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Prevalence of nutrient canals in diabetes mellitus and hypertension: A radiographic study

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ABSTRACT

Aim: The present study is undertaken primarily to determine if a correlation in the appearance of nutrient canals with hypertension and diabetes exists and to determine whether the presence of nutrient canals can be used as a clue for the detection of hypertensive and diabetic patients. **Patients and Methods:** A total of 300 subjects were selected from the out-patient department comprising of 100 diabetic patients, 100 hypertensive patients and 100 patients without any systemic diseases as control group. Intraoral periapical radiograph of all these patients were taken for evaluation. **Statistical Analysis Used:** Statistical analysis of the data was done using the statistical package for the social sciences (SPSS 15.0) using Chi-square analysis. Differences were considered as significant when $P \leq 0.05$. **Results:** Of all these 300 patients, 162 patients exhibited nutrient canals whereas 118 patients didn't have nutrient canals. Of the 100 patients in Group I, 62 patients exhibited nutrient canals which accounts to 62% prevalence, 64 out of 100 patients in Group II, exhibited nutrient canals which account to 64% prevalence and 72 out of 100 patients in control group exhibited nutrient canals which account to 36% prevalence. **Conclusion:** As the study showed positive correlation, we conclude same that presence of nutrient canal can be used as an aid to rule out systemic diseases like diebeeis mellitus and hypertension.

KEY WORDS: Diabetes, hypertension, nutrient canals, radiograph

Diagnostic radiography in dentistry is primarily related to the three most common types of disease, namely dental caries, periodontal disease and periapical changes, and to relatively gross manifestations of osseous change in the maxilla and mandible. Very little effort has been made to relate less obvious radiographic appearances in the maxilla and mandible to sub clinical oral and systemic conditions. It has been recognized for many years that a wide variations exist in the radiographic appearance of identical anatomic structures. Trabecular space size, thickness of trabeculae, presence or absence of nutrient canals, pulp chamber and canal size are the few examples of such anatomic considerations.

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Nutrient canals are the spaces in the bone and are considered to be the channels that contain blood vessels. Hirschfield in 1923 first described the roentgenographic appearance of interdental canals. In most of the cases they have been described as normal anatomic features and no consideration has been given to the fact that they can be seen in radiographs of relatively few individuals. There are some investigators who consider nutrient canals as normal structures, whereas others have correlated the radiographic appearance of nutrient canals with various pathologic conditions such as periodontal disease, hypertension, diabetes, tuberculosis, rickets, calcium deficiency, disuse atrophy and coarctation of aorta.

The present study is undertaken primarily to determine if a correlation in the appearance of nutrient canals with hypertension and diabetes exists and to determine whether the presence of nutrient canals can be used as a clue for the detection of hypertensive and diabetic patients.

Materials and Methods

This is a cross sectional hospital based study conducted between September 2011 and June 2012 in the outpatient Department, Department of Oral Medicine and Radiology. Subjects of the present study consisted of patients who gave a medical history of having diabetes and hypertension. About 100 subjects with medical history of hypertension, 100 subjects with medical history of diabetes mellitus in the age group of 21-60 years were included in the study. 100 subjects with no relevant medical history with in this age group were selected randomly as controls among the patients attending radiology department during this period. A detailed history of the patient and thorough clinical examination was done and findings recorded. Patient's blood pressure was recorded using a sphygmomanometer and the patients were subjected for blood examination for random blood sugar levels. If the values of the blood sugar were above the normal limits, patients were advised to come on empty stomach on the next day and the patients were subjected for fasting blood sugar evaluation. After the clinical examination and blood investigations, an intraoral periapical radiograph of the mandibular anterior region was taken using bisecting angle technique under International council for radiation protection (ICRP) guidelines, protecting the patient and the operator.

Results

The distribution of patients in different groups of different ages was shown in Table 1. Of all these 300 patients, 162 patients exhibited nutrient canals whereas 138 patients didn't have nutrient canals. Among these, Group I had 62%, Group II had 64% and Group III had 36% prevalence.

When sex is taken into consideration, males had 50.54% (92 of 182) whereas females had 59.32% (70 of 118) prevalence.

Group I (diabetes)

Of the 100 patients in Group I, 58 were males of which 40 patients exhibited nutrient canals which account to 68.96% prevalence and 42 were females of which 22 patients exhibited

Table 1: Distribution of patients in different age groups and prevalence of nutrient canals in each group

Groups	Age				Nutrient canals		(%) age prevalence
	21-30 years	31-40 years	41-50 years	51-60 years	Present	Absent	
Group 1	8	26	38	28	62	38	62
Group 2	8	22	30	40	64	36	64
Group 3	8	44	36	12	36	64	36
Total	24	92	104	80	162	138	-

Table 2: Prevalence of nutrient canals in group 1 and group 2 in different age groups

Age group	Diabetic patients				Hypertensive patients			
	No. of patients	Nutrient canals		(%) prevalence	No. of patients	Nutrient canals		(%) prevalence
		Present	Absent			Present	Absent	
21-30 years	8	2	6	25	8	4	4	50
31-40 years	26	14	12	53	22	16	6	72.7
41-50 years	38	24	14	63.2	30	16	14	53.3
51-60 years	28	22	6	78.6	40	28	12	70
	Chi-square value 4.333			*P* value 0.227	Chi-square value 1.757			*P* value 0.624

Table 3: Prevalence of nutrient canals when compared with duration of diabetes and hypertension

Duration	Diabetic patients			Hypertensive patients		
	Nutrient canals		(%) age incidence	Nutrient canals		(%) age incidence
	Present	Absent		Present	Absent	
<=3 years	24	22	52.2	28	24	53.8
4-6 years	26	8	76.5	20	10	66.7
7-10 years	12	8	60.0	12	2	88.9
	Chi-square value 2.470		*P* value 0.290	Chi-square value 3.629		*P* value 0.162

Table 4: Prevalence of nutrient canals in diabetic and hypertensive patients when compared to controls

Patients	Nutrient canals		Chi-square value	*P* value
	Present	Absent		
Diabetics	62	38	6.673	0.008**
Hypertensives	64	36	7.840	0.004**
Control	36	64	-	-

*Statistical significance at 5% level

nutrient canals which accounts to 52.38% prevalence [Table 1].

Of the 100 patients examined, the prevalence of nutrient canals had shown a drastic increase with age of the patient [Table 2] and the duration of the disease [Table 3].

On comparing the prevalence of nutrient canals of patients in Group I (diabetes) with the patients in Group III (Controls), the *P* value was found to be 0.008 and was found to be statistically significant at 5% level [Table 4].

Group II (hypertensive patients)

Of all these 100 patients, 64 patients exhibited nutrient canals whereas 36 patients didn't have nutrient canals, which accounts to 64% incidence [Table 1].

Of the 100 patients examined, there was 50% prevalence of nutrient canals in the age group of 21-30 years, 72.7% prevalence in the age group of 31-40 years, 53.3% prevalence the age group of 41-50 and 70.0% prevalence years in the age group of 51-60 years [Table 2].

Of these 100 patients, the duration of the disease and incidence of nutrient canals were compared and found, 53.8% prevalence in patients with disease duration less than 3 years; 66.7% prevalence with disease duration between 4 years and 6 years; 88.9% prevalence with disease duration between 7 years and 10 years [Table 3].

Of the 100 patients, the prevalence of nutrient canals and the severity of hypertension were compared and found, 64 patients were having stage I hypertension of which 40 patients exhibited nutrient canals which accounts to 62.5% prevalence and 36 patients were having Stage II hypertension of which 24 patients exhibited nutrient canals which accounts to 66.6% prevalence. On comparing the prevalence of nutrient canals of patients of Group II (Hypertensive patients) with the patients of Group III (Controls), the *P* value was found to be 0.004 and was found to be statistically significant at 5% level [Table 4].

Group III (controls)

Of the 100 patients examined, 8 were in the age group of 21-30 years of which two patient exhibited nutrient canals, which accounts to 25% prevalence; 44 patients in the age group of 31-40 years of which 20 patients exhibited nutrient canals which accounts to 45.5% prevalence, 36 patients in the age group of 41-50 years of which eight patients exhibited nutrient canals which accounts to 22.2% prevalence and 12 patients in the age group of 51-60 years of which six patients exhibited nutrient canals which accounts to 50.0% prevalence [Table 1].

Discussion

There had been a varied opinion regarding the sex distribution of the nutrient canals as expressed by various authors. Patel and Wuehrmann[1] said that there was no correlation between the existence of nutrient canals and sex of the patients. Many studies showed that there was an increased incidence of nutrient canals in the female patients;[2-4] whereas Patsakas and Donta[5] in their study had reported that the incidence was increased in males. No valid explanation had been provided for the increased incidence in a particular sex in the above mentioned studies. Our study showed a slightly higher prevalence in females where males showed 50.54% prevalence to that of females with 59.32% prevalence.

Considering the radiographic technique, few authors had not mentioned the radiographic technique used in their study.[4,6,7] Some researchers used bisecting angle technique,[2,8,9] whereas Patel and Wuehrmann[1] had employed paralleling technique. Bisecting angle technique had been used in this study for taking the radiographs to bring out the better appearance of nutrient canals.

Group I (diabetes mellitus) and nutrient canals

The occurrence of nutrient canals in diabetes mellitus patients was 62% when compared to the control group which was 36%. The *P* value was found to be 0.008, which was statistically significant at 5% level. Similar findings were also reported by Patel and Wuehrmann[1] where there was 58.4% prevalence in diabetes mellitus patients to that of 43.9% prevalence in non-diabetics and Pierrakou and Donta[10] where there was 75.34% prevalence in diabetes mellitus patients to that of 41.6% in non-diabetics. This may be because of higher sample size in their study compared to that of our study. The prevalence of nutrient canals in diabetes mellitus patients was slightly higher in males which were 68.94% to that of females which was 52.38% in our study. Similar results were given by Pierrakou and Donta[10] where there was 54.5% in males to that of 46% in females.

According to Isselbacher, *et al.*[11] the deficiency of insulin has the mitogenic action on the endothelial cells, which would lead to collateral vessel formation. In diabetes mellitus also the process of atherosclerosis can be seen leading to narrowing of blood vessel lumen. So we could expect collateral vessel formation as a compensatory mechanism, which leads to increased incidence of nutrient canals. This implies that, though the medication delays the systemic effects it cannot be totally prevented.

Group II (hypertension) and nutrient canals

The occurrence of nutrient canals in hypertensive patients was 64% when compared to that of the controls which was 36%. The *P* value was found to be 0.004, which was significant at 5% level. Our results were almost similar to the study results given

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by Patel and Wuehrmann[1] where the prevalence of nutrient canals in hypertensive patients was 60% to that of normal patients was 40% prevalence. Compared to the study by Patni, *et al*.,[9] where the prevalence of nutrient canals in hypertensive patients was 70.4% and that of normal patients was 56.2% in non-hypertensives. This could be because of the larger sample size and the difference in sampling procedures in their study.

Haslett, *et al*.[12] in 2002 said that the principle effects of hypertension are the dilatation of arterioles, hypertrophy and hyperplasia of the vessel wall, and arteriosclerosis. In arteriosclerosis, along with thickening of the arterial wall, there is narrowing of the lumen which may lead to the opening of more collateral to compensate the blood supply. Thus, either dilatation of the vessel wall or opening of more collateral or both of these changes, may be responsible for the increased incidence of nutrient canals in hypertensive patients.

The study by Patsakas and Donta[5] in 1990 showed the prevalence of nutrient canals was higher in hypertensive patients, which was 55% to that of 41.66% in non-hypertensives. They also told that the nutrient canals were more frequent in hypertensive males (68.75%) than in females (39.28%) and a gradual increase in the prevalence as the age increases. Compared to their study, our study showed higher prevalence of nutrient canals in hypertensives than in non-hypertensives. Our study showed a higher prevalence of nutrient canals hypertensive females which were 75.0% to that of males which was 56.66%. Our study also showed a gradual increase in the prevalence of nutrient canals with age as said in the above study.

Compared to the study by Bilge, *et al*.[2] in 1992, where the prevalence of nutrient canals in hypertensives was 79.16% whereas our study showed less prevalence than their study, which was only 64% prevalence in hypertensive patients. The prevalence of nutrient canals in hypertensive patients with moderate bone loss was higher (70.0%) when compared to the hypertensive patients with mild bone loss (55%). Similar study done by Patsakas and Donta[5] in 1990 showed 58.33% prevalence in hypertensive patients with moderate bone loss and 54% in hypertensive patients with mild bone loss.

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