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Research Article

Evaluation of Pulp Stones in Permanent Molars and their Correlation with Systemic Diseases - A Panoramic Radiographic Study

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Abstract

Pulp stones are found during radiographic examination and can occur throughout the lifespan of individual. There are numerous studies with variations in prevalence rates and the association of the pulp stones with certain systemic conditions like cardiovascular and renal diseases. The present study was designed to understand incidence, pattern and distribution of pulp stones on panoramic radiographs (N = 355). Further the evaluation of presence of any systemic diseases in those patients was done retrospectively from their case records. In addition, it attempted to compare the presence of pulp stones identified by the radiologist and the intern. The occurrence of pulp stones was statistically significant among molars (2.84%) while 4.97% maxillary left first molars showed pulp stones. Association of pulp stones with systemic diseases was not promising. Also, comparison of pulp stone identification by the radiologist and the student was not significant (p = 0.127). Number of pulp stones was statistically significant in maxillary molars than mandibular molars. Their finding on radiographs should require assessing the risk of systemic diseases among patients.

Keywords: *Pulp Stones; Molars; Panoramic Radiograph; Systemic Diseases; Intern*

Introduction

Pulp stones are discrete calcified masses found in the coronal or radicular pulp. They have similar calcium phosphorous ratio like that of dentin and can be seen in healthy, carious, or even unerupted teeth [1]. Pulp stones may be free or embedded and vary in number, shape, and size. Although, many microscopic and histochemical studies have been performed in the past to know the cause of their formation, no specific etiology is being explained. However, there are several conditions like pulp degeneration, inductive interactions between the epithelium and pulp tissue, age caries operative procedures periodontal diseases and orthodontic treatment that can induce the formation of pulp stones [2]. Pulpal calcifications can develop throughout life, and studies have reported prevalence rates from 8% - 90%. The pulp stones can be seen on radiographs and are easily identifiable [1,2].

The prevalence of pulp stones in teeth, based on radiographic examination, has been reported to be around 20 - 25% [3]. Nevertheless, the incidence and prevalence of pulp stones have been studied in many populations and have exhibited notable differences in their occurrence. The frequency of pulp stones incidence has been reported to increase with age. However, some studies did not find any difference in occurrence between genders while other studies have found a higher percentage among the female population [1,2,4].

Studies among Iraqi and Jordanian populations show 19.2% and 22% of the teeth containing pulp stone [4,5]. Turkish population revealed 27.8% prevalence of pulp stones, while a study in Saudi Arabian subpopulation pulp stones were identified in 50.93% of patients [6,7].

A panoramic radiograph is routinely used tool for evaluation of the general dental status of patients and can be a useful modality for the identification of pulp stones. Also, there are studies showing the relationship between the presence of pulp stones and systemic diseases among patients [3]. Further, there are very limited studies among the Arab population for pulp stone incidence and relationship with sys-

temic diseases. With this vies in mind, the present study was intended to assess the incidence of pulp stones among dental patients and their association with systemic diseases if any.

Materials and Methods

The study was approved by the Ethical Committee of the Batterjee Medical College for Science and Technology, Jeddah Saudi Arabia. A total of 355 digital panoramic radiographs of patients visiting Batterjee medical college Jeddah, were selected for evaluation between the span of October 2018 to September 2019. Radiographs with distortion, lack of sharpness, overlap and missing molars were excluded from the study. Thus, a total of 2840 molars were examined for the presence of pulp stones. Further, the systemic diseases present in those patients were recorded using data from their case files.

All the radiographs were evaluated for the presence of pulp stones in all molar teeth by the maxillofacial radiologist. Also, an intern was trained to evaluate panoramic radiographs for detection of the pulp stones in teeth.

Statistical analysis

Data obtained was collated in an excel sheet (Microsoft Excel 2016) for statistical analysis. Percentages were calculated for all the data obtained and the Chi-square test was applied to find statistical significance. $P < 0.05$ was considered for significance.

Results

A total of 355 panoramic radiographs were examined by a maxillofacial radiologist and an intern independently for the presence of pulp stones in molars of all quadrants. A chi-square test of independence showed that there was no significant association between the pulp stones evaluation by the radiologist and the intern ($p = 0.127$) (Table 1).

Molar	Maxillary right molars			Maxillary left molars			Mandibular right molars			Mandibular left molars			Total pulp stones	Chi-square statistic	p-value
Observer	16	17	18	26	27	28	36	37	38	46	47	48		X^2	
Radiologist	26	13	3	37	14	2	7	1	0	10	5	3	121	5.6902	0.127
Intern	27	14	0	40	14	3	7	6	8	9	12	7	147		

Table 1: *Distribution and comparison of pulp stones evaluation between Radiologist and intern.*

Maxillofacial radiologist's evaluation was considered for statistical analysis wherein 70 (19.7%) radiographs showed pulp stones. Thus, out of 4260 molars, 121 (2.84%) molars revealed pulp stones. Maximum numbers of pulp stones were found in maxillary left molars (4.97%) followed by maxillary right and mandibular left molars (3.94% and 1.96% respectively) and were statistically significant. Mandibular right molars showed the least number of pulp stones (2.3%) but their percentage is statistically not significant (Table 2).

Molar	No. of molars examined	No. of molars with pulp stones	% of molars with pulp stones	Chi-square statistic (X^2)	p-value
Total Molars	4260	121	8.5%	44.257	< 0.00001
Maxillary right molars	1065	42	11.8%		
Maxillary left molars	1065	53	14.9%		
Mandibular right molars	1065	8	2.3%		
Mandibular left molars	1065	18	5.1%		

Table 2: *Quadrant-wise distribution of pulp stones.*

In tooth-wise assessment, the highest numbers of pulp stones were found in the left first molar while the third molars showed the least number in both arches. Mandibular right third molars did not show pulp stones. The presence of pulp stones in maxillary molars was found to be significant while that of mandibular molars was non-significant (Table 3).

Quadrant/molar	First molar	Second molar	Third molar	Chi-square statistic (X^2)	p-value
Maxillary right molars	26	13	3	19.780	0.00005
Maxillary left molars	37	14	2	37.686	< 0.00001
Mandibular right molars	7	1	0	4.5513	0.0328
Mandibular left molars	10	5	3	4.4078	0.1103

Table 3: *Molar-wise distribution of pulp stones as evaluated by the maxillofacial radiologist.*

Out of 355 radiographs, 285 radiographs were of male patients and 70 radiographs were of female patients. The gender-wise distribution of pulp stones was found to 18.2% and 25.7% for males and females respectively (Table 4).

Gender (Age)	No. of radiographs examined	No. of radiographs with pulp stones	% of radiographs with pulp stones
Males	285	52	18.2%
Females	70	18	25.7%
Total	355	70	19.7%

Table 4: *Gender-wise distribution of pulp stones.*

Out of 355 patients, 121 (13.22%) patients were having systemic disorders. The maximum number was of diabetic patients of which only 1 (2.7%) was detected with pulp stones. In a group of cardiovascular patients, 42.8% hypertensive and 16.6% angina individuals were found with pulp stones. Patients with arthritis (19.23%) and peptic ulcers (10.7%) and kidney stones (20%) also showed pulp stones (Table 5).

Disorder	Total cases	No. of cases with pulp stones	% of patients with pulp stones
Arthritis	26	5	19.23%
diabetes	37	1	2.7%
Peptic ulcer	28	3	10.7%
hypertension	7	3	42.8%
Goiter	6	1	16.6%
Angina	12	2	16.6%
Kidney stone	5	1	20%
Total	121	16	13.22%

Table 5: *Systemic diseases and presence of pulp stone.*

Discussion

Pulpal calcifications can be identified throughout life, and the reported prevalence rates range from 8%-90% while their radiographic prevalence has been reported to be in the range of 20% - 25%. Yet prevalence of microscopic examination is always greater than radiographic prevalence as the detectable size of 200 micrometers is required to visualize the pulp stone on a radiograph. They tend to form more frequently in the coronal pulp but can be found in radicular pulp [8,9]. Detection of pulp stones using dental radiographs in most of

the studies is done by using paralleling technique or bitewing radiographs whereas some studies used panoramic radiographs [6,10,11]. Further, numerous studies have been attempted to establish a relationship between certain systemic diseases and the presence of pulp stones [2,12].

The present study was proposed to find the prevalence of pulp stones in molars and the possible relationship between systemic disorders. A total of 355 panoramic radiographs were included in the study and 4260 molars were evaluated for the presence of pulp stones by maxillofacial radiologist. Besides, an intern was trained to perform a radiographic evaluation for the presence of pulp stone. The comparison of the number of pulp stones detected by the maxillofacial radiologist and the intern was found to statistically non-significant.

In this study, 70 (19.7%) out of 355 panoramic radiographs showed pulp stones wherein 4260 molars were examined. A total of 121 (2.84%) molars shown pulp stones. These findings were in accordance with a prevalence study by Turkal., *et al* [13]. On the contrary, studies by Colak., *et al*, Patil., *et al*. and Kannan., *et al*. found a higher prevalence of pulp stones [6-8]. These findings can be attributed to point that molars have large pulp chambers with good blood supply to the pulp thus producing more calcific deposits [4,14].

The present study showed maximum numbers of pulp stones in maxillary left molars (4.97%) followed by maxillary right and mandibular left molars (3.94% and 1.96% respectively) in quadrant wise evaluation. Whereas mandibular right molars showed the least number of pulp stones (2.3%). Further, in tooth-wise assessment, the highest numbers of pulp stones were found in the left first molar while the third molars showed the least number in both arches. However, mandibular right third molars did not show pulp stones. However, Kannan., *et al.* found a higher prevalence in maxillary left second molar [8].

The gender-wise distribution of pulp stones was found to 18.2% and 25.7% for males and females respectively with a higher incidence among females. These findings were in accordance with Tassoker., *et al* [15]. However, Hamasha., *et al*. and Baghdady., *et al*. found a higher incidence in the male patients [4,5].

A total of 121 (13.22%) patients were having systemic disorders. The maximum number was of diabetic patients of which only one (2.7%) was detected with pulp stones. In a group of cardiovascular patients, 42.8% hypertensive and 16.6% angina individuals were found with pulp stones. Patients with arthritis (19.23%) and peptic ulcers (10.7%) also showed pulp stones. Nayak., *et al*. noted a positive correlation of pulp stones in patients with known systemic diseases wherein most patients were suffering from cardiovascular disorders. He further observed 7.6% of pulp stones in diabetic patients [3]. Babu., *et al*. suggests a careful assessment of patients with multiple pulp stones for risk of coronary artery diseases in the presence of other risk factors [16]. Edds., *et al*. also found a higher prevalence of pulp stones in patients with ischemic heart disease [1]. Talla., *et al*. found a higher prevalence of pulp stones in patients with hypertension, diabetes and gastritis as compared to their overall prevalence [2].

In the present study, one patient was found to have pulp stones out of 5 patients with kidney stones. A study by Patil., *et al*. on the relationship between pulp and renal stones was not significant [17]. On the other hand, Bains., *et al*. found a significant relationship between renal and pulp stones. So far, it is suggested that pulp stones are not directly correlated with the development of renal stones [12]. However, it suggested that calcifying nanobacteria that are termed as calcifying nanoparticles may induce pulp calcification and kidney stone formation. These nanoparticles are found in the blood circulation and form nucleate hydroxyapatite crystals that lead to pathological calcifications in kidneys, gall bladder, joints, atherosclerotic plaques and pulp [18].

Thus, from the present study, it is quite apparent that it is not uncommon to find pulp stones on routine radiographic examination. Nevertheless, there is an observable correlation between pulpal calcifications and systemic diseases. We found few patients of arthritis and peptic ulcers with the presence of pulp stone, although there is no supporting literature to establish any significant association. It is stated that although the formation of pulp calcifications is a physiological process, their size or number may increase secondary to local or systemic factors. Nonetheless, these calcifications are only a concern during endodontic procedures. Further, this entity shares a definite correlation with numerous systemic and genetic conditions, it warrants thematic research in this connection [19,20].

Conclusion

In the present study, the pulp stones are noted frequently in the molars due to their morphological features like large pulp chambers and adequate blood supply. Numerous systemic diseases showed the presence of pulp stones, nevertheless, their presence in patients with peptic ulcers was interesting. As the sample size in this study is small, there is a need for multi-centered studies on a large group to understand the need for early detection of pulp stones and identify the possible risk factors for systemic diseases in those individuals.

Conflict of Interest

None.

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