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Araştırma Makalesi / Research Article

Can Intra Oral Periapical Radiographs be Used as an Adjunct Diagnostic Marker in Detecting Underlying Systemic Diseases? A Randomised Case Control Study'

İntra Oral Periapikal Dental Radyografiler Altta Yatan Sistematik Hastalıkların Tespitinde Yardımcı Diagonostik Markerlar Olarak Kullanılabilir mi?- Randomize Edilmiş Vaka Kontrol Çalışması

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ABSTRACT

Purpose: Periapical dental radiography, despite being two dimensional and limited in size appears to be the best projection to identify the nutrient canals in the mandibular anterior region. A study was undertaken to evaluate the presence of mandibular nutrient canals in the anterior region using intra oral periapical films in subjects with hypertension, diabetes mellitus, completely and partially edentulous mandible, periodontally compromised subjects and in post menopausal women and was compared with controls.

Material and Method: The study consisted of seven groups each with 50 subjects. The radiographic analysis of the anterior mandible was done using the intra oral periapical radiographs and the presence or absence of nutrient canals was evaluated.

Results: A statistical increase in the prevalence of nutrient canals was observed in all the study groups. The nutrient canals were present in 8% in the control group, 34 % in the hypertensive group, 60% in the diabetes group, 72% in subjects with both diabetes and hypertension, 70% in completely and partially edentulous patients, 62 % in the periodontitis group and 50% in the post menopausal women.

Conclusion: The presence of nutrient canals can be used as an adjunct diagnostic marker for detection of underlying systemic diseases.

Key words: Nutrient,diabetes, dental.

ÖZET

Amaç: Periapikal dental radyografi , iki boyutlu ve boyutun sınırlı olmasına rağmen, alt çenenin ön bölgesindeki besin kanallarını belirlemek için en iyi projeksiyon tipi olarak görülür. Çalışma; hipertansiyona , diabetes mellitus a, tamamen ve kısmen dişsiz alt çeneye sahip kişilerde, periodontal olarak risk taşıyan hastalarda ve menopoz sonrası kadınlarda intraoral periapikal filmler kullanılarak ön bölgedeki mandibular besin kanallarının varlığını ölçmeyi hedeflemiştir ve sonuçlar kontrollerle kıyaslanmıştır.

Materyal ve metod: Çalışma her biri 50 deneği içeren 7 gruptan oluşmuştur. Anterior mandibulanın radyografik analizi intra oral periapikal radyografiler kullanılarak yapıldı ve besin kanalların varlığı veya yokluğu değerlendirildi .

Bulgular: Besin kanalların prevalansındaki istatistiksel artış , tüm çalışma gruplarında gözlendi. Besin kanalları kontrol grubunun % 8' inde , hipertansif grubun % 34' ünde , diyabet grubu'nun % 60'ında , hem diyabeti hem de hipertansiyonu olan hastaların % 72'sinde, tamamen ya da kısmen dişsiz hastaların % 70'inde , periodontitis grubun % 62'sinde ve menopoz sonrası kadınların % 50'sinde bulunmaktadır.

Sonuç: Besin kanallarının varlığı, altta yatan sistematik hastalıkların tespiti için yardımcı tanı belirteci olarak kullanılabilir.

Anahtar kelimeler: Besin, Diyabet, Diş

INTRODUCTION

Intraoral radiography is undoubtedly the backbone of dental radiology. It has a key role in arriving at a confirmed diagnosis following clinical examination. Although the oral physicians are well versed with the normal anatomy, slight variations may highlight unrecognized systemic disorders. For example, loss of lamina dura in absence of any dental pathology may be taken as normal, but can be a manifestation of hyperparathyroidism, widening of periodontal membrane space without dental pathology may be indicative of a condition like scleroderma. Similarly the presence of another landmark namely nutrient canal has been correlated with various systemic diseases over a period of time which can be of clinical significance if thoroughly evaluated. Nutrient canals are spaces in bones and are considered to be channels that contain blood vessels and nerves[1]. They are frequently seen as fine linear, curvilinear or circular radiolucencies situated interproximally within the alveolar bone and inferior to the tooth roots.

They appear most frequently in the intra oral periapical radiographs of the mandibular anterior region, followed by the premolar region, the maxillary premolar area and the wall of the maxillary sinus. They have a vertical rather than a horizontal direction[2]. Nutrient canals were first described by Hirschfeld in 1923 and are also called interdental canals[3].

Many authors have interpreted nutrient canals as a diagnostic sign in confirming calcium deficiency. Some consider nutrient canals as normal structures, whereas others have correlated the radiographic appearance of nutrient canals with hypertension, diabetes mellitus, periodontal disease, rickets, calcium deficiency and disuse atrophy. The questions regarding the clinical significance and relationship between the presence of nutrient canals and various pathologies remain unanswered and it is not clear why they appear in some and not in others. Therefore, the purpose of the study was to evaluate the presence of nutrient canals in the intra oral periapical radiographs of the mandibular anterior region, thereby correlating their presence with a variety of disease states like hypertension, diabetes, periodontitits and partially and completely edentulous arches and physiological state like menopause and comparing them with the control group.

MATERIALS and METHOD

The present study is a randomized case control study conducted on subjects reporting to the Department of Oral Medicine and Maxillofacial Radiology. The study sample consisted of 350 subjects divided into 7 equal groups of 50 patients each of either gender, between the ages of 20 years to 70 years.

The groups were:

Control Group 1: Healthy subjects without any systemic and oral diseases.

Group 2: Subjects diagnosed with hypertension with blood pressure more than or equivalent to 140/90 mm of Hg or and who are on medication.

Group 3: Subjects diagnosed with Type 2 diabetes confirmed with random blood sugar estimation more than or equivalent to 200 mg/dl or who are on medication.

Group 4: Subjects diagnosed with both Type 2 diabetes and hypertension or as who are on medication. .

Group 5: Healthy subjects with bilaterally missing lower posterior teeth (partially edentulous) and completely edentulous

Group 6: Subjects with probing depth more than or equivalent to 4 mm and clinical attachment loss more than or equivalent to 2 mm.

Group 7: Post menopausal women above 45 years of age.

Written informed consent was obtained from each patient after the aims and methodology of the study was explained. In a case history performa, detailed history was recorded for each subject and thorough oral examination was performed for all the subjects.

I) Clinical Examination

Selected individuals were clinically evaluated by making the patients sit comfortably on a dental chair. Blood pressure was measured with stethoscope and sphygmomanometer by auscultatory method preceded by palpatory method. Random blood sugar levels were measured using GOD-POD method.

II) Radiographic Procedure

Dental intraoral x-ray machine (SATELEC) with 70 kvP and 8 mA and an exposure time of 0.4-0.8 seconds which was provided with a total filtration of 2mm aluminum equivalent was used in the study.

The mandibular anterior region was selected as the site of study due to higher frequency of occurrence of nutrient canals in this region. The patients were seated comfortably on a conventional dental chair and intraoral radiographic procedure was done by using paralleling cone technique as described by White SC, Pharoah MJ. XCP film holding instrument was used to position the film in position. A long 16 inch target film distance was used to compensate for the image magnification. After proper adjustment of the angulations, the films were exposed for appropriate time that was set on the timer. The edentulous patients were instructed to remove all non-fixed prostheses from the mouth before the radiographic procedure.

III) Processing of the Exposed Films

The films were then processed by the automatic processor (Durr periomat).

IV) Interpretation of Radiographs

Interpretation of radiographs was carried out with the help of radiographic viewer and a magnifying lens. The radiographs were evaluated for the presence or absence of radiolucent lines running vertically either in interdental area or in the periapical region.

All the radiographs were evaluated by two inter examiners [‘1’ and‘2’], if any conflict was detected between the findings of the radiographs a third inter examiner was introduced [‘3’]. The observations were then entered in the proforma from which master charts were prepared.

Data obtained were analyzed using Tukeys test for multiple comparisons between the groups, Chi- Square Test for comparison of individual study group to the control group and ANOVA test for gender matching using *SPSS* version 18 software.

RESULTS

108 subjects (60.7%) had the presence of nutrient canals who were above 50 years of age and the least was found in 11 subjects(6.2%) who were under 30 years of age (Graph 1).

Out of 350 subjects, 167 were males and 183 were females. Nutrient canals were present in 100 male subjects (59.88%) and in 78 female subjects (42.62%). There was a statistically significant increase in the occurrence of nutrient canals among the male subjects compared to female subjects. (p= 0.001) (Graph 2).

A statistically significant increase in the presence of nutrient canals in group 2, 3 subjects was observed when compared to subjects of group 1. (p= 0.001)

A statistically significant increase in the presence of nutrient canals in subjects of group 4 was observed when compared to subjects of group 1. (p= 0.001) When the prevalence of nutrient canals in group 2 (hypertensive) (34%) was compared to group 4 (72%) (both hypertensive and diabetic),a statistically very highly significant difference was observed [p‹ 0.001] .Similarly on multiple comparisons, group 4 showed a statistically very highly significant increase in the presence of nutrient canals when compared to group 3 (diabetic) (60%) [p‹ 0.001]. (Graph 3)

A statistically significant increase in the presence of nutrient canals in group 5 subjects was observed when compared to subjects of group1 subjects. (p= 0.001)

When an inter comparison was made between completely and partially edentulous group, a statistically significant difference was observed. (p= 0.001) A statistically significant increase in the presence of nutrient canals in group 6 subjects was observed when compared to subjects of group 1. (p= 0.001)(Graph 4)

A statistically significant increase in the presence of nutrient canals in group 7 was observed when compared to subjects of group 1. (p= 0.001)

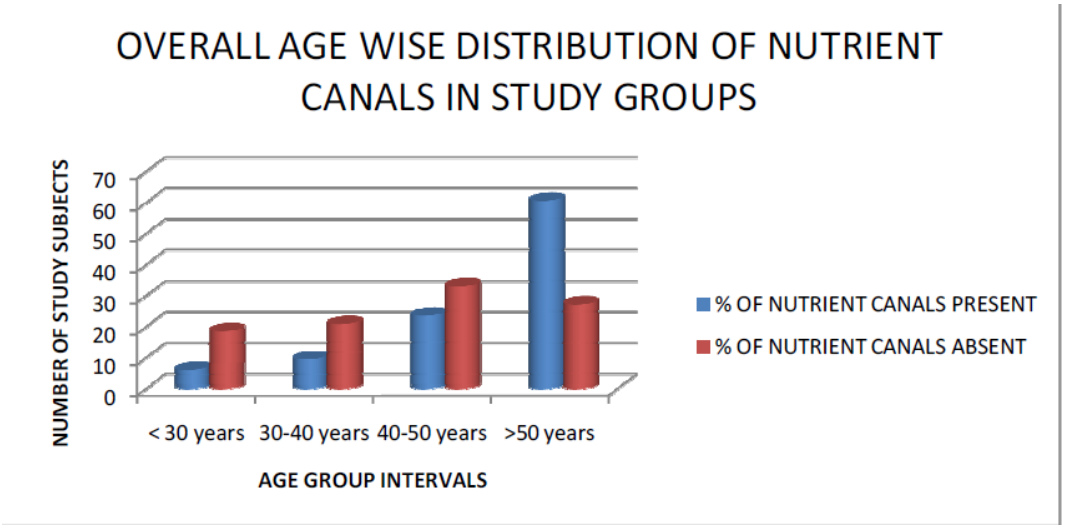

Figure.1. Overall Age Wise Distribution of Nutrient Canals

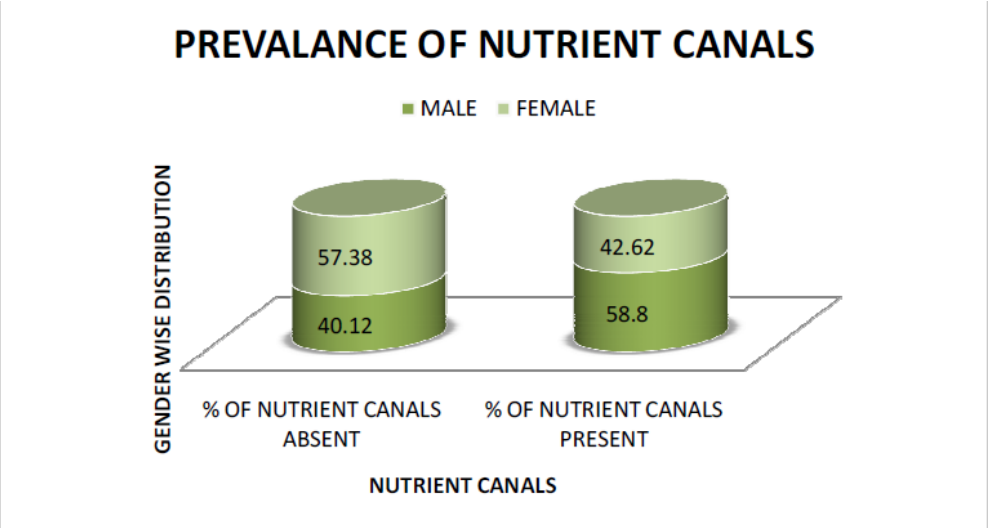

Figure 2. Overall Gender Wise Prevalence Of Nutrient Canals In Study Groups

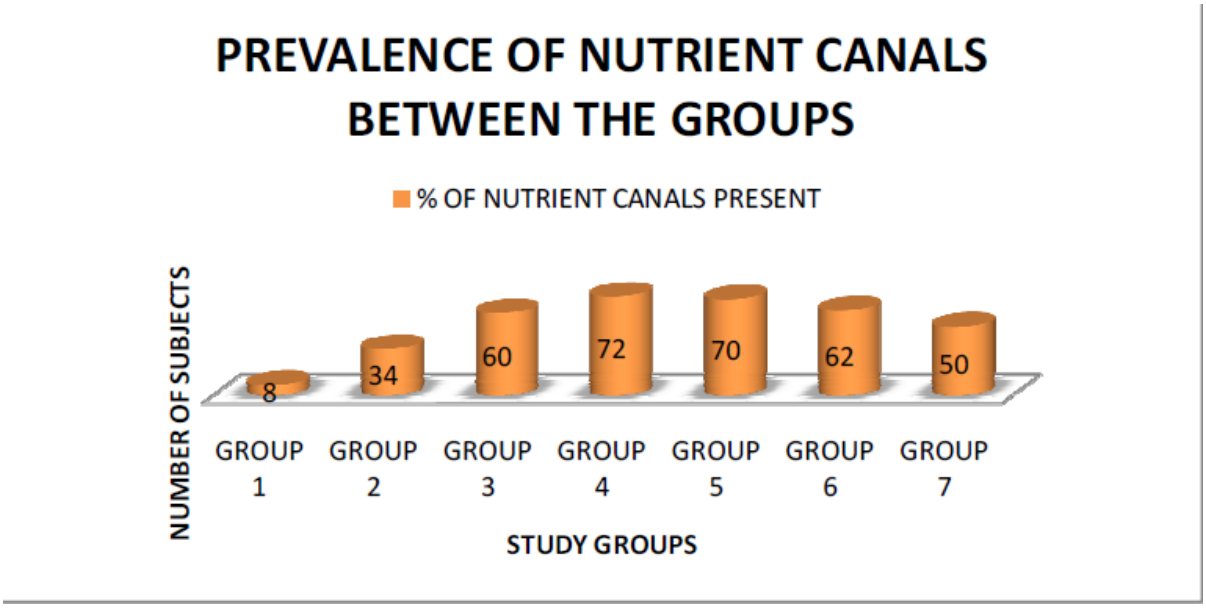

Figure.3. Prevalence of Nutrient Canals Between the Groups.

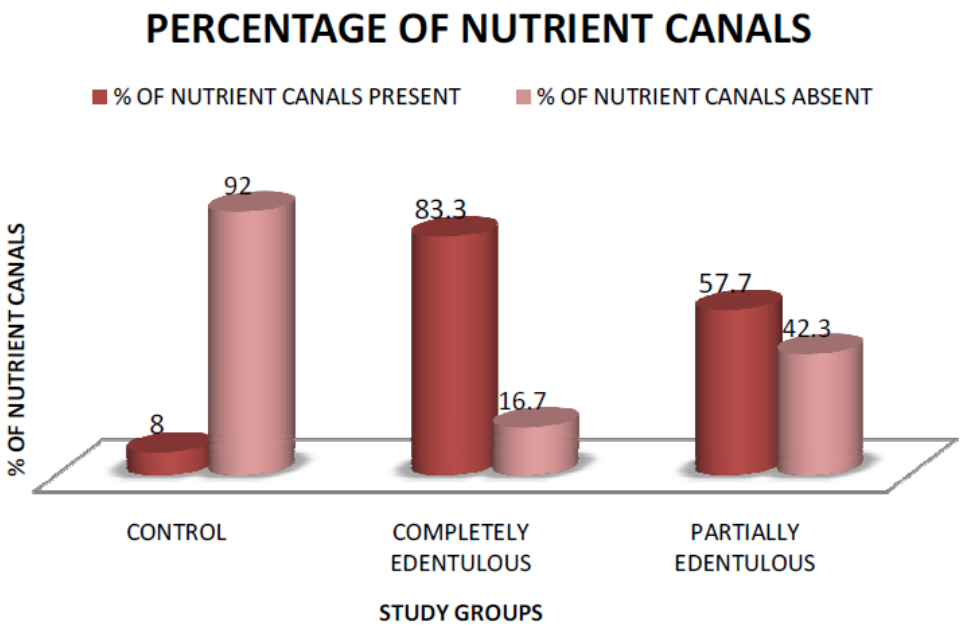

Figure. 4. Comparison of The Presence of Nutrient Canals Between Completely and Partially Edentulous Subjects.

DISCUSSION

Nutrient canals are frequently observed in the dental periapical radiographs, and they are considered to serve as conduits for blood vessels and nerves[4]. The predominance of nutrient canals in the anterior region is attributed to a thin alveolar process, horizontally arranged trabeculae and decreased bony support of cortical and cancellous bone which is more prone to irritation from calculus and trauma[1]. Of all the anatomic landmarks encountered on radiographic examination, nutrient canals remain the most enigmatic in their presence as well as absence[1]. Very few studies on nutrient canals have been conducted in Indian population when compared to studies undertaken on western population.

In the present study, the prevalence of nutrient canals was increased in the age group >50 years, which was in accordance with studies carried out by Reddy VG et al[1]. The possible factors for the increase in the nutrient canals can be attributed to edentulism, periodontitis, hypertension, diabetes mellitus etc. In the present study higher prevalence of NC was observed in males which was in accordance with studies carried out by Patel JR et al[2], Pierrakou ED et al[5] and Patsakas AJ et al[6] .

According to a study conducted by Greer DF et al 1968 [7], nutrient canals appear on 5% of routine intraoral radiographs. In the present study nutrient canals were present in 8% of control group. The nutrient canals are considered as a normal anatomical landmark in radiographic examination and it is not clear why they appear in some and not in others. The results of the present study were also in agreement with the majority of studies which reported an increased prevalence of nutrient canals in hypertensive subjects which could be due to dilatation of arterioles, hypertrophy and hyperplasia of the vessel wall, and arteriosclerosis, along with thickening of the arterial wall. There is narrowing of the lumen which may lead to the opening of more collateral blood vessels to compensate for the diminishing blood

supply. All these changes contribute to the increased presence of nutrient canals in hypertensive patients[1,8]

In the present study the prevalence of nutrient canals was more in the diabetes group which was in accordance with studies carried out by Pierrakou et al [5] and Reddy VG et al [1] They also reported that the recent blood glucose value and duration of disease has significant effect on the prevalence of nutrient canals. The reason postulated for the increase of nutrient canals in the diabetic group could be attributed to the deficiency of insulin having mitogenic action on endothelial cells which would lead to collateral vessel formation. The process of atherosclerosis can also be seen leading to narrowing of blood vessel lumen. Therefore, this collateral vessel formation may act as a compensatory mechanism which leads to increased prevalence of nutrient canals[1].

In the present study, an increased prevalence of nutrient canals was observed in patients with both diabetes and hypertension when compared to prevalence of nutrient canals in patients with only diabetes or only hypertension. None of the studies reported so far have evaluated the presence of nutrient canals in the patients with diabetes mellitus and hypertension. Since both the disease entities can cause alterations in vasculature and formation of collaterals their simultaneous presence may have probably caused the increase in the prevalence of nutrient canals.

In the present study, an increased prevalence of nutrient canals was observed in partially edentulous patients when compared to the control group which was in agreement with the study conducted by Kishi et al [9] who observed that the patients with a higher rate of mandibular molar loss were associated with the appearance of nutrient canals in the anterior mandible. The association between the loss of molars and the appearance of nutrient canals in the anterior mandible suggests that a shift in the occlusal stress towards the anterior teeth may have some effect on the osseous pattern.

Besides this, the present study also evaluated patients with completely edentulous. An increased prevalence of nutrient canals was observed in completely edentulous patients when compared to partially edentulous patients. This was in agreement with studies carried out by Bilge OM et al[10] and Kishi et al[9]. Wood NK et al[11] reported that nutrient canals appear much more pronounced on intra oral periapical radiographs when the teeth are missing. The anatomic structure of the anterior mandible in edentulous patients is quite different from that of dentulous patients. The higher incidence of nutrient canals in edentulous persons may be associated with resorption of the alveolar bone following tooth loss and the thickness of the remaining alveolar bone. The knowledge of the anatomy of the nutrient canals in edentulous patients would be useful as they contain blood vessels which could be a potential bleeding point during any minor surgical procedure carried out in the mandibular anterior region. The presence of nutrient canals also indicates a thin ridge which is useful in implant assessment[12] . In the present study, an increased prevalence of nutrient canals was also observed in periodontally compromised patients with bone loss which was in accordance with the studies carried out by Patel JR et al[2] and Kishi et al[9]. The incidence of nutrient canals and the number of observable canals increased as the evidence of bone resorption became more severe. The presence of nutrient canals appears to be associated with the presence of periodontal disease that brings about sclerotic changes in the trabecular bone pattern. They also appear more pronounced due to the ability of radiographs to record the thinner bony structures clearly[1].

Hirschfeld[3] interpreted nutrient canals as a diagnostic sign in confirming calcium deficiency but later, in 1927, said that it was a normal entity. Some authors have also considered nutrient canals as a diagnostic sign in confirming calcium deficiency[2]. In the study reported here, post menopausal women were also evaluated for the presence of nutrient canals. A higher prevalence

was observed in the post menopausal group when compared to the control group. This may probably be due to calcium deficiency in post menopausal women. However, in the present study confirmatory bone densitometry test was not conducted to detect for calcium deficiency, hence the presence of nutrient canals cannot be considered as a confirmatory finding in the study. The present study lays down a hypothesis that the presence of nutrient canals could be used as a radiographic diagnostic sign in confirming calcium deficiency following bone densitometry test which is mandatory.

Thus the study revealed that nutrient canals in the mandibular anterior region were increased in the subjects with hypertension, diabetes mellitus, completely and partially edentulous subjects, periodontally compromised subjects and in post menopausal women.

Finally, as there was an increase in the prevalence of nutrient canals in the systemic diseases like hypertension and diabetes, a larger sample of individual groups is needed to have an in depth knowledge of the small variations according to duration and frequency which might help in arriving at better diagnosis and for better treatment planning. The findings of this study could be used as a radiographic diagnostic marker for further investigations so as to bring forth the underlying systemic conditions.

CONCLUSION

The statistically significant findings from this study can be used to recommend that the presence of nutrient canals can act as an adjunct diagnostic marker for detection of underlying systemic diseases like diabetes mellitus, hypertension etc. Further confirmation and evaluation of the patient by referral to general physician will benefit the patient in long term and also add a new dimension in the diagnosis of underlying systemic condition. The present study also laid down a hypothesis that the presence of nutrient canals in post menopausal women can be suspected as a sign of calcium deficiency.

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