistical significance level was taken as $p < 0.05$.

Ethical approval

Our study was accepted in accordance with the ethical rules with the letter numbered 80576354-050-99/597 of Kafkas University Faculty of Medicine Ethics Committee.

RESULTS

In the demographic analysis of our study, 54% of the randomly selected patients were female and 46% were male (Table 1).

Table 1. Gender grouping.

Gender Grouping	n	Column N %
Female	81	54.00%
Male	69	46.00%

n: Count, %: Column percentage.

Gingivitis was present in 82.7% and periodontitis in 17.3% of the randomly selected patients (Table 2).

A statistically significant and low power positive correlation was found between age and bleeding index and DMFT index ($p < 0.05$), a statistically significant

and low power negative correlation was found between ICON and IOTN index ($p < 0.05$) (Table 3).

Table 2. Gingival disease status.

Gingival Disease Status	n	Column N %
Gingivitis	124	82.70%
Periodontitis	26	17.30%

n: Count, %: Column percentage.

There was a statistically significant and low strength negative correlation between DMFT index and ICON index ($p < 0.05$) (Table 3).

There was a statistically significant and positive (medium-high power) correlation between ICON index and DAI and IOTN indices ($p < 0.05$) (Table 3).

There was a statistically significant and positive correlation between DAI index and IOTN index ($p < 0.05$) (Table 3).

According to the ICON index, 63.3% of the patients did not require treatment, while 36.7% required orthodontic treatment (Table 4).

According to the IOTN index, 19.3% of the patients did not need treatment, 16% needed little treatment, 26% were borderline cases, 33.3% needed treatment and 5.3% needed serious treatment (Table 5).

According to the DAI index, 27.3% of the patients had normal or minor malocclusion, 12% had definite malocclusion, 16.7% had severe malocclusion and 44% had obstructive malocclusion (Table 6).

Table 3. Correlation analysis between the measurements used.

Correlations		Periodontal pocket depth	Bleeding Index	DMFT Index	ICON Index	DAI Index	IOTN Index
Age	r	0.221**	0.230**	0.234**	-0.274**	-0.104	-0.256**
	p	0.007	0.005	0.004	0.001	0.206	0.002
Periodontal pocket depth	r	1	0.534**	-0.036	0.016	-0.003	0.036
	p		0.000	0.660	0.842	0.970	0.662
Bleeding Index	r		1	0.145	-0.045	-0.052	0.038
	p			0.076	0.583	0.531	0.647
DMFT Index	r			1	-0.163*	-0.066	-0.043
	p				0.046	0.425	0.602
ICON Index	r				1	0.604**	0.715**
	p					0.000	0.000
DAI Index	r					1	0.643**
	p						0.000

** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

Table 4. Treatment necessity according to ICON index.

Necessity of treatment according to ICON index	Count	Column N %
No need for treatment	95	63.30%
Need for treatment exists	55	36.70%

Table 5. Treatment grading according to IOTN index.

Rating according to the IOTN index	Count	Column N %
1	29	19.30%
2	24	16.00%
3	39	26.00%
4	50	33.30%
5	8	5.30%

1: No need for treatment 2: Little need 3: Borderline case 4: Treatment required 5: Treatment required (severe).

Table 6. Malocclusion grading according to the DAI index.

Rating according to the DAI index	Count	Column N %
1	41	27.30%
2	18	12.00%
3	25	16.70%
4	66	44.00%

1: 25 and below; normal or minor malocclusion. No need for treatment

2: 26-30; definite malocclusion. Optional need for treatment

3: 31-35; severe malocclusion. Treatment need

4: 36 and above; disabling malocclusion. Great need for treatment.

DISCUSSION

Due to the insufficient number of dentists per capita in our society in spite of the increasing population, it is necessary to use the available resources correctly, carefully and diligently. This situation becomes even more evident when it comes to specialised procedures and main branches of science.

Gum disease is a common problem that causes aesthetic and functional problems affecting the oral health of the individual. It is thought that this situation may have an effect on dental aesthetic perception and orthodontic treatment.

While tooth position distortions and occlusal distortions lead to deterioration of periodontal health and thus increase the need for orthodontic treatment, globally validated indices such as ICON, IOTN DAI play an important role in objectively determining the need for treatment.

According to the results of our study, significant and positive correlations were found between DAI, IOTN and ICON indices; the need for orthodontic treatment was determined as 63.30% according to ICON index, 38.6% according to IOTN index, while the rate of severe and obstructive malocclusion was determined as 60.7% according to DAI index.

Zhang et al. showed that the rate of orthodontic treatment need evaluated by using different occlusion indices varied and this suggests that the rate of individuals determined to need orthodontic treatment will vary depending on the occlusion indices used (Zhang et al., 2009).

Perillo et al. reported that the need for treatment was 27% according to the IOTN index in a patient population with an age group of 12 years (Perillo et al., 2010), while Ferreria reported that the need for treatment was 75% according to the ICON index and 94% according to the IOTN index (Ferreira, 2005).

In general, it can be concluded that it is acceptable to have different results due to the different age distribution of the study groups and the indices used. Kerosuo et al. reported that the need for orthodontic treatment was low when the age groups were different, but the need for treatment was high in patients who applied for orthodontic treatment (Kerosuo et al., 2004).

Individuals may not perceive the need for treatment as much as a periodontist or orthodontist. In some cases,

they may feel periodontal and orthodontic problems more severe than they are psychologically. In this regard, Helm et al. reported that the anxiety of individuals increased especially with disorders in the anterior region teeth (Helm et al., 1986), while Sheats et al. reported that the rate of discomfort from dental appearance was higher in women than in men (Sheats et al., 1998).

Akpınar et al. reported that 51.9% of patients applying to periodontology clinic had gingivitis and 47.8% had periodontitis (Akpınar et al., 2012). In our study, the proportion of patients with gingivitis was determined as gingivitis in 82.7% and periodontitis in 17.3%. The different results may be attributed to the difference in the number of people in the studies.

Vidaković et al. reported that DAI and ICON indices showed moderate agreement in the evaluation of malocclusion severity scores and the assessment of the severity of malocclusion (Vidaković et al., 2018).

Farahani et al. reported that, in general, ICON has a lower need for treatment compared to IOTN (Farahani & Eslamipour, 2010).

Study Limitations and Strengths

One of the limitations of the study is the cross-sectional design. Another limitation of the study is the small patient sample. The main strengths of this study are that pre-validated survey instruments were used to measure the study outcomes and the data analysis technique used addressed the clustered nature of the data and controlled for potential confounders.

CONCLUSION

It was determined that 36.70% of the randomly selected patients had gingivitis according to the ICON index, 60.7% of the group with severe malocclusion (3-4) according to the DAI index, and 38.60% of the group requiring orthodontic treatment (4-5) according to the IOTN index. 82.70% of the patients had gingivitis. Statistically significant correlations were determined between age and bleeding index, DMFT index, DAI and IOTN indexes, and between DMFT index and ICON index ($p < 0.05$). According to the results obtained, it was determined that the majority of the patients who applied to the periodontology department with the need for treatment had orthodontic problems and the society should be more aware of this issue.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: GYÖ, AKÖ, YÖK; **Material, methods and data collection:** GYÖ, GÖ, YÖK; **Data analysis and comments:** KS; **Writing and corrections:** GYÖ, AKÖ.

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Ethical Approval

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