

Periapical and Endodontic Status of Type 2 Diabetic Patients: A Cross-sectional Study

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Abstract:

Background: The aim of this study was to investigate the currency of apical periodontitis (AP) and root canal treatment in instance of type II diabetic patients and control subjects.

Materials and Methods: In this study, the radiographic inscription of 60 patients reporting a history of type 2 diabetes mellitus (DM) (study group) and 60 subjects who reported no history of DM (control group) were tested. Periapical status and root canal treatment success were radiographically investigated.

Results: The DM patients ranged 27–82 years of age with a mean age of 51 years, and a small majority being males (26,20%). The control patients ranged 15–64 years of age with a mean age of 34 years, and a small majority being males (36,70%) The average number of teeth in the diabetic patient and control groups was 22.9 and 28.6 teeth, respectively ($P < 0.001$). AP with root-filled teeth was found in 29 diabetic patients (48,3%) and in 23 control subjects (38,3%) ($P = 0,386$). One or more root-filled teeth were found in 129 and 80 of diabetic and control subjects, respectively ($P = 0.054$). Adjusting for teeth number, multivariate logistic regression analysis showed that periapical status ($P = .0071$) and the number of root-filled teeth ($P = .0035$) were significantly associated with diabetic status. The results showed that in adult patients, type 2 DM is significantly associated with an increased prevalence of AP and root canal treatment.

Key Word: Apical periodontitis, diabetes mellitus, endodontics

Date of Submission: 15-07-2020

Date of Acceptance: 31-07-2020

I. Introduction

Diabetes mellitus (DM) is a metabolic disorder of deficient insulin secretion that rises serious and weaken complications. DM changes many functions of the immune system and is associated with delayed healing and compromised immune responses. This is due to chronic inflammation, progressive tissue defect, and diminished tissue repair capacity. Aggressive forms of periodontal diseases, periapical lesions, wound healing difficulties have been associated with hyperglycaemia¹.

Apical periodontitis (AP) is an inflammatory disorder of periradicular tissues caused by induced and remained by bacterial infection of the root canal system². AP is a common disease, reporting a prevalence of AP attending from 34% to 61% of patients and 2–14% of teeth³⁻⁵. However, clinical and radiographic studies have determined that an association between periodontal disease and important systemic diseases, such as DM⁶, smoking^{7,8}, coronary heart disease⁹. An analysis found that root canal treatment success decreased in diabetic patients with periapical lesion¹⁰. Numerous studies reported a higher prevalence of periapical lesions in diabetic patients than in nondiabetic patients¹¹⁻¹⁴.

Chronic inflammatory disease of periodontal and endodontic origins are similarities that are chronic infections fascinating oral tissues, part a prevelant microbiota that frequently is associated with gram-negative anaerobic bacteria, high systemic cytokines and inflammatory mediators levels have been observed in connective with both disease processes¹. Well-established root canal treatment cured AP¹⁵. Despite that, root canal fillings with low quality that are risk factors for the continuity of periapical lesions usually associated with a secondary root canal infection^{16,17}.

The aims of this study were determine the prevalence and technical quality of endodontic treatment and currency of AP in diabetic and nondiabetic patients attending KSU by analysis of panoramic radiographs.

II. Material And Methods

Patient selection

The local university's ethical board approved this study. A random 120 sample of subjects (60 diabetic and 60 nondiabetic-control) attending the dental clinics at KSÜ (Kahramanmaraş, Turkey), for the first time between 2017 and 2020 were evaluated. These patients were randomly selected. Panoramic radiographs taken by a well-trained radiographic technician using a digital panoramic radiograph device (Gendex GXDP-700,

Hatfield, PA, USA) were evaluated by expert researcher. Periapical and endodontic status were diagnosed by examining the digital panoramic radiographs.

The samples were randomly selected according to the following inclusions criteria: subjects over 15 years of age with more than 10 teeth (excluding third molars) who required the panoramic radiograph as part of dental diagnosis and treatment plan were included in the study.

Panoramic radiographs of good quality and showing the periapical status of the present teeth were evaluated. All teeth were recorded according to the FDI. The following data were recorded on a structured form for each subject: patient's age and gender, health status (diabetic or nondiabetic), teeth present, , number and location of root-filled teeth with and without AP, the technical quality of the root canal filling. Multi-root teeth were evaluated as a single unit.

Radiographic examination

The radiographs were analyzed for several variables such as radiographic quality and health of the apical status according to the criteria proposed by Ørstavik et. al.¹⁸.

The scale was maintained at 100%, and all radiographs were saved in JPEG format under a code. The operator was calibrated and subsequently evaluated all coded radiographs blindly.

The periapical status

The periapical status was assessed using the periapical index (PAI) as described previously^{19, 20}. Each tooth was assigned to one of the PAI scores by using visual references for the five categories within the scale²¹. A score greater than 2 (PAI ≥ 3) was considered to be a sign of periapical pathology. The worst score of all roots was taken to represent the PAI score for multirrooted teeth.

Quality of root canal fillings

As noted in the clinical records, technical standard was analysed solely on the filling of canals with gutta-percha and sealer.

Root canal filling 0–2 mm short of the radiographic apex (adequate) root canal filling >2 mm short of the radiographic apex (inadequate) root canal filling extruded beyond the radiographic apex (inadequate) root canal filling limited to the pulp chamber (inadequate)

Statistical method

The suitability of the data for normal distribution was examined with the Kolmogorov-Smirnov test. Logistic regression analysis was applied to examine the effect of clinical parameters on periapical and endodontic conditions. Group comparisons were examined with exact test for normally distributed variables and Mann-Whitney u test for non-normally distributed variables. Statistical parameters were expressed in Median (q1-q3). R.3.3.2 statistical software and SPSS version 22 program (IBM SPSS Statistics for Macintosh, Version 22.0; IBM, Armonk, NY) were used to evaluate the data.

III. Result

The DM patients ranged 27–82 years of age with a mean age of 51 years, and a small majority being males (26,20%). The control patients ranged 15–64 years of age with a mean age of 34 years, and a small majority being males (36,70%, $p=0,216$). There were 1275 teeth in the entire sample with a mean verage number of teeth DM per patient of 23,0 (min=3.0; max=30.0) a mean average number of teeth per patient of 29,0 (min=6.0; max=32.0) ($P<0.001$). The average number of teeth per patient was 22.9 ± 5.4 and 28.6 ± 3.6 teeth in the diabetic and control groups, respectively ($P<0.001$). One or more root-filled teeth were found in 129 and 80 of diabetic and control subjects, respectively ($P = 0.054$). AP with root-filled teeth was found in 29 diabetic patients (48,3%) and in 23 control subjects (38,3%) ($P = 0,386$).The analysis recommended that both periapical and endodontic condition were significantly associated with diabetic situation. Adjusting for teeth number, multivariate logistic regression analysis revealed that periapical status ($p=0,386$) and number of root-filled teeth ($p=0.054$) remained significant.

Root fillings of inadequate technical quality in length and density were seen in only 40.6% of root-filled teeth. Of 129 root-treated teeth in DM patients, 59 teeth (45.7%) had incomplete length of filling, being short of the apex, 52 teeth (40.3%) had incomplete condensation of filling. Of 80 root-treated teeth in control patients, 32 teeth (40%) had incomplete length of filling, being short of the apex, 22 teeth (27.5%) had incomplete condensation of filling.The most prevalent root canal treated tooth was the mandibular molar (18,6%) in diabetic and nondiabetic patients followed by the maxillary premolar (13,3%).

IV. Discussion

Some studies have used the PAI with panoramic radiographs because of the relevance of acquiring panoramics and the effectiveness of using panoramics for diagnosis of periapical pathosis in research^{22, 23}. The PAI score²⁴ were used to aveluate the appearance of AP. We were radiographically evaluated in order to inform the situation of root canal treatments, the quality of the fulfill treatments, and the periapical condition of the study grups.

The ordinary number of teeth was lower in diabetic grups than in control subjects in this study. The numerous reports shows that DM, especially when badly controlled is associated with meaning tooth loss because of the improved incidence and seriousness of caries and the aggressive forms of periodontal disease²⁵. Wang et al. reported that diabetic patients were significantly associated with tooth extraction risk²⁶.

Regarding the prognosis of root canal treatment, the technical quality of root fillers has been extensively investigated. In the literature, many epidemiological studies recommend a higher prevalence of inadequate root canal fillings and also a higher rate ratio of AP associated with root canal filled teeth^{12, 22, 27, 28}. In these studies, there is a large percentage of insufficient root fillings in the range of 49-87%²⁹⁻³². The quality of endodontic treatment in this study was 45.7% and 40% of diabetic and control subjects of root fillings being inadequate, respectively.

Most studies in the literature reported that the technical quality of root fillings has been assessed with different criteria. . Some of retrospective studies evaluating technical quality of root fillings have only regard as length and density^{20, 22, 33}. The percentage of root canal fillings with inadequate length was 45.7% and 40% of diabetic and control subjects in the present study respectively. In the literature, many studies have considered the ideal root canal filling length within 2 mm of the radiographic apex as the gold standard^{20, 24}. When the technical standard of root canal treatment was considered sufficient, recovery rates of 68% to 100% were found in non-diabetic and diabetic patients.^{34, 35} Root canal infections in diabetic patients are associated with decreased success in endodontic treatment, and flare-ups may have increased in these patients³⁵. In addition, the presence of AP in diabetic patients also increases the absence of DM control. This relationship shows a cross- susceptibility between both diseases, which increase the clinical degree of root canal treatment failure¹.

Our study group comprise of 73.8% diabetic females and 26.2% diabetic males; 63.3% nondiabetic females and 63.3% nondiabetic males . Some epidemiological studies have reported that gender has no impact on the number of endodontic treated teeth or AP existence^{20, 36}. The healing process in patients with DM is difficult. This means the progression of periapical lesions after treatment, and this is not gender dependent. Britto et al found that men with type 2 diabetes were extremely likely have lesions after endodontic treatment³⁷.

Maxillary and mandibular molars, followed by premolars were frequently treated with root canal treatment in our study sample. Compared with maxillar, mandibular teeth had a high prevalence of root canal treatment and AP. Because mandibular molars show many morphological variations of their complex root canal anatomies, this may be the reason for the high prevalence of failure made in these teeth³⁸.

In the present study, 48,3% of the root-filled teeth were associated with periapical lesions in diabetic patients and 28.8% of teeth had nonhealthy periapical structure in nondiabetic patients. In our study, periapical lesions were more prevalent and larger in diabetic patients than in nondiabetic ones . This result is in relevant with previous reports^{10, 14, 21, 39, 40}. In non diabetic patients, this percentage was absolutely a result of the higher incidence of inadequate endodontic treatment, as epidemiological studies have shown that the higher prevalence of AP found in root filled teeth is involved in the poor technical quality of root fillings^{14, 41, 42}. The investigators reported the close relation of healing of AP (94%) and the roots filled ideally close (0–2 mm) to apex and the healing ratio of AP were 68%²⁸. However, most studies also prove a high prevalence of AP in patients with uncontrolled diabetes^{10, 13, 37, 39, 43}. Some studies have suggested increased sensitivity to lesions in patients with diabetes, as well as reduced defense against pathogens in periapical tissue after root canal treatment^{11, 44}. In addition in patients with uncontrolled diabetes, an increased periapical radiolucency was observed after root canal treatment in theeth with pulp necrosis³⁹.

In the literature, there is contradictory results relevant to the influence of root-filling density: Some studies have demonstrated that homogeneous root filling teeth cause more stable healing^{31, 45}, whereas some of the other studies have shown no difference between adequately and inadequately root fillings^{29, 30, 41}, and AP can be eliminated by increasing the quality of root canal fillings²⁰.

One study has suggested that failure of canal treatments in patients with diabetes may increase the rate of permanent AP³⁹. In the present study, 40.3% of all root-filled teeth in DM grup had inadequate density of filling, while 27.5% had inadequate root filling density in control grup.

Root canal filling is sufficient only when the length, tapering and density of the filling are acceptable. 59.7% of patients in diabetic and 72.5% of non-diabetic patients were found to be adequate with these criteria together. The result of this prevalence is acceptable of all articles, among which was published an adequate root filling in the range of 17.7–64.5%^{28, 46}.

V. Conclusion

This study demonstrates a higher prevalence of AP in DM patients and increased number of root canal treatment. The prognosis for root-filled teeth was worse in diabetics. a higher rate of root canal treatment failure with an increased prevalence of AP were observed.

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Aliye Kamalak, et. al. "Periapical and Endodontic Status of Type 2 Diabetic Patients: A Cross-sectional Study." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(7), 2020, pp. 60-64.