PREVALENCE OF APICAL PERIODONTITIS IN DIABETIC PATIENTS

Prevalência de lesão endodôntica em pacientes diabéticos

Prevalencia de lesión endodóntica de pacientes diabeticos

Original Article

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ABSTRACT

Objective: To investigate the prevalence of apical periodontitis (AP) in diabetic and nondiabetic patients. **Methods:** Cross-sectional study, in which the radiographic records (panoramic and full-mouth periapical radiographs) of 80 patients, being 40 type II diabetic patients and 40 nondiabetic subjects, had the periapical and endodontic regions of all teeth present evaluated by means of the periapical index score. Data was analyzed through BioEstat 5.3® software. **Results:** At least one tooth was found with apical periodontitis in 90% (n=32) of the diabetic patients and in 52% (n=21) of nondiabetic subjects (p=0.0001). Regarding root-filled teeth, 44% (n=51) presented AP amongst the diabetic patients, whereas only 17% (n=17) (p=0.0004) were affected in the control group. The diabetic patients presented larger quantity of apical periodontitis than did the nondiabetics (p=0.0189). **Conclusion:** According to these results, type 2 Diabetes Mellitus is associated with an increase in the prevalence of apical periodontitis.

Descriptors: Apical periodontitis; Diabetes Mellitus; Endodontics.

RESUMO

Objetivo: *Investigar a prevalência de lesões endodônticas em pacientes diabéticos e não diabéticos.* **Métodos:** *Em estudo transversal, exames radiográficos (panorâmica e seriografia) de 80 pacientes, sendo 40 diabéticos tipo II e 40 não diabéticos, receberam avaliação, por meio de um índice de escores periapicais, das regiões perioendodônticas de todos os elementos dentais presentes. Os dados foram analisados pelo programa BioEstat 5.3®.* **Resultados:** *Encontrou-se pelo menos 1 dente apresentando lesão apical em 90% (n=32) dos pacientes diabéticos e 52% (n=21) dos pacientes não diabéticos (p=0,0001). Quanto aos dentes tratados endodonticamente, nos pacientes diabéticos, foram encontrados 44% (n=51) com lesões endodônticas, e apenas 17% (n=17) (p=0,0004) no grupo controle. Os pacientes diabéticos apresentaram maior quantidade de lesões endodônticas em relação aos pacientes não diabéticos (p=0,0189).* **Conclusão:** *De acordo com esses resultados, pode-se concluir que a Diabetes Mellitus tipo II está associada ao aumento da prevalência de lesões endodônticas.*

Descritores: *Doenças Periapicais; Diabetes Mellitus; Endodontia.*

RESUMEN

Objetivo: *Investigar la prevalencia de lesiones endodónticas de pacientes diabéticos e no diabéticos.* **Métodos:** *Estudio transversal con pruebas radiológicas (panorámica y seriografía) de 80 pacientes, siendo 40 diabéticos tipo II y 40 no diabéticos que recibieron evaluación a través del índice de puntuaciones periapicales de las regiones perioendodónticas de todos los elementos dentales presentes. Los datos fueron analizados con el programa BioEstat 5.3.* **Resultados:** *Se encontró por lo menos un diente con lesión apical en el 90% (n=32) de los pacientes diabéticos y el 52% (n=21) de los no diabéticos (p=0,0001). Respecto a los dientes tratados endodónticamente, el 44% (n=51) de los pacientes diabéticos presentó lesiones endodónticas y solamente el 17% (n=17) (p=0,0004) en el grupo control. Los pacientes diabéticos presentaron más lesiones endodónticas que los no diabéticos (p=0,0189).* **Conclusión:** *A partir de los resultados se concluye que la Diabetes Mellitus tipo II está asociada con el aumento de la prevalencia de lesiones endodónticas.*

Descriptores: *Enfermedades Periapicales; Diabetes Mellitus; Endodoncia.*

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INTRODUCTION

Diabetes Mellitus is a chronic systemic disease that involves the metabolic, vascular and endocrine systems, probably of hereditary nature, in consequence of partial or total insulin deficiency, which leads to the inappropriate use of carbohydrates and alterations in lipid and protein metabolism[1-5].

Such systemic change results in a deep or absolute deficiency of insulin production – type I, dependents on daily insulin therapy (corresponding to 5-10% of cases), or tissue resistance to its cellular metabolic effects – type II, non-insulin dependent, occurring in 90% of cases, in which the patient achieves control of their glycemia merely through diet, insulin being used in exceptional cases[5-7].

Diabetes mellitus affects some functions of the immune system and is associated with failures of the tissue healing process and compromise of the immune responses[7,8]. Statistical studies show that diabetes is directly related to high mortality rates in the United States[9,10]. In Brazil, it is estimated that this disease has already affected 13 million individuals[2,11].

The oral complications in patients with uncontrolled diabetes may include dry mouth, poor healing, infections, increase in dental caries incidence and severity, candidiasis, gingivitis and periodontitis[12]. Severe periodontal diseases have been associated to high serum glucose levels[13], especially in uncontrolled patients[12]. It is demonstrated that diabetic patients present high loss of periodontal attachment[9], even occurring contraindications in circumstances where dental implants are needed to promote prosthetic rehabilitation[14].

The apical bone losses, named endodontic lesions or apical periodontitis, radiographically visualized as radiolucent areas, are the first sequela related to the contamination of the root canal system as a result of untreated dental caries[15] or endodontically treated teeth not properly restored[16]. Epidemiological researches have shown high prevalence of apical periodontitis, ranging from 1.4%[17] to 8.0%[18], using teeth as units of investigation. When individuals are used as units, the prevalence is found above 61.1%, increasing with age[15,19].

Root canal treatment is the therapy of choice for cases where apical periodontitis are present, and clinical and radiographic follow-up must be performed in those cases, so that their success or failure can be safely evaluated[20,21]. Literature associating pathogenesis with progression and repair of endodontic diseases is, however, markedly vague[17,18].

Furthermore, studies that clinically evaluated the possibility of association between diabetes mellitus and apical periodontitis have been disclosed[22-24]. The theme arouses interest, given how poorly investigated it is. The aim of this study was thus to investigate the prevalence of apical periodontitis in diabetic and nondiabetic patients.

METHODS

This is a quantitative, cross-sectional and retrospective study conducted using data from the medical records and radiographs in the patient archive of the School of Dentistry and the *Núcleo de Atenção Médica Integrada* - NAMI (Integrated Medical Care Center) of the University of Fortaleza (UNIFOR). The medical records and radiographs (panoramic and periapicals) from the period of 2000-2011 were evaluated, comprising 80 patients, being 40 affected by type II Diabetes Mellitus (13 men and 27 women, with ages ranging from 37 to 68 years), and 40 nondiabetics (16 men and 24 women, with ages ranging from 35 to 70 years), whose data was collected in 2011.

In order to reduce the influence of the periodontal disease in this study, patients presenting less than 7 teeth in the dental arch were excluded, because they are classified as severe periodontal disease[15]. All the type II diabetic patients who did not have the periodontal exclusion criterion had their X-rays analyzed. With respect to nondiabetic individuals, the choice was randomized within the database cited above.

In possession of the 80 patients' medical records, three calibrated examiners initially filled an Excel spreadsheet containing the patient's individual data: (i) number of teeth present, (ii) number of endodontic lesions, (iii) number of endodontically treated teeth (iv) number of endodontically treated teeth with endodontic lesions, (v) number of teeth without endodontic treatment with endodontic lesions. The treatment time and previous dental history were considered, as means of knowing whether the tooth under investigation had apical lesion before the endodontic treatment. Through the records, it was possible to make a correlation between the treatment time and the present radiographic image. Where there were not - or the radiographic images did not show - appropriate assessment conditions (compromised image), or the evaluations had been registered prior to two years before, patients were asked to perform new radiographs (panoramic and periapicals).

Proceeded then to the analysis of radiographic images, and all teeth were initially categorized as endodontically treated or not, so that one could conceptualize them according to the Periapical Index scores, of the PAI scale[25], shown in Table I. All teeth that had the pulp cavity filled with radiopaque material were assigned the rating of 'endodontically treated'.

The radiographs evaluation was then performed by each examiner, being repeated in different sequences after 7 and 14 days, to test data validity. By means of an appropriate negatoscope, with an increase of 3.5x, the images were observed, in order to facilitate the visualization of details of periapical structures. Each score used in the PAI scale represented a numerical data according to the stage of evolution of the apical lesion[25], where values in the PAI scale > 2 indicate the presence of apical pathology. Data assigned with different scores by the examiners underwent a new combined analysis to reach a new concept in the PAI scale.

The results obtained were statistically analyzed using the BioEstat 5.3® program for Windows (Marimauá Institute, AM, Brazil), using the Wilcoxon test when individuals were the units of analysis, and the Chi-square test when the units of analysis were the teeth.

The research project of the present study was approved by the Ethics Committee on Research with Human Beings (COETICA) of the University of Fortaleza (UNIFOR) under opinion No. 172/2008.

RESULTS

The mean number of teeth was 22.1±3.8 and 18.3±3.7 for nondiabetic and diabetic patients, respectively (p=0.0001). The presence of apical periodontitis in at least one tooth occurred in 90% (n=32) of the diabetic patients and 52.5% (n=21) of nondiabetic patients (p=0.0001).

One or more endodontically treated teeth were equally found in both groups (97.5%) in 39 patients in each group (p> 0.05). Among the diabetic patients, 77.5% (n=31) of endodontically treated teeth had apical periodontitis, whereas in the control group this fact occurred in 40% (n=16) of cases (p=0.03) (Table II).

As for the analysis of all the teeth, 1,620 teeth were assessed, 734 in diabetic patients, 12.1% (n=89) of those found with apical periodontitis (PAI≥3), with bone structure alterations and formation of radiographically visible lesions. In the control group, this type of change was also the most frequent (PAI≥3), since 4.1% (n=37) of the 886 evaluated teeth presented apical periodontitis. Diabetic patients presented larger quantity of endodontic lesions than did the nondiabetics (p=0.0189).

Regarding endodontically treated teeth, 44.3% (n=51) were found with endodontic lesions among the diabetic patients; in the control group, only 17.3% (n=17) (p=0.0004).

Teeth with apical periodontitis and without endodontic treatment accounted for 42.7% (38) of the teeth in diabetic patients; in the control group, the number was much lower, only 20.4% (20) (p = 0.0045) (Table III).

Table I - Periapical Index Scores - PAI Scale*.

Score	Criteria
1	Normal periapical structures
2	Mild alteration in bone structure
3	Alteration in bone structure with lesion onset
4	Lesion with well-defined radiolucent area
5	Extensive lesion with diffuse edges

*Adapted from Ørstavik D, Kerekes K, Eriksen HM. The periapical index: a scoring system for radiographic assessment of apical periodontitis. Endod Dent Traumatol. 1986;2(1):20-34.

Table II - Prevalence of apical periodontitis in diabetic and nondiabetic patients assisted at the *Núcleo de Atenção Médica Integrada* (NAMI). Fortaleza-CE, 2011.

Lesions	Diabetics (%)	Nondiabetics (%)	*p*
AP	36 (90%)	21 (52.5%)	0.0001
ETT	39 (97.5%)	39 (97.5%)	>0.05
ETT-AP	31 (77.5%)	16 (40%)	0.001
NETT-AP	28 (70%)	17 (42.5%)	0.03

AP: teeth with apical periodontitis; ETT: endodontically treated teeth; ETT-AP: endodontically treated teeth with apical periodontitis; NETT-AP: not endodontically treated teeth with apical periodontitis

Table III - Distribution of diabetic and nondiabetic patients assisted at the *Núcleo de Atenção Médica Integrada* (NAMI) with total number of teeth associated with apical periodontitis. Fortaleza-CE. 2011.

Totality of Teeth	Diabetics (%)	Nondiabetics (%)	*p*
	n=734	n=886	
AP	89 (12.1%)	37 (4.1%)	0.0189
ETT	115 (15.6%)	98 (11.1%)	>0.05
ETT-AP	51 (44.3%)	17 (17.3%)	0.004
NETT-AP	38 (42.7%)	20 (20.4%)	0.0045

AP: teeth with apical periodontitis; ETT: endodontically treated teeth; ETT-AP: endodontically treated teeth with apical periodontitis; NETT-AP: not endodontically treated teeth with apical periodontitis.

DISCUSSION

Diabetes Mellitus is a pathological entity characterized by a disorder of the intermediary metabolism, especially with regard to carbohydrates, leading to increased serum levels of glucose, potentially fatal acute metabolic complications and to a range of multisystemic chronic complications such as kidney failure and coronary heart disease[7,12]. It

also comprises deficiencies in fighting infections due to leukocyte deficiencies[26], and in repairing and/or healing of pathological processes due to vascular ischemia[6].

In this study, the population of patients with type II Diabetes Mellitus within a database was evaluated. The disease was usually diagnosed in subjects over 40 years of age, of both sexes and obese (80%). Its pathophysiological hallmark is the combination of two factors: (i) peripheral insulin resistance and (ii) impairment of pancreatic beta cells, which secrete insulin in insufficient quantities for adequate metabolic control[9,20]. It has been proven that this is a disease resulting from the combination of strong genetic predisposition, environmental factors and lifestyle habits[7].

Evaluation of success in root canal treatments is performed with basis on various parameters. The sovereign and most consistent points, however, are the clinical aspects, directly linked to the maintenance of clinical symptoms and to radiographic evidence indicating the repair of endodontic lesions[5,20,27]. Uncompensated diabetic patients show maintenance of or increase in apical periodontitis, even when painful clinical symptoms are not associated[10,15], indicating failure in the apical repair process[23]. In a study involving the Swiss population, a higher incidence of endodontic lesions was verified in endodontically treated teeth in diabetic patients, regardless of age and sex[18]. Therefore, such facts associate diabetes with decreasing success in endodontic treatment, especially in cases where the apical lesion is the indication factor for root canal treatment[10,15,27]. In the present study a higher prevalence of radiographically visible periapical lesions was observed among diabetic patients.

Probably, the occurrence of these lesions, in many cases, does not arise from local endodontic failure, but from the deficiency in tissue repair capacity due to metabolic alterations caused by diabetes, that is, a systemic deficiency.

Because Diabetes Mellitus directly affects the immunological and regenerative responses, the apical repair process is also affected[15]. Consequently, it can cause an overestimation of the incidence and prevalence rates of endodontic lesions in diabetic patients with endodontically treated teeth compared with patients without diabetes[15].

In this research the majority of patients were female, similarly to other studies[10,15,23]. Gender and age are factors that did not influence on results related to the frequency of endodontically treated teeth and the presence of apical periodontitis[19,25].

To analyse the presence of endodontic lesions, the use of periapical radiographs is still the most employed and widespread method, reaching detailed analysis and definition of such region[2,5,18,23]. Probably in the near future, further studies will adopt tomography as the standard method to highlight the presence of apical periodontitis because it allows to detect early lesions[28]. Studies have excluded the analysis of apical regions of teeth with absence or failure of coronal restoration, teeth with inadequately treated root canals, and teeth overlapping anatomical radiolucent areas[8,23]. This fact, however, is believed to directly influence the periapical profile of patients database investigated in the present study. Therefore, all the teeth present in the patients were analyzed, except the third molars.

The lower amount of teeth in diabetic patients in the present study is consistent with other researches, which show that Diabetes Mellitus, especially when uncontrolled, allows severe advances in dental caries and periodontal diseases[5,8,14]. Patients who presented less than 7 teeth were excluded, because they are classified as severe periodontal disease[15]. This fact led to a reduction in the influence of periodontal disease on this study.

The results of this study demonstrated a higher incidence of apical periodontitis in diabetic patients. These results agree with those obtained in an epidemiological work of the 1960s, when the authors suggest that diabetics may experience failures in the apical tissue repair, or that this process occurs more slowly than in nondiabetic patients[24]. Subsequently, it was demonstrated that there really is a need for more time for repairing endodontic lesions in diabetic patients[22].

Many animal models have been developed with the aim of correlating Diabetes Mellitus with the characteristics of the apical periodontitis. In rats with streptozotocin-induced diabetes, severe inflammation in the periodontal ligament, root and bone resorption were demonstrated in higher incidence, in comparison with control groups[29]. In type II diabetic mice, alveolar bone resorption was reported to be more severe, consequently, with larger endodontic lesions[30]. However, the results of the present study, just as the ones previously obtained[15], showed no difference in the PAI scale applied to teeth with apical periodontitis in diabetic and nondiabetic patients. It is probable that if these studies had been performed with use of computed tomography, lesions in early stages, which were not detected by using periapical radiographs, would have been detected.

Unlike the findings from other studies[15,16], in the present investigation there was a higher percentage of apical periodontitis in endodontically treated teeth in diabetic patients compared to the control group - the same occurring in teeth with apical periodontitis and without endodontic treatment. Diabetic patients showed an increase in periodontal disease in endodontically treated teeth, showing a significant reduction in the success of root canal treatment, but only when apical lesion was initially present. However, the overall endodontic success in the surveyed

population was not influenced by the presence of type II Diabetes Mellitus[10].

Further epidemiological studies should be performed, in order to correlate data of endodontic treatments in teeth subjected to periodontal treatments, and enable the detection of any influences and interrelation in the success rate of those treatments in diabetic patients.

CONCLUSION

It can be concluded that patients with type II Diabetes Mellitus present higher prevalence of apical periodontitis, regardless of the treatment conditions related to the dental element. This fact may directly affect the follow-up and the determination of the endodontic success.

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