J Periodontal Implant Sci. 2023 Apr;53(2):135-144
hpps://doi.org/10.5051/jpis.2202560128
pISSN 2093-2278·eISSN 2093-2286

JPIS
Journal of Periodontal & Implant Science

Research Article
Periodontal Science

Check for updates

A retrospective epidemiological investigation of periodontitis risk and current smoking status based on the number of cigarettes per day and the Fagerström Test for Nicotine Dependence: a preliminary pilot study

OPEN ACCESS

Received: May 23, 2022
Revised: Jul 22, 2022
Accepted: Aug 30, 2022
Published online: Oct 11, 2022

***Correspondence:**
Jae-Hong Lee
Department of Periodontology, College of Dentistry and Institute of Oral Bioscience, Jeonbuk National University, 20 Geonji-ro, Deokjin-gu, Jeonju 54907, Korea.
Email: ljaehong@gmail.com
Tel: +82-63-250-2114
Fax: +82-63-250-2114

ORCID iDs
Ji-Hoo Han
https://orcid.org/0000-0001-9487-8284
Seong-Nyum Jeong
https://orcid.org/0000-0003-4890-989X
Jae-Hong Lee
https://orcid.org/0000-0002-2375-0141

Funding
This work was supported by Wonkwang University in 2023.

Conflict of Interest
No potential conflict of interest relevant to this article was reported.

Ji-Hoo Han [1], **Seong-Nyum Jeong** [1], **Jae-Hong Lee** [2,3,*]

[1]Department of Periodontology, Daejeon Dental Hospital, Institute of Wonkwang Dental Research, Wonkwang University College of Dentistry, Daejeon, Korea
[2]Department of Periodontology, College of Dentistry and Institute of Oral Bioscience, Jeonbuk National University, Jeonju, Korea
[3]Research Institute of Clinical Medicine of Jeonbuk National University-Biomedical Research Institute of Jeonbuk National University Hospital, Jeonju, Korea

ABSTRACT

Purpose: The aim of this study was to investigate the risk of periodontitis according to current smoking status based on the number of cigarettes smoked per day (CPD) and the Fagerström Test for Nicotine Dependence (FTND).
Methods: All enrolled patients were diagnosed and classified according to the new periodontal classification scheme, and current smoking status was investigated via a self-reported questionnaire. The correlation between smoking status (CPD and FTND) and periodontitis risk (severity of periodontitis and tooth loss due to periodontal reasons) was statistically assessed using Spearman correlation coefficients. Moreover, partial correlation analyses between smoking and periodontal status were performed after adjusting for age, sex, and diabetes mellitus.
Results: Overall, data from 74 men and 16 women (mean age: 48.1±10.8 years) were evaluated. The mean number of missing teeth, CPD, and FTND score were 3.5±5.2, 24.6±15.5, and 3.5±2, respectively. CPD and the FTND were significantly positively correlated with each other (r=0.741, P<0.001). CPD and the FTND were also significantly correlated with the severity of periodontitis (CPD: r=0.457, P<0.05 and FTND: r=0.326, P<0.05) and the number of missing teeth due to periodontal reasons (CPD: r=0.525, P<0.05 and FTND: r=0.480, P<0.05), respectively.
Conclusions: Within the limitations of this study, both CPD and the FTND were significantly correlated with the severity of periodontitis and the number of periodontally compromised extracted teeth.

Keywords: Periodontal diseases; Periodontitis; Smoking; Tobacco use disorder; Tooth loss

JPIS
Journal of Periodontal & Implant Science

Author Contributions

Conceptualization: Ji-Hoo Han, Jae-Hong Lee, Seong-Nyum Jeong; Formal analysis: Ji-Hoo Han, Jae-Hong Lee, Seong-Nyum Jeong; Investigation: Ji-Hoo Han, Jae-Hong Lee, Seong-Nyum Jeong; Methodology: Ji-Hoo Han, Jae-Hong Lee, Seong-Nyum Jeong; Project administration: Ji-Hoo Han, Jae-Hong Lee, Seong-Nyum Jeong; Writing - original draft: Ji-Hoo Han, Jae-Hong Lee, Seong-Nyum Jeong; Writing - review & editing: Ji-Hoo Han, Jae-Hong Lee, Seong-Nyum Jeong.

INTRODUCTION

Periodontitis is a chronic oral disease induced by host-mediated inflammation, which results in the loss of periodontal attachment and alveolar bone support [1]. Dental plaques are known as a major cause of periodontitis, and some specific periodontal pathogens, such as *Porphyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythia*, are associated with local disease progression and the systemic inflammatory response [2]. Recent studies support a bidirectional interaction between periodontitis and major lifestyle-related diseases, and studies on the underlying mechanisms between periodontitis and various systemic inflammatory diseases continue to be conducted [3-5].

Extensive epidemiological, observational, and clinical studies have identified common etiological causes and risk factors, such as poor oral hygiene, lack of regular dental maintenance, diabetes mellitus, and smoking, associated with the severity and extent of periodontitis [6-8]. In particular, over the past decade, numerous clinical and epidemiological studies have suggested a possible causative role of cigarette smoking in periodontitis [9-11]. A recent systematic review showed that smoking was consistently associated with the prevalence of periodontitis (odds ratio [OR]=2.78; 95% confidence interval [CI], 2.23–3.48; P<0.05) [12]. Another recent systematic review and meta-analysis also confirmed that current smoking has a detrimental and serious effect on the incidence and progression of periodontitis (risk ratio=1.85; 95% CI, 1.5–2.2), and suggested that smoking cessation reduces the risk of periodontitis by approximately 14% [13].

In most periodontal-related studies, current smoking status, which is a recognized risk factor for periodontitis, was simply classified into smoking and non-smoking or was evaluated by the number of cigarettes smoked per day (CPD) [12,13]. The Fagerström Test for Nicotine Dependence (FTND), which comprises 6 simple questions and is another indicator of current smoking status, is a widely used instrument for assessing the intensity of physical addiction to nicotine. Several epidemiological studies have confirmed its usefulness and reliability [14-16]. Many medical researchers have preferred the FTND for assessing the association between current smoking status and various health-related problems [17-19]. Nevertheless, research evaluating the clinical efficacy of the FTND in dentistry, especially in periodontology, is relatively scarce [20,21]. Therefore, we hypothesized that the FTND could enhance or improve CPD as an indicator of current smoking status in periodontal research. This preliminary, pilot study aimed to investigate the association between periodontitis risk and current smoking status based on CPD and the FTND.

MATERIALS AND METHODS

Ethical statements

This study was approved by the Institutional Review Board (IRB) of Daejeon Dental Hospital, Wonkwang University College of Dentistry (approval No. W2201/001-001), and written according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [22]. Because this study was designed as a retrospective cross-sectional study, the IRB waived the requirement for informed consent from participants.

https://doi.org/10.5051/jpis.2202560128

Participants

All patients were recruited from the Department of Periodontology at Daejeon Dental Hospital, Wonkwang University, from January 2021 to December 2021. The following inclusion criteria were applied: 1) age ≥20 years, 2) generalized periodontitis (≥30% of teeth involved), and 3) current smoking status (≥1 cigarette per day). The following exclusion criteria were established: 1) non- or former smoker, 2) localized periodontitis, 3) previous periodontal treatment, and 4) any treatment or intake of medications that could influence bone turnover, including antiresorptive agents, chemotherapy, and radiotherapy.

Classification of periodontitis

Patients' periodontal status was diagnosed and classified according to the new periodontal classification scheme, which was released by the American Academy of Periodontology and the European Federation of Periodontology in 2018 [10]. The determination of periodontal staging (I/II/III/IV) and grading (B/C) was performed by a single periodontist (JHH) based on clinical (bleeding on probing, pocket probing depth, gingival recession, clinical attachment level, tooth mobility, furcation impairments, secondary occlusal trauma, bite collapse, drifting or flaring, occlusal pairs, and periodontally related tooth loss) and radiographic (periodontally compromised tooth related bone loss) parameters noted at the time of the first visit [23]. To achieve intra-examiner reliability and validity, 10 patients were randomly selected and diagnosed twice according to the new periodontal classification scheme based on electronic medical and dental records and dental panoramic and periapical radiographs. The intra-examiner correlation exhibited 85.3% reproducibility.

Current smoking status

All enrolled patients filled out a self-report questionnaire, and current smoking status was investigated using both CPD and the FTND, which is a revision of the Fagerström Tolerance Questionnaire [17]. Current smokers answered a 6-question survey, and were categorized in 1 of 3 groups according to their score: low (0–3 points), moderate (4–6 points), and high dependence (score 7–10 points), using the FTND as follows: 1) "How soon after waking do you smoke your first cigarette?" (available response options: within 5 minutes [3 points]; within 6–30 minutes [2 points], within 31–60 minutes [1 point]; after 60 minutes [0 points]); 2) "Do you find it difficult to refrain from smoking in places where it is forbidden?" (available response options: yes [1 point], no [0 points]); 3) "Which cigarette would you hate to give up?" (available response options: the first one in the morning [1 point], all others [0 points]); 4) "How many cigarettes/day do you smoke?" (available response options: 10 or less [0 points], 11–20 [1 point], 21–30 [2 points], 31 or more [3 points]); 5) "Do you smoke more frequently during the first hours after waking than during the rest of the day?" (available response options: yes [(1 point], no [0 points]); 6) "Do you smoke even if you are so ill, such that you are in bed most of the day?" (available response options: yes [1 point] no, [0 points]).

Statistical analysis

Descriptive variables were reported as frequencies and proportions (%). Spearman correlation analysis was conducted to evaluate the strength of the relationship between current smoking (including CPD and the FTND) and periodontal status (including the stage of periodontitis and number of missing teeth). In addition, the partial correlation coefficient (r) between current smoking and periodontal status was also calculated after adjusting for age, sex, and diabetes mellitus. All statistical analyses were performed using statistical software (SPSS version 28; IBM Corp., Armonk, NY, USA, and JMP version 16.1; SAS Institute, Cary, NC, USA), and $P<0.05$ was considered statistically significant.

https://doi.org/10.5051/jpis.2202560128

JPIS
Journal of Periodontal & Implant Science

RESULTS

Baseline characteristics

Of 1,246 patients who were diagnosed with primary periodontitis, 1,156 were excluded for the following reasons: non- or former smoking (n=1,051), localized periodontitis (n=13), previous periodontal treatment (n=80), declined survey (n=5), and missing data or records not available (n=7). Finally, 90 patients were included and analyzed. Data from 74 men (82.2%) and 16 women (17.8%) patients, with a mean age of 48.1±10.8 years (range: 22–78 years), were evaluated. Those who were aged 40–49 years (n=35) accounted for 38.9% of the eligible patients, and 7 (7.8%) patients had diabetes mellitus. The mean number of missing teeth was 3.5±5.2 (range: 0–20 missing teeth), the mean CPD was 24.6±15.5 (range: 4–60 cigarettes per day), and the mean FTND was 3.5±2.3 (range: 0–8 points). The detailed baseline characteristics of the enrolled patients and relationships between current smoking status (including CPD and FTND) and patients' clinical factors (including sex, age, diabetes mellitus, missing teeth, and periodontitis by stage and grade) are presented in **Table 1**.

Spearman correlation analysis between current smoking and periodontal status

Spearman correlation analysis revealed that CPD positively correlated with the FTND (r=0.741, P<0.05), and both CPD and the FTND were significantly correlated with periodontal status, including the stage of periodontitis and number of missing teeth. Specifically, CPD was more significantly correlated with the stage of periodontitis (r=0.512, P<0.05) than the

Table 1. Baseline characteristics of the enrolled patients (n=90)

Variables	Values
Sex	
Men	74 (82.2)
Women	16 (17.8)
Age group (yr)	
20–29	6 (6.7)
30–39	11 (12.2)
40–49	35 (38.9)
50–59	26 (28.9)
≥60	12 (13.3)
Diabetes mellitus	
Yes	7 (7.8)
Missing teeth[a]	
0	40 (44.4)
1–5	30 (33.3)
6–10	8 (8.9)
11–15	7 (7.8)
≥16	5 (5.6)
Current smoking status	
1–9 cigarettes per day	13 (14.4)
10–19 cigarettes per day	31 (34.4)
≥20 cigarettes per day	46 (51.1)
Stage	
I	8 (8.9)
II	17 (18.9)
III	48 (53.3)
IV	17 (18.9)
Grade	
B	8 (8.9)
C	82 (91.1)

Values are presented as number of patients (%).
[a]Extractions due to periodontal reasons and third molars excluded.

https://doi.org/10.5051/jpis.2202560128

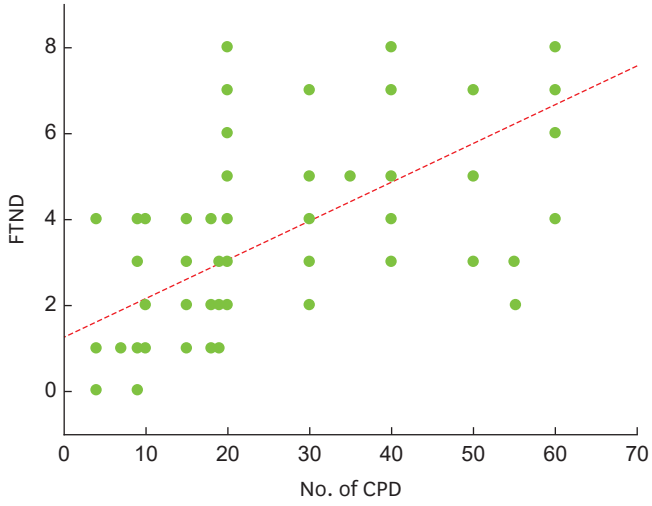

Figure 1. Scatterplot of the association between the number of CPD and FTND. CPD was positively and significantly correlated with the FTND.
CPD: cigarettes smoked per day, FTND: Fagerström Test for Nicotine Dependence.

Table 2. Spearman correlation analysis between current smoking and periodontal status

Variables	CPD	FTND	Stage of periodontitis	Number of missing teeth
CPD	1.000			
FTND	0.741*	1.000		
Stage of periodontitis	0.512*	0.310*	1.000	
Number of missing teeth	0.402*	0.432*	0.367*	1.000

CPD: cigarettes smoked per day, FTND: Fagerström Test for Nicotine Dependence.
Data are expressed as Spearman correlation coefficients, and statistically significant differences are shown with asterisks (P<0.05).

FTND (r=0.310, P<0.05), whereas the FTND exhibited a more significant correlation with the number of missing teeth (r=0.432, P<0.05) than CPD (r=0.402, P<0.05). A scatterplot revealed a positive correlation between CPD and the FTND (**Figure 1**), and the results of a more detailed correlation analysis are presented in **Table 2**.

Partial correlation analysis between current smoking and periodontal status

Partial correlation analyses revealed that CPD was positively correlated with the FTND (r=0.663, P<0.05), and both CPD and the FTND were significantly correlated with periodontal status, including the stage of periodontitis and the number of missing teeth, after adjusting for age, sex, and diabetes mellitus. Specifically, CPD was more significantly correlated with the stage of periodontitis (r=0.457, P<0.05) and the number of missing teeth (r=0.525, P<0.05) than the FTND. A scatterplot revealed a positive correlation between current smoking status and periodontal status (**Figure 2**), and the results of a more detailed partial correlation analysis are presented in **Table 3**.

Table 3. Partial correlation analysis between current smoking and periodontal status

Variables	CPD	FTND	Stage of periodontitis	Number of missing teeth
CPD	1.000			
FTND	0.663*	1.000		
Stage of periodontitis	0.457*	0.326*	1.000	
Number of missing teeth	0.525*	0.480*	0.370*	1.000

Adjusted for age, sex, and diabetes mellitus.
CPD: cigarettes smoked per day, FTND: Fagerström Test for Nicotine Dependence.
Data are expressed as partial correlation coefficients, and statistically significant differences are shown with asterisks (P<0.05).

https://doi.org/10.5051/jpis.2202560128

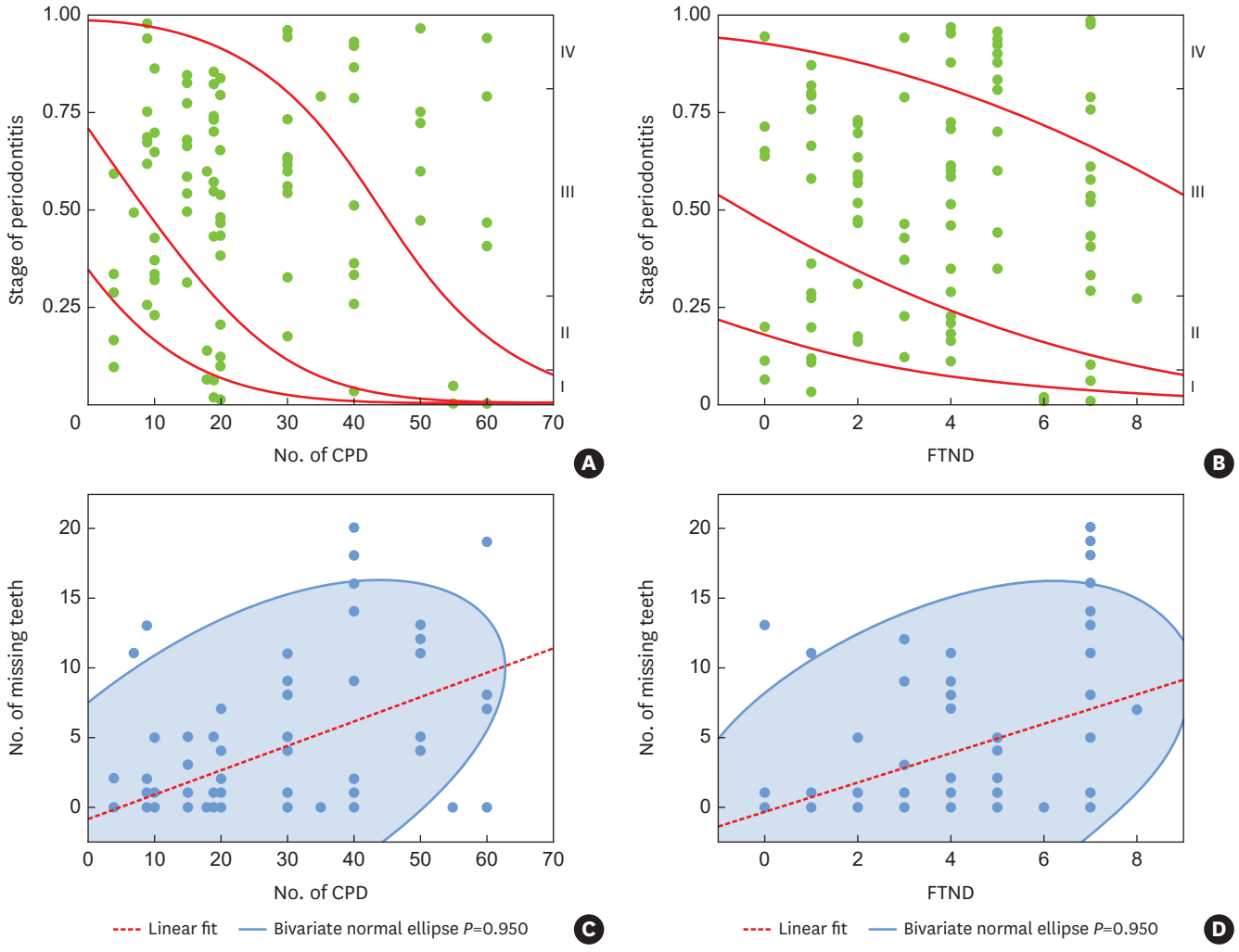

Figure 2. Scatterplots of the association between current smoking status (CPD and the FTND) and periodontal risk. (A and B) The correlation between current smoking status and the stage of periodontitis. (C and D) the correlation between current smoking status and the number of missing teeth due to periodontal reasons. The Spearman and partial correlation analyses revealed that current smoking status was positively and significantly correlated with periodontal status. CPD: cigarettes smoked per day, FTND: Fagerström Test for Nicotine Dependence.

DISCUSSION

Recent studies have clearly shown that smoking directly affects the prevalence and severity of periodontal disease regardless of oral hygiene and dental health status, and negatively influences the response to conventional non-surgical and surgical treatment of periodontitis [9,10]. Accordingly, smoking was not officially included in the past periodontitis classification scheme, but it was included as a major risk factor along with uncontrolled diabetes mellitus in the recent new periodontitis classification system [10,24].

Extensive research has focused on the negative effects of smoking on healthy gingiva [25,26]. Smoking is known to significantly suppress bleeding on probing (BOP); heavy smoking (>10 CPD) reduces the possibility of BOP by nearly 50%, particularly in healthy gingiva, which highlights the dose-dependent suppressive effect of smoking on gingival BOP (OR=0.56; 95% CI, 0.45–0.70) [25]. Likewise, smoking is known to trigger vasoconstriction; however,

https://doi.org/10.5051/jpis.2202560128

excessive smoking increases gingival blood flow [26]. Studies have shown that the effect of vasoconstriction was offset by excessive smoking-induced blood pressure elevation [26].

The most recent literature reports that the use of the FTND in addition to CPD as an indicator of smoking status is more useful than CPD alone [21]. In particular, it was confirmed that the combined use of both CPD and the FTND is highly effective for identifying severe periodontitis, including stage IV [21]. Similarly, in this study, the association between current smoking status and periodontitis was investigated based on CPD and the FTND, and we found that CPD and the FTND were significantly correlated to the severity of periodontitis and the number of periodontally compromised extracted teeth.

Several studies have reported that cigarette consumption is correlated with periodontitis severity [27-29]. One case-control study reported that smoking more than 30 CPD greatly and significantly increased the possibility of periodontitis (OR=11.0, $P<0.01$), and in particular, the risk of periodontitis in men increased even more significantly (OR=38.7, $P<0.01$) [27]. Another recent study using Mendelian randomization analysis also found that a higher CPD (OR per 1 standard deviation [1 SD] increment=1.56; 95% CI, 1.18–2.07) and lifetime smoking (OR per 1 SD=1.26; 95% CI, 1.04–1.53) were associated with an increased risk of periodontitis [28]. In addition, a long-term dose-response relationship between smoking and periodontitis has been suggested [27,29]. In a population-based study, those who had been smoking less than 5 years had an OR of 1.10 (95% CI, 0.59–2.02), and those who had been smoking for more than 21 years had an OR of 5.01 (95% CI, 3.98–6.31), which was significantly higher [29]. Likewise, another study also reported that smoking for more than 10 years (OR=2.8) nearly doubled the risk for periodontitis in comparison to smoking for less than ten years (OR=1.5) [27].

Smoking has a distinctly negative effect on alveolar bone loss around a tooth, but debate continues regarding whether smoking is directly correlated to tooth loss. A 20-year prospective study of the effects of smoking on tooth loss reported that there was no statistically significant correlation between smoking and tooth loss [30]. Nevertheless, another recent cohort study reported that more than 15 CPD was associated with a higher risk of tooth loss in men (OR=3.6; 95% CI, 3.0–4.4) and women (OR=2.5; 95% CI, 2.1–2.9) under the age of 50 [31]. Our data also showed that both CPD and the FTND, which indicate the degree and dependence of current smoking status, were statistically significantly and positively associated with the loss of teeth due to periodontal reasons ($P<0.05$).

Smokers can adjust the number of cigarettes they smoke according to their needs; therefore, CPD may be affected by the titration effect [21]. Moreover, the development of nicotine dependence, with its underlying neurobiological changes, is complex and involves several neuropsychological functions, and CPD alone is not sufficient as an ideal marker [32,33]. Therefore, a low CPD may not accurately represent an individual's low-volume but high-intensity smoking status, whereas the FTND may serve as a useful biomarker for smoking status and indicate high dependence levels [21].

Our results revealed a significant positive correlation between CPD and FTND ($r=0.741$, $P<0.05$), which is consistent with the results reported in a previous study that identified a significant correlation between CPD and FTND ($r=0.57$, $P<0.001$) [21]. However, we observed that CPD was more significantly associated with the severity of periodontitis and the number of missing teeth due to periodontal reasons than the FTND after adjusting for age, sex, and

https://doi.org/10.5051/jpis.2202560128

diabetes mellitus. Although these findings may be attributed to the study's retrospective nature and small sample size, our results and implications can serve as a starting point for prospective and longitudinal large-scale research.

The present study had several limitations. First, several studies have reported that e-cigarette smoking was positively correlated with the release of pro-inflammatory cytokines and significantly associated with the aggravation of periodontitis; however, e-cigarette smoking was not included in this study [34,35]. In addition, although the diagnosis of diabetes mellitus based on hemoglobin A1c (HbA1c) is an important factor along with smoking status in determining the grade of periodontitis, the fact that HbA1c-based diabetes mellitus was not included in this study is also a limitation. Second, due to the limitations of the short-term cross-sectional survey design, the effects of the cumulative dose of smoking or the period of smoking cessation on the severity of periodontitis or the number of teeth lost could not be considered. Third, another major limitation was that tooth loss due to periodontal reasons could have been underestimated or overestimated because of the use of a self-reported questionnaire regarding the subjective experience of cognition. Therefore, it is necessary to carefully interpret the results of the correlation analysis, and further long-term, large-scale, and well-designed studies including e-cigarettes are needed to confirm our findings.

Within the limited number of patients and subject to the selective biases inherent to the retrospective design, the current study's findings indicate that both CPD and the FTND are significantly correlated with the severity of periodontitis and the number of periodontally compromised extracted teeth.

REFERENCES

1. Savage A, Eaton KA, Moles DR, Needleman I. A systematic review of definitions of periodontitis and methods that have been used to identify this disease. J Clin Periodontol 2009;36:458-67.
PUBMED | CROSSREF
2. Socransky SS, Haffajee AD, Cugini MA, Smith C, Kent RL Jr. Microbial complexes in subgingival plaque. J Clin Periodontol 1998;25:134-44.
PUBMED | CROSSREF
3. Hussain SB, Botelho J, Machado V, Zehra SA, Mendes JJ, Ciurtin C, et al. Is there a bidirectional association between rheumatoid arthritis and periodontitis? A systematic review and meta-analysis. Semin Arthritis Rheum 2020;50:414-22.
PUBMED | CROSSREF
4. Stöhr J, Barbaresko J, Neuenschwander M, Schlesinger S. Bidirectional association between periodontal disease and diabetes mellitus: a systematic review and meta-analysis of cohort studies. Sci Rep 2021;11:13686.
PUBMED | CROSSREF
5. Lee JH, Choi JK, Jeong SN, Choi SH. Charlson comorbidity index as a predictor of periodontal disease in elderly participants. J Periodontal Implant Sci 2018;48:92-102.
PUBMED | CROSSREF
6. Dye BA. Global periodontal disease epidemiology. Periodontol 2000 2012;58:10-25.
PUBMED | CROSSREF
7. Ramseier CA, Woelber JP, Kitzmann J, Detzen L, Carra MC, Bouchard P. Impact of risk factor control interventions for smoking cessation and promotion of healthy lifestyles in patients with periodontitis: a systematic review. J Clin Periodontol 2020;47 Suppl 22:90-106.
PUBMED | CROSSREF
8. Scannapieco FA, Gershovich E. The prevention of periodontal disease-an overview. Periodontol 2000 2020;84:9-13.
PUBMED | CROSSREF

https://doi.org/10.5051/jpis.2202560128

9. Chambrone L, Chambrone D, Lima LA, Chambrone LA. Predictors of tooth loss during long-term periodontal maintenance: a systematic review of observational studies. J Clin Periodontol 2010;37:675-84.
PUBMED | CROSSREF
10. Caton JG, Armitage G, Berglundh T, Chapple IL, Jepsen S, Kornman KS, et al. A new classification scheme for periodontal and peri-implant diseases and conditions - Introduction and key changes from the 1999 classification. J Periodontol 2018;89 Suppl 1:S1-8.
PUBMED | CROSSREF
11. Lang NP, Suvan JE, Tonetti MS. Risk factor assessment tools for the prevention of periodontitis progression a systematic review. J Clin Periodontol 2015;42 Suppl 16:S59-70.
PUBMED | CROSSREF
12. Aminoshariae A, Kulild J, Gutmann J. The association between smoking and periapical periodontitis: a systematic review. Clin Oral Investig 2020;24:533-45.
PUBMED | CROSSREF
13. Leite FR, Nascimento GG, Scheutz F, López R. Effect of smoking on periodontitis: a systematic review and meta-regression. Am J Prev Med 2018;54:831-41.
PUBMED | CROSSREF
14. Pomerleau CS, Carton SM, Lutzke ML, Flessland KA, Pomerleau OF. Reliability of the Fagerström Tolerance Questionnaire and the Fagerström Test for Nicotine Dependence. Addict Behav 1994;19:33-9.
PUBMED | CROSSREF
15. Fagerström K, Furberg H. A comparison of the Fagerström Test for Nicotine Dependence and smoking prevalence across countries. Addiction 2008;103:841-5.
PUBMED | CROSSREF
16. Pérez-Ríos M, Santiago-Pérez MI, Alonso B, Malvar A, Hervada X, de Leon J. Fagerström Test for Nicotine Dependence vs heavy smoking index in a general population survey. BMC Public Health 2009;9:493.
PUBMED | CROSSREF
17. Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. Br J Addict 1991;86:1119-27.
PUBMED | CROSSREF
18. Payne TJ, Smith PO, McCracken LM, McSherry WC, Antony MM. Assessing nicotine dependence: a comparison of the Fagerström Tolerance Questionnaire (FTQ) with the Fagerström Test for Nicotine Dependence (FTND) in a clinical sample. Addict Behav 1994;19:307-17.
PUBMED | CROSSREF
19. Sharma MK, Suman LN, Srivastava K, Suma N, Vishwakarma A. Psychometric properties of Fagerström Test of Nicotine Dependence: a systematic review. Ind Psychiatry J 2021;30:207-16.
PUBMED | CROSSREF
20. Goyal J, Menon I, Singh RP, Gupta R, Sharma A, Bhagia P. Prevalence of periodontal status among nicotine dependent individuals of 35-44 years attending community dental camps in Ghaziabad district, Uttar Pradesh. J Family Med Prim Care 2019;8:2456-62.
PUBMED | CROSSREF
21. Salhi L, Seidel L, Albert A, Lambert F. Fagerström Test for Nicotine Dependence as an indicator in tobacco-related studies in periodontology. J Periodontol 2021;92:298-305.
PUBMED | CROSSREF
22. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol 2008;61:344-9.
PUBMED | CROSSREF
23. Tonetti MS, Sanz M. Implementation of the new classification of periodontal diseases: decision-making algorithms for clinical practice and education. J Clin Periodontol 2019;46:398-405.
PUBMED | CROSSREF
24. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: framework and proposal of a new classification and case definition. J Clin Periodontol 2018;45 Suppl 20:S149-61.
PUBMED | CROSSREF
25. Dietrich T, Bernimoulin JP, Glynn RJ. The effect of cigarette smoking on gingival bleeding. J Periodontol 2004;75:16-22.
PUBMED | CROSSREF
26. Mavropoulos A, Aars H, Brodin P. Hyperaemic response to cigarette smoking in healthy gingiva. J Clin Periodontol 2003;30:214-21.
PUBMED | CROSSREF

27. Calsina G, Ramón JM, Echeverría JJ. Effects of smoking on periodontal tissues. J Clin Periodontol 2002;29:771-6.
PUBMED | CROSSREF

28. Baumeister SE, Freuer D, Nolde M, Kocher T, Baurecht H, Khazaei Y, et al. Testing the association between tobacco smoking, alcohol consumption, and risk of periodontitis: a Mendelian randomization study. J Clin Periodontol 2021;48:1414-20.
PUBMED | CROSSREF

29. Tomar SL, Asma S. Smoking-attributable periodontitis in the United States: findings from NHANES III. J Periodontol 2000;71:743-51.
CROSSREF

30. Jansson L, Lavstedt S. Influence of smoking on marginal bone loss and tooth loss--a prospective study over 20 years. J Clin Periodontol 2002;29:750-6.
PUBMED | CROSSREF

31. Dietrich T, Walter C, Oluwagbemigun K, Bergmann M, Pischon T, Pischon N, et al. Smoking, smoking cessation, and risk of tooth loss: the EPIC-Potsdam study. J Dent Res 2015;94:1369-75.
PUBMED | CROSSREF

32. Balfour DJ. The neurobiology of tobacco dependence: a commentary. Respiration 2002;69:7-11.
PUBMED | CROSSREF

33. Benowitz NL. Cigarette smoking and nicotine addiction. Med Clin North Am 1992;76:415-37.
PUBMED | CROSSREF

34. Javed F, Kellesarian SV, Sundar IK, Romanos GE, Rahman I. Recent updates on electronic cigarette aerosol and inhaled nicotine effects on periodontal and pulmonary tissues. Oral Dis 2017;23:1052-7.
PUBMED | CROSSREF

35. Figueredo CA, Abdelhay N, Figueredo CM, Catunda R, Gibson MP. The impact of vaping on periodontitis: a systematic review. Clin Exp Dent Res 2021;7:376-84.
PUBMED | CROSSREF