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Evaluation of Soft Tissue Calcifications in the Head and Neck Region on Panoramic Radiography of Edentulous Patients

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ABSTRACT

Aim: The aim of this study is to determine the types and incidence of soft tissue calcifications observed on panoramic radiographs of edentulous patients.
Material and methods: A total of 1297 panoramic radiographs of edentulous patients who applied to Fırat University School of Dentistry for different reasons between 2013 and 2022 and had a consent form were evaluated retrospectively. 131 radiographs with magnification and positioning errors were not included. Calcifications were classified according to localization, number, structure, shape and appearance. IBM SPSS Statistics 22 program was used for statistical analysis. Compatibility of the parameters with normal distribution was evaluated with the Kolmogorov-Smirnov test. In addition to descriptive statistical methods; Mann-Whitney U, Chi-Square, Fisher's Exact Chi-Square, Kruskal Wallis tests and Continuity (Yates) Correction were used. Significance was evaluated at $p<0.05$.
Results: A total of 1166 panoramic radiographs (539 female, 627 male) were examined and soft tissue calcifications were detected in 274 patients (23.5%). The ages of patients with calcification range from 36 to 88; 146 (53.3%) were male and 128 (46.8%) were female. The mean age was 64.45±9.06 years. Tonsillolith in 17.5%, carotid artery calcification in 10.6%, lymph node calcification in 4.8%, triticeous cartilage calcification in 2.1%, antrolith in 0.9%, rhinolith in 0.7%, sialolith in 0.4% and phleboliths were detected in only one patient (0.08%) of all cases.
Conclusion: The diagnosis of soft tissue calcifications by dentists and their differentiation from anatomical structures and pathologies are very crucial. In this way, it is possible to prevent unnecessary examinations and treatments and also to refer patients for further examinations when necessary.

Total Dişsizlik Durumunda Baş ve Boyun Bölgesindeki Yumuşak Doku Kalsifikasyonlarının Panoramik Radyografi Aracılığıyla Değerlendirilmesi

Makale Bilgisi

Makale Geçmişi

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Anahtar Kelimeler:
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ÖZET

Amaç: Bu çalışmanın amacı dişsiz hastaların panoramik radyografilerinde görülen yumuşak doku kalsifikasyonlarının tipini ve görülme sıklığını belirlemektir.
Gereç ve yöntemler: 2013-2022 yılları arasında Fırat Üniversitesi Diş Hekimliği Fakültesi'ne farklı nedenlerle başvuran ve onam formu bulunan dişsiz hastalara ait toplam 1297 panoramik radyografi retrospektif olarak değerlendirildi. Magnifikasyon ve pozisyonlandırma hatası olan 131 radyografi çalışmaya dahil edilmedi. Kalsifikasyonlar lokalizasyon, sayı, yapı, şekil ve görünümlerine göre sınıflandırıldı. İstatistiksel analiz için IBM SPSS İstatistik 22 programı kullanıldı. Kolmogorov-Smirnov testi ile parametrelerin normal dağılıma uygunluğu değerlendirildi. Tanımlayıcı istatistiksel yöntemlerin yanı sıra Kruskal Wallis, Mann-Whitney U, Ki-Kare, Fisher's Exact Ki-Kare testleri ve Süreklilik (Yates) Düzeltmesi kullanıldı. $P<0,05$ anlamlı olarak kabul edildi.
Bulgular: Toplam 1166 panoramik radyografi (539 kadın, 627 erkek) incelendi ve 274 hastada (%23,5) yumuşak doku kalsifikasyonu tespit edildi. Kalsifikasyonu bulunan hastaların yaşları 36 ile 88 arasında değişmekte olup 146'sı (%53,3) erkek, 128'i (%46,8) kadındı. Ortalama yaş 64,45±9,06 olarak bulundu. Tonsillolit %17,5, karotid arter kalsifikasyonu %10,6, lenf nodu kalsifikasyonu %4,8, tritiseöz kıkırdak kalsifikasyonu %2,1, antrolit %0,9, rinolit %0,7, sialolit %0,4 ve sadece bir hastada (%0,08) flebolit tespit edildi.
Sonuç: Diş hekimleri tarafından yumuşak doku kalsifikasyonlarının teşhisi ve anatomik yapı ve patolojiler ile ayırıcı tanısının yapılması oldukça önemlidir. Bu sayede gereksiz tetkik ve tedavilerin önüne geçilebileceği gibi gerekli durumlarda da hastaların ileri tetkikler için yönlendirilmesi mümkün olacaktır.

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INTRODUCTION

Complete edentulism is a marasmic and irreversible situation and defined as the "last marker of disease burden" for oral health. This condition is an important public health problem for the elderly population and a possible threat for the young population through affecting primary healthcare services.[1] Edentulism is known to have negative effects on oral health as well as functional, psychologic and social limitations, systemically.[1-3] While the complete edentulism have been decreasing in all age groups in many Western countries over the last 20 years; the situation is exactly the opposite and it is still increasing in less developed countries.[4,5] Abnormalities in edentulous jaws are often overlooked because most of the time they do not cause clinical signs and symptoms A detailed radiological examination should be performed in these patients and normal anatomical formations, foreign bodies, pathological lesions such as cysts and tumors, impacted teeth and roots should be evaluated.[6] The prevalence of soft tissue calcifications is quite common and it is important to diagnose them correctly to differentiate benign lesions from pathologies.[7] Considering the rate of edentulous patients in the general population, detection of these findings is essential for successful dental treatment.

Panoramic radiography (PR) maintains its place as the most important imaging method used in the diagnosis and treatment planning of many oral and maxillofacial diseases in dentistry practice, under favour of its advantages such as low radiation dose, ease of application, low cost and easy accessibility.[8] Soft tissue calcifications (STCs), which occur with the precipitation of calcium salts, are generally asymptomatic radiopaque formations observed on PR images during routine dental examination. In the presence of STC, identification of calcification, differentiation from anatomical variations or pathological formations and the need for treatment must be determined. It is the responsibility of dentists to diagnose STCs which superimposed on anatomical structures, to make a differential diagnosis with dental anomalies, bone lesions, foreign bodies and artifacts and also normal anatomical entities that give a radiopaque appearance.[9,10]

Calcified lymph nodes, tonsilloliths, cysticercosis and arterial calcifications are dystrophic calcifications that give a radiopaque appearance in the head and neck region and are usually asymptomatic. Lymph node calcification, which is often occurs in the submandibular, deep and superficial cervical lymph nodes, is located in the angulus mandible, below or above the lower edge or superimposed on the mandible. Rarely, it can be seen as a single or multiple chains in between the posterior ramus and the cervical vertebra. Radiographically, it has an irregular shape with distinct borders and often a cauliflower-like appearance. Radiopacity may occur to varying degrees in different parts of the lesion and in this case it exhibits a layered appearance called ‘‘eggshell calcification’’. Tonsilloliths or tonsil stones are calcified deposits that generally form on tonsillar crypts unilateral or bilaterally in older individuals, seen as multiple, ill-defined, small radiopaque entities of varying sizes which superimposed on the middle parts of the ramus. It rarely reaches large sizes, and its density is close to the cortical bone.[8,9] Carotid artery calcifications occur in the damaged endothelium of the intima layer of the vessels. They are observed as numerous calcifications with a heterogeneous, irregular structure in the soft tissue in the postero-inferior aspect of the angulus mandible at the C4 intervertebral level.[7] Sialolith, antrolith, rhinolith, dacryolith, phlebolith and laryngeal calcifications detected in the head and neck region can be listed as idiopathic calcifications.[9,11] Submandibular sialoliths are seen superimposed on the

mandibular corpus or below, mesial to the angulus of the mandibula above the level of the hyoid bone. While the sialoliths localized in the duct are cylindrical and smooth-surfaced; those localized within the gland are large and irregularly bordered. Sialoliths originating from the parotid gland are superimposed on the superior 1/3 part of the ramus or located anterior or posterior to the ramus. They can be seen superimposed on the roots of premolar and molar teeth on periapical radiographs.[11] Antroliths are generally found on the sinus floor in the form of a regular/irregular structure, unilateral or bilateral, single or multiple radiopacities. Radiographically, the integrity of the sinus walls is generally intact. Rhinolith (nasal calculus) is seen as a well-circumscribed, flat or irregular, usually single radiopaque mass within the nasal fossa.[11] Phleboliths are commonly seen in the buccal mucosa, lips, salivary glands, mental and masseter region and they appear as numerous, round or oval, bull's eye or target-like appearance radiographically.[8,9]

The objective of this study is to determine the types and frequency of soft tissue calcifications that are encountered incidentally and can often be overlooked in panoramic radiographs of edentulous patients which taken for diagnostic and therapeutic reasons.

MATERIALS AND METHODS

1297 digital panoramic radiographs of edentulous patients who applied to Fırat University School of Dentistry for different reasons between 2013 and 2022 and had a consent form were evaluated retrospectively. All images had been taken using a panoramic radiographic system (Planmeca ProMax 3D mid, Planmeca OY, Helsinki, Finland) with the exposure settings of 10 mA, 85 kVp, and 14 sec. All examinations and measurements were made together under soft light by two dentists, a specialist and a research assistant. The length measurement tool and magnifying glass feature in the existing software (Metasoft) were used. 131 PRs with magnification and positioning errors were not included. The age and gender were recorded based on the Metasoft system. Calcifications were classified according to localization, number, structure, shape and appearance.

Statistical Analysis

IBM SPSS Statistics 22 program was used for statistical analysis. Compatibility of the parameters with normal distribution was evaluated with the Kolmogorov-Smirnov test. In addition to descriptive statistical methods (minimum, maximum, mean, standard deviation, median, frequency), the Kruskal Wallis test was used for comparisons between more than two groups of parameters that did not show normal distribution in comparing quantitative data and the Mann-Whitney U test was used for comparisons between two groups. Chi-Square, Fisher's Exact Chi-Square tests and Continuity (Yates) Correction were used to compare qualitative data. Significance was evaluated at $p<0.05$.

RESULTS

PRs of a total 1166 patients (539 female, 627 male) were evaluated and STCs were detected in 274 patients (23.5%). The ages of patients with calcification range from 36 to 88; 146 (53.3%) were male and 128 (46.8%) were female. The mean age was 64.45±9.06 years. Tonsillolith in 17.5%, carotid artery calcification in 10.6%, lymph node calcification in 4.8%, triticeous cartilage calcification in 2.1%, antrolith in 0.9%, rhinolith in 0.7%, sialolith in 0.4% and phleboliths were detected in only one patient (0.08%) of all cases (Table 1).

Among the 274 patients with calcification, 51.5% had one type of calcification, 39.4% had two types of calcification, 8.4% had three types of calcification and 0.7% had four types of calcification. The total calcification type ranged from 1 to 4, the average was 1.58±0.67 and the median was 1 (Figure 1).

Table 1: Prevalence of Soft Tissue Calcifications

Calcification Type	n	%
Carotid Artery Calcifications	124	10.6
Tritiseous Cartilage Calcifications	25	2.1
Tonsilloliths	204	17.5
Lymph Node Calcifications	56	4.8
Antroliths	11	0.9
Phleboliths	1	0.08
Rinoliths	8	0.7
Sialoliths	5	0.4

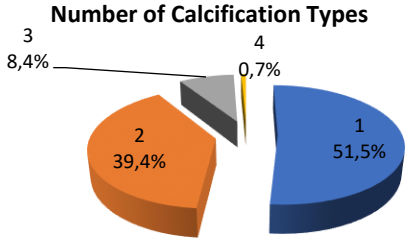

Figure 1: Prevalence of the number of calcification types

Among patients with calcification, the rate of carotid artery calcification in female (57.8%) was statistically significantly higher than in male (34.2%) (p:0.001; p<0.05).

The prevalence of tonsillitis in male (80.8%) was statistically significantly higher than in female (67.2%) (p:0.010; p<0.05). There was no statistically significant difference between genders in terms of the prevalence of other calcifications (p>0.05) (Table 2).

There was no statistically significant difference in terms of number of the calcification types between genders (p>0.05) (Table 3).

Among patients with calcification, the average age of patients with tonsilloliths was statistically significantly lower than those without tonsilloliths (p:0.033; p<0.05). There was no statistically significant difference in the mean age for other calcifications (p>0.05) (Table 4).

Table 2: Distribution of calcification types by gender

	Male (n=146)	Female (n=128)	
Calcifications	n (%)	n (%)	p
Carotid Artery Calcifications	50 (%34.2)	74 (%57.8)	[1]0.001*
Tritiseous Cartilage Calcifications	10 (%6.8)	15 (%11.7)	[2]0.235
Tonsilloliths	118 (%80.8)	86 (%67.2)	[1]0.010*
Lymph Node Calcifications	34 (%23.3)	22 (%17.2)	[1]0.212
Antroliths	8 (%5.5)	3 (%2.3)	[2]0.312
Phleboliths	0 (%0)	1 (%0.8)	[3]0.467
Rinoliths	5 (%3.4)	3 (%2.3)	[3]0.727
Sialoliths	1 (%0.7)	4 (%3.1)	[3]0.188

[1]Chi-square test [2]Continuity (yates) correction [3]Fisher's Exact Test *p<0.05

Table 3: Distribution of number of calcification types by gender

	Male (n=146)	Female (n=128)	
Total Number	n (%)	n (%)	p
1	76 (%52.1)	65 (%50.8)	0.177
2	61 (%41.8)	47 (%36.7)	
3 and above	9 (%6.2)	16 (%12.5)	

Chi-square test

Table 4: Evaluation of calcification types according to age

		Yaş		
		Min-Max	Ort±SS (medyan)	p
Carotid Artery Calcifications	Absent	40-81	63.8±8.6 (64)	0.183
	Present	36-88	65.3±9.5 (65)	
Tritiseous Cartilage Calcifications	Absent	36-88	64.4±9.2 (64)	0.801
	Present	54-85	65.3±7.1 (65)	
Tonsilloliths	Absent	36-87	66.6±9.5 (67)	0.033*
	Present	37-88	63.7±8.8 (64)	
Lymph Node Calcifications	Absent	36-88	64.4±9.3 (64)	0.866
	Present	49-81	64.8±7.9 (65)	
Antroliths	Absent	36-88	64.5±9.2 (65)	0.510
	Present	54-76	63.2±6.5 (62)	
Phleboliths	Absent	36-88	64.4±9 (65)	-
	Present	77-77	77	
Rinoliths	Absent	36-88	64.5±9.1 (65)	0.833
	Present	48-81	64.1±9.8 (63)	
Sialoliths	Absent	36-88	64.4±9.1 (65)	0.551
	Present	63-72	66.6±3.8 (65)	

Mann Whitney U test *p<0.05

There was no statistically significant difference in the number of calcification types in terms of average age (p>0.05) (Table 5).

Table 5: Evaluation of the number of calcification types according to age

	Age		
Total Number	Min-Max	Average±SD (median)	p
1	36-87	64.1±9.4 (64)	
2	37-88	65.3±9.2 (65)	0.276
3 and above	48-71	62.6±5.5 (64)	

Kruskal Wallis test

DISCUSSION

The rate of aged 60 and over in the world was 11% in 2006, this rate is expected to increase up to 22% in 2050. The world population has increased fourfold in the last 100 years between 1950 and 2050 and according to estimations the elderly population will increase tenfold and 7-69% of this population will be completely edentulous.[12-14] Although aging is not a cause of tooth loss, it is a fact that functional insufficiency that occurs with advancing age and the high frequency of dental and systemic diseases predispose elderly patients to be edentulous.[8] Considering the rate of edentulous patients in the general population, evaluation of positive findings detected on PR is essential for a successful dental treatment.

In the literature, the prevalence of STCs on PR has been reported to be between 2.61-19%.[7] In the present study, this rate was found to be higher. This result may be because of present study included edentulous and older age groups.

While STCs can be observed as a single type, more than one type of calcification can be seen together in the same patient. Çitir and Gündüz[7] detected more than one type of calcification with a rate of 3.7% in their studies. In the current study, the rate of patients with more than one type of calcification was found to be higher. The reason for this may be that the prevalence of systemic diseases are relatively higher in this population.

In the literature, the incidence of tonsilloliths on PR has been reported between 1.45-8.14%.[15-19] In the present study, it was more common than in the literature. Unlike studies stating that there is no difference between genders; the incidence of tonsilloliths in male was statistically significantly higher than female.[7, 17-19] While there are a few studies stating that the incidence of tonsilloliths is not related to age; there are more studies reporting that it increases with age.[7,20] The high rate of tonsillitis in the present study may be due to the fact that included patients were in the older age group and systemic diseases were more common in this group.

In the present study, carotid artery calcifications were determined as the second most common STC. Maia et al.[21]'s study, which included only older adults, carotid artery calcifications are reported as 12.5%, similar to current results. This may be due to the similarity of the populations included. Brito et al.[22] investigated the factors that may predispose to the formation of carotid artery calcification in young and elderly people and it was found that age was an important factor in the development of these calcifications. The authors reported that young people were nine times less likely to have carotid artery calcification than patients over 60 years of age.

In addition to the chronic nature of calcifications, the higher frequency of carotid artery calcifications in older adults may be due to the higher prevalence of related diseases such as diabetes, cardiovascular disease and severe chronic kidney disease in this age group.[21]

Although carotid artery calcifications are often asymptomatic, they can be an indicator of atherosclerotic disease, so detection by the dentist on routine PRs may enable early diagnosis of cerebrovascular and embolic diseases. This finding is especially important in older adults, as atherosclerotic disease can predispose to the development of cardiovascular disorders such as myocardial infarction and stroke, which are leading causes

of death in people aged 60 and over.[9,21]

Calcified lymph nodes are more easily distinguished from other calcifications with their irregular specific structure with often cauliflower-like appearance is evaluated together with their localization.[9] It has been reported that lymph node calcifications occur with a frequency of 0.1-3.6% in the literature.[15,16] Current results were similar to the literature. Triticeous cartilage calcification is differentiated from carotid artery calcifications by its more medial location and generally well-circumscribed, oval, smooth structure.[7, 23] Its incidence is reported to be 8.6-10.6%.[7,24] In the present study it was found to be lower than in the literature. In terms of gender, it was found to be higher in women, similar to the literature.[7]

In a recent study with a sample size of 9553 investigating the prevalence of STCs on PR, antroliths were reported as 0.8% and rhinoliths as 0.1%.[25] In the present study, the rates of antrolith and rhinolith were higher. In the same study, the sialolith rate was reported as 1.9%, which is similar to current results.[25] In another study investigating STCs on PR of 1175 patients, phlebolith was detected in only one patient.[21] Similarly, phlebolith was observed in only one patient among 1166 patients in the present study.

PR has disadvantages such as magnification, distortion and superposition as a result of imaging three-dimensional structures in two dimensions. Some researchers have reported that these calcifications can be better evaluated with advanced imaging methods such as computed tomography.[26,27] A limitation of the present study is that some calcifications cannot be detected on PR, even if they are present. However, the higher biological and financial costs of advanced imaging methods should also be taken into account.

CONCLUSION

STCs are incidental findings that commonly encountered during routine radiographic examination. It is important for dentists to diagnose the STCs observed on PR and to differentiate from existing anatomical structures and pathologies. Thus, it is possible to prevent unnecessary radiological examinations and treatments and also to refer patients for further examinations when necessary.

Ethical Approval

The ethical approval for this study was received by the Fırat University Non-Pharmaceutical and Medical Device ethics committee (2022/02-15).

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The authors declare that this study received no financial support.

Conflict of Interest

The authors deny any conflicts of interest related to this study.

Author Contributions

Study Design: MD, SCB. Data collection: MD. Analysis and interpretation of data: MD, SCB. Literature research: MD, SCB, Writing: MD, SCB.

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