

# Radiographic evaluation of the prevalence of enamel pearls in a sample adult dental population

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**Abstract.** – **AIM:** Enamel pearls are a tooth anomaly that can act as contributing factors in the development of periodontal disease. Studies that have addressed the prevalence of enamel pearls in populations were scarce. The purpose of this study was to evaluate the prevalence of enamel pearls in the permanent dentition of Turkish dental patients by means of panoramic radiographs.

**PATIENTS AND METHODS:** Panoramic radiographs of 6912 patients were examined for the presence of enamel pearls. All data (age, sex and systemic disease or syndrome) were obtained from the patient files and analyzed for enamel pearls. Descriptive characteristics of sexes, jaws, and dental localization were recorded. The Pearson chi-squared test was used.

**RESULTS:** Enamel pearls were detected in 5.1% of subjects and 0.85% of the teeth examined. Prevalence of enamel pearls was higher in males (6.58%) compared to females (3.96%). The mandibular first was the most commonly affected tooth. Enamel pearls were significantly more common in the mandibula compared with the maxilla (81.2% cf 18.8% respectively,  $p = 0.000$ ). No statistically significant differences were found between the right-side and left-side occurrences.

**CONCLUSIONS:** With the prevalence of 5.1% among the Turkish population, every possible effort should be made for locating of this anomaly especially in molars because it might be useful for prevention periodontal problems.

*Key Words:*

Enamel pearls, Prevalence, Panoramic radiography.

## Introduction

Enamel, which is normally restricted to the anatomic crowns of human permanent teeth, may be found ectopically on the root, either as enamel pearls<sup>1</sup> or as cervical enamel projections<sup>2</sup>. Enamel pearls are also known as enamloomas, enamel droplets, enamel globules, enamel nodules, enamel knots, and exostoses<sup>3,4</sup>.

One theory of the enamel pearl etiology is that enamel pearls develop as a result of a localized developmental activity of a remnant of Hertwig's epithelial root sheath which has remained adherent to the root surface during root development<sup>5</sup>. It is believed that cells differentiate into functioning ameloblasts and produce enamel deposits on the root. The conditions needed for local differentiation and functioning of ameloblasts in this ectopic position are not fully understood<sup>6,7</sup>.

The most common site for enamel pearls is at the cemento-enamel junction of multirooted teeth<sup>5</sup>. They are most commonly mesial or distal on maxillary teeth and buccal or lingual on mandibular teeth<sup>4</sup>. Enamel pearls most often occur singly and can be composed exclusively of enamel. They vary in size from microscopic to a few millimeters<sup>3</sup>. Histologically, enamel pearls are classified as true enamel pearls (formed entirely of enamel), composite enamel pearls or enamel-dentin pearls (formed by enamel and dentin), and enamel-dentin-pulp pearls (formed by enamel, dentin, and pulpal tissue)<sup>3,4</sup>. Radiologically, they are depicted as dense, smooth radio-opacities overlying any portion of the crown or root of an otherwise unaffected tooth<sup>8</sup>. The major radiologic differential diagnosis is projection geometry causing overlap of root contours in multirooted teeth. In the primary dentition, radiographic interpretation and detection of the enamel pearl can be complicated by the superimposition of the developing permanent tooth<sup>8</sup>.

Studies that have addressed the prevalence of enamel pearls in populations were scarce. A review of the literature showed that over the last two decades, increasing case reports have been made of the occurrence of the condition. The reported prevalence is ranging from 1.1% to 9.7%<sup>2,6,8,9</sup>. Because of the insufficient epidemiologic data, there is little information about the true prevalence of this malformation. Additional-

ly, there was also scarce prevalence result with respect to enamel pearls in Turkish dental patients. The aim of this study was to determine the prevalence of enamel pearls in a Turkish dental patient population with respect to sexes, jaws, and dental localization, to determine the relation between sex and this anomaly.

### Methods

Panoramic radiographs from 8567 patients (4324 women and 4243 man, age range from 15 to 50 years) attending Kırıkkale University Dental Faculty Hospital during the period from July 2009 to August 2011 were reviewed for the presence of enamel pearls. Radiographic interpretation was undertaken by two examiners. Exclusion criteria included patients who were less than 15 years of age, records with poor quality radiographs and record with radiographs of only primary teeth. In addition, carious or restored teeth, when present, were not included in the study. The final sample included 6912 patients (3,860 women and 3052 men, mean age; 29.04 years from 15 to 45 years). Because of the limitations of panoramic radiographs showing anterior teeth only posterior teeth included.

Radiologically as a well-defined radioopacity comparable in radiodensity to the enamel crown, either superficially attached to the root surface or within the dentin of the tooth was considered as enamel pearl<sup>8</sup>.

After the enamel pearl positive radiographs were identified, the demographics, clinical characteristics, and radiographic features were assessed. The parameters of age, gender, location, were assessed for all enamel pearl positive radiographs.

To minimize variability in the present study, examinations were carried out jointly by the first and second authors of the article (2 academic from the Department of Restorative Dentistry) over approximately 4 months.

### Statistical Analysis

Statistical analysis of the data was using the Statistical Package for the Social Sciences (SPSS 15.0). Chi-square test was also used to compare the prevalence of enamel pearls between male and female subjects and upper and lower jaws  $p < 0.05$  was considered statistically significant.

### Results

6912 patients, 3860 women and 3052 men between the Ages of 15 and 50 years (average, 29.04  $\pm$  8.68 years) were considered in this study; 97362 posterior teeth (including third molars) were evaluated. Maxillary posterior comprised 48437 teeth and mandibular posterior 47803 teeth (Table I). 354 patients were found to have an enamel pearl (153 women and 201 men ( $p = 0.000$ )). Enamel pearls were not detected in premolars. The overall prevalence of patients with enamel pearls was 5.1% (3.96% for females and 6.58% for males) (Table II). The distribution of enamel pearls among different teeth in the upper and lower arches is shown in Table I. Enamel pearls were significantly more common in the mandibula compared with the maxilla (81.2% cf 18.8% respectively,  $p = 0.000$ ). The prevalence of enamel pearls from all molar teeth examined was 0.85%. The mandibular first molar (45.2%) was the most common tooth involved followed by the mandibular second mo-

**Table I.** Frequency of the prevalence of pulp stones amongst different tooth types

|                   | Tooth           | Number of teeth examined | Number of teeth with pulp stones | Percentage of pulp stones |
|-------------------|-----------------|--------------------------|----------------------------------|---------------------------|
| <b>Maxilla</b>    | First premolar  | 12124                    | 0                                | 0                         |
|                   | Second premolar | 12158                    | 0                                | 0                         |
|                   | First molar     | 12023                    | 32                               | 0.27                      |
|                   | Second molar    | 12132                    | 44                               | 0.36                      |
|                   | <b>Total</b>    | <b>48437</b>             | <b>76</b>                        | <b>0.15</b>               |
| <b>Mandibular</b> | First premolar  | 12267                    | 0                                | 0                         |
|                   | Second premolar | 12311                    | 0                                | 0                         |
|                   | First molar     | 11642                    | 183                              | 1.57                      |
|                   | Second molar    | 11583                    | 146                              | 1.26                      |
|                   | <b>Total</b>    | <b>47803</b>             | <b>329</b>                       | <b>0.68</b>               |
| <b>Total</b>      |                 | <b>96240</b>             | <b>405</b>                       | <b>0.42</b>               |

**Table II.** The distribution of enamel pearls according to sex and statistical comparison.

|        | Number of Patients | Enamel pearls | $\chi^2^*$ | <i>p</i> value** |
|--------|--------------------|---------------|------------|------------------|
| Female | 3860               | 153 (3.96%)   | 24.116 a   | 0.000            |
| Male   | 3052               | 201 (6.58%)   |            |                  |

\*Pearson chi-squared test. \*\*The level of significance (*p* < 0.05 was considered statistically significant).

lars (36.1%). The distributions and the prevalence are given in detail in Table II. There was no statistical significant difference in the prevalence of three-rooted enamel pearls between the right-side and left-side occurrences (*p* = 0.561) (Table III). The Figure 1 shows examples of enamel pearls belonging different tooth types on formed panoramic radiography.

### Discussion

The data of the present work were collected from Turkish who attended Restorative Dentistry Department of Kırıkkale University Dental School (KUDS). Caution was taken in extrapolating the results of the present survey to larger population. This study investigated enamel pearls in adults; no attempt was made to include examination for permanent teeth in children's. The results reflect the prevalence of enamel pearls only in patients who attended dental clinics at KUDS. However, there is no reason to believe that this group of patients is different from other Turkish adults.

There are many cases reported in the literature on enamel pearls and their presence with other anomalies. Extensive prevalence studies have not been performed so far. There is wide variance in the prevalence estimates between studies. It is likely that the reason for this variance is differences in how the data were collected, that is,

methodological issues. Some investigations presented the prevalence based on person and teeth numbers, and the others reported only the prevalence based on teeth number. The person prevalence of enamel pearl in the present study was 5.1%. These results are comparable with what was reported in Jordanian<sup>8</sup> (4.5%) and Turkish population<sup>9</sup> (4.69%), but lower than what was reported for Eskimos<sup>10</sup> (7.7%).

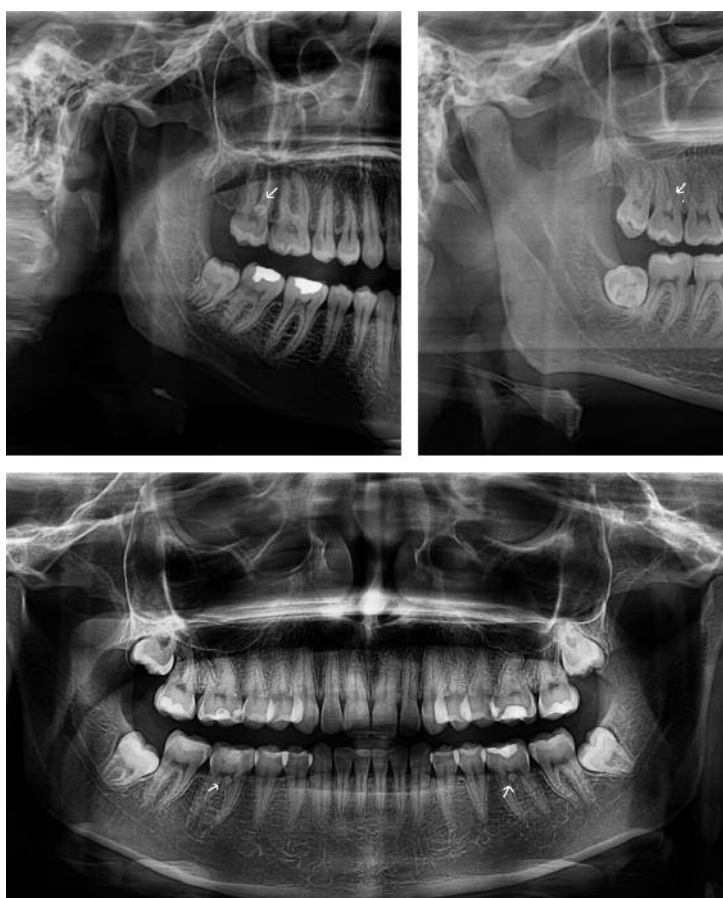
Also, the prevalence of enamel pearls in molar teeth varies according to the study population, tooth groups and upper and lower jaw. The results of the present study on a group of Turkish dental patients has shown an overall prevalence of 0.85% (405 of the 47380 molar teeth) for all molar teeth examined teeth. Risnes<sup>1,2</sup> studied 8,854 extracted molars and reported that 2.28% had enamel pearls. A study by Chrcanovic et al<sup>6</sup> generated the largest sample size (45,785 teeth) and found total prevalence of enamel pearls was 0.82%. In the same study, within the molar teeth, they found a higher prevalence of enamel pearls (1.71%). Both of these reports are consistent with our findings.

The gender-specific distribution of enamel pearls in this study showed that the prevalence was much higher among males (6.58%) than females (3.96%). However, other papers reported that no significant difference according to gender<sup>8,9</sup>.

In this study, there was no significant difference observed according to the side occurrence (right

**Table III.** The distribution of enamel pearl according to dental arches, sex and location.

|                  | Female     |              |           |              |            |              | Male      |              |            |              |            |              | Total      |               |
|------------------|------------|--------------|-----------|--------------|------------|--------------|-----------|--------------|------------|--------------|------------|--------------|------------|---------------|
|                  | Right      | %            | Left      | %            | Total      | %            | Right     | %            | Left       | %            | Total      | %            | Total      | %             |
| <b>Maxilla</b>   |            |              |           |              |            |              |           |              |            |              |            |              |            |               |
| First molar      | 12         | 2.96         | 9         | 2.22         | 21         | 5.19         | 3         | 0.74         | 8          | 1.98         | 11         | 2.72         | 32         | 7.90          |
| Second molar     | 11         | 2.72         | 15        | 3.70         | 26         | 6.42         | 7         | 1.73         | 11         | 2.72         | 18         | 4.44         | 44         | 10.86         |
| <b>Mandibula</b> |            |              |           |              |            |              |           |              |            |              |            |              |            |               |
| First molar      | 51         | 12.59        | 28        | 6.91         | 79         | 19.51        | 54        | 13.33        | 50         | 12.35        | 104        | 25.68        | 183        | 45.19         |
| Second molar     | 35         | 8.64         | 30        | 7.41         | 65         | 16.05        | 25        | 6.17         | 56         | 13.83        | 81         | 20.00        | 146        | 36.05         |
| <b>Total</b>     | <b>109</b> | <b>26.91</b> | <b>82</b> | <b>20.25</b> | <b>191</b> | <b>47.16</b> | <b>89</b> | <b>21.98</b> | <b>125</b> | <b>30.86</b> | <b>214</b> | <b>52.84</b> | <b>405</b> | <b>100.00</b> |



**Figure 1.** Examples of enamel pearls belonging different tooth types on formed panoramic radiography.

versus left side,  $p > .05$ ). On the other hand, previously other researches<sup>8,9</sup> not highlighted to enamel pearls right or left side occurrence.

According to our findings, there was not a significant difference between left and right occurrence ( $p > 0.05$ ). However, right or left side occurrence was not highlighted in previous publications<sup>6,8,9</sup>.

Our finding of a higher prevalence of enamel pearls in the mandibular molar, especially the first molar teeth, is consistent with that of Darwazeh and Hamasha<sup>8</sup>. In contrast, Akgül et al<sup>9</sup>, Risnes<sup>1</sup> and Moskowsky and Canut<sup>3</sup> found enamel pearls to be more frequent on roots of maxillary molars rather than mandibular molars. This might be explained by that the sample used in this study might be different than that of other nations. This difference might also be due to the fact that our study is radiographic survey of radiographs from dental records.

Although several reports have been carried out to explore the prevalence of enamel pearls, they have differed in methodology. Some have used periapical radiographs<sup>8</sup> whilst others used cone-beam computed tomography<sup>9</sup>. Moreover, some previous

works have used extracted teeth<sup>1,6,11</sup> to identify enamel pearls. It is, therefore, impossible to make interstudy comparisons relating to gender and bilateral occurrence differences for such enamel pearls from extracted teeth, unless detailed recordings were performed before tooth extraction, as in the cases of some previous articles. In the present report, non-invasive and inexpensive panoramic radiographs were used. The advantages of extra-oral techniques are related to its simple operation and handling. Moreover, within one large film, panoramic X-rays reveal all of your upper and lower teeth and parts of your jaw. Clinical oral examination with periodontal probing and a review of a patient's personal dental records combined with either two- or three-dimensional radiographic techniques like microcomputed tomography may be more accurate means for the investigation of such a tooth anomaly as regards to the relative prevalence among different ethnic groups.

Although bacterial plaque is a primary cause of the initiation and progression of periodontal disease, anatomic factors (such as ectopic enamel) are often associated with advanced localized periodon-

tal destruction<sup>5,12</sup>. Connective tissue cannot form an attachment to enamel<sup>13</sup>. Instead, the junctional epithelium is present in these areas and consists of hemidesmosomes and basal lamina. As a result, when enamel forms on roots, it may predispose the area to increased probing depths in the presence of gingival inflammation<sup>14</sup>. Early detection of enamel pearls allows for timely intervention. Failure to achieve timely detection often results in more extensive treatment combined with a poorer outcome. Making a panoramic and periapical radiograph at the appropriate time is a matter of professionalism. Failure to do so might well constitute professional negligence. Once the pearl is exposed to the oral ambient, the therapy would aim to surgically eliminate them so the patient can access the area for good plaque control. Moreover, odontoplasty, tunnelling, root separation, or resection is indicated<sup>4,15</sup>.

Enamel pearls should be distinguished from enamel projections, which are tongue-like radicular extensions from the cemento-enamel junction commonly seen near the bifurcation of the second mandibular molars<sup>2</sup>. Moreover, the differential diagnosis should also include an isolated piece of calculus, a pulp stone or a composite resin-based cervical restoration<sup>16</sup>. Additionally, the overlap of the images of the furcation boundaries in multi-rooted teeth commonly simulates a circular radiopacity near the pulpal floor and may be mistaken for enamel pearls<sup>16</sup>. Pindborg<sup>17</sup> pointed out that the orientation of the cemento-enamel border varies with race. Eskimos, Lapps and American Indians show more frequent extensions in relation to root bifurcations and furrows.

## Conclusions

The clinical recommendations can be given that, although seldom with a prevalence of 2%, the clinician should be aware of the enamel pearls especially in mandibular first molars even when treating Turkish dental patients.

## Conflict of Interest

The Authors declare that there are no conflicts of interest.

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