



A Tomographic Evaluation of Prevalence of Pulp Stones -A Hospital Based Study

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ABSTRACT

Pulp stones are dystrophic calcifications of the dental pulp that pose difficulties during endodontic treatment. They are present either in the pulp chamber or block the patency of the root canal orifices and root canals. The best way to analyse their position is through radiological examination. With the advancement in this field, CBCT is a sensitive tool in the detection of pulp stones and their integrity. Also a geographical variation in the distribution of pulp stones is supported by literature which has led to the design of the present study. The aim was to study the prevalence of pulp calcifications using Cone Beam Computed Tomography (CBCT) in a hospital set up. Retrospective CBCT data of 200 scans of various subjects was included in the study. 1034 teeth in total were assessed for pulp stones. Further, the total sample was divided based on age into 4 groups-group I, II, III and IV. The presence of pulp stones was documented in terms of arch, quadrant and current condition of tooth involved. Statistical analysis was done using Chi-square test. The sample group was observed to have a prevalence of pulp stones among 60% of scans and 16.5% of total teeth examined. Comparing genders, males (79.1%) were found to have higher prevalence compared to females (63.3%). Molars, under type of tooth category and attrited teeth, under condition of tooth were found to have highest prevalence. Pulp stones in the study population over a year, were most prevalent in molars and attrited teeth. No statistical significance was obtained when arch and side of tooth involved, gender were correlated with presence of pulp stones.

Keywords- Pulp stones, Pulp calcifications, CBCT

Received 13.06.2024

Revised 19.07.2024

Accepted 19.08.2024

INTRODUCTION

Pulp stones are discrete nodular calcifications of the dental pulp that may further undergo changes to become diffuse, dystrophic calcifications. Pulp stones usually occur in the pulp tissue of healthy, diseased and unerupted teeth, either in the anterior or posterior dentition or irrespective of age group (1). While the etiology of pulp stones is unclear, predisposing factors for their formation include traumatic occlusion, caries, restorations, orthodontic treatment, periodontal disease, pulp related factors like pulpal degeneration, disturbances in pulpal circulation and aging (2). Pulp stones are prevalent both in the coronal and the radicular portions of the tooth and may present as free, attached or embedded calcifications attached to the dentinal wall. Radiographically they appear as round or ovoid radiopacities of similar radio density as that of dentin within a radiolucent pulp (3). Teeth with pulp stones are often asymptomatic. However, they present difficulties and complicate endodontic treatment. Pulpal calcifications present in the pulp chamber physically obstruct root canal orifices, whereas those within the root canals decrease the accessibility and patency of canals to endodontic files, increasing the risk of instrument breakage. Moreover, their occurrence leads to changes in the access cavity preparation, thus slowing down the process of cleaning and shaping of root canal system (4). Pulp stones are best assessed radiographically. Two dimensionally they can be visualized in peri-apical and bitewing views. However, pulp stones smaller than 200µm in diameter go undetected in these radiographs. Also, distortion and superimposition of adjacent anatomic structures obscure root canal visibility. This can be overcome by three dimensional CBCT which has been reported to be a sensitive tool (5). Pre-operative knowledge of the incidence rates of pulp stones can guide the endodontist in selection of a pre-operative diagnostic modality as well as determination of treatment plan. There has been an evidence-based disparity in the prevalence of pulp stones among worldwide populations which can be attributed to ethnic and geographic location (7). Based on this, the present study was performed to assess the prevalence of pulp stones tomographically in a South

Indian sub-population of West Godavari district over a fixed period of time while co-relating the data with several parameters.

MATERIAL AND METHODS

A retrospective tomographic study design was carried out in a dental college and hospital of West Godavari district sub population. Ethnic clearance and institutional research board approval was obtained with a reference number – VDC/RT/2022/52. CBCT scans of 200 subjects who previously visited the hospital for various treatment needs within a time frame of one year (January 2021-December 2021) were obtained from the CBCT archives of the department of oral and maxillofacial radiology and details of age and gender were recorded. CBCT scans presenting with teeth with a closed apex were included in the study. Incomplete CBCT images, images with artifacts, endodontically treated teeth, teeth with deep carious lesions or deep restorations approximating the pulp were excluded from the study. This was done keeping in view that pulp involved teeth have a possibility of presence of previous pulp stones thus reducing the actual incidence rates. The scans were previously obtained using a CRANEX 3D, SOREDEX CBCT unit (Soredex, Tuusula, Finland). Scans with a field of view of 61x41mm or 61x78mm were analyzed using the On Demand 3D software. The sample was categorized based on age into 4 groups (Group I-21-30 years, Group II-31-40 years, Group III-41-50 years, and Group IV-51-60 years). Teeth were analyzed in all the three orthogonal sections (Figure 1,2,3). The pulp stones were identified as either oval or round dense radiopaque structures in the radiolucent pulp chamber and canals. The position of involved tooth with respect to arch and quadrant, tooth type, current condition of involved tooth in terms of restored, attrited or non-pathologic tooth were tabulated and statistical analysis was done.

Settings and Design:

Retrospective, observational study

Statistical analysis used:

The data obtained was analyzed statistically using SPSS software version 21.0 by applying Chi-square test to compare the prevalence of pulp stones between age, gender, arch, location, status and quadrant of the teeth involved.

RESULT

Overall Prevalence of Pulp Stones and Distribution between genders:

Among a total of 200 scans evaluated, 120(60%) and out of 1034 teeth, 171 teeth (16.5%) presented with pulp stones. Comparing genders, males (55.6%) had a higher percentage compared to females (44.4%). Correlation between presence of pulp stones and gender was not statistically significant (Table 1).

Distribution of pulp stones among age groups:

There was no statistical significance among 4 age groups. However, group II (31-41yrs) had the highest prevalence whereas group III (41-50yrs) recorded the least.(Table 2)

Prevalence of pulp stones based on their location within the tooth and tooth condition:

Location within the pulp is categorized into three types- pulp stones in coronal pulp, radicular pulp and both coronal and radicular pulp. Out of 171 teeth with pulp calcifications, the highest was found in the coronal portion of pulp (15.3%) and least percentage (0.1%) of teeth exhibited pulp stones both in coronal and radicular portion. (Table 3) In this study, three tooth conditions were taken in to consideration specifically-teeth presenting with attrition, with restoration and those with no pathology. Out of the 1034 teeth examined, 92 were attrited, 3 were restored, and 939 teeth had no pathology. Frequency was calculated in each category. All restored teeth were found to have pulp stones, followed by teeth that underwent attrition (39.15%) and least frequency was noted in those without pathology (14.1%). However these values were not statistically significant. (Table 4) Taking in to perspective, the no of pulp stones per tooth, 93.6% of the 171 teeth with pulp stones had a single calcification, where as 6.4% has two pulp stones.

Distribution of pulp stones according to side of jaw and arch:

The distribution of pulp stones according to the arch (Table 5) presented with the following frequencies: when correlating number of maxillary pulp stones with total sample of maxillary teeth, there was a frequency of 14.8%, where as that of mandibular pulp stones with total sample of mandibular teeth, frequency of 19.3% was obtained. Comparing maxillary and mandibular teeth showing presence of pulp stones with total sample having pulp stones (171), percentages were found out to be 56.1% and 43.85% respectively. (Table 6)

Distribution of pulp stones according to tooth type:

Table 5 shows the distribution of pulp stones according to tooth type. Left mandibular first molars showed highest prevalence (76.9%) followed by right maxillary first molars(74.4%).

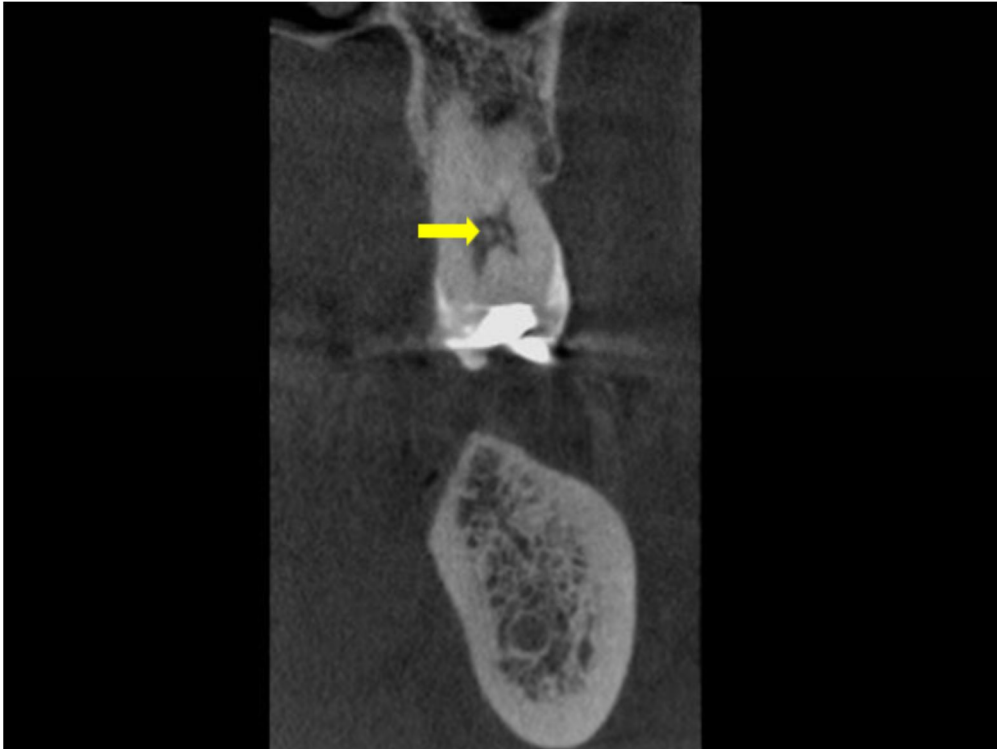


Figure 1: Coronal section of CBCT with pulp stones

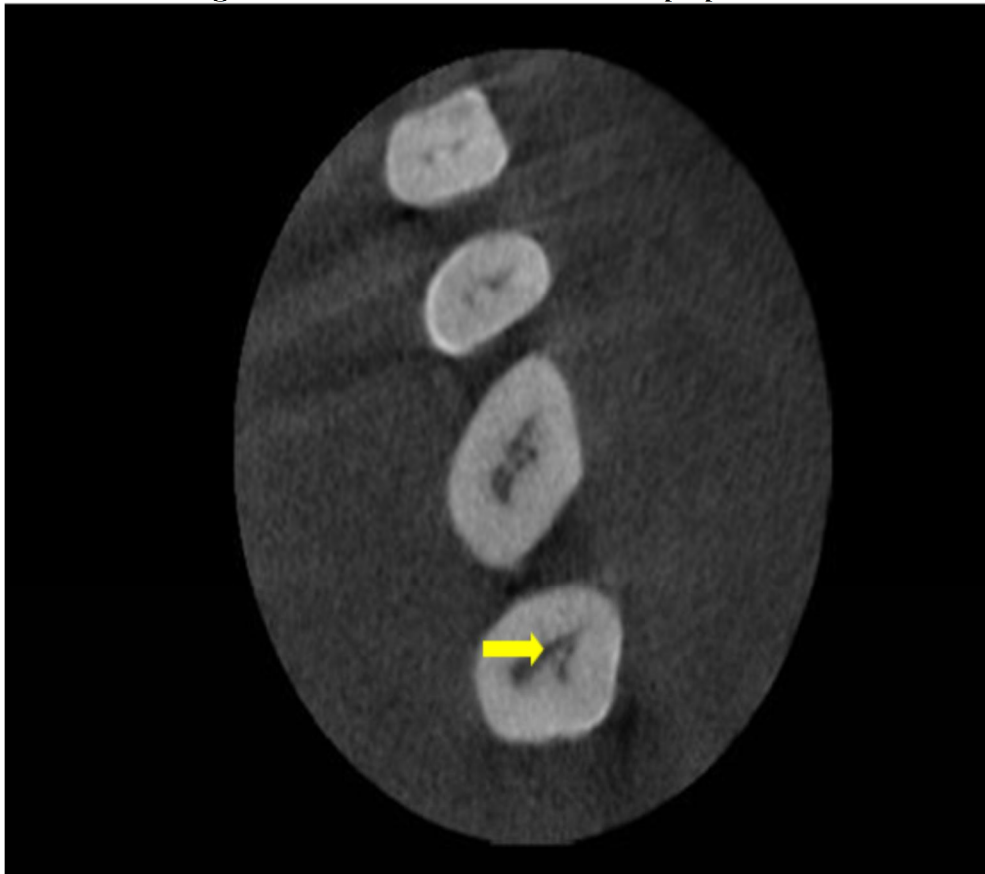


Figure 2: Axial section of CBCT with pulp stones



Figure 3: Saggital section of CBCT with pulp stones

TABLE 1: Distribution of pulp stones according to gender

Gender	Total number of teeth examined	No of teeth with Pulp stones	Percentage of teeth with pulp stones (%)
Males	171	95	55.6
Females	171	76	44.4

TABLE 2: Distribution of pulp stones by age

Age in yrs	Total number of teeth examined	No of teeth with Pulp stones	Percentage of teeth with pulp stones(%)
20-30	53	9	17.9
31-40	306	56	18.3
41-50	614	95	15.5
51-60	61	11	18.0

TABLE 3: Prevalence according to location within the teeth

Location within the teeth	Total number of teeth examined	No of teeth with Pulp stones	Percentage of teeth with pulp stones(%)
Coronal pulp	1034	158	15.3
Radicular pulp	1034	12	1.2
Both coronal and radicular pulp	1034	1	0.1

Table 4: Prevalence according to teeth status

Teeth type	Total number of teeth examined	No of teeth with Pulp stones	Percentage of teeth with pulp stones(%)
Attrited teeth	92	36	39.1
Restored teeth	3	3	100
Teeth with no pathology	939	132	14.1
Total	1034	171	16.5

Table 5: Distribution of pulp stones according to arch, side of jaw and teeth type

	Teeth type	Total number of teeth examined	No of teeth with Pulp stones	Percentage of teeth with pulp stones(%)
Maxillary arch Right quadrant	Central incisor	39	0	0
	Lateral incisor	42	1	2.4
	Canine	53	3	5.7
	1 st premolar	60	0	0
	2 nd premolar	55	6	10.9
	1 st molar	43	32	74.4
	2 nd molar	48	8	16.7
	3 rd molar	13	1	7.7
Left quadrant	Central incisor	31	1	3.2
	Lateral incisor	36	0	0
	Canine	40	1	2.5
	1 st premolar	42	5	11.9
	2 nd premolar	48	5	10.4
	1 st molar	42	20	47.6
	2 nd molar	42	10	23.8
	3 rd molar	12	2	16.7
Total		646	96	
Mandibular arch Left quadrant	Central incisor	9	0	0
	Lateral incisor	12	0	0
	Canine	22	1	4.5
	1 st premolar	34	1	2.9
	2 nd premolar	43	4	9.3
	1 st molar	26	20	76.9
	2 nd molar	33	14	42.4
	3 rd molar	11	3	27.3
Right quadrant	Central incisor	9	0	0
	Lateral incisor	12	0	0
	Canine	17	0	0
	1 st premolar	39	2	5.1
	2 nd premolar	47	4	8.5
	1 st molar	21	8	38.1
	2 nd molar	44	19	43.2
	3 rd molar	9	0	0
Total		388	75	

TABLE 6: Prevalence according to arch

Arch	Total No of Teeth with Pulp stones	Percentage of teeth with pulp stones(%)
Maxilla	96	56.1
Mandible	75	43.8

DISCUSSION

In the present study, prevalence of pulp stones was assessed retrospectively over a year in CBCT scans of a dental hospital. Though peri-apical and bite wing radiographs are the most commonly used, they reveal the presence of pulp stones only in the tooth of interest and multiple radiographic exposures are required for analyzing the entire dentition of a single patient. To overcome this issue, Orthopantomogram (OPG) can

be considered as a good substitute for screening all the teeth for pulp stones in both arches with in a single frame. OPG being a 2D image of 3D maxillofacial region has several disadvantages that come into play such as superimposition of adjacent structures, soft tissue shadows, ghost images leading to an obstruction to view the complete tooth. This leads to decrease in the actual prevalence rates of pulp stones (9). On the contrary, advent of 3D imaging modality-CBCT has proved to be efficient in analyzing the morphology of root canal in three dimensions with high resolution in all planes, thus enabling proper identification and localization while preventing structure superimposition. CBCT scan uses less amount of ionizing radiation which is almost similar to that of OPG, thus reducing the bio hazardous risk of radiation to the patient and providing accurate diagnostic information leading to a better treatment plan (10). To mention a few prevalence studies in Indian subcontinent, Raviraj et al, (12) conducted a study to assess the prevalence of pulp stones in South Indian sub population using digital panoramic images. Pulp stones were observed in 51.4% of the study population with females (53.7), showing a significantly higher prevalence rates compared to males (51.4) with maxillary molars being the teeth with highest number of pulp stones(16.5%).Yousuf et al,(10) conducted a study to assess the prevalence of pulp stones in a South Indian population, using Orthopantomogram showed higher number of pulp stones in females compared to males with pulp stones present in 54 subjects of 374 examined subjects. CBCT significantly reduces radiation risk to the patient and provides accurate diagnostic information leading to a better treatment plan and more successful treatment outcomes. Till date, no study has been done to evaluate pulp stones prevalence in West Godavari district using CBCT scans (10) In the current study, pulp calcifications were found in 16.5% of teeth of West Godavari district population. This is a slightly higher prevalence rate when compared to the study done by Patil et al,(7) in adult Saudi population with a prevalence rate of 10.6%, study by Da Silva et al,(3)in Barzilian population with a teeth prevalence of 9.5%,Kuzekanani M et al,(5)with 9.6% prevalence in Iranian population, Kalaji et al,(16)with a3.99% prevalence in Yemeni population, Kannan et al,(2) with 15.7% of prevalence in Malaysian population and Sisman et al,(15) with 15% prevalence in Turkish population. On the contrary, a slightly high prevalence of 31.3% is seen in northern Taiwanese population in study done by Hsieh et al.(6) Acharya et al,(9) with 41.05% in adult Nepalese population, a study by Baghdady et al,(1) showed a prevalence of 19.2% in teenage Iraq population. The frequency of pulp stones is reported between 9.9%-85% in patients and 4%-90% of teeth, these variations in prevalence rates may be due to factors such as study method, radiograph used, sample size, age and ethnicity of the population tested. In this study pulp stones were found to have higher prevalence in attrited teeth than teeth with restorations and teeth with no pathology. On the contrary, Da Silva et al found that the chance of occurrence of pulp stones increases by 2% with the presence of restorations in the teeth (2), He stated that this could be due to physical, chemical irritants such as attrition, restorations cause alteration in the blood flow within the pulp chamber leading to thrombosis and ultimately calcifications. First molars showed a higher prevalence of pulp stones. These results were in accordance with the literature which stated that molars have the biggest pulp chamber volume in oral cavity and present with significant amount of pulp tissue and a greater supply of blood that increases the formation of calcification. These results were in accordance to the studies done by Raviraj et al and Ravanshad et al,(12,11) In the present study ,patients in the age group of 20-60years were divided in to four groups (20-30,31-40,41-50,51-60), although the results were not statistically significant, the patients in the age group of 31-40yrs showed a higher prevalence of pulp stones(18.3%),these results were in accordance to study done by Hsieh et al,(6)in Brazilian population. Relating pulp stones by age, Pulp stones can be seen in any of the age groups, also pulp stone were seen even in very young teeth and developing tooth germs, so pulpal pathology is unlikely to be the only etiological factor for the formation of pulp stones, (6) In this study, no significant difference in distribution of pulp stones is found when maxillary and mandibular arches were compared. These findings are similar to study done by Patil et al, (7) However a study done by Hsieh et al,(6), mandibular arch has greater number of pulp stones than the mandibular arch. An in significant difference was also seen in the distribution of pulp stones according to gender and sides of the jaw. Similar results were also seen in the study done by Ranjitkar S et al and Gulsahi A et al,(13,14). However, studies done by Sisman et al, (15) and Al Ghurabi et al showed higher no of pulp stones in females than males. These variations in the prevalence rates may be due to difference in sample size, ethnicity and geographic locations. In this study, a greater number of pulp stones were seen in the coronal pulp than in the radicular pulp. The prevalence of pulp stones in the third molars was also assessed which accounted for a prevalence of 0.6%.

CONCLUSION

Variation in the prevalence of pulp stones is seen according to different geographic populations. In this study, the pulp stone was found to be equally distributed in men and women in West Godavari district population, with the first molars having maximum number of pulp stones compared to other teeth, with no significant distribution according to arch, location, side of the jaw and tooth status. The awareness of pulp

stones can help dentists in clinical endodontic practice and CBCT being a sensitive tool for the detection of pulp stones can aid in the treatment plan and effect the success rate of endodontic treatment.

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CITATION OF THIS ARTICLE

Chinnamurthy B, Koneru J, Reddy Sudhakara R, Tatapudi R, Srujana Daniella Re, Budumuru R. A Tomographic Evaluation of Prevalence of Pulp Stones -A Hospital Based Study. *Bull. Env.Pharmacol. Life Sci.*, Vol 13 [9] August 2024: 34-40.