RADIOGRAPHIC STUDY OF THE PREVALENCE OF APICAL PERIODONTITIS AND ENDODONTIC TREATMENT IN THE ADULT POPULATION OF SÃO LUÍS, MA, BRAZIL

ESTUDO RADIOGRÁFICO DA PREVALÊNCIA DE PERIODONTITE APICAL E TRATAMENTO ENDODÔNTICO NA POPULAÇÃO ADULTA DE SÃO LUÍS, MA, BRASIL

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ABSTRACT

*T*his study investigated the prevalence of apical periodontitis (AP) and its association with endodontically treated teeth in residents of São Luís, MA, Brazil. Two-hundred complete series of periapical radiographs taken over a 10-year period (1993-2003) were retrieved from the files of four prosthesists and five periodontists. The Periapical Index (PAI) was used and the age range, sex, tooth groups, location and association with endodontic treatment (ET) were also analyzed. The Cohen Kappa and Chi-square tests were used for statistical analysis. Out of 200 patients, 135 presented at least one case of AP, which corresponds to a prevalence of 67.5%. Of the 5008 teeth examined, 296 had AP and 553 had ET. Therefore, considering the total number of teeth, AP and ET prevalences were 5.9% and 11%, respectively. Of the 553 endodontically treated teeth, 235 (42.5%) were associated with AP. Chi-square test showed a strong correlation between AP and ET ($p<0.05$). The 40-year-old age group was significantly the most prevalent ($p<0.05$). There was no association between AP and patient's sex ($p>0.05$). The maxillary incisors were the most affected group of teeth ($p<0.05$). AP had predilection for the maxilla and was strongly associated with endodontically treated teeth ($p<0.05$). The prevalence of apical periodontitis and endodontically treated teeth with AP was high and similar to the results of studies performed in other countries.
uniterms: Periapical periodontitis; Apical periodontitis; Root canal treatment, Radiography, Epidemiology.

RESUMO

O objetivo deste estudo foi investigar a prevalência de Periodontite Apical (PA) e sua associação com dentes tratados endodonticamente em residentes de São Luís, MA, Brasil. Foram selecionadas 200 séries completas de radiografias periapicais de arquivos de quatro protesistas e cinco periodontistas dos últimos 10 anos (1993-2003). O Índice Periapical (PAI) foi utilizado e a faixa etária, sexo, grupos dentais, localização de maior prevalência e associação aos dentes com tratamento endodôntico (TE) foram analisados. Os testes Cohen Kappa e qui-quadrado foram utilizados para análise estatística. Dos registros de 200 pacientes, 135 apresentavam algum caso de PA, resultando numa prevalência de 67,5%. Do total de 5008 dentes, 296 tinham PA e 553 tinham TE. Desse modo, a prevalência de PA foi de 5.8% e de TE foi de 11%. Dos 553 casos de dentes tratados endodonticamente, 235 (42.5%) estavam associados com PA. A faixa etária de 40 anos foi significativamente mais prevalente ($p<0.05$). Não houve associação entre PA e sexo ($p>0.05$). O grupo dental mais acometido foi dos incisivos superiores ($p<0.05$). A PA teve predileção pela maxila e apresentou-se fortemente associada com dentes tratados endodonticamente ($p<0.05$). A prevalência de periodontite apical e de tratamento endodôntico de dentes associado com PA encontrada neste estudo foi alta e está de acordo com resultados de estudos realizados em outros países.
Unitermos: Periodontite apical; Tratamento dos canais radiculares; Radiografia; Epidemiologia.

INTRODUCTION

Pulp infection mainly results from dental caries, trauma and restorative procedures and commonly proceeds to pulp necrosis and apical periodontitis with localized bone destruction. In these circumstances, the apical periodontium, formed by cementum, periodontal ligament and alveolar bone in the root apex region, is the scene where complex inflammatory reactions take place. Apical periodontitis (AP) is defined as a pathology with inflammatory characteristics that arises from the dynamics between microbial action and host's immune response. Briefly, it is characterized by a reaction of relatively low intensity and long duration against bacteria and irritants originated in the root canal[1].

Knowledge of the prevalence of apical periodontitis is important in order to evaluate the outcomes of endodontic therapy within a community. Studies have shown that up to 2/3 of the AP cases can be associated with endodontic treatment[2], and that this pathology is most commonly related to teeth with root canal fillings over 2 mm distant from the root apex[3-5]. Studies have reported a high prevalence of AP in several countries [6-10].

Apical periodontitis is the main indication for root canal therapy and is the most common evidence of an inadequate or failed endodontic treatment. Therefore, diagnosing chronic apical periodontitis is extremely important to settle an effective treatment plan involving either endodontic treatment, retreatment or endodontic surgery, or even a combination of them. Due to the lack of epidemiological data about this pathology in the city of São Luís, MA (Brazil), this survey reports the prevalence of chronic apical periodontitis in this city.

MATERIAL AND METHODS

Sample Selection

Two-hundred complete series of periapical radiographs taken between March 1993 and July 2003 from patients over 20 years of age in the city of São Luís, MA (Brazil) were selected for this study. The radiographs were retrieved from the files of 4 prosthesists and 5 periodontists chosen at random.

A series of 14 radiographs within a radiographic quality control prerequisite was included in the study, all of the images presenting good diagnostic conditions. Radiographs with cuts, distortion, poor fit of the apical region, veiling or significant radiographic density alteration and images suggestive of endo-periodontal disease or root-end surgery were excluded. Periapical radiographs from patients with fewer than 10 remaining teeth in the oral cavity were also excluded. According to De Cleen et al.[3], these patients frequently have periodontal disease at an advanced stage, which makes it difficult to determine whether the etiology of the periapical lesions is of endodontic or periodontal origin.

After sample selection, the radiographs were assigned to the following groups, according to patients' sex and age: 20 to 29; 30 to 39; 40 to 49; 50 to 59; and =60 years old (see Tables 1 and 2).

Calibration of the Examiners

An endodontist and a radiologist with over 10 years of clinical experience participated in the study as examiners. Before they evaluated the radiographs, both examiners were calibrated. For such purpose, a series of 20 periapical radiographs were used and 460 teeth were examined. As part of the calibration phase, the examiners were given explanations about the study methodology; familiarized themselves with the scores they should attribute to the periapical radiographic images, as well as with the established evaluation method for the study, in order to foresee or minimize discrepant results and provide greater reliability to the scores.

Calibration Analysis

The inter-observer statistical analysis was done by the *Kappa* coefficient, which showed a strong agreement (0.93). Given the good agreement between the examiners and the consistency, sensitivity and specificity of the method, the definitive radiographic assessment was then performed

Data Collection

At all times during the analysis of the radiographs, the same environment conditions were maintained. The room was darkened and a black mask was used around the radiograph, to limit light emission from the liquid crystal negatoscope (Kaiser Fototechnik GmbH & Co. Kg, Buchen, Germany), thus enhancing the visualization of the radiographic images. The year of radiographic examination, patients' sex and age, absent teeth, teeth that had endodontic treatment (ET) and the number

TABLE 1- Distribution of patients by age group and sex (n=200)

Age group	F	M	Total (%)
20-29	12	06	18 (9.0%)
30-39	25	14	39 (19.5%)
40-49	40	40	80 (40.0%)
50-59	20	20	40 (20.0%)
≥ 60	15	08	23 (11.5%)
Total	112	88	200 (100%)

TABLE 2- Distribution of teeth by age group (n= 5008)

Age group	No. of teeth	%
20 - 29	509	10.1%
30 - 39	1033	20.7%
40 - 49	1994	39.8%
50 - 59	964	19.2%
≥ 60	508	10.2%
Total	5008	100%

of teeth examined were recorded. The use of a X3 magnifying glass (Intex, Sorocaba, Brazil) was limited to the cases of doubtful diagnosis that could benefit from image amplification.

Apical periodontium status was assessed by the Periapical Index (PAI) proposed by Ørstavik et al.[11], according to which 5 scores were attributed to the apical area of the radiographic images, as follows: 1. normal periapical structures; 2. small changes in bone structure; 3. changes in the bone structure with little mineral loss; 4. periodontitis with well-defined radiolucent area; 5. severe periodontitis with exacerbating features.

Prior to starting the analysis, the proposed criteria for scoring the teeth with AP were explained to the examiners: 1) choose the score that most closely represented the apical periodontium status of the tooth under analysis: 2) in case of doubt, the highest score should be given; 3) for multi-rooted teeth, use the highest score given to individual periapices; 4) all teeth with AP should be scored.

For teeth scored 3, 4 and 5, i.e., those with chronic apical periodontitis, the abbreviation "AP" was used. For teeth with AP associated with endodontic treatment the abbreviation "AP/ET" was used. In case of disagreement between the examiners, the radiographs were reviewed and a consensus score was reached.

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistic 5.1 software (Microsoft Corporation, Redmond, WA, USA). AP was calculated regarding the total number of individuals, the total number of teeth, sex and age group. Afterwards, AP ratio with regard to sex, age group, location, tooth group and endodontic treatment was analyzed by Chi-square non-parametric test at 0.05 significance level.

RESULTS

Out of the used 200 series of periapical radiographs, representative of 200 patients, 5008 teeth were examined. Table 1 shows the distribution of patients by age group and sex, while Table 2 shows the distribution of teeth by age group.

Out of 200 patients, 135 presented at least one case of AP, which corresponds to a prevalence of 67.5% (Table 3).

Table 3 shows that the prevalence of AP and ET increased with patient's age. Out of 5008 teeth examined, 296 had AP and 553 had ET, which correspond to a prevalence of 5.9% for AP and 11% for ET. Out of the 553 endodontically treated teeth, 235 (42.5%) were associated with AP. Chi-square test showed a strong correlation of AP with ET ($p<0.05$). AP was also significantly associated with patients in the 40-year-old age group ($p<0.05$). There was no association of AP with patient's sex ($p>0.05$).

Maxillary teeth were significantly more affected by AP than mandibular teeth ($p<0.05$). Furthermore, there was significant association between AP and maxillary incisors and premolars and mandibular molars ($p<0.05$) (Table 4).

TABLE 4- Distribution of AP by tooth type

	without AP	With AP	Total	% AP
Maxilla	2264	209	2473	70.6%
Incisors	649	86	735	11.7%
Canines	357	17	374	4.5%
Premolars	523	66	589	11.2%
Molars	735	40	775	5.2%
Mandible	2448	87	2535	29.4%
Incisors	766	17	783	2.2%
Canines	383	3	386	0.8%
Premolars	667	27	694	3.9%
Molars	632	38	670	5.7%

TABLE 3- Distribution and prevalence of AP, ET and AP/ET by age group

Age group	No. of Patients w/AP	No. of Teeth	Teeth w. AP (%)*	Teeth w. ET (%)*	Teeth w. AP/ET (%)**
20 – 29	11	509	19 (3.7%)	27 (5.3%)	13 (48.1%)
30 – 39	23	1033	50 (4.8%)	82 (7.9%)	42 (51.2%)
40 – 49	54	1994	114 (5.7%)	226 (11.3%)	90 (39.8%)
50 – 59	27	964	63 (6.5%)	124 (12.8%)	54 (43.5%)
≥ 60	20	508	50 (9.8%)	94 (18.5%)	36 (38.2%)
Total	135	5008	296 (5.9%)	553 (11.0%)	235 (42.5%)

* percent values apply to the number of teeth examined
** percent values apply to the number of endodontically treated teeth

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DISCUSSION

This study deals with a sectional type of radiographic investigation. Although radiography provides a static image of a dynamic process, at the time of radiographic assessment, the AP in an endodontically treated tooth may be either evolving or healing. However, it has been shown that the number of teeth with AP that had regression after ET compared to the number of endodontically treated teeth that developed new cases of AP was similar in the same period[12-13]. Therefore, the results of these studies[12-13] demonstrate that sectional investigations may provide reliable information on the prevalence of AP in a given population.

To evaluate AP prevalence, complete series of periapical radiographs were used because they provide better images for the examination of apical periodontium.. Although many studies have been carried out with panoramic radiographs[2,3,14,15], many other authors have chosen complete series of periapical radiographs[6,7,16,17] or the association of both [2,18-20].

The criterion for diagnosing AP radiographically varies among studies [3,4,7,16]. In this study, the Periapical Index (PAI) proposed by Ørstavik et al.[11] was used because it facilitates comparison to other epidemiological studies and is easy to reproduce. Delano et al.[21] showed that PAI is an index that can be operational and is reliable.

The findings of this study revealed a high AP prevalence (67.5%) in the surveyed population. AP might be a sequela of either dental caries or its unsuccessful treatment. Therefore, it is suggested that this high AP prevalence in a sample composed of various age groups reflects a consequence of inappropriate treatments, as well as a lack of programs for integrated prevention and control of dental caries.

Ödesjö et al.[16] reported that AP was 5 to 12 times more associated with endodontically treated teeth. In the present study, AP was almost 4 times more associated with ET teeth compared to teeth without ET. Statistical analysis showed a significant association between AP and ET. These findings are consistent with those of Sidaravicius et al.[8] The high prevalence of AP associated with endodontically treated teeth indicates that root canal therapy did not prevent or control the disease. These data are similar to those found in studies performed worldwide (Table 5).

An important aspect to be emphasized is that the results of this study showed an increase in the prevalence of AP and ET with the increase of patients' age (Table 3). This is in agreement with the findings of previous studies [7,10]. This is expected as age advances given that, the tooth is exposed to caries, periodontal disease, attrition and various operative procedures that increase the risk of pulp involvement and consequent need for endodontic therapy. On the other hand, there was no significant association between sex and AP. This result corroborates the findings of other authors [3,10].

Regarding AP location, the maxilla was significantly more

TABLE 5- Total number of patients, total number of teeth examined, frequency of AP, ET and frequency of teeth with ET associated with AP in different studies

Author/Country	No. of Patients	No. of Teeth	Teeth w/ AP (%)*	Teeth w/ ET (%)*	Teeth w/ ET/AP (%)**
This study (São Luís, Brazil)	200	5008	5.9	11	42.5
De Cleen et al. (Germany 1993)	184	4196	6.0	2.3	39.2
Buckley & Spangberg. (USA 1995)	208	5272	4.1	5.5	31.3
Sidaravicius et al. (Lithuania. 1999)	147	3892	7.2	15.0	39.4
De Moor et al. (Belgium 2000)	206	4617	6.6	6.8	40.4
Lupi-Peguirier et al. (France 2002)	344	7561	7.3	18.5	31.5
Dugas et al. (Canada 2003)	610	16148	2.3	3.1	45.5
Jiménez-Pizón et al. (Spain, 2004)	180	4453	4.2	2.1	64.5

* percent values apply to the number of teeth examined
** percent values apply to the number of endodontically treated teeth

affected than the mandible (Table 4), which is consistent with the outcomes of other authors [15,22]. As far as tooth group is concerned, a higher prevalence of AP was associated with the maxillary incisors. These findings are in agreement with those of Spatafore et al. [22], according to whom the maxillary lateral incisors are difficult to treat endodontically due to the curvature in the apical third of their roots. In spite of this, lateral and central incisors are widely treated endodontically by general practitioners. On the other hand, the literature has shown a more frequent association of AP with mandibular molars [3,7].

It is believed that with the improvement of techniques for root canal therapy and the correct application of biological knowledge for the treatment of endodontic infections, the profile of apical periodontitis and endodontic treatment shall change over the next few years.

CONCLUSION

The data collected in this study showed that apical periodontitis was a highly prevalent pathology and was significantly associated with endodontically treated teeth. Apical periodontitis in the surveyed population of São Luis, MA (Brazil) maintained a pattern of prevalence similar to that observed in other countries.

REFERENCES

1- Kakehashi S, Stanley HR, Fittizgerald RJ. The effects of surgical exposure of dental pulps in germ-free and convencional laboratory rats. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1965;20**:**340-9.

2- Eriksen HM, Bjertness E. Prevalence of apical periodontits and results of endodontics treatment in middle-aged adults in Norway. Endod Dent Traumatol. 1991;7**:**1-4.

3- De Cleen MJ, Schuurs AH, Wesselink PR, Wu MK. Periapical status and prevalence of endodontic treatment in an adult Dutch population. Int Endod J. 1993;26:112-9.

4- De Moor RJ, Hommez GM, De Boever JG, Delmé KI, Martens GE. Periapical health related to the quality of root canal treatment in Belgian population. Int Endod J. 2000;33:113-20.

5- Hommez GM, Coppens CRM, De Moor RJG. Periapical health related to the quality of coronal restorations and root fillings. Int Endod J. 2002;35:680-9.

6- Imfeld NT. Prevalence and quality of endodontic treatment in an elderly urban population of Switzerland. J Endod. 1991;17:604-7.

7- Buckley M, Spångberg LS. The prevalence and technical quality of endodontic treatment in american subpopulation. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1995;79:92-100.

8- Sidaravicius B, Aleksejuniene J, Eriksen J. Endodontic treatment and prevalence of apical periodontits in an adult population of Vilnius, Lithuania. Endod Dent Traumatol.1999;15:210-5.

9- Dugas NN, Lawrence HP, Pharoh MJ, Teplitsky PE, Friedman S. Periapical health and treatment quality assessment of root-filled teeth in two Canadian populations. Int Endod J. 2003;36:181-92.

10- Jiménez-Pinzón A, Segura-Egea JJ, Poyato-Ferrera M, Velasco-Ortega E, Rios-Santos JV. Prevalence of apical periodontitis and frequency of root-filled teeth in na adult Spanish population. Int Endod J. 2004;37:167-73.

11- ØRSTAVIK D, KEREKS K, ERIKSEN, HM. The periapical index: a scoring system for radiographic assessment of apical periodontitis. Endod Dent Traumatol. 1986;2:20-34.

12- Petersson K. Endodontic status of mandibular premolars and molars in adult Swedish population. A longitudinal study 1974-85. Endod Dent Traumatol. 1993;9:13-8.

13- Kirkevang LL, Horsted-Bindslev P, Ørstavik D, Wenzel A. Frequency and distribution of endodontically treated and apical periodontitis in a urban Danish population. Int Endod J. 2001;34:198-205.

14- Marques MD, Moreira B, Eriksen HM. Prevalence of apical periodontits and results of endodontic treatment in in adult Portuguese population. Int Endod J. 1998;31:161-5.

15- Lupi-Pegurier L, Bertrano MF, Muler-Bolla M, Rocca JP, Bolla M. Periapical status, prevalence and quality of endodontic treatment in an adult French population. Int Endod J. 2002;35:690-7.

16- Ödesjö B, Hellden L, Saloneni L, Langeland K. Prevalence of previous endodontic treatment, technical standard and occurrence of periapical lesions in a randomly selected adult, general population. Endod Dent Traumatol. 1990;6:265-72.

17- Kirkevang LL, Wenzel A. Risk indicators for apical periodontits.Community Dent Oral Epidemiol. 2003;31:59-67.

18- Eriksen HM, Bjertness E, Ørstavik D. Prevalence and quality of endodontic treatment in an urban adult population in Norway. Endod Dent Traumatol. 1998;4:122-6.

19- Eriksen HM, Berset GP, Hansen BF, Bjertness E. Changes in endodontic status 1973-1993 among 35 year-olds in Oslo, Norway. Int Endod J. 1995;28:129-32.

20- Weiger R, Hitzler S, Hermle G, Löst C. Periapical status, quality of root canal fillings and estimated endodontic treatment needs in an urban German population. Endod Dent Traumatol. 1997;13:69-74.

21- Delano EO, Ludlow JB, Ørstavik D, Tyndall D, Trope M. Comparison between PAI and quantitative digital radiographic assessment of apical healing after endodontic treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001;92:108-15.

22- Spatafore CM, Griffin JA, Keyes GG. Periapical biopsy report: an analysis over a 10 year period. J Endod. 1990;16:239-41.