Prevalence of pulp stone (Orthopantomographic-based)

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ABSTRACT
Background: Pulp stones (denticles) are discrete calcified aggregates that occur most frequently in the dental pulp. It was found in healthy, diseased and sometimes in erupted teeth. Its number appears to increase with increasing age. It is usually detected during radiographic examination as radiopaque masses of variable size and shape. The aims of this study were to calculate the prevalence of pulp stones in young Iraqi adults by using digital orthopantomograph, and to report any associations between occurrence of pulp stones with, gender, tooth type, and dental arch.

Subject, Material and Method: A total of 390 digital panoramic radiographs were collected from oral diagnosis department /College of Dentistry for Iraqi sample, University of Baghdad and Al-Karkh General Hospital. The sample composed of 169 male and 221 female with mean age (26.9 years). About 10510 teeth were evaluated; pulp stones scored as present or absent, number of stone and associations with, gender, tooth type and dental arch were recorded.

Result: From 390 (OPG) total of 3758 teeth were examined, 136 patients have pulp stone present in (276) teeth. According to gender, 75 female with 143 teeth (51.8%) and 61 male with 133 teeth (48.1), that is mean there was no significant difference of (pulp stone occurrence) found between female and male. Their presence were seldom found in the premolars 18 teeth (7%) but was much higher in the molars 258 teeth (93%) and the difference is statistically significant. Pulp stone occurrence was significantly more common in the first molars than in the second molars and in the first premolars than in the second premolars in each dental arch. No difference between the two arches could be identified.

Conclusion: Pulp stones are not only incidental radiographic findings of the pulp tissue but may also be an indicator of some serious underlying disease. On the other hand, they may provide useful information to predict about the susceptibility of patients for other dystrophic soft tissue calcifications such as urinary calculi and calcified atheromas.

Key words: OPG radiograph, pulp stone, denticles, prevalence.

INTRODUCTION
Pulp stones are calcified bodies in the dental pulps of the teeth in the primary and permanent dentition. They can be seen in the pulps of healthy, diseased, and even unrequited teeth (1). Their locations are more common in the coronal than in the ridicular portions of the pulp and they can be observed as free, attached, and embedded in the dentinal surface of the Pulp chamber.

Pulp stones are classified according to their structure as true, false, and diffuse. They range in size from small microscopic particles to large masses that almost obliterate the pulp chamber (6)

Although the exact cause of pulp calcification is unknown some factors have been implicated in stone formation such as genetic predisposition (3), orthodontic tooth movement, dentine dysplasia, dentinogenesis imperfect and in certain syndromes such as Vandrwoude syndrome (4), circulatory disturbance in pulp, age (5), interactions between the epithelium and pulp tissue, idiopathic factors (6), and long-standing irritants like caries, deep restorations, and chronic inflammation (7).

Studies related to the prevalence of pulp stones, based on radiographic examinations, have been reported with various percentages (ranging from 8% to 95%) (1, 8, 9).

With age the pulp spaces of teeth decrease in size through the deposition of secondary and tertiary dentine. When tooth wear, caries or operative intervention is a feature this process becomes more evident. In most pulps, dystrophic calcification is found to be of a variable degree, and even in teeth without caries or restorations scattered calcification occurs, unrelated to disease (10).

Pulp stones can be structurally classified and based on location (10,11). Structurally, there are true and false pulp stones; the distinction being morphological. A third type, ‘diffuse’ or ‘amorphous’ pulp stones, is more irregular in shape than false pulp stones, occurring in close association with blood vessels (10, 12). True pulp stones are made of dentine and lined by odontoblasts, whereas false pulp stones are formed from degenerating cells of the pulp that mineralize (4). Such mineralization occurs in stages; initially cell nests become enclosed by concentrically arranged fibers (i.e. an organic phase precedes mineralization) which then become impregnated with mineral salts. Calcified increments are then added (1,2). Based on location, pulp stones can be embedded, adherent and free. Embedded stones are formed in the pulp but with
ongoing physiological dentine formation they become enclosed (sometimes fully) within the canal walls \(^{10,13}\). They are found most frequently in the apical portion of the root and the presence of odontoblasts and calcified tissue resembling dentine can occur on the peripheral aspect of these stones \(^2\). Adherent pulp stones are simply less attached to dentine than embedded pulp stones; the difference between adherent and embedded can be subjective, but adherent stones are never fully enclosed by dentine. Adherent and embedded pulp stones can interfere with root canal treatment if they cause significant occlusion of canals or are located at a curve \(^{10}\). They may also become dislodged. Free pulp stones are present within the pulp tissue proper and most commonly seen type on radiographs \(^{10,14}\).

The aim of this radiographic-based study was to determine the prevalence of pulp stones, and to evaluate possible associations between pulp stones and gender, tooth type, and side, and to compare the results with published data presenting a new perspective in forensic medicine.

**SUBJECTS AND METHODS**

A total of 390 digital panoramic radiographs (OPG) were collected from oral diagnosis department /College of Dentistry, University of Baghdad and Al-Karkh General Hospital. Digital panoramic radiographs were taken by using DIMAX3 digital x-ray unit system machine (Finland). The sample composed of 169 male and 221 female with mean age (26.9) years. Information about name, age and gender had been recorded for each patient. The digital panoramic radiographs were examined by two oral and maxillofacial radiologists at the same time after put the radiograph on a viewer; Only Images of good quality which had the clearest reproduction of teeth without any superimposition were included. About 10510 teeth were evaluated; teeth with crowns or bridges that prevented adequate vision of the pulp chamber were not included in the study sample. Considering that teeth with deep fillings and caries lesions are more inclined to have pulp stones, only teeth which were non-carious and undestroyed, or those with shallow fillings, were included. Definite radiopaque bodies observed inside the pulp chambers of the teeth were identified as pulp stones (Fig. 1,2) and were scored as present or absent, number of stone and associations with, gender, dental arch and tooth type were recorded. No attempt was made to determine the details of the pulp stones, such as their size, type and location in the pulp chamber and the condition of the associated tooth. To ensure of the accuracy of the diagnosis, only the teeth that were confirmed by our two examiners to have pulp stones were scored as present.

**RESULTS**

A total of 390 patients (221 females and 169 males) participated in the present study. The age range of the subjects was 15 - 50 years, pulp stone were observed in 136 patients with 276 teeth; 75 female with 143 teeth and 61 male with 133 teeth, as shown in table 1.

According to the gender the occurrence of pulp stone in female was slightly higher than in male, so the pulp stone in female upper 1st molar was found in 40 teeth (14.9%),while in male 35 teeth (12.7%). In female the upper 2nd molar was found in 37 teeth (13.4%), while in male was 25 teeth (9%). The pulp stone in female upper 1st premolar was found in 3 teeth (1.2%), in male was found in 2 teeth (1.3%), in 2nd upper premolar for female was found in 1 tooth (0.3%), while for male was found in 2 teeth (0.7%).

For mandible the 1st molar in female was found in 78 teeth( 28.2%), while in male was found in 43 teeth (15.5%), lower 1st premolar in female was found in 2 teeth (1.3%), in male was found in 3 teeth (1.2%), for lower 2nd premolar in female was found in 3 teeth (1.2%), while in male was found in 1 tooth (0.3%). Total number of teeth with pulp stone in female was 143 teeth (51.8%) and in male was found in 133 teeth (48.1), as shown in table 1.

According the arch also the difference between upper and lower arch was very small so the total number of 1st molar in maxilla was75 teeth (27.1%), while in mandible was 78 teeth (28.2%), and 2nd molar in maxilla was 62 teeth (22.4%), while in mandible was 43 teeth (15.5%). The total number of 1st premolar in maxilla was 7 teeth (2.6%), while in mandible was 5 teeth (1.5%), and 2nd premolar in maxilla was 3 teeth (1%), while in mandible was 4 teeth (1.4%), the total number in the maxilla was 146 teeth (52.8), while in the mandible was 130 teeth (47.1) so the difference between maxilla and mandible was no significant, as shown in table 1. P=0.2.

According tooth type the statistic study show that, Pulp stones were found in only 18 (6.8 %) of the premolars and in 258 (93.2 %) of the molars examined, with differences in occurrence being statistically significant (p<0.01).The frequency of pulp stones was higher in the first molars than in the second Molars and in first premolars than in second premolars in each dental arch.
DISCUSSION
Calcification in the dental pulp can lead to denticles, commonly known as pulp stones. They are hard, bone-like structures that form within the pulp of tooth, either within the crown or within the root canals. They are usually detected on X-ray examination, present as a radiopaque entity in either the pulp chamber and/or root canal space. They may be either singular or multiple and can be detected easily unless they are too small or not dense enough to show up on an x-ray. Pulp stones are incidental findings and do not need treatment and in the literature the incidence of pulp stones has been investigated in many histological and radiological studies based on periapical or bitewing radiographs but there is no study evaluate the prevalence of pulp stone using the digital panoramic radiograph (OPG). When the literature related to pulp stones was reviewed, there were a limited number of studies regarding the incidence of pulp stones. Moreover, the reported rates of prevalence also differed in the studies. Some researchers reported prevalence based on the number of patients and teeth (1), whereas the others represented only the rates based on teeth numbers (2,9,15,16).
In the present study, we presented rates based both on the number of patients and teeth. On the basis of the number of patients we found the rate of prevalence to be 34.8%, which is within the reported range in the literature (1, 9, 17, 18, 19). On the basis of numbers of teeth examined, we found 276 teeth with pulp stones and the percentage is 7.3%, and this is within the range reported by other researchers in previous studies. Baghdady et al. in 1988 found (14.8%) out of the 6,228 teeth examined in a teenage group of 515 subjects. In another study conducted by Al-Hadi and Darwazeh in 1998, the prevalence of pulp stones was found to be 22.4% in 1,028 of 4,573 teeth examined. Ranjitker et al. found the prevalence to be 10.1% in 333 out the 3,296 teeth examined (17). Another report related to the prevalence of pulp stones showed pulp stone incidence to be 4.8% in 747 out of the 15,326 teeth examined (9). In the present study, we found that the prevalence of pulp stones was 15% in 1,038 of 6,926 teeth examined. Sisman et al. reported 15% as pulp stone prevalence in molars and premolars teeth of Turkish population. According to gender, from 136 patients with pulp stones, 75 were females (with 143 teeth have pulp stones) and 61 were males (with 133 teeth have pulp stones), so the female was more than males but there are no significant differences between the genders in each tooth type and arch. The prevalence of pulp stones noted in females and males in this study agrees with previous studies that it is greater in females (1,7,8,16,18).
In the present study, the occurrence of pulp stones was more frequently found in the maxilla than in the mandible in each tooth type and location (right-left). In the maxillary arch there are (146) teeth with pulp stones while in mandibular arch there are (130) teeth, so the occurrence is higher in maxilla but the difference is not significant statically. These results are in agreement with previous studies (1,17).
In the present study pulp stones were significantly more common in first molars than in second molars, premolars and incisors in both maxillary and mandibular arches. Also the first premolar is more than second premolar in both arches. This results are in agreement with other studies (1,16-18).
A probable explanation of this result may be related to the fact that the molars are the largest teeth in the arch, provide a better supply of blood to the pulp tissue and have the strongest chewing force in the arch. This may lead to greater precipitation for calcification (1). Also the early eruption of the first molar will expose them for long period of time to more degenerative changes, thus confirming that calcification of the pulp increases with age.

REFERENCES

Table 1: Distribution of pulp stone according to arch for both genders

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxilla</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1st molar</td>
<td>35</td>
<td>40</td>
<td>75 (27.1%)</td>
</tr>
<tr>
<td>2nd molar</td>
<td>25</td>
<td>37</td>
<td>62 (22.4%)</td>
</tr>
<tr>
<td>1st premolar</td>
<td>4</td>
<td>3</td>
<td>7 (2.6%)</td>
</tr>
<tr>
<td>2nd premolar</td>
<td>2</td>
<td>0.7%</td>
<td>3 (1%)</td>
</tr>
<tr>
<td>total</td>
<td>66</td>
<td>81</td>
<td>146 (53.3%)</td>
</tr>
<tr>
<td>Mandible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st molar</td>
<td>38</td>
<td>40</td>
<td>78 (28.2%)</td>
</tr>
<tr>
<td>2nd molar</td>
<td>25</td>
<td>18</td>
<td>43 (15.5%)</td>
</tr>
<tr>
<td>1st premolar</td>
<td>3</td>
<td>3</td>
<td>6 (2.4%)</td>
</tr>
<tr>
<td>2nd premolar</td>
<td>1</td>
<td>0.35%</td>
<td>2 (0.7%)</td>
</tr>
<tr>
<td>total</td>
<td>67</td>
<td>62</td>
<td>130 (47.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>133</td>
<td>142</td>
<td>100%</td>
</tr>
</tbody>
</table>

P < 0.2

Figure 1: Digital Panoramic Radiograph showing pulp stone.

Figure 2: A: pulp stones in the pulp chamber of maxillary and mandibular second molars. B: pulp stones in the pulp chamber of maxillary first and second molars. 35% (276 teeth of 136 subjects) with pulp stone
Figure 3: This figure shows the percentage of teeth involved with pulp stone.

55% 1st molar (Red)
38% 2nd molar (Green)
5% 1st premolar (Blue)
2% 2nd premolar (violet)

No significant difference between maxilla and mandible

Figure 4: Pulp stone distribution according to tooth type for both arcs