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Prevalence and patterns of palatine and adenoid tonsilloliths in cone-beam computed tomography images of an Iranian population

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ABSTRACT

Background: Tonsilloliths are calcified concretions that develop in tonsillar crypts. They are usually small and asymptomatic, so they are found accidentally during routine dental radiogrphy procedure. Large tonsilloliths can occur with clinical signs and symptoms. The purpose of this study was to evaluate the prevalence and patterns of palatine and adenoid tonsilloliths in cone-beam computed tomography (CBCT) images.

Materials and Methods: In this cross-sectional study, 0.5-mm axial and coronal slices of 134 CBCT images were evaluated to determine the presence of palatine and adenoid calcifications. Their patterns such as being unilateral or bilateral as well as single or multiple and their largest linear sizes were reported.

Results: Fifty-four (40.3%) patients with palatine tonsilloliths and 17 (12.7%) with adenoid calcifications were found. Thirty (55.6%) palatine tonsilloliths were unilateral, 19 (35.2%) were detected in the left tonsils. Approximately, 54 cases of 78 palatine calcifications were multiple. Seventeen patients had adenoid calcifications that 41.1% of them were unilateral. Fourteen adenoid calcifications were single. The mean ages of patients with palatine tonsilloliths and adenoid calcifications were 45.59 years and 46.53 years, respectively. The range of linear measurements of palatine tonsil calcifications was 0.9–4.2 mm (2.47-mm mean size) while adenoid calcifications ranged from 0.5 to 2.2 mm (0.95-mm mean size). The level of statistical significant difference was <0.05.

Conclusion: Gender did not affect total prevalence, the pattern of tonsilar calcifications and their linear sizes. The prevalence of tonsilloliths increased with aging, but this variable did not have an effect on their linear size.

Key Words: Adenoid, cone-beam computed tomography, palatine tonsil

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INTRODUCTION

There are three major groups of tonsils that include palatine tonsils, pharyngeal tonsils (the adenoids) and lingual tonsils that are disposed in a discontinuous ring to form Waldeyer's ring.[1] Lymphoid tissue located between the palatoglossal fold (anterior tonsillar pillar) and the palatopharyngeal fold (posterior tonsillar pillar) forms the palatine tonsil and is separated from the surrounding pharyngeal musculature by a thick fibrous capsule. The adenoid is a single aggregation of lymphoid tissue that occupies the superior and posterior pharyngeal wall.[2] Tonsilloliths are relatively uncommon calcified structures of lymphoid tissue. The mechanism, by which these calcifications

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form, is still unclear. Although it seems that they result from organic debris, bacteria, and fungus that accumulate within the intonsillar crypts following chronic inflammation.[3] Frequently, tonsilloliths have a hard consistency in different shapes and colors.[4] In the review of literature by Mesolella *et al*., the sizes of tonsilloliths were reported from 1mm to few centimeters and their weight ranged from 0.56 to 42 g.[4] These calculi are composed of calcium as well as magnesium salts and contain ammonium radicals.[5]

Ram *et al*. reported a mean age of 46.2 years (16–77 year range) for occurrence of tonsilloliths in a review of literatures.[6] Small tonsilloliths may be asymptomatic so they can be diagnosed incidentally along with routine screening radiographs such as panoramic view. While more severe forms may present with pain and a foreign body sensation in the throat, swelling in the tonsillar fossa, odynophagia, otalgia, peritonsillar abscess, and halitosis.[6] Tonsilloliths on panoramic radiographic views appear as single or multiple ill-defined radiopacities on the mandibular ramus.[7] Superimposition of hard and soft tissue structures on this area making challenges in interpretation of these opacities.[8,9] Therefore, it is sometimes difficult to determine whether these calcifications are within the soft tissue or appear as a central lesion.

The most common differential diagnoses of tonsilloliths may be phleboliths, lymph node calcifications, calcified granulomas, malignancies, deep fungal infections, foreign bodies, and isolated bone or cartilage derived from embryonic rests.[9,10] The presence of ghost images as well as the effects of distortion and superimposition of other anatomical structures are the limitations of panoramic radiographs; thus, they cannot be considered to be a useful screening tool for the detection of tonsilloliths in the general dental population.[6]

This fact underscores the importance of computed tomography (CT) technique. Recently, volumetric imaging such as cone beam CT (CBCT) has been used increasingly as a diagnostic tool and, in turn, has provided the facility of acquiring high-quality multiplanar images using lower doses of radiation in comparison with CT. It can, thus, permit a more accurate diagnosis to be made to enable effective treatment planning.[11] CBCT images can also serve as a valuable diagnostic tool for the localization of soft tissue calcifications by oral and maxillofacial radiologists.[12] On CT images, tonsilloliths appear as ovoid homogenous calcifications as a solitary or multiple clustered that looks like "rice grain" superficial to the lateral oropharyngeal airway space.[13] There were a limited number of studies on CBCT evaluation of soft tissue calcifications such as tonsillar calcifications.[14-16]

The objective of the present study was to determine the prevalence of palatine and adenoid tonsilloliths in an Iranian population on CBCT images.

MATERIALS AND METHODS

In this cross-sectional study, CBCT images of 134 patients referred to a Maxillofacial Radiology Clinic in Rasht, Guilan, from May 2013 to July 2014 were selected. The field of view (FOV) of all of selected images was 9 inch. The CBCT images focused on the anatomical area that included the region that extended from the inferior portion of the mandible up to the inferior orbital rim. The images having motion artifact and nasopharyngeal mass were excluded from this study. Our sample size consisted of a 134-patient group that included 81 males and 53 females. Their mean age was 40.39 ± 13.75 years within a 7–75 year range. The demographic data of patients were recorded based on individual patient data in an image file. All CBCT images were taken by a CBCT scanner (NewTom VG, QR Srl Company, Verona, Italy).

Then, all images were reconstructed in axial and coronal sections having both a 0.5 mm thickness and interval. The voxel size of 9-inch FOV was within a 0.25–0.3 mm range. Image pixels were set on 512 × 512 automatically.

Next, the CBCT images were evaluated by a maxillofacial radiologist, who was familiar with CBCT and had more than 10 years of professional experience. Thirty CBCT images were reviewed again by same maxillofacial radiologist. Intraobserver agreement was 99% for presence and patterns of calcifications and 98.2% for linear measurements of calcifications. This individual evaluated the images to determine the presence of palatine and adenoid tonsil calcifications, their locations (unilateral or bilateral), the form of calcifications (single or multiple) and their largest linear sizes. In CBCT images, the "measurement" tool available in NNT Viewer software (QR Srl Company, Verona, Italy), Version 2.21 is used to measure the largest diameter of the biggest calcification in axial view. Figure 1a and b reveal the presence of palatine

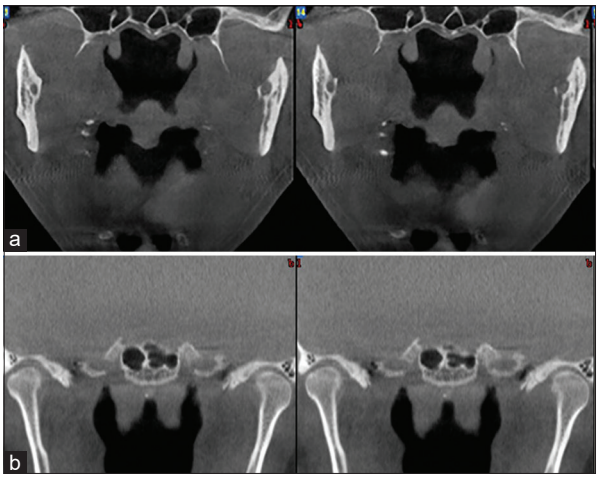

Figure 1: (a) Multiple calcification of palatine tonsils, (b) single calcification of adenoid tonsil.

and adenoid tonsil calcifications. Patients were categorized into several age groups (0–10, 11–20, 21–30, 31–40, 41–50, 51–60, 61–70, 71–80). The total frequency of palatine and adenoid tonsilloliths along with their incidence in male and female patients was evaluated.

Then, to determine the relation between the variables of gender and age with the presence of tonsilloliths, the frequency of tonsilloliths, their forms and linear sizes were compared between the gender and age groups. An independent *t*-test was used for comparing the age groups to confirm the presence of tonsilloliths while a comparison between male and female patients was made by Chi-square test. The size of calcifications among the different age groups was compared using ANOVA and between the genders by independent *t*-test. Statistical analysis was conducted through SPSS Version 21 software (SPSS, Chicago, IL, USA). The level of statistical significance was established at a $P < 0.05$.

RESULTS

Palatine tonsilloliths were present in 54 CBCT scans (40.3%) while adenoid calcifications were found in 17 cases (12.7%). Seven patients had both types of tonsilloliths (5.2%). Exactly, 55.6% of palatine tonsilloliths occurred unilaterally (35.2% in the left and 20.4% in the right tonsil). When considering the right and left palatine tonsils separately, approximately 78 palatine calcifications were seen in the CBCT scans of 54 patients. A total of 24 out of 78 palatine calcifications had a single pattern while the remaining 54 of the same 78 were multiple. Finally, we detected 43 calcifications in the left palatine tonsil and 35 in the right one. There was no statistically significant difference between the left and right sides regarding detection of tonsilloliths as revealed by Chi-square test analysis ($P < 0.001$). Of the 17 CBCT scans that revealed adenoid tonsilloliths, 7 were unilateral (41.1%), 1 was bilateral (5.8%), and 9 were detected in the mid-portion of the adenoids (52.9%). Hence, 14 out of 18 adenoid calcifications were single, and the remaining four were multiple. There were no statistically significant differences between each pair of three sites viewed of adenoid tonsils ($P = 0.74$ when comparing the left and right sides, 0.29 right to the middle and 0.17 left to the mid-portion, respectively).

Regarding the frequency of palatine tonsilloliths occurring based on gender, the incidence was 12.7% (17 CBCT) for females and 27.6% (37 CBCT) for males, but there was no statistically significant difference between genders based on Chi-square test results ($P = 0.12$). Adenoid tonsilloliths were seen in 12 males (9%) and in 5 females (3.7%) with no significant difference noted between them ($P = 0.36$).

To assess the relation between gender and the pattern of tonsilloliths, there was no statistically significant difference between the patterns of calcifications and gender (P for single palatine calcifications was 0.27 and P for multiple ones was 0.32). In the same way, the comparison of single or multiple adenoid calcifications between the genders reveals that there was no significant difference since P for single calcifications was 0.59 and P for multiple ones was 0.45 as noted in Table 1.

The mean ages of patients with palatine tonsilloliths and adenoid calcifications are shown in Table 2. Overall, there was a statistically significant difference in the mean age of the patients with and without tonsilloliths in both tonsils. The average age of the patients having tonsilar calcification was more than second group. In Figure 2, frequencies of palatine and adenoid tonsil calcifications in different age groups could be detected. The analysis of the relation between age groups and the presence of different patterns of calcifications in both tonsils was another point of investigative concern as reflected in Table 3. There were significant differences between age groups in the presence of "multiple" pattern of palatine tonsilloliths and also "single" form of adenoid calcifications.

The linear sizes of calcifications were measured in the adenoid and palatine tonsils. The mean size of

palatine tonsil calcifications was 2.45 ± 0.74 mm. An independent *t*-test was used for comparing the mean linear sizes of calcifications on the right (2.42 ± 0.76 mm) and left (2.47 ± 0.74 mm) sides. No statistically significant difference between the mean sizes of calcifications detected in right and left palatine tonsils was found (P = 0.76). However, the mean size of adenoid calcifications was 0.95 ± 0.55 mm. ANOVA analysis showed a statistically significant difference (P = 0.004) among the different locations of adenoid calcifications; right (0.56 ± 0.13 mm), left (0.72 ± 0.38 mm), and middle portion (1.27 ± 0.60 mm).

In the next step, ANOVA analysis was applied to assess the mean sizes of calcifications in each tonsil type found among different age groups [Table 4].

Finally, an independent *t*-test was used to determine role that gender plays in affecting the size of calcifications. The mean sizes of palatine tonsil calcifications for males (0.73 ± 2.41 mm) and females (0.78 ± 2.53 mm) were compared which showed no statistically significant differences between them. The same analysis was done to calculate the mean size of adenoid calcifications between males (0.57 ± 0.98 mm) and females (0.54 ± 0.88 mm), and there were no statistically significant difference between them.

DISCUSSION

In present study on CBCT images, the prevalence of palatine tonsil calcifications was 40.3%, which was higher than that reported by Aspestrand and Kolbenstvedt (16%)[17] and Fauroux *et al*. (24.6%)[18] on CT scans. CT scan sections had 5 mm thickness and 0–3 mm interval in Aspestrand and Kolbenstvedt[17] and 0.625–1.25 mm thickness and 0.2–1 mm interval in Fauroux *et al*.[18] studies. Centurion *et al*.[14] indicated the prevalence of tonsiloliths on CBCT images with 15 mm of thickness as 27%. These differences can be explained by the slice thickness and distance of scans which were in both studies higher than those of present study. Such differences could lead to variations in the capability to

Table 1: Frequency of single and multiple calcifications detected in males and females

Calcification	Gender	Single (%)	Multiple (%)	Total (%)
Palatine tonsil	Male	17 (6.3)	38 (14.2)	55 (20.5)
	Female	7 (2.6)	16 (6)	23 (8.6)
	Total	24 (9)	54 (20/1)	78 (29.1)
Adenoi Adenoid tonsil	Male	11 (2.7)	2 (0.5)	13 (3.2)
	Female	3 (0.7)	2 (0.5)	5 (1.3)
	Total	14 (3.5)	4 (1.0)	18 (4.5)

Table 2: Mean ages of patients with or without calcifications

Patients	Number	Mean age	*P
Palatine tonsil			
With calcifications	54	14.032±45.59	<0.001
Without calcifications	80	12.466±36.88	
Adenoid tonsil			
With calcifications	17	46.53±16.032	0.048
Without calcifications	117	39.50±13.234	

*Independent *t*-test; P<0.05

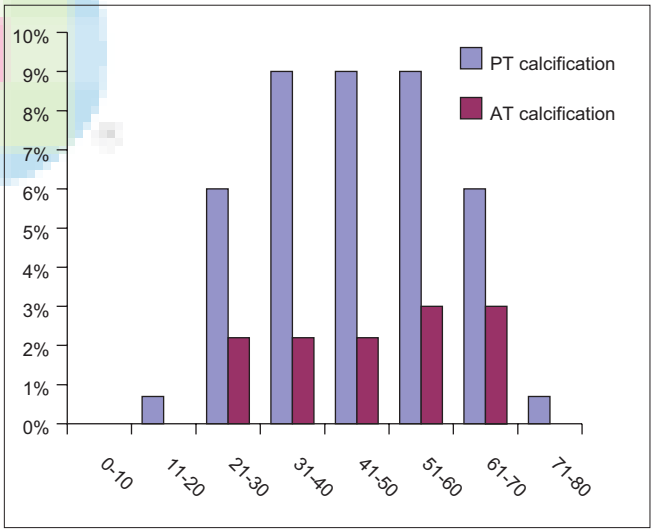

Figure 2: Frequency of palatine tonsil and adenoid tonsil calcifications detected in each patient age group. PT: Palatine tonsil, AT: Adenoid tonsil.

Table 3: Single and multiple palatine and adenoid tonsilloliths seen among different age groups

Kind of tonsilolith	Age groups								
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	P*
Single PT†	0 (0)	1 (0.4)	4 (1.5)	4 (1.5)	7 (2.6)	5 (1.9)	3 (1.1)	0 (0)	0.955
Multiple PT	0 (0)	0 (0)	7 (2.6)	14 (5.2)	12 (4.5)	11 (4.1)	9 (3.4)	1 (0.4)	0.007
Single AT¥	0 (0)	0 (0)	3 (0.7)	2 (0.5)	2 (0.5)	4 (1.0)	3 (0.7)	0 (0)	0.029
Multiple AT	0 (0)	0 (0)	0 (0)	1 (0.2)	1 (0.2)	0 (0)	2 (0.5)	0 (0)	0.15

†Palatine tonsilloliths; ¥Adenoid tonsilloliths; *Chi-square test; P<0.05

Table 4: Mean sizes of calcifications between age groups

Tonsil calcification	Age groups	Number	Mean size	*P**
Palatine	0-10	0	-	0.476
	11-20	1	2.20±0.00	
	21-30	11	2.35±0.92	
	31-40	18	2.69±0.63	
	41-50	19	2.57±0.73	
	51-60	16	2.23±0.80	
	61-70	12	2.42±0.77	
	71-80	1	1.80±0.00	
	Total	78	2.47±0.75	
Adenoid	0-10	0	0	0.126
	11-20	0	0	
	21-30	3	0.83±0.20	
	31-40	3	1.07±0.66	
	41-50	3	1.60±0.95	
	51-60	4	0.95±0.28	
	61-70	5	0.56±0.13	
	71-80	0	0	
	Total	18	095±0.55	

detect small calcifications. The variability in studied population could be considered in reported differences in the prevalence of palatine tonsil calcifications. In our study, CBCT slice thickness and spacing were both 0.5 mm. Oda *et al*.[19] reported palatine tonsil calcifications were detected in 46.1% of 482 CT scans. However, the CT section thickness used in their study was 3 mm; higher than present study but was contiguous.

Adenoid calcification was found in 12.7% of the samples which was almost the same as the prevalence of adenoid calcification (12.9%) that was reported by Hosam *et al*.[20] whereas Ben Salem *et al*.[21] presented a lower incidence (6%) on the CT scans of Egyptian patients.

In our study, seven patients (5.2%) had both palatine and adenoid tonsil calcifications. However, Hosam *et al*.[20] and Ben Salem *et al*.[21] showed an approximate 9.6% coincidence of calcification in both tonsils, which was higher than that of our report.

Among the 54 patients who had palatine tonsilloliths on their CBCT scans, thirty patients had unilateral calcifications (19 in the left palatine tonsil and 11 in the right). A total of 24 had the bilateral form of palatine tonsil calcification. Overall, 43 calcifications occurred in the left palatine tonsils and 35 on right tonsils. Overall, the statistical analysis showed that there was a statistically significant difference affecting the prevalence of calcifications detected in the right and left palatine tonsils. The only study that reported the same finding did not reveal any statistically significant difference between the prevalence of calcifications in right and left palatine tonsils was that of Oda *et al*.[19]

There were 78 calcifications in right and left palatine tonsils of which 24 were single and 54 were multiple. Similar to other studies[18-20] single palatine tonsillolith prevalence was lower than that of multiple ones except for the Aspestrand and Kolbenstvedt[17] study which showed the single form had higher incidence than the multiple form. CBCT images showed 18 adenoid calcifications; 14 were single and the remaining 4 were multiple. Ben Salem *et al*.[21] also showed that the prevalence of single adenoid calcifications was higher than that of multiple ones.

In our study, the ratio of males (81):females (53) was 1.5:1 but the prevalence of palatine and adenoid tonsil calcifications did not show any statistically significant differences between genders, a finding similar to that reported by other investigators.[18-20] Aspestrand and Kolbenstvedt[17] showed a different incidence in males and females. Overall, it seems that gender should not be considered as a risk factor for the formation of tonsilloliths. Our investigation showed no statistically significant differences between males and females concerning the formation of single and multiple calcifications in both tonsils.

In this study, the comparison of mean ages of patients with and without calcifications showed a significant effect of aging upon their presence in palatine and adenoid tonsils. It may be due to increasing the chance of exposure to inflammatory disease. This result was same as other studies.[19,21] Oda *et al*.[19] showed the relation between the detection of tonsilloliths and, the over and under 40-year-old groups. The average age of 42.2 years for nasopharyngeal tonsilloliths in Ben Salem *et al*.[21] study was near to present study report for adenoid calcifications (45.59 years). Even though Aspestrand and Kolbenstvedt[17] Fauroux *et al*.,[18] and Centurion *et al*.[14] found no significant relation between age and the presence of tonsilloliths, statistical analysis showed the occurrences of multiple palatine tonsilloliths were different between various age groups, and the peak of incidence happened between 31 and 40 years of age in present study.

The largest palatine tonsil calcification in this study was 4.2 mm, which was smaller than the size range

of largest calcifications (7–8 mm) that were reported in other studies.[17-20] The largest adenoid tonsillolith reported in our study was 2.2 mm which was smaller than the <4–4.5-mm sizes described in other studies.[20,21] The mean size of calcifications in the left and right palatine tonsils showed no significance differences, but the mean size of calcifications in the middle portion of adenoids was larger than those found in other locations. In present study, the relation between age and gender with the size of adenoid and palatine tonsil calcifications was not confirmed. Mesolella *et al*.,[4] in their review of literature, stated that the patients with larger than 2-cm calcifications had often clinical signs.

The limitation of this study was that clinical signs and past medical history of the patients were not accessible. An additional limitation of this research was that only a limited population of Iranian people was examined. Thus, it is suggested that the relation between patients chief complaints and the characteristics of tonsilloliths such as size, being multiple or single forms, and unilateral or bilateral presence as a multi-center study will be further assessed.

CONCLUSION

Palatine tonsilloliths and adenoid calcifications were found in 40.3% and 12.7% of CBCT scans, respectively. The gender is an independent variable to on the formation of palatine and adenoid tonsil calcifications. It does not affect the pattern and linear size of calcifications. Palatine tonsilloliths, especially multiple forms, occurred in the 31–50 aged patients, more frequently than in any other age range. However, the size of calcifications did not have a difference in various age groups.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

REFERENCES

1. Pilch BZ, editor. The nasopharynx and waldeyer's ring. In: Head and Neck Surgical Pathology. 1st ed. Philadelphia: Lippincott Williams & Wilkins; 2001. p. 157-94.
2. Wetmore RF. Tonsils and adenoids. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF. Nelson Textbook of Pediatrics. 19th ed. Philadelphia: Saunders Elsevier; 2011. p. 1442-5.
3. Neville BW, Damm DD, Allen CM, Bouquot JE. Oral and Maxillofacial Pathology. 2nd ed. Philadelphia: W.B. Saunders; 2009. p. 183-284.
4. Mesolella M, Cimmino M, Di Martino M, Criscuoli G, Albanese L, Galli V. Tonsillolith. Case report and review of the literature. Acta Otorhinolaryngol Ital 2004;24:302-7.
5. Babu BB, Tejasvi ML, Avinash CK, Chittaranjan B. Tonsillolith: A panoramic radiograph presentation. J Clin Diagn Res 2013;7:2378-9.
6. Ram S, Siar CH, Ismail SM, Prepageran N. Pseudo bilateral tonsilloliths: A case report and review of the literature. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004;98:110-4.
7. Laurie C. Soft tissue calcification. In: White SC, Pharoah MJ. Oral Radiology Principles and Interpretation. 6th ed. St. Louis: Mosby; 2014. p. 524-41.
8. Caldas MP, Neves EG, Manzi FR, de Almeida SM, Bóscolo FN, Haiter-Neto F. Tonsillolith – Report of an unusual case. Br Dent J 2007;202:265-7.
9. Sezer B, Tugsel Z, Bilgen C. An unusual tonsillolith. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2003;95:471-3.
10. Neshat K, Penna KJ, Shah DH. Tonsillolith: A case report. J Oral Maxillofac Surg 2001;59:692-3.
11. Bodner L. Giant salivary gland calculi: Diagnostic imaging and surgical management. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2002;94:320-3.
12. Howerton WB Jr., Mora MA. Use of conebeam computed tomography in dentistry. Gen Dent 2007;55:54-7.
13. Scarfe CW, Allan GF. Soft tissue calcifications in neck: Maxillofacial CBCT presentation and significance. AADMFR newsletter. 2010;2:2-15.
14. Centurion BS, Imada TS, Pagin O, Capelozza AL, Lauris JR, Rubira-Bullen IR. How to assess tonsilloliths and styloid chain ossifications on cone beam computed tomography images. Oral Dis 2013;19:473-8.
15. Nunes LF, Santos KC, Junqueira JL, Oliveira JX. Prevalence of soft tissue calcifications in cone beam computed tomography images of the mandible. Rev Odontol Ciênc 2011;26:297-303.
16. Misirlioglu M, Nalcaci R, Adisen MZ, Yardimci S. Bilateral and pseudobilateral tonsilloliths: Three dimensional imaging with cone-beam computed tomography. Imaging Sci Dent 2013;43:163-9.
17. Aspestrand F, Kolbenstvedt A. Calcifications of the palatine tonsillary region: CT demonstration. Radiology 1987;165:479-80.
18. Fauroux MA, Mas C, Tramini P, Torres JH. Prevalence of palatine tonsilloliths: A retrospective study on 150 consecutive CT examinations. Dentomaxillofac Radiol 2013;42:201-4.
19. Oda M, Kito S, Tanaka T, Nishida I, Awano S, Fujita Y, *et al.*

Prevalence and imaging characteristics of detectable tonsilloliths on 482 pairs of consecutive CT and panoramic radiographs. BMC Oral Health 2013;13:54.

20. Hosam YA, Yousef HA, Mohamed KM, Omar MK, Ahmad MK, Farghaly TM. Tonsillar calcification, computed tomography and clinical findings, a case study. Med J Cairo Univ 2012;80:427-34.
21. Ben Salem D, Guiu B, Duvillard C, Couaillier JF, Ricolfi F. Nasopharyngeal tonsillolith: A report of 31 cases. J Radiol 2007;88:259-62.