

Prevalence Of Pulpal Calcification In Patients With Hypertension - A Retrospective Study

Research Article

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Abstract

Introduction: Pulpal calcification are discrete or diffuse calcified structures present in any portion of pulp tissue. The aim of this study is to assess the rate of pulpal calcification in patients with hypertension.

Methodology: A retrospective study was conducted during a period 18 months, from June 2019 to March 2021. A total of 100 digital panoramic radiographs of patients were examined. The frequency of occurrence of pulp calcifications between age, gender, tooth number, hypertensive patients and non hypertensive patients were compared and analysed by chi square test using Spss software 23.0.

Results: A total of 100 orthopantomograph (OPGs), 2800 teeth were assessed, and the total number of patients with pulp calcifications were 55. Chi-square analysis was used to compare the frequency of occurrence of the pulp stones, the overall distribution was more in males, 50 - 69 years age group, mandibular first molars and in hypertensive patients. . Data was analysed using SPSS Statistics Software (version 23.0 - IBM) with the level of significance set as $P < 0.05$.

Conclusions: Within the limitations of the present study association between hypertension and calcification could not be established. However calcification was more prevalent among hypertensive patients especially male population. Mandibular 1st molar (36) was identified to have calcification more often and patients with 50 to 69 years age groups had calcification more often.

Keywords: Pulpal Calcification; Hypertension; Panoramic Radiographs.

Introduction

These calcifications under the term of dental pulp nodules have been first mentioned by Norman and Johnston in 1921. Kronfield has classified pulp calcification based on morphology. Seltzer has classified pulp stones based on their structure, size and location. Pulp calcification is one of the most commonly faced challenge by clinicians during root canal treatment. Sometimes pulp chamber may be completely blocked, which increases the difficulty of pulp chamber access and the risk of instrument breakage.

Successful root canal treatment depends on accurately locating

canal's, cleaning, shaping, and three-dimensional obturation of the root canal system [1]. Pulp calcification is one of the most commonly faced challenge by clinicians during root canal treatment. Sometimes pulp chamber may be completely blocked, which increases the difficulty of pulp chamber access and the risk of instrument breakage. Calcified structures are commonly present in dental pulps. The two types of pulp calcifications are diffuse calcifications and discrete pulp stones. Pulp stones present in the coronal part are mostly concentric and discrete calcifications, while calcifications in the radicular portion exist more diffusely [2]. Pulp stones can be attached to dentin walls, embedded or freely within the pulp tissue. They are found in both decidu-

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ous and permanent dentition [3]. The exact cause of pulp stone formation remains unknown. However, several factors that have been implicated in stone formation include: trauma, restorations, aging, orthodontic tooth movement, periodontal disease, cardiovascular diseases, various systemic diseases, deep caries, and genetic predisposition [4].

There are many theories as to the etiology of pulpal calcification. A number of conditions have been claimed to predispose to pulp stone formation such as pulp degeneration, inductive interactions between the epithelium and pulp tissue [5]. As a person ages, the size of the pulp chamber is reduced, there is a decrease in vascular and cellular elements, and an increase in fibrous elements. There is also evidence that hypercalcemia, gout and renal lithiasis are predisposing factors to pulpal calcification [6]. Na ¨stro ¨m et al. show that narrowing and calcification of the pulpal chamber are found with increased incidence in patients with end-stage renal disease [7]. Others demonstrate that periodontal disease and caries are contributors to pulpal calcification [8]. Carious lesions stimulate inflammatory changes within the pulp leading to secondary (reparative) dentin formation and increased calcification [6, 7]. Periodontal disease interferes with the blood supply and nutrition of the pulp causing a decrease in cellular elements and an increase in calcification. Other studies show an association between periodontal disease and CVD, indicating that periodontal inflammation secondary to infection may have a role in systemic vascular disease via inflammatory mediators. Recent literature still suggests that pulp stones are a feature of an irritated pulp, attempting to repair itself [9].

Moura and Paiva confirmed increased pulpal calcifications in subjects with coronary atherosclerosis upon radiographic examination [10]. Bernick finds calcifications and lumen narrowing within extirpated dental pulp vessels, both medium and small precapillary arterioles, in people as young as 40 yr of age [10, 11]. Ni-nomiya et al. isolates the non collagenous protein osteopontin, found in atherosclerotic plaques, in pulp stones by immunohistochemistry [12].

Yet, there is a conflicting literature on this subject. Although Krell et al. demonstrates lingual artery plaques in atherosclerotic monkeys, no similar changes are seen in pulpal arterioles [12, 13]. Oguntebi et al. show pulpal arteriolar lumen narrowing and atheromatous plaque development without evidence of calcification in hypercholesterolemic induced swine [14]. The study was limited by its short duration, which could explain the absence of calcifications [15].

Previous studies have reached no consensus regarding prevalence of pulp stones and reported results range from 8% to 90% [14-16]. Sizes of pulp stones vary from small particles to large masses enough to obliterate the pulp chamber. In clinical practice, pulp stones can be identified in orthopantomograph, periapical and bite-wing radiographs [17].

The purpose of this study is to assess the prevalence of pulpal calcification in patients with hypertension.

Previously our team has a rich experience in working on various research projects across multiple disciplines [18-32]. Now the growing trend in this area motivated us to pursue this project.

Materials And Methods

This retrospective study was conducted during a period 18 months, from June 2019 to March 2021. A total of 100 digital panoramic radiographs of hypertensive patients, an equal number of male and female patients (45 females and 55 males), who attended the Department of Oral Medicine and Radiology in Saveetha Dental College & Hospital, Chennai, were examined. Digital panoramic radiographs were taken by using the ORTHOPHOS XG machine. Only images of good quality, which had the clearest reproduction of teeth, without any superimposition were included. Orthopantomograph of patients between the age group of 20 and 70 years were included in the study. Previous records of the patients were collected and only OPGs of patients with any other systemic diseases. All healthy erupted teeth were examined. Teeth with crowns, bridges, deep restorations, orthodontic bands, and brackets were excluded from this study. A total of 2800 teeth were assessed. Definite radiopaque bodies were observed inside the pulp chambers and root canals of all the teeth were identified as pulp calcifications and were assessed. The number of calcifications, tooth type, and side of the dental arches were also recorded. The pulp calcifications were counted by two examiners to ensure accuracy of assessment.

Statistical analysis

The chi-square analysis was used to compare the frequency of occurrence of the pulp stones between age, genders, tooth no, hypertensive and non hypertensive patient wise distribution. Data was analysed using SPSS Statistics Software (version 23.0 - IBM) with the level of significance set as $P < 0.05$.

Results And Discussion

A total of 100 digital panoramic radiographs of hypertensive patients, an equal number of male and female patients (50 females and 50 males).

Prevalence and distribution based on tooth type

All the calcifications assessed in this study were found in premolars and molars [Fig 1]. The anterior teeth did not show any calcifications. The overall distribution of pulp calcifications was more in the mandibular first molars compared to the premolars and other molars.

Pulp calcifications are calcified structures present in dental pulps. They may be present in either coronal and radicular or both portions of the pulp. Pulp calcifications are commonly present and they are routine findings clinically and in radiographs [11]. Calcifications may occur as a single large or several small radio-opacities within the pulp chambers or root canals and they vary in number in a single tooth. Pulpal calcifications are usually asymptomatic, they often develop in teeth that appear to be quite normal [10, 11]. However, it has been reported that pulp calcifications cause pain, which vary from mild neuralgia to severe excruciating pain, resembling tic douloureux [33]. They are present in deciduous and permanent dentition. Pulp calcifications are divided into three types: Denticles, pulp stones, and diffuse linear calcifications [34]. Discrete calcifications are formed due to epithelial mesenchymal interaction within the developing pulp; so these are usu-

ally seen in the young developing pulp. Pulp stones and diffuse linear calcifications are usually age related phenomena triggered by certain pathological conditions [35]. Most of the previous prevalence studies on pulp calcifications were done with bitewing radiographs and intraoral periapical radiographs (IOPARs). The radiation exposure of OPG is less compared to that of bitewing radiographs and IOPARs and a single exposure was helpful in the detection of pulp calcifications of the entire teeth at the same time. Therefore, OPGs were preferred for the assessment [35, 36]. Some studies have reported two prevalence rates. One, based on the number of subjects involved in the study and the other based on the number of teeth assessed. Some of the prevalence rates reported in different countries by various researchers include the following: Ranjitkaret al. examined the prevalence of pulp stones in the Australian population and found them in 46% of the subjects and 10% of the teeth examined [37]. Zainab H et al examined 390 digital panoramic radiographs and reported a prevalence rate of 34.8% in the subjects and 7.3% in the teeth assessed. Nayaket al. in a study on the Indian population examined 1432 teeth and found 9.35% prevalence of pulp calcifications [38]. Sismanet al. examined the bitewing radiographs of 469 Turkish patients and found 57.6% prevalence of pulp stones in their patients and 15% prevalence among the teeth examined. Tallaet al. examined 2000 south Indian patients and reported a prevalence of pulp calcifications in 26% of the patients and 18% of the teeth examined. In the present study, the prevalence rate of pulp calcifications was 53.3% of the subjects and 6.4% of the total teeth examined. These values are in accordance with some of the previous prevalence studies.

Two main causes of pulp stone formation include local metabolic dysfunction and trauma. Any local metabolic dysfunction may lead to hyalinization of the cells followed by fibrosis and mineralization of the fibrosed areas, which can act as a nidus for further mineralization and finally lead to pulp stone formation. In a similar manner, trauma may lead to vascular damage followed by mineralization, which may act as a nidus for further mineraliza-

tion and pulp stone formation. There are various studies in literature that report an association between pulp stones and systemic diseases. Pulp stones have been noted in patients with systemic or genetic diseases, such as, diabetics, hypertension, dentin dysplasia, dentinogenesisimperfecta, osteogenesisimperfecta, and in certain syndromes such as the Van der woude syndrome, Elfin-facies syndrome, and Ehlers Danlos syndrome. Maura and Paiva confirmed the presence of increased pulpal calcifications in subjects with coronary atherosclerosis upon radiographic examination [10]. Edds et al. suggested that 74% of the patients with reported cardiovascular disease had detectable pulp stone, while only 39% of the patients without a history of cardiovascular disease had pulp stones [16]. In the present study, an association between pulp calcification and age, gender, tooth number, and between hypertensive and non hypertensive group patients have been assessed. In the present study, More number of hypertensive patients had calcification. However there was no significant association between hypertensive group, non hypertensivegr,morenumberoup and calcification, chi square test (P = 0.70) [Figure 2]. In the present study, more number of patients of 50 – 69 age group had calcification. However there was no significant association between age and calcification, chi square test (P value = 0.104) [Figure 3]. In the present study, even though the overall distributions of pulp calcifications were more in males, the difference was not statistically significant [Figure 4]. This may be due to the small sample size taken in this study. More incidences in males may be due to the fact that parafunctional habits like bruxism are commonly seen in males, which may trigger degenerative changes in the pulp. However, in this study, only healthy teeth and healthy patients with hypertension were assessed. that is, the pulp calcifications assessed in this study were of idiopathic origin. In the present study, the overall distribution of pulp calcifications was more in the mandibular first molars compared to the premolars and other molars, and the difference in the distribution was statistically not significant. This finding was in agreement with the study by Hamashaet al., who found more distribution in the mandibular molars among Jordanians [39]. The high distribution in molars may

Figure 1. Bar Graph shows association between teeth number and distribution of calcification. More number of patients had calcification in relation to teeth no 36.

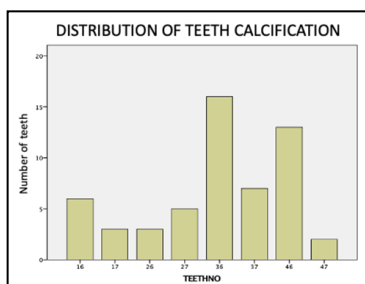


Figure 2. Bar Graph shows association between Hypertensive groups, non hypertensive groups and calcification. More number of hypertensive patients had calcification. However there was no significant association between hypertensive group, non hypertensive group and calcification, chi square test (P = 0.70).

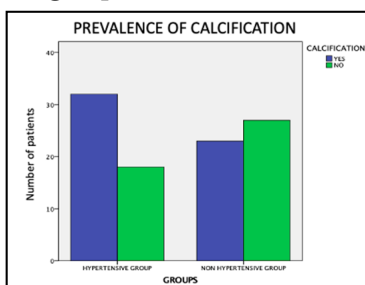


Figure 3. Bar Graph shows association between age of patients and number of patients. More number of patients of 50 – 69 age group had calcification. However there was no significant association between age and calcification, chi square test (P value = 0.104).

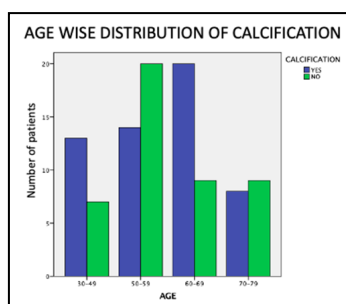
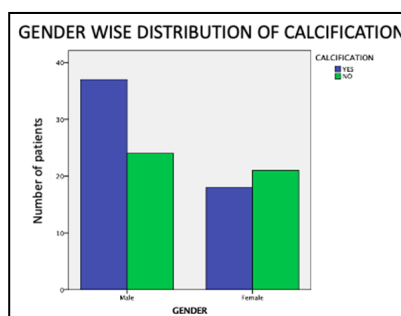


Figure 4. Bar Graph shows association between gender and number of patients. More number of male patients had calcification. However there was no significant association between gender and calcification, chi square test (P value = 0.155).



be due to the fact that molars are the first teeth to erupt into the oral cavity and due to their large surface area bear most of the occlusal forces, which may lead to early degenerative changes. Another reason is its rich blood supply that may lead to precipitation of calcification in the molars [37].

There are many studies in the literature, which report that pulp calcifications are age-related phenomena [16, 37]. However, in the present study, even though an age group of 30-80 years was considered, most of the patients with pulp calcifications were within the age group of 50-69 years. This finding was in accordance with a study conducted by Satheshkumaret al., where he concluded that aging and the reactive process may not be the only reason for pulp calcifications [40]. Leila et al found that out of 122 patients who met the criteria, 68.2% of the patients with CVD had pulp chamber calcifications [41]. Pulp calcification in panoramic radiography had a sensitivity of 68.9% to predict CVD. In the present study overall distribution of pulp calcifications were more in the hypertensive group(58%) than in nonhypertensive group(42%). Atherosclerosis is a life-threatening disease and it rarely manifests any signs or symptoms; therefore, its early detection is crucial in preventing stroke or heart attack. Panoramic radiographs are relatively inexpensive and are already made routinely in a large part of the adult population. Therefore, these radiographs might represent an enormous potential as a screening tool for many systemic diseases. Bains et al in their study, 500 routine dental outpatients within the age group of 18–67 years were involved in the study [42]. Molar bitewing of left and right side of each patient was taken with XCP bitewing instrument and size 2 film. The presence or absence of pulp stones was recorded. Overall prevalence of pulp stones was 41.8%. Pulp stones were significantly higher in maxilla (11.59%) than mandible (6.54%), left side than right side, and first molar than other molars. Higher numbers of pulp stones were recorded in patients with cardiovascular disease (38.89%) than with cholelithiasis and renal lithiasis.

Our institution is passionate about high quality evidence based research and has excelled in various fields [43-53].

Conclusion

Within the limitations of the present study association between hypertension and calcification could not be established. However calcification was more prevalent among hypertensive patients especially male population. Left mandibular molar was identified to have calcification more often and patients with 50 to 69 years age groups have more calcification. It is suggested that the routine dental radiography could possibly be used as an available screening method for early detection of patients at risk of cardiovascular diseases.

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