



A Cone Beam Computed Tomography Study of the Prevalence of Pulp Stones in a Saudi Arabian Adolescent Population

Santosh R. Patil¹, Kazuyuki Araki², Huwaina Abd Ghani³, Ibrahim A. Al-Zoubi⁴, Mohammed G. Sghaireen⁵, Ravi Kumar Gudipaneni⁶, Mohammad Khursheed Alam⁷

¹Department of Oral Medicine and Radiology, College of Dentistry, Jouf University, Sakaka, Aljouf, Kingdom of Saudi Arabia.

²Division of Radiology, Department of Oral Diagnostic Sciences, Showa University School of Dentistry, Japan.

³Lecturer, School of Dental Science, USM Health Campus, Kelantan, Malaysia

⁴Department of Preventive Dentistry, College of Dentistry, Jouf University, Kingdom of Saudi Arabia.

⁵Department of Prosthodontics, College of Dentistry, Jouf University, Kingdom of Saudi Arabia.

⁶Department of Pedodontics, College of Dentistry, Jouf University, Kingdom of Saudi Arabia.

⁷Department of Orthodontics, College of Dentistry, Jouf University, Kingdom of Saudi Arabia.

Author to whom correspondence should be addressed: Dr. Santosh R. Patil, Department of Oral Medicine and Radiology, College of Dentistry, AlJouf University, Sakaka, Saudi Arabia. E-mail: drpsantosh@gmail.com.

Academic Editors: Alessandro Leite Cavalcanti and Wilton Wilney Nascimento Padilha

Received: 12 January 2018 / Accepted: 01 April 2018 / Published: 05 April 2018

Abstract

Objective: To assess the prevalence of pulp stones using Cone Beam Computed Tomography (CBCT) in a Saudi Arabian adolescent population. **Material and Methods:** CBCT scans of 237 individuals comprising of 1018 teeth were examined. All teeth were analyzed in three dimensions and the presence of pulp stones were identified as a round or oval shaped dense structures in the pulp space. The location of involved tooth in terms of arch, side involved and the status of the tooth were documented. Statistical analysis was carried out by applying Chi-square test. The level of significance was set at 5%. **Results:** Pulp stones were observed in 119 out of the 237 participants, and in 118 teeth out of 1018 teeth examined, with the patient prevalence of 50.2% and tooth prevalence 10.6%. Pulp stones were observed in 76 (51.3%) of males and 43 (48.3%) of females, with no significant difference ($p > 0.05$). A nonsignificant difference was also noted when maxillary and mandibular arches and the left and right sides were compared. Pulp stones were observed more frequently observed in molars and in carious (8.8%) and restored teeth (17.1%). **Conclusion:** The prevalence of pulp stones was high in molars and in carious and restored teeth. No significant difference was noticed between gender, arch and side of tooth involved with pulp stones.

Keywords: Cone-Beam Computed Tomography; Dental Pulp Calcification; Prevalence.

Introduction

Pulp stones are discrete calcified masses located in the dental pulp. They can be noticed in both healthy teeth, diseased, and even unerupted teeth. Pulp stones can be found in both in the primary and permanent teeth [1]. Pulp stones may be observed in the coronal part of the pulp or may be even in the radicular pulp, as free, attached, or embedded calcified bodies in the dentine [2]. The size of the pulp stones may vary from a macroscopic to microscopic dimension. Histologically pulp stones are classified true, which contains irregular dentine and the false, comprising of degenerative pulpal calcifications [3].

The aetiology behind the formation of pulp stones is still not established till date. Numerous predisposing factors, including ageing, long standing caries, restorations abrasions, periodontal disease, trauma and orthodontic treatment have been proposed [4]. Pulp stones may be round or oval in shape and may vary in number; generalized occurrence of pulp stones has also been reported in some systemic or genetic diseases. The frequency of occurrence of pulp stones has been reported to increase with age [5].

Pulp stones may be observed on the radiographs as a definite round or ovoid radiopacities within the coronal or radicular portion of the pulp. They may appear as discrete entities or as multiple dense bodies [6]. The histologically observed incidence of pulp stones was found to be more than that of the radiographically observed incidence [7].

Numerous studies have been carried out to know the prevalence of pulp stone in adult population but limited data is available in literature about the prevalence of pulp stones in adolescent population. Moreover these studies have been carried out using the conventional radiographic methods [8,9], with this background, the present study is carried out to know the prevalence of pulp stones in adolescent Saudi Arabian population and to know any correlation between the occurrences of pulp stones with gender, tooth involved and status of the tooth.

Material and Methods

The present study is carried out in the College of Dentistry, Jouf University, Kingdom of Saudi Arabia after obtaining ethical clearance. CBCT scans of 237 adolescents aging 12-19 years were analyzed. All the CBCT scans were taken for various needs of the patients.

The CBCT unit used in the present study was Scanora 3D (Soredex, Tuusula, Finland) with 6 mA and 89 kVp and the scans were analysed using the accompanying software (NewTom 3G: NNT, QR SRL; Scanora 3D: OnDemand®, Cypermed Inc., Irvine, CA). The teeth were analyzed in all the three dimensions by two qualified and experienced observers. In order to check the intraobserver variations, the same examiners carried out measurements after two weeks.

The pulp stones were recognised as presence of a round or oval dense radiopaque structure in the pulp space (Figures 1 to 3). The location of involved tooth with regards to arch and side, status of involved tooth in terms of intact or non-intact (caries or restored) were documented from the observed CBCT scans.



Figure 1. Sagittal of CBCT showing pulp stones in non-intact teeth.



Figure 2. Coronal section of CBCT showing pulp stones.



Figure 3. Axial section of CBCT showing pulp stones.

Data Analysis

The obtained data were statistically analyzed using SPSS 21.0 (SPSS Inc., Chicago, IL, USA) by applying Chi-square test to compare the prevalence of pulp stones between genders as well as the jaw and side involved. The reliability of measurements was evaluated by Kappa statistics.

Results

The reliability was very good, with Kappa values of 0.94 for intraoperator agreement and of 0.86 for interoperator agreement. In the present study, pulp stones were observed in 119 out of the 237 participants, and in 118 teeth out of 1018 teeth examined, with the patient prevalence of 50.2% and tooth prevalence 10.6%. Pulp stones were observed in 76 (51.3%) of males and 43 (48.3%) of females, with no significant difference between genders (Table 1).

Table 1. Distribution of pulp stones according to gender.

Gender	Patients Examined	Patients with Pulp Stones		p-value
	N	N	%	
Male	148	76	51.3	0.78
Female	89	43	48.3	
Total	237	119	50.2	

Distribution and comparison of pulp stones according to jaw and side is mentioned in Table 2. We did not notice any significant difference when maxillary and mandibular arches and the left and right sides were compared ($p > 0.05$).

Table 2. Distribution and comparison of pulp stones according to arch and side.

Teeth Location	Side	Teeth		
		Examined	with Pulp Stones	%
Maxillary Arch	Left Side	268	27	10.0
	Right Side	234	30	12.7
Mandibular Arch	Left Side	242	33	13.6
	Right Side	274	28	10.2
Total		1018	118	10.6
Maxillary <i>versus</i> Mandibular	Left Side		$p = 0.72$	
	Right Side		$p = 0.91$	

Out of 118 involved teeth, pulp stones were observed more frequently in carious teeth (18.8%) and restored teeth (17.1%) when compared with the intact teeth (4.7%) and this difference was statistically significant (Table 3).

Table 3. Distribution of pulp stones by tooth status.

Tooth Status		Teeth Examined	Teeth with Pulp Stones	p-value
		N	N (%)	
Non-Intact Teeth	Carious	260	49 (18.8)	0.0001
	Restored	239	41 (17.1)	
Intact Teeth		609	28 (4.7)	
Total		1108	118 (10.6)	

Pulp stones were most frequently observed in the first and second molars of maxillary and mandibular teeth with significant difference when compared to premolars (Table 4).

Table 4. Comparison of between presence and absence of pulp stones according to type of tooth and jaw.

Tooth Type	Maxillary Arch			Mandibular Arch		
	Teeth Examined	Teeth with Pulp Stones	%	Teeth Examined	Teeth with Pulp Stones	%
	N	N		N	N	
First Premolar	127	6	4.72	138	8	5.79
Second Premolar	101	8	7.92	113	10	8.84
First Molar	149	25	16.77	145	24	16.55*
Second Molar	125	18	14.40	120	19	15.83*
Total	502	57	13.33	516	61	13.36

*Statistically significant.

Discussion

The prevalence of pulp stones reported to vary depending on the type of examination, either histological or radiological, sample size and the population studied. In the present study pulp stones were observed in 10.6% of adolescents, this observation was slightly less than the prevalence found in the patients of age group between 13-14 years, where a prevalence rate of 19.2% is noticed [9].

A comparatively higher percentage of pulp stones prevalence was observed previously in Turkish population (27.8%) [10], Jordanian (22%) [11], Israeli (20.7%) [12], Malaysian (15.7%) [7] and in Iraqi population (11.2%) [13]. Whereas, a lower prevalence of pulp stones was observed in a Malaysia (6.7%) [14], New Zealand (4%) [15] and in German population (3%) [16].

No significant difference in distribution of pulp stone was noticed between both genders. These findings are similar to those previously described [7,17,18]. However, some authors reported a significant gender difference in the distribution of pulp stones between males and females [11,12].

In the present study, we did not observe any significant difference between maxillary and mandibular jaws and the sides of the involved teeth. These findings were in compliance with the observations of some authors [7,8,11]. However, previous studies have reported difference in occurrence of pulp stones with regards to jaws and sides [17,18].

The presence of pulp stones was comparatively high in carious and restored teeth when compared to the normal teeth. Although these findings are in agreement with other studies [7,8], some researchers did not notice any significant difference between prevalence of pulp stones in intact or non-intact teeth [9,12,13].

The first molars were found with the highest incidence of pulp stones, which was in agreement with the findings from other studies [9,11,17]. The variations in the findings of the present study in comparison with other studies may be due difference in age group of the sample, ethnic variations and geographical differences.

One of the main limitations would be the limited sample size, which included only adolescents, and the sample obtained from only one centre. Detailed configurations of pulp stones were also not analyzed in this study.

Conclusion

In the present study pulp stones were observed in 10.6% of the teeth of Saudi Arabian adolescent population. No significant difference was noticed between gender, arch and side of tooth involved with pulp stones. Pulp stones were found more frequently in molars and in carious and restored teeth.

References

1. Patil SR. Prevalence of and relationship between pulp and renal stones: A radiographic study. *J Oral Biol Craniofac Res* 2015; 5(3):189-92. doi: 10.1016/j.jobcr.2015.06.010.
2. Kaswan S, Patil S, Maheshwari S, Rahman F, Khandelwal S. The relationship between pulp calcifications and salivary gland calcifications. *J Clin Exp Dent* 2014; 6(5):e474-e478. doi: 10.4317/jced.51518.

3. Patil S, Sinha N. Pulp stone, haemodialysis, end-stage renal disease, carotid atherosclerosis. *J Clin Diagn Res* 2013; 7(6):1228-31. doi: 10.7860/JCDR/2013/5087.3042.
4. Berès F, Isaac J, Mouton L, Rouzière S, Berdal A, Simon S, et al. Comparative physicochemical analysis of pulp stone and dentin. *J Endod* 2016; 42(3):432-8. doi: 10.1016/j.joen.2015.11.007.
5. Ertas E T, Veli I, Akin M, Ertas H, Atici M Y. Dental pulp stone formation during orthodontic treatment: A retrospective clinical follow-up study. *Niger J Clin Pract* 2017; 20(1):37-42. doi: 10.4103/1119-3077.164357.
6. Sharma S, Mahajan N, Kotwal N, Gupta R, Kharyal S, Tomar V. Incidence and distribution of pulp stones found in radiographic dental examination of adult Jammu dental patients. *Int J Sci Stud* 2017; 5(7):121-3. doi: 10.17354/ijss/2017/508.
7. Kannan S, Kannepady SK, Muthu K, Jeevan MB, Thapasum A. Radiographic assessment of the prevalence of pulp stones in Malaysians. *J Endod* 2015; 41(3):333-7. doi: 10.1016/j.joen.2014.10.015.
8. da Silva EJNL, Prado MC, Queiroz PM, Nejaim Y, Brasil DM, Groppo FC et al. Assessing pulp stones by cone-beam computed tomography. *Clin Oral Investig* 2017; 21(7):2327-33. doi: 10.1007/s00784-016-2027-5.
9. Baghdady VS, Ghose LJ, Nahoom HY. Prevalence of pulp stones in a teenage Iraqui group. *J Endod* 1988; 14(6):309-11. doi: 10.1016/S0099-2399(88)80032-3.
10. Çolak H, Çelebi AA, Hamidi MM, Bayraktar Y, Çolak T, Uzgur R. Assessment of the prevalence of pulp stones in a sample of Turkish central Anatolian population. *Sci World J* 2012; 2012: 804278. doi: 10.1100/2012/804278.
11. Al-Hadi Hamasha A, Darwazeh A. Prevalence of pulp stones in Jordanian adults. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998; 86(6):730-2.
12. Tamse A, Kaffe I, Littner MM, Shani R. Statistical evaluation of radiologic survey of pulp stones. *J Endod* 1982; 8(10):455-8. doi: 10.1016/S0099-2399(82)80150-7
13. Ravanshad S, Khayat S, Freidonpour N. The prevalence of pulp stones in adult patients of Shiraz Dental School: A radiographic assessment. *J Dent* 2015; 16(4):356-61.
14. Yaacob HB, Hamid JA. Pulpal calcifications in primary teeth: A light microscope study. *J Pedod* 1986; 10(3):254-64.
15. Chandler NP, Pitt Ford TR, Monteith BD. Coronal pulp size in molars: A study of bitewing radiographs. *Int Endod J* 2003; 36(11):757-63. doi: 10.1046/j.1365-2591.2003.00726.x.
16. Hillmann G, Geurtsen W. Light-microscopical investigation of the distribution of extracellular matrix molecules and calcifications in human dental pulps of various ages. *Cell Tissue Res* 1997; 289(1):145-54.
17. Ranjitkar S, Taylor JA, Townsend GC. A radiographic assessment of the prevalence of pulp stones in Australians. *Aust Dent J* 2002; 47(1):36-40. doi: 10.1111/j.1834-7819.2002.tb00301.x.
18. Sisman Y, Aktan AM, TarimErtas E, Ciftci ME, Sekerci AE. The prevalence of pulp stones in a Turkish population. A radiographic survey. *Med Oral Patol Oral Cir Bucal* 2012; 17(2):212-7. doi: 10.4317/medoral.17400.