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Research Article

DISTRIBUTION AND SEVERITY OF APICAL ROOT RESORPTION IN INFLAMMATORY PERIAPICAL PATHOLOGIES AMONGST DIABETIC AND NON DIABETIC PATIENTS – A PILOT STUDY

Durgadevi B[1*], Jimsha VK[2], Srinivasan SV[3], Jonathan Daniel M[4]

[1]Postgraduate Resident, Department of Oral Medicine and Radiology, Mahatma Gandhi Postgraduate Institute of Dental Sciences Pondicherry, Puducherry (U.T), India
[2]MDS, Asst. Professor, Department of Oral Medicine and Radiology, Mahatma Gandhi Postgraduate Institute of Dental Sciences Pondicherry, Puducherry (U.T), India
[3]M.D.S., Professor, Department of Oral Medicine and Radiology, Mahatma Gandhi Postgraduate Institute of Dental Sciences Pondicherry, Puducherry (U.T), India
[4]B.SC, M.D.S, Associate Dean (Academic), Professor and Head, Department of Oral Medicine and Radiology, Mahatma Gandhi Postgraduate Institute of Dental Sciences Pondicherry, Puducherry (U.T), India

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*Corresponding Author: **Dr. B. Durgadevi**
Department of Oral Medicine and Radiology, Mahatma Gandhi Postgraduate Institute of Dental Sciences Pondicherry, Puducherry (UT), India,
Phone number: +91 8838418036, E-mail: durgaboopathi@gmail.com

ABSTRACT

Diabetes mellitus is one of the common metabolic disorders that affect multiple organs. Diabetes and oral diseases such as dental caries and periodontal disease have been extensively studied.

Aim: The aim of the study was to assess the distribution and severity of apical root resorption in inflammatory periapical pathologies and to correlate the severity amongst diabetes mellitus and non diabetes mellitus patients.

Materials and methods: This pilot study included 24 patients, 12 diabetic patients grouped as case group and 12 non-diabetic patients grouped as control group. Periapical pathologies were assessed by clinical examination. Intraoral periapical radiograph was recorded and severity was studied.

Results: The prevalence of apical root resorption was evidenced more in the case group compared to control group. Moderate and severe root resorption was more in periapical abscess group of diabetes patients when compared to apical periodontitis group.

Keywords: Apical root resorption, diabetes mellitus, pulpal disease, periapical abscess, apical periodontitis.

INTRODUCTION

Dental caries is the most common, often overlooked oral disease. It often affects the pulp of the teeth, leading to pulpitis and extending to the periapical inflammation of the apical and periradicular tissues. Sequelae of dental caries being pulpitis, apical periodontitis, periapical abscess and granuloma, the inflammation of the periradicular tissues might cause the resorption of the root apex.

Diabetes mellitus (DM) is a group of complex multisystem metabolic disorders due to deficiency in insulin secretion caused by pancreatic ß-cell dysfunction and/or insulin resistance in liver and muscle. The relationship between oral health and diabetes has been extensively reported in the literature, in regard to periodontal disease. However, in the endodontic context, experimental and clinical studies also demonstrate a higher prevalence of periapical lesions in patients with uncontrolled diabetes.

Patients with diabetes are prone to developing oral complications such as caries (Bender & Bender 2003, Zhen et al. 2010, Sano et al. 2011), pulp and periapical pathosis (Bender & Bender 2003). These studies were further backed up by Segura et al[1] (2012) who found higher prevalence of apical periodontitis at 81.3% in diabetics compared with 58% in control subjects. Among diabetic patients, 7% of teeth had apical periodontitis, whereas in control subjects 4% of teeth were affected. Similar results of increased prevalence of periapical lesions in patients with diabetes were reported by other studies suggesting that diabetes may serve as a disease modifier of periapical lesions.

Root resorption is defined by Ne et al[2] as "a condition associated with either a physiologic or a pathologic process resulting in the loss of dentin, cementum or bone". It may be caused in sequence to orthodontic treatment, trauma, and chemical irritant or chronic periapical inflammation. A number of chemical mediators of inflammation, including the cytokines IL-1a, IL-1b, TNFa, prostaglandins and LPS, seem to be related to the pathogenesis of periapical lesions (Schein & Schilder 1975, Schonfeld et al. 1982, Burchett et al. 1988, Wang & St Henko 1993). These substances may stimulate root

resorption in the same way that they stimulate bone resorption (Hammarstro & Lindkog1992)[3].

Pathogenesis of inflammatory apical root resorption:

Diabetes mellitus may accentuate the chronic inflammatory disease by following mechanisms:

DM-induced changes in immune cell function produce an inflammatory immune cell phenotype (up-regulation of pro-inflammatory cytokines from monocytes / polymorphonuclear leukocytes and down regulation of growth factors from macrophages). This predisposes to chronic inflammation, progressive tissue breakdown, and diminished tissue repair capacity.

Apical root resorption in periapical pathologies may result from local inflammation thereby releasing chemical mediators such as cytokines IL-1a, IL-1b, TNF alpha, prostaglandins and lipopolysaccharides, thus initiating the pathogenesis of root resorption. In support to this hypothesis, a previous study by Kohsaka et al[4], where the changes in pulpal and periapical tissues were studied histologically and histometrically, after pulpal exposure in streptozotocin-induced diabetic rats and found, in experimental rats, inflammation in the apical periodontal ligament and root resorption and alveolar bone resorption were found more severe than that in control rats. Among other intraoral and panaromic radiographic imaging, intraoral periapical radiographs (IOPAR) provides accurate information for diagnosis and treatment planning of periapical lesions and more precise on the periapical status of the teeth[5].

MATERIALS AND METHODS

This pilot study was conducted in Mahatma Gandhi Post Graduate Institute of Dental Sciences, Pondicherry among 24 patients. Patients of age between 35 – 65, with clinically diagnosed inflammatory periapical pathologies in permanent teeth- apical periodontitis and periapical abscess were included in the study and patients suffering from other endocrine imbalances and systemic diseases, root canal treated teeth, primary dentition, advanced orofacial syndromes were excluded.

Patients with uncontrolled diabetes were chosen from diabetic clinic in the institution and confirmed by fasting blood sugar and post prandial blood sugar levels and grouped into case group (12). Patients with no history of systemic disease were grouped as control group (12). By prompt clinical examination, chronic inflammatory periapical pathologies in the groups were detected and grouped as apical periodontitis and periapical abscess.

An intraoral periapical radiograph was recorded, using a E speed adult size film and intraoral X ray machine with exposure parameters of 70 Kvp, 10 mA , time - 0.05 seconds. Manual processing done and the radiograph was interpreted for the pathology using magnifying lens with a 3 X magnification. All procedures were carried out by a single individual in the same intraoral machine and exposure parameters.

CLINICAL EXAMINATION

Patients reporting with signs and symptoms of periapical inflammatory pathology were clinically examined.

- Clinical history
- Sensitivity to percussion
- Presence of intraoral and extra oral swelling
- Sensitivity to hot and cold fluids
- Presence of fistula, sinus opening

RADIOGRAPHIC ASSESSMENT

Each periapical radiograph was assessed in a fixed intensity view box, to check the morphology of the root surface, width of periodontal ligament space and continuity of the lamina dura and status of periapical bone. Apical periodontitis is evidenced as widening of periodontal space with intact lamina dura, whereas Periapical abscess as loss of continuity of lamina dura and presence of irregular ill defined radiolucency at the periapex.

The teeth with periapical radiolucencies was examined for the absence or presence of resorption in the apical third of the root and were divided into three categories[6,7].

- No resorption: Intact outline of the root surface with uniform density in root contour.
- Mild resorption: Slight/ mild blunting of the root tip.
- Moderate resorption: Presence of blurred irregularities on the apical root contour, with less radio dense areas than the rest of the root.
- Severe resorption: Presence of distinct radiolucent indentations or shortening of root tip.

STATISTICAL ANALYSIS

The data was collected systematically among the case and control groups, and the severity of the root resorption was recorded among the gender and sub groups. The case and control group were subdivided into apical periodontitis and periapical abscess group and the severity of root resorption was recorded and subjected to SPSS statistical analysis. The comparison between and within groups were conducted by chi square test.

RESULTS

Table 1 shows Comparison of mean age between diabetics and non-diabetics showed that there was no statistically significant difference observed $p>0.05$. The case group and control group were matched for further statistical analysis. Table 2 shows the comparison of Degree of apical root resorption between apical periodontitis and periapical abscess group showed that there was no statistical significant difference found $p>0.05$. However, the periapical abscess group showed higher distribution of moderate and severe degree of apical root resorption. 40% of apical periodontitis group and 57.14% of periapical abscess group had moderate resorption, whereas 20% of apical periodontitis group and 28.57% of periapical abscess group had severe root resorption.

Table 3 shows that In the Non-diabetics group, comparison of Degree of apical root resorption between apical periodontitis and periapical abscess groups showed that there was no statistical significant difference found $p>0.05$ and about 62.5% of apical periodontitis group and 50% of periapical abscess group showed no evidence of root resorption. Table 4 shows Comparison of Degree of apical root resorption between Diabetics and Non-Diabetics group showed that there was a statistical significant difference found $p<0.05$.

Table 1: Comparison of mean age between diabetics and non-diabetics showed that there was no statistically significant difference observed p>0.05

Group	N	Mean Age	SD	F	*P* Value
Diabetics	12	49.25	8.68	0.017	0.898
Non-Diabetics	12	48.33	8.65		

Table 2: Comparison of Degree of apical root resorption between apical periodontitis and periapical abcess group in case group

Diabetics	Degree of apical root resorption				Chi-Square	*P* Value
	No resorption	Mild	Moderate	Severe		
Apical periodontitis	1 (20%)	1(20%)	2(40%)	1(20%)	1.714	0.634
Periapical abcess	0	1(14.28%)	4(57.14%)	2(28.57%)		

Table 3: Comparison of Degree of apical root resorption between apical periodontitis and periapical abscess in Non Diabetes group

Non-Diabetics	Degree of apical root resorption			Chi-Square	*P* Value
	No resorption	Mild	Moderate		
Apical periodontitis	5(62.5%)	2(25%)	1(12.5%)	0.321	0.852
Periapical abcess	2(50%)	1(25%)	1(25%)		

Table 4: Comparison of Degree of apical root resorption between Diabetics and Non-Diabetics group showed that there was a statistical significant difference found p<0.05

Group	Degree of apical root resorption				Chi-Square	*P* Value
	No resorption	Mild	Moderate	Severe		
Diabetics	1(8.335)	2(16.67%)	6(50%)	3(25%)	9.700	**0.021**
Non-Diabetics	7(58.33%)	3(25%)	2(16.67%)	0		

DISCUSSION

Pathological apical root resorption is a complex process involving inflammatory cells, resorbing cells, cytokines and various enzymes. In apical root resorption, the outer surface of the root is resorbed by odontoclasts. Radiographically, it appears as radiolucency on the external surface of the dentin with or without shortening of roots. Diabetes mellitus can increase the prevalence of apical root resorption among periapical inflammatory pathologies by increased interleukins, altered inflammatory process due to malfunctioning of leukocytes and more gram negative bacteria present in periradicular tissues.

Cytokines such as tumor necrosis factor (TNF)-a, interferon (IFN)-c, interleukin (IL)-2 and IL-12 produced by type 1 T helper cells (Th1) are bone resorption activators, whilst IL-4, IL-5, IL-6, IL-10 and IL-13, considered as type 2 T helper cells (Th2), are bone resorption inhibitors (Fukada et al. 2009, Teixeira-Salum et al. 2010)[9]. Britto et al[9] investigated the prevalence of radiographic periradicular radiolucencies in root-filled teeth and untreated teeth in patients with and without diabetes. Results showed that men with type 2 diabetes who had root canal treatments were more likely to have residual lesions. This may be due to the residual microbes that suggested to be adhering to the irregular peri foraminal region caused by apical root resorption.

In this study, the overall prevalence of apical root resorption is more in diabetic group compared to non diabetic group (p value < 0.05).The severity of apical root resorption is more among periapical abscess group of case group, when compared to apical periodontitis group. Whereas, the severity and distribution of apical root resorption in the control group is not statistically significant. Patients with diabetes showed increased extent of apical root resorption, even in early stage of periapical disease, rather than non diabetic patients. Fig 1 depicts no apical root resorption visible in a case of apical periodontitis in relation to 36. Fig 2 shows moderate and severe root resorption evident in relation to 37 and 36 respectively. Fig 3 shows Moderate root resorption evident in relation to 26, a long standing periapical inflammation. Fig 4 depicts severe root resorption visible in a clinically diagnosed case of periapical abscess.

Figure 1: Apical root resorption evident in periapex of 36, without any sign of resorption

Figure 2: Moderate and severe root resorption evident in apex of 36 and 37

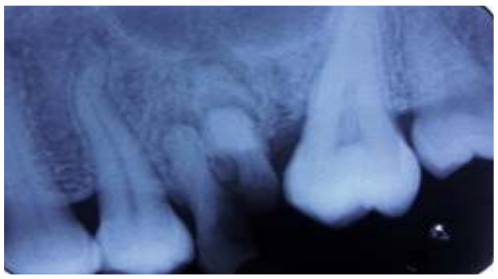

Figure 3: Moderate root resorption irt 26

Figure 4: Severe root resorption in a case of periapical abscess

Lim Xin Wei et al[10] assessed the root resorption in inflammatory periapical pathology among 333 patients. Of which 135 (40.5%) showed definite apical root resorption. Among 135 ARR, 97 (71.9%) were moderate resorption , 38 (28.1%) were severe resorption. Apical root resorption was significantly greater in periapical granuloma and cyst (72.8%) followed by periapical abscess (35%) and acute apical periodontitis (18.1%) which was statistically significant (P<0.001). It is proposed that histological study is the gold standard in regard to apical root resorption and periapical inflammation in most cases, causes intra foraminal and peri foraminal root resorption, even though not radiographically evidenced.

CONCLUSION

This pilot study addresses the association of diabetes mellitus and oral periapical inflammatory pathologies. Apical root resorption may affect the outcome of endodontic treatment, increasing the chances of obturating materials extruding into the periapical region, induce further root resorption. Diabetes mellitus may increase the extent and distribution of apical root resorption by altering the inflammatory process and also odontoclasts. Proper control of diabetic mellitus is important not only for periodontal health, but also for maintaining pulp and periapical health. Chronic inflammatory periapical lesion should be assessed for apical root resorption since it can alter the prognosis of endodontic treatment. This study may be further carried out among a larger study population with more precise and advanced radiographic techniques, in affirmative to the hypothesis of this study.

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