

## Prevalence of Apical Periodontitis in a Public Dental Service in Northern Brazil

Laíssa Gualberto Silva de Araújo<sup>1</sup>, Larissa Macedo Marques<sup>2</sup>, Ana Claudia Garcia Rosa<sup>3</sup>, Eduardo Zambaldi da Cruz<sup>4</sup>, André Machado de Senna<sup>5</sup>

<sup>1</sup>Dentistry Student, ITPAC Palmas School of Dentistry, City of Palmas, Tocantins State, Brazil.

Email: [jssagualberto@gmail.com](mailto:jssagualberto@gmail.com)

<sup>2</sup>Dentistry Student, ITPAC Palmas School of Dentistry, City of Palmas, Tocantins State, Brazil.

Email: [larimarm53@gmail.com](mailto:larimarm53@gmail.com)

<sup>3,4,5</sup>Professor, ITPAC Palmas School of Dentistry, City of Palmas, Tocantins State, Brazil

Received: 20 May 2022,

Received in revised form: 10 Jun 2022,

Accepted: 16 Jun 2022,

Available online: 26 Jun 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Apical Periodontitis,  
Epidemiology, Periapical Lesion, Prevalence

**Abstract—** Apical periodontitis (AP) is characterized by a peri-root inflammatory process presented by the host's immune response, from infections that affect the root canal system. The objective of this study was to verify the prevalence of apical lesions in digital periapical radiographs performed in a public dental care service in the northern region of Brazil. To this end, 3967 digital periapical radiographs performed on patients seen in 2019 were analyzed and classified using the Ørstavik periapical index (PAI). A total of 7172 teeth were analyzed. Four hundred and twenty-one of these teeth had already received endodontic treatment with root filling. The prevalence of AP in teeth without endodontic treatment was equivalent to 14.6%. In teeth with TE, the prevalence was 33.5%. The overall prevalence, when at least one tooth of an individual had apical periodontitis, was 49.9%. The prevalence found was lower than the reported worldwide prevalence, but still considered high in this specific population and indicates the need for directing public policies to improve this condition.

### I. INTRODUCTION

Periapical alterations mostly come from aggression to the dental pulp due to unremoved chemical, physical or biological lesions. According to Leonardi *et al.* (2011) the pulp tissue can present interruption of its metabolic process, leading to pulp necrosis and consequently invasion of microorganisms to the root canals. Such microorganisms can reach the periapical region through the apical foramen or exposed dentinal tubules. In this way, an inflammatory process occurs from the immune response of the periradicular tissues, to prevent the spread of infectious processes to the bone and other regions of the body (Lopes & Siqueira, 2015).

Apical periodontitis (AP) is a result of the host immune response, and it is characterized by bone loss in the region of the tooth apex, which radiographically presents with a radiolucent appearance. In clinical practice, periapical radiography is the imaging resource most used to diagnose apical and root canal system lesions (Mendes, 2011).

Ørstavik *et al.* (1986) used the results of the Brynolf study to develop a periapical index (PAI), used as a method of radiographic interpretation in epidemiological studies. PAI consists of 5 categories, numbered 1 - 5. PAI 1 is considered as normal periapical structure, PAI 2 bone alteration without mineral loss, PAI 3 bone alteration with mineral loss, PAI 4 apical periodontitis, PAI 5 severe periodontitis (Mendes, 2011).

Knowing the periapical health status of a population is important for the improvement of public health policies as it enables better management of resources for the prevention and treatment of endodontic problems. Thus, the objective of this study is to verify the prevalence of apical lesions in periapical radiographs performed in a public dental care service in the northern region of Brazil.

## II. MATERIAL AND METHODS

The present epidemiological study has a retrospective descriptive observational character. The research project was approved by the Research Ethics Committee (CAAE 99151718.9.0000.0014). The methodology was based on the Periapical Index by Ørstavik *et al.* (1986), which considers five grades, from grade 1, which corresponds to healthy periapex, to grade 5, considered severe periodontitis. For the purposes of this research, PAI greater than or equal to 2 was considered apical periodontitis. The evaluators were trained and calibrated for this evaluation.

The sample consisted of all periapical radiographs requested by public health units, and which were performed digitally at the Public Center of Dental Specialties in the city of Palmas, Tocantins, Brazil, in 2019.

The criteria for exclusion of a periapical radiograph were: 1- Images obtained in a non-digital way; 2- Images of non-periapical radiographs; 3- Images that did not contain teeth; 4- Images that showed only deciduous teeth. The exclusion criteria for teeth in the images were: 1- Teeth that did not appear completely in the image; 2- Extra-numerary teeth; 3- Teeth that appear only in the form of root remains 4- Deciduous teeth.

All collected data were recorded in the Microsoft Excel database, and descriptive statistical analysis was subsequently performed.

## III. RESULTS AND DISCUSSION

The total number of radiographs analyzed was 3697. According to the exclusion criteria, 227 radiographs were excluded. In total, 3470 images, from 1125 individuals, were considered for the evaluation of the periapical index. When the same tooth appeared in more than one radiograph, it was considered only once. In total, 7172 teeth were evaluated. (Fig. 1).

The population of the present study consisted of patients treated at a public dental care center, not representing a random sample of the population of the city of Palmas. Nevertheless, the results of this study may provide useful data for evaluating trends on the prevalence

of apical periodontitis in teeth with and without filled roots, as well as on the general dental condition of the population.

Apical periodontitis, when asymptomatic, can be identified only by radiographic examinations from a visible periapical radiolucency due to bone loss. The most used means of diagnosing AP are conventional or digital periapical radiography, cone-beam computed tomography (CBCT) and panoramic radiography (Persoon & Ozok 2017).

Despite limitations such as the presence of distortions and ghost images, panoramic radiographs can be considered an acceptable diagnostic tool for the detection of periapical lesions (Llic *et al.*, 2014), however periapical radiographs are more accurate than panoramic in the evaluation of periapical lesions and provide better visualization of periodontal tissues (López *et al.*, 2012; Terças *et al.*, 2006). Several researches were carried out by the analysis of radiographs. Tibúrcio-Machado *et al.*, 2021, reviewed and included in a meta-analysis 114 studies that analyzed periapical, panoramic and CBCT radiographs. In our study, digital periapical radiography was used to score the periapical status of the analyzed teeth. The scoring method used was the Ørstavik PAI index, which allows comparison with other epidemiol studies. It is simple to reproduce and is widely used in the literature, both in periapical and panoramic images. (Al-Omari *et al.*, 2011; Llic *et al.* 2014; López *et al.*, 2012; Merini *et al.*, 2017; Terças *et al.*, 2006).

In our study, radiographs of 1125 patients were evaluated and 562 had at least one case of AP, which corresponds to a prevalence of 49.9%. Tibúrcio-Machado *et al.* (2021), in a systematic review and meta-analysis, reported an overall prevalence of 52% of individuals with at least one case of AP. The prevalence found in our study (49.9%) was lower than the global prevalence and even lower when compared to the prevalence among individuals coming from dental care services. Also relevant is that although the population studied was from a city in the North of Brazil (North and Northeast are the regions with the lowest Human Development Index in Brazil), the global prevalence was lower than that of developing countries (53%), in transition (80%) and developed (51%). Although in the studied sample the prevalence of AP (49.9%) was lower than the global one (52%), the studied population still has a very high prevalence, a fact that serves as a warning for the direction of mitigating public policies.

In the present study, the radiographs analyzed were periapical, performed using phosphor plates. When comparing the overall prevalence of AP of 49.9%, at the

individual level, it was also lower than that of other studies that used periapical radiographs (56%), but higher when compared to studies related to panoramic radiographs

(56%), a fact that may be due to the better detailing of periapical radiographs in relation to panoramic radiographs.

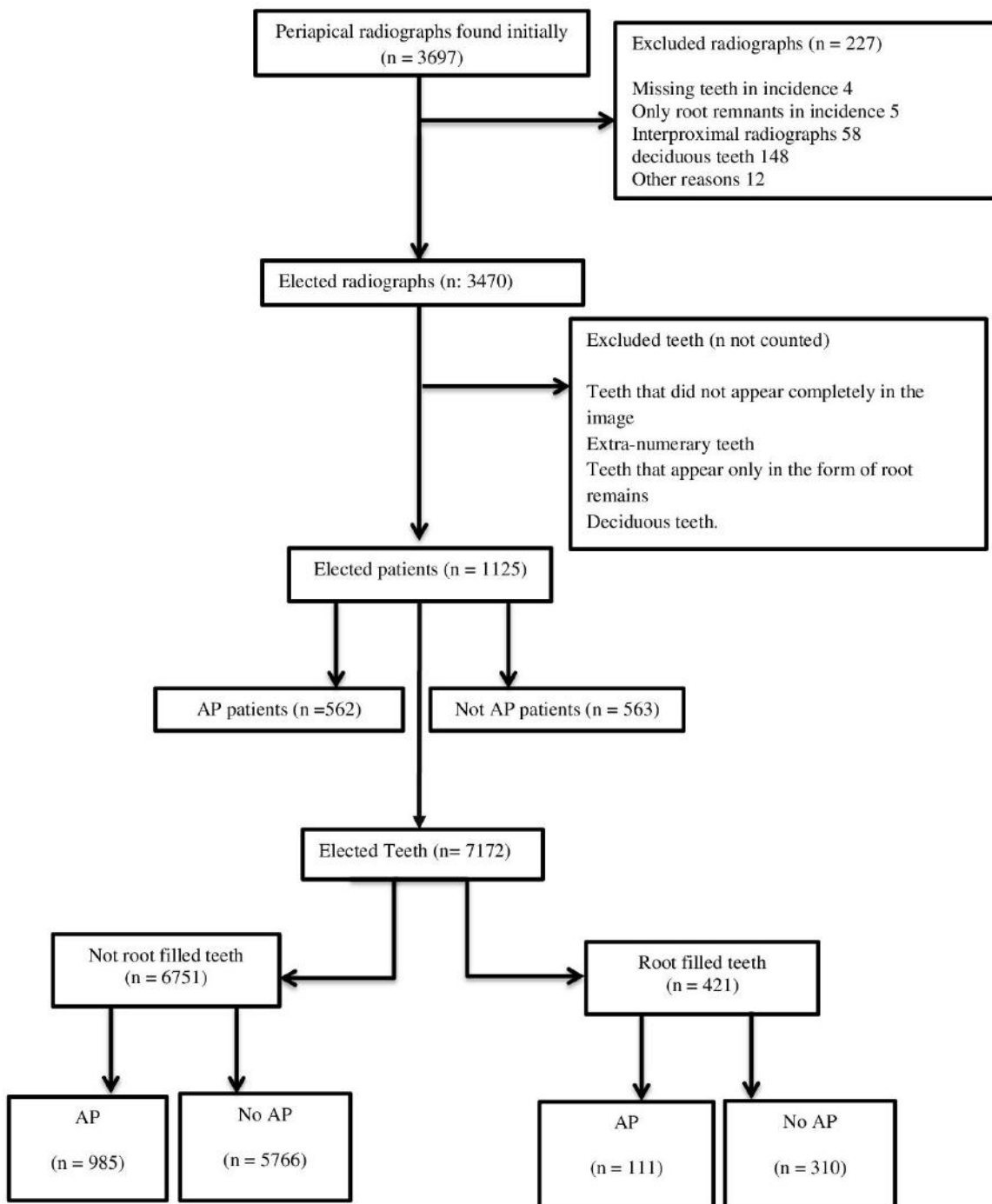


Fig.1: Flowchart of the selection process.

At the dental level, 1126 individual images of teeth (total of 7172 images) presented AP (Table 01), which corresponds to a prevalence of AP  $\geq 2$  of 15.7%.

Table 01: Total teeth analyzed

TOTAL TEETH		
PAI	n	%
1	6046	84,30
2	210	2,93
3	346	4,82
4	454	6,33
5	116	1,62
Total	7172	100

When analyzed at the individual level, 421 (5.87%) were teeth with root canal treatment and 6751 (94.13%) were nontreated teeth (Table 02).

Table 02: Root-filled teeth and nontreated teeth

TOTAL TEETH				
PAI	Nontreated teeth		Root filled teeth	
	N	%	n	%
1	5766	85,4	280	66,5
2	185	2,7	25	5,9
3	285	4,2	61	14,5
4	406	6,0	48	11,4
5	109	1,6	7	1,7
Totals	6751	100	421	100

The prevalence of PAI 1 was higher in nontreated teeth than in root filled teeth. However, for all other levels (PAI  $\geq 2$ ) root filled teeth had a higher prevalence of AP. Despite this difference, endodontic treatment cannot be credited as the cause of the higher prevalence, since the radiographic image only records the moment it was performed, and it is not possible to know if at a given moment the lesion was stabilized, regressing, increasing, or being just a scar mark, without biological compromise, as suggested by Kruse *et al.*, 2017.

#### IV. CONCLUSION

The prevalence of apical lesions identified in periapical radiographs performed in a public dental care service in a city in the northern region of Brazil was 49.9%. This prevalence is lower than the global prevalence, but still

considered high and indicates the need to direct public policies to improve this condition.

#### REFERENCES

- [1] Al-Omari. M. A., Hazza. A., Haddad F. & Jordan . I. (2011). *Frequency and distribution of root filled teeth and apical periodontitis in a Jordanian subpopulation*. Oral Surg Oral Med Oral Pathol Oral Radiol Endod,
- [2] Kruse, C., Spin-Neto, R., Reibel, J., Wenzel, A., & Kirkevang, L. (2017). Diagnostic validity of periapical radiography and cbct for assessing periapical lesions that persist after endodontic surgery. *Dentomaxillofac Radiol*, 46, 20170210. <https://doi.org/10.1259/dmfr.20170210>
- [3] Leonardi. D. P., Giovanini. A. F., Almeida. S., Schramm. C. A., & barrato-Filho. F. (2011) *Alterações Pulpares e Apicais*. Oct-Dec, 8(4), 47-61.
- [4] Llić, J., Vujasković. M., Tihček-Sojić., L. & Milić-Lemić. A. (2014). et al. Frequency and quality of root canal fillings in an adult Serbian population. *Srp Arh Celok Lek*, 142(11-12), 663-668. DOI: 10.2298/SARH1412663I
- [5] Lopes. H. P. & Siqueira. J. F. (2015). *Endodontia Biologia e Técnica*. Elsevier.
- [6] López-López. J., Jané-Salas. E., Estrugo-Devesa. A., Castellanos-Cosano. L., Matin-González. J., Velasco-Ortega. E & Segura-Egea. J. J. (2012). *Frequency and distribution of root-filled teeth and apical periodontitis in an adult population of Barcelona, Spain*. *International Dental Journal*, Spain, 62(1), 40-46. Doi: 10.1111/j.1875-595X.2011.00087.x
- [7] Mendes. L. M. (2011). *Associação entre a periodontite apical e o diabetes mellitus: uma revisão da literatura*. RFO UPF, 24(1), 58-66. <http://dx.doi.org/10.5335/rfo.v24i1.8840>
- [8] Merini. H. E., Amarir. H., Lamzawaq. A. & Hamza. M. (2017). Periapical Status and Quality of Root Canal Fillings in a Moroccan Subpopulation. *International Journal of Dentistry*. <https://doi.org/10.1155/2017/1068982>
- [9] Ørstavik. D., Kereks. K., & Eriksen. H. M. (1986). *The periapical index: a scoring system for radiographic assessment of apical periodontitis*. *Endod Dent Traumatol*, 2, 20-34
- [10] Persoon I. F & Özok A. R.(2017). *Definitions and Epidemiology of Endodontic Infections*. *Curr Oral Health Rep*, 4, 278-285. <https://doi.org/10.1007/s40496-017-0161-z>
- [11] Terças. A. G., Oliveira. A. E. F., Lopes. F. F. & Maa Filho. E. M. (2006). *Radiographic Study of The Prevalence of Apical Periodontitis and Endodontic Treatment in the Adult Population of São Luís, MA, Brazil*. *J Appl Oral Sci*. 14(3),183-7. <https://doi.org/10.1590/S1678-77572006000300007>
- [12] Tiburcio-Machado, S. C., Michelon, C., Zanatta, B. F., Gomes, S. M., Marin, A. J. & Bier, A. C. (2021). The global prevalence of apical periodontitis: a systematic review and meta-analysis. *International Endodontic Journal*, 54, 712–735. <https://doi.org/10.1111/iej.13467>