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ORIGINAL RESEARCH ARTICLE

Incidental Radiopaque Lesions in the Jaw Bones: Retrospective Analysis

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Abstract

Purpose: Among the most used diagnostic techniques is panoramic radiography, which enables us to assess the entire jaw. This retrospective investigation aimed to evaluate the radiopaque lesions in the jaws visible on panoramic radiographs.
Materials and Methods: 1108 patients' panoramic radiographs were used in the investigation. Idiopathic osteosclerosis, condensing osteitis, soft tissue calcification, hypercementosis, periapical osseous dysplasia, odontoma, fibrous dysplasia, fluoride osseous dysplasia and cementoblastoma, were among the radiopaque lesions whose frequency, gender, and localization were assessed in this study. Fisher exact tests, chi-square, and descriptive statistics were employed in the data analysis.
Results: 499 (45.03%) of the patients were male and 609 (55.97%) were female. The patients included in the study ranged in age from 14 to 83 years, with a mean age of 33.45 (± 13.80) years. Of the 1108 patients in this study, 85 (7.7%) had radiopaque lesions. 44 cases (4.0%) of idiopathic osteosclerosis, 13 cases of condensing osteitis, 12 cases of soft tissue calcification, 4 cases of hypercementosis, 3 cases of fluoride osseous dysplasia (0.3%), 3 cases of periapical osseous dysplasia, 2 cases of odontoma, and 1 case of fibrous dysplasia (0.01%) were reported. For any of the lesions, there was no statistically significant variation based on gender.
Conclusions: Panoramic radiography, which is now commonly utilized, can be used to examine radiopaque lesions of the jaws. In this study, the most common radiopaque lesion was idiopathic osteosclerosis, while cementoblastoma was not found at all.

Key words: Cementoblastoma; Panoramic radiography; Radiopaque lesions; Osteosclerosis

Introduction

Clinicians can make an accurate diagnosis and arrange treatment with the use of studies on radiopaque and radiolucent lesions in the maxilla and mandible.[1] While some of the lesions exhibit symptoms like pain and swelling, others are seen on regular radiography and do not exhibit any symptoms. Despite the advancement of numerous contemporary imaging modalities, radiography continues to be the primary way of study for assessing lesions in the jaw. Intraoral radiographs provide an extremely detailed image of the teeth and bone in the exposed area, but due to the tiny film size, they cannot be used for lesions larger than 3 cm.[1,2] Extraoral radiographs are utilized to visualize the skull and facial structures and to investigate bigger lesions. A unique method that covers a large region with a low radiation dose and can be applied to patients who are unable to open their mouths is panoramic radiography.[1–3]

One might categorize jaw lesions as radiolucent, radiopaque, or mixed based on the density of the surrounding bone. In the jaw, radiolucent lesions account for more than 80% of lesions.[2] Rigidly spreading benign process usually indicated by well-defined borders and unilocular radiolucent lesions. Multilocular lesions with well-defined boundaries point to a benign but aggressive proliferation. Inflammatory or benign causes are usually responsible for well-defined, radiopaque lesions.[2–4] Lesion margins are usually firmly defined and benign, while lesions with fuzzy borders nearly always represent aggressive, inflammatory, or malignant processes. Mixed radiolucent-radiopaque lesions may arise due to fibro-osseous lesions, inflammatory processes, metabolic abnormalities, or, less commonly, malignant processes.[5]

Radiopaque lesions are idiopathic osteosclerosis, condensing osteitis, hypercementosis, odontoma, cementoblastoma, fibro-osseous lesions and soft tissue calcifications.[6] Idiopathic osteosclerosis is the name given to an asymptomatic increase in radiopacity of unknown etiology, detected in the jaws during normal radiological tests. These lesions are more likely to be seen in mandibular premolar and molar region.[7–9] Condensing osteitis are radiopaque le-

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sions caused by low-grade inflammation at the apices of tooth roots, primarily seen as apex-associated radiopacity in the mandibular premolars or molars.[10–12] Odontomas are benign tumors, also known as hamartomas, that affect all dental tissues and are encircled with radiolucent tape. The complex type of odontoma often prefers the posterior and ramus of the mandible, while the compound type is most common in the anterior maxilla.[12–14] Cementoblastomas are benign lesions formed by cement or cement-like tissues developed by cementoblasts in tooth roots and are frequently seen in the premolar and first molar regions of the mandible.[15,16] Fibro-osseous lesions are a type of lesion in which normal bone tissue is replaced with fibrous tissue and varied proportions of cementum and bone. These lesions are typically found in the jaw and face bones. Fibro-osseous lesions are divided into three categories: ossifying fibroma, periapical osseous dysplasia, and fibrous dysplasia.[17] Periapical osseous dysplasia is mostly observed in the anterior region of the mandible, while fluoride osseous dysplasia is common in the posterior region of the mandible. Fibrous dysplasia is more frequently localized in the maxilla compared to the mandible.[18,19]

This retrospective study set out to evaluate incidentally identified radiopaque lesions on panoramic radiographs.

Material and Methods

Patient selection

A selection of panoramic radiographs from the Department of Oral and Maxillofacial Radiology's repository at Van Yüzüncü Yıl University's Faculty of Dentistry was made for this retrospective study. 1108 panoramic radiographs obtained in the years 2022–2023 were chosen at random and added to the study. Ethical approval for the study was obtained from the Van Yüzüncü Yıl University Non-Interventional Ethics Committee (approval number: 2023/04-17). Written informed consent was obtained in accordance with the Declaration of Helsinki.

Panoramic radiographs registered in the system since the start of the study were retrospectively reviewed. Panoramic radiographs were opened in full screen mode. Overexposed more radiolucent images and underexposed more radiopaque images were sharpened using software tools. If a patient had multiple panoramic radiographs, only one was included in the study, selecting the one with the best image quality. Images containing radiopaque lesions were identified and recorded.

Images with image quality of sufficient clarity and resolution to make a diagnosis were included in the study. Poor quality images with patient movement or metal artifacts were excluded. Images with an unclear diagnosis due to overlapping structures or lack of clarity were excluded. In addition, individuals who had undergone surgery in the maxillofacial region or had pathological formations that would affect the diagnosis were excluded from the study.

Radiographic examination

Panoramic radiographs were obtained with Sirona (Bensheim, Germany). Imaging parameters were 60 kVp, 3 mA, 14.1 s. Panoramic images were analyzed with a Lenovo Yoga 520 Core i5 computer (Beijing, China). The presence of radiopaque lesions (idiopathic osteosclerosis, condensing osteitis, odontoma, cementoblastoma, hypercementosis, periapical osseous dysplasia, fluoride osseous dysplasia and fibrous dysplasia) was evaluated retrospectively on panoramic radiographs by a researcher with eight years of experience (A.G.Ö.T). In addition, these radiopaque lesions were recorded according to gender and their location in the incisive, canine, premolar and molar regions of the mandible and maxilla. (Figure 1)(Figure 2)(Figure 3)

Table 1. Distribution of radiopaque lesions according to gender.

	Female n= n (%)	Male n= n (%)	Total n= n (%)
Radiopaque lesions	44(%7.2)	41(%8.2)	85(%7.7)
Idiopathic osteosclerosis	26(%4.3)	18(%3.6)	44(%4.0)
Condensing osteitis	6(%1.0)	7(%1.4)	13(%1.2)
Soft tissue calcification	4(%0.7)	8(%1.6)	12(%1.1)
Hypercementosis	1(%0.2)	3(%0.6)	4(%0.4)
Fluoride osseous dysplasia	3(%0.5)	-	3(%0.3)
Periapical osseous dysplasia	2(%0.3)	1(%0.2)	3(%0.3)
Odontoma	1(%0.2)	1(%0.2)	2(%0.2)
Fibrous dysplasia	-	1(%0.2)	1(%0.1)

Statistical analysis

The data were analyzed with Statistical Package for Social Sciences (SPSS) for Windows 21.0 (IBM, Chicago, USA). Descriptive statistical methods were used for evaluation of the data. The Chi-square and Fischer exact tests were used to evaluate comparisons between qualitative data. Values of $p < 0.05$ were interpreted as significant. Fisher exact test was used to determine the significance of the differences according to gender for the lesions "hypercementosis, odontoma, periapical osseous dysplasia, supernumerary teeth" with an expected value less than 5. For the other lesions where the expected value was greater than 5, the chi-square test was used.

Results

The study included 1108 patients. 609 (55.97%) of these patients were female, and 499 (45.03%) were male. The patients included in the study ranged in age from 14 to 83 years, with a mean age of 33.45 ±13.80 years. The study's female patients ranged in age from 14 to 83 years old, with a mean age of 33.55 ±13.43. Male patients ranged in age from 14 to 80 years, with a mean age of 34.54 ±14.20). In this investigation, 85 (7.7%) out of 1108 individuals had radiopaque lesions.

Forty-two (7.2%) and 41 (8.2%) of the lesions were discovered in females and males respectively. Between 26 (4.3%) females and 18 (3.6%) males, a total of 44 (4.0%) patients had idiopathic osteosclerosis. Six (1.0%) females and seven (1.4%) male out of the 13 (1.2%) patients had condensation. Twelve (1.1%) patients, six (0.7%) females and eight (1.6%) males had soft tissue calcification. Three (0.6%) male patients and one (0.2%) female patient both had hypercementosis. There were 3 (0.3%) female patients with fluoride osseous dysplasia. Three (0.3%) patients, two (0.3%) females and one (0.2%) male had periapical osseous dysplasia. Two (0.2%) patients, one female and one male were found to have odontoma (Table 1).

There was no statistically significant difference in radiopaque lesions between genders ($p > 0.05$) (Table 2). In addition, fibrous dysplasia was found in only one male patient, while the gender of the three patients with florid osseous dysplasia was female. Table 3 displays the subgroup distribution of radiopaque lesions based on their location. Condensing osteitis and idiopathic osteosclerosis were most common in the mandibular molar region.

Discussion

Although the cause of most radiopaque lesions in the jaws is unclear, etiological factors for some of these lesions are gradually being discovered. These radiopaque lesions, most of which are asymptomatic, are detected by radiographs taken for any reason.[20]

The radiography revealed that the most frequent radiopaque lesion was idiopathic osteosclerosis. This lesion typically manifests radiographically as a radiopaque zone in the premolar or molar region, next to the tooth apex or interradicular region. In younger

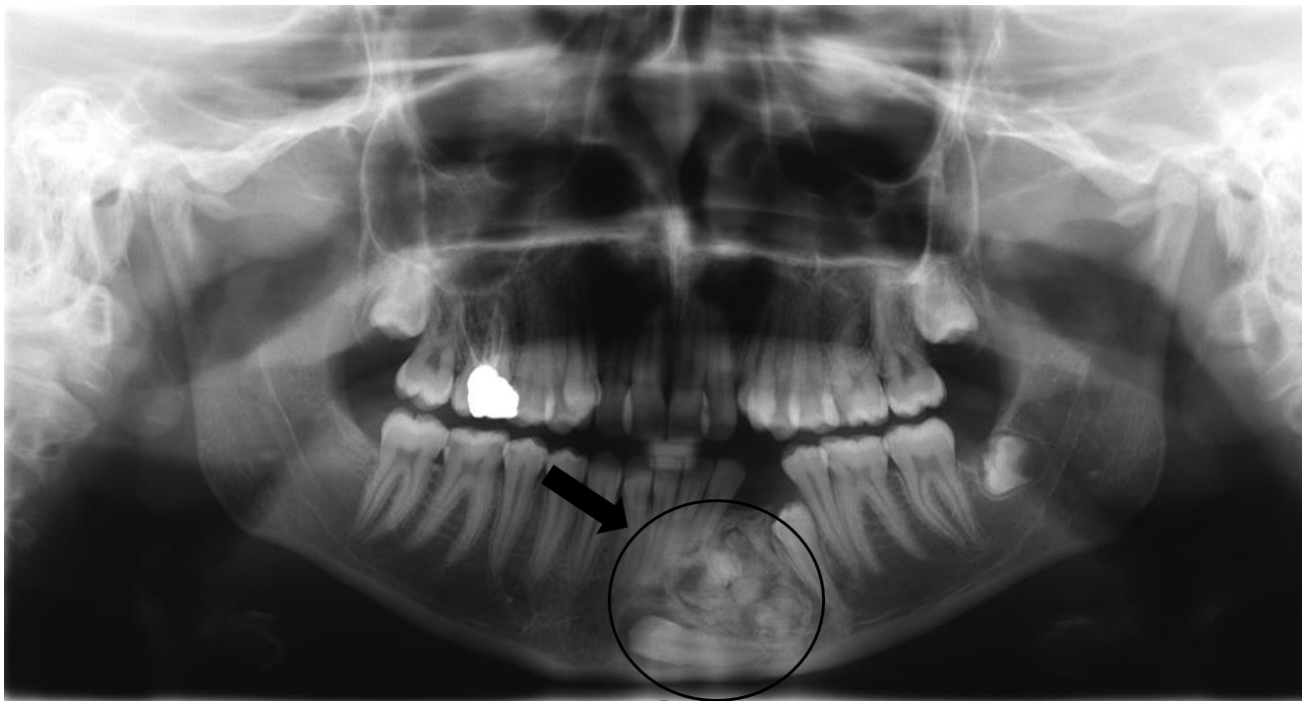

Figure 1. Panoramic view of a patient with odontoma

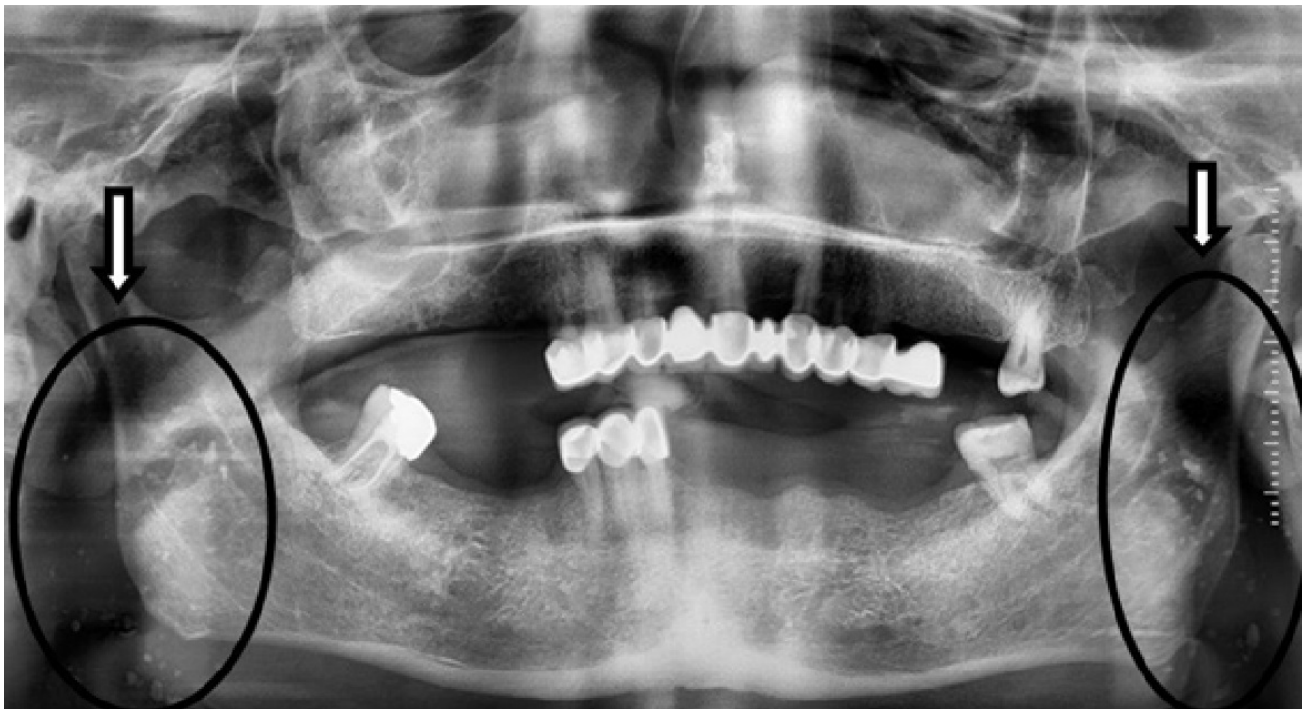

Figure 2. Panoramic radiographic image of a patient with soft tissue calcification

Table 2. Comparison of radiopaque lesions between genders.

	Female n=n (%)	Male n=n (%)	p
Radiopaque lesions	44(%7.2)	41(%8.2)	0.5371
Idiopathic osteosclerosis	26(%4.3)	18(%3.6)	0.5741
Condensing osteitis	6(%1.0)	7(%1.4)	0.5211
Soft tissue calcification	4(%0.7)	8(%1.6)	0.1301
Hypercementosis	1(%0.2)	3(%0.6)	0.3322
Periapical osseous dysplasia	2(%0.3)	1(%0.2)	0.5742
Odontoma	1(%0.2)	1(%0.2)	0.6982

01Chi-square Test 2 Fisher exact p< 0.05

people, it manifests asymptomatically and may be multifocal.[21] The prevalence of osteosclerosis was studied in a study involving 1921 patients. The distribution of the lesion and the finding that the lesion was not statistically significant across genders were identical to our study's findings.[22] Other investigations using panoramic radiography reported a frequency of 2.4% to 6.1% for idiopathic osteosclerosis.[23–25] AlHarbi et al.[26] analyzed 4010 panoramic radiographs and found incidental findings in 400 patients. The most common lesion in the category of incidental radiopaque lesions was osteosclerosis (7.5%).[26] MacDonald and Yu[27] scanned 6252 panoramic radiographs and evaluated the incidental findings by

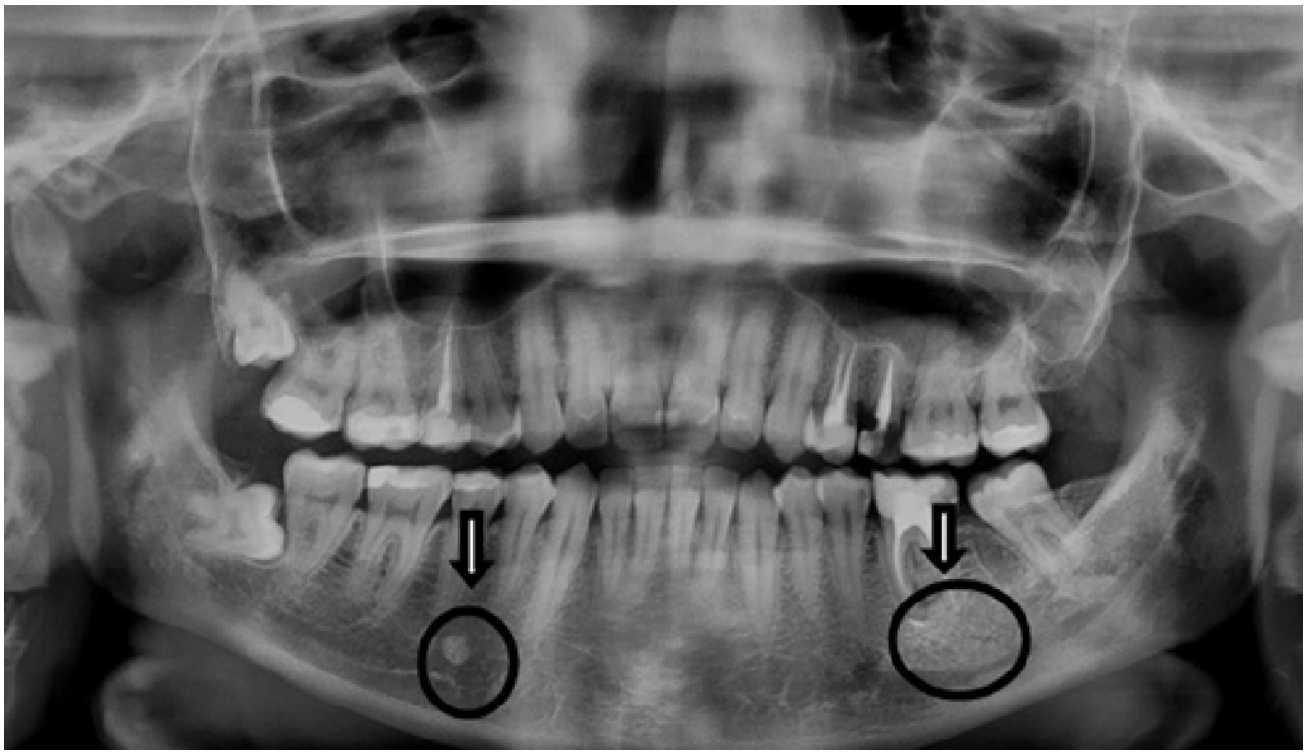

Figure 3. Osteosclerosis in the right mandibular premolar region and condensing osteitis at the apex of tooth number 36 in the left mandibular molar region

Table 3. Subgroup distribution of radiopaque lesions according to their localization.

Radiopaque lesions	Localization						
	Angulus	Mandibular anterior	Mandibular molar	Mandibular premolar	Ramus	Maxillary anterior	Maxillary molar
Idiopathic osteosclerosis	-	2	27	9	-	2	4
Condensing osteitis	-	1	11	1	-	-	-
Soft tissue calcification	3	-	-	-	9	-	-
Hypercementosis	-	-	4	-	-	-	-
Fluoride osseus dysplasia	-	-	3	-	-	-	-
Periapical osseous dysplasia	-	-	3	-	-	-	-
Odontoma	-	2	-	-	-	-	-
Fibrous dysplasia	-	-	-	-	-	-	1

grouping them. They defined radiopacities in the jaws as idiopathic osteosclerosis, condensing osteitis, bone dysplasia, odontomas and osteomas. They reported the most common type of radiopacity as idiopathic osteosclerosis and found no significant difference according to gender. They also reported that the majority (273) of the 377 osteosclerosis detected were localized in the mandibular molar region.[27] In terms of idiopathic osteosclerosis localization in Geitz and Katz's study, most of the lesions were located in the mandibular premolar region, but in our study, these lesions were found more frequently in the mandibular molar region.[21]

Condensing osteitis, also known as focal sclerosing osteomyelitis, represents a mild form of focal sclerosing osteomyelitis that occurs in the root apices of premolar or molar teeth.[2] In a recent study conducted in a Turkish subpopulation, 2.27% of 1011 individuals screened were found to have condensing osteitis.[1] In another prevalence study conducted in a larger sample size (6151 individuals) in the Turkish population, a lower rate (0.81%) was found. This study, which also determined the dental relationship of the lesions, favored the idea that condensing osteitis lesions could be considered as reactive formations.[23] In another study conducted in a Saudi subpopulation (752 individuals), the distribution of condensing osteitis was found to be 5.9%.[10] Related studies conducted in the Turkish population show similarities with our study in terms of the distribution of the lesion and also show similarities in the distribution between genders. When Dedeoğlu and Arıkan[1] evaluated radiopaque lesions, condensing osteitis lesions were detected most frequently in the mandibular molar region. Miloğlu et al.[23] examined condensing osteitis and idiopathic osteosclerosis lesions in the Turkish population and found condensing osteitis lesions mostly in the mandibular molar region. In the study of Al-Habib[10], condensing osteitis lesions were also found mostly in the mandibular molar region. The results of these studies were compatible with our study.

According to the World Health Organization's (WHO) current categorization, mesenchyme and/or odontogenic ectomesenchyme tumors with or without odontogenic epithelium include cementoblastoma. Less than 1% of all odontogenic tumors are cementoblastomas, an uncommon benign odontogenic tumor.[28] Cementoblastoma incidence in the study by Dedeoğlu and Arıkan[1] was determined to be 0.009. In this study, cementoblastoma which is typically observed in the first molar tooth was discovered in the premolar tooth. In this study, no cementoblastoma lesion was detected on panoramic radiography.

Periapical osseous dysplasia is a lesion where normal bone tissue is replaced with fibrous tissue and a substance that resembles cement due to a localized change in normal bone metabolism. It typically affects female who are older than 40. Since these lesions in adults don't cause any symptoms, they are typically discovered by coincidence on radiographs that were taken during an examination for another purpose.[4] On radiography, this lesion may show up

as radiolucent, hazy, or radiopaque. When it is radiolucent, care should be taken because it could be mistaken for a periapical lesion.[29] In their study, Cavalcanti et al.[30] discovered that the prevalence of periapical osseous lesions was 0.4% and that they were more common in female.[30] In addition, in their study, they found periapical osseous dysplasia in the mandibular anterior region as in our study.[28] According to Dedeoğlu and Arıkan[1], females had a higher frequency of periapical osseous lesions, with a prevalence of 0.69%.[1] This incidence was determined to be 0.3% in our investigation. Out of the three periapical osseous lesions found, two were observed in females. Only radiological follow-up is necessary because the majority of these lesions are self-limiting.[29]

Physiological or pathological mineralization causes the soft tissue structures in the head and neck region to become calcified. Anatomical placement, number, distribution, size, and shape of soft tissue calcifications are critical diagnostic factors. They are exceedingly hard to find when overlaid on anatomical structures. As a result, having a thorough understanding of the relevant region's hard and soft tissue architecture is crucial.[31,32] Panoramic radiographs taken during normal dental exams can reveal calcifications in the head and neck area.[33] In investigations using panoramic radiography, the incidence of soft tissue calcification/ossification has been found to be between 2 and 19%.[34–36] Another study, Altındağ and Yüksel[37] discovered soft tissue calcification in 157 out of 2640 patients (5.94%).[37] In our study, 12 out of 1108 patients (1.1%) had soft tissue calcification. The limited sample size could be the cause of the lower rate when compared to the literature.

Conclusion

In this study, the most common radiopaque lesion was idiopathic osteosclerosis, while cementoblastoma was not encountered. In addition, radiopaque lesions were most frequently observed in the mandibular molar region, while no radiopaque lesion was found in the maxillary premolar region. Panoramic radiographs provide physicians with important data in terms of evaluation of incidental radiopaque lesions. As a result of these findings, the correct diagnosis, treatment or follow-up of these lesions, which usually do not give symptoms, by clinicians will prevent patients from being directed to unnecessary or wrong treatments. This study underlines the need for dentists to systematically and comprehensively examine and appropriately manage panoramic radiographs for all patients.

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Author Contributions

A.G.Ö.T.: Contributed to conception and design, drafted and critically revised manuscript. F.N.P.: Contributed to conception, design, and data analysis, drafted and critically revised the manuscript. All authors gave final approval and agreed to be accountable for all aspects of the work.

Conflict of Interest

There is no conflict of interest between the authors.

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