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The relationship between Smoking and DMFT Index Scores and Tooth Loss

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Abstract: *We aimed* to investigate the relationship between smoking, periodontal diseases, and tooth loss. The smoking features scores of 248 patients who presented to the Ondukuz Mayıs Faculty of Dentistry between 10.03.2020 and 01.10.2020 were investigated. All participants' oral hygiene behavior and practices, oral medical history, and dental visits were also investigated. Decayed, Missing, and Filled Teeth (DMFT) index scores were calculated following oral examination and radiography. The mean age of the participants was 38.42±14.46 years, and 116 (44.4%) smoked every day. Mean numbers of missing teeth were higher among smokers than non-smokers (4.14±0.8 vs 3.06±0.9, respectively $p<0.001$), as were mean DMTF scores (11.27±6.14 vs 8.23±5.76, respectively $p<0.001$). The number of missing teeth and DMFT scores increased with the number of cigarettes smoked per day (r=0.288 and r=0.347), pack-years (r=0.436 and r=0.326), and Fagerström Test for Nicotine Dependence (FTND) scores (r=0.298 and r=0.329, respectively) ($p<0.05$ for all). Linear regression analysis showed that 61% of the change in the number of missing teeth can be explained by the independent variables of age (95%CI, OR=0.004-0.291), number of cigarettes consumed a day (95%CI, OR=0.967-3.457), pack-years (95%CI, OR=-0.131-0.049), FNDT score (95%CI, OR=0.199-1.427), and frequency of tooth brushing (95%CI, OR=-7.378—1.296). Our results indicate the frequency and intensity of smoking have a significant association with DMFT scores and the number of missing teeth

Keywords: *DMFT Index, Fagerström Nicotine Dependence Test, Smoking, Tooth loss,*

I. Introduction

Many physicians engaged in the global fight against smoking frequently neglect the effects of smoking on oral and dental health (1). Oral and dental disorders are the most overlooked among the many health problems caused by smoking addiction (such as cancer, cardiovascular diseases, and chronic obstructive lung diseases). Any form of tobacco consumption can lead to cleft lip, cleft palate, and other congenital defects in children whose mothers smoked during pregnancy (2). In adulthood, smoking is a risk factor for numerous oral and dental health problems, from severe oral diseases such as mouth cancer, to discoloration of teeth and restorations, halitosis, deterioration in the senses of smell and taste, periodontal disease (inflammatory diseases affecting the tissues supporting the teeth) and tooth decay (3, 4). Tobacco use is one of the most important epidemiological risks for oral squamous cell carcinoma, the eighth most common cause of cancer-related deaths worldwide (5). Smoking increases the risk of oral cancer five to 10 times compared to non-smokers (6). The nicotine and tar produced by smoking seep into the dental enamel through minute pores, leaving the teeth discolored. The tar adds a brown tinge to the teeth, while nicotine, combined with oxygen, causes yellowing. Smokers also emit a stale odor created by the chemical compounds in cigarette smoke that can combine with saliva. Exposure of olfactory tissue to cigarette smoke generates a decrease in sensory cell production capacity,

causing a loss of sensibility to odors and olfactory recognition. The gustatory disturbance is a consequence of the change occurring in the form, quantity, and vascularization of the taste buds caused by tobacco consumption (7).

Smoking is one of the modifiable risk factors for and has an enormous impact on the development, progress, and therapeutic outcomes of periodontal disease (8). The periodontium consists of the gingiva, alveolar bone, and periodontal ligaments, and periodontitis is a condition involving inflammation in one of these tissues. Tooth loss may be expected as the final outcome of periodontal disease and dental caries if adequate precautions are not taken. Although there is solid evidence concerning the role of smoking addiction in the etiopathology of periodontal diseases, the effect of smoking on dental caries and mechanisms related to tooth loss in these patients is not yet clearly understood (9). However, researchers are generally agreed that possession of more than 20 teeth in adult life has a serious positive effect on general health and quality of life (10,11). Nutritional problems are less common in individuals with healthy gums and teeth, while tooth loss has severe effects on the morbidity of certain chronic diseases (such as diabetes mellitus and hypertension), and on cognitive functions, especially in the elderly (12,13). Lack of oral hygiene, irregular dental visits to the dentist, low income, and a low education level have also been identified as risk factors for tooth loss, although the most important risk factors are periodontal disease and dental caries (14). More detailed studies have postulated that individuals under 50 generally experience tooth loss because of tooth decay, and those over 50 due to periodontal disease (15).

Studies have reported that ex-smokers (clinically defined as individuals who quit smoking two or more years previously) experience less tooth loss than current smokers but more than individuals who have never smoked. Furthermore, the likelihood of developing increasing periodontal disease increases in line with exposure in terms of frequency and the amount of tobacco smoked (16). To the best of our current knowledge, smoking increases the risk of periodontal diseases through its effects on saliva and oral flora. Smokers experience significant decreases in the 3-OH fatty acids associated with the consensus (high potency) enteric lipopolysaccharide (LPS) structure compared with non-smokers. Smoking is thus associated with specific structural alterations to the lipid-A-derived 3-OH fatty acid profile in saliva, which are consistent with an oral microflora with reduced inflammatory potential (17). Evidence indicates that the commensal bacterium Streptococcus sanguinis exhibits less competitive capability in the presence of nicotine, while microorganisms such as Streptococcus Mutans and Lactobacillus in oral flora increase with smoking (18). Smoking affects saliva by lowering its buffer capability, altering its chemical agent and bacterial components, reducing the flow rate, and promoting the formation of a caries-susceptible environment resulting from an increase in dental caries (19). More inflammatory molecules have been detected in the gums of smokers than non-smokers (20). This has been shown to reduce tissue healing and increase inflammation (21). However, limited data are available concerning smokers with periodontal problems and tooth decay and loss.

This study was intended to investigate the relationship between smoking and tooth decay and loss in patients with periodontal diseases.

II. MATERIALS AND METHODS

1.1. Study Design

This research was designed as an analytic descriptive study. The sample size was determined as 220 (110 smokers and 110 non-smokers) using G-power software at an impact size of 0.362, α=0.05, and power (1-β) =0.80 at a confidence level of 95%. Patients who had presented to the Department of Restorative Dentistry at Ondokuz Mayis University between 10.03.2020 and 01.12.2020 were eligible. A total of 1042 patients had presented to the department during that period. Three hundred twelve participants older than 18 with the loss of at least one tooth due to dental caries and/or periodontal disease were selected, 262 of whom agreed to take part after the study aims had been explained. All 262 were asked about their smoking status. Fourteen individuals who had once been smokers but subsequently quit were also omitted from the study. The remaining 248 subjects were enrolled as the study populations, and written consent was obtained from these. Individuals who smoked more than 100 cigarettes over the previous six months or longer were considered smokers. The participants were divided into a study group (smokers, n=116), and a control group (non-smokers, n=132) based on smoking

status. We investigated how many cigarettes each smoker consumed a day. The Fagerström Test for Nicotine Dependency Test (FTND) was applied to all members of the study group, and their pack-years were calculated. All the participants completed a questionnaire investigating their sociodemographic characteristics and oral hygiene practices. We asked about their brushing techniques, frequency, and duration. The frequency of dental examinations during the previous five years was also examined. Clinical oral examinations were then performed, and patients' dental radiographs from the previous six months were evaluated (if available). Decayed, Missing, and Filled Teeth (DMFT) Index values were then calculated. The study design is presented in Figure 1.

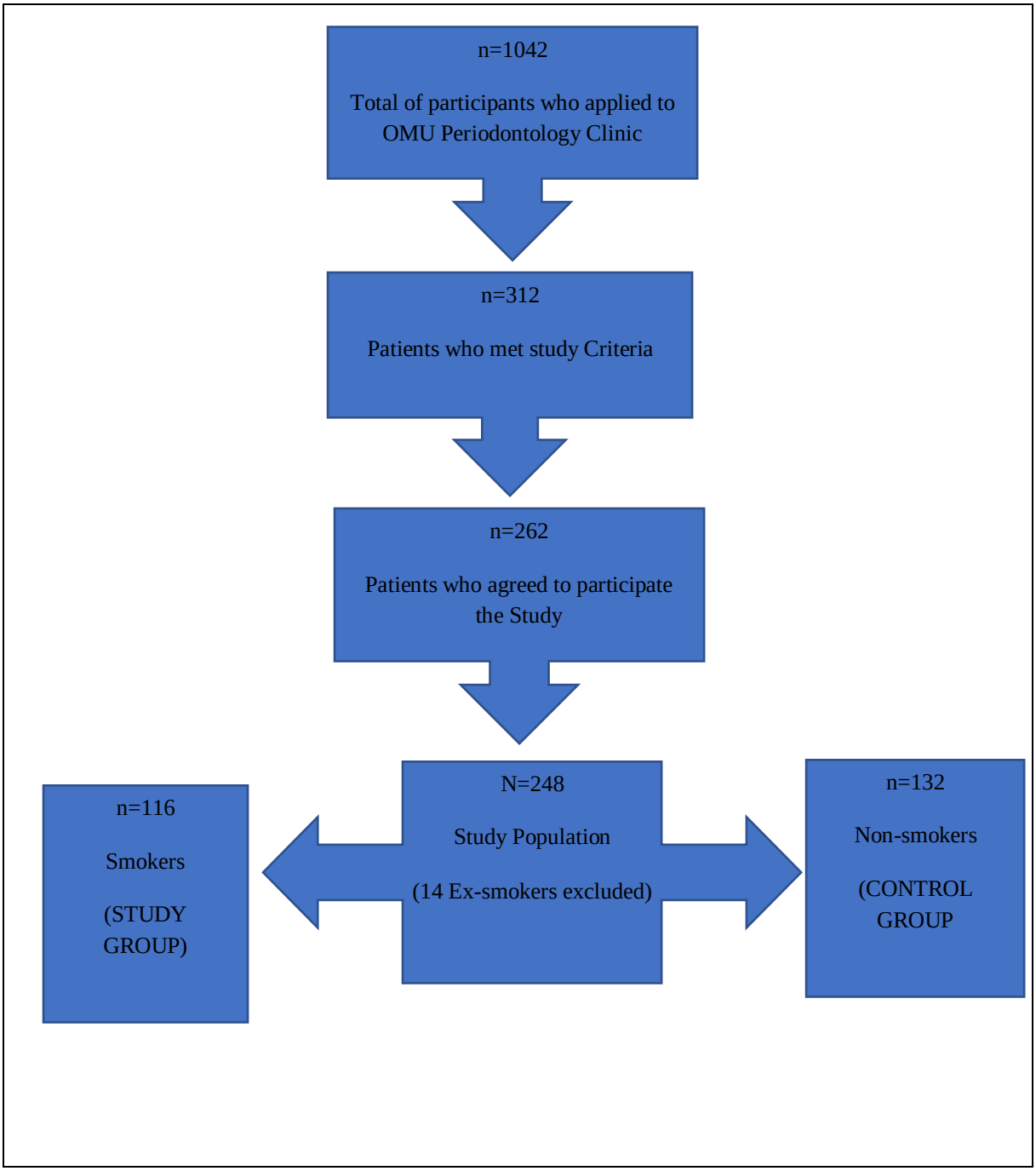

Figure 1: Study Design

2.2. The Tools

2.2.1. The Fagerström Test for Nicotine Dependence

The FTND is a self-assessment scale developed by Heatherton et al. (22) consisting of six questions, scored between 0 and 10, used to assess the risk of physical nicotine dependence. It is important to determine the smoker's nicotine addiction, to determine the difficulties that will be encountered during smoking cessation treatment, and to predict the treatment method. The two most important determinants for nicotine addiction are the time of day when the first cigarette was smoked and how many cigarettes were smoked in a day. Although various scales are used to evaluate nicotine addiction, the FTND is the most frequently employed. The validity and reliability of the FTND in Turkish were studied by Uysal et al. (2004) (23). Scores of 0-2 are interpreted as indicating low-level addiction, 3-7 as medium-level addiction, and 8-10 as high-level addiction.

2.2.2. The Decayed, Missing, and Filled Teeth (DMFT) Index

The DMFT index shows the total number of decayed, missing, and filled permanent teeth. It reveals a population's average oral and dental health risks. The DMFT index is important in terms of determining the level of dental health in the community, determining dental treatment needs, and planning and prioritizing dental health services. It is currently the dominant population-based measure of experience of caries worldwide (24). The index yields the sum of an individual's decayed, missing, and filled permanent teeth or surfaces (DMF score). For example, an individual with two decayed, three filled, and one missing tooth will have a DMFT value of 6. It is important to note that the DMF score does not indicate the number of teeth at risk or of healthy teeth. Moreover, the DMF does not distinguish between decayed, missing, and filled teeth or surfaces or whether teeth have been lost for reasons other than caries. This therefore reduces the validity of the DMF score. All teeth except for third molars are included, so for adults, DMFT values range from zero to 28, and DMF scores range from zero to 128, with molars and premolars having five surfaces and incisors and canines four. This index accounts for teeth that are restored and missing, and teeth that are decayed. The DMF score is irreversible, and an individual's DMF score cannot therefore decrease. For population-based measures, the sum of all DMFT/S scores is divided by the number of individuals in the total sample. It is important to note that DMF counts are highly skewed with a mode of zero, and linear models are generally not appropriate when a DMF count is a dependent variable (25).

Although the DMF score provides an indicator of both current and past caries, individual variables (decayed/missing/filled) can be separated in the data collection process.

2.2.3. Pack Year

The term pack-year is used to describe the amount an individual has smoked over an extended period. It is calculated by multiplying the number of packs of cigarettes smoked per day by the number of years smoked. For example, one pack per year is equivalent to smoking one pack per day for one year, or two packs per day for half a year.

2.3. Statistical Analyses

The data obtained were transferred onto IBM Statistical Package for Social Sciences version 22 software (SPSS). The data are presented as number, percentage, mean, and standard deviation values and were compared using the Chi-square and Student's t-tests. Descriptive statistics were presented as mean standard deviation, minimum and maximum values, frequency distributions, and percentages. The chi-square test, continuity-corrected chi-square test, and Fisher's exact probability test were used to evaluate categorical variables. The Kendall-Tau correlation test was used as a statistical method for determining statistical significance between two quantitative variables. In addition, a linear regression model including independent variables was created. A p-value <0.05 was considered statistically significant.

2.4. Ethical Consent

Ethical approval for the study was provided by the Ondokuz Mayis University Clinical Research Ethical Committee (OMU-KAEK 2020/62).

II. RESULTS

Two hundred forty-eight patients with a mean age of 38.42±14.46 years (min=18, max=72), 46.8% (n= 116) of whom were men, were included in the study. The sociodemographic comparisons of the study and the control group are shown in Table 1.

Table 1: The participants' sociodemographic and smoking features

Variable	Study Group n=116	Control Group n=132	p
Age (years) (min-max)	43.22±13.88 (18-69)	33.72±13.59 (18-72)	p<0.001
Gender			p=0.021
Men	66 (57.6%)	48 (36.9%)	
Women	50 (42.4%)	82 (63.1%)	
Marital Status			p=0.275
Married	80 (69%)	82 (62.1%)	
Divorced	30 (25.9%)	48 (36.4%)	
Widowed	6 (5.2%)	2 (1.5%)	
Occupation			p=0.017
Civil Servant	40 (34.4%)	31 (23,4%)	
Housewife	28(24.1%)	36 (27.2%)	
Retired	14 (10.1%)	16 (12.1%)	
Other	34 (29.3%)	45 (34%)	
Education status			p=0.842
<High School	22 (19.2%)	28 (21.2%)	
High School	28 (22.8%)	22 (16.6%)	
University	66 (57.8%)	82 (62.1%)	
Income			p=0.006
<Minimum wage	42 (36.2%)	86 (65.1%)	
Minimum wage	40 (34.4%)	14 (10.6%)	
>Minimum wage	34 (29.3%)	32 (24.2%)	
Place of residence			p=0.668
City	82 (71.2%)	88 (67.7%)	
Town	30 (25.4%)	40 (30.8%)	
Village	4 (3.4%)	4 (1.5%)	
Smoking status			p=0.141
Current smoker	68 (58.6%)	50 (37.8%)	
Never smoked	48 (41.3%)	80 (62.1%)	
Fagerström Nicotine Dependence Score (mean)	3.8±2.34	3.04±2.79	p=0.207
Package year	21.30±23.5	16.68±17.53	p=0.225
Daily cigarette consumption (mean)	12.25±2.8	9.32±1.9	P=0.001

2.1. Study Group Smoking Features

One hundred and sixteen (44.3%) participants smoked. Their mean age at starting smoking was 20.2±6.9 (12-52) years, and the mean duration of smoking was 21.7±12.9 years. They consumed an average of 10.47±1.8 cigarettes a day. The study group's mean FTND score was 3.45±2.56 (0-9) and their mean package/year value was 19.34±21.14 (min 2, max 145).

There was no significant gender difference in terms of the mean value of Fagerstrom Nicotine Dependence Score (men=3.8±2.34 vs. women=3.04±2.79, p=0.207) and package/year (men=21.30±2.8 vs. women=16.68±17.53, p=0.225). However, men participants consumed more daily cigarettes compared with women participants (12.25±2.8 vs. 9.32±1.9 p<0.001).

2.2. The Participants' Oral Health Features

The mean number of decayed teeth among the participants was 1.54±2.11 (min 0, max 12). The mean number of missing teeth was 3.57±3.9 (min 1, max 19), and the mean number of filled teeth was 4.47±3.82 (min 0, max 16). The mean DMFT index value was 9.58±6.08 (min 1, max 28).

A comparison of missing, decayed, and filled teeth numbers and DMFT index values between the study and control groups is presented in Table 2.

Table 2: Comparison between the study and control group in terms of numbers of missing, decayed, and filled teeth and DMFT index values

	Study Group n=116	Control Group n=132	U	P
Decayed teeth	1.71±2.01	1.38±2.13	1665.5	0.182
Missing teeth	4,14±4,08	3,06±3,68	1286	0.001
Filled teeth	5.22±4.27	3.78±3.24	1565	0.077
DMTF index	11.27±6.14	8.23±5.76	1354.5	0.005

A significant difference was observed between the groups in terms of the number of missing teeth and DMFT index values (p<0.05), but no significant difference was determined in terms of the average numbers of decayed and filled teeth (p>0.05).

The patients' oral hygiene practices were also investigated. One hundred fourteen (46%) brushed their teeth at least twice a day, 84 (33.9%) once a day, and 50 (20.2%) only occasionally. One hundred thirty (50%) claimed to brush their teeth for more than two minutes on each occasion. In addition, 170 (68.5%) patients reported visiting a dentist only in case of oral health problems, while 54 (21.8%) made regular visits and 24 (9.7%) occasional visits. One hundred eighty-two (73.4%) reported having undergone a dental examination in the previous year. The mean number of dental examinations in the past five years was 1.2±0.8.

An intergroup comparison of teeth brushing frequencies and durations, dental examinations in the previous year, and the mean number of dental examination visits in the last five years is presented in Table 3.

Table 3: Comparison of the study and control groups in terms of teeth brushing frequencies, brushing durations, dental examinations in the previous year, and mean numbers of dental examination visits in the previous five years

Variables	Study Group n=116	Control Group n=132	p
Teeth-brushing frequency			0.006
At least twice a day	42 (37.3%)	70 (53.8%)	
Once a day	36 (30.5%)	48 (36.9%)	
Occasionally	38 (32.2%)	14 (9.2%)	
Brushing duration			0.007
< two minutes	52 (62.7%)	50 (38.5%)	
>two minutes	44 (37.3%)	82 (61.5%)	
Did you have a dental examination last year?			0.078
Yes	72 (62.7%)	108 (83.1%)	

No	44 (37.3%)	24 (16.9%)	
The mean number of dental visits in the previous five years	2.02±1.7	1.03±1.8	0.002

This revealed significant differences between the groups in terms of teeth-brushing frequency, brushing duration, and mean number of dental visits in the previous five years ($p<0.005$).

2.3. The Relationship between the DMFT Index and Mean Missing Teeth Numbers and Smoking Features.

The mean age at first tooth loss among the patients in the study was 18.56±8.59 years (min 11, max 60). Mean ages at first tooth loss differed significantly between the study (20.63±9.68) and control (16.68±7.01) groups ($t=1.403$, $p<0.001$).

Statistically significant positive relationships were observed in the study group between the mean number of missing teeth and the number of cigarettes smoked daily ($r=0.288$, $p=0.027$), package years ($r=0.436$, $p<0.001$), and the FTND ($r=0.298$, $p=0.017$). The DMFT Index was also significantly positively correlated with the number of cigarettes smoked daily ($r=0.347$ $p<0.001$), package years ($r=0.326$, $p=0.012$), and the FTND ($r=0.329$, $p=0.014$).

The Linear Regression Model for the DMFT Index in Smokers.

We tested four independent variables (age, pack years, FTND score, and tooth brushing frequency) in linear regression models for the mean number of missing teeth and DMTF index.

There was a statistical relationship between age (95%CI: 0.004-0.291), FTND (95%CI 0.191-1.427), and teeth brushing frequency (95%CI: -7.378-1.296) ($p<0.05$) and the DMFT index ($R2=0.619$, $F=7,772$, $p<0.001$) in smoker participants. The regression analysis investigating the relationship between the DMFT index and other independent variables is presented in Table 4.

Table 4: Linear regression model of the relationship between DMFT Index and other independent variables (age, pack-year, FTND, and teeth brush frequency)

Model	Unstandardized Coefficients		t	**Sig**	95.0% Confidence Interval for B	
	B	Std Error			Lower Bound	Upper Bound
Constant		3.335	1.283	0.205	-2.434	11.042
Age	0.338	0.071	2.068	0.014	0.004	0.291
Pack-year	-0.150	0.045	-0.913	0.366	-0.131	0.049
FTND	0.350	0.306	2.660	0.010	0.199	1.427
Teeth Brushing Frequency	-0.350	1.514	-2.864	0.006	-7.378	-1.296
Mean Number of Cigarettes Consumed a Day	0.960	1.401	8.874	0.001	0.967	3.457

a. Dependent Variable: DMFT score

III. DISCUSSION

We selected patients with periodontal diseases for this study. By comparing smoker and non-smoker participants in terms of tooth decay, tooth loss, and DMTF index values we sought to compare the cumulative risk of smoking on periodontal diseases with other known risk factors. Our results confirmed that smoker patients (the study group) with periodontal disease not only registered higher DMTF index scores, but also had more filled, decayed, and missing teeth than non-smokers (the control group). The smokers in our study scored nearly 3 points higher on the DMTF index than the non-smokers. They also had an average of 1.5 more lost teeth, 1.5 more filled teeth, and 0.4 more decayed teeth than non-smokers. The results confirmed that 61% of the score increase in the DMFT is related to the independent variables in our linear regression model.

Our results indicated that numbers of missing teeth and DMFT index scores increase in line with the number of cigarettes consumed per day (r=0.288 and r=0.347, respectively), the amount smoked (pack years) (r=0.436 and r=0.326, respectively), and the FTND (r=0.298 and r=0.329, respectively). Several studies have determined that the risk of tooth loss increases in line with the amount and duration of smoking (26, 27). Similarly, to our results, Ilhan et al. identified older age (>65 years), female gender, low education status, smoking 11-40+ cigarettes a day, and being employed as risk factors for tooth decay and loss in Turkey (28). A very large cohort study from Finland reported that the duration of smoking was also associated with tooth loss, with individuals who had smoked for several years having a significantly higher probability of tooth loss than those who had not. In this study, individuals who had smoked for more than 30 years had a higher risk of tooth loss than those who had smoked for a shorter period (RR = 1.66, 95 % CI = 1.29–2.12) and those who had never smoked (RR = 1.72, 95 % CI = 1.20–2.45) (29). Carson et al. (30) also reported a strong dose-dependent association between cigarette smoking and the risk of tooth loss. Interestingly, those authors also reported that the risk of tooth loss declines after cessation of cigarette smoking, but may remain elevated for up to 20 years compared with individuals who have never smoked. A study from Australia investigated the incidences of periodontal diseases and tooth loss among the 911 initial participants and compared these with the remaining 693 participants (76.1%) two years later. Relative risks were calculated for population subgroups, and multivariate logistic regression was applied to construct risk prediction models in that research. Approximately 19.5% (95% CI = 15.4-23.6%) of individuals lost one or more teeth during this two-year period. Men, individuals with recent tooth extractions, those who brushed their teeth infrequently, smokers, and participants born outside Australia exhibited a significantly ($p< 0.05$) greater risk of tooth loss. Baseline clinical predictors of tooth loss included a greater number of missing teeth, retained roots, decayed root surfaces, periodontal pockets, and periodontal recession. In a multivariate model that controlled for baseline clinical predictors, former smokers (RR = 2.55, 95% CI = 1.48-4.40) and current smokers (RR= 2.06, 95% CI= 0.92-4.62) exhibited similarly elevated risks of tooth loss compared with non-smokers (31). Mai et al. (27) investigated tooth loss in postmenopausal women (n = 1.106). After adjusting for age, education, income, body mass index, history of diabetes, calcium supplement use, and frequency of dental visits, those authors reported that heavy smokers (≥ 26 pack-years) were significantly more likely to report tooth loss compared with individuals who had never smoked (OR = 1.82; 95% CI, 1.10-3.00). Smoking status, packs smoked per day, years of smoking, pack-years, and years since quitting smoking were significantly associated with tooth loss due to periodontal diseases. Patients with high pack-year values included in the study had a dramatically higher risk of tooth loss compared to individuals who had never smoked (OR = 6.83, %95 percent CI, 3.40 -13.72). Interestingly, there was no significant association between smoking and tooth loss due to caries in this study. Haniaka et al. (32) investigated the relationship between smoking and tooth loss based on the dental records of 3,999 individuals aged over 40 in Japan. The overall prevalence of tooth loss in terms of having fewer than 19 existing teeth was 37.3%. Smoking rates differed between males (45.6%) and females (7.8%). The prevalence of tooth loss in non-smokers, former, and current smokers were 28.5%, 38.6%, and 36.9% in males, and 38.6%, 34.3%, and 38.9% in females, respectively. Adjusted mean numbers of existing teeth after controlling for confounders by smoking status were 21.5, 19.7, and 18.2 in men and 19.0, 19.2, and 16.4 in women, respectively. The association with tooth loss was non-significant in former smokers but significant in current smokers: adjusted odds ratios (95% confidence intervals) for non-smokers were 0.86 (0.46, 1.60), compared to 1.29 (0.92-1.80) for former smokers and 2.22 (1.61-3.06) current smokers, respectively. A dose-response relationship was observed between lifetime exposure to smoking and tooth loss (p for trend <0.001). A study from Italy involving young (<40 years) military personnel (94.6% men and 5.4% women) reported higher DMFT scores in smokers compared to non-smoking personnel (33).

Consistent with our results, a large cohort study based on five years of patient records in a periodontal department in Turkey reported mean DMFT scores of 12.9±6.4 in smokers and 11.6±6.7 in non-

smokers (34). The mean DMFT score in that study is similar to our own results since the participants were also selected from patients with periodontal diseases. That study also reported a close relationship between the amount of cigarettes smoked per day and the severity of periodontal diseases. Golmohamadi et al. (35) also observed saliva pH and DMFT index scores in their smoking study population. The mean DMFT values in that research were 7.60±0.5 for smokers and 4.80±0.5 for non-smokers. Our DMFT index scores in both groups were higher than those reported by Golmohamadi et al., although that study was population-based.

One of the interesting findings of this study concerns the time of initial tooth loss in both groups. The participants in the control group (non-smokers) lost their first teeth an average of four years later than the smokers. However, the study group lost their first teeth an average of one year after starting smoking. A large cohort study from Finland found that tooth caries increase after four years of smoking in adults (36). Benedetti et al. (3) also confirmed that tobacco smoking is closely associated with an increased risk of caries, although there were differences between smokers and non-smokers in terms of education, economic status, and oral health care routines in their research. Several investigations have shown that smokers tend to have poor eating habits, pay less attention to oral self-care, rarely seek professional medical treatment, and exhibit poor compliance after treatment (37). All these factors may affect the increasing incidence of caries. In the present study, the frequency and duration of tooth brushing in the case group were significantly lower than those in the control group. In the light of these findings, it may be speculated that smokers attach less importance to oral hygiene than non-smokers. Our results revealed that the members of the study group more frequently brushed their teeth less than twice a day and for less than two minutes on each occasion compared to the control group. Brushing twice a day for more than two minutes on each occasion is known to be essential for oral and dental health (38). It therefore appears highly likely that the effect of smoking increased the risk of periodontal disease in our selected patients.

Although the frequency of dental examinations in the previous year in our case group was significantly lower than that in the control group, there was no significant difference in terms of the frequency of dental examinations. The low frequency of dental visits in the previous year among smokers may be attributed to lower socioeconomic and cultural status, a generally negative attitude towards preventive health services, the inability to afford dental services, and regional differences in such services.

This study has a number of strengths and weaknesses. As described, we selected our patients from individuals who already had periodontal disease. Only patients who smoked continually after adopting the habit or who had never smoked were included in the study. This helped us isolate the effect of smoking among the complex risk factors for periodontal diseases. Different participants with different smoking parameters, such as ex-smokers, have been included in other study populations. While the number of cigarettes per day and FTND scores were used for the short-term measurement of the amount of cigarette smoke to which the cases were exposed, pack/year units were used in the long term. The contents of the cigarettes smoked also differ from one another, and the effects of the smoke to which individuals are exposed to may also differ from person to person.

It is not possible for this study to represent normal tooth loss and periodontal disease rates in the normal population. However, periodontal disease rates in Turkey are estimated to very high, as reported in a large multicenter cohort including 9500 participants (aged between 18 and 79), in which the average DMFT score was 6.72 ± 4 (38). Additionally, the smoking rate among the cases included in the present study was higher than that of the normal population in Turkey. Approximately 47.8% of the individuals in this study were smokers. According to the 2016 Turkish Global Adult Tobacco Survey, 31.6% of Turkish adults (age 15+) currently smoke tobacco (44.1% of men and 19.2% of women) (39). This may have affected our results.

4.1. Conclusions

We observed a clear intensity- and duration-dependent relationship between smoking and tooth loss among adults with access to subsidized dental care and in good oral health. The study findings reveal that smoking is a major risk factor for tooth decay and tooth loss. Smokers also registered higher DMTF scores than non-smokers. It may be very useful for physicians involved in smoking cessation activities and therapies to obtain information about the oral and dental health of their patients. This information may also affect patients' motivation to quit smoking. Further studies involving long-term follow-up and evaluating changes in periodontal, oral, and dental health after smoking cessation process will be very useful.

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