

PREVALENCE AND CHARACTERISTICS OF TONSILLAR CALCIFICATIONS VISIBLE IN DENTAL PANORAMIC RADIOGRAPHS IN A SAMPLE OF POLISH POPULATION

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ABSTRACT

INTRODUCTION: Calcifications found in the crypts of palatal tonsils, called tonsilloliths, are considered an incidental finding in panoramic radiographs. Dentists and radiologists should be aware of their radiological appearances in order to avoid diagnosis of different calcifications.

OBJECTIVES: The objective of the research was to examine the prevalence and characteristics of tonsillar calcifications visible in panoramic radiographs in a sample of Polish population.

MATERIAL AND METHODS: The study included one thousand consecutive digital dental panoramic radiographs taken with Planmeca Prostyle X-ray machine in 577 females and 423 males aged from 5 to 88 years. The presence of tonsilloliths, their characteristics (single or multiple) as well as localization according to 6 regions (1-3 shadows cast on the mandibular ramus above, at and below the level of soft palate, 4 – below mandible, 5 – below and posterior to mandibular angle, 6 – posterior to mandibular ramus) were assessed.

RESULTS: Tonsilloliths were detected in over 24% of panoramics. Prevalence in females and males was comparable. Findings were more prevalent in the following age groups: 30-39 years, 50-59 years (37.5%), and 40-49 years (35%). They were far less frequent in patients below 30 years of age. Tonsillar calcifications were found in 511 regions in 242 patients, and in 116 cases they were single. Almost 30% of calcifications were detected in region 2 and 25% in region 3. Over 65% of tonsilloliths were found bilaterally.

CONCLUSIONS: Tonsilloliths are frequent incidental finding in X-rays. About one-quarter of analyzed panoramics revealed the presence of stones.

KEY WORDS: palatine tonsil, tonsilloliths, dental panoramic radiograph.

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INTRODUCTION

One type of calcifications that are found in maxillofacial region are stones in palatal tonsils. Tonsilloliths (TLs) are calcifications, which arise from mass of epithelium, serum, bacteria, and organic debris in palatine tonsillar crypts. They may be asymptomatic or cause dysphagia, globus sensation, halitosis, otalgia, peritonsil-

lar abscess, swelling in the tonsillar fossa, glossopharyngeal neuralgia, orofacial pain, upper airway obstruction, and sleep breathing disorders. They may be incidentally found in three- and two-dimensional radiological examinations [1-13]. TLs appear as small opacities, overlapping the middle portion of mandible ramus, or as multiple poorly defined radio-opacities, which may be oval, round, or irregular in shape, superimposed on the soft

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tissues' shadows. Their borders are poorly defined, and densities vary from slightly radiopaque to close in intensity to the cancellous bone [8, 14, 15]. Changliang *et al.* [15] showed that the density of majority of tonsilloliths was over 120 Hounsfield units (HU) in computed tomography (CT) scans.

Overall calcifications in soft tissues in the maxillofacial region are uncommon, and generally correspond to radiographic findings in examinations such as panoramic radiograph. Nowadays, dental panoramic radiograph is an inherent diagnostic tool in correlation with the clinical examination, which reveals general condition of teeth and surrounding structures in maxillofacial region. The most important features of diagnostic evaluation are location, distribution, number, size, and shape of the calcifications [16]. Differential diagnosis for radiological image of TLs in maxillofacial region include sialoliths of the submandibular glands, carotid artery calcifications, calcified submandibular lymph nodes, or other foci of idiopathic osteosclerosis [1, 11, 16].

OBJECTIVES

The objective of present study was to examine occurrence and characteristics of tonsilloliths, as inciden-

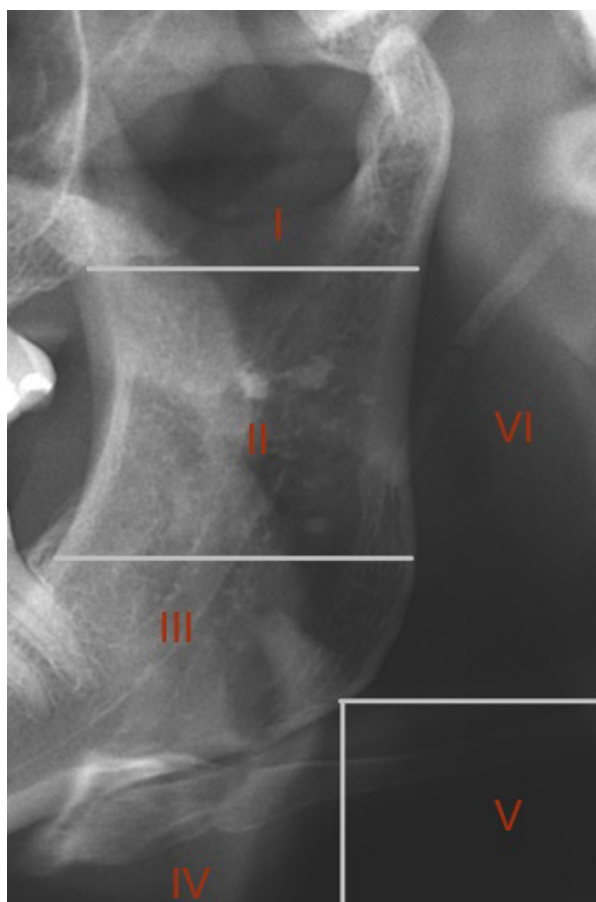


FIGURE 1. Regions of presence of tonsilloliths

tal findings on dental digital panoramic radiographs in a sample of Polish population.

MATERIAL AND METHODS

The material of the study consists of one thousand consecutive digital dental panoramic radiographs taken by Planmeca Prostyle (Finland) X-ray machine in 577 females and 423 males aged from 5 to 88 years. The radiographs were taken in the Department of Dentomaxillofacial Radiology at the Medical University of Lublin. Examinations were prescribed due to various clinical reasons. We excluded images with technical errors and any pathological lesions in examined regions. The group of patients was selected into nine age range categories, between 5-9 years old and 80-89 years old.

The presence and localization of tonsilloliths were assessed by one observer. Each image of mandible was bilaterally divided into 6 regions: 1 – shadows cast above the mandibular ramus, 2 – at the level of soft tissue, 3 – below the level of soft palate, 4 – below mandible, 5 – below and posterior mandibular, and 6 – posterior mandibular ramus [17]. Tonsilloliths were classified according to the areas (Figure 1).

RESULTS

Among one thousand examined radiographs, tonsilloliths were detected in 242 of X-rays (24.2%) in all age groups. The highest prevalence of calcifications was found in patients in two age groups: 50-59 years (37.5%) and 30-39 years (37.4%); the least in 9-year-old's children (3.3%) (Table 1).

The group with palatine tonsil stones included 142 females and 100 males, which constituted 24.6% of examined women and 23.6% of men. Thus, no gender predilection was found in the study group.

One hundred twenty-six patients had calcifications in more than one region. In total, they were present in 511 regions (Table 2).

Calcifications were prevalent in mandibular ramus, on the level of soft palate (64.97%) and below soft palate (24.27%) (Figure 2). Next was the area below and backwards from the angle of mandible, with thirty-four (6.65%) tonsilloliths observed (Figure 3).

In 158 radiographs (65.3%), stones were observed bilaterally (Figures 4 and 5). Forty-three calcifications were found on the right side (17.8%), while 41 (16.9%) on the contralateral side.

A smaller percentage of calcifications (2.15%) was observed posteriorly to the ramus of mandible. Only six calcifications occurred at the level of mandible, above the soft palate (1.17% of all palatine tonsil stones). Only in four cases (0.78%), calcifications were visible below the body of mandible.

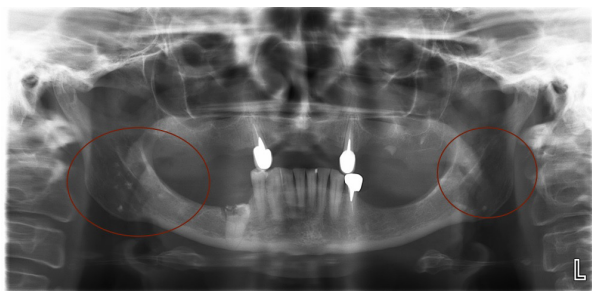


FIGURE 2. Tonsilloliths cast bilaterally on the mandibular ramus at the level of soft palate and below



FIGURE 3. Tonsilloliths found in region 5



FIGURE 4. Bilateral tonsilloliths in region 2

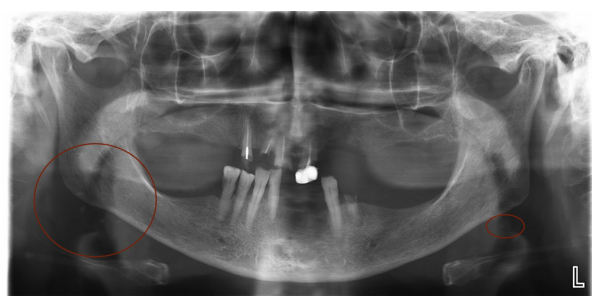


FIGURE 5. Bilateral calcifications in palatal tonsils in region 4, furthermore on the right side in region 3

DISCUSSION

Calcifications in maxillofacial region such as tonsilloliths may be incidental findings in X-ray panoramic radiographs in daily practice, whenever there is an indi-

TABLE 1. Classification of the patients to age groups

Age group (years)	Patients with TLs	All patients	Percentage
< 9	2	61	3.3
10-19	20	173	11.6
20-29	49	287	17.1
30-39	49	131	37.4
40-49	41	116	35.3
50-59	39	104	37.5
60-69	27	78	34.6
70-79	8	29	27.6
80-89	7	21	33.3
Total	242	1,000	24.2

TLs – tonsilloliths

TABLE 2. The number and percentage of tonsilloliths (TLs) found in specific regions

Region	Number of TLs	Percentage
1	6	1.17
2	332	64.97
3	124	24.27
4	4	0.78
5	34	6.65
6	11	2.15
Total	511	100

cation [18]. Previous studies reported that the detection of palatine tonsilloliths varies, and the prevalence in CT is 16.0-46.6% and in panoramic radiographs – 7.3-13.4% only [7]. Two-dimensional image, superimposition of structures, distortion, and magnification may be diagnostic challenges in interpretation of panoramic radiographs [2, 9, 13, 19]. The detection of TLs in panoramic radiographs might be related to their amount, degree of calcification, or size [4].

Takahashi *et al.* [17] evaluated 2,244 panoramic radiographs, and stones in palatal tonsils were found in 300 of these (13.4%), while in our study, it was 24.2%. TLs were predominantly superimposed on the level of the soft palate in 176 patients (49.9%), inferior to the level of the soft palate in 90 individuals (25.5%) in the quoted study.

Aoun *et al.* [20] studied 500 digital panoramic radiographs of Lebanese adult patients (281 females and 219 males), with an average age of 47.9 years. Authors found TLs in 36 radiographs (7.2%), with 18 females and the same number of males. Thirteen cases were located on the right side, twelve on the left side, and eleven bilaterally. Affected patients' age ranged from

24 to 84 years (mean, 61 years). There was no statistically significant relation between stones presence and gender. Moreover, a low positive correlation between tonsilloliths and age ($r = 0.193$) was observed. Two-dimensional examination may be used for early diagnosis of calcifications, but in order to confirm the findings, more detailed imaging is needed. Three dimensional scans are a good option to provide precise diagnosis of calcifications, especially symptomatic ones [1].

Schreiner-Tiefenbacher *et al.* [1] examined panoramic radiographs and cone-beam computed tomography (CBCT) scans of 822 patients. If one or more calcifications in panoramic radiograph were found, CBCT was evaluated. The study group consisted of 43.8% men and 56.2% women, divided into three following age groups: 21-39 years (16.7%), 40-59 years (48.9%), and 60-89 years (34.4%). The authors analyzed the presence of tonsilloliths, sialoliths of the submandibular salivary gland, carotid artery calcifications (CAC), calcified submandibular lymph nodes, and any other idiopathic osteosclerosis. At least one calcification was detected in panoramic radiographs of 415 patients. Tonsilloliths were visible in diagnosed calcifications in 249 (30.2%) examinations and their presence was confirmed in 121 (29.2%) three-dimensional volumes. Predominantly, they were bilateral, and more common in women than men. It was in 38.7% of accordance between TLs diagnosed on the CBCT and panoramic radiographs and the tonsilloliths diagnosed in CBCT.

Oda *et al.* [4] in a study with 482 pairs of panoramic radiographs and CT scans compared the occurrence and characteristics of tonsilloliths. Among 482 patients, 222 (46.1%) were classified to group with calcifications in palatine tonsils in CT scans, while TLs were found only in 37 (7.7%) panoramics. The authors observed 185 cases of disagreement between two- and three-dimensional imaging. It was supposed that density in Hounsfield units and size of stone might explain the detection in CT images only. Certainly, there was a significant correlation between the Hounsfield units value and the detection of tonsilloliths in panoramics (Spearman $r = 0.429$; $p < 0.0001$). The higher CT number, the higher tonsilloliths detection rate, which means that denser stones were more detectable in radiographs. Ninety-five cases with density beneath 300 HU were not visible on panoramic radiographs for the observer. The authors found significant correlation between size and tonsilloliths detection rate on panoramic radiographs (Spearman $r = 0.318$; $p < 0.0001$), which was higher as the size of stones increased.

Kim *et al.* [8] analyzed 3,886 CT scans and reported palatine tonsilloliths in 1,179 of cases (30.3%). Five hundred fifty (33.3%) patients were male and 629 (28.2%) were female. The prevalence of tonsilloliths was significantly higher in men than in women ($p < 0.05$). The mean age of the patients with tonsilloliths was 39.8 years. Tonsilloliths were detected bilaterally in 392 pa-

tients (33.2%), and 430 of stones were located unilaterally on the right side and 357 on the left. There was no significant difference in prevalence between the right and left sides.

Tonsilloliths in palatine tonsils are often diagnosed, but it is important to be aware of the possibility of presence of calcifications in lingual tonsils in panoramic radiographs [21].

Lee and Mandel [21] reported a case of a 71-year-old man, whose panoramic radiograph showed 2 opacities bilaterally present in soft tissues, posteriorly to the angle of mandible. CT confirmed the existence of two tonsilloliths in lingual tonsil. Bilateral calcifications were noted in two-dimensional image, because the opacities on the right side were “ghost shadows” of the left side calcifications. “Ghost shadows” are examined objects, which arise when these objects are not inside the focal trough of the panoramic unit.

Missias *et al.* [24] studied prevalence of soft tissue calcifications in the maxillofacial region detected by CBCT. The following conditions were evaluated: tonsilloliths, calcified stylohyoid ligament, elongated styloid process, calcified triticeous cartilage, sialoliths, calcified carotid artery atheroma, calcinosis cutis, calcified superior cornu of thyroid cartilage, antroliths, phleboliths, and calcified lymph nodes. They examined 224 maxillary and mandibular CBCTs, 484 of maxilla and 292 of mandibular CBCTs only. Tonsilloliths were found in 69 (30.8%), 100 (20.7%), and 72 (24.7%) of these examinations, respectively.

On the base of analyzed studies, where results of 2-dimensional and 3-dimensional examinations were compared, the effectiveness of CBCT and CT are unquestionable. The main limitation of our study is the use of panoramic images and not CBCT. However, our paper aimed at highlighting the necessity of comprehensive analysis of panoramic radiographs, as these X-rays are commonly taken radiographs in dental office settings.

CONCLUSIONS

Calcifications in the palatine tonsils are a common incidental finding in panoramic images. Radiological images of calcifications are superimposed on both hard and soft tissue shadows, and the occurrence of tonsil stones is similarly observed in women and men. In many cases, radiological image of calcifications in palatine tonsils helps in correct interpretation of images calcification in this localization.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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