Prevalence of granulomas, abscesses and periapical cysts in inflammations of endodontic origin

Luisa de Mello Florentino **GUEDES**[1,3]
Orlando Aguirre **GUEDES**[2,4]
Marcus Vinícius Corrêa da **COSTA**[1,5]
Artur Aburad de **CARVALHOSA**[2,6]
Cyntia Rodrigues de Araújo **ESTRELA**[2,7]
Carlos **ESTRELA**[1,8]

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ABSTRACT

Introduction: Necrosis of pulp tissue followed by colonization and infection of root canal space are determinant events to the trigger for, development and perpetuation of apical periodontitis. **Objective:** To evaluate the prevalence of different types of periapical inflammatory lesions of endodontic origin. **Methods:** The sample comprised 805 histopathological reports issued and filed by the Oral Pathology Department of Public Laboratory of Mato Grosso, Brazil, between 2008 and 2014. The following information was collected from diagnosis requisition sheets and histopathological reports: sex, age, tooth group, anatomical localization and histopathological diagnosis (periapical granuloma, periapical abscess and root cyst). Statistical treatment analyzed data through frequency distribution and chi-square tests. The level of significance was set at 5% for all analyses. **Results:** A higher occurrence of periapical lesions was observed in males (n = 405; 50.31%) and participants between 21 and 30 years old. The most affected teeth were mandibular molars (n = 293; 36.40%), followed by maxillary molars (n = 213; 26.46%). Periapical granuloma (n = 458; 56.89%) was the most common periapical lesion. Statistically significant associations were observed between the type of periapical lesion and anatomical localization ($p < 0.05$). **Conclusions:** There was a high prevalence of periapical lesions in males and participants between 21 and 30 years old. Periapical granuloma was the most commonly diagnosed periapical lesion, the mandibular posterior teeth were the most affected teeth.

Keywords: Periapical periodontitis. Diagnosis. Epidemiology. Periapical granuloma.

[1]Universidade Federal de Goiás, Programa de Pós-graduação em Ciências da Saúde (Goiânia/GO, Brazil).

[2]Universidade de Cuiabá, Programa de Pós-graduação em Ciências Odontológicas Integradas (Cuiabá/MT, Brazil).

[3]Master's degree in Health Sciences, Universidade Federal de Goiás (Goiânia/GO, Brazil).

[4]Doctorate degree in Health Sciences, Universidade Federal de Goiás (Goiânia/GO, Brazil).

[5]Master's degree in Integrated Dental Sciences, Universidade de Cuiabá (Cuiabá/MT, Brazil).

[6]Doctorate degree in Oral Pathology, Universidade de São Paulo (São Paulo/SP, Brazil).

[7]Doctorate degree in Cellular and Molecular Biology, Universidade Federal de Goiás (Goiânia/GO, Brazil).

[8]Doctorate degree in Endodontics. Universidade de São Paulo (São Paulo/SP, Brazil).

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Contact address: Orlando Aguirre Guedes
Faculdade de Odontologia, Universidade de Cuiabá, Av. Beira Rio, 3100
Jardim Europa, Cuiabá/MT – CEP: 78.065-900
E-mail: orlandoaguedes@yahoo.com.br

Introduction

Pulp tissue necrosis followed by colonization and infection of root canal space are determinant events to the trigger for, development and perpetuation of an inflammatory process at the periodontal ligament, which is also known as apical periodontitis.[1] Interactions between irritants coming from the root canal and the host's immune mechanisms result in the formation of different types of apical periodontitis,[2] usually seen as periapical granulomas, periapical abscesses or root cysts.[2-4]

Over the years, numerous attempts have been made, without success, in the search for identifying elements that would allow for a differential diagnosis among types of apical periodontitis.[5-8] Definitive diagnosis of periapical inflammatory diseases can be achieved only by histopathological examination.[9-11] Microscopically, a periapical granuloma is characterized by a granulomatous fibrovascular tissue, epithelialized or not, infiltrated by mast cells, macrophages, lymphocytes and plasmocytes. Occasionally, foamy macrophages and giant cells are found, mainly associated with deposits of cholesterol crystal.[12] Periapical abscess is an outbreak of acute inflammation characterized by polymorphonuclear leukocytes, neutrophils and cellular debris, and it is surrounded by macrophages, lymphocytes and some plasma cells.[2] Root cyst is a pathological cavity completely lined by stratified squamous epithelium not keratinized with variable thickness, which is separated from the capsule connective tissue by a basal membrane.[2,13,14] Two types of root cyst have been described. The true cyst presents a distinct pathological cavity so that there is no communication with the root canal. The opposite is observed in bay cyst.[2,13,14]

Previously published studies have reported a prevalence of periapical granulomas ranging from 2.5-93%, periapical abscesses from 1.1-42% and root cysts from 6-55%.[2,4,12,15,16] The variations found reflect differences in selection and sample size, the technique used to obtain and treat surgical specimens and the histopathological diagnostic criteria.[15] Discrepancy in the results of studies, rather than providing a solid base of knowledge, creates insecurity for the clinician, especially when choosing the best treatment to be carried out.[17] Typically, non-surgical endodontic treatment is indicated for the management of periapical lesions diagnosed as periapical granulomas and periapical abscesses, while surgical treatment is often performed in resolution of cases in which a probable clinical diagnosis of root cyst is established.[18] Another cause for concern is the growing number of reports on non-endodontic lesions found in the periapical region of teeth with periapical radiolucencies,[19,20] such as nasopalatine duct cysts, traumatic bone cysts, calcifying odontogenic cysts, chondrosarcoma mesenchymal, lymphangioma, ameloblastoma and central giant cell lesions.[21]

Knowledge of the histopathological pattern of periapical lesions is important, since these lesions have distinct behaviors requiring different treatment modalities. Thus, retrospective analysis of histopathological examinations of tissues associated with the apex of extracted teeth, with a view to standard understanding of periapical pathologies of patients seen daily in dental offices, becomes justified.

Material and methods

This was a cross-sectional, descriptive and retrospective study carried out by verifying histopathological examinations of surgical specimens sent to the Oral Pathology Department of the Public Laboratory of Mato Grosso (MT laboratory), Cuiabá, Mato Grosso, Brazil, emitted in the period of 2008 to 2014. The research was based on the requested examinations records and histopathological reports, all filed in the database of MT Laboratory.

Inclusion criteria for this study were duly completed histopathological results for periapical lesions associated with extracted teeth and the diagnosis of periapical granulomas, cysts and periapical root abscesses. Records that had information regarding periapical lesions in primary teeth were excluded. Information related to patient's sex and age, the anatomical location of the lesion (maxilla or mandible and anterior or posterior region), the dental group associated with the injury, and the histopathological diagnosis were collected and stored in digital spreadsheets. Prior to data collection, a pilot study involving 10% of the final sample was carried out to test the feasibility of the study and to train and calibrate examiners regarding the criteria used.

Criteria used for histopathological classification of periapical lesions adopted in the Oral Pathology De-

partment of MT laboratory are described by Araújo and Araújo.[22] Thus, diagnosis of periapical granulomas was established in the presence of a lesion comprising fibrous or granulation tissue with varying degrees of inflammatory infiltrate. These injuries could present as epithelialized or not. Periapical abscesses were recorded in the presence of cavitated lesions containing pus and surrounded by a fibrous capsule with chronic inflammatory infiltrate. The microscopic criterion for diagnosis of root cyst included the presence of a cavity lined by epithelium surrounded by fibrous connective tissue.

This study was approved by the local Research Ethics Committee (CAAE 37414814.2.0000.5156).

Data were analyzed using IBM SPSS for Windows 21.0 (IBM Corporation, Somers, NY, USA), including frequency distribution and cross-tabulation. Chi-square tests were used to compare qualitative data, and statistical significance was set at 5%.

Results

This study involved 805 histopathological examinations (405 male patients, 50.31%; and 400 were female patients, 49.69%; male-to-female ratio = 1.01:1) of patients aged from 6 to 114 years (mean = 31.47 years, standard deviation = 16.20). The highest frequency was in the group of patients aged 21-30 years (26.33% each) (Table 1).

Table 1. Distribution of periapical inflammatory lesions by sex, age, anatomical location and tooth.

Variables	Histopathological diagnosis			Total	*p*
	Granuloma (n = 458)	Cyst (n = 250)	Abscess (n = 97)		
Sex (n = 805)					
Female	221 (27.45%)	123 (15.28%)	56 (6.96%)	400 (49.69%)	> 0.05
Male	237 (29.44%)	127 (15.78%)	41 (5.09%)	405 (50.31%)	
Age (n = 805)					
6-10 years	26 (3.23%)	8 (0.99%)	3 (0.37%)	37 (4.60%)	
11-20 years	112 (13.91%)	56 (6.96%)	28 (3.48%)	196 (24.35%)	
21-30 years	123 (15.28%)	69 (8.57%)	20 (2.61%)	212 (26.34%)	
31-40 years	82 (10.19%)	49 (6.09%)	21 (2.61%)	152 (18.88%)	> 0.05
41-50 years	50 (6.21%)	34 (4.22%)	13 (1.61%)	97 (12.05%)	
51-60 years	30 (3.73%)	20 (2.48%)	6 (0.75%)	56 (6.96%)	
≥ 61 years	35 (4.35%)	14 (1.74%)	6 (0.75%)	55 (6.83%)	
Anatomical location (n = 805)					
Maxilla	206 (25.59%)	124 (15.40%)	46 (5.71%)	376 (46.71%)	
Mandible	252 (31.30%)	126 (15.65%)	51 (6.34%)	429 (53.29%)	< 0.05
Anterior	73 (9.07%)	54 (6.71%)	77 (9.57%)	204 (25.34%)	
Posterior	385 (47.83%)	196 (24.35%)	20 (2.48%)	601 (74.66%)	
Tooth (n = 805)					
Maxillary incisor	28 (3.48%)	27 (3.35%)	8 (0.99%)	63 (7.83%)	
Maxillary canine	7 (0.87%)	11 (1.37%)	6 (0.75%)	24 (2.98%)	
Maxillary premolar	46 (5.71%)	20 (2.48%)	10 (1.24%)	76 (9.44%)	
Maxillary molar	125 (15.53%)	66 (8.20%)	22 (2.73%)	213 (26.46%)	> 0.05
Mandibular incisor	24 (2.98%)	11 (1.37%)	3 (0.37%)	38 (4.72%)	
Mandibular canine	14 (1.74%)	5 (0.62%)	3 (0.37%)	22 (2.73%)	
Mandibular premolar	44 (5.47%)	20 (2.48%)	12 (1.49%)	76 (9.44%)	
Mandibular molar	170 (21.12%)	90 (11.18%)	33 (4.10%)	293 (36.40%)	

A total of 429 lesions (53.29%) were in the mandible while 376 (74.66%) were in the maxilla. Most lesions were in the posterior maxilla (n = 601; 52.96%). The most commonly involved teeth were mandibular molars (n = 293; 36.40%), followed by maxillary molars (n = 213; 26.46%), mandibular premolars (n = 76; 9.44%) and maxillary premolars (n = 76; 9.44%) (Table 1).

Periapical granuloma (n = 458; 56.89%) and root cyst (n = 250; 31.06%) were the most prevalent inflammatory periapical lesions (Table 1).

There was statistically significant difference between the type of periapical lesion and the anatomical location ($p < 0.05$). It was observed that 74.66% of periapical lesions were in the posterior region of the jaw. However, cases of periapical abscess were most commonly diagnosed in the anterior region (n = 77; 79.38%) (Table 1). There was no statistically significant difference in the occurrence of lesions by sex and age ($p > 0.05$).

Discussion

Epidemiological studies contribute with valuable information about public health, which along with clinical observations and laboratory research provides several fundamental observations in all segments of science. Analysis on the prevalence of diseases in different populations is important for comparisons, and so it is to monitor health status, so as to observe trends in different populations/individuals and to establish planning of health services, prevention programs, disease control and a basis for future research.[23-25]

Analysis developed in this study was retrospective, based on verification of histopathological examinations of surgical specimens sent to the Oral Pathology Department of the Public Laboratory in Mato Grosso (MT laboratory) between 2008 and 2014. Cross-sectional studies conducted in different populations[4,10-12,15-17,26,27] served as support to the present research.

The Oral Pathology Department of the MT laboratory was created through Decree #195 of the Health State Secretary of Mato Grosso, which established the State Policy Attention to Diseases of the Mouth and Face.[28] Such actions were consolidated on June, 30th 2005, under Law #8342, which determined that basic health units in Mato Grosso should work on achieving oral diagnostic tests (exfoliative cytology and biopsies), and established MT Laboratory as a state center reference for sending examinations.[29] Thus, MT Laboratory file presents diagnoses of mouth and face lesions for the entire state, as well as demographic data (sex, age and origin) related to these injuries. The concentration of reports in a single laboratory made analysis developed in this study easier.

Retrospective studies are relatively easy and economical to perform, making them a viable source for creating hypotheses.[23] However, they have limitations, such as the inability to establish the time connections necessary to prove cause and effect, since both are collected at the same time.[24,25] Moreover, the quality of information obtained depends on the correct completion of documents (clinical record, requisition form, report, etc.). Thus, when some information fails to be registered, the result of the study is compromised and/or limited. Reports with inconclusive histological diagnoses, classified as insufficient or inadequate material for diagnosis, and presenting blank fields and/or unspecified data were excluded.

In the present study, most endodontic lesions were diagnosed in male subjects (n = 405; 50.31%), in a proportion of 1.01:1 males to females. These results corroborate the outcomes obtained by Gbolahan et al[11] that observed a proportion of 1.02:1 males to females. However, Bhaskar[26] found a higher ratio (1.32:1) than recorded in the present study. Other studies have found a reduction or even a reversal in this disparity between males and females.[4,10,15-17] There are several factors influencing the relationship between sex and disease, such as the socioeconomic and cultural characteristics of the sample. This study was performed in a public diagnostic service based on the verification of histopathological reports of material obtained during the tooth extraction procedure. The population studied belonged to sectors with low socioeconomic status. Thus, the high prevalence of injuries among males observed in this analysis may be associated with the fact that they often look at the extraction procedure as treatment for caries and periodontal disease.[30]

Several studies point to the fourth decade of life, as it includes a greater proportion of subjects with

periapical lesions of endodontic origin.[12,16] Hollanda et al[31] assessed the prevalence of endodontically treated teeth in a population of Brazilian adults and observed a high number of procedures in participants older than or equal to 46 years old. In the present study, there was a high number of lesions in participants aged between 21 and 30 years (26.34%). In fact, 55% of granulomas, abscesses and cysts were diagnosed in individuals aged below 30 years, which agrees with results obtained by other studies.[11,15,26] However, care should be taken when comparing the prevalence among studies that used different methodologies due to absence of a standard definition for the age group.

Previously published studies point to the anterior region of the jaw as the most affected anatomical region.[10,15-17,20,26,27] Most periapical lesions observed in this study came from the posterior region of the mandible (45.84%), and the molar was the most commonly associated tooth (n = 293; 36.40%). This result is similar to the outcomes obtained by Gbolahan et al.[11] It should be emphasized that the investigated anatomical location is directly related with the procedure used to obtain the sample. In other words, depending on the methodology used in the study, surgical specimens subjected to histopathological analysis are obtained through dental extractions or periradicular surgery. A high number of periapical surgeries are performed on maxillary teeth,[32] whereas posterior teeth are routinely extracted.[30] This fact may explain the reduced number of lesions found in the anterior region in this study.

The most frequent periapical lesions identified in the present study were periapical granulomas (n = 458; 56.89%) (Table 1). This result was similar to other studies[2,35,13,17,18,26,33] in which histological sections showed a greater number of lesions composed of fibrous or granulating tissue and varying degrees of inflammatory infiltrate. In contrast, Bacaltchuk et al[15] found a large number of root cysts, while Omeregie et al[12] detected a high amount of periapical abscesses. The second most commonly diagnosed periapical lesion was root cyst (n = 250; 31.06%), which was also observed by Lin et al.[16] This differs from the results of other studies in which periapical abscess was the second injury most commonly found.[2,4,8,15] Variations are reflective of the different methodologies used in data collection and analysis from each study.[15]

Lack of information on the prevalence of periapical granulomas, periapical abscesses and root cysts in several regions of Brazil motivated this study. The results of this research will assist in clinical decision-making based on better-defined therapeutic protocols. Prospective future studies, based on the monitoring of patients to different treatment modalities in Endodontics, need to be developed to assess diagnostic and therapeutic protocols and their implications.

Conclusion

There was a higher prevalence of periapical lesions of endodontic origin in male individuals. The most affected age group was between 21 and 30 years. Periapical granuloma was the most commonly diagnosed lesion. Teeth located in the posterior region of the jaw were the most affected.

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