Prevalence of Soft Tissue Calcifications in Panoramic Radiography: A Retrospective Study

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Abstract

Aim Soft tissue calcifications in the dentomaxillofacial region are unusual and relatively asymptomatic. They are often found incidentally on panoramic radiographs during routine examination. The aim of the present study was to evaluate the prevalence of soft tissue calcifications of the dentomaxillofacial region in panoramic radiography in relation to demographic features and localization of the jaws.
Material and method Panoramic x-ray images of 1000 patients (558 females, 442 males) aged 12-74 years were used in the study. The presence of calcified lymph node, tonsillolith, calcified atherosclerotic plaque, sialolith, phlebolith, anthrolith and styloid ligament calcification were examined. The findings were subjected to statistical analysis to examine the relationship with the gender and age parameters.
Results While the most common calcification was styloid ligament calcification (8.4%), phlebolith was never found. The most common calcification was styloid ligament calcification (8.4%), followed by tonsillolith (2.1%) and carotid plaque calcification (1.5%).
Conclusion Soft tissue calcifications are rarely seen on panoramic radiographs. However, when it is encountered, dentists should be able to identify and establish the differential diagnosis of the main soft tissue calcifications in the dentomaxillofacial region, which may be of high importance in patients' health.

Keywords Calcification, Soft tissue, Panoramic radiography, Prevalence, Radiology

Introduction

Calcification is the deposition of calcium salts in a normal body. It is important in bone formation, but calcium salts, especially calcium phosphate, can be deposited irregularly in soft tissue, causing heterotopic calcification. This accumulation causes the soft tissue to harden, and this soft tissue appears radiopaque on radiographs (1,2).

Heterotopic calcifications are divided into three subgroups as dystrophic, idiopathic and metastatic according to the mechanism of calcification, aetiology and localization (3,4). Metastatic calcifications are usually caused by the deposition of calcium and other salts in previously undamaged tissues as a result of excess salts in the circulating blood. They also occur bilaterally and symmetrically due to hypercalcemia secondary to metabolic causes or skeletal deposits of malignant disease (5-8). Idiopathic calcification, also called calcinosis, causes calcium to accumulate in normal tissues with a normal mineral balance (7). Dystrophic calcifications constitute most of the soft tissue calcifications seen in the head and neck region, and these calcifications occur in degenerative or dead tissue due to trauma, inflammation, injections, presence of parasites, and disease-related changes (5,8). Some examples of lesions with dystrophic calcification include: rhinolith, antrolith, phlebolith, tonsillolith, calcified lymph nodes, and elongated styloid ligament (6,7).

Soft tissue calcifications in the dentomaxillofacial region are unusual and relatively asymptomatic. They are often found incidentally on panoramic radiographs during routine examination of patients seeking dental care (5,7,8). However, the diagnosis of these incidental calcified lesions in oral soft tissues can be challenging, because the structures are very close to each other and it is difficult to distinguish radiopacity in bone or soft tissue due to the superimpositions (5,8-10). Interpreting radiographic representations of these calcifications accurately requires precise knowledge about their anatomical location, shape, number, pattern of distribution and approximate prevalence (11).

In this study, we aimed to evaluate the prevalence of soft tissue calcifications of the dentomaxillofacial region in panoramic radiography in relation to demographic features and localization of the jaws.

Material and Methods

In this retrospective study, panoramic radiographs of the patients who admitted to the Department of Oral and Maxillofacial Radiology in Faculty of Dentistry at Biruni University were analysed for the detection of soft tissue calcifications. The design of this retrospective study was reviewed and approved by the Research Ethics Committee of Biruni University Faculty of Dentistry (2023/80-21).

Panoramic x-ray images of 1000 patients (558 females, 442 males) aged 12-74 years were evaluated in the study. Radiographic images with poor image quality, large pathological lesions, maxillofacial surgery and images not including the area to be examined were excluded from the analysis. High quality images with a clear view of the area to be examined were included in the study.

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Table 1: Description of the radiographic appearances and location of soft tissue calcifications (3)

Diagnosis	Location	Radiographic appearance
Calcified lymph node	The submandibular region, below the inferior border of the mandible near the angle	Irregular radioopacities, lobulated appearance similar to the outer shape of cauliflower
Tonsillolith	Midramus region where the image of the dorsal surface of the tongue crosses the ramus in the oropharyngeal air spaces	Round single or multiple, small, ill-defined radiopacities
Calcified atherosclerotic plaque	Posteroinferior to the mandibular angle, adjacent to the cervical vertebrae C3, C4, or the intervertebral space of them	Circular when small and vertical linear oriented when enlarged, irregular, heterogeneous radiopacities
Sialolith	Submandibular sialolith; below the border of the mandible close to the region of the ramus	Unilateral and diffusely calcified radiopacities with regular contours
Phlebolith	Common region; posterior body of the mandible	Multiple, small,mixed radiolucent-radiopaque, targetoid appearance
Anthrolith	In the antrum of the maxillary sinus	Single, well-defined, smooth, or irregular radiopacity
Styloid ligament calcification	The styloid process measures >30 mm from the lower border of the external auditory to the hyoid bone.	Long, tapering, thin, radiopaque process that is thicker at its base and lies downward and forward

The presence of calcified lymph node, tonsillolith, calcified atherosclerotic plaque, sialolith, phlebolith, anthrolith and styloid ligament calcification were examined. The evaluation criteria of radiopacities, which have their own characteristics in terms of their radiographic appearance and localization, are shown in Table 1.

All images were examined by two Oral and Maxillofacial Radiology specialist (FBD & MPA), and the evaluations were completed by consensus on different results. The findings were subjected to statistical analysis to examine the relationship with gender and age parameters.

Statistical Analysis

All analysis were performed using IBM SPSS 25 program. In the study, descriptive statistics (number and percentage) of the data are given in Table 2. Pearson Chi-Square test and Fisher&Exact tests were applied to test the relationship between the categorical variables.

Results

Calcifications found in this study include calcifications of the styloid ligament, lymph node, calcified atherosclerotic plaque, sialolith, tonsillolith, and antrolith (Figure 1). The distribution of our findings is demonstrated in Table 2. When the descriptive statistics for the demographic characteristics of the images used in the study were examined, 613 were in individuals under 40 years old (61.3%) and 387 in individuals over 40 years old (38.7%). There were 558 females (55.8%) and 442 males (44.2%).

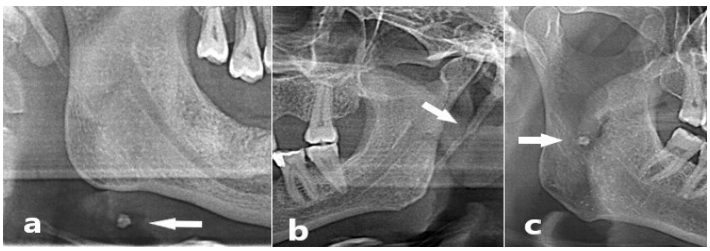

Figure 1: a) Lymph node calcification, b) Styloid ligament calcification, c) Sialolith

The most common calcifications were respectively styloid ligament calcification (8.4%), tonsillolith (2.1%) and calcified atherosclerotic plaque (1.5%). However, there were no radiopacities in the sample which suggested a phlebolith. Of the 1000 radiographs examined for evidence of soft tissue calcifications and a total of 201 calcifications (20.1%) were identified in 135 individuals, of which 77 were female (55.8%) and 68 were male (44.2%). Although the prevalence of calcifications in females was much higher than that in males, no statistical difference was found between them in all calcification types (p>0,05) (Table 2).

Table 2: Distribution of calcifications by gender of individuals

	Female (n, %)		Male (n, %)		Total (%, p)	
Tonsillolith	9	1,6	12	2,7	2,1	0.225
Calcified atherosclerotic plaque	9	1,6	6	1,4	1,5	0.741
Calcified lymph node	2	0,4	5	1,1	0,7	0.251
Sialolith	1	0,2	5	1,1	0,6	0.093
Anthrolith	2	0,4	0	0	0,2	0.506
Styloid ligament calcification	54	9,7	30	6,8	8,4	0.102

Pearson Chi-Square test and Fisher&Exact tests, (p<0,005)

When the presence of soft tissue calcification was analysed according to the groups under 40 years of age and over 40 years of age, a statistically significant link was found between being over age 40 with tonsillolith, calcified lymph node and calcified atherosclerotic plaque (p<0.001, p<0.015, and p<0.006, respectively). In terms of age, there were significant differences between the presence of these calcifications and an increase in age (Table 3).

Table 3: Distribution of calcifications by age of individuals

	<40 (n,%)		>40 (n,%)		p
Calcified lymph node	1	0,2	6	1,6	0.015
Anthrolith	0	0	2	0,5	0.150
Calcified atherosclerotic plaque	4	0,7	11	2,8	0.006
Tonsillolith	5	0,8	16	4,1	0.001
Styloid ligament calcification	48	7,8	36	9,3	0.414
Sialolith	4	0,7	2	0,5	0.454

Pearson Chi-Square test and Fisher&Exact tests, (p<0,005)

Discussion

Soft tissue calcifications are mostly asymptomatic, so they are detected incidentally during routine radiological examination. In addition, the detection and diagnosis of these calcifications can be difficult in cases of superposition caused by the two-dimensionality of panoramic radiographs (8). Nevertheless, the specific localizations and radiological appearances of the calcification types were considered as a reference in our study when investigating.

Previous studies showed the prevalence of soft tissue calcifications identifiable on panoramic radiographs between 2.61% and 8% (5,7,12). In the present study, a higher prevalence of 20.1% was observed similar to study conducted by Riberio et al. (19.7%) (10). The reason of high difference for our study and the study of Ribeiro et al. may be the inclusion of styloid ligament calcifications (10).

The highly prevalent soft tissue calcification in the current study was styloid ligament calcifications (%8.4), followed by tonsillolith (%2.1), carotid artery plaque (1.5%), calcified lymph node (0.7%), sialolith (0.6%), antrolith (0.2%) respectively. However, Ramadurai & Umamaheswar reported that the highly prevalent soft tissue calcification was sialolith (30.43%) followed by atherosclerotic plaque (17.39%), while Icoz & Akgunlu reported that the most observed calcification type was tonsilloliths (38.9%) (7,8). According to the study of Sutter et al., it was revealed that of 1042 patients, whose panoramic radiographs were evaluated, 5.7% had tonsilloliths, 0.9% had sialoliths, 5.7% had carotid artery plaques, 3.6% had calcified lymph node (13). Akin to our study, there has been no incidence of phleboliths in almost all of the previous studies (14), but only Ramadurai et al. reported a prevalence of 17.39% of phleboliths (7).

Our study results showed no significant difference in the presence of calcifications between both genders, whereas most of the studies in the literature showed a significant relationship between genders and the prevalence of the calcifications within soft tissue, which is found a greater prevalence in men (15) or women (7,11,12). Moreover, the majority of calcifications, especially for calcified lymph node, carotid artery plaque and tonsillolith, were more common in ages over 40 years in this study. Similarly, some authors stated that the prevalence of these calcifications increases with age (7,11,16). In general, controversy in the results of different epidemiologic studies can be due to the fact that the number of panoramic radiographs evaluated in the majority of the aforementioned studies was lower than that in our study.

In our study, calcification of the styloid complex was the most prevalent (%8.4), differing from other radiographic studies found in the literature, where prevalence rates range from 3.7% to 52.1%, (10,17-19). High variability in its prevalence rate can be due to anatomical and racial variations, nutritional habits, lifestyle, muscle tension due to occlusal interferences and different study populations and variability among the observers. Moreover, previous authors, similar to ours, reported the same prevalence rates in males and females (11,20). A higher prevalence of calcification of this complex in patients aged 40 years and older in agreement with the results previously reported (21), whereas, some researchers reported a higher prevalence in younger than 40 years old (11,22).

According to the present study's results, the second most observed calcification type was tonsillolith with the percentage of 2.1% of all study samples. A similar percentage (0.9%) was reported by Riberio et al. (10). On the other hand, also including only panoramic images, Bamgbose et al. and Maia et al. found a percentage of tonsilloliths of 8.14% and 9.1% respectively (9,23).

In this current study, apart from the styloid ligament calcification and tonsillolith, another calcifications that are mostly observed are carotid artery plaque, followed by calcified lymph node, sialolithiasis, and antrolith respectively. The prevalence of carotid artery calcifications was 1.5% in our study compared to the study done by Riberio et al. (5.1%) (10). According to the results of the same study, the prevalence rate of sialolith was reported as 0.5%, and this result is in consistency with the present study (0.6%) (10). El Deeb et al. also reported that sialoliths affect the 0.01%–1% of the population and according to Garay et al., it is 0.3% (15,24). Moreover, the prevalence of the calcified lymph node was detected in 0.7% of the evaluated images, and this result is slightly higher than the study of Vengalath et al. which is 0.12% (5). In the literature, lymph node calcification of the head and neck region is reported as 1% of enlarged nodes, which is consistent with our results (5,8). In our study, only two antroliths were visualised (0.1%) and Riberio et al., found that only one patient (0.1%) had antrolith (10).

Conclusion

Soft tissue calcifications in orofacial area are fairly unusual and they are usually incidentally detected on routine radiographic examination. It is noteworthy that soft tissue calcification especially in the cervical region could happen due to physiologic process and as a result of wide range of pathologies. For this reason, dentists and maxillofacial radiologists should be alert to these calcifications during the routine dental examinations.

The remarkable point in our study was that the incidence of calcification increased with advanced age. While the most common calcifications were respectively styloid ligament calcification, tonsillolith and calcified lymph node. Phlebolith was not found in our study.

Declarations

Author Contributions: *Conception/Design of Study- F.B.D., M.P.A.; Data Acquisition- F.B.D., M.P.A.; Data Analysis/Interpretation- F.B.D., M.P.A.; Drafting Manuscript- F.B.D., M.P.A.; Critical Revision of Manuscript- F.B.D., M.P.A.; Final Approval and Accountability- F.B.D., M.P.A.; Material and Technical Support- F.B.D., M.P.A.; Supervision- F.B.D., M.P.A.*

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