Statistical evaluation of radiologic survey of pulp stones

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Pulp stones are a form of calcification found in dental pulp. "True" pulp stones histologically resemble dentin, and "false" pulp stones are composed of a localized mass of calcified material.' A third type, "diffuse" or "amorphous" pulp stones, was described by Mjor and Pindborg[2] as more irregular in shape than false pulp stones, occurring in close association with blood vessels. Slenvik and Mjor' suggested that pulp stones may be formed in response to detached cells of the inner enamel epithelium. Baume[4] defined pulp stones as a paraphysiologic phenomenon wherein new dentin is formed. These pathologic degenerations, sometimes called "calcific degenerations" or "denticles," should be classified according to Baume's dentin taxonomy as "intrapulpal calcifications."

Pulp stones range in size from small microscopic particles to stones large enough to sometimes obliterate the entire pulp chamber? William[0] found areas of pulp calcification in 87% of the teeth examined, but he was able to observe only 15% of the calcifications radiographically. James and others[7] found mineralization of the pulp in 56% of the young permanent teeth studied, and Stafne and Szabo[3] found pulp stones in 46% of the 200 teeth studied. Hill[9] observed that the frequency of occurrence of pulp stones did not di Her either according to sex of the patient or among the various teeth in the dental arch. Likewise, Sundell and others' found no significant correlation between formation of pulp stones and sex. We do, however, share the opinion expressed by Stafne and Szabo[8] that pulp nodules occur more frequently in females than in males.

The primary purpose of the current study was to statistically evaluate, using dental radiographs, the prevalence of radiographically visible pulp stones in the pulp chambers of mandibular premolars and molars in male and female patients. Because local factors, especially the type of operative procedure used, have been suggested as those being associated with the formation of pulp stones?-[811]"" we also examined the correlation between the condition of the crown (intact, carious, or restored) and the presence of pulp stones.

METHODS AND MATERIALS

Full-mouth radiographic surveys and bitewing radiographs of 150 female patients and 150 male patients, aged 20 to 40 years, were chosen at random from the files of Tel Aviv University School of Dental Medicine. Medical examination of the patients was not contributory. A total of 1,380 mandibular premolars and molars (679 in female patients, 701 in male patients) were selected for evaluation. (It was assumed that with the bisecting angle technique pulp stone detection would be easier for mandibular maxillary teeth.) The condition of the crown was evaluated radiographically and recorded either as intact, carious, or restored.

The radiographic examination focused solely on the pulp chambers, using an X-ray viewer and magnifying glass. Pulp stones were recorded only when a definitive radiopaque mass could be seen in the pulp chamber.

RESULTS

Distribution of the pulp, according to condition and location of the teeth and the sex of the patient, is summarized in Table 1.

Of the 1,380 teeth examined, 20.7% were found to contain pulp stones. Pulp stones were found in 24.7% of the 679 teeth in the female group (Table 2) and 16.9% of the 701 teeth in the male group (Table 3).

Results were evaluated by Chi-square analysis described by Spiegel.[12] The number of pulp stones found in the female group was statistically higher than the number in the male group ($P<.0001$). In addition, as shown in Tables 2 and 3, teeth 36 and 46 in both female and male groups showed a higher percentage of pulp stones.

The sum of Chi square and *P* values for all teeth is indicated in Table 4. No significant difference was found between the presence of pulp stones and the condition of the crown of the tooth (intact, carious, or restored).

When periapical radiographs were compared with bitewing radiographs for usefulness in diagnosing pulp stones in the pulp chamber, differences were found for only 14 of the 1,380 teeth evaluated.

Table 1 • Distribution of the pulp stones according to condition and location of the teeth and the sex of the patient.

Tooth Location (Mandibular)	intacı		Carious		Restored		Total	
	Female	Male	Female	Male	Female	Male	Female	Male
Left first premolar	88	85	36	27	17	26	136	138
Left second premolar	46	53	35	31	37	30	118	114
Left first molar	9	14	15	65	62	86	86	
Right first premolar	79	77	33	36	24	25	136	138
Right second premolar	37	52	31	44	40	27	108	123
Right first molar	8	15	16	20	71	67	95	102
Total	265	291	165	173	249	237	679	679

Table 2 • Percentage of pulp stones in the six teeth and crown conditions in the female group.

Tooth location (mandibular)	Intact			Carious			Restored			Total		
	Total	No. of stones	%	Total	No. of stones	%	Total	No. of stones	%	Total	No. of stones	%
Left first premolar	88	4	4.5	36	1	2.7	12	1	8.3	136	6	4.4
Left second premolar	46	6	13.0	35	2	5.7	37	*6*	16.2	118	14	11.9
Left first molar	7	4	57.1	14	10	71.4	65	42	64.6	86	57	66.3
Right first premolar	79	5	6.3	33	4	12.1	24	4	16.6	136	13	9.6
Right second premolar	37	3	8.1	31	3	9.6	40	4	10.0	108	10	9.3
Right first molar	8	8	100.0	16	12	75.0	71	48	67.6	95	68	71.1
Total										679	168	24.7

Table 3 • Percentage of pulp stones in the six teeth and crown conditions in the male group.

Tooth location (mandibular)	Intact			Carious			Restored			Total		
	Total	No. of stones	%	Total	No. of stones	%	Total	No. of stones	%	Total	No. of stones	/£>
Left first premolar	85	7	8.2	27	4	14.8	26	1	3.8	138	12	8.7?
Left second premolar	53	1	1.8	31	3	9.6	30	2	6.6	114	6	5.3
Left first molar	9	4	44.4	15	5	33.3	62	24	38.7	86	34	39.5
Right first premolar	77	6	7.7	36	i	2.2	25	3	12.0	138	10	7.2
Right second premolar	52	4	7.6	44	0	0	27	3	11.1	123	5	4.4
Right first molar	15	8	53.3	20	9	45.0	67	34	50.7	102	52	51.0,
Total										701	119	16.?

Table 4 • Sum of chi-square and *P* Values for the teeth evaluated.

T ooth no.	X^2	df	p
Left first premolar	2.05	1	0.55
Left second premolar	3.21	1	0.07
Left first molar	12.34	1	0.00004
Right first premolar	0.48	1	0.49
Right second premolar	2.56	1	0.11
Right first molar	8.00	1	0.0031

DISCUSSION

As pulp stones can be disclosed clinically only with dental radiography, our statistical evaluation was based on radiographic survey. We thought the stones would be better seen using bitewing radiographs rather than periapical radiographs because the central beam in the bitewing radiographs is perpendicular to the long axis of the tooth, whereas distortion occurs in the bisecting technique. However, results'indicated differences in only 14 of the 1,380 teeth evaluated.

Since 1933 when Stafne and Szabo[8] reported that pulp stones are more common in females than in males, no other studies regarding this subject have been published in the periodic literature or in the dental textbooks. The results of the current study statistically confirm those findings.

The group of teeth examined in our study included mandibular premolars and first molars; the statistical significance *(P* < .00004 for tooth no. 36; *P* < .0031 for tooth 46; *P* < .0001 for the total number of teeth represented by both groups, males and females) assures that this tendency exists in other teeth as well. It may, therefore, be postulated that the aforementioned findings are a manifestation of the hormonal differences between the sexes; however, this has yet to be proved.

A higher prevalence for pulp stones was observed in molars compared with premolars. In the male group, pulp stones were found in 45.2% of molars and in only 6.1% of the premolars. In the female group, pulp stones were found in 65.9% of the molars compared with only 5.8% of the premolars. Shafer and others,[1] Seltzer and Bender[14] and Sicher[15] claimed that calcifications, in general, increased with advancing age. Therefore, the higher prevalence of pulp stones in the molars may be caused by the earlier eruption of the molars compared with premolars, exposing molars for more time to possible degenerative changes. In addition, molars have a better blood supply and more pulp tissue than premolars,[16] which may enhance conditions that can cause calcifications. It has been assumed[17] that the formation of pulp stones is congenital because in some patients all the teeth are filled with stones.

The correlation between chronic trauma to the pulp and pulp calcifications has been discussed before in the literature. Sundell and others[5] suggested that the formation of coronal pulp stones may represent a previously overlooked late response after an inflammatory process in the pulp. Such processes occur frequently after operative procedures, such as large restorations; more chronic causes (caries, periodontal disease, abrasion, and erosion) have also been cited.[7] Our study, however, did not indicate any significant difference among intact teeth, teeth with caries, or restored teeth in relation to propensity to develop pulp stones.

In conclusion, the results of this study show that female patients are statistically more predisposed to developing pulp stones than male patients; no significant difference was observed in the incidence of pulp stones among intact, carious, and restored teeth; and no significant difference was seen between periapical and bitewing radiography in disclosing pulp stones.

SUMMARY

Full-mouth radiographic surveys and bitewing radiographs of 150 male and 150 female patients aged 20 to 40 years were evaluated for the presence of pulp stones in the pulp chambers of the mandibular premolars and molars. Results indicated that of the 1,380 teeth examined, 20.7% contained pulp stones. Significantly more pulp stones were found in female patients (24.7%) than in male patients (16.9%) *(P* < .0001). This difference was more significant for molars: mandibular left first molar (P < .00004) and mandibular right first molar (P<.0031).[7] There were significantly more pulp stones in the mandibular molars than in the premolars in both groups, but no significant difference was found in the prevalence for pulp stones among the three recorded conditions of the crown. Comparison of periapical and bitewing radiographs showed no significant difference in the diagnosis of pulp stones.

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