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ORIGINAL ARTICLE

AID OF A DIGITAL ORTHOPANTOMOGRAM IN THE DETECTION OF CAROTID ATHEROMAS

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ABSTRACT: Atherosclerosis is a form of macrovascular disease that is characterized by arterial fatty deposits that cause reduced elasticity of the blood vessel which may occlude the carotid artery leading to cerebrovascular accidents (CVA).The risk factors include Cigarette smoking, Obesity, Diabetes Mellitus, Hypertension. Partially calcified atheroma in the bifurcation, which lies within 40 mm of the angle of the mandible, can be detected on panoramic dental radiographs. **METHODOLOGY:** A study was planned to detect these atheromas in a digital orthopantomograph (OPG).OPGs of 15patients above 40 years with the above mentioned risk factors and who were diabetic or hypertensive for more than 5 years were selected. Exclusion criteria included poor quality radiographs and a history of transient ischemic attack or stroke. Patients were advised Colour Doppler Ultrasonography (USG) and sent to a general radiologist once the atheromas were detected on OPG and confirmed by two maxillofacial radiologists. **RESULTS:** Out of 15 cases selected for the study, 10 patients underwent USG. All the 10 patients who had showed calcified plaques on an OPG were confirmed to have carotid atherosclerosis with Colour Doppler USG. **CONCLUSION:** OPG is a simple economical mode of imaging the teeth and the jaws in dental radiography. Incidentally it gives valuable information about carotid atherosclerosis. There is always a chance of these calcified plaques enlarging or getting dislodged and thus increasing the chances of cerebrovascular accidents. Hence such calcified plaques if noticed in an OPG should be investigated further.

KEYWORDS: OPG-Orthopantomogram, USG-Ultrasonography, CVA/CVA-Cerebrovascular accidents.

INTRODUCTION AND THE PURPOSE OF THIS STUDY: Atherosclerosis, a generalized vascular disease, is a major source of disability and death in the Western world. In 2009, in the United States, it is estimated that 785,000 individuals will have suffered a myocardial infarct and 795,000 individuals a cerebrovascular accident.[1] Stroke is one of the leading causes of death and disability in India. The estimated adjusted prevalence rate of stroke range from 84-262/1,00000 in rural and 334-424/1,00000 in urban areas. The incidence rate is 119-145/1,00000 based on the recent population studies.[2] Some of these adverse vascular events will have had no prodromal sign nor symptom and many will result in death. A comprehensive identification of risk factors will assist clinicians in determining which individuals are most vulnerable to the disease.

The etiology of atherosclerosis has historically been attributed to risk factors that include cigarette smoking, hyperlipidemia, obesity, diabetes mellitus, and hypertension.

Coronary artery atherosclerosis may initially present as a fatal myocardial infarct without prodromal symptoms. Clinicians have therefore long sought non-invasive contrast-agent–free methods of imaging the coronary vessels. Unfortunately these methods are limited by vessel motion during the cardiac and respiratory cycles, the complex 3-dimensional course of the vessels and their relatively small caliber. To overcome these obstacles, investigators often use USG images of the carotid artery as a surrogate marker for coronary artery atherosclerosis.[3]

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The image of the atheroma may appear on an OPG as a nodular radiopaque mass or as radiopaque vertical lines inferiorly about 1.5 to 4cms inferior to the angle of the mandible and posteriorly to C3 and C4 vertebral bodies, separate and distinct from other radiopaque structures.[4]

OPG is a simple economical mode of imaging the teeth and the jaws in dental radiography. Incidentally it gives valuable information about carotid atherosclerosis.

MATERIALS AND METHODS: 2 groups were selected namely the study group and the control group irrespective of whether the patient was a male or a female.

Study group consisted of those patients above 40 years with the risk factors like Cigarette smoking, Obesity and who were diabetic or hypertensive for more than 5 years. Exclusion criteria included poor quality radiographs and a history of transient ischemic attack or stroke.

Control group consisted of those patients above 40 years without the above risk factors.

Both the study group and the control group patients were selected from the OPD of the Department of Oral Medicine & Maxillofacial Radiology of SDM College of Dental Sciences, Dharwad.

The patients were informed about the study and its importance and impact on their health.

The Procedures followed were in accordance with the ethical standards committee.

Patients consent was taken and an OPG was taken for each patient. Care was taken to select patients who needed an OPG for their dental treatment. Once the atheromas were confirmed by two maxillofacial radiologists on the OPG, the particular patient was advised a Colour Doppler USG of both the right and left sides and the reliability of an OPG as an useful adjunct was evaluated.

Radiographic interpretations using previously published criteria to determine the presence of atheromas were performed.[5,6,7,8]

Once the atheromas were confirmed on Colour Doppler USG by a general radiologist who was blinded and unaware of the OPG results, these particular patients were evaluated by a M.D. physician and put on medications as needed.

RESULTS AND INTERPRETATION:

- Out of 15 cases selected for the study, 10 patients underwent USG. All the 10 patients who had showed calcified plaques on an OPG were confirmed to have carotid atherosclerosis with Colour Doppler USG. The rest 5 were excluded from the study because three of the patients were not ready for the USG Test and the atheroma images of the remaining two patients were not clear on the OPG.
- The control group patients didn't show presence of any calcified plaques on the OPG.

DISCUSSION: Atherosclerosis is a chronic inflammatory disease of multifactorial origin characterized by artery walls thickening or elasticity loss, many times associated with presence of atheromas. Atheromas are plaques that may calcify caused by accumulation of lipids or fibrous tissue in blood vessels.[9,10,11] As carotid arteries are affected by atheromas, stenosis of the vessel lumen occurs which considerably increases the risk for development of stroke.[12]

Most CVAs, commonly referred to as noncardiogenic strokes and occur as a result of atherosclerosis involving the common, internal and external carotids arteries due to atheroma formation. Several factors influence atheroma formation such as hypertension, smoking, diabetes mellitus, hypercholesterolemia, obesity and sedentary lifestyle among others. When atheromas are positioned inside the vessel lumen, they alter the flow of blood causing the stroke. These atheromas that are calcified plaques can be observed in panoramic radiography.[13]

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Atherosclerotic lesions in the carotid artery territory appear on panoramic films either as a nodular radiopaque mass or masses or as diffuse, multiple nodules with vertical, linear distribution or as two radiopaque vertical lines. Carotid artery calcifications usually appear to be at the level of the lower margin of the third cervical vertebra (C-3) at the level of the C3-C4 intervertebral junction.[5,6,7,8]

The carotid atheromas on USG give a hyperechoic signal with distal acoustic shadow in the examined vessels.[14] Both uniformly increased intima-media thickness and protruding plaques appear to be ultrasound markers of atherosclerosis, the latter being an expression of more advanced disease and a potential precursor of clinical events. Lipid rich plaques poorly reflect emitted ultrasound and appear echolucent (Dark) and heterogeneous on ultrasound images.[15]

In our study all the patients in the study group showed carotid atheromas in the OPG which were later confirmed by Colour Doppler USG.

None of the patients in the control group who were similar to the patients in the study group but without the risk factors showed evidence of any carotid atheromas in the OPG.

A dentist caring for a patient with a suspected atheroma on his or her radiographs should show the patient the lesion, as well as its relationship to the course of the common and internal carotid arteries and angle of the mandible. Such a patient should also be informed that these lesions often are markers of generalized atherosclerosis and may be associated with a future CVA and/or myocardial infarct.

This protocol is consistent with a dentist's professional responsibilities to diagnose oralmanife stations of systemic disease and to counsel patients properly about the importance of arranging for and following through with the consultation.[16]

The limitations of our study were in diagnosing and detecting these calcifications on OPG since we had to differentiate them with other calcified structures like calcified lymph nodes, the hyoid bone, epiglottis, phleboliths, submandibular gland sialoloths etc which are commonly found in the region and also some of the calcification may not be calcified enough to be visible on the radiograph. These may be what we call as the lipid rich plaques. We could have also studied the correlation between the cardiovascular features with the size of the atheroma. The reliability of OPG in the detection of these atheromas could have been increased if USG would have been done for control patients too which we couldn't do because of financial constraints. We emphasise that since panoramic dental radiographs are widely used for general dentistry and oral surgery, dentists and oral surgeons could have an opportunity to discover these carotid artery calcifications in the course of their daily work.[17]

Dentists are in a unique position to use the noninvasive tool of panoramic radiography toidentify those at risk of developing cardiovascular disease or CVAs.

CONCLUSION: Panoramic radiography presents a satisfactory image for the identification of asymptomatic patients with risk of developing CVA. Dentists should be trained to identify these calcifications in the carotid artery through panoramic radiography. If there are doubts about the diagnosis, a radiologist should be consulted to obtain a second opinion.

After a diagnosis is agreed upon, the patient should be referred to the physician for the evaluation of risk of developing CVA, so as to receive the early treatment and minimize the irreparable damage and hence the associated morbidity and mortality.

In our study we found that all the atherosclerotic plaques identified on the OPG were confirmed to be present in USG. We had a small sample size in this study since we knew the difficulties in detecting these elusive atheromas but we encourage similar studies with a larger sample size to verify the aid of OPG in identifying atherosclerotic atheromas.

We propose that OPG can be an easily accessible and economical imaging modality for the detection of carotid atheromas in patients with a positive history of diabetes and hypertension for more than 5 yrs.

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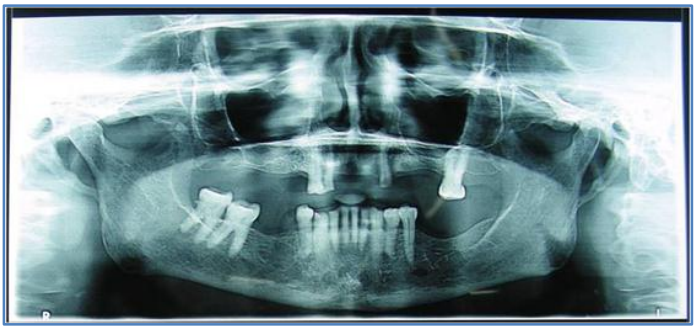

Fig. 1: Bilateral radiopaque nodules seen on OPG

Fig. 2: Radio opacity at right carotid

Fig. 3: Radio opacity at left carotid

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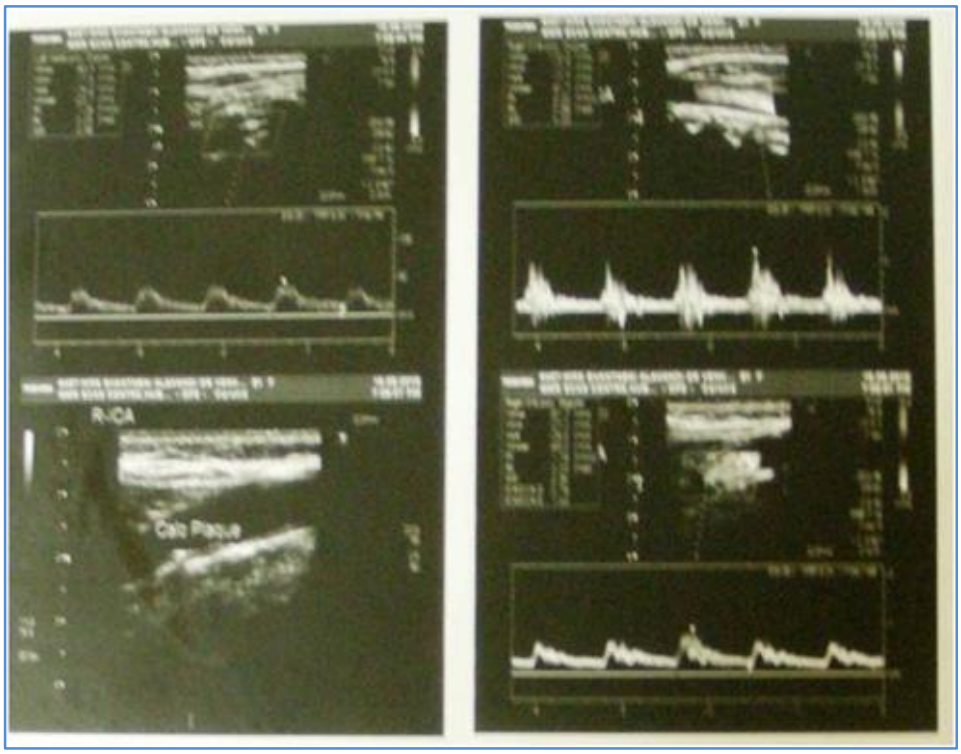

Fig. 4: Ultrasonographic image showing small calcified plaque at right carotid bifurcation

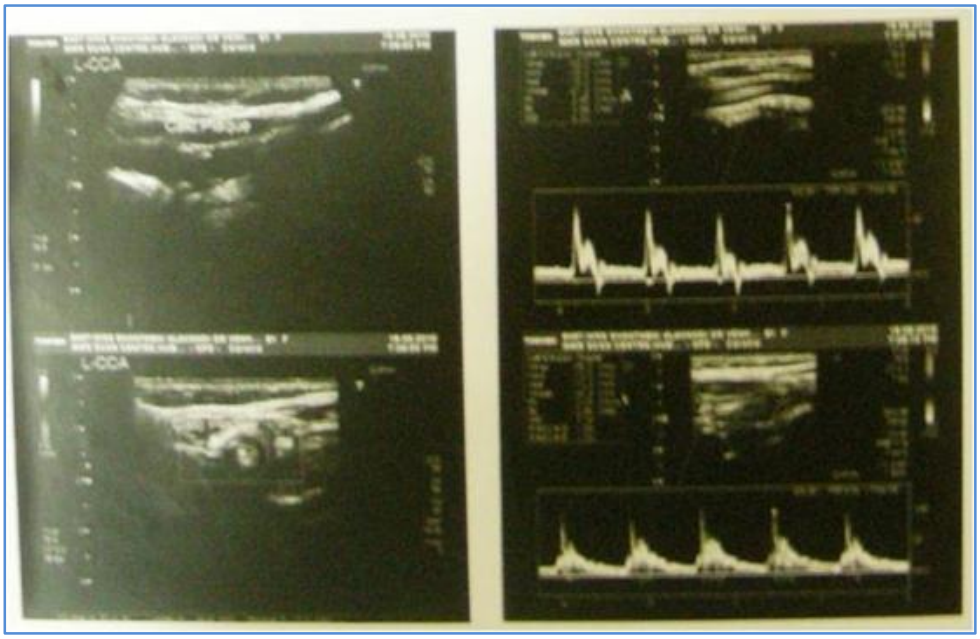

Fig. 5: Ulrasonographic image showing calcified plaque at left carotid bifurcation- 70% blockage

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Fig. 6, Fig. 7 and Fig. 8: Atheroma- a nodular radiopaque mass or as two radiopaque vertical lines inferiorly (1.5 - 4.0 cm inferior to the angle of the mandible) & posterior to the C3 and C4 vertebral bodies, separate and distinct from other radiopaque structures and at the bifurcation of the Internal and External Carotid Arteries.

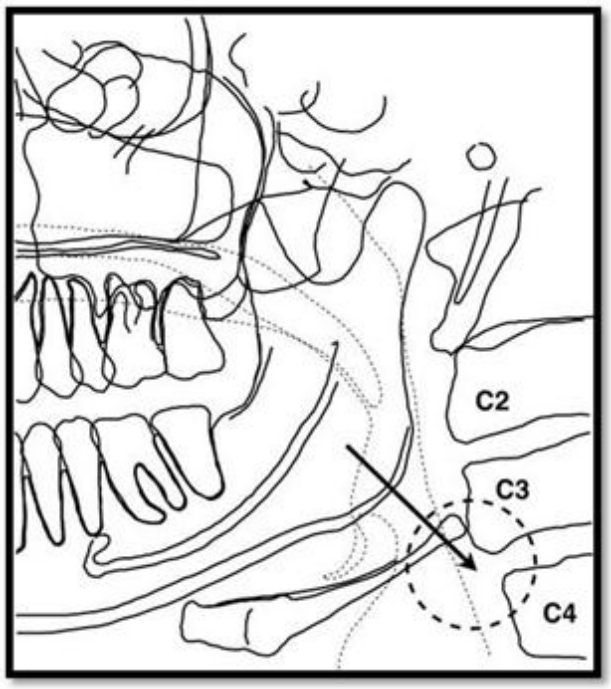

Fig. 6

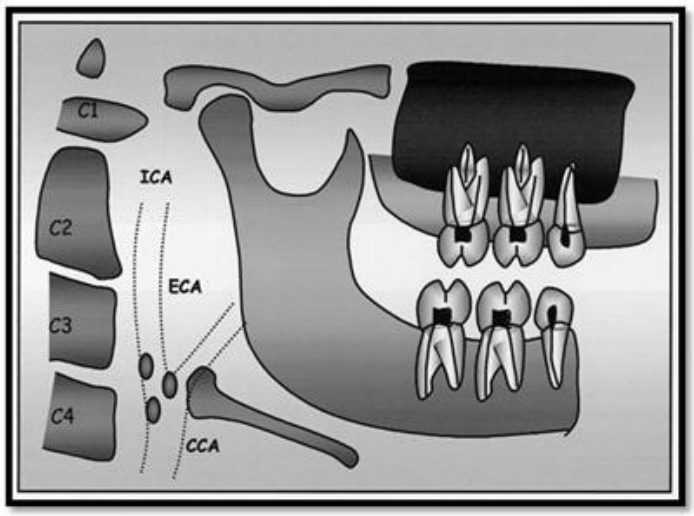

Fig. 7

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Fig. 8

Study Group:

Patient name	Age/sex	OPG	USG Finding
Preeti Lala	66/F	+	+
Iahwarappa	68/M	+	+
Sakarewwa N.	60/F	+	+
Shantabai Alavandi	81/F	+	+
Shashikala	62/F	+	+
Shivaputrappa R.	71/M	+	+
Sulochana Javali	64/F	+	+
Vaman Kulkarni	67/M	+	+
Veena Patil	60/F	+	+
Irrama Kulkarni	73/F	+	+

Table 1: The Study Group(with risk factors) +denotes positive finding or presence of atheromas

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Control Group:

Patient name	Age/sex	OPG
Vijaya H.	68/F	-
Ranjan Kotecha	60/M	-
Sadanand C.	62/M	-
Gopalalla A.	58/M	-
Chinnava K.	62/F	-
Prema Gouda	69/F	-
Sanjana S.V.	58/F	-
Shripad Joshi	70/M	-
Renuka	80/F	-
Hanumanthara K.	58/M	-

Table 2: The Control Group (without the risk factors/no history-(negative sign) denotes negative finding or absence of atheromas

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