Detection of Radiolucid Lesions in Digital Panoramic Radiographs

Emilly K. F. Rodrigues, Milena T. M. Santos, and Sandra A. Marinho

ABSTRACT

This study evaluated the presence of radiolucid lesions in digital panoramic radiographs from the archives of the State University of Paraiba (UEPB) Diagnostic Imaging Clinic, performed in 2017. After surveying the radiographs performed by the service in that year, those with radiolucent lesions were selected, being excluded those with poor quality and with patient positioning errors. By means of a structured form, the characteristics observed in the radiographs were recorded by a single trained and calibrated observer. The analysis took place through descriptive statistics and all ethical aspects were respected. There was a low prevalence (14.2%) of radiographs with radiolucent lesions, which mainly affected young female patients. These lesions were small in size, located predominantly in the posterior periapical region of the mandible, with a unilocular aspect, being associated with a posterior tooth, mainly premolar. Inflammatory lesions were the most prevalent, with a presumptive diagnosis highlighting the predominance of abscesses followed by cysts/granulomas. The dentigerous cyst was the third most prevalent odontogenic lesion, occurring in its entirety in females. Odontogenic keratocysts and Stafne's bone cavity were also detected.

Keywords: diagnostic imaging, panoramic radiography, radiography

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E. K. F. Rodrigues

Dentistry Course, Araruna, PB, Brazil (e-mail: emilly_r@hotmail.com)

M. T. M. Santos

Dentistry Course, Araruna, PB, Brazil (e-mail: milenathays41@gmail.com)

S. A. Marinho*

Dentistry Course, Araruna, PB, Brazil (e-mail: san_mar2000@yahoo.com.br)

*Corresponding Author

I. INTRODUCTION

Panoramic radiography (PR) is widely used in the diagnosis of various pathologies in hard tissues, mainly due to the convenience of having images records of the dentomaxillofacial structures in a single film [1]

The PRs have an important role in the evaluation of lesions present in the maxilla and mandible, mainly by observing the location, margins, aspect and effects of these lesions in the adjacent structures, allowing an expressive auxiliary contribution in the diagnosis [2]. In addition, they can also lead to the occasional discovery of asymptomatic lesions [3]. However, because it is a two-dimensional image of threedimensional structures, overlapping images, changes in the shape and dimension of objects can happen, and therefore, it is important to know these structures in order to avoid errors in the diagnosis [1].

Through panoramic radiographs, a variety of radiolucent lesions can be analyzed, whether odontogenic or not [4]. Most of the radiolucent lesions found are benign, and the most commonly found are periapical granulomas, inflammatory cysts and abscesses. Other benign radiolucent lesions (developmental cysts), such as dentigerous cyst and odontogenic keratocyst and benign odontogenic tumors, such as ameloblasma, can also be seen on panoramic radiographs [5]. In addition to inflammatory and odontogenic lesions, there are other non-odontogenic lesions, such as the nasopalatine duct cyst, which represents 80% of the cysts of this class [6].

For diagnosis, the radiographic size or the presence of a radiopaque halo are often not sufficient to determine which type of lesion it is treating, since many pathological processes have radiographic similarities, making it necessary to associate them with clinical or histological analysis, to arrive to a definitive diagnosis [7], [8].

Therefore, the purpose of this work was to evaluate the presence of radiolucent lesions in digital panoramic radiographs performed in 2017, filed at the UEPB Diagnostic Imaging Clinic, Campus VIII.

II. MATERIAL AND METHODS

Cross-sectional, retrospective and descriptive study, with a quantitative approach, carried out at the Diagnostic Imaging Clinic of the State University of Paraíba, located in the city of Araruna, PB, Brazil.

The PRs were obtained using the EAGLE 3D Computerized Tomograph (Dabi Atlante, Ribeirão Preto, SP, Brazil), with a standard exposure time of 14s, 8mA, 60 to 85 kVp, following the manufacturer's instructions. Biosafety rules were also followed, and it was essential to control biological and radiation risks. To capture the digital image, the Dental Imaging Software Setup Wizard software (Dabi Atlante, Ribeirão Preto, SP, Brazil) was used. All images were captured on a single computer.

The sample consisted of the Clinic's digital PR collection held in 2017. All PR in great detail, and medium density and contrast were included. Radiographs without complete patient data, with low quality images, and which had positioning errors and the presence of artifacts were excluded. The radiographs were numbered sequentially, based on the date they were taken, without any identification of the patient, guaranteeing the confidentiality of the research.

The data were collected through a structured form, in which the patient's sex and age were recorded, and data related to the lesion (location, shape, aspect of the edges and relationship with adjacent structures). The radiographs were evaluated by a single examiner, properly trained and calibrated.

The data were analyzed using descriptive statistics, with the aid of the Statistical Package for Social Sciences program (SPSS® Inc., Chicago, USA) version 22.0.

According to Resolution 466/12 of the National Health Council/Ministry of Health, this work was registered with the National Research Ethics System (SISNEP) and only started after approval by the Research Ethics Committee (CEP, CAAE 13904718.7 .0000.5182).

III. RESULTS

The collection of panoramic radiographs taken at the Diagnostic Imaging Clinic of the Dentistry course at UEPB campus VIII presented a total of 840 radiographs (from 2016-2018). Of these, 356 (42.4%) were performed in 2017. After considering the inclusion and exclusion criteria, a sample of 310 (87.1%) PR performed in 2017 was reached, used for data collection. The minimum age of patients was five years and the maximum was 79 years (mean 27.6 years), with a higher prevalence of females (n=181, 58.4%).

Of the total radiographs analyzed, only 44 (14.2%) presented some radiolucent lesion, with 52.27% corresponding to presumptive abscess characteristics; 25% corresponding to the presumptive diagnosis Cyst/Granuloma; 9.1%, of dentigerous cyst and a total of 6.8% of presumptive diagnosis of odontogenic keratocyst. In addition to the aforementioned injuries, two cases of Stafne's bone defect (4.5%) and one presumptive case of odontogenic myxoma (2.3%) were observed (Table I).

The minimum size of the lesions was 0.2 cm and the maximum was 14.5 cm (mean size=1.55cm), where 42 (95.5%) of them were smaller than 5 cm. The most prevalent location was the posterior mandible (n=21, 47.7%), followed by the posterior maxilla (n = 10, 22.7%). The vast majority of injuries were associated with the peripexis of the teeth (n = 13, 89.7%) and the teeth most involved were premolars (n=17, 43.6%), followed by molars (n=15, 38.5%, Table I).

A total of 26 lesions (59.1%) had an ill-defined shape; 43 (97.7%) presented unilocular appearance and 34 (77.3%) did not exhibit sclerotic edges. Only three (6.8%) caused root resorption and displacement of adjacent teeth, two (4.5%) broke the cortical bone and none presented internal calcification (Table I).

Periapical lesions were the most prevalent, abscesses being the most common, occurring mainly in males (Table II). There was no preferential region of this lesion in the maxilla, however, in the mandible they presented with great prevalence in the posterior region. Cysts/granulomas, on the other hand, showed a preference for the posterior region (Table III), especially in adult patients (Table IV).

TABLE I: CHARACTERISTICS OF THE LESIONS OBSERVED IN PANORAMIC RADIOGRAPHS (N=44).

OBSERVED IN PANORAMIC RADIO	
VARIABLE	n (%)
Presence of lesion	
Yes	44 (14.2)
No	266 (85.8)
Localization	
Anterior region of maxilla	7 (15.9)
Posterior region of maxilla	10 (22.7)
Anterior region of mandible	4 (9.1)
Posterior region of mandible	21 (47.7)
Angle and ramus of mandible	2 (4.5)
Shape	
Well defined	18 (40.9)
Poorly defined	26 (59.1)
Aspect	
Unilocular	43 (97.7)
Multilocular	1 (2.3)
Presence of sclerotic edges	
Yes	10 (22.7)
No	34 (77.3)
Tooth association	
Yes	39 (88.6)
No	5 (11.4)
Place of the association	
Coroa	4 (10.3)
Periápice	35 (89.7)
Number of associated teeth	
One	35 (89.7)
More than one	4 (10.3)
Tooth envolved	
Molar	15 (38.5)
Premolar	17 (43.6)
Canine	1 (2.6)
Incisive	6 (15.4)
Rooth resorption of the adjacent teeth	
Yes	3 (6.8)
No	41 (93.2)
Displacement of djacent teeth	2 (50)
Yes	3 (6.8)
No	41 (93.2)
Cortical disruption	2/15
Yes	2 (4.5)
No	42 (95.5)
Internal calcifications	0 (0)
Yes	0 (0)
No	44 (100.0)
Diagnostic Hypothesis/ Presumptive	
diagnosis	11 (25.0)
Cyst/Granuloma	11 (25.0)
Abscess	23 (52.3)
Dentigerous cyst	4 (9.1)
Odontogenic keratocyst	3 (6.8)
Stafne Bone Defect	2 (4.5)
Odontogenic Myxoma	1 (2.3)

TABLE II: PREVALENCE OF LESIONS RELATED

TO THE PATIENT'S GENDER.				
	Geno	der		
Diagnostic Hypothesis	n			
	Female	Male		
Cyst/Granuloma	5	6		
Abscess	7	16		
Dentigerous cyst	4	0		
Odontogenic keratocyst	1	2		
Stafne Bone Defect	0	2		
Odontogenic Myxoma	1	0		
TOTAL	18	26		

TABLE III: TOPOGRAPHIC LOCATION OF THE LESIONS.

			LC	CALIZATION				
		Maxilla (n=17)				Mandible (n=27)		
Presumptive Diagnosis	Anterior region	Posterior region	Total n (%)	Anterior region	Posterior region	Base	Angle and ramus	Total n (%)
Cyst/Granuloma	1	4	5 (29.4)	2	4	0	0	6 (22.2)
Abscess	3	3	6 (35.3)	1	16	0	0	17 (62.9)
Dentigerous cyst	1	2	3 (17.6)	0	1	0	0	1 (3.7)
Odontogenic keratocyst	1	1	2 (11.7)	1	0	0	0	1 (3.7)
Stafne Bone Defect	0	0	0	0	0	0	2	2 (7.4)
Odontogenic Myxoma	1	0	1 (5.9)	0	0	0	0	0

TABLE IV: MEAN AGE OF THE PATIENTS.

	Average age
Presumptive Diagnosis	(years)
Cyst/Granuloma	29
Abscess	34
Dentigerous cyst	18
Odontogenic keratocyst	20
Stafne Bone Defect	64
Odontogenic Myxoma	23

IV. DISCUSSION

X-rays are essential complementary exams in dentistry for the diagnosis, planning and execution of the treatment of bone alterations and patient follow-up. Among the extraoral techniques, PR is the most used, as it allows an overview of maxillomandibular structures and teeth, and can be used as a screening method, as well as contributing to the early detection of lesions [3]. For this reason, this work aimed to assess the presence of radiolucent lesions in panoramic radiographs.

In this present study, a low prevalence of radiolucent lesions was found on the radiographs taken in 2017, due to the small sample size. Radiolucent lesions were more prevalent in mandible than maxilla, as seen by other authors [3], [9], most of which have a benign character [5]. However, as this work was performed only on radiographs, the diagnosis was only presumptive, based on the radiographic characteristics of the lesion, without histopathological confirmation, which is one of the limitations of the study. Only the biopsy would the definitive diagnosis of the lesions.

Inflammatory periapical lesions were the most prevalent, with the presumptive diagnosis of abscess being the most commonly found in this study. For the presumptive diagnosis of abscess, the presence of an ill-defined radiolucency in the region of dental periapex was considered, which may present a thickening of the periodontal space in the apical region [10]. Other inflammatory lesions, such as granulomas and periapical cysts, were also prevalent in this study, unlike other authors, who found, in their works, a higher prevalence of granulomas and cysts, in relation to abscesses [5], [11. A Study [12] found that about 92% of the bone pathologies of the jaws corresponded to radiolucent lesions, and that about 85% of these were located in the periapex.

As also verified in other study [3], the cysts/granulomas of the present study were more prevalent associated with the roots of mandibular posterior teeth.

However, it was not possible to differentiate the granuloma of the cyst in a PR, which were evaluated together, since there is necessary a biopsy for this histological differentiation. However, granulomas have a slight predilection for the anterior region of the maxilla and females [11], [13]. Granulomas can be well circumscribed or poorly defined, with or without sclerotic borders [4] Evaluating 17,038 lesions, a study [11] observed that 72.8% of them corresponded to inflammatory lesions, with periapical granuloma being the most prevalent (59.7% of lesions), followed by radicular cysts (29.2%).

In the present study, the mean age of patients with a lesion (inflammatory or not) was 27.6 years. The mean age of patients with a presumptive diagnosis of inflammatory lesions such as an abscess was 34 years and of cyst/granuloma, 29 years. However, in a study [11], the mean age of patients with some inflammatory lesion was considerably higher (44 years), with men slightly more affected than women, as in the present study, which also had a predilection for inflammatory lesions by men, which were mainly, abscesses.

Of the non-inflammatory odontogenic lesions, the dentigerous cyst was the most prevalent in this study, mainly in the posterior region, both in maxilla and mandible, in young female patients. A study [14] found a slight predilection for males and a higher occurrence in the mandible. Another study [15] also observed a high prevalence of these cysts in the posterior region of mandible. This cyst is formed around the crown of an unerupted or impacted tooth, as a unilocular radiolucent lesion, with well-defined sclerotic edges, with greater occurrence in lower third molars, as seen in this study. However, this cyst has a greater predilection for males, being more common between the second and fourth decades of life [4], [6], [16], in contrast to what was found in the present study, where there was a total prevalence of females (100%) and an average age of 18 years.

In this work, the presumptive presence of odontogenic keratocyst was observed in three young male patients, with two of the lesions observed in the maxilla. However, a study [17] found a higher prevalence of this lesion in the mandible in male patients, between the third and fourthy decades. However, only the biopsy will confirm the diagnosis.

Stafne's bone defect was observed in two male patients, with a mean age of 64 years. It is a radiolucent, asymptomatic, well-defined alteration, rounded to ovoid, observed in the region of the mandible angle, unilaterally, in the vast majority of cases, which accommodates the submandibular gland [18], [19], requiring no treatment.

A presumptive case of odontogenic myxoma was also observed in the anterior region of the maxilla in a 23-year-old patient. Despite presenting a difficult diagnosis, the lesion was locally invasive and promoted resorption and displacement of the roots of the adjacent teeth [20], aspects evident during the radiographic evaluation, which led to this diagnostic hypothesis.

Although this study presents the great limitation of a small sample, it demonstrated the importance of knowing the radiographic characteristics of different radiolucent lesions. in order to assist in their presumptive diagnosis. Further studies are needed, using larger samples.

REFERENCES

- [1] S. Mallya and E. Lam. White and Pharoah's Oral Radiology: Principles and interpretation. 8th ed. Maryland: Elsevier, 2018.
- A. Gohel, A. Villa, and O. Sakai, "Benign Jaw Lesions," Dent Clin North Am. vol. 60, pp.125-141, 2016.
- A. J. Langaroodi, S. S. Lari, A. Shokri, H. S. H. Zarch, and P. Akbari, "Intraosseus benign lesions of the jaws: a radiographic study," Iran J Radiol. vol. 11, pp. 7683-7687, 2014.
- [4] L. Avril, T. Lombardi, A. Ailianou, K. Burkhardt, A. Varoquaux, P. Scolozzi, and M. Becker, "Radiolucent lesions of the mandible: a pattern-based approach to diagnosis," Ins Image, vol. 5, pp. 85-101, 2014.
- [5] T. Koivisto, W. R. Bowles, and M. Rohrer, "Frequence and distribuition of radiolucent jaw lesions: A retrospective analysis of 9.723 cases," J Endod, vol. 38, pp.709-732, 2012.
- A. K. Ei-Naggar, J. K. C. Chan, J. R. Grandis, T. Takat, and P. J. Slootweg. WHO Classification of Head and Neck Tumours. 4th ed. Lyon: IARC. 2017.
- M. Harmon, M. Arrigan, M. Toner, and S. A. Okeeffe, "A radiological approach to benign and malignant lesion of the mandible," Clin Radiol, vol .70, pp. 335-350, 2015.
- M. Çaliskan, M. E. Kaval, U. Tekin, and T. Unal, "Radiographic and histological evaluation of persistet periapical lesions associated with endodontic failures after apical microsurgery," Int Endod J, vol. 49, pp. 1011-1019, 2015.
- [9] J. Araujo, C. A. Lemos, T. G. Miniello, and F. A. Alves, "The relevance of clinical and radiographic features of jaw lesions: A prospective study", Braz Oral Res, vol. 30, pp. 96-104, 2016.
- [10] L. X. Wei, F. H. Pei, S. Z. Syed, E. K. Wei Ling, K. V. Suresh, K. B. Abd Muttalib, and D. D. Dicksit, "Radiographic assessment of apical root resorption in inflammatory periapical pathologies," J Indian Acad Oral Med Radiol, vol. 30, pp. 132-136, 2018.
- [11] K. Becconsall-Ryan, D. Tong, and R. M. Love, "Radiolucent inflammatory jaw lesions:a twenty-year analysis," Int Endod,. vol. 43, pp. 859-865, 2010.
- [12] M. C. C. Antoniazzi, P. L. D. Carvalho, and C. H Koide, "Importance of knowledge about radiographic anatomy for the interpretation of boné pathologies," RGO, vol. 56, pp. 195-199, 2008. [In Portuguese].
- [13] D. P. Tavares, J. T. Rodrigues, T. C. R. B. Santos, L. Armada, and F. R. Pires, "Clinical and radiological analyses of a series of periapical cysts and periapical granulomas diagnosed in a Brazilian population," J Clin Exp Dent, vol. 9, pp. 129-135, 2017.
- [14] H. P. Lin, Y. P. Wang, H. M. Chen, S. J. Cheng, A. Sun, and C. P. A. Chiang, "Clinicopathological study of 338 dentigerous cysts," J Oral Pathol, vol. 42, pp. 462-467, 2013.
- [15] M. Henien, C. Sproat, J. Kwok, K. Beneng, and V. Patel, 'Coronectomy and dentigerous cysts: a review of 68 patients, Surg Oral Med Oral Pathol Oral Radio, vol. 123, pp. 670-674, 2017.
- [16] L. L. Zhang, R. Yang, L. Zhang, W. Li, D. Macdonald-Jankowski, and C. F. Poh, "Dentigerous cyst: a retrospective clinicopathoogical analysis of 2082 dentigerous cysts in British Columbia, Canada, "Int J Oral Maxillofac Surg, vol. 39, pp. 878-882, 2010.
- [17] P. Pitak-Annnop, A. Chaine, N. Oprean, K. Dhanuthai, J. Bertrand, and C. Bertolus, "Management of odontogenic keratocysts of the jaws: A ten-year experience with 120 consecutive lesions," J Cranio Maxillofac Surg, vol. 38, pp. 358-364, 2010.

- [18] B. L. Dunfee, O. Sakai, R. Pistey, and A. Gohel, "Radiologic and pathologic characteristics of benign and malignant lesions of the mandible,". RadioGraph. vol. 26, pp. 1752-1768, 2006.
- [19] A. Z. Syed, B. Jadallah, M. Uzcategui, and S. M. Shaik, "CBCT Diagnosis of a Stafne bone defect. Mich Dent Assoc, vol. 99, pp. 44-46, 2017.
- [20] L. Benjelloun, N. Cherradi, A. Kessab, and S. Dghough, "An atypical odontogenic myxoma," J Stomatol Oral Maxillofac Surg, vol. 119, pp.

Emilly K. F. Rodrigues was born in Paraiba, is graduated in Dentistry in UEPB (2019).

She is a Dental surgeon and was a CNPq scientific iniciation fellow (PIBIC). Miss Rodrigues acts as a general dentist in a dental

Milena T. M. Santos was born in Paraiba, is graduated in Dentistry in UEPB (2019).

She is a Dental surgeon and was a CNPq scientific iniciation fellow (PIBIC). Miss Santos acts as a general dentist in a dental office.

Sandra A. Marinho was born in Minas Gerais, is a PhD in Oral Medicine (PUCRS, Porto Alegre, RS, Brazil, 2006).

She is a Professor of UEPB Dentistry Course since 2011. Act in the areas: Oral medicine and oral radiology.

Prof. Dr. Marinho published the paper "Injuries to the stomatognathic system in Brazilian jiu-jitsu athletes," Sci Rep,vol. 9, pp. 1-7, 2019.