

Association of smoking and endodontic variables in hypertensive patients

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Abstract

Introduction: The aim of this study was to investigate the relationship between smoking and the prevalence of apical periodontitis and root canal treatment in hypertensive patients.

Methods: In a cross-sectional study, the records of 100 hypertensive patients, 50 smokers and 50 nonsmokers, were examined. Periapical status of all teeth was assessed by using the periapical index score.

Results: Apical periodontitis in 1 or more teeth was found in 92% of smoker patients and in 44% of nonsmoker subjects ($P = .000$; odds ratio [OR], 16.8; 95% confidence interval [CI], 4.6–61.3). One or more root-filled teeth were found in 58% and 20% of smoker and nonsmoker subjects, respectively ($P < .01$; OR, 5.5; 95% CI, 2.3–13.5). Among smoker hypertensive patients, 6% of the teeth had apical periodontitis, whereas in the nonsmoker subjects, 2% of teeth were affected ($P < .01$; OR, 3.3; 95% CI, 2.0–5.4). The percentage of root-filled teeth in the smoker and nonsmoker groups was 3.6% and 1.2%, respectively ($P < .01$; OR, 2.9; 95% CI, 1.6–5.5).

Conclusions: The prevalence of apical periodontitis and root canal treatment was significantly higher in smoker hypertensive patients compared with nonsmoker subjects.

Keywords: endodontics, hypertension, smoking

Introduction

The chronic medical condition in which the blood pressure in the arteries is elevated is known as high blood pressure (BP) or hypertension (HTN). Moderate elevation of arterial BP leads to shortened life expectancy, and persistent HTN is one of the risk factors for coronary heart disease, strokes, heart failure, and arterial aneurysm and is a leading cause of chronic kidney failure [1]. Several studies have demonstrated a relationship between high BP and more severe periodontal parameters in such a way that hypertensive patients show a poorer periodontal state [2]. Periodontal disease and chronic apical periodontitis (AP) share a common gram negative anaerobic microbiota [3], and both are associated with elevated levels of cytokines and inflammatory mediators [4]. The studies that have analyzed the possible association between HTN and endodontic variables have found that HTN contributes to decreased retention of root-filled teeth [5, 6], but it is not significantly associated with dental periapical condition [7]. Cigarette smoking, a known risk factor for HTN [8], has been associated with periodontal disease. Cross-sectional and longitudinal studies have demonstrated the harmful effects of tobacco smoking on the periodontal bone [9]. On this basis, it was assumed that it might be a risk factor for AP, exerting a negative influence on the apical periodontium of endodontically compromised teeth, facilitating the extension of the process of periapical bone destruction, and/or interfering with healing and repair events after root canal treatment (RCT). Consequently, an increased number and/or size of periapical lesions would be expected in smokers [10]. Moreover, epidemiologic studies [11–14] have found a relationship between tobacco smoking, AP, and the outcome of RCT. If smoking influenced the

prevalence of endodontic variables in hypertensive patients, which is reported to have no increased risk of AP and RCT [7], this would be further evidence of the relationship between smoking and periapical status. The aim of the present study was to investigate the relationship between smoking and the prevalence of AP and RCT in hypertensive patients.

Material and methods

Among the patients looking for routine dental care at the GDC (Srinagar), 100 subjects reporting a history of well-controlled HTN, that is, diastolic blood pressure ≤ 90 mm Hg [15], and receiving treatment for HTN were included in the study. Fifty of the patients were smokers (mean age, 60.0 ± 9.6 years), and 50 were nonsmokers (mean age, 58.3 ± 9.6 years). Patients younger than 18 years and patients with less than 8 remaining teeth were excluded. Smoking history was obtained by interviewer-administered questionnaires as previously described [12]. Hypertensive patients were classified as nonsmokers if they answered “no” to the question, “Have you ever smoked?” On the contrary, patients who answer “yes” to the previous question were classified as smokers. The total sample consisted of 53 men (53%) and 47 women (47%), aged 58.7 ± 9.6 years. The ethics committee of the School of Dentistry approved the study, and all the patients gave written informed consent. All participants underwent a full-mouth radiographic survey consisting of 14 periapical radiographs.

From the full-mouth radiographic survey all teeth, excluding third molars, were recorded. Teeth were categorized as root-filled teeth if they had been filled with a radiopaque material

in the root canal(s), as described previously [16]. The following information was recorded on a structured form for each subject: (1) number of teeth present, (2) number and location of teeth without root fillings (untreated teeth) with identifiable periapical lesions, (3) number and location of root-filled teeth, and (4) number and location of root-filled teeth with identifiable periapical lesions. The periapical status was assessed by using the periapical index (PAI) [17], as described previously [18, 19]. One observer (an endodontist with 12 years of clinical experience) examined the radiographs. The method of viewing the radiographs was standardized; films were examined in a darkened room by using an illuminated viewer box with magnification (3.5) while mounted in a cardboard slit to block off ambient light emanating from the viewer. Before evaluation, the observer participated in a calibration course for PAI system, which consisted of 100 radiographic images of teeth, some root-filled and some not. Each tooth was assigned to 1 of the 5 PAI scores by using visual references [17]. After scoring the teeth, the results were compared with a gold standard atlas, and the Cohen kappa was calculated as 0.72. Intraobserver reproducibility was evaluated by the repeat scoring of 50 patients 2 months after the first examination. These patients were randomly selected.

Raw data were entered into Excel (Microsoft Corp, Redmond, WA). All analyses were done in an SPSS environment (Version 21; SPSS, Inc, Chicago, IL). The Student t test, c2 test, and logistic regression analysis were used to determine the significance of differences between groups. Data are reported as mean standard deviation.

Results

The average number of teeth per patient was 20.8±4.0 and 22.3±4.3 teeth in smoker and nonsmoker patients, respectively. AP in 1 or more teeth was found in 46 smoker

patients (92%) and in 22 nonsmoker subjects (44%) (Table 1). The average number of teeth with AP per patient was 1.3±0.7 and 0.4±0.5 in smokers and nonsmokers, respectively (P <.01). One or more root-filled teeth were found in 58% (29) and 20% (10) of smoker and nonsmoker subjects, respectively (P <.01; OR, 5.5; 95% CI, 2.3–13.5). Among smoker patients with root-filled teeth, 20 (70%) had AP affecting at least 1 treated tooth. Among nonsmokers with root-filled teeth, 9 (90%) had AP affecting at least 1 treated tooth (P >.05).

Multivariate logistic regressions analyses were run with age, number of teeth, and smoking habits (smoker = 1) as independent variables and periapical status (apical periodontitis = 1) as the dependent variable (Table 2). Results showed that smoking was associated with increased risk for periapical lesions (P =.000; OR, 16.8; 95% CI, 4.6–61.3). The total number of teeth examined in the smokers was 1039; 64 (6.2%) had AP (PAI ≥3) (Table 3). Among the 1124 teeth examined in the nonsmokers, only 22 (2.0%) had AP (P <.01). The number of root-filled teeth in the smokers and nonsmokers was 37 (3.6%) and 14 (1.2%), respectively (P <.01). Among smoker hypertensive patients, 24 root-filled teeth had AP, whereas among the nonsmoker hypertensive patients, 9 root-filled teeth exhibited associated periapical radiolucency (P >.05). Finally, among untreated teeth, 34 and 13 were associated with AP in smokers and nonsmokers, respectively (P <.01).

Table 1: Prevalence of Apical Periodontitis (AP), Root-filled Teeth (RFT), and Root-filled Teeth with AP (RFT-AP) in Smoker (n = 50) and Nonsmoker (n = 50) Hypertensive Patients

	AP (%)	RFT (%)	RFT-AP (%)
Smoker	46 (92)	29 (58)	20 (70)
Non-Smoker	22 (44)	10 (20)	9 (90)
Total	68 (68)	39 (39)	29 (74.4)

Table 2: Multivariate Logistic Regression Analysis of the Influence of the Independent Variables Age, Number of Teeth, and Smoking Habits (Smoker = 1) on the Dependent Variable Periapical Status (AP = 1)

Independent variables	B value	P value	OR	95% CI, lower limit	95% CI, upper limit
Age	0.0705	0.0190	1.0730	1.0116	1.1381
Teeth(n)	-0.1786	0.0116	0.8365	0.7282	0.9609
Smoking	2.8206	.0000	16.7874	4.5967	61.3089

Table 3: Distribution of Teeth with Apical Periodontitis (AP), Root-filled Teeth (RFT), Root-filled Teeth with AP (RFT-AP), and Untreated Teeth with AP (UT-AP) in Smoker and Nonsmoker Hypertensive Patients

	Total teeth	AP	RFT	RFT-AP	UT-AP
Smokers	1039	64 (6.2)	37 (3.6)	24 (64.9)	34 (3.4)
Non-smokers	1124	22 (2.0)	14 (1.2)	9 (64.3)	13 (1.2)
Total	2163	86 (3.4)**	51 (2.4)**	33 (64.7)**	47 (2.2)**

RFT-AP values are out of all RFTs. Smokers vs nonsmokers: *P >.05. **P <.01

Discussion

The aim of this study was to investigate the relationship between smoking and endodontic variables in hypertensive patients. Results revealed a statistically significant association between smoking habits, periapical status, and prevalence of RCT. The study included adult patients attending the dental service of the Faculty of Dentistry of Sevilla (Spain) for the first time. The recruitment of subjects was the same as those used by other investigators [7, 16, 20].

There were not significant differences between smokers and nonsmokers in the age or in the average number of teeth per patient. On the contrary, other investigators found a higher prevalence of edentulism among smokers [21, 22]. Periapical radiographs were used to evaluate the presence of AP. However, at the present time there are more sensitive radiographic methods available to detect the presence of periradicular disease, such as cone-beam computed tomography (CBCT) [23], although endodontic outcome predictors as determined with CBCT scans might not be the same as determined with PA [24]. The results of the present study showed that the prevalence of AP in smoker hypertensive patients (92%) is significantly higher than in nonsmoker subjects (44%). Moreover, the frequency of teeth affected with AP among smokers (6%) was significantly higher than in nonsmokers (2%). Although some studies have not found association between smoking and periapical status [10, 25], the results of the present study are in agreement with those reported by Kirkevang and Wenzel [11]. The percentage of subjects having at least 1

root-filled tooth varied significantly in smokers (58%) and nonsmokers (20%) ($P < .01$; OR, 5.5), suggesting that smoking is correlated with the prevalence of RCT. This finding is in agreement with the results of the longitudinal study carried out by Krall *et al* [12], who reported a significant dose-response relationship between cigarette smoking and the risk of RCT. These authors calculated that compared with never-smokers, current cigarette smokers were 1.7 times more likely to have RCT ($P < .001$). The prevalence of RCT in the total sample of hypertensive patients (39%) was low compared with previous reports [26]. The possible connection between chronic oral inflammatory processes of infectious origin, that is, chronic apical AP and periodontal disease, and systemic health is now one of the most interesting aspects faced by the medical and dental scientific community [27]. Several epidemiologic studies have investigated the association between systemic health and periodontal disease [2, 28]. Also, results of a number of studies suggest that chronic AP and the outcome of the endodontic therapy could be associated with systemic diseases. Type II diabetes mellitus [16, 20] and coronary heart disease [29-31] seem to influence the periapical status. The results of the present study conclude that the prevalences of AP and RCT are significantly higher in smoker hypertensive patients compared with nonsmoker subjects, suggesting a relationship between smoking and these 2 endodontic variables. However, this study has several limitations. First, there are factors not recorded, such as prevalence of diabetes that could affect the incidence of both AP [16] and HTN, acting as confounding factor. Second, systematic reviews have identified 4 factors that influence the outcome of RCT, namely presence or absence of preoperative AP, density and apical extent of root filling, and quality of coronal restoration [24, 32]. In the present study, the preoperative periapical status and the quality of root canal filling and coronal restoration have not been considered in the multivariate logistic regression analysis; thus they can act also as confounding factors. A large prospective clinical and interventional study, controlling all the possible confounding factors, will be needed to definitively assess the relationship between HTN, smoking, and endodontic variables.

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