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Incidental Soft Tissue Calcifications in Cone-Beam Computed Tomography Images: A Retrospective Study

Konik Işınlı Bilgisayarlı Tomografide Rastlantı Bulgusu Olarak Görülen Yumuşak Doku Kalsifikasyonları: Bir Retrospektif Çalışma

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This study was presented as orally in Oral Diagnosis and Maxillofacial Radiology Society 3rd International Congress, 25-28 April 2019, Antalya, Türkiye.

ABSTRACT Objective: It was aimed to retrospectively evaluate the soft tissue calcifications (STCs) in cone-beam computed tomography (CBCT) images. **Material and Methods:** CBCT images (Planmeca Romexis®, 3D Mid Planmeca Oy, Helsinki, Finland) of 1,566 patients (54.2% females; 45.8% males) were collected from the database of Department of Dentomaxillofacial Radiology. The hyperdense masses were examined. Patients with head and neck trauma or a history of surgery were excluded. If present, soft tissue calcifications were classified according to type, locations, distribution, age, and gender using descriptive statistics and chi-square tests. **Results:** Of the 1,566 patients, 390 (24.9 %) showed calcifications. The mean age of these patients was 47.3±16.1. The frequency of STCs was 48.7% in males and 51.3% in females. Tonsilloliths (53.6 %) were found to be common, followed by ossified stylohyoid ligament (29.5%), pineal gland calcification (3.6%) and sialolith (2.8%). No statistically significant differences were recorded between genders (p>0.05). STCs were detected either bilaterally (51.1%) or unilaterally (48.9%). The frequency of the STCs according to age groups: Tonsillolith was seen mostly in individuals older than 55-year-old (40.7%), whereas ossified stylohyoid ligament was seen in patients younger than 35-year-old (36.5%). **Conclusion:** STCs may often be incidentally diagnosed on CBCT images. Clinicians should recognize the characteristics of STCs, particularly regarding early diagnoses of certain systemic diseases.

Keywords: Physiologic calcification; calcinosis; cone-beam computed tomography; salivary gland calculi

ÖZET Amaç: Bu araştırmada konik ışınlı bilgisayarlı tomografi (KIBT) görüntülerinde rastlantı bulgusu olarak görülen yumuşak doku kalsifikasyonlarının retrospektif olarak değerlendirilmesi amaçlanmıştır. **Gereç ve Yöntemler:** Ağız, Diş ve Çene Radyolojisi ABD'nin arşivinde yer alan, Planmeca Promax 3D Mid ile alınmış (Planmeca Oy, Helsinki, Finlandiya) KIBT görüntülerinde (n=1.566, %54,2 kadın; %45,8 erkek) hiperdens olan kitlelerin varlığı retrospektif olarak incelenmiştir. Baş ve boyun travması veya operasyon hikâyesi olan hastalar çalışma dışı bırakılmıştır. Yumuşak doku kalsifikasyonları sınıflandırılarak, kalsifikasyonların çeşitleri, lokasyon ve dağılımları, yaş ve cinsiyetler arası farklar açısından betimleyici istatistiksel ve ki-kare testleri ile değerlendirilmiştir. **Bulgular:** Bin beş yüz altmış altı hastanın (yaş ortalamaları 47,3±16,1) 390'ında (%24,9) yumuşak doku kalsifikasyonuna rastlanmıştır. Yumuşak doku kalsifikasyonu sıklığı erkeklerde %48,7, kadınlarda %51,3 olup, en yaygın görülen kalsifikasyon ise tonsilit (%53,6) olarak tespit edilmiştir. Bunu styloid ligament ossifikasyonu (%29,5), epifiz bezi kalsifikasyonu (%3,6) ve siyalolit (%2,8) takip etmiştir. Cinsiyetler arasında istatistiksel olarak anlamlı farklılık saptanmamıştır (p>0,05). Yumuşak doku kalsifikasyonlarının %51,1'i bilateral, %48,9'u tek taraflı olarak tespit edilmiştir. Tonsilit en çok 55 yaş üstü bireylerde (%40,7), ossifiye styloid ligament ise 35 yaşından küçük hastalarda (%36,5) görülmüştür. **Sonuç:** KIBT görüntülerinde yumuşak doku kalsifikasyonları sıklıkla rastlantı bulgusu olarak izlenebilmektedir. Klinisyenlerin, erken tanı açısından sistemik hastalıklarla ilgili yumuşak doku kalsifikasyonları hakkında bilgi sahibi olmaları ve tanımaları gerekmektedir.

Anahtar Kelimeler: Fizyolojik kalsifikasyon; kalsinoz; konik ışınlı bilgisayarlı tomografi; tükürük bezi taşı

Bone calcium salts, mainly calcium phosphate, may occur in an unorganized way in soft tissues and are named as heterotopic ossification. Heterotopic calcifications are divided into three categories: Dystrophic, idiopathic and metastatic calcification. Calcifications in degenerated, diseased and dead tissue, despite normal serum calcium and phosphate levels, are referred to as dystrophic calcifications. In some

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cases, calcium accumulation may occur in normal tissue despite normal serum calcium and phosphate levels. Metastatic calcification usually occurs bilaterally when minerals precipitate into normal tissue as a result of higher than normal serum levels of calcium (e.g., hyperparathyroidism, malignancy) or phosphate (e.g., chronic renal failure).[1]

Soft tissue calcifications (STCs) are frequently observed in individuals aged 40 and over.[2,3] In maxillofacial region, heterotopic calcification or ossification may not cause significant signs or symptoms; they most often are detected as incidental findings during radiographic examination.[1-3]

When STCs are detected, the aim should be to diagnose the calcification/ossification and determine whether the treatment is required.[1,4] It is essential for radiological diagnosis to evaluate the calcifications/ossifications in terms of localization, shape, distribution, formation mechanism, and their etiology.[1] It is also of great importance to know the exact soft tissue anatomy.[2] If STCs/ossifications are adjacent to any bone tissue, it may not be easy to determine whether it is in bone or soft tissues. In such cases, the anamnesis and clinical examination should be detailed, and advanced imaging methods should be used.[1] Cone-beam computed tomography (CBCT) images are found to be valuable in examining the STCs.[5]

This retrospective study aimed to document the STCs as incidental CBCT findings and to evaluate their types, distributions and locations.

MATERIAL AND METHODS

This study was approved by Marmara University Faculty of Dentistry Clinical Research Ethics Committee (Protocol number: 2019-295). Informed consent was obtained from all individuals included in this retrospective study.

CBCT images of patients who applied to the Department of Oral and Maxillofacial Radiology between 2018-2020 with various complaints were examined from archive records. CBCT images of a total of 1566 patients (54.2% females; 45.8% males, 18-80 years old) with optimum diagnostic quality taken with Planmeca Promax 3D Mid (Planmeca Oy, Helsinki, Finland) were included in the study. Patients with head and neck trauma or a history of surgery were excluded. The isotropic voxel size of the images obtained was 0.2 mm^3, and the slice thickness is 0.2 mm. The maxillary and mandibular images taken with 16x16 cm field of view (FOV) were combined with the Planmeca Romexis 4.6.2.R program.

The STCs were classified as follows: tonsillolith; ossified stylohyoid ligament (OSL); pineal gland calcification (PGC); sialolith; antrolith; calcified carotid artery; phlebolith, calcified lymph node; intracranial calcification, rhinolith, myositis ossificans, and osteoma cutis. The present STC types were evaluated according to gender, locations, and age.

STATISTICAL ANALYSIS

Statistical package for Social Sciences (SPSS IBM, New York, USA) 25.0 software for Windows was used for statistical analysis. Descriptive statistical analysis and chi-square tests were used for statistical analysis and $p<0.05$ was considered statistically significant.

RESULTS

The incidence of STCs in 1,566 patients constituting the study group was 24.9% and the mean age of these patients was 47.3±16.1.

While the frequency of STCs was 48.7% in males and 51.3% in females, no statistically significant differences were found in the incidence of STCs in all patients with different calcification groups ($p>0.05$).

Figure 1 presents an overview of the distributions of STCs. Tonsilloliths (53.6%) were found to be common, followed by ossified stylohyoid ligament (29.6%), PGC (3.6%), and sialolith (2.8%). Tonsillolith was seen more frequently in males, whereas ossified stylohyoid ligament was seen more frequently in females (Table 1).

STCs were detected either bilaterally (51.1%) or unilaterally (48.9%). Unilaterally seen STCs were, tonsillolith, antrolith, OSL and PGC. OSL was observed bilaterally ($p<0.05$), (Table 2).

Table 3 shows the frequency of the STCs according to age groups: Tonsillolith was seen mostly in individuals older than 55-year-old (40.7%),

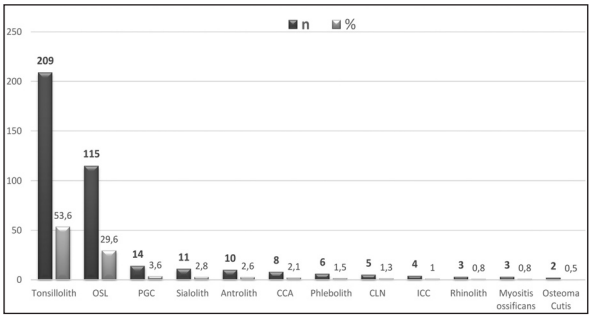

FIGURE 1: Descriptive analysis of soft tissue calcifications (decreasing sequence). **OSL:** Ossified stylohyoid ligament; PGC: Pineal gland calcification; **CCA:** Calcified carotid artery; **CLN:** Calcified lymph node; **ICC:** Intracranial calcification.

whereas OSL was seen in patients younger than 35-year-old (36.5%).

Exemplary STC cases were shown in Figure 2 and Figure 3.

DISCUSSION

STCs can be defined as pathologies consisting of mineral deposits that can be seen as an incidental finding on routine radiological images without causing any clinical complaints. STCs are mainly incidental findings in CBTC images requested by other

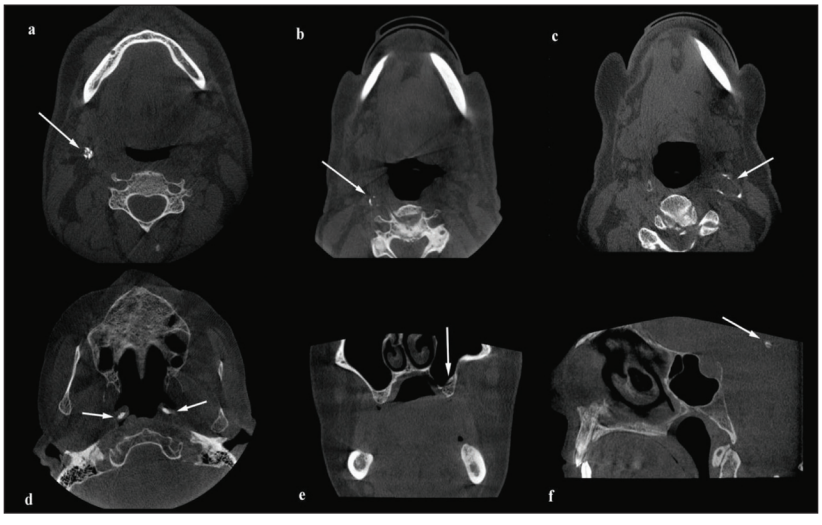

FIGURE 2: Exemplar soft tissue calcification cases are shown with arrows in cone-beam computed tomography images: **a)** Calcified lymph node; **b)** Calcified carotid artery; **c)** Phlebolith; **d)** Tubal tonsilloliths; **e)** Antrolith; **f)** Pineal gland calcification.

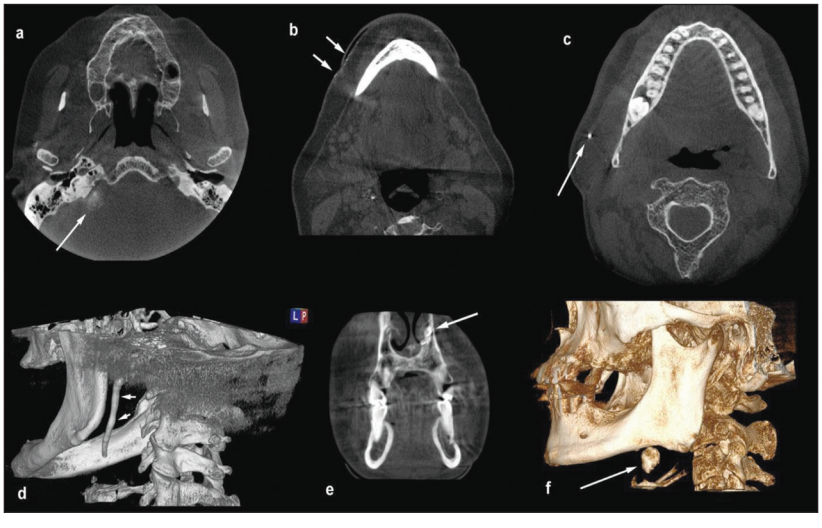

FIGURE 3 Exemplar soft tissue calcification cases are shown with arrows in cone-beam computed tomography images and 3D reconstruction: **a)** Intracranial calcification; **b)** Osteoma cutis; **c)** Myositis ossificans; **d)** Ossified stylohyoid ligament; **e)** Rhinolith; **f)** Sialolith.

TABLE 1: Distribution of STCs according to gender, and evaluation by chi-square test.

	Male [n=190; (48.7%)]				Female [n=200; (51.3%)]				
	Absence		Presence		Absence		Presence		
STC (total n=390)	n	%	n	%	n	%	n	%	p value
Tonsillolith	83	43.7	107	56.3	98	49	102	51	0.293
OSL	139	73.2	51	26.8	136	68	64	32	0.264
PGC	186	97.9	4	2.1	190	95	10	5	0.206
Sialolith	183	96.3	7	3.7	196	98	4	2	0.485
Antrolith	184	96.8	6	3.2	196	98	4	2	0.534
CCA	187	98.4	3	1.6	195	97.5	5	2.5	0.724
Phlebolith	186	97.9	4	2.1	198	99	2	1	0.439
CLN	188	98.9	2	1.1	197	98.5	3	1.5	1
ICC	189	99.5	1	0.5	197	98.5	3	1.5	0.624
Rinolith	188	98.9	2	1.1	199	99.5	1	0.5	0.615
Myositis ossificans	189	99.5	1	0.5	198	99	2	1	1,000
Osteoma cutis	188	98.9	2	1.1	200	100	0	0	0.146

TABLE 2: Distribution of STCs according to gender, and evaluation by chi-square test.

	Unilateral [n=191; (48.9%)]				Bilateral [n=199; (51.1%)				
	Absence		Presence		Absence		Presence		
STC (total n=390)	n	%	n	%	n	%	n	%	p value
Tonsillolith	72	37.7	119	62.3	109	54.8	90	45.2	**0.001***
OSL	171	89.5	20	10.5	104	52.3	95	47.7	**<0.001***
PGC	177	92.7	14	7.3	199	100	0	0	**<0.001*****
Sialolith	182	95.3	9	4.7	197	99	2	1	0.057
Antrolith	182	95.3	9	4.7	198	99.5	1	0.5	**0.009****
CCA	189	99	2	1	193	97	6	3	0.285
Phlebolith	189	99	2	1	195	98	4	2	0.685
CLN	186	97.4	5	2.6	199	100	0	0	**0.027****
ICC	187	97.9	4	2.1	199	100	0	0	0.057
Rhinolith	188	98.4	3	1.6	199	100	0	0	0.117
Myositis ossificans	188	98.4	3	1.6	199	100	0	0	0.117
Osteoma cutis	190	99.5	1	0.5	198	99.5	1	0.5	1,000

*Pearson chi-Square; **Fisher's exact test; ***Continuity correction; STC: Soft tissue calcification; OSL: Ossified stylohyoid ligament; PGC: Pineal gland calcification; CCA: Calcified carotid artery; CLN: Calcified lymph node; ICC: Intracranial calcification.

dentomaxillofacial reasons; while the clinical importance of some cases is insignificant, several cases are life-threatening entities. Therefore, the importance of prevalence and further knowledge of STC type is crucial for dental practitioners requesting these images.[1] The present study assessed the incidence and distributions of STCs using CBCT images with a standardized (FOV).

Several studies conducted by CBCT images have reported various data on the prevalence of STCs in different populations. Previous STC studies carried out by panoramic radiography or by CBCT examinations with restricted FOV reported variable data.[2,6,7] In this study, the incidence of STCs was found as 24.9%; compared to 15-62.6% in Brazilian, 25.9% in Iranian, 25.48% in Saudi Arabian, and 6.4-36.4% in previous Turkish studies.[8-14] The difference between the current study in terms of incidence may be attributed to radiological examination methods used in the previous studies.

TABLE 3: Prevalence of STCs according to age group.

	Age groups					
	<35	35-44	45-54	≥55	Total	
STC	n (%)	n (%)	n (%)	n (%)	n (%)	p value
Tonsillolith	38 (18.2)	42 (20.1)	44 (21.1)	85 (40.7)	209 (100)	0.082
OSL	42 (36.5)	25 (21.7)	16 (13.9)	32 (27.8)	115 (100)	**<0.001***
PGC	3 (21.4)	3 (21.4)	2 (14.3)	6 (42.9)	14 (100)	0.944
Sialolith	1 (9.1)	2 (18.2)	3 (27.3)	5 (45.5)	11 (100)	0.687
Antrolith	5 (50)	0 (0)	3 (30)	2 (20)	10 (100)	0.09
CCA	0 (0)	0 (0)	2 (25)	6 (75)	8 (100)	0.089
Phlebolith	0 (0)	0 (0)	1 (16.7)	5 (83.3)	6 (100)	0.116
CLN	1 (20)	1 (20)	0 (0)	3 (60)	5 (100)	0.642
ICC	0 (0)	1 (25)	1 (25)	2 (50)	4 (100)	0.745
Rhinolith	1 (33.3)	0 (0)	2 (66.7)	0 (0)	3 (100)	0.156
Myositis ossificans	0 (0)	0 (0)	3 (100)	0 (0)	3 (100)	**0.006***
Osteoma cutis	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)	0.349
Total n (%)	91 (23.3)	74 (19)	77 (19.7)	148 (37.9)	390 (100)	

*Pearson chi-square; STC: Soft tissue calcification; OSL: Ossified stylohyoid ligament; PGC: Pineal gland calcification; CCA: Calcified carotid artery; CLN: Calcified lymph node; ICC: Intracranial calcification.

Panoramic radiographs have some limitations such as magnification, superposition and distortion. When compared to two-dimensional panoramic radiographs, three-dimensional CBCT images provide valuable information and superior findings.[15,16] Various findings were revealed in previous STCs studies conducted with panoramic radiographic and CBCT imaging methods. In a retrospective study of Yeşilova and Bayrakdar, peripheral/internal characteristics and the dimensions of calcifications between two imaging modalities were found synchronised.[17] However, Ozdede et al. highlighted that tonsilloliths larger than 2 mm were more likely to be detected on panoramic radiographic images.[18]

Several studies reported STC differences between genders. Altındağ et al. reported that males STCs were twice as high than females.[19] In contrast, Patil et al. and Çakmak et al. showed that STCs were more often in females.[11,14] This study was in line with their finding with a 51.3% STC incidence in females.

In CBCT studies, Khojastepour et al. and Çakmak et al. mostly showed the unilateral pattern of STCs (62.8%, 69.2% respectively).[10,14] The pattern of STCs of the present study was consistent with those observed in earlier studies.

STCs/ossifications are often observed in individuals ≥40-year-old, only a few studies reported the presence of STCs in children.[2,3] Nunes et al. and Çakmak et al. found a high prevalence of calcification in middle-aged individuals.[8,14] In accordance with previous studies of Missias et al. and Khojastepour et al., the highest number of patients with STCs was found in ≥55-year-old group in the present study.[9,10]

Takahashi et al. retrospectively examined 8,133 CT images taken from the head and neck region for various reasons and reported that the prevalence of tonsillolith was 39.9%.[20] Altındağ et al. assessed the 691 CBCT images and reported the frequency of tonsillolith as 86.03%.[19] In this study, in which CBCT images of 1,566 patients were evaluated, tonsillolith was the most common calcification with a frequency of 53.6%, although this frequency was higher than the findings of Takahashi et al. and lower than the findings of Altındağ et al., similar to their reports, tonsillolith was more common in males and also in advanced age groups.[19,20] When the tonsillolith was evaluated according to having uni- or bilateral pattern, 56.9% of 209 tonsillolith cases were detected as unilateral.

In a previous study, Öztaş et al. scanned the 2,000 panoramic radiographs and stated that the frequency of stylohyoid ligament ossification was

67.5% and it was more common between the ages of 50-59.[21] Contrary to their findings, the frequency of stylohyoid ligament ossification was found to be 29.6% with a 82.6% bilateral pattern and it was more common in patients aged less than 35-year-old.

Intracranial calcifications can be physiological or pathological due to mineral (e.g. calcium) or metal (e.g. iron) accumulation in blood vessels, glands, cortices or other structures within the brain.[22] The prevalence of intracranial calcification varied among studies. This inconsistency may be due to the imaging methods or FOV of the CBCTs. This study recorded the prevalence as 1%. Although the frequency of intracranial calcification differs from previously published studies of Yalçın et al. (11.7 %) and Barhgan et al. (23.1%), it was consistent with the finding of Altındağ et al. which was 0.42%.[12,19,23]

As an intracranial region calcification, PGC was evaluated as a separate group in the present study. In the retrospective studies/reviews of Allareddy et al. and Pette et al. the frequencies of PGC were recorded varying from 14.7 to 19.2%, and our PGC frequency (3.6%) was found to be lower than findings.[24,25]

Sialoliths are calcified structures, and they may be found frequently in the salivary glands as the most common soft tissue pathologies and males are affected twice more than females.[1,26] Although it can be seen at any age, it is frequently observed in the 4th, 5th and 6th decades. In line with previous reports, this study showed that sialoliths were more frequent in males than females with a 2:1 ratio.[27] Of the sialolith cases, 81.8% were bilateral and 45.5% were found in patients aged >55.

The accumulation of salts such as calcium phosphate and calcium carbonate in the nasal cavity and maxillary sinuses form the rhinolith and antrolith.[1] In previous studies, Yalçın et al. and Riberio et al. showed lower rhinolite frequency (0.2%).[7,12] Cho et al. scanned 13,946 CBCT images and they reported the prevalence of antroliths as 0.99%.[28] In the present study, the frequencies of rhinolite and antrolith were found to be 0.8 and 2.6%, respectively.

Degeneration and loss of elastic fiber in the arteries cause deposition of calcium in the vessel's medial coat and as a result, calcifications are observed.[1] In the study of Patil et al., artery calcification prevalence was stated as 31.4%.[11] Contrary to their findings, Altındağ et al. indicated the frequency of carotid artery calcification as 1.7%.[19] Our finding regarding artery calcification (2.1%) was consistent with the report of Altındağ et al. as being more common, particularly in older age groups (≥55).[19] The discrepancy among different investigations could be attributed to the mean age of examined groups.

Calcified thrombus found in veins, venules or sinusoidal vessels of hemangiomas are named as phleboliths.[1] Although Patil et al. stated the frequency of calcified thrombus as 8.1%, the present study showed a lower prevalence (1.5%) and this was slightly higher than the study of Missias et al. showing a 0.4% prevalence.[9,11] In accordance with previous reports, phleboliths were observed more frequently in older age groups.

Various diseases, frequently granulomatous disorders cause dystrophic calcifications in chronically inflamed lymph nodes. Lymph node calcifications may affect a single node or a linear series of nodes.[1] Patil et al. examined 159 CBCT with STCs, and the prevalence of lymph node calcifications was identified as 3.7%.[11] Although the number of patients was higher (STC n=390) in this study, the frequency of lymph node calcifications was found as 1.3%.

The formation of bone and cartilage tissue within the skeletal muscle is called myositis ossificans. It is seen in the masseter, temporal and pterygoid muscles in the evaluation of the maxillofacial region.[29] In the recent CBCT study of Yalçın et al., 7 (1.34%) out of 520 STC cases were defined as myositis ossificans.[12] Yet, we observed only 3 (0.8%) unilateral myositis ossificans cases which were in the 45-54 age group.

Osteoma cutis, a rare STC, occurs as a result of focal bone development in the skin or subcutaneous tissues.[1] In the CBCT analyses of Altındağ et al., Yalçın et al. and Pekince et al., the frequencies of osteoma cutis were found as 2.33%, 2.88%, and 6.9% respectively.[12,19,30] In contrast to their findings, there were only 2 (0.5%) older male patients with osteoma cutis in this study.

Dacryolith, cysticercosis, laryngeal cartilage calcifications and metastatic calcifications were not detected in CBCT. Cysticercosis occurs as a result of the death and subsequent calcification of the larvae of the *Taenia Solium* parasite in organs such as the brain, muscle, skin, liver, lung and heart.[1] This is more common in communities with pork consumption and it synchronizes with the traditional food habits of the studied populations.

This study assessed the prevalence of STCs in scanned 1,560 CBCT images with the standard FOV sizes. The distribution of 390 cases showed the current trends of STCs. While some of these calcifications have been reported to be of no clinical significance, some of them may cause life-threatening issues.[10,31] The number of the patients aged over 55 was 148 (37.9%) and this was a limitation. The larger number of subgroups (i.e. older patients) might make the presence of life-threatening calcifications more frequent. A further study focusing on the older population is therefore suggested.

CONCLUSION

Based on the obtained results of this research, tonsillolith was the most frequently observed calcification whereas osteoma cutis was the least. Life-threatening calcifications, which the patient is unaware of, should be referred to a specialist. Although many cases do not require treatment, it should be kept in mind that STCs should not be overlooked, particularly in CBCT examinations. Physicians who frequently encounter STCs should know their locations and importance. A greater focus on elderly populations could produce interesting findings that account more for life-threatening calcifications.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Nuran Bayramov, Şebnem Erçalık Yalçınkaya;* ***Design:*** *Nuran Bayramov;* ***Control/Supervision:*** *Şebnem Erçalık Yalçınkaya;* ***Data Collection and/or Processing:*** *Nuran Bayramov, Asel Üsdat Öztürk;* ***Analysis and/or Interpretation:*** *Nuran Bayramov, Şebnem Erçalık Yalçınkaya;* ***Literature Review:*** *Nuran Bayramov, Asel Üsdat Öztürk, Şebnem Erçalık Yalçınkaya;* ***Writing the Article:*** *Nuran Bayramov, Asel Üsdat Öztürk, Şebnem Erçalık Yalçınkaya;* ***Critical Review:*** *Şebnem Erçalık Yalçınkaya;* ***References and Fundings:*** *Nuran Bayramov.*

REFERENCES

1. Carter LC. Soft Tissue Calcification and Ossification. White SC, Pharoah MJ, eds. Oral Radiology: Principles and Interpretation. 6th ed. St. Louis, Mo: Elsevier; 2009. p.526-40. [Link]
2. Garay I, Netto HD, Olate S. Soft tissue calcified in mandibular angle area observed by means of panoramic radiography. Int J Clin Exp Med. 2014;7(1):51-6. [PubMed] [PMC]
3. Thakur JS, Minhas RS, Thakur A, Sharma DR, Mohindroo NK. Giant tonsillolith causing odynophagia in a child: a rare case report. Cases J. 2008;1(1):50. [Crossref] [PubMed] [PMC]
4. Keberle M, Robinson S. Physiologic and pathologic calcifications and ossifications in the face and neck. Eur Radiol. 2007;17(8): 2103-11. [Crossref] [PubMed]
5. Howerton WB Jr, Mora MA. Use of conebeam computed tomography in dentistry. Gen Dent. 2007;55(1):54-7;quiz 58, 79-80. [PubMed]
6. Monsour PA, Romaniuk K, Hutchings RD. Soft tissue calcifications in the differential diagnosis of opacities superimposed over the mandible by dental panoramic radiography. Aust Dent J. 1991;36(2):94-101. [Crossref] [PubMed]
7. Ribeiro A, Keat R, Khalid S, Ariyaratnam S, Makwana M, do Pranto M, et al. Prevalence of calcifications in soft tissues visible on a dental pantomogram: a retrospective analysis. J Stomatol Oral Maxillofac Surg. 2018; 119(5): 369-74. [Crossref] [PubMed]
8. da Silva Nunes LF, Santos KCP, Junqueira JLC, Oliveira JX. Prevalence of soft tissue calcifications in cone beam computed tomography images of the mandible. Rev Odonto Cienc. 2010;26(4):297-303. [Crossref]
9. Missias EM, Nascimento E, Pontual M, Pontual AA, Freitas DQ, Perez D, et al. Prevalence of soft tissue calcifications in the maxillofacial region detected by cone beam CT. Oral Dis. 2018;24(4):628-37. [Crossref] [PubMed]
10. Khojastepour L, Haghnegahdar A, Sayar H. Prevalence of Soft Tissue Calcifications in CBCT Images of Mandibular Region. J Dent Shiraz Univ Med Sci. 2017;18(2):88-94. [PMC]

11. Patil SR, Alam MK, Moriyama K, Matsuda S, Shoumura M, Osuga N. 3D CBCT assessment of soft tissue calcification. J Hard Tissue Biol. 2017;26(3):297-300. [Crossref]
12. Yalcin ED, Ararat E. Prevalence of soft tissue calcifications in the head and neck region: a cone-beam computed tomography study. Niger J Clin Pract. 2020;23(6):759-63. [Crossref] [PubMed]
13. Icoz D, Akgunlu F. Prevalence of detected soft tissue calcifications on digital panoramic radiographs. SRM J Res Dent Sci. 2019;10(1):21-5. [Crossref]
14. Kurşun Çakmak EŞ, Bayrak S, Atakan C. Prevalence and characteristics of soft tissue calcifications in Cbct images of mandibular region. Clin Exp Heal Sci. 2020;1(4):68-71. [Crossref]
15. Mısırlıoglu M, Nalcaci R, Adisen MZ, Yardımcı S. Bilateral and pseudobilateral tonsilloliths: three dimensional imaging with cone-beam computed tomography. Imaging Sci Dent. 2013;43(3):163-9. [Crossref] [PubMed] [PMC]
16. Scarfe WC, Farman AG, Sukovic P. Clinical applications of cone-beam computed tomography in dental practice. J Can Dent Assoc. 2006;72(1):75-80. [PubMed]
17. Yeşilova E, Bayrakdar İŞ. Radiological evaluation of maxillofacial soft tissue calcifications with cone beam computed tomography and panoramic radiography. International Journal of Clinical Practice. 2021;75(5):e14086. [Crossref] [PubMed]
18. Ozdede M, Akay G, Karadag O, Peker I. Comparison of panoramic radiography and cone-beam computed tomography for the detection of tonsilloliths. Med Princ Pract. 2020;29(3): 279-84. [Crossref] [PubMed] [PMC]
19. Altındağ A, Avsever H, Borahan O, Akyol M, Orhan K. Incidental findings in cone-beam computed tomographic images: calcifications in head and neck region. Balk J Dent Med. 2017; 1(2):100-7. [Crossref]
20. Takahashi A, Sugawara C, Kudoh T, Uchida D, Tamatani T, Nagai H, et al. Prevalence and imaging characteristics of palatine tonsilloliths detected by CT in 2,873 consecutive patients. Sci World J. 2014;2014:4-8. [Crossref] [PubMed] [PMC]
21. Öztaş B, Orhan K. Investigation of the incidence of stylohyoid ligament calcifications with panoramic radiographs. J Investig Clin Dent. 2012;3(1):30-5. [Crossref] [PubMed]
22. Sedghizadeh PP, Nguyen M, Enciso R. Intracranial physiological calcifications evaluated with cone beam CT. Dentomaxillofac Radiol. 2012;41(8):675-8. [Crossref] [PubMed] [PMC]
23. Barghan S, Tahmasbi Arashlow M, Nair MK. Incidental findings on cone beam computed tomography studies outside of the maxillofacial skeleton. Int J Dent. 2016;2016:9196503. [Crossref] [PubMed] [PMC]
24. Allareddy V, Vincent SD, Hellstein JW, Qian F, Smoker WR, Ruprecht A. Incidental findings on cone beam computed tomography images. Int J Dent. 2012;2012:871532. [Crossref] [PubMed] [PMC]
25. Pette GA, Norkin FJ, Ganeles J, Hardigan P, Lask E, Zfaz S, et al. Incidental findings from a retrospective study of 318 cone beam computed tomography consultation reports. Int J Oral Maxillofac Implants. 2012;27(3):595-603. [PubMed]
26. Odell EW, Cawson RA. Cawson's essentials of oral pathology and oral medicine. 9th ed. Edinburgh: Elsevier; 2017. p.341. [Link]
27. Lustmann J, Regev E, Melamed Y. Sialolithiasis. A survey on 245 patients and a review of the literature. Int J Oral Maxillofac Surg. 1990;19(3):135-8. [Crossref] [PubMed]
28. Cho BH, Jung YH, Hwang JJ. Maxillary antroliths detected by cone-beam computed tomography in an adult dental population. Imaging Sci Dent. 2019;49(1):59-63. [Crossref] [PubMed] [PMC]
29. Harorlı A. Ağız, Diş ve Çene Radyolojisi. 1. Baskı. İstanbul: Nobel Tıp Kitabevleri; 2014. [Link]
30. Pekince A, Azlağ Pekince K, Çağlayan F, Sümbüllü MA. Determination of frequency of osteoma cutis in maxillofacial region by dental volumetric tomography. Turkiye Klinikleri J Dental Sci. 2019;25(3):248-53. [Crossref]
31. MacDonald D, Chan A, Harris A, Vertinsky T, Farman AG, Scarfe WC. Diagnosis and management of calcified carotid artery atheroma: dental perspectives. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012;114(4):533-47. [Crossref] [PubMed]