

Original Article

Soft tissue calcified in mandibular angle area observed by means of panoramic radiography

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Abstract: The aim of this research is to determine the prevalence of soft tissue calcifications detectable on panoramic radiographs, in the mandibular angle area. 3,028 digital panoramic radiographs taken between June 2009 and June 2011 were evaluated. Soft tissue calcifications found in the mandibular angle area were recorded according to gender, age and bilaterality. Data were analyzed with the Chi squared test and Fisher's exact test, with $\alpha < 0.05$ being considered statistically significant. The panoramic radiographs analyzed revealed a total of 79 calcifications (2.61%) in 75 individuals, of which 55.7% were women and 44.3% were men. The calcifications found were tonsilloliths (56%), carotid artery calcification (29%), sialoliths (11%), calcified lymph nodes (4%). A statistically significant link was found between being over age 40 with tonsilloliths ($p < 0.001$) and calcifications of the carotid artery ($p < 0.001$). In terms of gender, men had a higher likelihood of tonsilloliths ($p = 0.007$). *Conclusions* There is a low prevalence of soft tissue calcifications detectable on panoramic radiographs, which increases with age.

Keywords: Panoramic radiography, calcifications, calcinosis

Introduction

Soft tissue calcifications in the maxillofacial area are uncommon, and generally correspond to radiographic findings in routine examinations such as panoramic radiographs. The most important diagnostic criteria are anatomical location, distribution, number, size and shape of the calcifications [1]. The differential diagnosis must be made with hyoid bone, triticeous cartilage, styloid process, superior horn of thyroid cartilage and epiglottis. Epidemiologically, these calcifications are most frequently found in individuals over age 40, however, a few cases of children have been reported [2]. Additionally, Freitas [1] and White [3] presented a classification that could be useful in the diagnosis.

The few studies conducted regarding calcified lymph nodes deal with the diagnosis by means of ultrasonography and computerized tomography. Eisenkraft [4] studied 2,300 CT scans of the cervical area, of which 26 (1%) presented lymph node calcification without determining if it was benign or malignant. Ram [5] and De Moura [6] reported cases of patients with ton-

silloliths found on panoramic radiographs that were later confirmed by CT scan. Cogolludo [7] and Silvestre [8] also reported cases of calcifications in patients with symptomatology analyzed by CT scan.

It has been indicated that the prevalence of carotid artery calcifications is between 3% to 5% of the general population [9-13], although the link between carotid artery calcifications detectable on panoramic radiographs, cardiovascular risk factors and a potential stroke remains controversial [14]. Nevertheless, most of the studies found are consistent in the high diagnostic and preventive value of panoramic radiography in detecting atheromas [9, 10, 13, 15-21].

Another pathology that exhibits calcifications is sialolithiasis, the most common disease in the greater salivary glands after parotiditis with a higher incidence in men aged between 30 and 60 years [22]. Finally, the phleboliths are idiopathic calcifications of the thrombus, which are frequently associated with vascular lesions in the head and neck [23].

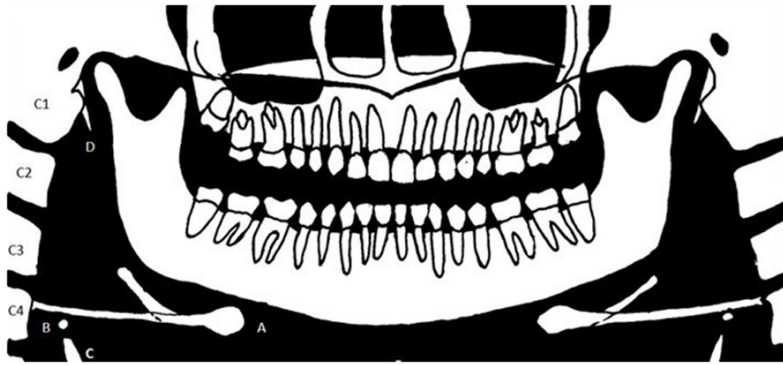


Figure 1. Structures on panoramic radiograph. At level of mandibular angle, the differential diagnosis among soft tissue calcifications is with: hyoid bone (A), superior horn of thyroid cartilage (C), triticeous cartilage (B) and with ossification of stylohyoid ligament, mainly in the portion next to the lesser spear of the hyoid bone.

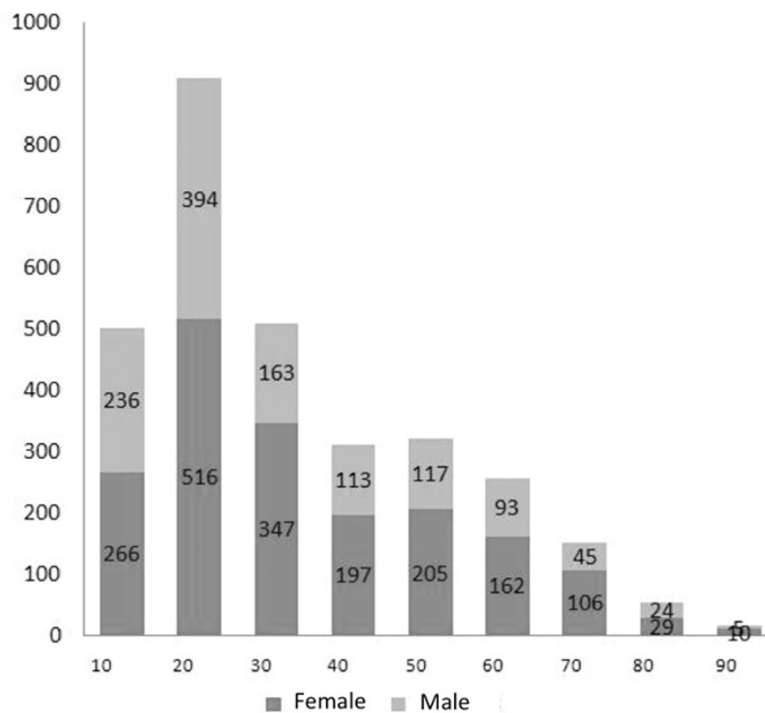


Figure 2. Age distribution and proportion of men and women.

Considering the broad range of pathologies and the low research in recent years, the aim of this investigation is to identify calcifications in the mandibular angle area by analyzing digital panoramic radiographs.

Materials and methods

Patient selection

A population-based descriptive study was designed to evaluate 3,028 digital panoramic

radiographs of patients who attended a private radiology center (Temuco, Chile) for the analysis and diagnosis of pathologies linked to implantology, orthodontics, oral surgery or general diagnosis between June 2009 and June 2011. The patients with facial deforming pathologies or maxillofacial operations associated with trauma or surgical resection of bone were excluded. All panoramic radiographs of subjects were included with no discrimination of age or gender.

Image acquisition

The panoramic radiographs were obtained from an orthopantomographic device, Instrumentarium OP200 D, Finland, 2008, using Cliniview XV software on a LG 19" Flatron monitor. The radiographic images were taken by a specially trained assistant, with kV 66, mA 5-10 and an exposure time of 17.6 seconds. The images were approved by an oral and maxillofacial radiologist with 6 years of experience; later the same professional performed the evaluations to determine the study variables.

Image analysis

The presence of radiopacities over projected on compatible mandibles with calcifications and with a ghost image on the opposite side were studied as well as their uni- or bilateral characteristics. The area between the anterior border of the cervical spine, inferior border of the mandibular body and posterior border of the ramus and mandibular angle was assessed. The images where no cervical spine was observed were also included due to the possibility of finding calcifications close to the mandibular angle. Those images with an ambiguous diagnosis

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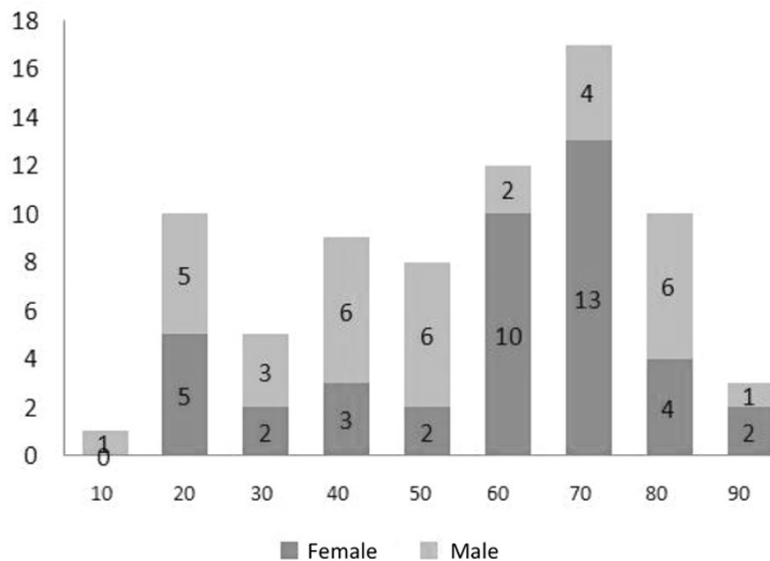


Figure 3. Distribution of calcifications according to gender and age.

Table 1. Soft tissue calcifications in mandibular angle area related to age of patient

Calcification	3-40 year old		40-90 year old		p
	n	%	n	%	
Calcification of ganglion	1	0.04	2	0.25	0.171
Tonsilloliths	19	0.85	25	3.14	<0.001*
Carotid artery calcification	1	0.04	22	2.76	<0.001*
Calcification of salivary gland	4	0.18	5	0.63	0.059

*Statistically significant (Chi Square and Exact Fisher test).

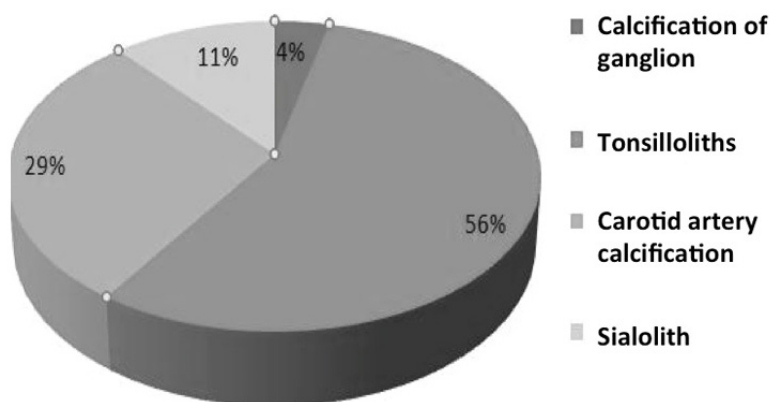


Figure 4. Distribution of calcifications.

due to over projection of structures or lack of clarity were discarded (**Figure 1**).

The panoramic radiographs were observed on full screen; overexposed images or those with a greater density in the study area due to the presence of an airway were clarified using the

software at two points so slightly calcified areas could be observed. Additionally, the compatible areas with calcifications and that had low radiopacity were evaluated using a software tool with a magnification of 2x. Only the radiopacities compatible with calcification were included; ossification of the stylohyoid ligament was excluded.

Statistical analysis

The statistics software Stata 9.0/SE was used, applying the Chi squared test and Fisher's exact test; $\alpha=0.05$ was considered statistically significant.

Results

Of the 3,028 panoramic radiographs analyzed 1,838 were women and 1,190 were men. The patients' ages at the time the panoramic radiographs were taken ranged from 3 to 90 years, with a mean of 28 years (SD: 18.5) (**Figure 2**).

A total of 79 calcifications (2.61%) were identified in 75 individuals, of which 44 (55.7%) were women and 35 (44.3%) were men. The proportion of calcification according to age group is shown in **Figure 3**. Of the individuals in whom calcifications were found, 25 (33.33%) were 40 years of age or younger, and 50 (66.66%) were over age 40 (**Table 1**).

The calcifications found were tonsilloliths, atheromas, sialoliths and calcified lymph nodes; no images compatible with phleboliths were found on the images (**Figure 4**). With respect to the presence of calcifications in terms of gender, only statistically significant differences were found in tonsilloliths ($p=0.007$) (**Table 2**).

Table 2. Soft tissue calcifications in mandibular angle area related to the sex of patient

Calcification	Female		Male		p
	n	%	n	%	
Calcification of ganglion	1	0.05	2	0.17	0.565
Tonsilloliths	18	0.98	26	2.18	0.007*
Carotid artery calcification	18	0.98	5	0.42	0.090
Calcification of salivary gland	7	0.38	2	0.17	0.497

*Statistically significant (Chi Square and Exact Fisher test).

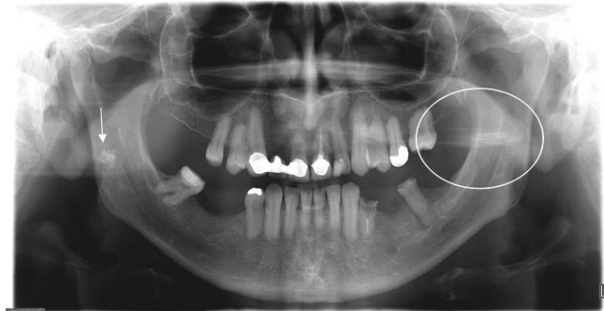


Figure 5. Tonsilloliths over-projected in right mandibular ramus, ghost image in left mandibular ramus.



Figure 6. Bilateral carotid artery calcifications at level of third cervical vertebra. Superior horn of thyroid cartilage and triticeous cartilage observable at level of fourth cervical vertebra.



Figure 7. Sialolith under right mandibular border.

A large number of the calcifications found were small, of low density and unilateral. There were

no significant differences with regard to the uni- or bilaterality of the calcifications and there were also no significant differences in terms of laterality and gender.

Discussion

This study presents the classic limitations of cross-sectional studies, where it is not possible to obtain the patient’s entire history. Moreover, there is a bias in there being no other studies to corroborate the findings on the panoramic radiography; however, the size of the sample being 3,028 panoramic images makes it possible to gain valuable information and orient future investigations in this field.

According to the authors’ search, after the study published by Monsour [24], there are no other studies of prevalence in the literature regarding calcifications detectable on panoramic radiographs. In this study, a prevalence of 2.61% of the presence of calcifications was found on the panoramic radiographs, while Monsour [24] found calcifications in 4% of a total of 2,628 non-digital panoramic radiographs. The low percentage of radiopacities found in our study could significantly increase if it were to include ossification of the stylohyoid ligament or the elongated styloid process, a pathology not analyzed here as it deals with organized bone formation and not calcium salt deposits at the soft tissue level.

In addition, this study uses digital panoramic radiographs which, unlike the study by Monsour [24], which enables low density calcifications to be identified, given that the density characteristics and image contrast can be modified and/or magnified.

Tonsilloliths

These mainly produce a ghost artifact or image on the contralateral side, generally from above, which is related to what was suggested by Ram [5] and Monsour [24]. Although tonsilloliths are uncommon, radiopaque masses over projected on the mandibular ramus must be considered in the differential diagnosis in such a way that other studies, such as computerized tomography or magnetic resonance, maybe needed to

define ghost images or a truly bilateral pathology (**Figure 5**).

We observed the presence of tonsilloliths in a broad age range, with the youngest patient being 10. Most of the tonsilloliths were observed in patients over age 40, with statistically significant differences being found between this group and those under 40, partially concurring with Monsour [24].

Carotid artery calcification

Most studies dealing with soft tissue calcification correspond to calcifications of atheromatous plaque at the bifurcation level of the carotid artery. Its prevalence is between 3% and 5% of the population [9-13]. In our study, a prevalence of 2.76% of atheromas was observed in the population aged over 40.

It is worthy of note that Kamikawa [25] conducted a study on cadavers, where the area of carotid bifurcation and triticeous cartilage was marked with gutta-percha, determining a wide variability between observers in recognizing the anatomical structures, which is indicative of the difficulty in determining calcifications of the carotid artery on panoramic radiographs and the probable diagnostic error in detection. In the observation from the anterior zone to the cervical spine, at C3 and C4, a differential diagnosis must be made with calcified lymph nodes, superior horn of thyroid cartilage and mainly triticeous cartilage. In our study, the images compatible with atheroma were observed to be of a low density, irregular edges and elongated (**Figure 6**).

Bayer [13] reported that the images compatible with carotid artery calcification were more common in women (64.8%) than in men (32.5%). Our study is consistent with Bayer *et al.* [13], although with a higher percentage difference between men (22%) and women (78%). Phleboliths and other calcifications were not observed in this research.

Calcification in salivary glands

In this sample, no images were observed to be over projected on the mandibular body or dental roots that were compatible with calcifications of the submandibular gland. These calcifications were observed under the mandibular border (**Figure 7**).

El Deeb [22] reported that sialolithiasis affects 0.01% to 1% of the population, which is consistent with our results, as we found sialoliths in 0.3% of the general population. However, there are differences with this study regarding gender; Deeb [22] found a greater prevalence in men and our study observed a greater prevalence in women. In terms of age, a greater prevalence has been reported in the group aged between 30 and 60 [22, 26], although in our investigation no differences were observed in the groups older and younger than 40.

Finally, we can conclude that the presence of calcifications on panoramic radiographs has a low prevalence, but their detection is important to orient the diagnosis and prevention of diseases. Other studies are needed to confirm the presence and severity of the different calcifications presented here.

Disclosure of conflict of interest

None.

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