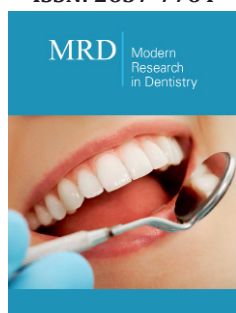


# The Relationship between Coronary Atherosclerosis and Dental Pulp Calcification

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## Abstract

A coronary artery disease is considered an important cause of mortality in society and imposed the extensive costs for patients. Therefore, the aim of this mini review was to evaluate the relationship between coronary arteriosclerosis and dental pulp calcification in patients. Dental radiography has the potential to be used as a rapid screening method for the early detection of coronary artery disease. Given the routine request for panoramic radiographs in dental examinations, dentists can use the technique to screen individuals with a risk of Cardiovascular Diseases (CVD). This shows the role of dentists in the general health of the public in society.

**Keywords:** Calcification; Pulp Stone; Coronary Artery Disease; Panoramic Radiography

## Introduction

Mineral deposits can be formed in ectopic areas or dystrophic lesions under various conditions in the body [1], this mineral deposition can make changes with the appearance of a lesion or plaque and be observed radiographically [1].

Calcification of atherosclerotic lesions is very common [1], the mechanism of atherosclerotic calcification can be performed as passive mineral deposition, bone formation, or remodeling [1]. Atherosclerosis can occur as a chronic disease and increases by aging, where during the process, the cholesterol crystal deposits attach to the inner layers of the arteries [2] and gradually increase in size and volume, followed by calcium deposition.

The main characteristic of atherosclerosis is narrowing and loss of elasticity of blood vessels [2]. On the other hand, the most common cause of myocardial ischemia is the presence of atherosclerotic lesions in one or more coronary arteries [3]. This process reduces myocardial blood flow and cause insufficient myocardial perfusion by the coronary artery [3] and identified as one of the main causes of mortality in the world [4].

Pulp stones are calcified bodies in the dental pulp of the teeth [5], classified into two classes of "true" and "false" [5]. True pulp stones are quite rare and contain dentine with specific dentinal tubules surrounded by odontoblast cells [5], whereas the false pulp stones are made up of concentric layers of mineralized tissue created through the mineralization of calcium on vascular epithelial and neuron cells [6]. In fact, the collagen bundles of vascular and neural sheaths are the center of calcification [6]. Pulp stones are more reported in the coronal pulp, compared to the apical pulp [7], and the pulp stones larger than 200  $\mu\text{m}$  can be detected in radiographic assessments [7].

However, the main cause of pulp stones remains unknown [8], several factors have been recognized for their formation including aging [9] and idiopathic factors [10]. Other factors involved in this area include dental orthodontic movements [11], prolonged exposure to stimuli such as decay and deep fillings [12], surgical procedures and periodontal diseases [13]. This condition also occurs in patients with systematic diseases [14], genetic diseases

(e.g., Dentin Dysplasia and Dentinogenesis Imperfecta) [15], and syndromes such as Van der Woude [16] and Marfan syndrome [17]. Furthermore, evidence shows that hypercalcemia, gout and kidney stones [18,19] could be predisposing factors for pulp calcification.

Since pulp stones are ectopic calcification on vascular walls, they may have similar pathogenesis to the calcifications of other body organs, including coronary artery atherosclerosis. Therefore, detecting them in normal dental radiographs can be used as a screening method for early detection of cardiovascular diseases. Taking panoramic dental radiograph is a part of a dental checkup, and pulp stones can be detected in panoramic radiographs as much as they can be identified in periapical and bitewing radiographs [20].

Most studies reported that the frequencies of pulp stones were highest in molars [12,20-24]. Given the fact that pulp stones smaller than 200  $\mu\text{m}$  are not shown in radiographs, it is possible that the prevalence of pulp stones is estimated lower than the real amount [7]. Otherwise, the use of Cone Beam Computed Tomography (CBCT) imaging for all teeth is not ethical due to the high x-ray dose. Therefore, normal radiographs are recognized as a non-invasive method in clinical assessments.

In some studies, the pulp of extracted teeth is assessed in terms of histopathology to evaluate the prevalence of pulp stones [25]. In these studies, it is also possible to estimate less than the actual value if adequate sections of the tooth have not been prepared [25].

In fact, there is debate and uncertainty about the correlation between pulp stones and systematic disorders. In the one of studies, Sener et al. [26] found that there was no association between cardiovascular diseases and pulp stones. Also, in a histological assessment, Krell et al. [27] reported that there were no atherosclerotic changes in dental pulp vessels of atherosclerotic monkeys. Alsweed et al. [1], Horsley et al. [28], and Yilmaz et al. [29] investigated the dental pulp calcification and calcification in the carotid artery bifurcation area on panoramic radiography, and they found no significant statistical relationship in this regard.

It is notable that the calcification of carotid arteries was evaluated in these studies and not coronary arteries, while the nature of vascular calcification was considered in both states. So, the different results are obtained. One of the causes of this difference is the use of panoramic radiographs to assess carotid calcification.

Furthermore, angiography images are used in the assessment of coronary arteries, which yield more accurate results. Besides, some studies have shown a strong correlation between dental pulp stones and systematic diseases, where Mathew et al. [30] were found that there was a significant correlation between the prevalence of dental pulp stones and systematic diseases, especially Diabetes Mellitus (DM) and Cardiovascular Diseases (CVD). According to the results of these researchers, 86% of the cases had pulp stones with DM or CVD. It was also reported that the prevalence of pulp

stones was higher in male subjects and the elderly. Similarly, Sridevi et al. [31] found that the patients who suffer from coronary artery disease (100%) had a high chance of developing pulp stones, but in this study, no significant difference was observed in terms of prevalence based on gender. In addition, Edds et al. [32] reported after using the pericardial radiography that individuals with pulp stones were (4.4) times more prone to CVD, compared to those without pulp stones. Likewise, results presented by Panwar et al. [33] were indicative of a high chance of pulp stones in patients with CAD. Also, the high presence of pulp stones in different teeth makes individuals prone to CVD, especially in the presence of other risk factors.

Given the routine request for panoramic radiographs in dental examinations, dentists can use the technique to screen individuals with a risk of CVD. This shows the role of dentists in the general health of the public in society.

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