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Original research article

Pulpal and periapical diseases experience in a central Brazilian population

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Abstract

Introduction: Diseases of the pulp and periapical tissues comprise the major reasons for seeking emergency dental care services. **Objective:** This retrospective cross-sectional study aimed to investigate the prevalence of pulpal and periapical diseases in a central Brazilian population. **Material and methods:** The sample was comprised of patients treated at the Basic Attention Integrated Clinic of the Dental School of the Universidade de Cuiabá, between 2011 and 2015. The following information was collected from the patients' records: sex, age, tooth, anatomical location, and the pulpal or periapical diagnosis. The statistical analysis included frequency distribution and cross-tabulation. The data were analyzed by using χ^2 tests. The level of significance was set at 5% for all analyses. **Results:** The analysis involved 1,277 patients (822 female; 64.4%), aged between 6 and 78 years old. The highest frequency of pulpal and periapical diseases was observed in patients aged 21 to 30 years old (n = 389; 30.5%). A total of 1,488 pulpal and periapical diseases was recorded. Symptomatic pulpitis (n = 467; 31.4%) and infectious symptomatic apical periodontitis (n = 456; 30.6%) were the most common type of diseases. Seven hundred and sixty-seven

affected teeth (51.5%) were maxillary teeth, and 1,247 (83.8%) were located in the jaws' posterior region. The most affected teeth were the mandibular molars (n = 516; 34.7%) and maxillary molars (n = 355; 23.9%). Statistically significant difference was observed between the type of pulpal and periapical disease and sex, age, anatomical location (anterior or posterior), and tooth ($p < 0.05$). **Conclusion:** There was a higher prevalence of pulpal and periapical diseases in female individuals aged between 21 and 30 years old and involving teeth located in the posterior region of the jaw.

Introduction

Orofacial pain is a significant public health problem, defined as a painful condition associated with the hard and soft tissues of the head, face, neck and oral structures [3, 7, 14, 15, 20, 23]. Dental pain is the most frequent type of orofacial pain and causes the most damage at individual and collective level [8, 15, 20]. It has been demonstrated that pain of odontogenic origin is a strong predictor for the use of health dental services [3, 7, 14] and the perception for the need for dental treatment [19].

Diseases of the pulp and periapical tissues comprise the major reasons for seeking emergency dental care services [18, 24, 26], and, despite being a source of physical and emotional stress and representing a substantial economic burden to the community [4, 23, 26, 33], there is a limited amount of information on their frequency and distribution [3, 4, 10].

In Brazil, only a few studies have been focused on the epidemiological profile of pulp and periapical diseases [3, 9, 10, 11, 27]. Facchin and Rodrigues [11] developed an etiologic survey of pulpal and periapical diseases and observed that approximately 50% of the diagnoses were of pulp necrosis, followed by 28% of acute pulpitis. De Quadros *et al.* [9] evaluated the clinical outcomes of root canal treatments and found that 29.4% of the teeth presented with the diagnosis of necrosis, and 32.3% exhibited irreversible pulpitis. Pereira and Carvalho [27] conducted an epidemiological evaluation of endodontic treatment outcomes and noticed that a significant amount of root canal treatment was undertaken in teeth presenting with necrosis and periapical lesions (28.9% for females and 36.5% for males). Albuquerque *et al.* [2] evaluated the endodontic diagnosis at an endodontic specialist clinic and found prevalence of 69.3% of pulp necrosis and 30.4% of apical periodontitis. Estrela *et al.* [10] determined the frequency and clinical factors associated with pulpal and periapical pain. The authors observed higher prevalence of symptomatic pulpitis (28.3%) and infectious symptomatic apical periodontitis (26.4%). The discrepancy in the study results may reflect methodological differences in selection and sample size [3, 7, 23] and the diagnostic criteria [1, 10], and rather than providing a solid base of knowledge, it creates difficulties for the development and implementation of integrated and effective dental care models by public administrators [14].

Public health administrators need to establish priority actions with a view to prevention and attention to individuals [26]. The planning of activities should consider the regional knowledge of the social and behavioral components of the diseases [7, 23, 35]. Based on evidence from the small number of studies in Brazilian populations [3, 9, 10, 11, 27], and considering the specificities and demographic, cultural and socioeconomic differences of each population, this study assessed the prevalence of pathologies of endodontic origin and associated factors in a central Brazilian population.

Material and methods

The study protocol was reviewed and approved by the local Research Ethics Committee (protocol number 37418314.9.0000.5165).

This cross-sectional descriptive study was conducted by reviewing the dental records of all consecutive patients that had presented for treatment at the Basic Attention Integrated Clinic (BAIC) of the Dental School of the Universidade de Cuiabá (UNIC), Cuiabá, Mato Grosso, Brazil (latitude 15°35'46" South, longitude 56°05'48" West), between March 2011 and December 2015. Inclusion criterion for this study was dental records of patients affected by diseases involving the pulpal and periapical tissues and treated at that clinic. Cases affecting primary teeth and dental records featuring blank fields and/or unspecified data were excluded from the study.

The following information was collected from each patients' dental records: sex, age, tooth, anatomical location (maxilla or mandible and anterior or posterior region), and the pulpal or periapical diagnosis. The type of pulpal or periapical pathologies were classified according to the system described by Estrela *et al*. [10] (Table I). Prior to data collection, a pilot study involving 10% of the final sample was performed to test the feasibility study, and to train and calibrate the examiners regarding the criteria used.

Data were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) for Windows 21.0 (IBM Corporation, Somers, NY, United States), including frequency distribution and cross-tabulation. Chi-square tests were used to compare qualitative data, and the level of statistical significance was set at 5%.

Results

The analysis involved 1,277 patients [822 female patients (64.4%) and 455 male patients (35.6%); female-to-male ratio = 1.8:1], aged between 6 and 78 years old (mean = 31.9 years old, standard deviation = 13.5). The highest frequency of pulpal and periapical diseases was observed in the group of patients aged 21–30 years old (n = 389; 30.5%), followed by the participants from 31–40 years old (n = 285; 22.3%), 11–20 years old (n = 260; 20.4%), 41–50 years old (n = 201; 15.7%), 51–60 years old (n = 83; 6.5%), ≥ 61 years old (n = 40; 3.1%), and 6–10 years old (n = 19; 1.5%).

A total of 1,488 pulpal and periapical diseases was recorded. Pulpal diseases were the most common, with 748 cases (50.3%), compared to 740 cases (49.7%) of periapical diseases. The most common types of pulpal diseases were symptomatic pulpitis (SP) (n = 467; 31.4%) and hyperreactive pulpalgia (HP) (n = 234; 15.7%), while infectious symptomatic apical periodontitis (ISAP) (n = 456; 30.6%) and periapical abscess without fistula (stage in evolution) (PA-SE) (n = 75; 5%) were the most common type of periapical diseases (Table II). From the 1,488 involved teeth, 767 (51.5%) were maxillary teeth, and 721 (48.5%) were mandibular teeth (Table III). Two hundred and forty-one affected teeth (16.2%) were anterior, and 1,247 (83.8%) were posterior teeth (Table III). The most affected teeth were the mandibular molars (n = 516; 34.7%), followed by the maxillary molars (n = 355; 23.9%) and maxillary premolars (n = 224; 15.1%) (Table III). The number of involved teeth per patient was 1.16. A total of 1,113 participants (87.2%) had one affected tooth, and 164 (12.8%) had two or more affected teeth.

A statistically significant difference between the type of pulpal or periapical disease and sex, age, anatomical location (anterior or posterior), and tooth was observed ($p < 0.05$) (Tables II and III).

Table I – Classification of pulpal and periapical diseases according to Estrela et al. [10]

Pulpal diseases	Hyperreactive pulpalgia (HP)
	Symptomatic pulpitis (SP)
	Asymptomatic pulpitis (AS)
	Pulp necrosis (PN)
Periapical diseases	Traumatic symptomatic apical periodontitis (TSAP)
	Infectious symptomatic apical periodontitis (ISAP)
	Asymptomatic apical periodontitis (AAP)
	Periapical abscess without fistula (initial stage) (PA-IS)
	Periapical abscess without fistula (stage in evolution) (PA-SE)
	Periapical abscess without fistula (advanced) (PA-A)
	Periapical abscess with fistula (PAWF)

Table II – Distribution of pulpal and periapical diseases by sex and age

	Pulpal diseases					Periapical diseases							
	HP n (%)	**SP n (%)**	**AS n (%)**	**PN n (%)**	**TSAP n (%)**	**ISAP n (%)**	**AAP n (%)**	**PA-IS n (%)**	**PA-SE n (%)**	**PA-A n (%)**	**PAWF n (%)**	**Total**	**P-value**
Gender (n = 1,488)													
Male	93 (6.3)	166 (11.2)	14 (0.9)	7 (0.5)	5 (0.3)	166 (11.2)	26 (1.7)	17 (1.1)	17 (1.1)	10 (0.7)	25 (1.7)	548 (36.8)	0.008
Female	141 (9.5)	301 (20.2)	6 (0.4)	20 (1.3)	7 (0.5)	290 (19.5)	38 (2.6)	37 (2.5)	58 (3.9)	12 (0.8)	32 (2.2)	940 (63.2)	
Age (n = 1,488) (years old)													
6–10	6 (0.4)	8 (0.5)	0 (0)	1 (0.1)	0 (0.0)	0 (0)	0 (0)	0 (0)	2 (0.1)	0 (0)	3 (0.2)	20 (1.3)	
11–20	53 (3.6)	114 (7.7)	8 (0.5)	3 (0.2)	2 (0.1)	66 (4.4)	7 (0.5)	10 (0.7)	15 (1)	3 (0.2)	9 (0.6)	290 (19.5)	
21–30	55 (3.7)	152 (10.2)	2 (0.1)	8 (0.5)	5 (0.3)	153 (10.3)	15 (1)	14 (0.9)	17 (1.1)	6 (0.4)	21 (1.4)	448 (30.1)	
31–40	40 (2.7)	107 (7.2)	4 (0.3)	5 (0.3)	3 (0.2)	109 (7.3)	15 (1)	17 (1.1)	17 (1.1)	5 (0.3)	9 (0.6)	331 (22.2)	< 0.001
41–50	46 (3.1)	53 (3.6)	2 (0.1)	6 (0.4)	2 (0.1)	81 (5.4)	15 (1)	7 (0.5)	17 (1.1)	5 (0.3)	11 (0.7)	245 (16.5)	
51–60	25 (1.7)	24 (1.6)	2 (0.1)	1 (0.1)	0 (0)	37 (2.5)	5 (0.3)	6 (0.4)	4 (0.3)	2 (0.1)	2 (0.1)	108 (7.3)	
≥ 61	9 (0.6)	9 (0.6)	2 (0.1)	3 (0.2)	0 (0)	10 (0.7)	7 (0.5)	0 (0)	3 (0.2)	1 (0.1)	2 (0.1)	46 (3.1)	

HP: hyperreactive pulpalgia; SP: symptomatic pulpitis; AS: asymptomatic pulpitis; PN: pulp necrosis; TSAP: traumatic symptomatic apical periodontitis; ISAP: infectious symptomatic apical periodontitis; AAP: asymptomatic apical periodontitis; PA-IS: periapical abscess without fistula (initial stage); PA-SE: periapical abscess without fistula (stage in evolution); PA-A: periapical abscess without fistula (advanced); PAWF: periapical abscess with fistula

Table III - Distribution of pulpal and periapical diseases by anatomical location and tooth

	Pulpal diseases					Periapical diseases						Total	P-value
	HP n (%)	SP n (%)	AS n (%)	PN n (%)	TSAP n (%)	ISAP n (%)	AAP n (%)	PA-IS n (%)	PA-SE n (%)	PA-A n (%)	PAWF n (%)		
Anatomical location (n = 1,488)													
Maxilla	115 (7.7)	219 (14.7)	10 (0.7)	19 (1.3)	7 (0.5)	242 (16.3)	41 (2.8)	31 (2.1)	37 (2.5)	11 (0.7)	35 (2.4)	767 (51.5)	0.093
Mandible	119 (8)	248 (16.7)	10 (0.7)	8 (0.5)	5 (0.3)	214 (14.4)	23 (1.5)	23 (1.5)	38 (2.6)	11 (0.7)	22 (1.5)	721 (48.5)	
Anterior	34 (2.3)	28 (1.9)	3 (0.2)	7 (0.5)	3 (0.2)	85 (5.7)	17 (1.1)	20 (1.3)	21 (1.4)	11 (0.7)	12 (0.8)	241 (16.2)	< 0.001
Posterior	200 (13.4)	439 (29.5)	17 (1.1)	20 (1.3)	9 (0.6)	371 (24.9)	47 (3.2)	34 (2.3)	54 (3.6)	11 (0.7)	45 (3)	1,247 (83.8)	
Tooth (n = 1,488)													
Maxillary incisor	13 (0.9)	11 (0.7)	1 (0.1)	5 (0.3)	2 (0.1)	43 (2.9)	11 (0.7)	16 (1.1)	14 (0.9)	8 (0.5)	10 (0.7)	134 (9)	
Maxillary canine	8 (0.5)	9 (0.6)	2 (0.1)	0 (0)	0 (0)	23 (1.5)	5 (0.3)	1 (0.1)	4 (0.3)	1 (0.1)	1 (0.1)	54 (3.6)	
Maxillary premolar	35 (2.4)	68 (4.6)	2 (0.1)	5 (0.3)	3 (0.2)	73 (4.9)	13 (0.9)	4 (0.3)	8 (0.5)	1 (0.1)	12 (0.8)	224 (15.1)	
Maxillary molar	59 (4)	131 (8.8)	5 (0.3)	9 (0.6)	2 (0.1)	103 (6.9)	12 (0.8)	10 (0.7)	11 (0.7)	1 (0.1)	12 (0.8)	355 (23.9)	
Mandibular incisor	5 (0.3)	4 (0.3)	0 (0)	1 (0.1)	1 (0.1)	9 (0.6)	0 (0)	1 (0.1)	2 (0.1)	1 (0.1)	1 (0.1)	25 (1.7)	< 0.001
Mandibular canine	8 (0.5)	4 (0.3)	0 (0)	1 (0.1)	0 (0)	10 (0.7)	1 (0.1)	2 (0.1)	1 (0.1)	1 (0.1)	0 (0)	28 (1.9)	
Mandibular premolar	34 (2.3)	35 (2.4)	1 (0.1)	2 (0.1)	1 (0.1)	48 (3.2)	6 (0.4)	7 (0.5)	11 (0.7)	1 (0.1)	6 (0.4)	152 (10.2)	
Mandibular molar	72 (4.8)	205 (13.8)	9 (0.6)	4 (0.3)	3 (0.2)	147 (9.9)	16 (1.1)	13 (0.9)	24 (1.6)	8 (0.5)	15 (1)	516 (34.7)	

HP: hyperreactive pulpalgia; SP: symptomatic pulpitis; AS: asymptomatic pulpitis; PN: pulp necrosis; TSAP: traumatic symptomatic apical periodontitis; ISAP: infectious symptomatic apical periodontitis; AAP: asymptomatic apical periodontitis; PA-IS: periapical abscess without fistula (initial stage); PA-SE: periapical abscess without fistula (stage in evolution); PA-A: periapical abscess without fistula (advanced); PAWF: periapical abscess with fistula

Discussion

Prevalence studies offer relevant data on public health associated with clinical and *ex vivo* studies and provide essential data to all science segments [14]. The assessment of the frequency and distribution of diseases in several populations is essential to establish comparison. It favors the monitoring of health status, the observation of trends, planning health services and prevention programs, and serves as a basis for future investigations [9, 23].

The epidemiological analysis developed in the present study was retrospective, based on the revision of dental records of patients with pulpal and periapical diseases and treated in the BAIC of the Dental School of UNIC, between March 2011 to December 2015. Cuiabá is in the Midwest region of Brazil and has approximately 585,000 inhabitants [17]. Economically, it stands out in commerce, services and industry [17]. The BAIC offers low and medium complexity regular and emergency dental treatment. The population attending this service resides in a sector of the city with low social, educational, and economic levels, may present a more significant number of oral health problems and has difficulties in accessing health services [5, 7, 14, 15, 23, 35]. Alexandre *et al*. [3] stated that individuals with low education and income tend to seek preventive services less frequently and have less preventive self-care.

Retrospective studies are relatively easy and economical to conduct, constituting a viable source for establishing hypotheses [7, 19]. However, they present as the main restriction the establishment of temporal nexus, needed for the proof of cause and effect, since both are collected simultaneously [14, 26, 33]. Additionally, the quality of information depends on the accuracy of the initial examination and the correct completion of dental records. Thus, when any examination or information is not recorded during diagnosis or is not registered in the dental form, the study result is compromised and/or limited [7]. Dental records with inconclusive diagnosis and presenting blank fields and/or unspecified data were excluded from the present study.

Numerous classification systems have been proposed for endodontic diagnoses [1, 10]. Most of them have attempted to correlate the histopathological features of pulpal and periapical tissues to the clinical symptoms and signs, which may lead to contradiction and confusion since there is little correlation between them [1, 10, 18]. The diagnosis of pulpal and periapical tissues established in the present study was based on the criteria proposed by Estrela *et al*. [10], which is based on the evaluation of biophysical characteristics of the tooth and surrounding tissues, symptomatology presented, pulp vitality test and radiographic features (Table I). The adoption of a classification system based on patient history and description of pain, clinical examination, and various diagnostic tests may favor the development of logical reasoning that improve the diagnostic process [10, 18] and may assist clinicians in choosing the less expensive and most appropriate treatment modality for each disease of endodontic origin [1, 16, 24, 26].

Female participants presented with more pulpal and periapical diseases than males (1.8:1). This finding corroborates the results obtained by De Quadros *et al*. [9], Munerato *et al*. [24], Pereira and Carvalho [27], Albuquerque *et al*. [2], and Allareddy *et al*. [4], that reported female-male ratios of 2.03:1, 1.87:1; 1.9:1, 2.04:1 and 1.8:1, respectively. However, Facchin and Rodrigues [11], Nalliah *et al*. [25], Nalliah *et al*. [26], and Shah *et al*. [33] observed lower female-male ratios: 1.5:1, 1.09:1, 1.03:1 and 1.07:1, respectively, while Travassos *et al*. [35] saw a higher female-male ratio (3.14:1) and Quiñonez *et al*. [29] reached a male-female ratio of 1.10:1. Several factors may influence the relationship between gender and dental diseases, such as the social, economic, environmental, and biological characteristics of the sample [8, 15, 27, 32]. The higher prevalence of pulpal and periapical diseases among female participants observed in this analysis may be associated with more female than male patients seeking routine dental services and may not be a real trend [2, 3, 5, 15, 16, 19, 28]. Future studies with longitudinal assessment could better understand the relationship between endodontic diseases and gender.

In the present study, patients with a history of pulpal and periapical diseases ranged from 6 to 78 years old (mean = 31.8 years old). When analyzing the distribution of patients according to age group, it was observed that the highest frequency of diseases was among participants with ages ranging from 21 to 30 years old (30.5%). This is very similar to what was reported by Farrell and Burke [12] and may be related to the low knowledge and the deleterious attitudes and practices of young people regarding their oral health [19, 21, 22]. The lowest prevalence was observed among participants aged 6 to 10 (1.5%) and ≥ 61 years old (3.1%). The low number of cases verified in the participants with 6 to 10 years old may be explained by the fact that this age group is commonly referred for treatment in a pediatric dental clinic [34]. With regards to participants aged ≥ 61 years old, the

decrease in pulp and periapical diseases observed may be associated with a decline in the number of natural teeth [30]. The finding of the present study contrasts with the results found out by Facchin and Rodrigues [11], De Quadros *et al.* [9], Hollanda *et al.* [16], Quiñonez *et al.* [29], that registered the most significant number of endodontic treatments and emergency department visits among patients aged 31 to 40, 26 to 49, 46 to 60 and 20 to 44 years old, respectively. Nalliah *et al.* [26] assessed the frequency of hospital emergency department visits attributed to pulpal and periapical diseases and observed that the average patient age was 32.9 years old. Shah *et al.* [33] studied the trends of 61,439 hospitalizations primarily attributed to periapical abscess and noticed that the average age was 37 years old. Care is required when comparing the prevalence among the studies due to the absence of standardization in the definitions of age groups studied [7, 23].

The most observed type of disease in the present study was SP (31.4%). This result agrees with those of previous studies [3, 9, 10, 18, 24, 31], in which a larger number of patients presented for treatment due to pulpal conditions. In contrast, Pereira and Carvalho [27], Quiñonez *et al.* [29], Nalliah *et al.* [26], and Allareddy *et al.* [4] observed a high number of teeth with apical periodontitis. It should be emphasized that the type of pulpal and periapical diseases noticed is directly related to the place where the study was undertaken. Thus, more complex cases, such as periapical abscess without fistula (advanced), are usually observed in patients that seek treatment or are referred to hospital-based emergency service and not to a dental office [4, 26, 33]. Additionally, pathologies with no symptoms or visible complications tend to remain untreated [6, 35]. An important aspect is that pulpal and periapical diseases have dental caries as their main etiological factor [2, 9, 10, 11, 18, 27], and therefore they are preventable and treatable conditions [27, 33]. Thus, regular dental appointments are essential, since through early diagnosis and treatment they can avoid progress of caries to the stage of urgent and emergency dental treatment [3, 11, 13, 19, 33].

In the present study, pulpal and periapical pathologies were more frequently diagnosed in maxillary teeth (51.5%) than in mandibular teeth (48.5%). Mandibular and maxillary molars were the most often affected teeth (58.6%). These findings agree with the results of previously published studies [2, 9, 27] and contrast with the results of Hollanda *et al.* [16], that observed a high rate of endodontic treatment in maxillary premolars. The eruption chronology associated with molars' anatomical characteristics and location may justify their greater involvement [2, 5, 9, 27]. Another possible explanation is related to where the study was developed and the type of etiological factors [27]. Dental school students and general practitioners tend to treat patients with pathologies involving anterior and/or single root teeth, while post-graduate students and specialists tend to perform endodontic procedures on multirooted teeth and with greater anatomical complexity (molars) [2, 9, 27]. In addition, a higher prevalence of root canal treatment in maxillary and anterior teeth in a population may be explained by a higher number of traumatic dental injuries [27], which are known to more frequently affect this group.

The study's motivation was the lack of data on the experience of pulpal and periapical diseases in several geographical regions of Brazil. This study aimed to collect data about several aspects of patients with endodontic needs and treated in a dental school located in the Midwest region of Brazil. This data will assist the understanding of the evolutionary mechanism of endodontic diseases, improvements in treatment, the determination of appropriate therapy, and, consequently, the obtainment of a greater success rate in endodontic treatment. It will also aid in the development of policies for prevention.

Conclusion

There was a higher prevalence of pulpal and periapical diseases in female individuals. The most affected age group was the one between 21 and 30 years old. SP and ISAP were the most diagnosed pathologies. Teeth located in the posterior region of the jaw were the most affected.

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