



## **Evaluation and Correlation of Pulpal Calcification in the Patients with Cardiovascular Diseases in Vidarbha Region, India**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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**Study Protocol**

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## **ABSTRACT**

**Background:** The dental pulp is soft tissue enclosed in the hard tissues of teeth. Calcification occurring in the body affects the dental pulp too. Pulp undergoes calcification as whole or in discrete masses known as denticles or pulp stones. Pulp stones are nodular, calcified masses seen more frequently in coronal pulp than radicular pulp. Pulp stones can vary from small structures embedded in pulp tissue to large masses.

**Aim:** To evaluate and correlate the pulpal calcification with cardiovascular diseases in the patients using radiograph in Vidarbha region.

### **Objectives:**

- To evaluate the presence of pulpal calcification in the patients with cardiovascular disease using Ortho-pantomogram images.
- To co-relate the radiological findings with the cardiovascular disorders.

**Methodology:** The present study comprises of 30 patients out of whom 15 patients will be in test group and 15 patients in control group. The test group will consist of patients suffering from cardiovascular diseases and control group will consist of healthy patients with no significant medical history. Ortho-pantomogram will be taken of each participant and the anterior and posterior teeth will be assessed for any pulpal calcification and obliteration of pulp chamber and root canals.

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**Expected Results:** Positive correlation is expected between pulp calcification and cardiovascular diseases.

**Conclusion:** Positive correlation can be found between the occurrence of pulpal calcifications and cardiovascular disease. Hence the occurrence of pulpal calcifications can be used to predict the future chances of cardiovascular diseases in the otherwise normal person. Early detection of pulp calcification can be used as a tool to predict the disease and will help in taking possible steps to avoid the future episodes of heart diseases.

*Keywords: Cardiovascular disease; dental pulp calcification; ortho-pantomogram.*

## 1. INTRODUCTION

Calcification is the accumulation of calcium salts in various parts of the body. It gets accumulated in the soft tissue which gradually becomes hard. There are various causes of calcification in the soft tissues like muscles of body including the organs. One of the causes is reviewed as deficiency of Vitamin K<sub>2</sub>. The dental pulp is soft tissue enclosed in the hard tissues of teeth. Calcification occurring in the body affects the dental pulp too. Pulp undergoes calcification as whole or in discrete masses known as denticles or pulp stones. Pulp stones are nodular, calcified masses seen more frequently in coronal pulp than radicular pulp [1]. Pulp stones can vary from small structures embedded in pulp tissue to large masses. They are commonly seen in molars. Pulp stones occur due to pulp degradation, ageing, orthodontic tooth movement and trauma. There are incidences where whole pulp gets calcified and the canals are completely obliterated. This condition is generally seen in the elderly population and can be co-related with increasing age. It is generally predicted that people suffering from cardiovascular disease have high chances of pulp stones or calcifications [2,3].

Cardiovascular disease means any patient suffering from coronary heart disease, myocardial infarction, peripheral artery disease, or angina pectoris which usually results due to atherosclerosis or thickening of heart muscles. Atherosclerosis is a disease which tends to form plaque in the vessels and leads to damage of the endothelium which is the innermost layer of blood vessel. Osteopontin, a new constituent of atherosclerotic plaque plays an important role in plaque formation [4,5]. Due to the deposition of calcified plaque, the arteries thicken and get stiff which causes a decrease in blood supply to the vital organs like heart and brain which further causes stroke. Early diagnosis of vascular calcification with the help of various imaging techniques like ultrasound and radiography helps

to reach certain conclusion and early intervention is possible [6]. There is a definite co-relation of pulpal calcification and cardiovascular episodes which can be evaluated using radiographic techniques to diagnose the pulpal calcification and co-relate it with future cardiovascular diseases [7,8,9]. Ortho-pantomogram is a type of dental X-ray which produces images of maxilla and mandible. Radiographic findings include the calcifications like occurrence of pulp stones and complete obliteration of root canals of teeth. In radiographs pulp stones appear as round or ovoid opacities as well as completely opaque canals of the teeth [10,11]. Thus Oral and Maxillofacial radiology might be useful in the early detection and co-relation of pulpal calcifications with future chances of cardiovascular episodes. Hence the prediction of cardiac disease can't be ruled out with diagnosis of pulpal calcification. Radiography can be used as a rapid method for identification of cardiovascular disease. There is limited data on this study hence decided to see this correlation.

### 1.1 Aim

To evaluate and correlate the pulpal calcification with cardiovascular diseases in the patients, using radiograph, in Vidarbha region.

### 1.2 Objectives

- To evaluate the presence of pulpal calcification in the patients with cardiovascular disease using orthopantomograph images.
- To co-relate the radiological findings with the cardiovascular disorders

## 2. MATERIALS AND METHODS

30 patients will be selected for this study admitted in the Department of Cardio-thoracic Medicine in AVBR and hospital, Datta Meghe institute of Medical sciences, Wardha with cardio-vascular diseases. After obtaining ethical

permission from Institutional ethics committee, the admitted patients will be evaluated for the study. Patients will be briefed about the nature of study and a written consent will be obtained.

A detailed case history will be taken to access patient's information which shall include age, sex, dental status, systemic diseases, and periodontal status. Patients between the age group of 18- 55 years will be selected for this study. Patient will be asked to procure previous dental radiographs for better comparison.

Ortho-pantomogram an extraoral specialised X-ray machine will be used. The patient will be taken to the X-ray room where the radio technician will instruct the whole procedure. The whole procedure will take nearly 20 seconds. It is the radiograph where all the teeth can be captured in one film hence multiple intraoral radiographs can be avoided.

The findings of OPG will be co-related with the patient's cardiovascular episode for various parameters like.

- Age of the patient
- gender of patient

The values thus obtained will be subjected to statistical analysis and the results thus obtained will be analysed to reach the prediction of co-relation of pulpal calcification with the cardiovascular diseases

## 2.1 Sources of Data

Patients reporting at Out Patient Department of Conservative dentistry and Endodontics will be considered for the study. Complete detail clinical examination of the patients will be done and assessed for the eligibility for the participation in the study.

## 2.2 Sample Size Calculation

- Significance level Type I error rate,  $\alpha = 0.05$
- Power (1-beta) = 0.8
- Z alpha value = at 90% 1.645
- Z beta value = at 80% 0.842
- Ratio of sample size, Treatment /control =1
- Allowable difference,  $d = \mu_T - \mu_C = 0.3$
- Expected population standard deviation, SD = 0.5

- $\delta (>0)$ , Margin = 1.1
- Drop rate (%) = 8
- Sample Size  $n_1$  – Treatment = 15
- Sample Size  $n_0$  – Control = 15
- Total sample size = 30

$$n_1 = \left[ \frac{(z_\alpha + z_\beta)^2 (\sigma_1^2 + \sigma_0^2 r)}{(d - \delta)^2} \right]$$

$$n_0 = \left[ \frac{(z_\alpha + z_\beta)^2 (\sigma_1^2 / r + \sigma_0^2)}{(d - \delta)^2} \right]$$

Sample size depends on the true mean difference,  $d$ , standard deviations for the two groups, and a level of significance  $\alpha$  (type | error), and the power. The total sample size  $n = n_1 + n_0$  is minimized when  $r = \sigma_1 / \sigma_0$ .

With above mentioned calculation, sample size determination is 30 considering the drop outs; sample size has been estimated 15 samples in each group. The total minimum sample size with 90% of confidence interval is 30.

## 2.3 Inclusion Criteria

- Cardiovascular patients.
- Patients between the age group of 18-55years.
- Patient giving consent to participate in the study.

## 2.4 Exclusion Criteria

- Patients with metal crowns and metallic restorations.
- Patients with grossly destructed tooth on molars and canines.
- Patient not giving consent to participate in the study.
- Pregnant females.

## 3. EXPECTED RESULTS

Positive correlation is expected between pulp calcification and cardiovascular diseases.

## 4. DISCUSSION

According to one study pulp stones were 41.8% in which females showed higher pulp stones than males and maxillary teeth had higher pulp stones than mandibular teeth. [1,12].

It also showed higher pulp stones in first molar than in second molar. It might be due to early eruption of 1<sup>st</sup> molar will expose for a long period of time which will eventually cause more degenerative changes thus showing that pulp calcification increases with time [13].

According to another study it showed that pulp calcification was found in molars due to greater blood supply to pulp molars caused precipitation of calcium in the pulp chamber [14,15].

Pulp stones have been considered as the initial risk factor for the early detection of cardiovascular diseases. Calcification seen in kidney, teeth, joints and atherosclerotic plaques are usually made up of calcium phosphate crystals. These crystals can precipitate an acute immunological reaction leading to an inflammatory response within the arteries. Such event becomes a leading cause for ischemic heart disease causing significant mortality and morbidity [16-20].

## 5. LIMITATIONS

- Sample size is small.
- The patients are with age group between 18 -55 hence the correlation of pulpal obliteration may be biased as the older patients may have natural calcifications.

## 6. CONCLUSION

Positive correlation can be found between the occurrence of pulpal calcifications and cardiovascular disease. Hence the occurrence of pulpal calcifications can be used to predict the future chances of cardiovascular diseases in the otherwise normal person. Early detection of pulp calcification can be used as a tool to predict the disease and will help in taking possible steps to avoid the future episodes of heart diseases.

## CONSENT AND ETHICAL APPROVAL

After obtaining ethical permission from Institutional ethics committee, the admitted patients will be evaluated for the study. Patients will be briefed about the nature of study and a written consent will be obtained.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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