Prevalence and Analysis of Factors Related to Occurrence of Pulp Stone in Adult Restorative Patients

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Abstract

Background: *Pulp stone, though of an unclear aetiology, is clinically common. It potentially poses procedural difficulty to the endodontist and may also be a marker of an underlying systemic condition.*

Objectives: *The study investigated pulp stone occurrence in adult restorative patients. It also highlighted the relationship between pulp stone and pristine posterior teeth, chronic periodontitis and posterior teeth with abrasion, as well as the effect of age and gender on pulp stone occurrence.*

Method*: Three hundred subjects, aged 18-60 years participated in the cross sectional study. Pristine teeth, teeth with chronic periodontitis and those with abrasion were recruited.*

Result*: Pulp stone was seen more often in the 41-50 years age band, in molars and in teeth with chronic periodontitis but less often in teeth with abrasion. In addition, coronal and free form of pulp stone were more popular.*

Conclusion*: It is recommended that researchers should pay special care in case selections, and during biomechanical coronal instrumentation.*

Key words: Pulp stone; chronic periodontitis; abrasion; age; gender.
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Introduction

Pulp stone (PS) is a calcified mass that may occur in the dental pulp of healthy, diseased or unerupted teeth, [1, 2] which may be 'true' or 'false'. Whilst a 'true' PS may histologicaly look like dentine, a 'false' PS is mainly a localised mass of calcified material.[3] Pulp stones may be located in the coronal or radicular pulp, where they may be free, attached or embedded in the dentine. They may range in size from a macroscopic to microscopic mass, less than 200µm, beyond radiographic resolution.[4]

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Though the aetiology of PS is unclear, a number of predisposing factors, including ageing, caries, operative procedures, as well as periodontal disease have been reported.[1] Others are orthodontic tooth movement, idiopathic and genetic predisposing factors.[1]

The prevalence of PS varies from 8-90%, depending on the study type, design and radiographic technique employed.[4] Histological method of evaluation is reported to yield higher values than radiographic method.[5] The latter method, however, is incapable of resolving stones less than 200µm.[4] In their study, Tamse *et al.* (1982) reported a PS prevalence rate of 20.7 % in

all teeth,[6] while Hamasha *et al.* (1998) found a rate of 51.4% in Jordanian adults.[2]

The exact mechanism of PS formation is ill defined. However, its occurrence may be associated with long standing irritation.[7] The endodontic importance of PS lies in the challenges it presents to the clinician during root canal treatment.

Most authors agree that PS occurs with increasing age.[8] However, authors have fixed views on the effect of gender on PS occurrence, with some reporting no effect,[9] while others report a female predilection.[10] Further more, PS is known to occur in similar frequency in the arches, although some disagree.[2]

The literature on the current subject is scanty. Until now, the effect of abrasion, periodontal disease and pristine teeth on PS occurrence remained uninvestigated. PS poses potential challenges during root canal treatment. The challenges range from hindrance in canal location to negotiation. Also, when combined with relevant patient records, radiographic matching of PS may be a useful tool in forensic dentistry. Furthermore, PS may be a marker of an underlying systemic condition. The purpose of this study was to investigate the occurrence of PS in adult restorative patients and to highlight the relationship between its occurrence and pristine posterior teeth, chronic periodontitis and posterior teeth with abrasion, as well as the effect of age and gender on PS occurrence.

Subjects and Methods

This is a cross sectional study, involving three hundred randomly selected (simple random sampling) subjects with 1154 teeth and aged 18 to 60 years participated in the study. Informed verbal consent and ethical clearance was obtained from the relevant authority. The subjects attended a Specialist Private Restorative Clinic over an 18 months period (December 1, 2008-May 31, 2010).

Subjects who possessed periapical radiographs of pristine posterior mandibular teeth and those with abrasion were recruited in the study. Others were posterior mandibular teeth with chronic periodontitis (grades 1 and 2 mobility). Participants below 18 years of age and those with poor quality periapical radiograph were excluded from the study. Carious teeth, teeth with abrasion that communicated with pulp, subjects with a history of orthodontic treatment and those without radiographs were also excluded.

The subjects were clinically examined with mouth mirror, dental probe and periodontal probe. On the data sheet were recorded pristine posterior teeth, posterior teeth with abrasion and those with chronic periodontitis (grades 1 and 2).

Also, recorded were age and gender of subjects. PS was scored when a pulp stone-like radiopaque mass was identified on the radiograph using a magnifying glass, either in the coronal or radicular pulp. However, stones smaller than 200µm in size would have been missed, since they cannot be resolved by conventional radiographic method. Others were whether the PS was free or attached.

A grade 1 mobility was scored when a tooth moved from 0.2-1mm buccolingually on a gentle buccal push, while a left lingual finger watched. Similarly, grade 2 mobility scored movements over 1mm buccolingually.

Two senior consultants independently reviewed the radiographs with magnifying glass, focus of

attention being on PS and its characteristics (location and form). At the end, the reviewers agreed 90% of times, while the 10% disparity was later resolved after a joint session by the two reviewers.

The data was analysed with SPSS version 12 and the result tested with Chi-Square. Statistical significance was set at the 5% probability.

Results

The mean age of the study population was 32.3±10.2 (Male: 32.2±10.3: Female, 32.4±10.1). Out of the 300 subjects, 63(21.0%) had PS, and from the 1154 teeth examined, 114 (9.9%) had PS.

PS occurred more often in the 41-50 years age group (57.6%), whereas it was rare in the 18-30 year age band ($P < 0.0001$). The relationship between gender and PS occurrence was not statistically significant ($P = 0.872$) (Table 1).

PS occurrence increased progressively from first premolar to second molar, with the highest prevalence in the latter tooth type (13.4%) ($P = 0.020$) (Table 2).

PS occurred more often in teeth with either grade 1 or grade 2 mobility (37.0%), followed by pristine teeth (4.6%) and teeth with abrasion (4.6%) ($P < 0.0001$) (Table 3).

PS was more often coronally located (9.3%) than radicular (6.0%) ($P = 0.002$), while the free form, (10.0%) occurred more often than the attached form (5.3%) ($P = 0.006$) (Table 4).

Table 1: **Pulp Stone by Age and Gender**

		No of patients	No with PS (%)	*P* - value
Age (years)	18-30	142	0 (0.0)	$P < 0.0001$
	31-40	88	19 (21.6)	
	41-50	59	34 (57.6)	
	51-60	11	10 (90.9)	
Gender	Male	130	28 (21.5)	$P = 0.872$
	Female	170	35 (20.6)	

Table 2: **PS by Tooth Type**

Tooth type	**No of Teeth**	**No with PS** (%)	***P*-value**
First Premolar	295	19 (6.4)	$P = 0.020$
Second Premolar	292	25 (8.6)	
First molar	285	32 (11.2)	
Second molar	282	38 (13.4	

Table 3: **PS by Dental Status**

Dental status	**No. of Patients**	**No with PS** (%)	***P* – Value**
Periodontitis	63	11 (37.0)	$P < 0.0001$
Abrasion	64	12 (4.0)	
Pristine tooth	173	8 (4.6)	

Table 4: **PS By Location and Form**

	PS (%)	***P*-value**
Location		
Coronal	28 (9.3)	$P = 0.002$
Radicular	18 (6.0)	
Form		
Free	30 (10.0)	$P = 0.006$
Attached	16(5.3)	

Discussion

Of the two usually employed methods, namely histological and radiographic methods of detecting PS, the latter method was employed in the current study, despite the reported edge of accuracy of histological method over radiographic method.[11] However, histological method has limited applicability in clinical settings.

Furthermore, the reported prevalence rate in the current study may be lower than the true figure. This may be accounted by missed PS whose size was less than 200µm in diameter, beyond radiographic resolution power.[4] Also, because this method stretched the researcher's skill and power of observation, the study was prone to observational error.

Also, PS prevalence in the current study may have been lower than the reported figure, because the very olds were missed in the study. Ranjitkar *et al.* (*2002)* reported that PS is an age related disease.[5] Unlike histological method, radiographic method enjoys the strength of being both a non invasive and a clinically friendly method of studying PS, as well as being a time saving instrument.

As earlier mentioned, PS prevalence and distribution vary across studies, possibly due to variations in study design, sampling procedures and type of radiograph and techniques employed. The PS prevalence in the current study is similar to those of Tamse *et al.* (1982)[6] and Hamsha *et al.* (1998), [2] but not with those of Baghdad *et al.* (1988)[1] and Ranjitkar *et al.(*2002).[5] The variation may be due to age and possibly other relevant factors. The subjects in

the current study were in the 18-60years age band, while Ranjitkar *et al.* (2002),[5] employed subjects in the 17-35 years age band.

The current finding of association between advancing age and increasing rate of PS occurrence agrees with earlier reports,[3,6] but not with that of Hamasha *et al.* (1998).[2] The increased secondary and tertiary dentine depositions, seen with advancing age, may account for this. Also, it may be a reflection of pulp's ageing process, which results in reduction in the number of fibroblasts, odontoblasts and mesenchymal cells, which have been reported to reduce by 50% from 20-70years, [12] or presence of pulp fibrous atrophy.[13] In addition, fat deposition in the pulp may occur with age. It is reported that calcification commonly takes place within these deposits.[14]

The effect of gender is conflicting. While the effect is not proven in the current report, Tamse *et al.* (1982), [6] and Stafne *et al.*(1933)[10] had an opposite report.

The report of most authors supports the present one that found a predilection of PS in premolars and molars in ascending order. The reason for this is unclear, but Ranjitkar *et al.* (2002)[5] alluded that molars, being the largest in the arch, may have a better blood supply to the pulp tissues, which may not be conducive for precipitation of more calcifications forming factors.

The reason for the proven statistically significant relationship between PS and periodontitis on one hand and PS and abrasion on the other in the current study is unclear. However, the relationship may not be unconnected with increased irritation which pulp tissues of teeth with abrasion and those teeth with chronic periodontitis are prone to.[7]

The report of preponderance of coronal and free forms of PS in the current study agrees with other reports.[15] Of the 3 forms of PS, namely free, attached and embedded, the free form is the commonest.[8] While the free PS are usually located in the coronal pulp, attached and embedded forms are commonest in the radicular portion.[16] Philippas *et al.*(1961) [17] are of the view that embedded PS are formed in the pulp, but with ongoing physiological dentine formation, they become enclosed fully within the canal walls, while attached ones are never fully embedded. On the other hand, free PS is found within the pulp tissues proper and may completely occlude the pulp chamber.[8] The clinical significance of pulp stones lies in their potential to interfere with root canal treatment, if they are of significant size or, if sited at root curve or if they are dislodged.[16] Though a cross sectional study, the report was limited by difficulties encountered in comparing the result with earlier ones. This may be due to variations in study designs, sampling procedures, radiographic types and techniques across studies. Further limitation of the current report includes failure to score for both PS size and number.

PS occurred most often in the 41-50 years age band, in advancing age and progressively in posterior teeth. Also, its relationship with periodontitis, abrasion and pristine teeth was statistically significant, but its association with gender was not proven. Free and coronal PS were most common forms in the study. It is recommended that to have comparable results across studies, researchers should adopt a

standardised study design, sampling protocols and radiographic techniques.

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