

## Panoramic Radiograph as Auxiliary of Carotid Atheroma Diagnosis

Bruno Ribeiro<sup>1</sup>, Carlos Eduardo da Silveira Bueno<sup>2</sup>, Camila Andrade<sup>3</sup>,  
Fábio Silveira de Souza<sup>4</sup>, Danielle Maia<sup>5</sup>, Yanessa Santos Muniz<sup>5</sup>, Carolina  
Loureiro<sup>5</sup>, Antônio Henrique Braitt<sup>5</sup> and Ana Grasiela da Silva Limoeiro<sup>5</sup>

<sup>1</sup>Department Of Endodontics, UNILESTE School Of Dentistry, MG, Brazil

<sup>2</sup>Department Of Endodontics, Dental Research Center, São Leopoldo Mandic University, Campinas, SP, Brazil

<sup>3</sup>Department Of Endodontics, Instituto Baiano De Pesquisa Odontologica (IBPO), Teixeira De Freitas, BA, Brazil

<sup>4</sup>Department Of Orthodontics, School Of Dentistry, Ilhéus University, Ilhéus, BA, Brazil

<sup>5</sup>Department Of Endodontics, School Of Dentistry, Ilhéus University, Ilhéus, BA, Brazil

---

**Abstract:** Most cerebrovascular accidents (CVA) not cardiogenic, commonly known as strokes, may be caused by atherosclerosis which mainly involves the common carotid arteries, internal and external. On account of this, the atheroma represents an increase in risk in coronary artery diseases. The atherosclerosis is a disease of multifactorial origin having various presumed causes, the atheroma being a calcified mass in the inner part of the arteries. Beside routine examinations for the study of atherosclerosis, the use of panoramic radiographs as complimentary examinations in dental practice allow dental surgeons to identify such mineralized mass located in the region just below the gonion of the jaw. Thus, the individual could be warned of their susceptibility to cerebral vascular diseases in routine dental examinations, as long as the panoramic radiograph is interpreted with almost care, especially if the patient has hypertension, diabetes mellitus, high cholesterol level and obesity, or also has a sedentary life and/or a tobaccoism habit.

---

### I. Introduction

Most cerebrovascular accidents (CVA) not related to heart problems, known as strokes are caused by atherosclerosis mainly involving the carotid arteries, internal and external, due to formation of atheroma. Thus the atheroma is an increase in risk of coronary artery disease. Atherosclerosis is a disease of multifactorial origin having as alleged causes: hypertension, smoking, diabetes mellitus, cholesterol high rate, physical inactivity, obesity, among others.

The atheroma produce progressive stenoses in the light of the arteries. First there is the formation of fat striae, and after the injury progresses to fibrous plaque, comprising elastic fibers, muscle, collagen and cholesterol. Inside the plaque there is necrotic tissue area that can contain calcium and cholesterol crystals. Endothelial integrity is altered by factors such as increased blood pressure, serum carbohydrate content, cholesterol and other factors (1,2).

The formation of these atheromatous plaques triggers progressive stenosis of the affected arteries, decreasing perfusion in various organs such as the heart and brain and causing major clinical syndromes (3). Myocardial ischemia and cerebrovascular disease are the most important (4).

In addition to conventional tests for the study of atherosclerosis, the panoramic radiographs used as additional tests in dental practice allow the DDS to identify such mineralized masses. Thus, the individual can be warned of this predisposition to heart diseases and CVD through routine exams.

Pathological examination in the arteries of American soldiers killed in the Korean War in 1952 and studies of a team of researchers from the University of Louisiana represented milestones in determining the natural history of atherosclerosis (5).

The team from the University of Louisiana contributed significantly to the study of atherosclerosis. The study called the International Atherosclerosis Project (IAP) coordinated by McGILL Jr. et al. (6) & GURMAN et al. (7) compared the pathological findings from different geographical regions. The IAP used 23,207 segments of aortas and coronary arteries obtained from people aged 10 to 69 years, submitted to autopsy in 14 countries between May 1960 and September 1965.

LOURES-VALLE et al. (8) reported the study of Multiple Risk Factor Intervention Trial (MRFIT) conducted in 1982, which was proved that with the increase of cholesterol level, there is also an increased risk of developing atherosclerotic disease. The risk is doubled when the cholesterol levels passes from 200 to 250 mg / dL and quadrupled when the level is 300 mg / dL.

Diabetic patients have increased the risk for heart disease 2 to 4 times (9) and complications of atherosclerosis are considered relevant to the male gender and age (10). And when diabetes is associated with obesity, risk of formation of atherosclerosis is greater (11).

Smoking is also a risk factor for CAD, causing adverse effects such as increased heart rate and blood pressure, elevated fibrinogen and endothelial dysfunction, acting synergistically with other risk factors (12).

The panoramic radiograph has been used to identify calcified atheromatous plaques in the region of the carotid arteries, about 1 cm to 4 cm from the bottom of the jaw angle and / or after the border of the mandible and the 2nd, 3rd, and 4th vertebrae neck (13). In a study of 134 patients aged 65-88 years at VAMC (Veterans Administration Medical Center), 4.5% had calcifications. The panoramic radiograph has been used in North American dental routine as screening clients usually over the age of 55, or medical and antecedent history of risks, where these are referred to professionals in cardiology and / or neurology for research and preventing the manifestation of neurological and / or cardiovascular diseases. These symptoms can develop into functional disabilities, with commitments partial or complete engines, and / or transient cardiac ischemia and subsequent progression to heart attack.

Panoramic radiographs are important in the different stages that make up the diagnosis (14), having the opportunity to examine the maxillo-mandibular complex and the relationship of the teeth and adjacent anatomical structures.

FRIEDLANDER et al. (15) related the use of panoramic radiographs with x-rays of the cervical spine for identification of calcified atherosclerotic lesions in the bifurcation region of the common carotid artery in 145 patients aged over 65 years. The images obtained with the cervical spine radiographs showed that the atherosclerotic lesions of calcified carotid coincided with the locations found in the panoramic radiographs. These patients had in their medical history at least three risk factors such as hypertension, smoking, obesity, hyperglycemia and dyslipidemia.

FRIEDLANDER & BAKER (16) studied 305 patients aged over 55 years with a history with at least four risk factors that showed calcifications in the carotid region as nodular radiopaque images close to the intervertebral space C3 and C4. To confirm the lesions was performed Doppler ultrasound for carotid that showed the calcified plaques in the same places that the panoramic radiograph identified.

FRIEDLANDER & GRATT (17) studied patients with CVA, in a total of 19 white men over the age of 65, with multiple risks and with the inclusion criteria: clinical suspicion or radiological study confirming carotid disease. After 21 days was carried out panoramic radiography seven patients (37%) had radiopaque nodular lesions near the intervertebral space C3 and C4. Six had unilateral calcifications with muscle weakness and paralysis contralateral to the lesion.

Bilateral atheroma calcified carotid, were found in the panoramic radiograph of a 75-year-old man in a routine examination, and the diagnosis was confirmed later by ultrasound, highlighting the importance of identifying calcifications in the carotid to prevent disease progression (18).

Hubar (19) studied 700 melanodermic patients treated at the Medical Center of Louisiana Charity Hospital in New Orleans, and 420 women with an average age ranging 14-77 years and 280 males aged 16-72 years and 0.42% (n = 3) with carotid radiopacity, demonstrating that these findings are very small in the black population.

They found 20.4% of atherosclerotic carotid lesions in insulin-dependent diabetics, affirming the significance of risk factors in the formation of atheroma (20)

It is essential to know all the anatomical accidents that cause similar radiopaque images to carotid atheroma as epiglottis, hyoid bone, stylomandibular ligaments and calcified estilohioideo, triticeous cartilage and pathological radiopaque images: submandibular glands and calcified thyroid, lymph nodes, phleboliths, and calcified sialolitos (21).

The appearance of atheroma of the carotid arteries on panoramic radiographs is not the only means for diagnosis of this pathology, being an auxiliary technique that is routine in dentistry and complements the diagnosis when combined with clinical history of the patient (22).

Angiography is today considered the best for the evaluation of vascular diseases, but it is an invasive test that may present complications such as bruising at the puncture site, allergic reactions to iodinated contrast, arterial or venous thrombosis and kidney damage (23).

The purpose of this work was to study atherosclerotic disease and its etiology, pathogenesis and analyzes the possibility to optimize the interpretation of panoramic radiography for the dental professional, aiming to inform their patients the consequences to their health in these radiographic findings.

## **II. Discussion**

The findings of the International Atherosclerosis Project were important to establish the natural history of atherosclerotic disease showing that despite the great variation in the extent of these injuries to the different groups, there was link between mortality from coronary artery disease and intensity and extent of arterial impairment. The frequency and extent of fatty streaks in the aorta increased in the third and fourth decades, and

their presence was almost constant from this age (6).

Panoramic radiograph have a curved image of the object, where a X-ray beam moves around the object while the images are recorded on the moving film (14).

Studies of calcifications in the carotid region by panoramic radiograph have identified the presence of atheroma on average 4.5% of the studied populations. These patients are older than 55 and have risk factors such as diabetes, hypertension, anxiety, smoking, obesity and dyslipidemia (13,16,17).

The atheromatous plaques are observed in panoramic radiograph in the area of the carotid arteries, about 1 cm to 4 cm from the bottom of the jaw angle and / or after the border of the mandible and the 2nd, 3rd and 4th cervical vertebrae (13,15 to 18 , 21,22).

It is very important to identify calcifications in the carotid by panoramic radiograph to prevent progression of the disease (22), however there is a need to supplement with ultrasound (noninvasive) (23,24) and angiography (invasive method ) to the most appropriate diagnosis and definition of the surgical strategy (23).

They were observed in panoramic radiographs of patients suffering from recent CVA, increased incidence (37%) of radiopaque lesions near the intervertebral space C3 and C4, with its own neurological clinical picture (15-17).

Anatomical structures that make up the carotid region can produce similar radiopaque images to carotid atheroma such as the hyoid bone, epiglottis, and calcified ligaments stylomandibular estilohioideo, triticeous cartilage. There are also pathological radiopaque images that can be confused with the atheroma, such as submandibular glands, calcified thyroid, sialolitos, phleboliths and calcified lymph nodes. (13,15- 17,22).

Lots of radiopaque structures of the carotid region were mistakenly identified as atheroma, by examining panoramic radiographs in the course of specialization of the American Academy of Oral and Maxillofacial Radiology (22). We must bear in mind that the panoramic radiograph is not a unique means for the diagnosis of carotid atheroma, being only a complementary method of Dentistry area that can assist in the diagnosis when combined with clinical history.

### **III. Conclusion**

Panoramic radiographs analyzed carefully allow the observation of the presence of calcified areas that may indicate the atheroma of the internal and external carotid arteries. This image obtained from widely used in dental radiographic examination may therefore indicate the presence of these calcifications that would serve as a warning to the patient, the possibility of cerebral vascular accidents.