

Prevalence of enamel pearls in teeth from a human teeth bank

Bruno R. Chrcanovic¹⁾, Mauro H. N. G. Abreu²⁾ and Antônio L. N. Custódio^{1,3)}

¹⁾Department of Morphology, Institute of Biological Sciences, Federal University of Minas Gerais, Belo Horizonte, MG, Brazil

²⁾Department of Social and Preventive Dentistry, School of Dentistry, Federal University of Minas Gerais, Belo Horizonte, MG, Brazil

³⁾Department of Oral and Maxillofacial Surgery, School of Dentistry, Pontifical Catholic University of Minas Gerais, Belo Horizonte, MG, Brazil

(Received 24 November 2009 and accepted 4 March 2010)

Abstract: Enamel pearls are anatomical structures that can bring about clinical implications if associated with the retention of plaque, in turn resulting in periodontal disease. In an attempt to avoid periodontal disease, the removal and treatment of these enamel pearls, may be a necessity in some circumstances. A total of 45,785 extracted teeth from a human teeth bank were analyzed for the presence of enamel pearls. The most prevalent anatomical location of enamel pearls was the permanent maxillary first and second molar region. An association between the prevalence of enamel pearls and dental class ($P < 0.001$) was observed, most frequently in the maxillary molars. In the maxillary molars, the most prevalent anatomical location of enamel pearls in the first and second molars was the furcation between the distobuccal and palatal roots. Enamel pearls are a common observation in molars in general, but are most commonly found in maxillary molars. (J Oral Sci 52, 257-260, 2010)

Keywords: dental enamel; abnormalities; ectopic mineralization.

Correspondence to Dr. Bruno Ramos Chrcanovic, Av. Raja Gabaglia, 1000/1209, Gutierrez, 30441-070, Belo Horizonte, MG, Brazil

Tel: +55-31-32920997

Fax: +55-31-25151579

E-mail: brunochrcanovic@hotmail.com

Introduction

Enamel, which is normally restricted to the anatomical crowns of human teeth, may be found ectopically on the root, either as enamel pearls (1) or as cervical enamel projections (2). The structure of the enamel is characterized as normal, but with considerable variations and irregular features that are most likely related to its ectopic development (3). The size range of enamel pearls extends both above and below the resolution afforded by the naked eye (0.25 mm) (3).

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. 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 (3).

Structurally, not all enamel pearls are composed only of enamel; they can also contain dentin and a pulp horn and commonly extend from the coronal pulp chamber or root canal (4). Pearls also may exhibit hypomineralized areas (3), but generally show a degree and pattern of mineralization, hardness, and chemical context that is similar to coronal enamel (5).

Although bacterial plaque is the primary cause of the onset and progression of periodontal disease, anatomical factors (such as ectopic enamel) are often associated with

advanced localized periodontal destruction (6-8). Enamel pearls have been shown to facilitate the progression of periodontal breakdown, considering that the enamel covering of the pearl can preclude a connective tissue attachment and the anatomy of the pearl allows for the retention of plaque (6). It could be observed that the smaller the distance between the cervical line of the enamel and the furcation vertex, the higher the chance of periodontal disease, even with the presence of minor enamel pearls (9). Thus, not only the enamel pearl size, but also its topographic relation with the furcation may well be a contributing factor to periodontal disease. Therefore, early recognition of enamel pearls is important in the prevention of periodontal disease and possibly in the prevention of tooth malpositioning (7).

Enamel pearls are usually found on the root surface of molar teeth; however, there are rare reports of these pearls occurring on the roots of maxillary premolars and incisors (10), and on rare occasions, these may actually be detected within the dentin (4,11,12) and in primary teeth (13,14).

The aim of this study was to assess the prevalence of enamel pearls on different types of extracted teeth from the Laboratory of Dental Anatomy, School of Dentistry, Universidade Federal de Minas Gerais, as well as to identify the most prevalent anatomical sites of these structures.

Materials and Methods

We analyzed a total of 45,785 extracted teeth from the human teeth bank of the Laboratory of Dental Anatomy, Department of Morphology, Institute of Biological Sciences, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil. A human teeth bank is a non-profit institution that is associated with a college, university, or other such institution. Its purpose is to fulfill academic needs by supplying human teeth for research or for preclinical laboratory training for students.

All teeth were analyzed by one examiner. The enamel

pearls were defined as an ectopic globule of enamel that was firmly adherent to the tooth root and that could be identified by the naked eye under direct light. Magnifying glasses and microscopes were not used. The age, sex, and race of the original donors could not be identified. The enamel pearls were most frequently observed in the permanent maxillary first and second molar regions.

The descriptive statistical analysis was based on the calculation of proportions. To compare the frequency of enamel pearls among the different dental classes, the Pearson chi-square test ($P < 0.05$) was applied.

The present study was approved by the Research Ethics Committee of the Institute of Biological Sciences, Universidade Federal de Minas Gerais (ICB/UFMG).

Results

This mainly retrospective study presents the overall prevalence of enamel pearls in 45,785 extracted teeth. A total of 45,539 teeth were permanent, while 246 were deciduous. Of the permanent teeth, 20,218 were molars, 11,741 premolars, 5,666 canines, and 7,914 incisors. The total prevalence of enamel pearls was 0.82% (375 of 45,785 teeth). There was an association between the prevalence of enamel pearls and tooth class ($P < 0.001$) as they were most frequent in maxillary molars (Table 1).

Within the molar teeth, 247 third molars presented 279 enamel pearls, 57 second molars presented 68 pearls, and 41 first molars presented 57 enamel pearls (Table 2).

The most prevalent anatomical location of the enamel pearls in the maxillary first molars was the furcation between the distobuccal and palatal roots (34 of 37 – 91.9%), which, curiously enough, was the same location for the maxillary second molars (31 of 50 – 62.0%).

In the maxillary first and second molars, enamel pearls were detected more frequently in the furcation between the distobuccal and palatal roots of maxillary first molars (43.03%), at the same location in maxillary second molars (39.24%), in the furcation between the mesiobuccal and

Table 1 Distribution of teeth with enamel pearls, Belo Horizonte, Brazil

Tooth class	Number of teeth	Enamel pearls	% Teeth with enamel pearls*
Molar	20,218	287 teeth with 1 pearl 57 teeth with 2 pearls 1 tooth with 3 pearls	1.71
Premolar	11,741	26 teeth with 1 pearl	0.22
Canine	5,666	4 teeth with 1 pearl	0.07
Incisor	7,914	-	0.00
Deciduous	246	-	0.00
Total	45,785	375 teeth with 434 pearls	0.82

* P value < 0.001

Table 2 Distribution of molar teeth with enamel pearls, Belo Horizonte, Brazil

Molar tooth	1 Enamel pearl	2 Enamel pearls	3 Enamel pearls	Total of teeth	%	Total of enamel pearls
First maxillary	23	14	0	37	10.72	51
Second maxillary	43	7	0	50	14.49	57
Third maxillary	205	21	1	227	65.80	250
First mandibular	2	2	0	4	1.16	6
Second mandibular	3	4	0	7	2.03	11
Third mandibular	11	9	0	20	5.80	29
Total	287	57	1	345	100.00	404

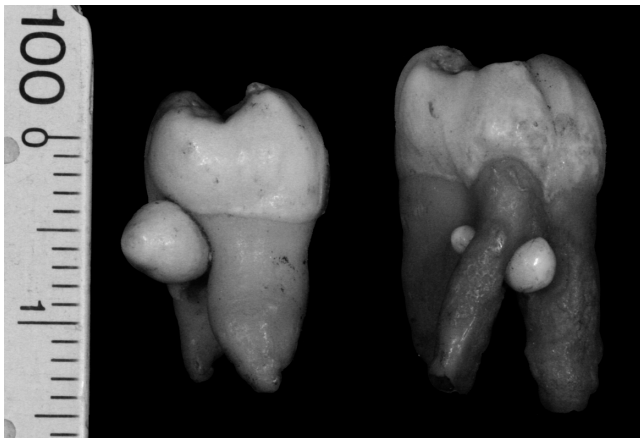


Fig. 1 A large enamel pearl on the lingual side of a right mandibular second molar (left) and two pearls in a single root of a right maxillary third molar (right). Scale in centimeters.

palatal roots of maxillary second molars (13.94%), at the center of trifurcation of maxillary first molars (2.53%), and at the palatal root of maxillary first molars (1.26%).

Examples of two molars with enamel pearls found in this study are shown in Fig. 1.

Discussion

The enamel pearl is an ectopic globule of enamel that firmly adheres to the tooth's root. The size range of enamel pearls extends both above and below the resolution afforded by the naked eye (0.25 mm) (3). The enamel pearl anomaly was first described in 1842 by Linderer and Linderer (14). Since then, it has been referred to as an enameloma, enamel droplet, enamel nodule, enamel globule, enamel knot, and enamel exostoses.

The variation in the reported prevalence may reflect ethnic, racial, or national variations in the prevalence of the condition (10). Risnes (1) studied 8,854 extracted molars in Norway and reported that 2.28% presented enamel pearls, which were reported to occur more commonly on the roots of maxillary molars, especially the

third molar, followed by the roots of mandibular molars.

Pederson (15) found a higher prevalence of enamel pearls in Eskimos (9.7%) than in other races (1.1 and 5.7%). The higher prevalence in a certain race could not be determined in this study, since the teeth of the bank were not classified by ethnicity. Another complicating factor is that the Brazilian population is very mixed. Even if the teeth were classified, the great mix of races in Brazil could render the result as uncertain.

The findings of Darwazeh and Hamasha (7), who reported that enamel pearls occur in 2.32% (48 of 2,064) of permanent molars when detected radiographically, is consistent with other studies that have reported a prevalence of 2.28% (1) but is higher than the 1.6% detected in extracted molar teeth by Sutalo et al. (16), and the 1.71% found in the present study. An even lower prevalence has been reported in primary teeth (1,4,10). Nevertheless, a remarkably high prevalence of 33% has been reported in a microscopic study of 44 deciduous teeth (13). This may suggest that the prevalence of enamel pearls could be higher if the specimens were examined histologically rather than macroscopically or radiographically (16).

Enamel pearls are usually found on the root surface of molar teeth; however, there are rare reports of these pearls occurring on the roots of maxillary premolars and incisors (10). This study found an occurrence of enamel pearls in 0.22% of premolars and no occurrence in incisors. On rare occasions, these pearls may also be detected within the dentin (internal enamel pearl) (4,11,12), showing a predilection for the premolar/canine region, and in primary teeth (13,14). In the present study, no occurrence in deciduous teeth was found. Complications arising from enamel pearls found in primary dentitions may include slower processes of enamel resorption, delayed exfoliation of the primary teeth, and/or deviation of the succedaneous tooth (14). Radiographic interpretation and detection of the enamel pearl may be complicated by the superimposition of the developing permanent tooth, and their incidences may actually be higher than reported (14).

Normally, only one single enamel pearl occurs on a

tooth, but up to 4 enamel pearls have been observed on the same tooth (4,10). The present study identified 57 teeth with 2 pearls and only one tooth with three enamel pearls, all of which were molars.

The study of Darwazeh and Hamasha (7) reported that enamel pearls are more common on the roots of mandibular rather than maxillary teeth, which contradicts findings from Risnes (1) and the present study. Moskow and Canut (10) found a higher prevalence of enamel pearls on maxillary third molars (approximately 75%), as was found in the present study.

On human molars, enamel pearls have a predilection for either the furcation or the furrow between incompletely separated roots (1,3), particularly in the maxillary second and third molars (10), as was observed in the present study. Most cervical enamel projections appear on the buccal surface (2).

Enamel pearls are a common observation in molars in general, but are most commonly found in maxillary molars. In the present study, the most prevalent anatomical location of enamel pearls for the maxillary first and second molars was the furcation between the distobuccal and palatal root.

References

1. Risnes S (1974) The prevalence, location and size of enamel pearls on human molars. *Scand J Dent Res* 82, 403-412.
2. Risnes S (1974) The prevalence and distribution of cervical enamel projections reaching into the bifurcation on human molars. *Scand J Dent Res* 82, 413-419.
3. Risnes S (1989) Ectopic tooth enamel. An SEM study of the structure of enamel in enamel pearls. *Adv Dent Res* 3, 258-264.
4. Cavanha AO (1965) Enamel pearls. *Oral Surg Oral Med Oral Pathol* 19, 373-382.
5. Anderson P, Elliott JC, Bose U, Jones SJ (1996) A comparison of the mineral content of enamel and dentine in human premolars and enamel pearls measured by X-ray microtomography. *Arch Oral Biol* 41, 281-290.
6. Hou GL, Tsai CC (1997) Cervical enamel projection and intermediate bifurcational ridge correlated with molar furcation involvements. *J Periodontol* 68, 687-693.
7. Darwazeh A, Hamasha AA (2000) Radiographic evidence of enamel pearls in Jordanian dental patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 89, 255-258.
8. Risnes S, Segura JJ, Casado A, Jiménez-Rubio A (2000) Enamel pearls and cervical enamel projections on 2 maxillary molars with localized periodontal disease: case report and histologic study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 89, 493-497.
9. Lima AFM, Nascimento A, Hebling E (1991) Projection of cervical enamel and its relations to bifurcations. *Odonto Mod* 18, 9-15. (in Portuguese)
10. Moskow BS, Canut PM (1990) Studies on root enamel (2). Enamel pearls. A review of their morphology, localization, nomenclature, occurrence, classification, histogenesis and incidence. *J Clin Periodontol* 17, 275-281.
11. Kaugars GE (1983) Internal enamel pearls: report of case. *J Am Dent Assoc* 107, 941-943.
12. Mahajan S, Charan CR (2005) An association of external and internal enamel pearls. *Indian J Dent Res* 16, 17-18.
13. Arys A, Dourov N (1987) Enamel pearls in the deciduous teeth. *J Biol Buccale* 15, 249-255. (in French)
14. Kupietzky A, Rozenfarb N (1993) Enamel pearls in the primary dentition: report of two cases. *ASDC J Dent Child* 60, 63-66.
15. Pederson PO (1949) The East Greenland Eskimo dentition. Numerical variations and anatomy. C. A. Reitzel, Copenhagen, 142, 149-155.
16. Sutalo J, Ciglar I, Bacić M (1989) The incidence of enamel projections on the roots of the permanent teeth. *Schweiz Monatsschr Zahnmed* 99, 174-180. (in German)