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NUTRIENT CANAL AS A DIAGNOSTIC AID

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ABSTRACT

Background: Nutrient canals are the radiolucency representing the spaces in bone through which blood vessels and nerves travel to supply surrounding structures. It is one of the incidental findings in the intraoral periapical radiograph which is often confused with fracture lines. **Aim:** To correlate the existence of nutrient canals in subjects with underlying systemic illness. **Objectives:** To determine whether the alteration in the presence or absence of nutrient canal can be a diagnostic aid in hypertensive and diabetic patients. **Materials And Method:** Radiographic evaluation of mandibular anterior intraoral periapical radiographs for the presence of nutrient canals in patients with hypertension and diabetes mellitus. 45 subjects were selected, which includes 15 diabetic subjects, 15 hypertensive subjects, and 15 subjects without any underlying systemic illness as control group. **Results:** There is a significant increase in the number of nutrient canals in diabetes and hypertensive patient compared to the normal healthy individual. **Conclusion:** Incidence of nutrient canals in the intra oral periapical radiograph can act as a supporting diagnostic aid in detection of underlying systemic conditions and aiding the patient in overall health and treatment planning.

KEYWORDS : nutrient canal, interdental canal, diabetes mellitus, hypertension, intraoral periapical radiograph, mandibular anterior region.

INTRODUCTION

Nutrient canal (NC) is defined as linear radiolucent space in the bone through which blood vessels and nerve travel to surrounding structures. It was 1st described by Hirschfield in the year of 1923. It is called by other names such as medullary canal, tubular canal, interdental canal, and vascular channel. It may arise from the incisive branch of inferior alveolar neurovascular bundle. [1,4] Commonly seen in Afro-Caribbeans.

Nutrient canal is predominately seen in anterior mandibular region, followed by maxillary premolar and wall of maxillary sinus. The reason for NC predominance in mandibular anterior is thin alveolar process, horizontally arranged trabeculae, decreased bony support of cortical and cancellous bone and more prone to irritation from calculus. NC has a vertical pattern rather than horizontal and is of varying width. Intraoral periapical radiograph is the best for visualizing the nutrient canal in mandibular anterior. [2,3]

Lovett classified NCs based on their radiographic appearance into 3 types. In Type I, Nutrient canal appear as radiolucent line with varying in size as a fine thread-like marking to a width of 0.5 mm and length from 1 to 2 cm. The course of NC may be linear, circular, and haphazard or a combination of any two or all three. In Type II, NC appears as moderately radiolucent line, with varying width from 0.5 to 1.5 mm and length from 3 mm to 2.5 cm. Their course is linear or circular and only occasionally haphazard. In Type III, NC has broad, slightly radiolucent line varying width from 1.5 to 4 mm and length of 6 mm to 7 cm. Their course is linear with smooth turns, or tight circular turns in the area of the mental foramen of the mandible. [1]

Some correlation was found between nutrient canal and pathological conditions such as diabetes mellitus, hypertension, tuberculosis, rickets, calcium deficiency, disuse atrophy, coarctation of aorta and periodontal diseases. Hence, Nutrient canal can be used as a diagnostic marker in detecting this systemic condition. [1]

AIM AND OBJECTIVE:

Aim of the study is to correlate the alteration of nutrient canals in subjects with type II diabetes mellitus and hypertension. To determine whether the alteration in the number of nutrient canals can be a diagnostic aid in hypertensive and type II diabetes mellitus patients.

MATERIALS AND METHOD

In the present study, patient aged between 20 to 60 years with a history of diabetes and hypertension were included. The total sample of 60 were divided into 3 equal groups. Healthy patients without any systemic diseases were included in group 1. Patient with appositive medical history of type 2 diabetes mellitus for minimum of 1 year (>200 mg/dl) were included in group 2. Patient with a positive medical history of hypertension for minimum of 1 year (>140/80 mm hg) were included in group 3. Patient with history of both diabetes mellitus and hypertension, lower anterior edentulous patient, periapical pathology, other systemic diseases and pregnancy were excluded from the study.

Ethical committee clearance for radiation exposure were obtained. Informed written consent was obtained from all the study participants. Radiographs were taken by bisecting angle technique using E speed films and confidence X ray unit of 7 mA and 70 kvp. The collection of Demographic data, medical history and clinical examination were performed. After assessing the diabetic and hypertensive status of the participants, IOPA were taken. All the radiographs are observed by two independent observers. The observation was entered and master chart were prepared for statistical analysis.

Statistical Analysis

Data, thus obtained were tabulated and subjected for further statistical analysis using SPSS 20.0 statistical software. Inter examiner reliability was assessed using kappa statistics for incidence of nutrient canal. Kruskal Wallis test was performed for intergroup comparison of NC. Mann-Whitney test value was performed for comparison of mean value of NC between male and female participants.

RESULT

The present study was prepared to correlate the alteration of nutrient canals in subjects with type II diabetes mellitus and hypertension.

The mean (SD) age of the study participants in Group 1, Group 2, Group 3 were estimated to be 37.2 (10.28) years, 38.70 (9.82) years and 40.40 (10) respectively. (Table 1)

According to observer 01, 12 members revealed NC of which 6 were males and 6 were females in Group 1; 19 members revealed NC of which 10 were males and 9 were females in Group 2 and 19 members revealed NC of which 8 were males and 11 were females in group 3.

According to observer 02, 14 members exhibit NC in group 1 of which 7 were males and 7 were females; 19 members exhibit NC in group 2 of which 10 were males and 9 were females and 18 members exhibit NC in group 3 of which 7 were males and 11 were females. (Table 2)

The Cohen kappa statistics test was performed to analyze interobserver reliability between two observer and showed disagreement between the observers. For the observer 1, p-value was statistically significant and the result showed the incidence of NC was more in Group 2 (DM) and Group 3(HT) compared to normal. (Table 3)

Table 1: Distribution Of Study Participants Based On Age

GROUPS	MEAN	SD	N
GROUP I - NORMAL	37.2	10.28	20
GROUP II- TYPE II DIABETES	38.7	9.82	20
GROUP III- HYPERTENSION	40.4	10	20

Table 2: Gender Wise Incidence Of Nutrient Canal Based On The Observers

GROUPS	Observer 1			Observer 2		
	Male	Female	Total	Male	Female	Total
Group 1 (normal)	6	6	12	7	7	14
Group 2 (type II Diabetic)	10	9	19	10	9	19
Group 3 (hypertension)	8	11	19	7	11	18

Table 3 Inter Examiner Reliability Using Kappa Statistics For Incidence Of Nutrient Canals

GROUP	OBSERVER 1		OBSERVER 2	
	Present	Absent	Present	Absent
GROUP 1 (NORMAL)	12	8	14	6
GROUP 2 (TYPE II DIABETIC)	19	1	19	1
GROUP 3 (HYPERTENSION)	19	1	18	2
Total	50 (83.3)	10 (16.7)	51 (85)	9 (15)
Kappa value	- 0.18		- 0.13	
p-value	0.003*		0.064	

DISCUSSION:

Nutrient canal stays the foremost mystery in its presence and furthermore as an absence. Some researchers associated the radiographic incidence of nutrient canals with the other factors like diabetes, rickets, calcium deficiency, periodontal disease, edentulous jaw and hypertension.

The present study was conducted to correlate the alteration of nutrient canals in subjects with type II diabetes mellitus and hypertension.

Nutrient canal was observed more in female participants in all the three groups. The difference in the NCs among the three groups in males and females was statistically insignificant. The present study is in accordance with the study done by Donta et al. who reported a prevalence of 60.8% in females and 39.2% in males but not consistent with the studies conducted by Patel and Wuehrmann, Kaur et al, and Bilge et al where the incidence of nutrient canal was prominent in males.
In the present study, Group 2 (DM) showed an increased incidence of nutrient canal. This is in accordance with the studies done by Ashima bali et al., Reddy et al. The reason behind this increased prevalence might be due to collateral vessel formation in patients with insulin deficiency. In DM, pronounced view of nutrient canal might be due to the contributing factors like resorption and reduced bone density especially in mandibular anterior region.

In addition, this study showed increased incidence of nutrient canal in Group 3 (hypertension) compared to control group. This is consistent with the study done by Kaur et al, and Smith bala et al.

The principal effects of hypertension are dilatation of arterioles, hypertrophy, and hyperplasia of the vessel wall and arteriosclerosis. In arteriosclerosis, there is a narrowing of the lumen due to thickening of the arterial wall, thus leading to more collateral opening of blood vessels, or both of which might be responsible for the increased incidence of nutrient canals in hypertensive patients.

On comparing the incidence of NC among the three groups, NCs were present more among Group 2 (diabetes) as compared to Group 3 (hypertension) due to combined effect of vascular dilatation and new collateral vessels.

In the present study, the presence of nutrient canals did not show any statistical significance on correlating with the systemic diseases, but an increased prevalence in diabetes and hypertension compared to control group.

CONCLUSION

Nutrient canal can also be used as an adjuvant diagnostic aid for the detection of systemic diseases. The presence of NC is not entirely indicative of systemic diseases but their presence should create the suspicion of systemic diseases which has to be investigated further. More studies with larger sample size should be conducted in the future.[2,4]

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