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EVALUATION OF APICAL PERIODONTITIS IN TEETH WITH AND WITHOUT ENDODONTICS IN PATIENTS WITH DIABETES MELLITUS

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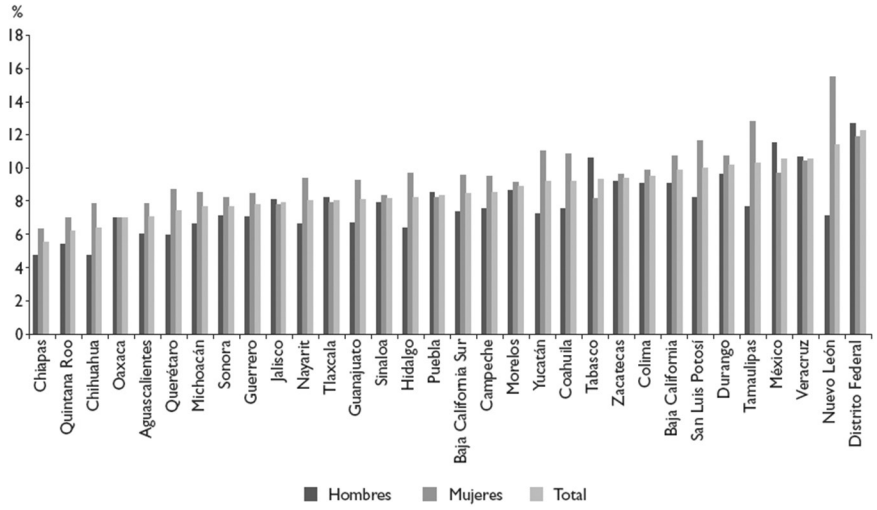
— Abstract—

The aim of this study was to study of apical periodontitis (AP) in patients with and without diabetes mellitus. In a retrospective cohort study, the record of 25 subjects with diabetes and 25 control subjects were examined. All participants underwent a full-mouth radiographic survey incorporating 14 digital periapical radiographs. The periapical region of all teeth, excluding third molars was assessed using the periapical index score. Apical periodontitis in at least one tooth was found in 96% of diabetic patients and in 68% of control subjects. Amongst diabetic patients 14.2 % of the teeth had AP, whereas in the control subjects 8.8 % of teeth were affected.

Keywords

Apical periodontitis, diabetes mellitus, Endodontics.

According to data from the Ministry of Health in Mexico, the prevalence of diseases due to lifestyle is high, such as diabetes mellitus. Of the total adult population in Mexico, 9.17% (95% CI 8.79% -9.54%) reported having a previous diagnosis of diabetes by a physician, equivalent to 6.4 million people. By sex, this percentage was 8.60% (IC 95% 8.00% - 9-20%) among males and 9.67% (IC 95% 9.13% - 10.22%) among females, equivalent to 2.84 million men and 3.56 million women. In the case of men, the entities with the highest proportion of individuals diagnosed with diabetes are the Federal District (12.7%), the State of Mexico (11.5%), and Veracruz (10.7%), while the women are located in Nuevo León (15.5%), Tamaulipas (12.8%), and the Federal District (11.9%) (Hernández-Ávila et al. 2013) (Figure 1).



Diabetes mellitus is a syndrome characterized by abnormalities in the metabolism of carbohydrates, lipids and proteins, resulting in either partial or absolute insulin deficiency (type 1) or tissue resistance to its metabolic effects (type 2) (Vernillo 2003). Diabetes also affects the functions of the immune system and is associated with slow healing and affects the immune response (Delamaire, 1997). Oral manifestations of uncontrolled diabetes include xerostomia, infection, poor healing, increased incidence and severity of caries, candidiasis, gingivitis, periodontal disease, and burning mouth syndrome (Little, 1997). Aggressive periodontal disease has been linked to high serum glucose levels, especially when it has not been well controlled

(Soskolone & Klinger, 2001). Also a high incidence of loss of periodontal insertion has been described among diabetic patients (Thomson et al, 2004).

On the other hand, periradicular disease or apical periodontitis (AP) is a sequel to dental caries caused by an infection of the duct system. Periradicular lesions are the result of irritants of the polymicrobial infection of the duct system in teeth with necrotic pulpal tissue. Different epidemiological studies have shown a prevalence of periradicular disease in a range of 1.4% (Eriksen et al 1998) to 8% (Imfeld 1991) when using the dental organs as a unit. When patients or individuals are used as a unit, the prevalence may be higher at approximately 61.1% and increases with age (Figdor 2002, Jiménez-Pinzón et al 2004). In order to preserve the dental organs, the treatment of choice is the treatment of ducts. There is the biological basis that diabetes mellitus can affect the periapical immune response which causes a delay in the healing process. Because of this, a high prevalence of posttreatment disease could be expected in diabetic patients than in subjects without diabetes. However, the literature on the pathogenesis, progression and repair of endodontic pathologies in diabetic patients is remarkably scarce. Few studies have studied the possible association between diabetes and apical periodontitis ((Falk et al. 1989. Bender & Bender 2003, Britto et al. 2003, Fouad & Burleson 2003).

The aim of this study is to investigate the prevalence of apical periodontitis (AP) in teeth with and without root canal treatment in diabetic patients and control subjects without diabetes, as well as to evaluate the prevalence of apical periodontitis in patients with and without endodontic treatment in systemically healthy patients (control group) and those diagnosed with diabetes.

MATERIALS AND METHODOLOGY

In AP patients who sought odontology treatment in the Faculty of Dentistry and Public Health of the University of Sciences and Arts of Chiapas, 25 patients reported diabetes mellitus which was diagnosed by a rapid glucose test. 25 patients who did not report a history of diabetes served as a control group. The total of the sample was 50 individuals: 24 men (48%) and 26 women (52%). The scientific committee of the Faculty approved the study and all AP patients were given informed consent to participate in the study. Each AP patient was given a series of 14 digital dentoalveolar radiographs, which were taken using a radiovisiograph (Kodak Carestream® RVG 5100) and x-ray unit (Corix®) using the parallel planes technique with adjustments of 70 kV, 10 mA and a focal-film distance of 28 cm.

Of the radiographic series that was taken, all dental organs present except for the third molars were included in the study. The teeth were

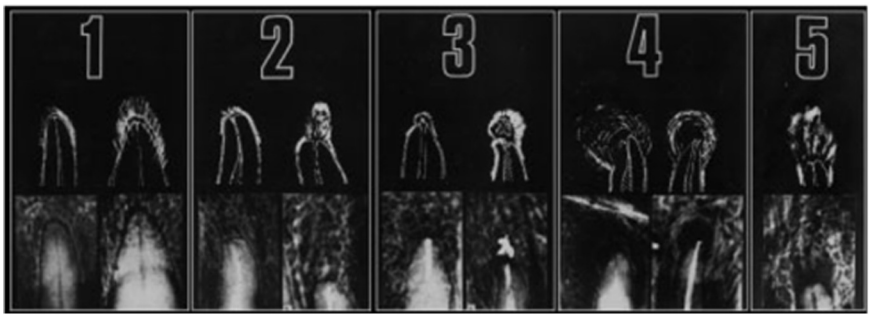
classified as sealed if radiopaque material was observed in the ducts on the radiograph. The following information was recorded on the data sheet for each patient: a) number of teeth present, b) number and location of teeth without fillings (untreated teeth) that had identifiable periapical lesions, and c) number and location of teeth with sealed roots and those having identifiable periapical lesions. The periapical state was analyzed using the periapical index (Orstavik et al., 1986) (Table 1). Each category used in the periapical index (IAP) represents a step in the ordinal scale of the record of periapical inflammation. The worst result of all roots was taken into account for the IAP in multiradicular teeth.

Table 1. Periapical Index (Orstavik et al., 1986)

VALUE	CRITERIA
1	Normal periapical structures
2	Small changes in bone structure
3	Changes in bone structure with mineral loss
4	Periodontitis with a well-defined radiolucent zone
5	Severe periodontitis

X-rays were observed on an 18-inch computer monitor (Lenovo), by an observer with 10-years of experience. The IAP> 2 was considered a sign of periapical pathology. The periapical status of all teeth was assessed (Figure 2).

FigurE 2. Orstavik IAP



The data obtained were recorded in Excel® (Microsoft Corporation, Redmond, WA, USA).

RESULTS

The study group consisted of 25 patients, 10 men and 15 women, in an age range of 25 to 71 years old. The control group consisted of a number of 25 patients, 14 men and 11 women, ranging in age from 24 to 63 years old. The average number of teeth per patient was 18.8 for diabetic patients and 26.5 for the control group. Apical periodontitis affected at least one or more teeth in 24 diabetic patients (96%) and in 17 patients in the control group (68%) (Graph 1) (Table 2). The mean number of teeth with apical periodontitis was 2.68 in diabetic patients and 2.36 in the control group. One or more teeth with sealed roots were found in 52% (13) and 56% (14) of diabetic and control patients respectively. Among diabetic patients with sealed roots, 12 (92%) had apical periodontitis affecting at least one dental organ. In the control group with sealed roots, 11 (79%) had AP affecting at least one treated dental organ.

Graph 1. Prevalence of AP in diabetic patients vs control group.

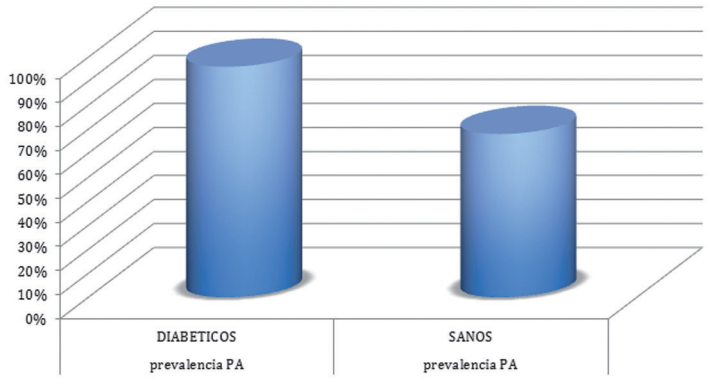


Table 2. Prevalence of Apical Periodontitis (AP), sealed dental organs (SDO), and sealed teeth with apical periodontitis (SDO-AP), in diabetic (n = 25) and control (n = 25) patients.

	PA (%)	ODO(%)	ODO-PA (%)
Diabetics	24 (96)	13 (52)	12 (92)
Control	17 (68)	14 (56)	11 (79)
Total	41 (82)	27 (54)	23 (85)

The total number of dental organs examined was 470 for the study group, of which 67 (14.2%) had apical periodontitis. In contrast, in the control group, 663 of the patients (59.8%) had AP. The number of sealed dental organs in the study group was 30 (6.38%) and 29 (4.37%) for the control group (Table 3) Among the diabetic patients, 17 dental organs (56%) presented BP, whereas in the control group 20 dental organs (68%) had AP. Finally, of dental organs without root canal treatment 50 (10.6%) and 39 (5.8%) were associated with AP in diabetic patients and in the control group respectively.

Table 3. Distribution of dental organs with AP, sealed dental organs (SDO), sealed dental organs with AP (SDOAP) and endodontically untreated dental organs with AP (EDUTAP)

	Total OD	PA	ODO	ODOPA	ODNTPA
Diabetics	470	67 (14.2)	30 (6.38)	17 (56)	50 (10.6)
Control	663	59 (8.8)	29 (4.37)	20 (68)	39 (5.8)
Total	1131	126 (11)	59 (5)	37 (62)	89 (8)

DISCUSSION OF RESULTS

Patients enrolled in this retrospective cohort study were adults who were seen for the first time in the Faculty of Dentistry and Public Health of UNICACH, Chiapas, Mexico. In relation to the gender of the patients, studies have been carried out which indicate that it does not affect the presence of AP or the frequency of root canal treatments (Orstavik et al 1986 , Jiménez Pinzón et al. 2004). Periapical radiographs have been used to evaluate the presence of AP. Previous studies have used periapical radiographs (Imfeld 1991, Kirkevang et al 2001, Boucher et al 2002, Britto et al 2003, Kirkevang et al. And Wenzel 2003). The apical periodontitis index (API) described to evaluate periapical radiographs was first described by Orstavik (Orstavik, 1986). This index has been used by other authors (Eriksen et al., 1998, Sidaravicius et al., 1999, Kirkevang et al 2001, Boucher et al 2002, Kirkevang and Wenzel 2003, Segura-Egea et al.). In order to perform the study, the third molars were excluded, teeth with defective or unrestored restorations were included, and treatments with poorly made ducts were included. On average, the total number of teeth was lower for diabetic patients than for the control group. These findings are consistent with numerous studies which convincingly demonstrate that uncontrolled diabetes mellitus is associated with the loss of more teeth due to the high incidence of caries and aggressive

periodontal disease (Little et al 1997, Katz 2001, Soskolone and Klinger 2001, Fouad 2003, Lagervall et al 2003, Vernillo 2003). On the other hand, another study found no difference between the number of teeth between diabetic and non-diabetic patients (Falk et al 1989).

The results of this study showed a high prevalence of AP, 96% compared to the control group. It is for this reason, as well as our results, that we can affirm that there is a relationship between diabetes mellitus and AP. In a previous study (Bender et al. 1963) Bender proposed that the cure of periapical lesions was unlikely to occur in patients with poorly controlled diabetes and despite the treatment of ducts, they increased in size.

Another study (Britto et al 2003) showed one or more teeth with AP (97%) in diabetic patients (96% in patients from this study and in 87% of patients in the control group (68% in the present study), with no statistical difference between these groups. However, the researchers discarded teeth with defective restorations or teeth without restorations, and teeth with inadequate root canal treatment. Because of this, their results do not reflect the actual periapical state of the compared groups, and therefore a definitive conclusion cannot be made. The total number of teeth with AP was 126, representing 11.1% of the total. The frequency of affected teeth with AP in diabetic patients was 14.2%, whereas in the control group it was 8.8%. Studies in animals have shown the relationship between diabetes and periodontitis. Diabetes was induced in rats using streptozocin (Koohaka et al. 1996). Diabetic rats developed severe inflammation of the periodontal ligament, radicular and bone resorption, compared to the control group. The percentages of patients who had at least one tooth with root canal treatment were 52% for diabetic patients and 56% for the control group. These percentages are low compared to other reports (Imfeld 1991, Sidaravicius et al., 1999). It was not the objective of this study, however it seems important to point out that diabetic patients had a greater number of absent dental organs which were extracted, either by caries, periodontal disease and periradicular periodontitis, taking into account that they have a higher prevalence of caries, periodontal disease and periradicular periodontitis.

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