

THE ASSOCIATION BETWEEN SMOKING AND THE STAGE OF PERIODONTITIS

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ABSTRACT

Introduction: Periodontitis is considered to be a complex disease of multifactorial origin. While periodontitis is unquestionably initiated by bacteria, several modifying and predisposing factors determine the clinical presentation and progression of periodontitis. In 2017 classification, smoking is regarded as a significant risk factor in the grade of periodontitis. Although the association between the grade of periodontitis and smoking was reported, the relationship between smoking and the stage of periodontitis has not been well-characterized. Therefore, the aim of this study is to determine how the influence of smoking is on the stage of periodontitis.

Methods: A total of 1194 individuals were included in the study. Clinical examination, the diagnosis of periodontitis and staging system were performed by an calibrated examiner. Demographic information and smoking history were conducted with a face-to face interview by another investigator who was blind to the stage of periodontitis. Three smoking variables; smoking cigarettes per day, smoking duration and pack-years of smoking were analyzed.

Results: The mean age was 39.67 ± 10.95 . The mean number of smoking cigarettes per day was 13.84 ± 8.71 , the mean year of smoking duration was 16.56 ± 9.76 and the mean number of pack-years of cigarette smoking was 12.85 ± 12.71 . There was a statistically significant difference between the stage groups and the mean number of three smoking variables ($p < 0.05$).

Conclusion: There was a statistically significant association between smoking and the stage of periodontitis. As the mean number of smoking variables increases, the stage of periodontitis increases as well.

Key words: periodontitis, classification, risk factors, smoking.

Introduction

Periodontitis is a multifactorial inflammatory disease and leads to destruction of the supporting structure of teeth.¹ Although periodontitis is initiated by bacteria, several factors such as alcohol consumption, socioeconomic status, obesity, stress² and smoking determine the clinical outcome and progression of the disease.^{3,4} Among these risk factors, smoking has emerged as the strongest preventable risk factor for periodontitis.^{5,6} Several epidemiological research studies presented the association between smoking and periodontitis and it is well-established that smoking increases the risk of periodontitis.⁷⁻⁹

The knowledge on the harmful effect of smoking has been improved since the relation between smoking and periodontal disease was mentioned for the first time as early as 1947.¹⁰ Developed knowledge indicates that smoking is a very important confounder in periodontal health and smoking history should be considered in the clinical diagnosis.¹¹ In the 2017 classification, staging and grading system was designed for diagnosis of

periodontitis.¹² According to new classification, the current level of smoking influences the grade of periodontitis which is used as an indicator of the rate of periodontitis progression and disease susceptibility.¹²

Although the new 2017 classification system determines the effect of smoking on the grade of periodontitis, the relationship between smoking and the stage of periodontitis has not been well-characterized. Therefore, the aim of this study is to determine how the influence of smoking is on the stage of periodontitis.

Materials and Methods

This study was conducted from September 2018 to February 2019 at Usak University, Faculty of Dentistry. A total of 1194 subjects whose ages were 18 year old and over were included in the study. To fully and accurately understand the effect of smoking on the stage of periodontitis, the participants met the following inclusion criteria: 1) diagnosed with periodontitis, 2) current smokers who continued to smoke and never quit smoking¹³; 3)

voluntary participation, 4) no alcohol consumption, 5) no diabetics, 6) brushing teeth at least once a day, 7) body mass index ≤ 30 kg/m²; 8) not being under any medication that could affect the periodontal conditions and not having received periodontal treatment in the past 6 months. Never smokers who reported smoking fewer than 100 cigarettes in lifetime, former smokers and individuals with a history of smoking cessation were excluded from the study.¹³

The study consists of clinical examination and questionnaire. The questionnaire includes demographic information (age, gender) and smoking history. Clinical examination and diagnosis of the stage of periodontitis were established by an investigator. After that, the questionnaire was conducted with a face-to face interview by other investigator who was blind to the stage of periodontitis. The study was approved by the Local Ethics Committee of Usak University and all the participants provided their written informed consent prior to the commencement of the study.

The patients were diagnosed according to the 2017 classification.¹² Patient was defined as a periodontitis if interdental clinical attachment loss (AL) was detectable at ≥ 2 non-adjacent teeth, or buccal or oral AL ≥ 3 mm with pocketing ≥ 3 mm is detectable at ≥ 2 teeth. Stage was used to classify the severity and the extent of destroyed and damaged tissue attributable to periodontitis (Stage I-II-III-IV). Interdental AL at the site of greatest loss is used to definition for four stages of periodontitis. In the presence of complexity factors, stage was shifted to a higher level.¹²

Smoking behavior was ascertained by a self-report. All smokers reported their number of smoking cigarettes per day and year of smoking duration. Pack-years of cigarette smoking was calculated in attempt to account complete smoking exposure. Pack-years calculated as the year of smoking duration multiplying by packet smoked per day.¹⁴ Intra-examiner variabilities for probing depth (PD) and AL measurements were assessed. The reproducibility of the parameters was verified by kappa coefficient. The kappa coefficient was 0.80 for PD and 0.68 for AL, which indicates substantial agreement.

Data analysis was performed by using the software Statistical Package version 17.0[#]. Descriptive statistics was used for each stage category to determine the mean values of three variables. Non-parametric Kruskal Wallis was used for comparison of the smoking variables and the stage of periodontitis. The data were presented as mean and standard deviation and statistical significance level was set at 0.05.

[#] SPSS Inc., Chicago, IL, USA

Results

A total of 1194 subjects, 756 (63.3%) male and 438 (36.7%) female, participated in the study. The age of the participants ranged from 18 to 70 and the mean age was 39.67 ± 10.95 . The mean number of smoking cigarettes per day was 13.84 ± 8.71 and the mean year of smoking duration was 16.56 ± 9.76 . The mean number of pack-years of cigarette smoking was 12.85 ± 12.71 . In the periodontal examination, 444 (37.2%) participants were diagnosed as stage I and 156 (13.1%) participants were diagnosed as stage IV. Table 1 presents the stage distribution of patients.

In stage I, there were 444 (258 male, 186 female) individuals. The mean age of stage I was 31.03 ± 8.7 . The mean number of smoking cigarettes per day was 9.76 ± 6.91 , the mean year of smoking duration was 9.49 ± 7.07 and the mean number of pack-years of cigarette smoking was 5.04 ± 5.71 (Table 2).

In stage II, there were 324 (210 male, 114 female) participants. The mean age was 42.96 ± 9.12 . The mean number of smoking cigarettes per day was 13.67 ± 9.42 , the mean year of smoking duration was 17.33 ± 8.53 and the mean number of pack-years of cigarette smoking was 12.15 ± 11.46 (Table 3).

In stage III, there were 270 (192 male, 78 female) patients. The mean age was 46.2 ± 8.05 . The mean number of smoking cigarettes per day was 16.82 ± 5.59 , the mean year of smoking duration was 22.38 ± 6.75 and the mean number of pack-years of cigarette smoking was 18.75 ± 8.04 (Table 4).

In stage IV, there were 156 (96 male, 60 female) individuals. The mean age was 46.15 ± 8.52 . The mean number of smoking cigarettes per day was 20.65 ± 10.21 , the mean year of smoking duration was 25.0 ± 9.50 and the mean number of pack-years of cigarette smoking was 26.31 ± 18.95 (Table 5).

There was a statistically significant difference between the stage groups and the mean number of smoking cigarettes per day ($p < 0.05$). The mean number of smoking cigarettes per day for stage I was significantly lower than the ones in other stage groups. Although the mean number of smoking cigarettes per day was increased as the stage groups increased, there were individuals who smoked 30 cigarettes per day in stage I and there were those who smoked 5 cigarettes per day in stage IV.

There was a statistically significant difference between the stage groups and the mean year of smoking duration ($p < 0.05$). The mean year of smoking duration for stage IV was significantly higher than the ones in other stage groups. In spite of the statistically significant difference, there were individuals in stage I who had been smoking for 30 years.

There was a statistically significant difference between the stage groups and the mean number of pack-years of

cigarette smoking ($p < 0.05$). The mean number of pack-years of cigarette smoking for stage II was significantly lower than the ones in stage III and stage IV. In incompatible with statistically significant difference, as the stage group increased, the minimum and maximum number of pack-years of cigarette smoking did not increase. In stage II, there were individuals whose pack-years of smoking was 42.5 and higher than the one in the patients of stage III.

Discussion

Smoking has been established as the strongest risk factor for periodontitis over the past three decades.^{5, 15} Since the new classification was established, smoking has been a risk factor which is able to shift the grade definition to rapid progression. Smoking is an essential element for the proper diagnosis and direct measurement of smoking history has main importance in clinical practice. It is, however, unknown how the stage of periodontitis changes as a function of smoking. At this point, we want to identify the relationship between smoking and the stage of periodontitis.

To determine the cumulative effect of smoking on periodontitis, evaluating the lifetime smoking history as accurate as possible has a great importance.¹⁶ For this purpose, pack-years of cigarette smoking, smoking duration and the number of smoking per day were used in this study. These three variables are old and simple methods that were used as the powerful predictor of the risk of various smoking-related diseases.^{17, 18}

In this current study, there was a statistically significant difference between the stage of periodontitis and the mean number of three variables of smoking. As the mean number of these variables increase, the destroyed and damaged tissue attributable to periodontitis increases as well. Our results were confirmed by Tomar et al. who established a dose-response association between smoking and the severity of periodontitis.⁶ Several cross-sectional studies which investigated the dose-effect of smoking on the severity of periodontitis reported that heavy smoking was strongly associated with more severe periodontitis than light smoking.¹⁹ It was also observed that patients with high number of smoking years were significantly associated with more periodontal destruction irrespective of other social and behavioral factors.²⁰ The longer years one smoked and the more cigarettes one smoked per day, the more had chance to the higher stage of periodontitis.¹¹

In this study, although there was a relationship between three smoking variables and the stage of periodontitis, the presence of individuals who do not comply with this

relationship is a fact. In particular, we highlight some possibilities. Firstly, these three variables of smoking may not be comprehensive smoking indexes and they may not account for various characteristics of smoking as a function of its biological effect in all situations despite being shown to have a positive correlation with periodontitis progression.¹¹ Secondly, although we controlled the other risk factors and the potential confounders related to periodontitis, the multifactorial etiology of periodontitis may explain this condition. Because initiation and the progression of periodontitis is the result of many interactions between inflammation, immune response and different environmental and host factors.²¹ In this instance, it is difficult to establish a clear risk assessment for the effect of smoking on the stage of periodontitis at the level of the individual. In addition this does not negate the importance of risk factors assessment. Because reduction and elimination of risk factors are essential in periodontal management.

Conclusion

The evaluation of the association between the stage of periodontitis and smoking is necessary for proper diagnosis and treatment. Knowing this relationship can significantly increase the clinician's ability to make accurate predictions. In the light of the existing evidence, it is known how the stage of periodontitis changes as a function of increasing smoking exposure and it can be concluded that there is a statistically significant association between smoking and the stage of periodontitis despite encountering rare examples.

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Table 1: The stage distribution of the patients

Stage classification	n	%
SI	444	37.2
SII	324	27.1
SIII	270	22.6
SIV	156	13.1

Table 2: The smoking and demographic information of stage I

		Gender	n	Mean±sd.	Min	Max
Stage I	Age	Male	258	32.74±9.07	18	51
		Female	186	28.65±7.68	18	51
		Total	444	31.03±8.70	18	51
	The number of smoking cigarettes per day	Male	258	10.79±7.28	1	30
		Female	186	8.32±6.19	1	20
		Total	444	9.76±6.91	1	30
	The year of smoking duration	Male	258	10.51±7.09	1	25
		Female	186	8.06±6.89	1	30
		Total	444	9.49±7.07	1	30
	The pack-years of smoking	Male	258	5.81±6.31	0.2	25.0
		Female	186	3.98±4.65	0.1	15.0
		Total	444	5.04±5.71	0.1	25.0

sd: standart deviation

min: minimum number of the variable in group

max.: maximum number of the variable in group

Table 3: The smoking and demographic information of stage II

			n	Mean±sd.	Min	Max
Stage II	Age	Male	210	43.11±9.61	27	66
		Female	114	42.68±8.39	24	58
		Total	324	42.96±9.12	24	66
	The number of smoking cigarettes per day	Male	210	15.23±10.44	1	50
		Female	114	10.79±6.49	2	20
		Total	324	13.67±9.42	1	50
	The year of smoking duration	Male	210	18.89±8.68	1	35
		Female	114	14.47±7.66	5	30
		Total	324	17.33±8.53	1	35
	The pack-years of smoking	Male	210	14.48±12.89	0.2	62.5
		Female	114	7.86±6.53	0.5	22.0
		Total	324	12.15±11.46	0.2	62.5

Table 4: The smoking and demographic information of stage III

classification		Gender	n	Mean±sd.	Min	Max
Stage III	Age	Male	192	44.28±8.28	31	70
		Female	78	50.92±5.14	38	59
		Total	270	46.20±8.05	31	70
	The number of smoking cigarettes per day	Male	192	17.00±5.74	3	30
		Female	78	16.38±5.39	5	20
		Total	270	16.82±5.59	3	30
	The year of smoking duration	Male	192	22.41±7.35	5	40
		Female	78	22.31±5.25	15	30
		Total	270	22.38±6.75	5	40
	The pack-years of smoking	Male	192	18.96±8.35	2.5	30.0
		Female	78	18.23±7.51	5.0	30.0
		Total	270	18.75±8.04	2.5	30.0

Table 5: The smoking and demographic information of stage IV

			n	Mean±sd.	Min	Max
Stage IV	Age	Male	96	45.88±8.72	35	68
		Female	60	46.60±8.62	31	60
		Total	156	46.15±8.52	31	68
	The number of smoking cigarettes per day	Male	96	23.13±8.73	10	40
		Female	60	16.70±11.59	5	40
		Total	156	20.65±10.21	5	40
	The year of smoking duration	Male	96	26.19±8.63	5	40
		Female	60	23.10±10.95	10	45
		Total	156	25.00±9.50	5	45
	The pack-years of smoking	Male	96	28.72±12.88	10.0	60.0
		Female	60	22.45±26.34	4.5	90.0
		Total	156	26.31±18.95	4.5	90.0

Table 6: The association between the stage groups and smoking variables

		n	Mean±s		H	p
The number of smoking cigarettes per day	Stage I	444	9.76±6.91	1	39.906	0.001*
	Stage II	324	13.67±9.42	1		
	Stage III	270	16.82±5.59	3		
	Stage IV	156	20.65±10.21	5		
The year of smoking duration	Stage I	444	9.49±7.07	1	76.288	0.001*
	Stage II	324	17.33±8.53	1		
	Stage III	270	22.38±6.75	5		

	Stage IV	156	25.00±9.50	5	45		
The pack-years of smoking	Stage I	444	5.04±5.71	.1	25.0	85.683	0.001*
	Stage II	324	12.15±11.46	.2	42.5		
	Stage III	270	18.75±8.04	2.5	30.0		
	Stage IV	156	26.31±18.95	4.5	90.0		

* p<0.05

Continuous variables are shown as mean ± standard deviation and median *There was a statistically significant difference between the stage groups and the mean number of smoking cigarettes per day, the year of smoking duration and the pack years of smoking (p <0.05) Non-parametric Kruskal Wallis tests