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RESEARCH ARTICLE

RADIOGRAPHIC ASSESSMENT OF PULP STONES: A RETROSPECTIVE STUDY

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ABSTRACT

Background: Pulp stones are discrete calcifications and can be identified in periapical and bitewing radiographs. Stones may exist freely within the pulp tissue or attached to or embedded in dentine. They are more frequently present in the coronal than in the radicular portion of the pulp with a predominating tendency to appear in the maxillary teeth especially the maxillary first molar. Pulp stones have been noted in patients with systemic diseases like cardiovascular, diabetes mellitus and hypertension or in genetic diseases like dentine dysplasia, dentinogenesisimperfecta and Van der Woude syndrome. Etiopathogenesis of pulp stone is still not clear inspite of many microscopic and histochemical studies. **Objective**: This retrospective study was planned to correlate the association of pulp stones with age, gender, location, dental or systemic disorders. **Methods:**.The material for this study was obtained by retrospective review of the case files of Annoor Dental College, Muvattupuzha from March 2016 to April 2018, a span of 2 years. A total of 2500 radiographs (OPG) were retrieved from the outpatient department and were assessed for pulp stones within age group of 12–72 years. Statistical Analysis was carried out using chi square test; Minitab (version 17.1.0.0). **Results**: Overall prevalence of pulp stones in both the gender was 28.9% (723/2500). Out of 723 cases, 411 females& 312 males had pulp stones. Pulp stones were significantly higher in maxilla than mandible (Max. = 67.3%, Mand. = 32.6%).More number of pulp stones were observed in females(56.8%) than males(43.1%).The prevalence of pulp stones in age group from 32–42 years showed higher pulp stones as compared to other groups (29.3%).The prevalence of pulp stones in dental conditions include (Caries -25.5%, Periodontitis- 28.8%, Restored 16.5%, Orthodontically treated teeth -18.9%).The prevalence of pulp stones in hyperlipaedimicpatients was 24.7& renal stones were 21.7%. **Conclusion:** Even though the aetiological factors involved in their formation are still not fully understood, it would appear that pulp stones are primarily a physiological manifestation and may increase in number and/or size due to local or systemic pathology. The radiographic assessment of pulp stones helps in early diagnosis of many systemic conditions which eventually helps for a better treatment plan.

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INTRODUCTION

Pulp stones or denticles are discrete nodular calcifications appearing in both coronal and radicular portions of pulp. They are reported to occur more often in the coronal region (Arys *et al.,* 1993).

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Two types of calcified bodies in the dental pulp have been described: denticles possessing a central cavity filled with epithelial remnants surrounded peripherally by odontoblasts, and pulp stones being compact degenerative masses of calcified tissues (Moss-Salentijn and Klyvert 1983). A single tooth may have stones ranging from 1 to 12 or even more, with sizes varying from minute particle to large masses that occlude the pulp space (Kantaputra *et al.,* 2002) .The prevalence of pulp stones in teeth, based on radiographic examination, has been reported to be around 20–25%, while histological

examinations reveal higher percentages (Sayegh *et al.,* 1968) [4].Though the exact etiology is unknown, various researchers have proposed few causative factors such as pulp degeneration, inductive interactions between epithelium and pulp tissue (Moss-Salentijn *et al.,* 1983), age (Hillmann *et al.,* 1997), circulatory disturbances in pulp (Sundell *et al.,* 1968) [6],orthodontic tooth movement (Stenvik *et al.,* 1970), idiopathic factors (Siskos *et al.,* 1990) and genetic predisposition (Van Den Berghe, 1999). The formation of pulp stones has also been associated with long-standing irritants such as caries, deep fillings and chronic inflammation (Kronfeld, 1933). Recent literature still suggests that pulp stones are a feature of an irritated pulp, attempting to repair itself (Lovdahl *et al.,* 1997). Calcification can occur in the dental pulp as diffuse forms or as discrete calcified stones that may exist 'freely' in pulp tissue or become 'attached' to or 'embedded' into dentine (Kronfeld, 1933). The free denticles are entirely surrounded by pulp tissue, attached denticles are partly fused with the dentin and embedded denticles are entirely surrounded by dentin. Pulp stones were histologically classified by Kronfeld into 'true' or 'false' forms. True denticles are similar in structure to dentin and are usually located close to the apical foramen. False denticles do not exhibit dentinal tubules but appear instead as concentric layers of calcified tissue. The present study intends to correlate the association of pulp stone with Age, Gender, Location, Dental and Systemic disorders.

MATERIALS AND METHODS

The material for this study was obtained by retrospective review of the case files of Annoor Dental College, Muvattupuzha from March 2016 to April 2018, a span of 2 years. A total of 2500 radiographs (OPG) were retrieved from the outpatient department and were assessed for pulp stones within age group of 12–72 years. Grossly destructed teeth, teeth with metal crowns, and extensive metallic restoration and poor quality radiographs were excluded from the study sample. Patients were categorized into 6 age groups (12–22 years, 22–32 years, 32–42 years, 42–52 years, 52–62 years and 62-72 years).Total numbers of pulp stones were assessed for males and females separately for each age group. Statistical Analysis was carried out using chi square test; Minitab (version 17.1.0.0) and the significance level were taken to be 0.05.

RESULTS

Round to ovoid well defined radiopaque mass of 1-2mm size were observed in the pulp chambers of various teeth (Fig 1a-d**)**. The results showed that out of 2500 patients, 723 patients or 28.9% of patients had pulp stones **(**Table 1). Out of 723 cases, females exhibited a greater frequency in the number of pulp stones as compared to males (F: M = 1.3:1). The age group from 32– 42 years showed a maximum occurrence of pulp stones among both the genders compared to other groups (29.3%). The highest occurrence of pulp stones were recorded in females in all age groups except in the age group of 62-72 years with a slight higher incidence in males. Statistically significance (p-value = .0227) was observed between age group and gender (Table 1 and Fig 2). Pulp stones were significantly found to be higher in maxilla than mandible (maxilla-67.3%, mandible-32.6%). The highest number of pulp stones was observed in first molars (39.5%) (Table 2). The prevalence of pulp stones in periodontally affected teeth was 28.8%, carious teeth -25.5%, restored teeth - 16.5% and in orthodontically treated patients - 18.9%.

The maximum number of pulp stones in maxillary teeth was found to be associated with periodontically involved teeth whereas in mandibular for carious teeth (Table 2 and Fig 3). The association of pulp stones with few systemic conditions were also noted. The prevalence of pulp stones in hyperlipidaemia patients was 24.7%, renal stone patients - 21.7% and diabetics - 7.5%. No significant association was observed between gender and Hyperlipedemia, renal stone. (Table 3 and Fig 4)

DISCUSSION

The present study comprised of 2500 patients, 411 females and 312 males within age group of 12–72 years showed the prevalence of pulp stones. Radiographs of right and left side of each patient were evaluated for presence of pulp stones. Pulp stones less than 200μm in diameter are unlikely to be detected in X-Ray (Moss-Salentijn *et al.,* 1983). The prevalence of pulp stone in this study was 28.9% and females exhibited higher pulp stones than males. Maxillary teeth had higher pulp stones than mandibular teeth. The prevalence of pulp stones in this study was found to be higher in the first molar when compared to other teeth which is in agreement with other investigators (Tamse *et al.,* 1982; Baghdady *et al.,* 1988). A possible explanation is that the early eruption of the first molar can undergo more degenerative changes since they are exposed for long period of time, thus confirming that with increase in duration of time, the degree of calcification of the pulp intensifies (Al-Nazhan, 1991).

It is thought that as age advances the structure of the normal pulp varies. This usually leads to a progressive decrease in the number of pulp cells as well as gradual increase in mucopolysaccharides and fibrous elements leading to calcification. But in the present study, 32–42 years group showed higher pulp stones which was not in harmony with other previous studies (Sayegh *et al.,* 1968). Our study showed that 28.8% teeth with pulp stones were associated with periodontal pathology. The outcome of periodontal disease on the pulp tissue showed a close association between the presence of pulp calcifications and periodontal disease. Sheykhrezaee *et al.* stated that periodontal disease can lead to fibrosis and calcification. Subay *et al.* suggested that periodontal disease interferes with blood supply and nutrition of the pulp causing diminution in cellular elements and increase in calcification. The inflammatory changes within pulp due to carious lesions can lead to secondary dentin formation and increased calcification (Holtgrave *et al.,* 2002).

A higher incidence of pulp calcification has been noted in carious tooth than in restored teeth, apparently because the pulps have some degree of chronic inflammation due to the caries and restorations (Hall DC 1968). In our study we observed that 25.5% of teeth showed pulp stones. It is thought that restorative procedure which can induce trauma leads to capillary thrombosis or vascular wall damage which on further mineralization can lead to formation of pulp stone. In this study, 16.5 % restored teeth had pulp stones. Correlation between orthodontically treated teeth and prevalence of pulp stones were noted in our study. In this study 18.9% of orthodontically treated teeth had prevalence of pulp stones. It is thought that may periodontal inflammatory reaction can be induced by orthodontic force application. Orthodontic forces can cause circulatory disturbances in human pulp tissue

Table 1. Comparison of pulp stones between age group and gender

Age Group	Number of Patients	PS Patients	Females	Males	Level of significance
2-22	177	31	17	14	p-value = .0227
22-32	339	81	53	28	
32-42	565	212	121	91	
42-52	499	153	91	62	
52-62	488	147	88	59	
62-72	432	99	41	58	
Total	2500	723	411	312	

Table 2. Frequency of pulp stone in molar teeth in different dental status

Teeth	Carious		Periodontitis		Restored		Orthodontically treated		Total occurrence/ teeth
	Max	Mand	Max	Mand	Max	Mand	Max	Mand	
1st M	63	34	87	31	56	27	67	29	394
2nd M	47	27	41	29	31	23	39	15	252
3rd M	16	8	18	4	22	9	0	0	77
Total	126	69	146	64	109	59	106	44	723
	195		210		168		150		

Table 3. Frequency of pulp stones systemic diseases

Gender	Hyperlipedemia	Renal stone	Total
Female	16	2	18
Male	22	3	25
Total	38	5	43

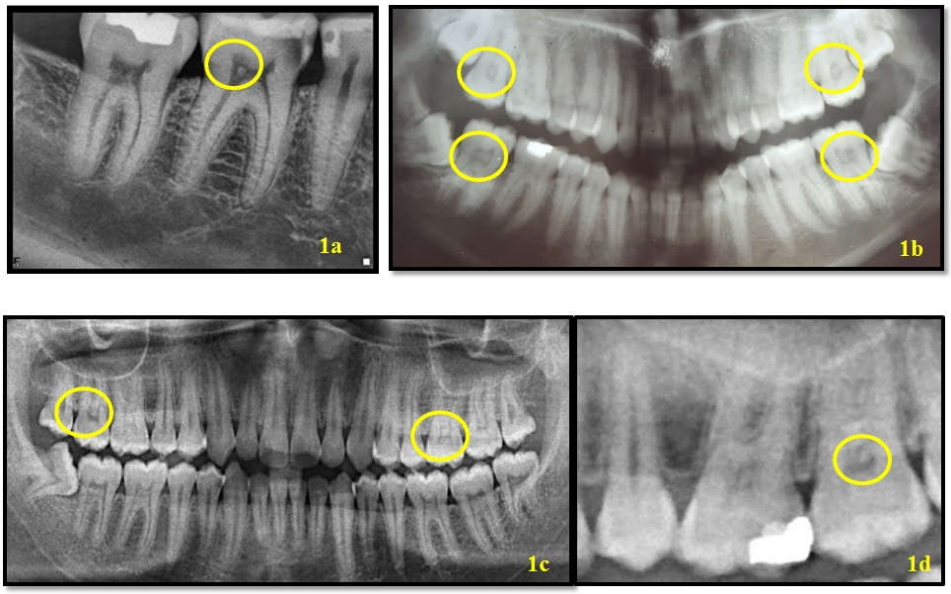

Figure 1. Radiographs (IOPA & OPG) showing pulp stones located in the pulp chamber of 46 (1a), 17, 27, 37 & 47 (1b), 17 & 26 (1c) & 27 (1d)

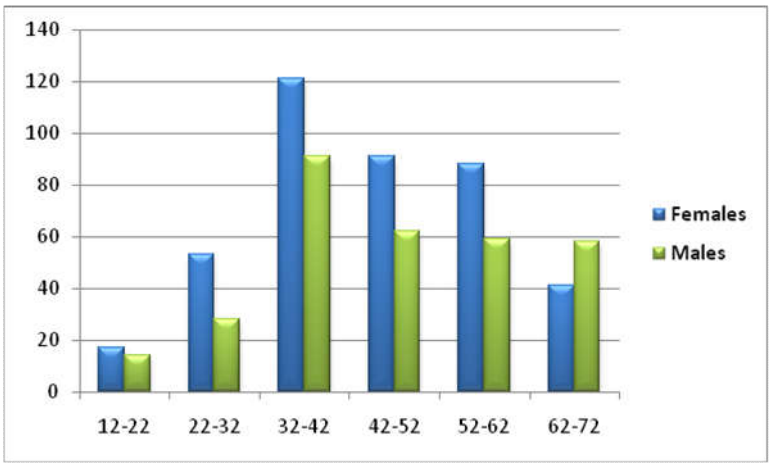

Figure 2. Bar graph of comparison of age group and gender

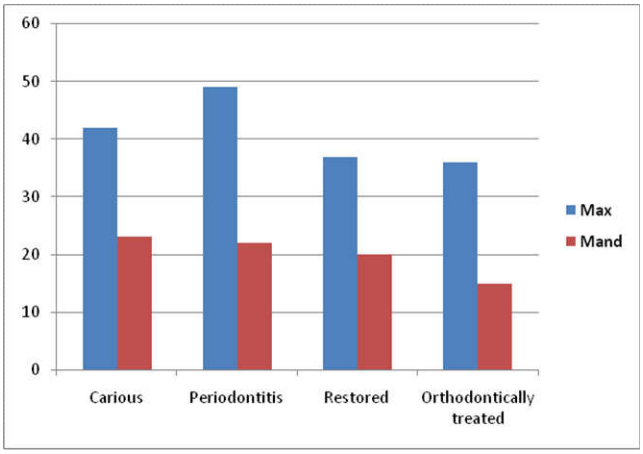

Figure 3. Bar graph showing the distribution of pulp stones in maxilla and mandible

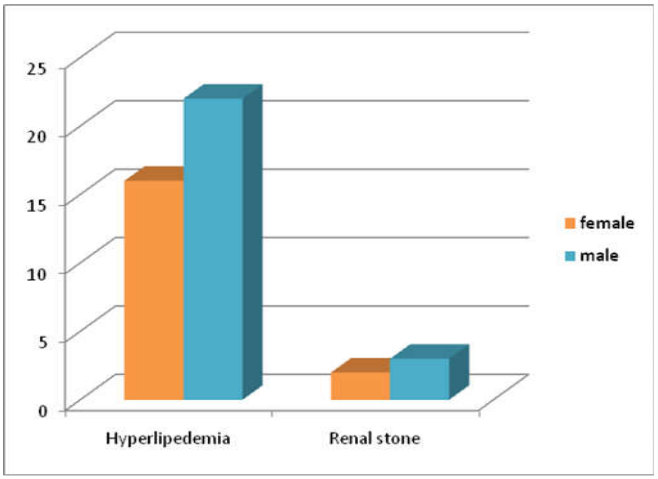

Figure 4. Bar chart of number of pulp stones in Hyperlipedemia and Renal Stone

leading to odontoblastic layer degeneration there by stimulating calcification. A study conducted by Subay *et al.,* 2001 in patients undergoing orthodontic treatment concluded that extrusive forces applied to teeth do not cause significant pathological changes in human pulp tissue. Atherosclerosis is a life-threatening disease and it rarely manifests any signs or symptoms; therefore, its early detection is crucial in pre-venting stroke or heart attack. Therefore, these radiographs might represent an enormous potential as a screening tool for many systemic diseases .Systemic variations such as arteriosclerosis and renal lithiasis can be considered as factors predisposing to pulpal calcification.

There is also evidence that hypercalcemia, gout and renal lithiasis are pre-disposing factors to pulpal calcification (Sayegh *et al.,* 1968). Edds *et al.,* found a significant (75%) relationship between pre-existing cardiovascular disease and pulp stones. In our study, 24.7% of hyperlipidemic patients had the presence of pulp stones which is less than that reported by Edds *et al.,* 2005. A pilot study of the correlation of pulp stones with cardiovascular disease demonstrated that patients with cardiovascular disease have an increased incidence of pulp stones (Edds *et al.,* 2005). High incidence of calcification was reported by Maura and Paiva 1987in the dental pulp of patients with coronary atherosclerosis upon radiographic examination. Regarding the large number of individuals who suffer from stroke and myocardial infarction each year, dentists may have a substantial role in the early diagnosis of these fatal diseases, and their incidental findings in panoramic radiographs can have a significant profit for public health. Stafne *et al.,* 1933 suggested that pulp stones are not directly responsible for the production of renal stones and gall stones. However, Ciftciouglu *et al.*1998 proposed that nano bacteria may induce pulp calcification, kidney stone and gall stone formation. In our study we found that 21.7% of renal stone patients had pulp stones .

Conclusion

Even though the aetiological factors involved in their formation are still not fully understood, it would appear that pulp stones are primarily a physiological manifestation and may increase in number and/or size due to local or systemic pathology. The radiographic assessment of pulp stones helps in early diagnosis of many systemic conditions which eventually helps for a better treatment plan.

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