

The Evaluation of the Awareness About the Effects of Smoking on Oral and Periodontal Health

Sigaranın Ağız ve Diş Eti Sağlığı Üzerindeki Etkileri ile İlişkili Farkındalığın Değerlendirilmesi

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ABSTRACT Objective: The clinical signs of periodontal disease may negatively affect the quality of life. In addition, smoking is an important risk factor for oral and periodontal diseases. Therefore, the aim of this study was to assess the patients' awareness of the effects of smoking on oral health and investigate the impacts of periodontal disease on oral health-related quality of life. **Material and Methods:** One hundred and forty participants were diagnosed according to the 2017 classification of periodontal and peri-implant diseases and conditions. A questionnaire was used to analyze the patients' awareness of the effects of smoking and oral health-related quality of life was measured using Oral Health Impact Profile-14 (OHIP-14) scale. Statistical tests were performed in order to assess the association between categorical variables and ordinal logistic regression was applied to evaluate risk factors of the OHIP-14 score. **Results:** The patients included in the study had low level of awareness of the relationship between smoking and the failure of periodontal and implant therapy. There was a significant difference among smokers, non- and ex-smokers in awareness of the effect of smoking on taste alteration. In study group, 32% of patients were diagnosed with gingivitis, 52% of patients were diagnosed with periodontitis and 16% of patients were diagnosed with reduced periodontium with gingivitis. No significant difference was found among periodontal disease groups in terms of total OHIP-14 scores. **Conclusion:** As a result of this study, smokers were aware of the effects of smoking on oral health as well as non-smokers and ex-smokers. It is important that dental professionals should inform their patients about the oral effects of smoking and encourage smoking cessation.

Keywords: Periodontitis; smoking; awareness; quality of life

ÖZET Amaç: Periodontal hastalık, bulgu ve semptomları yaşam kalitesini olumsuz etkileyebilir. Ek olarak sigara, oral ve periodontal hastalıklar için önemli bir risk faktörüdür. Bu nedenle bu çalışmanın amacı, hastaların sigara içmenin ağız sağlığı üzerindeki etkileri hakkındaki farkındalığını değerlendirmek ve periodontal hastalığın ağız sağlığı ile ilişkili yaşam kalitesine etkisini araştırmaktır. **Gereç ve Yöntemler:** Yüz kırk katılımcıya, 2017 periodontal ve peri-implant hastalıklar ve durumların sınıflandırılmasına göre teşhis konuldu. Hastaların, sigaranın etkileri hakkındaki farkındalıklarını analiz etmek için bir anket kullanıldı ve ağız sağlığı ile ilişkili yaşam kalitesi Oral Sağlık Etki Profili-14 ölçeği ile değerlendirildi. Kategorik değişkenler arasındaki ilişkiyi değerlendirmek için istatistiksel testler yapıldı ve Oral Sağlık Etki Profili-14 ölçeği skorunun risk faktörlerini değerlendirmek için ordinal lojistik regresyon uygulandı. **Bulgular:** Çalışmaya dâhil edilen hastalar, sigara ile periodontal ve implant tedavileri başarısızlığı arasındaki ilişki bakımından düşük düzeyde farkındalığa sahipti. Sigaranın tat değişikliği üzerine etkisinin farkındalığı bakımından; sigara içen, hiç içmemiş ve eski içiciler arasında anlamlı fark vardı. Çalışma grubunda, hastaların %32'sine gingivitis, %52'sine periodontitis, %16'sına azalmış periodonsiyumda gingivitis teşhisi konmuştur. Periodontal hastalık grupları arasında total Oral Sağlık Etki Profili-14 ölçeği puanları bakımından anlamlı farklılık bulunmadı. **Sonuç:** Çalışmanın sonuçlarına göre sigara kullananlar, hiç kullanmamış ve eski içiciler kadar sigaranın oral sağlığa etkileri ile ilgili farkındalığa sahiptirler. Bununla birlikte diş hekimlerinin, hastaların sigaranın oral etkileri ile ilgili bilgilendirmesi ve sigara bırakma konusunda cesaretlendirmesi önemlidir.

Anahtar Kelimeler: Periodontit; sigara içme; farkındalık; yaşam kalitesi

The use of tobacco products, especially smoking, causes many serious diseases and conditions, including lung and oral cancer, cardiovascular and respiratory diseases. The World Health Organization

has reported more than six million people die due to smoking each year, including approximately 900,000 non-smokers who lose their lives due to secondhand smoke globally.¹

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Periodontal disease is a common, multifactorial and inflammatory disease. The interactions between host immune response and microbial pathogens can be affected by several risk factors such as environmental, systemic and genetic factors. These interactions are critical in the pathogenesis of periodontal disease.² Periodontitis is often an asymptomatic disease during initial stages and causes few or no clinical symptoms. Therefore, patients may be unaware of their periodontal problems.³ In advanced stages, periodontitis may cause symptoms that impact the patient's oral health-related quality of life (OHRQoL). These symptoms can include bleeding, tooth mobility, pain, halitosis, unaesthetic gingival recession and loss of interproximal papillae.⁴ Age, gender, and race are associated with the progression and severity of the disease.⁵ Smoking has also been reported to be a major risk factor for periodontal destruction.⁶ Cigarette smoking causes alterations of host immune response, including neutrophil/monocyte activity, antibody production and inflammatory mediator release. Smoking also increases the prevalence of periodontal pathogens.⁷ Some studies have reported that smoking results in reduced levels of serum immunoglobulin G2 against *Aggregatibacter actinomycetemcomitans* in patients with generalized aggressive periodontitis.^{8,9} It has been demonstrated that smoking increases the risk of periodontal disease two to seven times.¹⁰ In addition to these harmful effects, the vasoconstrictive effect of smoking suppresses the signs of gingival inflammation so the patients may not recognize the clinical signs of periodontal disease.¹¹ Studies have reported that smokers have poorer clinical outcomes to surgical and non-surgical periodontal treatments compared with non-smokers, increased risk of dental implant loss and greater risk of cancerous and precancerous lesions.¹²⁻¹⁴ Smoking's visible effects are teeth staining and gingival melanin pigmentation. Because of these aesthetic problems, patients frequently apply to dental clinics.¹⁵ There is a limited number of studies about the dental patient's awareness of the impact of smoking on oral/periodontal health.^{16,17} Therefore, the aim of the present study was to assess the awareness of the effects of smoking on oral health and examine the impact of periodontal disease on OHRQoL.

MATERIAL AND METHODS

STUDY SAMPLE

This study included a total of 140 dental patients who were referred to Başkent University Faculty of Dentistry, Department of Periodontology, between 2018 and 2019. The study protocol was in accordance with guidelines of the Declaration of Helsinki of 1975, as revised in 2008. This study was approved by Baskent University Institutional Review Board (D-KA18/23) and supported by Baskent University Research Fund. The informed consent forms were obtained from all participants. The inclusion criteria for the study were: aged over 18 years; ability to understand and complete the questionnaires; no pregnancy, no use of electronic cigarettes. The patients who had missing data regarding clinical and radiological examination were excluded. The questionnaires were applied and clinical periodontal measurements were recorded by the same periodontist before periodontal treatment (MNNY).

DATA COLLECTION PROCEDURE

In the first part of the questionnaire, it was requested to complete the socio-demographic information including age, gender, income and education levels, oral hygiene habits, smoking status and dental visit frequency. Smoking status was categorized into three groups: smokers, non-smokers and ex-smokers. In the second part, anonymous questionnaire used by previously Lung et al. was answered by the patients about the effects of smoking on oral/periodontal health and then the impact of periodontal status on quality of participants' life was evaluated by the Turkish version of the Oral Health Impact Profile-14 (OHIP-14) scale.^{17,18} OHIP-14 scale is grouped into seven dimensions with two questions each, as follows: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. The responses are scored on a five-point Likert scale (0= never; 1=hardly ever; 2=occasionally; 3=fairly often; 4= very often). The total OHIP-14 score ranges from 0 to 56. Higher scores indicate poorer OHRQoL.¹⁹

PERIODONTAL EXAMINATION

All patients underwent a full-mouth periodontal examination which was performed at six points of each tooth except third molars. Probing depth (PD) and clinical attachment loss (CAL) were recorded by using a periodontal probe (HuFriedy, Chicago, IL, USA).²⁰ Bleeding on probing was recorded as present or absent within 20 seconds after PD measurement.²¹ Periodontal status was determined in accordance with the new periodontal disease classification proposed by European Federation of Periodontology and American Academy of Periodontology.²² Gingivitis on an intact periodontium was defined as having $\geq 10\%$ bleeding sites $PD \leq 3$ mm, no CAL and no alveolar bone loss radiographically due to periodontal disease. The patients who were diagnosed as gingivitis on reduced periodontium were defined as having $\geq 10\%$ bleeding sites $PD \leq 3$ mm, possible attachment loss and alveolar bone loss radiographically. The patient defined as a periodontitis case if interdental CAL was detected at two or more non-adjacent teeth, or if buccal or oral CAL was 3 mm and more with PD more than 3 mm was detected at two or more teeth. Initially, periodontitis staging was identified using the greatest interdental CAL and then for diagnosis of stage III and IV, the number of the extracted teeth due to periodontitis and complexity factors were assessed. Periodontitis grading was determined by the percent of radiographic bone loss at the most affected tooth divided by age of the patient. The presence of complexity factors such as probing pocket depths, vertical and/or horizontal alveolar bone loss, furcation involvement, tooth mobility can lead higher stage and the presence of risk factors such as smoking and diabetes can modify the grade.²²

STATISTICAL ANALYSIS

All statistical analyses were conducted by using SPSS statistical software package for Windows, version 18 (SPSS Inc., Chicago, IL., USA). Mean and standard deviation of continuous variables and frequency distribution of categorical variables were calculated for each group. The association between categorical variables was performed by Pearson Chi-square or Fisher's Exact tests. For more than two independent groups, Kruskal-Wallis test was used to

compare the OHIP-14 scores. The OHIP-14 score was considered as a dependent variable with "less affected", "moderately affected" and "seriously affected" categories and ordinal logistic regression was applied to examine the risk factors of the OHIP-14 score.⁴ In the ordinal logistic regression analysis, sex, age, smoking status and periodontal groups were considered as independent variables. The sample size was calculated at least 133 individuals with 80% power. The level of significance was set at $p < 0.05$.

RESULTS

DEMOGRAPHIC VARIABLES AND CLINICAL DIAGNOSIS

A total of 140 patients, 81 females and 59 males participated in the study. The mean age of patients was 43.4 ± 13.3 years. Socio-demographical characteristics and smoking status of the patients were shown in Table 1. Of the study sample, 42.1% were current smokers, 35.7% were non-smoker and 22.1% were ex-smoker (Table 1). Periodontal diagnosis of 140 patients were gingivitis ($n=45$), gingivitis on reduced periodontium ($n=22$) and periodontitis ($n=73$; Stage I=3, Stage II=18, Stage III=30 and Stage IV=22). The individuals with periodontitis were also evaluated according to their grade levels (Grade A=3, Grade B=30 and Grade C=40). In the present study, there was no statistically significant association between periodontal status and smoking status ($p=0.602$). The mean ages of gingivitis, periodontitis and gingivitis on reduced periodontium patients were 31.6 ± 11.1 , 48.9 ± 10.5 and 49.3 ± 10.0 years, respectively. There was a statistically significant difference between gingivitis and periodontitis groups and between gingivitis and gingivitis on reduced periodontium groups with respect to mean age ($p=0.000$ and $p=0.000$, respectively). The difference of the mean age was not statistically significant between periodontitis and gingivitis on reduced periodontium groups ($p>0.05$). The number of cigarettes smoked per day was 13.5 ± 6.3 ranging from 2 to 30. To calculate the pack-year, the number of packs smoked per day was multiplied by the number of years cigarettes smoked and the mean pack-year was 14.5 ± 14.7 . There was a statistically significant difference between gingivitis and peri-

TABLE 1: Socio-demographic characteristics and smoking status of the patients (values are count and percentage).

		n	%
Gender	Male	59	42.1
	Female	81	57.9
Marital status	Married	98	70.0
	Single	42	30.0
Education level	Low	16	11.4
	Medium	40	28.6
	High	84	60.0
Income level	Low	21	15.0
	Medium	79	56.4
	High	40	28.6
Dental visit frequency	Once a year	31	22.1
	Twice a year	21	15.0
	Less than 6 months per year	4	2.9
	When have complaint	84	60.0
Tooth brushing	More than twice	22	15.7
	Twice a day	76	54.3
	Once a day	28	20.0
	Less frequently	14	10.0
Interdental cleaning	Yes	44	31.4
	No	54	38.6
	Sometimes	42	30.0
Smoking status	Smoker	59	42.1
	Non-smoker	50	35.7
	Ex-smoker	31	22.1

odontitis groups with respect to mean pack-year (4.2 ± 3.1 and 20.7 ± 16.3 , respectively; $p=0.000$)

THE AWARENESS ABOUT THE EFFECTS OF SMOKING

Table 2 showed that the responses of patients about how smoking affects oral and periodontal health. The majority of patients stated that smoking causes bad breath, teeth staining and gingival disease (99.3%, 96.4% and 94.3% respectively). However, 25% of patients reported that they do not know whether any relationship between smoking and the failure of periodontal and implant therapy. Responses to the question ‘Do you think smoking causes taste alteration?’ were statistically significant associated with smoking status ($p=0.018$). More ex-smokers than smokers and non-smokers answered ‘Agree’. There was no significant association between responses to other questions and smoking status (Table 2).

ORAL HEALTH-RELATED QUALITY OF LIFE OUTCOMES

Regarding total OHIP-14 and subscale scores, no statistically significant difference was found among periodontal disease groups (Table 3). There were no statistically significant differences in total OHIP-14 scores among stage groups and among grade groups ($p=0.078$ and $p=0.480$, respectively).

The sum of scores was divided into three categories: “less affected”, “moderately affected” and “seriously affected”. The OHIP-14 score of less affected, moderately affected and severely affected participants ranged from 0 to 18, 19 to 37 and 38 to 56, respectively. In logistic regression analysis, the considered independent variables did not demonstrate a statistically significant effect on the dependent variable ($p>0.05$).

DISCUSSION

It is well documented that smoking causes several chronic diseases, including cardiovascular diseases, lung cancer, and other diseases of the respiratory system, and subsequent mortality. Turkey is among the ten countries with the highest smoking rates. In Turkey, about 110,000 people die from diseases caused by smoking every year.²³ In addition to the many disorders smoking causes, it also has a negative effect on health-related quality of life.²⁴ Therefore, we aimed to evaluate awareness of the effects of smoking and the impact of periodontal diseases on OHRQoL.

Epidemiological studies have shown that smokers have a significantly higher risk of developing periodontal disease than non-smokers and this risk increases with the duration of smoking and the number of cigarettes smoked per day. Smoking can also reduce the success rate of dental implants.⁶ In 2017, a new system for classifying periodontal diseases was proposed.²² According to the new classification, the periodontitis case definition is based on a staging and grading system. The grade is used to estimate the progression rate of periodontitis, which is categorized as slow, moderate or rapid. In this new classification, it is stated that smoking affects the progression rate of periodontitis and can modify the grading. Therefore,

TABLE 2: Responses of awareness of smoking about risk factor for oral health.

		Smokers %	Non-smokers %	Ex-smokers %	Total %	p value
Gingival disease	Agree	93.2	96.0	93.5	94.3	0.808
	Disagree	0.00	0.00	0.00	0.00	
	Neither	6.8	4.0	6.5	5.7	
Dental caries	Agree	72.9	90.0	77.4	80.0	0.137
	Disagree	6.8	0.00	6.5	4.3	
	Neither	20.3	10	16.1	15.7	
Bad breath	Agree	98.3	100.0	100.0	99.3	1.000
	Disagree	0.00	0.00	0.00	0.00	
	Neither	1.7	0.00	0.00	0.7	
Discoloration of tongue	Agree	81.4	88.0	87.1	85.0	0.562
	Disagree	5.0	0.00	0.00	2.1	
	Neither	13.6	12.0	12.9	12.9	
Discoloration of teeth	Agree	94.9	98.0	96.8	96.4	0.844
	Disagree	0.00	0.00	0.00	0.00	
	Neither	5.1	2.0	3.2	3.6	
Gingival pigmentation	Agree	77.4	90.0	77.4	81.4	0.066
	Disagree	0.00	0.00	0.00	3.6	
	Neither	22.6	10.0	22.6	15.0	
Taste alteration	Agree	72.9	80.0	93.5	80.0	0.018*
	Disagree	15.2	2.0	0.00	7.1	
	Neither	11.9	18.0	6.5	12.9	
Oral wound healing	Agree	79.7	88.0	77.4	82.1	0.581
	Disagree	3.4	0.00	3.2	2.2	
	Neither	16.9	12.0	19.4	15.7	
Oral cancer	Agree	78.0	86.0	83.9	82.1	0.539
	Disagree	5.1	0.00	0.00	2.1	
	Neither	16.9	14.0	16.1	15.8	
Tooth loss	Agree	71.2	78.0	80.6	75.7	0.290
	Disagree	8.5	0.00	3.2	4.3	
	Neither	20.3	22.0	16.2	20.0	
Failure of periodontal and implant treatment	Agree	67.8	78.0	67.7	71.4	0.410
	Disagree	5.1	0.00	6.5	3.6	
	Neither	27.1	22.0	25.8	25.0	

* Obtained from Fisher's exact test (p<0.05).

TABLE 3: Oral Health Impact Profile-14 and subscale scores according to periodontal status.

	Periodontitis Mean±SD	Gingivitis Mean±SD	Gingivitis on reduced periodontium Mean ±SD	p value*
Total OHIP-14	12.9±11.2	11.4±9.8	9.9±9.7	0.514
Functional limitation	1.6±2.1	1.2±1.4	1.3±1.4	0.757
Physical pain	2.7±2.1	2.8±2.2	1.7±1.7	0.125
Psychological discomfort	2.1±2.3	1.9±2.2	2.5±2.3	0.509
Physical disability	1.7±2.1	1.6±1.8	1.1±1.3	0.573
Psychological disability	1.9±2.1	1.7±1.9	1.5±2.1	0.432
Social disability	1.5±2.1	1.4±1.8	1.0±1.7	0.413
Handicap	1.3±1.8	0.8±1.3	0.7±1.4	0.116

*Obtained from Kruskal-Wallis test (p<0.05); SD: Standard deviation; OHIP-14: Oral health impact profile-14.

patient's awareness of the periodontal and oral effects of smoking is essential.

In our study, most of the participants were aware of the all adverse oral effects of smoking. However, fewer of the participants were aware of the effects of smoking on periodontal and implant treatments. Terrades et al. suggested that smokers were less likely than non-smokers to be aware of the impact of smoking on gum disease and wound healing.¹⁶ Most of the participants in that study indicated that smoking could cause bad breath (95%) and teeth staining (96.9%). This is in accordance with the findings of our study (Table 2). Furthermore, Lung et al. reported that 78% of their total sample were aware that smoking negatively impacts health; however, smokers (75%) were significantly less likely than non-smokers (80%) to be aware of the negative effect of smoking on oral health.¹⁷ We also found that non-smokers were more likely than smokers to be aware of the impact of smoking on oral health, specifically gingival pigmentation, taste alteration, poorer wound healing, oral cancer, and the success of periodontal and implant therapy. Non-smokers are generally more aware of these harmful effects of smoking on oral and periodontal health than smokers. This suggests that non-smokers may be more health-conscious than smokers, and therefore less likely to start smoking in the future.¹⁷

A recent systematic review concluded that periodontal disease may affect OHRQoL.²⁵ Karaaslan et al. reported that OHRQoL was lower at higher stage and grade of periodontitis.²⁶ In our study, the total OHIP-14 scores were not significantly different among gingivitis, gingivitis on reduced periodontium and periodontitis groups. In addition, stage and grade of periodontitis were not significantly associated with total OHIP-14 scores. The lack of a significant difference may be due to the limited sample size in our study. In addition, OHRQoL is a subjective phenomenon that can be affected by many confounding factors, including demographic and socioeconomic characteristics, oral hygiene behaviors, smoking status, dietary habits, difficulties in speaking and chewing, systemic diseases.²⁷

Smoking is acknowledged as one of the leading causes of death in the world and there is an increas-

ing awareness of the role of cigarette consumption in oral health problems such as periodontal disease and oral mucosal lesions.²⁸ Smoking is a major risk factor in the progression and severity of periodontal diseases and poor treatment outcomes.²⁹ Therefore, smoking cessation has crucial importance in medical and oral health. The dentists are more frequently in contact with the general population and they can clearly show the visible oral effects of smoking to their patients, which highlights the role of dentists in smoking cessation.³⁰

As a result, in the present study, smokers have as much awareness as non-smokers and ex-smokers about the negative effects of smoking on oral health. The reason for this finding may be due to the majority of the study population has a high education level.³¹ Nevertheless, dentists should inform all patients about the impacts of smoking on oral health, regardless of whether they are smokers, non-smokers, or ex-smokers. It has been reported that dental health professionals play an active role in smoking cessation support.³²

The fact that data related to systemic diseases and parameters such as body mass index were not included within the scope of the purpose of this study may be considered as a limitation. Different results can be obtained in studies examining the effects of smoking on the progression of periodontal diseases in patients with various systemic diseases and/or conditions. Due to the cross-sectional design of the study, when patients with periodontitis were classified according to stage and grade, the insufficient number of patients, especially in Stage I and Grade a groups, may be regarded as another limitation.

According to new periodontal disease classification, smoking can modify the grade of periodontitis and is a significant risk factor for periodontitis.²² For this reason, it is important to raise patient's awareness about the negative effects of smoking on oral health. However, studies evaluating the impact of periodontal disease on OHRQoL and awareness of the effect of smoking on oral health in patients who are diagnosed based on the new periodontal disease classification are quite limited.

CONCLUSION

The patients in this study had a general knowledge about the oral health impacts of smoking. The relationship between smoking and oral cancer, impaired wound healing, and failure of periodontal/implant therapy was less known. Dentists should explain to all their patients the adverse outcomes of smoking, recommend cessation programs to smokers and show the visible effects of smoking in the mouth.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Mediha Nur Nişancı Yılmaz, Elif İnönü; **Design:** Mediha Nur Nişancı Yılmaz, Elif İnönü; **Control/Supervision:** Mediha Nur Nişancı Yılmaz, Elif İnönü, Bahar Füsün Oduncuoğlu; **Data Collection and/or Processing:** Mediha Nur Nişancı Yılmaz, Elif İnönü, Deniz Özonur; **Analysis and/or Interpretation:** Mediha Nur Nişancı Yılmaz, Elif İnönü, Deniz Özonur; **Literature Review:** Mediha Nur Nişancı Yılmaz, Elif İnönü, Deniz Özonur; **Writing the Article:** Mediha Nur Nişancı Yılmaz, Elif İnönü, Bahar Füsün Oduncuoğlu; **Critical Review:** Bahar Füsün Oduncuoğlu, Elif İnönü, Deniz Özonur; **References and Fundings:** Mediha Nur Nişancı Yılmaz, Elif İnönü, Bahar Füsün Oduncuoğlu; **Materials:** Mediha Nur Nişancı Yılmaz, Elif İnönü, Bahar Füsün Oduncuoğlu.

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