International Journal of Applied Dental Sciences 2024; 10(4): 235-238

ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2024; 10(4): 235-238
© 2024 IJADS
www.oraljournal.com
Received: 10-10-2024
Accepted: 05-11-2024

Dr. Hilal Demir
Konya Beyhekim Oral and Dental Health Center, Konya, Turkey

Corresponding Author:
Dr. Hilal Demir
Konya Beyhekim Oral and Dental Health Center, Konya, Turkey

A radiographic evaluation of the prevalence of pulp stones

Hilal Demir

DOI: https://doi.org/10.22271/oral.2024.v10.i4d.2068

Abstract
Pulp stones are calcified masses that can be found in both the coronal and radicular pulp. The aim of this study is to determine the pulp stone prevalence in posterior teeth using digital panoramic radiographs. One thousand five hundred high-quality panoramic radiographs from an open-access dataset were evaluated. A total of 4,056 teeth on 256 panoramic radiographs that met the criteria were investigated to detect pulp stones. Pulp stones were detected in 664 (16.4%) of the evaluated teeth. They were more frequently found in molars compared to premolars. (p=0.000) When the jaws were compared, the pulp stone prevalence was higher in the maxillary arch than in the mandibular arch. (p=0.000) Digital panoramic radiographs are an effective imaging tool for diagnosing dental pathologies and are suitable for identifying pulp stone.

Keywords: Panoramic radiography, pulp stone, root canal treatment, prevalence

Introduction
Pulp stones (denticles) are calcified nodules located in the coronal and/or root pulp of both primary and permanent teeth. They can be observed in healthy, carious, and even impacted teeth. One or more teeth in the same individual may be affected [1]. These calcifications were first described by Norman and Johnston in 1921 [2].

Pulp stones appear as calcified, nodular masses located within the crown or root of a tooth. They form as aggregates of calcifications within the pulp, either as discrete entities or as diffuse calcified masses [3]. These stones can develop freely within the pulp tissue or may be attached to or embedded in the dentin wall. When composed of tubular dentin, they are classified as true denticles, whereas calcifications surrounding thrombi, collagen fibers, and degenerated cells are categorized as false denticles [4].

The exact mechanism behind the formation of pulp stones remains unclear. However, factors such as prolonged irritants (deep restorations, attrition, caries, and chronic inflammation), aging, genetic predisposition, pulp degeneration, trauma, orthodontic tooth movement, anemia, and certain medications are thought to contribute to their development [5]. Additionally, conditions such as dentinogenetic imperfecta, dentin dysplasia, Van der Wooed syndrome, and Ehlers-Danlos syndrome have been associated with pulp stone formation [4].

Pulp stones typically do not affect pulp vitality; therefore, no specific treatment is required upon detection. However, during root canal treatment, pulp stones can obstruct the canals and hinder irrigation procedures. This can complicate endodontic treatment and reduce the likelihood of post-treatment success [6].

Radiographically, pulp stones appear as oval or round opacities within the pulp. They can present as small opacities or as a single dense mass [7]. Calcified areas in the pulp smaller than 200 µg cannot be detected on radiographs [8]. Their size varies, with some reaching a diameter of 2-3 millimeters, while others can grow large enough to conform to the shape of the pulp [3].

According to previous studies, the prevalence of pulp stones has shown variability. These differences may be attributed to variations in inclusion criteria, observation methods, and research designs [6].

In this study, panoramic radiographs were used to assess the prevalence of pulp stones and to investigate their relationship with tooth location.

This will enable dentists to identify which types of teeth are more likely to present challenges during endodontic treatment.

Materials and Methods

Data Collection

This observational study was conducted by evaluating an open-access dataset consisting of 1500 high-quality panoramic radiographs [9]. All panoramic radiographs were screened based on the inclusion criteria, and 256 images that met the criteria were included in the study. A total of 4056 teeth in the included images were evaluated for the presence of pulp stones. Images of teeth with a clearly visible pulp chamber, no superimposition, and sufficient diagnostic quality were included in the study. Considering the high likelihood of pulp stones in teeth with deep fillings and caries, only teeth with superficial fillings or caries, or those that were completely healthy, were included in the study. It was ensured that all images included in the study were in the permanent dentition period. Teeth with crowns or bridges, or with orthodontic bands/brackets, were excluded from the study as their presence would obscure the visibility of the pulp chamber. Due to the use of an open-access dataset, age and gender information could not be included in the study.

Radiographic Evaluation

The presence of distinct radiopacity within the pulp chamber was considered as a pulp stone. (Figure 1, 2) The presence of pulp stones, tooth type, the dental arch it was located in, and the side of the jaw (right/left) were recorded. An experienced oral and maxillofacial radiologist evaluated all the images twice, with a one-month interval between the assessments. For images with discrepancies, a second opinion was sought from another oral and maxillofacial radiologist, and the final decision was made.

Statistical Analysis

All statistical analyses were performed using SPSS software (ver. 22.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics (mean, frequency) were used to determine the prevalence and distribution of pulp stones. The chi-square test was used to determine the difference between the right and left sides and the difference according to tooth groups. A level of $p < 0.05$ was considered statistically significant.

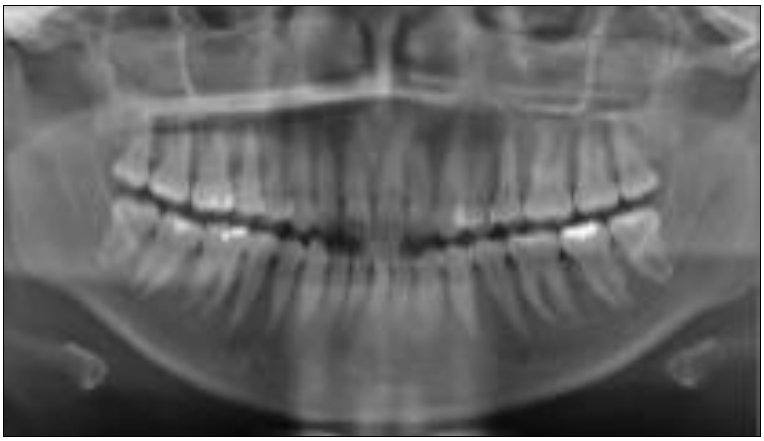

Fig 1: Panoramic image shows the pulp stones of molar teeth.

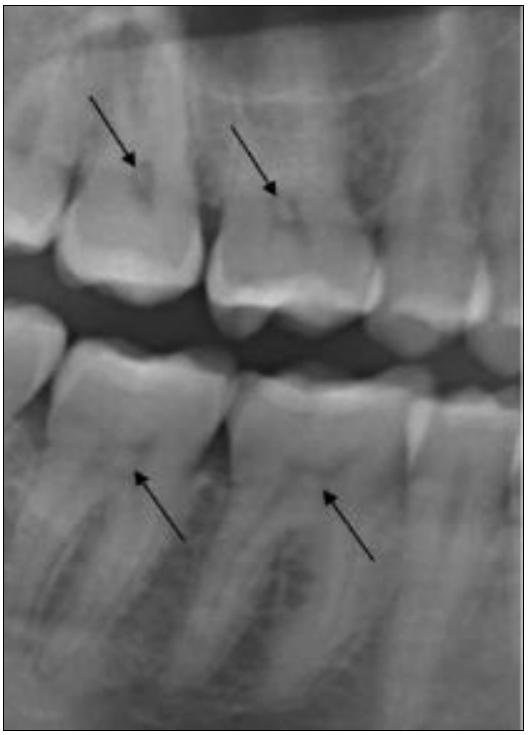

Fig 2: Black arrows show the pulp stone on a cropped panoramic image.

Results

A total of 4,056 teeth were evaluated on 256 panoramic radiographic images for the study. Pulp stones were detected in 664 (16.4%) of the evaluated teeth.

The distribution of pulp stone presence by tooth type is shown in Table 1. In the study group, no pulp stones were observed in the right mandibular second premolars. Pulp stones were most frequently observed in the right maxillary first molars (47.4%), followed by the left maxillary first molars (44.2%) and mandibular left (30.8%) and mandibular right (30%) molars, respectively.

Overall, when pulp stones were evaluated based on their occurrence in the jaws, no statistically significant difference was observed between the right and left sides. (p=0.601) It was determined that pulp stones were statistically more frequent in the left mandibular premolars compared to the right mandibular premolars. (p=0.002) (Table 2)

However, in both the mandible and maxilla, pulp stones were more frequently found in molars compared to premolars. (p=0.000) When the jaws were compared, the prevalence of pulp stones was higher in the maxilla than in the mandible. (p=0.000) (Table 3)

Discussion

Pulp stones can be evaluated both radiologically and histologically. Radiographically, only pulpal calcifications

larger than 200 μm can be detected. Periapical, bitewing, and panoramic radiographs are the techniques commonly used to assess these calcifications [4]. In this study, we identified pulp stones on panoramic radiographs. Although bitewing and periapical radiographs provide a clearer view of the pulp chamber [4, 10], panoramic radiographs, which are frequently taken during routine dental examinations, have also been found sufficient for detecting pulp stones [5]. Additionally, the ability to evaluate both the maxilla and mandible using a single radiographic image is a significant advantage [10], as it reduces the patient's exposure to radiation [5]. Particularly in the posterior region, reduced distortion may allow for the routine detection of pulp stones in this area. Therefore, in our study, we focused solely on the posterior region using panoramic radiographs.

The exact causes of pulpal calcifications have not yet been fully clarified. Factors such as gender, age, restorations, deep caries, and certain systemic diseases have been suggested to contribute to the formation of pulp stones. Additionally, a relationship between pulp stones and cardiovascular diseases has been highlighted. Therefore, incidentally detected pulpal calcifications may aid in diagnosing underlying conditions, such as cardiovascular diseases [11].

In our study, the tooth-based pulp stone prevalence was observed to be 16.4%. Prevalence rates vary across different studies. Turkal *et al.* [7] evaluated 6,912 panoramic radiographs and reported a prevalence of 2.1% in teeth. Al-Ghurabi and Najm [12] analyzed 390 panoramic radiographs and identified a prevalence of 7.3% in teeth. Similarly, Sreelakshmi *et al.* [2] reported a 6% prevalence of pulp stones in teeth based on 150 panoramic radiographs. In a retrospective study conducted by Colak *et al.* [13] on a Turkish population of 814 individuals, the prevalence of pulp stones in the examined teeth was found to be 27.8%. Sandeepa *et al.* [10] evaluated 1,000 panoramic radiographs and reported a tooth-based prevalence of 1.45%. Lyngdoh *et al.* [4] found the prevalence 3.6%. The variability in prevalence ranges can be attributed to differences in research methodologies, oral hygiene, dental habits, and ethnic backgrounds.

In the present study, regarding the location of the examined pulpal calcifications, pulp stones were found to be concentrated in the maxilla, particularly in the first molars. This result is consistent with other studies conducted by Sisman *et al.* [11], Turkal *et al.* [7], Sandeepa *et al.* [10], Ravanshad *et al.* [8], Lyngdoh *et al.* [4], Karadas *et al.* [14], Kalaji *et al.* [15] Unlike our study, Ravich *et al.* [16] found a higher prevalence of pulp stones in the mandible. In our study, molar teeth were also found to have more pulp stones compared to premolar teeth. The pulp stones' higher frequency in molars may be attributed to the earlier eruption of molars compared to premolars, which makes them more susceptible to degenerative changes. This result may be attributed to the fact that molar teeth are the largest teeth in the dental arch, generate the strongest masticatory forces, and have better vascularization in their pulps. Consequently, more calcification may be observed in the pulp.

There was no statistically significant difference between the left and right sides in this study. Similar to our study, Colak *et al.* also found no difference between the left and right arches. While Kalaji *et al.* [15], Turkal *et al.* [7] and Indrapriyadharshini *et al.* [1] reported a higher prevalence of pulp stones on the right side, Sisman *et al.* [11] demonstrated that the left side was more affected.

Pulp stones are typically asymptomatic and do not pose a clinical problem. However, they can create challenges during endodontic treatment by obstructing the canals and pulp chamber. The use of appropriate instruments, combined with adequate access and magnification, can minimize potential difficulties during root canal therapy.[8] More successful outcomes can be achieved using a dental operating microscope, dental loupe, nickel-titanium rotary instrument, ultrasonic device, and piezoelectric device [4].

The limitations of our study include the restriction in evaluating factors such as patients' age, gender, and systemic diseases due to the use of open-access data, as well as the difficulty in clearly examining due to distortion observed in panoramic radiographs.

Table 1: Presence of pulp stones according to the teeth.

	Maxillary (Right)				**Maxillary (Left)**			
	First premolar	**Second premolar**	**First molar**	**Second molar**	**First premolar**	**Second premolar**	**First molar**	**Second molar**
Present (n)	4	6	119	62	6	10	111	67
Absent (n)	252	249	132	194	250	243	140	188
Percentage (%)	1.6	2.4	47.4	24.2	2.3	4	44.2	26.3
	Mandibular (Right)				**Mandibular (Left)**			
	First premolar	**Second premolar**	**First molar**	**Second molar**	**First premolar**	**Second premolar**	**First molar**	**Second molar**
Present (n)	14	0	74	47	15	20	77	32
Absent (n)	242	254	173	207	240	234	173	221
Percentage (%)	5.5	0	30	18.5	5.9	7.9	30.8	12.6

Table 2: Distribution of pulp stones presence according to jaw sides.

		Present n (%)	**Absent n (%)**	**p**
Maxillary premolars	Right	10 (2)	501 (98)	0.229
	Left	16 (3.1)	493 (96.9)	
Maxillary Molars	Right	181 (35.7)	326 (64.3)	0.862
	Left	178 (35.2)	328 (64.8)	
Mandibular Premolars	Right	14 (2.7)	496 (97.3)	0.002*
	Left	35 (6.9)	474 (93.1)	
Mandibular Molars	Right	121 (24.2)	380 (75.8)	0.349
	Left	109 (21.7)	394 (78.3)	
Total	Right	326 (16.1)	1703 (83.9)	0.601
	Left	338 (16.7)	1689 (83.3)	

* Statiscally significant

Table 3: Distribution of pulp stone presence according to tooth groups.

	Maxillary		Mandibular		Total	
	Premolar	**Molar**	**Premolar**	**Molar**	**Maxillary**	**Mandibular**
Present n (%)	26 (2.5)	359 (35.4)	49 (4.8)	230 (22.9)	385 (18.9)	279 (13.8)
Absent n (%)	994 (97.5)	654 (64.6)	970 (95.2)	774 (77.1)	1648 (81.1)	1744 (86.2)
Total	1020	1013	1019	1004	2033	2023
p	0.000*		0.000*		0.000*	

* Statiscally significant

Conclusion

Digital panoramic radiographs are an effective imaging tool for diagnosing dental pathologies and are suitable for identifying pulp stone. Further large-scale studies are needed to determine its prevalence in the general population.

Acknowledgements

There was no conflict of interest in the related work.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Indrapriyadharshini J, Sharma AN, Vineeth R, Surenthar M, Mohanapriya S, Srinivasan SV. Prevalence of pulp stones using digital panoramic radiograph: A preliminary retrospective study. SRM Journal of Research in Dental Sciences. 2022;13:163-167.
2. Sreelakshmi, Nagaraj T, Sinha P, Goswami RD, Veerabasaviah BT. A radiographic assessment of the prevalence of idiopathic pulp calcifications in permanent teeth: A retrospective radiographic study. Journal of Indian Academy of Oral Medicine and Radiology. 2014;26:248-252.
3. Qasim AM, Alshanbari AM, Alrashidi MM, *et al*. Pulpal calcification and stone formation: Literature review. EC Dental Science. 2020;19(12):127-133.
4. Lyngdoh D, Alam S, Iftekhar H, Rehman A, Nisar Andrabi SM. The prevalence of pulp stones in a North Indian population: A retrospective panoramic radiograph study. Journal of Oral Research and Review. 2023;15:28-33.
5. Tassoker M, Magat G, Sener S. A comparative study of cone-beam computed tomography and digital panoramic radiography for detecting pulp stones. Imaging Science in Dentistry. 2018;48:201-212. https://doi.org/10.5624/isd.2018.48.3.201.
6. Zhang W, Wang Y, Ye L, Zhou Y. Distribution and influencing factors of pulp stones based on CBCT: A retrospective observational study from southwest China. BMC Oral Health. 2024;24(947):1-9.
7. Turkal M, Tan E, Uzgur R, Hamidi MM, Çolak H, Uzgur Z. Incidence and distribution of pulp stones found in radiographic dental examination of adult Turkish dental patients. Annals of Medical and Health Sciences Research. 2014;3:572-576.
8. Ravanshad S, Khayat S, Freidonpour N. The prevalence of pulp stones in adult patients of Shiraz Dental School: A radiographic assessment. Dental Journal of Shiraz University of Medical Sciences. 2015;16(4):356-361.
9. Silva G, Oliveira L, Pithon M. Automatic segmenting teeth in X-ray images: Trends, a novel database, benchmarking, and future perspectives. Expert Systems with Applications. 2018;107:15-31.
10. Sandeepa NC, Ajmal M, Deepika N. A retrospective panoramic radiographic study on prevalence of pulp stones in South Karnataka population. World Journal of Dentistry. 2016;7(1):14-17.
11. Sisman Y, Aktan AM, Tarım-Ertas E, Ciftci ME, Sekerci AE. The prevalence of pulp stones in a Turkish population: A radiographic survey. Medicina Oral, Patología Oral y Cirugía Bucal. 2012;17(2):212-217.
12. Al-Ghurabi ZH, Najm AA. Prevalence of pulp stone (orthopantomographic-based). Journal of Baghdad College of Dentistry. 2012;24(2):80-84.
13. Colak H, Çelebi AA, Hamidi MM, Bayraktar Y, Colak T, Uzgur R. Assessment of the prevalence of pulp stones in a sample of Turkish central Anatolian population. The Scientific World Journal. 2012;804278:1-7.
14. Karadas M, Hatipoglu O, Akdag MS, Demirbuga S. Evaluation of pulp stones in a subpopulation of northeast Turkey. Journal of Dentistry, Faculty of Atatürk University. 2015;25(1):29-34.
15. Kalaji MN, Habib AA, Alwessabi M. Radiographic assessment of the prevalence of pulp stones in a Yemeni population sample. European Endodontic Journal. 2017;2:1-6.
16. Ravichandran S, Vadivel JK. Prevalence of pulp stones in IOPA radiographs. Journal of Advanced Pharmaceutical Technology and Research. 2022;13:63-66.

How to Cite This Article

Demir H. A radiographic evaluation of the prevalence of pulp stones. International Journal of Applied Dental Sciences. 2024;10(4):235-238.

Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.