

International Journal of Medical Science and Advanced Clinical Research (IJMACR) Available Online at:www.ijmacr.com Volume – 8, Issue – 3, May - 2025, Page No.: 01 – 12

Assessment of Oral and Maxillofacial Soft Tissue Calcifications on Digital Panoramic Radiography

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How to citation this article: Dr. Helly Thakkar, Dr. Saba Khan, Dr. Tulika Sharma, Dr. Pragati Agarwal, Dr. Janki Savsani, Dr. Kanak Pareek, "Assessment of Oral and Maxillofacial Soft Tissue Calcifications on Digital Panoramic Radiography", IJMACR- May - 2025, Volume – 8, Issue - 3, P. No. 01 – 12.

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Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Soft tissue calcifications in the maxillofacial region are often incidental findings on panoramic radiographs and may indicate pathological or non-pathological conditions such as dystrophic, metastatic, or idiopathic calcifications.

Aims & Objectives: To assess and compare the prevalence of soft tissue calcifications across different age groups and between males and females, and to

evaluate the incidence of various calcifications—such as tonsilloliths, sialoliths, phleboliths, lymph node, stylomandibular ligament, stylohyoid ligament, and others on digital panoramic radiographs.

Material and methods: This retrospective study, conducted at the Department of Oral Medicine and Radiology, Darshan Dental College, Udaipur, for soft tissue calcifications using 500 digital orthopantomograms (OPGs). The radiographs were assessed for different types of calcifications across 12 anatomical regions.

Results: Soft tissue calcifications were identified in 23.6% of cases. The most common were calcified atherosclerotic plaques (38.98%), triticeous cartilage (16.11%), stylohyoid ligament (13.57%), and tonsilloliths (11.86%). The highest prevalence was seen in individuals aged 30–39 years (66.95%), followed by those aged 40–49 years (27.95%). Statistically significant differences (p<0.05) were noted in the distribution of tonsilloliths and thyroid cartilage calcifications across age and gender groups.

Conclusion: The study underscores the diagnostic value of digital panoramic radiographs in detecting soft tissue calcifications, some of which may be early indicators of systemic disease. Increased awareness among dental professionals is crucial for timely identification, referral, and management of underlying conditions.

Keywords: Soft tissue calcifications, panoramic radiography, orthopantomogram, dystrophic calcification, ossification, maxillofacial region, tonsilloliths, atherosclerotic plaques.

Introduction

Calcification refers to the deposition of calcium salts in tissues, differing from ossification, which involves bone formation with collagen and sometimes marrow components. In radiology, distinguishing between calcification and ossification is challenging without histopathological evaluation. Calcifications are classified as dystrophic, metastatic, or idiopathic. Dystrophic calcifications occur in damaged tissues despite normal serum calcium/phosphate levels, while metastatic calcifications result from elevated serum levels, and idiopathic calcifications occur in normal tissues with normal biochemistry. In the maxillofacial region, soft

tissue calcifications are uncommon and often detected incidentally on panoramic radiographs. Common sites include the carotid arteries, thyroid and triticeous cartilage, stylohyoid ligament, tonsils, lymph nodes, salivary glands, and venous system. These findings are clinically significant and may indicate systemic pathology. Panoramic radiography, though limited compared to CBCT, remains a widely used, low-cost, and low-radiation tool for initial detection. This study aims to describe the prevalence and radiographic features of soft tissue calcifications and ossifications seen in digital orthopantomograms (OPGs), providing insight into their demographics and aiding in early detection, appropriate management, or referral. The study hypothesizes that dystrophic calcifications are frequently observed on digital panoramic radiographs.¹⁻¹⁵

Aims & Objectives

This study aims to evaluate oral and maxillofacial soft tissue calcifications on digital panoramic radiographs. It focuses on identifying the prevalence of various calcifications, including tonsilloliths, sialoliths, phleboliths, rhinoliths, antroliths, calcified vessels, submandibular gland sialoliths, calcified stylohyoid ligaments, lymph nodes, and atherosclerotic plaques. It also compares their distribution across different age groups and between males and females.

Materials & Methods

This retrospective study was conducted at the Department of Oral Medicine and Radiology, Darshan Dental College and Hospital, Udaipur, to determine the prevalence and imaging features of soft tissue calcifications in digital orthopantomograms (OPGs). A total of 500 OPGs taken over a 24-month period using the Kodak Carestream CS 8000 C system were reviewed. (Figure 1).

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Figure 1: Digital panoramic and cephalometric extra-oral imaging system

Patient age, sex, and location of calcifications were recorded. The radiographs were divided into five agebased groups and analyzed using SPSS version 20.0, with Chi-square tests applied for statistical evaluation.

Inclusion criteria comprised radiographs of adequate diagnostic quality displaying both arches and supporting structures. Excluded were poor-quality images, distorted landmarks, or those missing anatomical margins. OPGs were divided into 12 regions using horizontal and vertical reference lines for precise calcification localization. (Figure 2).



Figure 2: Division of OPG into 12 boxes.

Soft tissue calcifications assessed included rhinoliths, antroliths, phleboliths, tonsilloliths, sialoliths, calcified vessels, stylohyoid ligaments, lymph nodes, triticeous and thyroid cartilages, and atherosclerotic plaques. (Figure 3-10).



Figure 3: Sialolith Homogeneous radiopacity with multiple layers of calcification having a smooth outline

situated at the left side angle or parasymphysis region of the mandible.



Figure 4: Arteriosclerosis Parallel pair of thin radiopaque lines that may have a tortuous or straight course.



Figure 5: Calcified atherosclerotic plaque Multiple irregular sharply defined radiopacities with radiolucent voids present adjacent to C3 C4 or inferior or superior to the greater cornu of the hyoid bone.



Figure 6: Phlebolith Multiple homogenous radiopacities with smooth periphery having laminations in the center.



Figure 7: Calcified triticeous cartilage Well-defined, homogenous smooth radio opacities located within soft tissue of pharynx inferior to greater cornua of hyoid.



Figure 8: Calcified stylohyoid ligament (Bilateral) Long tapering thin radiopaque processes extending from mastoid process, crossing posterior inferior aspect of ramus towards hyoid bone.



Figure 9: Tonsilloliths Clusters of ill-defined or welldefined radio opacities in the mid mandibular ramus region.



Figure 10: Thyroid cartilage calcification Homogenous radiopacity seen bilaterally at the lower edge of the panoramic radiograph.

Each was identified based on specific anatomical location and characteristic radiographic appearance. For example, phleboliths appeared as concentric "bull's eye" patterns, while atherosclerotic plaques were noted adjacent to C3–C4 vertebrae.

This study hypothesized that dystrophic calcifications are frequently observed in digital panoramic radiographs and aimed to expand current knowledge on their distribution and radiographic features across demographic groups.¹⁵⁻³⁰

Schematic Diagram of Methodology



Results

This study analyzed 500 digital panoramic radiographs to evaluate soft tissue calcifications in the head and neck region. The gender distribution was nearly equal, with 244 males (48.8%) and 256 females (51.2%). The majority of participants (264, 52.8%) were in the 30–39 year age group. (Table and Graph 1 & 2).

Table 1:

Gender	No. of patients	% of patients			
Male	244	48.8%			
Female	256	51.2%			
Total	500	100.0%			

Graph 1:



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Table 2:

Sr. No.	Age Group	No. of Patients	% of Patients
1	18-29 years	129	25.8%
2	30-39 years	264	52.8%
3	40-49 years	103	20.6%
4	\geq 50 years	4	0.8%
Total		500	100.0%

Graph 2:



Soft tissue calcifications were detected in 118 radiographs (23.6%), while 382 (76.4%) showed none. Among the calcification cases, females accounted for 62 (52.55%) and males for 56 (47.45%), though this difference was not statistically significant. Age-wise, most calcifications were found in the 30–39 year group (66.95%), followed by 40–49 years (27.95%), a result that was statistically significant (p = 0.043). (Table and Graph 3,4 & 5).

Table 3:

Soft Tissue Calcification	Number of Radiographs	%
Present	118	23.6%
Absent	382	76.4%
Total	500	100%

Graph 3:



Table 4:

Sr. No.	Gender	No. of Patients	%	Value of Significance
1	Male	56	47.45%	0.325
2	Female	62	52.55%	
TOTAL		118	100%	NS – Non Significant

Graph 4:



Table 5:

Age Group	No. of Patients	%	Value of Significance
18-29 years	5	4.23%	
30-39 years	79	66.95%	0.043 Statistically Significant (p < 0.05)
40-49 years	33	27.95%	
\geq 50 years	1	0.83%	
TOTAL	118	100%	

Graph 5:



Calcified atherosclerotic plaque was the most prevalent type (38.98%), followed by calcified triticeous cartilage (16.11%), stylohyoid ligament (13.57%), thyroid cartilage (13.57%), and tonsillolith (11.86%). Sialolith, phlebolith, arteriosclerosis, and calcified lymph nodes were less common, and rhinolith and antrolith were absent. (Table and Graph 6 &7)

Table 6:

Sr. No.	Various Soft Tissue Calcifications	Prevalence	%	Value of Significance
1	Rhinolith	0	0%	
2	Antrolith	0	0%	
3	Sialolith	4	2.54%	
4	Arteriosclerosis	1	0.84%	
5	Calcified atherosclerotic plaque	46	38.98%	0.041 Statistically Significant (p < 0.05)
6	Phlebolith	1	0.84%	
7	Calcified lymph nodes	2	1.69%	
8	Calcified triticeous cartilage	19	16.11%	
9	Calcified stylohyoid ligament	16	13.57%	
10	10 Tonsillolith		11.86%	
11	11 Thyroid cartilage calcification		13.57%	
TOTAL		118	100%	

Graph 6:



Table 7:

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Sr.	Soft Tissue	Males	%	Females	%	Total	%	Value of
No.	Calcification							Significance
1	Rhinolith	0	0	0	0	0	0	
2	Antrolith	0	0	0	0	0	0	-
3	Sialolith	1	25	3	75	4	100	0.331
4	Arteriosclerosis	1	100	0	0	1	100	0.148
	Calcified							0.038
6	athennelantia	10	20.12	20	60.97	16	100	Statistically
5	ameroscierotic	18	39.13	28	00.87	40	100	Significant (p
	plaque							< 0.05)
6	Phlebolith	1	100	0	0	1	100	0.307
7	Calcified lymph nodes	0	0	2	100	2	100	0.163
8	Calcified triticeous cartilage	7	36.84	12	83.16	19	100	0.069
9	Calcified stylohyoid ligament	12	75	4	25	16	100	0.002 Statistically Significant (p < 0.05)
10	Tonsillolith	11	78.57	3	21.42	14	100	0.004 Statistically Significant (p < 0.05)
11	Thyroid cartilage calcification	0	0	16	100	16	100	0.004 Statistically Significant (p < 0.05)

Graph 7:



Significant gender-based differences were observed in four types: calcified atherosclerotic plaque was more common in females (p = 0.038); calcified stylohyoid ligament and tonsillolith were significantly higher in males (p = 0.002 and p = 0.004, respectively); and thyroid cartilage calcification occurred exclusively in females (p = 0.004). (Table and Graph 8)

Table 8:

Soft Tissue Calcification	18–29 Years	30–39 Years	40–49 Years	≥ 50 Years	Total	Value of Significance
Rhinolith	0	0	0	0	0	
Antrolith	0	0	0	0	0	0.861
Sialolith	2	2	0	0	4	0.044
Arteriosclerosis	0	0	1	0	1	0.043
Calcified atherosclerotic plaque	0	34	11	1	46	0.044
Phlebolith	0	0	1	0	1	0.215
Calcified lymph nodes	0	2	0	0	2	0.570
Calcified triticeous cartilage	1	13	5	0	19	0.818
Calcified stylohyoid ligament	0	13	3	0	16	0.275
Tonsillolith	2	9	3	0	14	0.254
Thyroid cartilage calcification	0	6	10	0	16	0.144

Graph 8:



Age-wise, sialolith, arteriosclerosis, and calcified atherosclerotic plaques showed statistically significant distribution, with peak occurrences in the 30–39 year group. Site-wise analysis revealed significant left-side dominance for calcified triticeous cartilage and tonsillolith, while thyroid cartilage calcification was mostly bilateral (p = 0.04 for each). These findings suggest that certain calcifications vary significantly with age, gender, and anatomical location. (Table and graph 9).

Table 9:

S N	ör. lo.	Soft Tissue Calcification	Right Side	%	Left Side	%	Bilaterally	%	Value of Significance
	1	Rhinolith	0	0	0	0	0	0	-
	2	Antrolith	0	0	0	0	0	0	0.215
	3	Sialolith	1	25	3	75	0	0	0.352
	4	Arteriosclerosis	0	0	0	0	1	100	0.452
	5	Calcified atherosclerotic plaque	12	26.08	30	65.21	4	8.69	0.384
	6	Phlebolith	0	0	1	100	0	0	0.343
,	7	Calcified lymph nodes	0	0	2	100	0	0	0.351
	8	Calcified triticeous cartilage	5	26.31	12	63.16	2	10.54	0.04 Statistically Significant (p < 0.05)
	9	Calcified stylohyoid ligament	7	43.75	5	31.25	4	25	0.278
1	10	Tonsillolith	5	35.71	7	50	2	14.29	0.04 Statistically Significant (p < 0.05)
1	11	Thyroid cartilage calcification	3	18.75	3	18.75	10	62.50	0.04 Statistically Significant (p < 0.05)

Graph 9:



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Discussion

This study aimed to assess the prevalence and imaging characteristics of soft tissue calcifications in the head and neck region using panoramic radiographs. Panoramic imaging, widely used in dentistry due to its low radiation dose, broad coverage, and convenience, was employed to screen for calcifications in 500 patients from the Department of Oral Medicine and Radiology, Darshan Dental College, Udaipur, Rajasthan.

Out of the 500 radiographs, 118 (23.6%) showed one or more calcifications. The prevalence aligns with previous studies, though variations in rates were noted due to differences in study designs and imaging modalities. The 40-59-year age group had the highest prevalence (66.95%), and no significant gender difference was observed in calcification occurrence. Among calcifications, calcified atherosclerotic plaques (CAPs) were the most common (42.79%), with a predominance in females (58.95%). Other calcifications included (1.8%), calcified stylohyoid sialoliths ligaments (16.21%), tonsilloliths (13.06%), and thyroid cartilage calcifications (6.30%).

Certain calcifications like stylohyoid ligament ossifications and triticeous cartilage may resemble atherosclerotic plaques, highlighting the need for careful differentiation to avoid misdiagnosis. Additionally, soft tissue calcifications can serve as incidental findings that may require further medical evaluation, potentially preventing serious complications like stroke or infections.

The study underscores the importance of panoramic radiographs in detecting incidental calcifications. Although advanced imaging methods like CBCT can offer more detailed insights, panoramic radiographs remain a valuable tool for epidemiologic studies due to their affordability, accessibility, and low radiation exposure. The findings emphasize the need for dentists to meticulously review radiographs for such incidental pathologies, leading to timely medical referrals and interventions.³¹⁻⁶⁰

Conclusion

This study analyzed 500 panoramic radiographs to assess the prevalence of soft tissue calcifications. A total of 23.6% of radiographs exhibited calcifications, with the highest prevalence in the 40–59 age group. The most common calcifications were atherosclerotic plaques (42.79%), triticeous cartilage (16.11%), and stylohyoid ligament (16.21%). While panoramic radiography is a cost-effective screening tool, its limitations in detecting smaller or poorly calcified lesions are noted. Further imaging or medical referral is advised when significant findings, like carotid atheromas, are detected. Panoramic radiography remains an essential tool for early identification of potentially significant soft tissue calcifications.⁶¹⁻⁷⁰

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