

The Prevalence of Soft Tissue Calcifications in the Head and Neck Region Using CBCT among Egyptian Population

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Abstract

Background: calcifications may be physiological or pathological. Understanding about soft tissue calcifications help to reach appropriate diagnosis and take the right decision whether treatment, referral, further investigations or do nothing.

Aim: To detect the prevalence of soft tissue calcifications using (CBCT) scans in the Egyptian population.

Method: Retrospective Data Analysis was performed on (417) CBCT patients' scans collected from the database available at the Oral & Maxillofacial Radiology department, Faculty of Dentistry, Cairo University. Data collection of patient sex and age was made. Data was assessed for presence or absence of calcification, type of calcification, sidedness and single or multiple occurring.

Results: There were (94) scans detected with calcifications within the whole sample size (417 scans). The prevalence was (22.54%). There were (141) calcifications detected in the (94) scans. The soft tissue calcifications detected were calcified stylohyoid ligament, tonsilloliths, sialoliths, laryngeal cartilage calcification, carotid artery calcification and only one case of ethmoidal sinolith. There were 3 cases without certain final diagnosis.

Conclusions: The prevalence of calcifications seen on CBCT images is not uncommon, dental practitioners should be aware of their presence. Their detection during routine dental examination should be made to ensure the broad evaluation of the patients.

Keywords: Prevalence-Cone beam computed tomography-Soft tissue-Calcification.

Introduction

Calcification is a biochemical occurrence at which calcium salts, mainly calcium phosphate, deposit in certain regions of certain organ.¹ Calcification of soft tissues in the region of head and neck can exist as physiologic or pathologic mineralization.²

Heterotopic calcification denotes the deposition of calcium salts in an unorganized fashion in soft tissue. The word "heterotopic" comes from the greek roots "hetero" and "topos," which means (other place).^{3,4} Heterotopic calcifications are grouped into three categories: idiopathic, dystrophic and metastatic calcification.⁵

Idiopathic calcification is found in normal tissues despite normal levels of calcium and phosphorus. It is also called calcinosis.⁶ Dystrophic calcification occurs with normal serum calcium and phosphate levels. There is no systemic mineral imbalance. This type of calcification is usually confined to soft tissue injury sites. The most common causes are infection, inflammation, trauma, dulled injury.⁷

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In metastatic calcification the serum levels of calcium and phosphorus are raised resulting in precipitation of the minerals in normal soft tissues. Serum calcium is increased in hyperparathyroidism, hypercalcemia and malignancy. While serum phosphate levels are increased in chronic renal failure. Metastatic calcification usually found bilaterally and symmetrically. They are very rare.^{7,8}

Soft tissue calcifications within the head and neck region are seen in patients seeking dental care. They might be accompanied by clinical symptoms; or not. Some soft tissue calcifications may suggest the presence of a systemic condition and may cause threatening consequences.^{9,10} Understanding of the nature of soft tissue calcifications in the head and neck helps in proper diagnosis of these calcifications and in turn taking the right decision of asking for further investigation; referral or do.¹¹

CBCT has been incorporated into almost all fields of dentistry. CBCT offers 3D display of the complex anatomy of maxillofacial region.¹² CBCT reveals anatomy, hidden pathology and incidental radiographic findings that previous clinical assessment and conventional radiographic imaging modalities may have failed to disclose.^{13,14,15}

Although there are some articles about the prevalence of different soft tissue calcifications in conventional imaging especially panoramic radiography, there are limited CBCT centered studies on the prevalence of soft tissue calcification in head and neck region.¹⁰

This study aimed to determine the prevalence of soft tissue calcifications in the head and neck region in the Egyptian population. And the results will be correlated to the demographics of the patients.

Materials and Method

Data Collection: A total of (417) consecutive CBCT scans matching the eligibility criteria were collected from the data base available at the Oral & Maxillofacial Radiology department, Faculty of Dentistry, Cairo University. CBCT images were taken using Planmeca Pro Max 3D MID® (*Asentajankatu, Helsinki, Finland*). This was approved by the research ethics committee at faculty of dentistry, Cairo university (No:18.10.11).

CBCT scans of (0.4 mm) voxel size, scans with

large field of view and scans for patients' with age range from (10-80) years old were included. While scans with poor diagnostic quality and those subjected to patient movement during acquisition were excluded.

Data Coding: Data was entered and maintained using a Microsoft Excel spreadsheet (Microsoft Office Excel, 2013). This data was categorized as the following:

1. Patient Number: For each patient, a 2 or 3 digit numerical value was entered. For easy identification and accurate total sample count.
2. Gender: Male or Female. If the gender couldn't be found in the patient's file, his/her name was used to indicate the gender. Patients with names that could work for both genders were excluded.
3. Age: The patient's age was entered as a 2-digit numerical value.

Data Analysis: Retrospective Data Analysis was performed to CBCT scans in DICOM format (*Digital Imaging and Communications in Medicine*) using (Planmeca Romexis®). Assessment of images were done by 2 radiologists one with 8 years' experience and the other with 18 years' experience. Assessments were done by each radiologist 2 times at 2 weeks interval to evaluate the intra-observational and inter-observational variability. During CBCT images assessments; neither clinical information nor demographic data of the patients were available to any of the two radiologists.

Assessment strategy for images: CBCT scans were examined in sagittal, coronal and axial cuts of the whole volume .3D volume rendering images and MIP (maximum intensity projection) were also examined. Both examiners were allowed to adjust brightness and contrast according to their subjective perception. Zooming was also allowed to provide best visualization. The examination of images was made in a low-lit room. Diagnosis was based on the radiographic appearance for detection and categorization of soft tissue calcification (if present). Assessments for the following were made;

1. Presence or absence of calcifications.
2. Type of calcification present.
3. Sidedness: unilateral (right side or left side (orbilateral).
4. Single or multiple calcifications.

Statistical Analysis: Numerical data was represented as mean and standard deviation values. Categorical data was represented as frequencies and percentages and were analyzed using Fisher's exact test. The significance level was set at $p \leq 0.05$ within all tests. Statistical analysis was performed with IBM (IBM Corporation, NY, USA.) SPSS (SPSS, Inc., an IBM Company.) Statistics Version 26 for Windows.

Results

This study was conducted on (417) patients' scans [116 (27.8 %) for males and 301 (72.2%) for females] with the mean age of (36.33 ± 15.43) years.

From the examined (417) patients' scans, soft tissue calcifications were identified in (94) patients' scans while (323) patients' scans were free of soft tissue calcifications. The prevalence was (22.54 %).

Out of the (94) patients' scans [28 (29.8 %) were for males and 66 (70.2%) were for females]. Mean age of patients with soft tissue calcification was (42.07 ± 15.38) .

There were (141) calcifications detected in (94) patients' scans. Which means that more than one calcification presented in the same patient. The prevalence of calcifications detected were: (16.55%) calcified stylohyoid ligament (SHL) (figure 1), (6.71%) tonsilloliths (figure 2), (5.76%) sialoliths (figure 3), (1.92%) triticous cartilage calcification, (0.96%) thyroid cartilage calcification (figure 4), (0.96%) carotid artery calcification then (0.24%) ethmoidal sinolith (figure 5). There were (3) scans which we cannot reach a certain diagnosis of them with prevalence (0.72%). The frequency (n) and percentage of calcifications of each type detected is shown in table (1).

Although only calcified SHL, tonsilloliths, sialoliths and thyroid cartilage calcification were detected within males. While; all detected calcification in the study were seen within females. Yet, the prevalence within males (24%) was higher than females (22%).

Calcified SHL, tonsilloliths and sialoliths were found in all age groups. Laryngeal cartilage calcification (triticous) were not found in age groups (≤ 30) years old. Laryngeal cartilage calcification (thyroid) were found only in age groups ($< 30-40$) and ($< 40-50$). None of carotid artery calcification (CAC) and others were found in age group ($< 30-40$) years old. The only ethmoidal

sinolith was found in age group ($< 20-30$) years old. Majority of the cases (15) diagnosed with SHL were in ($< 30-40$) and ($< 40-50$) age groups. For tonsillolith, most of the cases (10) were in ($< 30-40$) age group. For sialolith, most of the cases (6) were in ($< 50-60$) age group. For laryngeal cartilage calcification (Triticous), most of the cases (3) were in ($< 40-50$) age group. For laryngeal cartilage calcification (Thyroid), cases were equally divided between ($< 30-40$) and ($< 40-50$) age groups. For carotid artery calcification, cases were found equally in (≤ 20), ($> 20-30$), ($< 40-50$) and ($< 50-60$) age groups. The case diagnosed with ethmoidal sinolith were belonged to ($> 20-30$) age group. Cases that could not be diagnosed were equally belonged to (≤ 20), ($> 20-30$) and ($< 40-50$) age groups. Frequency (n) of soft tissue calcifications in different age groups is shown in table (2).

Bilateral occurrence of calcifications was more than unilateral occurrence.

Calcified stylohyoid ligament was detected bilaterally in (94.2%) of cases with calcified SHL. While unilateral occurrence was found in (5.8%) cases. All unilateral cases occurred in the right side. Tonsilloliths was detected bilaterally in (39.3%) of cases of tonsilloliths; while unilateral occurrence was found in (60.7%). Distribution at right and left side was represented with (1:1.125) ratio. Sialoliths was detected bilaterally in (20.8%) while unilateral occurrence was found in (79.2%) of cases with sialoliths. Distribution at right and left side was represented with (1.1:1) ratio. Triticous cartilage calcification occurred bilaterally in (62.5%) of cases while unilaterally in (37.5%). Distribution at right and left side was represented with (2:1) ratio. Thyroid cartilage calcification occurred (100%) bilaterally. CAC was detected (100%) unilaterally with equal distribution at right and left side with (1:1) ratio. The only detected case of sinolith occurred at left side. Single occurrence of calcifications was more than multiple occurrence.

There was an excellent agreement between both observations which was statistically significant for the first and second observer. There was an excellent agreement between both observers (Kappa= 0.897) which was statistically significant (p value > 0.001).



Figure (1): 3D reconstruction of CBCT shows bilateral stylohyoid ligament calcification and connection with hyoid bone in a 20 years old female patient.

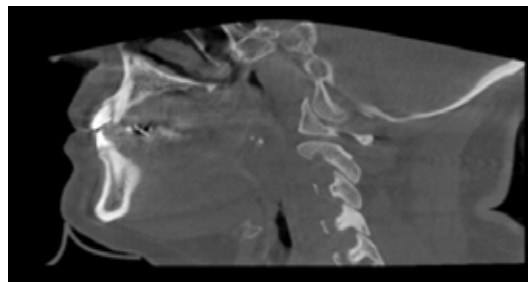


Figure (2): Tonsilloliths in a 40 years old female patient.

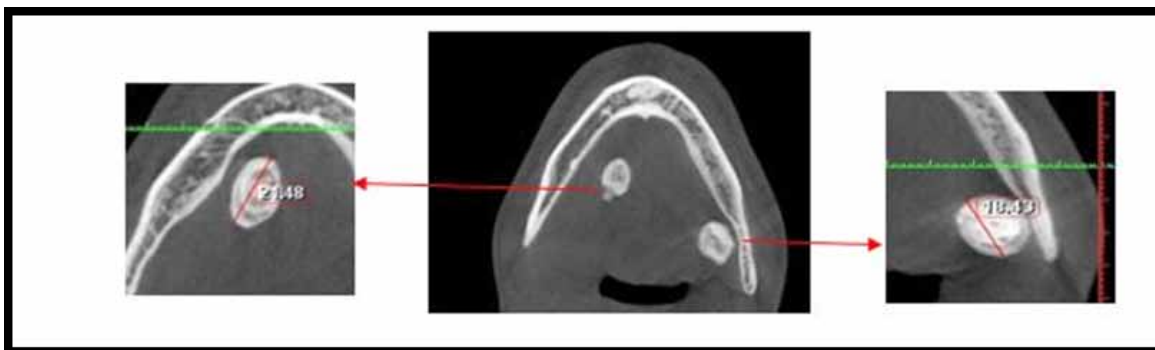


Figure (3): Axial cut CBCT shows bilateral submandibular megaliths medial to mandible. Both are of non-homogenous opacification. The linear measurement indicates that both are larger than (15mm) so considered megalith in a 35 years old male patient.

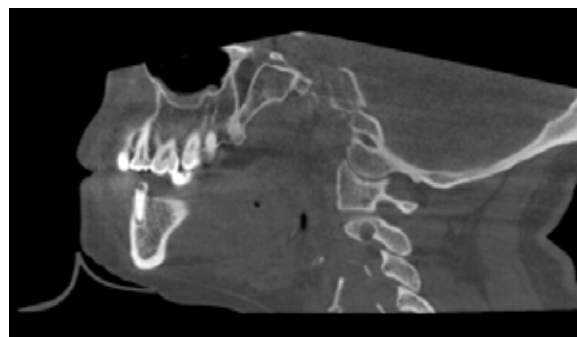


Figure (4): Sagittal cut CBCT shows perpendicular linear opacification inferior to the hyoid bone indicating thyroid cartilage calcification in a 34 years old female patient.

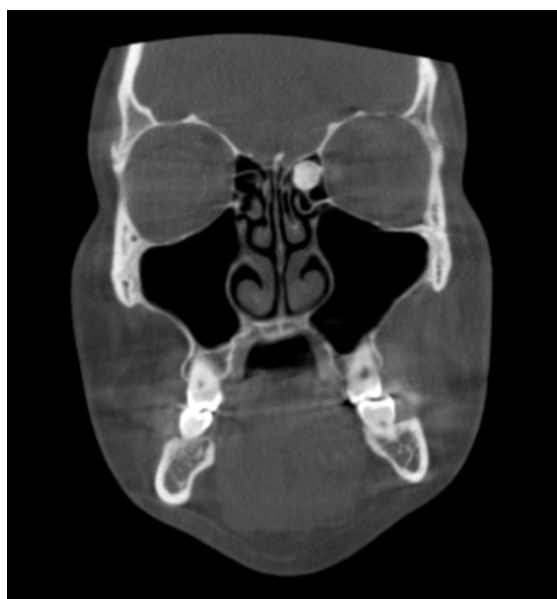


Figure (5): Coronal cut CBCT shows single round radiopacity in the ethmoidal sinus at the left side representing sinolith in a 23 years old female patient.

Table (1): Frequency (n) and percentage of calcifications of each type.

Calcification type	Frequency of calcifications	Percentage of patients in the whole sample (417)	Percentage of calcification in all (141)
Calcified stylohyoid ligament	69	16.55%	49%
Tonsillolith	28	6.71%	19.9%
Sialolith	24	5.76%	17%
Laryngeal cartilage calcification (Triticous)	8	1.92%	5.7%
Laryngeal cartilage calcification (Thyroid)	4	0.96%	2.8%
Carotid artery calcification	4	0.96%	2.8%
Ethmoidal Sinolith	1	0.24%	0.7%
Others	3	0.72%	2.1%
Total	141		100%

Table (2): Frequency (n) of soft tissue calcifications in different age groups.

STC (n=141)	Age group						Total
	≤ 20	> 20-30	> 30-40	> 40-50	> 50-60	> 60	
Calcified stylohyoid ligament	5	13	15	15	14	7	69
Tonsillolith	2	5	10	3	3	5	28
Sialolith	4	4	4	3	6	3	24
Laryngeal cartilage calcification (Triticous)	0	0	1	3	2	2	8
Laryngeal cartilage calcification (Thyroid)	0	0	2	2	0	0	4
Carotid artery calcification	1	1	0	1	1	0	4
Ethmoidal Sinolith	0	1	0	0	0	0	1
Others	1	1	0	1	0	0	3
Total	13	25	32	28	26	17	141

Discussion

Soft tissue calcifications can be incidental findings in radiographic examinations, such as panoramic radiographs or CBCT. Soft tissue calcifications are different in their anatomic location, shape, size, distribution, number, pattern of the calcification. These criteria are important factors in the radiographic interpretation of soft tissue radiopacities.^{3,16}

So that, dentists should identify, diagnose, treat or refer for treatment all pathological findings on radiographs. A combination of clinical, dental and radiographic examinations help to confirm most soft tissue calcifications and if needed additional radiographic method may be used to detect them.¹⁵

The prevalence of soft tissue calcification in our study was (22.54 %). (The prevalence in our study is much higher than Ramadurai and N. Umamaheswari, which showed Prevalence (1.75) and Vengalath et al., study which showed Prevalence (8%).^{7,8} This can reflect the superiority of CBCT with its 3D capability to detect and diagnose soft tissue calcifications over 2D panoramic radiographs used by them. While our results is close to Patil et al., study, which made a retrospective review on CBCT images of (624) patients and showed prevalence(25.48%).³

Calcified stylohyoid ligament had the highest prevalence value followed by tonsilloliths this matches with Diniz et al., study on CBCT images at which the calcified stylohyoid ligament had the highest prevalence(39.04%) then tonsilloliths with (19.52%).¹ In Diniz et al., study sialoliths showed prevalence (0.47%) within the whole sample.¹ which is much less comparing to our study calcified stylohyoid ligament is considered elongated if exceeded 30mm.

Also prevalence of laryngeal cartilage calcification in our study was less than Adam B. Wells, study at which tritricus cartilage calcification showed prevalence of (32.3%) and thyroid cartilage calcification showed prevalence (15%) within all detected calcification.⁹ As his study ensured that at least the 4th cervical vertebrae inferiorly are included in the selected scan this provided more numbers of scans that shows the area of laryngeal cartilages and in turn higher prevalence values. Regarding CAC, we detected 4 cases with (0.69%) prevalence within the whole sample. And this is considered less than Diniz et al., study which showed prevalence (4, 76%) within the whole sample.¹

Only one case in our study was detected with ethmoidal sinolith. The presence of sinolith in the ethmoidal sinus is very rare and only 5 cases in the English literature were documented with ethmoidal sinolith as mentioned by Sava and Rusu.¹⁶ Our case is considered the 6th one. There were 3 cases with uncertain final diagnosis as their radiographic features didn't resemble the radiographic criteria to any of the soft tissue calcifications. Absence of information about medical history, dental history and clinical examination of the patient made it harder to reach final diagnosis.

Regarding gender; although the frequency of females with calcifications was more than males, the prevalence within males was more than females because the sample includes females more than males. Some calcifications were seen only in females, we don't have certain justification for this. However, it was reported that women have been found to show greater percentage of carotid artery calcifications after menopause as the protective effect of female hormones is absent.^{3,8}

Calcified stylohyoid ligament and tonsilloliths detected bilaterally more than unilaterally as detected by Diniz et al.¹ The only detected ethmoidal sinolith occurred at left side. While the other (5) documented cases, (2) cases occurred at left side, (3) at right side.¹⁶

Conclusion

Soft tissue calcifications are not uncommon finding in the Egyptian population. So that, the dental radiologists should be aware enough of their presence. More than one type of calcifications could be present in one patient at the same time. This makes the broad evaluation of patients' scans necessary.

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Conflict of Interest: Nil.

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