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Prevalence of apical periodontitis and endodontic treatment in an adult endodontic treatment

Prevalência da periodontite apical e tratamento endodôntico na população adulta portuguesa

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Abstract

Introduction: Studies on the prevalence of apical periodontitis and endodontic treatment in Portugal are scarce and outdated. However, studies in other countries have shown that the prevalence of apical periodontitis is high, especially in endodontic treated teeth. Objective: To estimate the prevalence of root-filled teeth and apical periodontitis in an adult Portuguese population. Materials and methods: Panoramic radiographs of a random sample of 222 subjects over 18 years old, who had more than seven teeth, and went to the Faculty of Dentistry, University of Porto, for the first time in 2010, were examined. The number of teeth that were root-filled and the periapical status of all teeth were assessed. Results: Apical periodontitis (PAI ≥ 3) was found in 1.7% of all teeth in the population study. Out of 5.552 teeth, 215 (3.9%) had filled roots. The prevalence of apical periodontitis was greater for root-filled teeth, posterior teeth, and men. The prevalence of apical periodontitis is also increased with age. Conclusion: The prevalence of apical periodontitis in Portugal is similar to its prevalence in other

European countries and is higher for root-filled teeth than for non-treated teeth. The prevalence of root-filled teeth is different for Portugal than for other countries, which may be due to the differences in healthcare services provided in various countries.

Keywords: Apical periodontitis. Endodontic treatment. Epidemiology. Periapical status. Radiology.

Resumo

Introdução*: Estudos sobre a prevalência da periodontite apical e o tratamento endodôntico em Portugal são raros e desatualizados. Contudo, estudos noutros países revelaram que a prevalência da periodontite apical é alta, especialmente em dentes com tratamento endodôntico.* ***Objetivo****: Estimar a prevalência de tratamento endodôntico e periodontite apical em uma população adulta portuguesa.* ***Materiais e métodos****: Foram examinadas radiografias panorâmicas de uma amostra aleatória de 222 indivíduos maiores de 18 anos, que tiveram mais de sete dentes, e que atenderam a Faculdade de Odontologia da Universidade do Porto pela primeira vez em 2010. O número de dentes que receberam tratamento endodôntico e o estado periapical de todos os dentes foi avaliado.* ***Resultados****: Encontrou-se periodontite apical (PAI ≥ 3) em 1,7% de todos os dentes na população do estudo. De um total de 5.552 dentes, 215 (3,9%) apresentavam tratamento endodôntico. A prevalência de periodontite apical foi maior para dentes com canal tratado, dentes posteriores e homens. A prevalência de periodontite apical também aumentou com a idade.* ***Conclusão****: A prevalência de periodontite apical em Portugal é semelhante à sua prevalência em outros países europeus e é maior para dentes com canal tratado do que para os dentes não tratados. A prevalência de dentes com canal tratado é diferente em Portugal, comparado a outros países, em razão de diferenças nos cuidados de saúde prestados nos países.*

Palavras-chave*: Periodontite apical. Tratamento endodôntico. Epidemiologia. Estado periapical. Radiologia.*

Introduction

Apical periodontitis, or endodontically originating periapical lesions, is known to have a bacterial etiology. To remove these periapical lesions, endodontic treatment attempts to eliminate the infection present in the root canals. However, prior studies in Portugal (1) and other countries (2-16) have shown that the prevalence of apical periodontitis is high, especially in endodontically treated teeth.

According to the European Society of Endodontology (17), the assessment of endodontic treatment requires clinical and radiographic follow-up evaluations at regular intervals. Because apical periodontitis is often asymptomatic, its diagnosis is primarily radiographic; an assessment which may be performed using the Periapical Index (PAI) score (18) to document bone loss or normality. This system uses a scale of 1 to 5, ranging from a normal periapical structure (level 1) to severe periodontitis with exacerbated characteristics (level 5) and is based on the use of reference radiographs with confirmed histological diagnoses.

The success rate for endodontic treatment is almost 90% but decreases to 74% for teeth with apical periodontitis (19). However, studies have shown that endodontically treated teeth have a greater prevalence of apical periodontitis than untreated teeth, even in Scandinavian countries, where there is a strong demand for dentists and where the quality of dental treatment is high (2, 7, 15).

Because studies on the prevalence of apical periodontitis and endodontic treatment in Portugal are scarce and outdated, this type of research is very important, especially when research assesses the current use of the latest techniques, the optimisation of existing techniques or the development of new materials.

The objective of this study is to estimate the prevalence of teeth with apical periodontitis and endodontic treatment in an adult Portuguese population. We also attempt to identify the risk factors that may be associated with the persistence

of these lesions (i.e., sex, age, tooth type, presence of endodontic treatment, and type of coronal restoration).

Materials and methods

The study consisted of a sample of panoramic radiographs of 222 randomly selected individuals over 18 years old and with more than 7 teeth in their mouths; this sample was obtained from first-visit records at the Dental School of the University of Porto in 2010. A total of 5.552 teeth were analysed. The Orthoralix® 9200 DDE (Gendex) panoramic radiograph was used for all cases. The dental school's Ethics Committee approved the study.

All the teeth were documented and identified as anterior if they were incisors or canines and posterior if they were premolars or molars. The existing roots were identified as roots but were evaluated as a single dental unit. The teeth were classified as root-filled teeth (RFT) if they contained radiopaque materials in the pulp chamber or in the root canals. In the RFT group, the type of coronal restoration (fixed prosthesis or filling) or its absence was recorded.

The periapical status of each tooth was classified according to the Periapical Index – PAI (18): 1, normal periapical structure; 2, small alterations in the bone structure; 3, alterations in the bone structure with some demineralisation; 4, periodontitis with well-defined radiolucency; and 5, severe periodontitis with exacerbated characteristics. In cases of multi-root teeth, they were classified according to the root that showed the most severe periapical condition. The sex, age, number and locations of teeth (anterior/posterior), filled (RFT) or unfilled, type of crown restoration for filled teeth (or the absence of one), presence of a root, and periapical status (PAI) were recorded for each patient.

All the radiographs were evaluated using a computer in a darkened room in which the ambient light could be controlled for the best possible radiographic contrast. Two observers performed the assessment: one, with little endodontic experience and another, with 20 years of clinical endodontic experience. Both observers had participated in a calibration course for PAI system, which involved the evaluation of 100 radiographic images observed over two months. The intraobserver agreement on the PAI assessments was 0.67 (Cohen´s kappa) for the first observer and 0.80 for the second. If there was a disagreement on the observed index, a consensus was reached.

Analysis

All teeth with a PAI ≥ 3 were considered to have apical periodontitis (periapical lesions). The data were analysed using PASW Statistics 19.0 (SPSS®, version 19) and R (version 2.13.0; 2011-04-13). Depending on the type of variable, the analyses consisted of a descriptive study of the data — qualitative and quantitative variables (bar graphs, pie charts, frequency tables, box and whisker plots); an association study — Chi-square tests to assess the relationship between two nominal and/or categorical variables and a risk evaluation by associating measurements in 2 × 2 odds ratio tables.

The decision rule that was used consists of detecting statistically significant evidence for probability values (test statistic) under 0.05.

Results

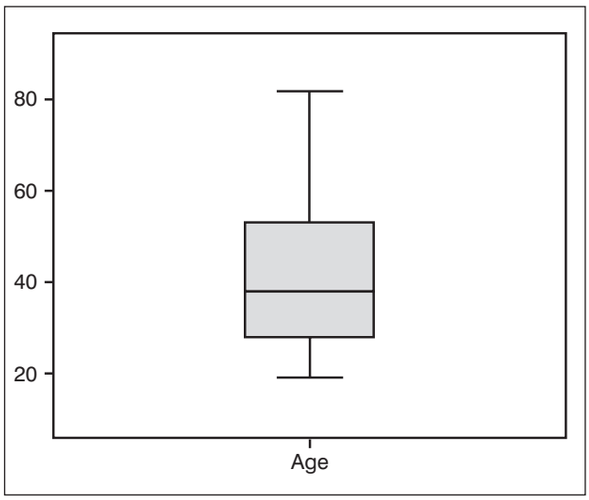
The initial sample of 222 individual panoramic radiographs included images from 119 females (53.76%) and 103 males (46.24%). The age distribution is shown in Table 1 and Graph 1. The mean age was 41.26 ± 15.86 years.

Table 1 - Distribution of age ranges of the patient's sample (n = 222)

		n	%
Age_Ag_mean	19 - 29 years	62	27.9
	30 - 39 years	45	20.3
	40 - 49 years	38	17.1
	50 - 59 years	37	16.7
	60 or more years	40	18
	Total	**222**	**100**

Source: Research data.

Of the 222 individuals evaluated, only 19 (8.6%) had all of their teeth, 50% had more than 26 teeth, and 25% had 18 or fewer teeth. The mean number of teeth per individual was 25.01 ± 5.06 (median = 26).



Graph 1 - Distribution of individuals by age

Source: Research data.

Of the 5.552 teeth evaluated, 5.337 (96.1%) were not filled, and 215 (3.9%) were RFT. There was a 3.9% prevalence of RFT with a 95% confidence interval (CI) between 3.4% and 4.4%.

The most prevalent periapical status was normal periapical structure (1) (Table 2). Considering that all teeth with a PAI ≥ 3 had periapical lesions, we found that 93 (1.7%) of the 5.552 teeth evaluated had periapical lesions. Of the 215 RFT, 25 (11.6%) had a PAI ≥ 3 (periapical lesions), and 68 (1.3%) of 5.337 unfilled teeth had periapical lesions (Graph 2).

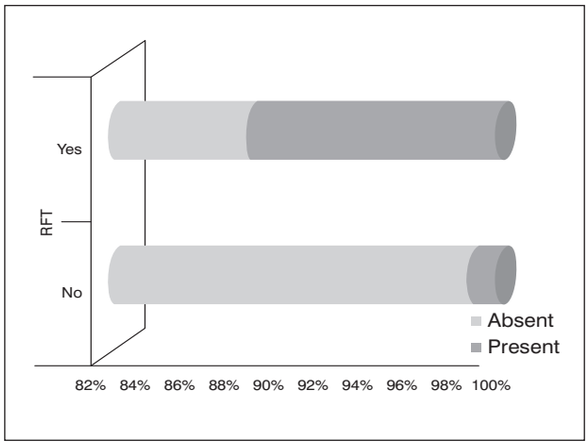
In terms of location, 2.516 teeth were classified as anterior (45.3%), and 3.036 as posterior (54.7%). The distribution of root-filled teeth according to their restorations is listed in Table 3. In total, 107 dental units (1.93%) were assessed as roots.

The application of odds ratio (OR) association techniques gave the results shown in Table 4. The prevalence of periapical lesions was related to the individual's sex, as males were almost 1.6 times more likely than females to have periapical lesions. For individuals with root-filled teeth (RFT), it was almost ten times more likely to have periapical lesions than unfilled teeth (Graph 2). Regarding location, posterior teeth were almost six times more likely than anterior teeth to have periapical lesions. As to the presence and type of coronal restoration, the Chi-square test (χ^2 = 3.574, gl = 2, p-value > 0.05) revealed no statistically significant association between a periapical lesion and the type of coronal restoration in endodontically treated teeth. The likelihood of periapical lesion was almost 31 times greater when the dental unit was a root than when it was not.

Table 2 - Distribution of PAI and respective confidence intervals at 95%

	n	%	95% CI
Normal periapical structure (1)	5.390	97.1%	96.6 - 97.5%
Small changes in bone structure (2)	69	1.2%	1 - 1.6%
Bone structure alterations with some demineralisation (3)	49	0.9%	0 - 1.2%
Periodontitis with well-defined radiolucency (4)	25	0.5%	0.3 - 0.7%
Severe periodontitis with exacerbated characteristics (5)	19	0.3%	0.2 - 0.5%

Source: Research data.



Graph 2 - Distribution according to the RFT and periapical lesion

Source: Research data.

The Graph 3 shows that a lack of lesions was associated with younger age. In addition, the presence of lesions increased with age. The Chi-square test (χ^2 = 39.716, gl = 16, p-value < 0.05) revealed a statistically significant association between periapical lesions and age. The probability of having a periapical lesion was almost two times higher for patients in the 30-39-year age range than those in the 19-29-year one. The probability of having a periapical lesion was almost three times higher for patients in the 40-49-year age range than those in the 19-29-year one. The possibility of having a periapical lesion was almost 2.9

Table 3 - Distribution according to the type of restoration (none, filling or fixed prosthesis) and respective confidence intervals

Factor	B	S.E.	Wald	df	p-value*	OR	95% confidence interval for OR	
							Lower	Upper
Sex	0.484	0.212	5.226	1	0.022	1.623	1.072	2.459
RFT	2.322	0.245	89.620	1	0.000	10.195	6.304	16.489
Location of tooth	1.844	0.322	32.744	1	0.000	6.321	3.361	11.888
Root	3.442	0.251	187.750	1	0.000	31.260	19.105	51.148

Source: Research data.
Note: *p-value < 0.05 indicates a statistically significant association between the considered factor and the presence of a periapical lesion.

Table 4 - Association between periapical lesion and other factors

	n	%	95% CI
None	40	18.7%	13.8 - 24.7%
Filling	143	66.8%	60 - 73%
Fixed Prosthesis	31	14.5%	10.2 - 20.1%

Source: Research data.

times higher for patients with 60 years or greater than for those in the 19-29-year age range (Table 5).

The results for the association between RFT and other factors are shown in Table 6. The association between RFT and the presence of apical periodontitis is important because of its clinical significance, as is the presence of posterior rather than anterior RFT. In addition, the association between the existence of roots remaining in the mouth and age is relevant, with a higher probability of RFT being observed in the age ranges of 30-39 years, 40-49 years, 50-59 years, and 60 or more years relative to the 19-29-year age range.

Discussion

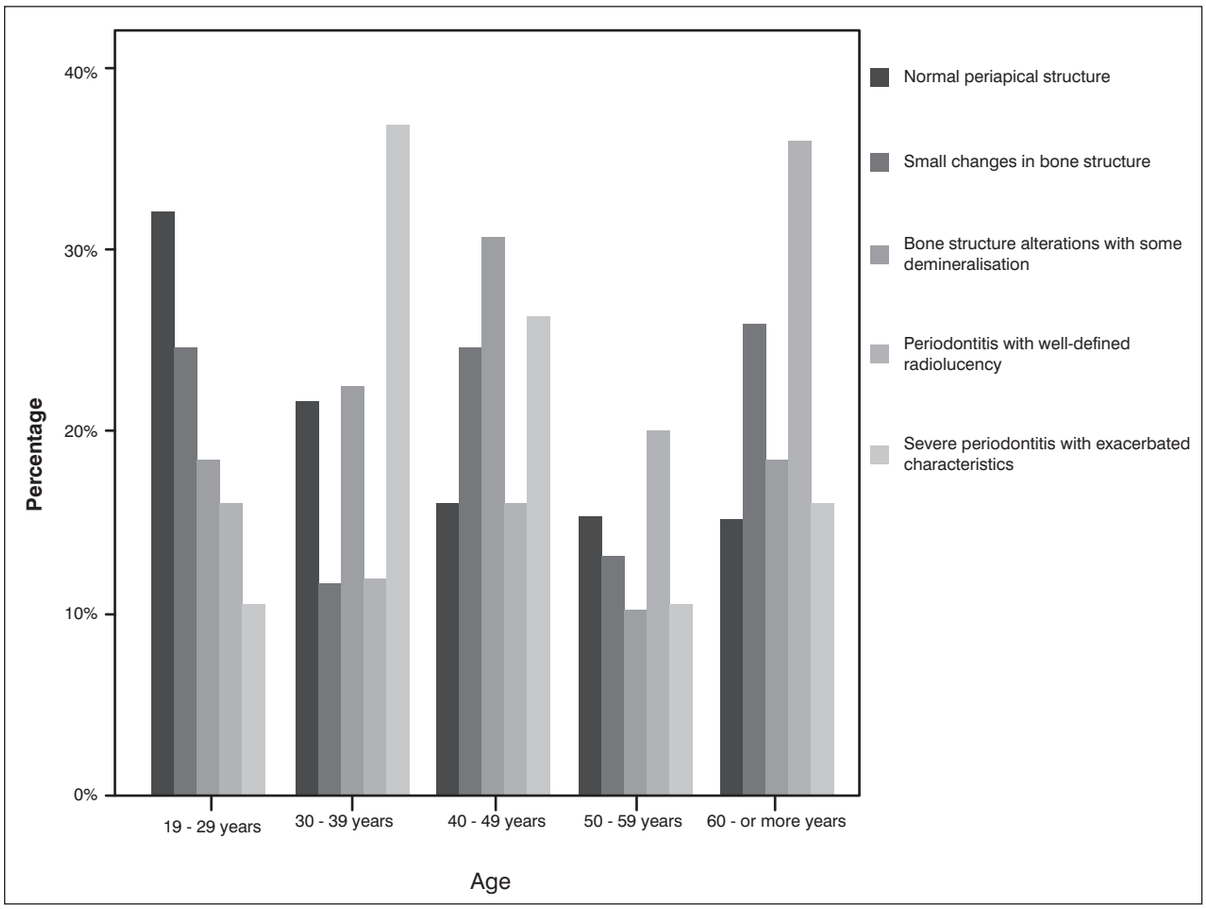
The results of this study provide a sample of panoramic radiographs for randomly chosen patients who came in for their first visits to the Dental School of the University of Porto, over 18 years old, and with more than seven teeth in their mouths.

Similar to other studies (1, 5, 6, 11), the sample is not representative of the Portuguese population or of the Porto area's population. Therefore, the results should not be directly extrapolated. However, over the last years, the population that currently receives care from dental schools are, no longer, only attracted by lower costs but seek more attentive care, particularly in certain fields of dentistry and endodontics. Therefore, the data collection from visits in 2010 reinforces the information that is available on the prevalence of apical periodontitis and endodontic treatment in Portugal, as does the fact that, since then, all of the digital images were taken using the same radiographic apparatus. The sample is comparable to or larger than samples from other studies. A total of 5.552 teeth were evaluated in 222

Table 5 - Distribution of periapical lesion by age ranges

	B	S.E.	Wald	df	p-value	OR	95% CI for OR	
							Lower	Upper
Age_Ag(1)	.732	.340	4.631	1	.031	2.079	1.067	4.050
Age_Ag(2)	1.159	.332	12.198	1	.000	3.185	1.663	6.103
Age_Ag(3)	.535	.390	1.886	1	.170	1.707	.796	3.664
Age_Ag(4)	1.073	.341	9.918	1	.002	2.924	1.500	5.701

Legend: Age_Ag(1) = 19-29 years; Age_Ag(2) = 30-39 years; Age_Ag(3) = 40-49 years; Age_Ag(4) = 50-59 years; Age_Ag(5) = 60 or more years.
Source: Research data.



Graph 3 - Distribution of teeth according to the lesion and age range
Source: Research data.

individuals, which allowed us to compare these results with similar studies in other countries, including Spain (11), where 4.453 teeth were evaluated in 180 individuals; Norway (2), where 2.940 teeth were evaluated in 119 individuals; Portugal (1), where 4.446 teeth were evaluated in 197 individuals; and Lithuania (5), where 3.892 teeth were evaluated in 147 individuals.

Similar to other studies (9, 11, 14), we excluded patients who had fewer than seven teeth in their mouths, thereby avoiding the need to account for differential diagnoses of endodontic/periodontal lesions.

There were more women (53.76%) than men (46.24%) in the sample, in accordance with other studies (8, 11). This distribution may reflect certain sociological aspects of the population in these countries.

The distribution by age showed that 50% of individuals were 38 years old or younger. This age distribution also occurred in other studies (6, 11), in which the authors suggested that this distribution might be because younger patients seek dental treatment more often than older patients.

We used digital panoramic radiographs because this assessment was the most accessible and the same apparatus was used for all patients. Several other studies used this type of radiographic exam (1,3, 6, 9, 12), while others used periapical radiographs (7, 8, 11, 14) or a combination of panoramic and periapical radiographs (2, 5, 10, 13, 16). Although there may be worse definition for assessments of lesion types, particularly in certain anatomical regions, studies have not shown statistically significant differences between the two methods (2, 20).

We used the PAI index to evaluate the periapical status of each tooth. Current studies on the prevalence of apical periodontitis are normally based on this index, independently of being applied with a periapical or panoramic radiograph. The results can, therefore,

Table 6 - Association of RFT with other factors

	B	S.E.	Wald	df	p-value	OR	95% C.I. for OR	
							Lower	Upper
Sex	-.265	.142	3.480	1	.062	.767	.581	1.013
Lesion_ag	2.322	.245	89.620	1	.000	10.195	6.304	16.489
Dental location	.518	.147	12.378	1	.000	1.678	1.258	2.239
Root	2.189	.237	85.130	1	.000	8.927	5.607	14.211
Age_Ag(1)	.608	.205	8.836	1	.003	1.837	1.230	2.743
Age_Ag(2)	.545	.223	5.997	1	.014	1.725	1.115	2.670
Age_Ag(3)	.488	.231	4.449	1	.035	1.629	1.035	2.562
Age_Ag(4)	.676	.219	9.538	1	.002	1.965	1.280	3.017

Legend: Age_Ag(1) = 19-29 years; Age_Ag(2) = 30-39 years; Age_Ag(3) = 40-49 years; Age_Ag(4) = 50-59 years; Age_Ag(5) = 60 or more years.
Source: Research data.

be compared easily. Although we achieved acceptable intraobserver agreement, we still had a second observer who was experienced in the field of endodontics. Furthermore, we only included teeth with a PAI ≥ 3 when assessing the prevalence of apical periodontitis in accordance with other studies (1, 2, 7, 8, 10-12, 14, 15, 16). In other studies using only periapical radiograph observations (2, 5, 12), the radiographs are only used to assess the periapical status of endodontically treated teeth. The results for the prevalence of apical periodontitis and RFT were obtained with this approach, generally using panoramic radiographs. Therefore, our results can be effectively compared with the ones from other studies.

The prevalence of teeth with apical periodontitis was 1.7% of all teeth. Our results were slightly lower than Norwegian (2), Danish (7), Spanish (11) and other Portuguese (1) studies, with 3.5%, 3.4%, 4.2% and 2%, respectively; but were clearly lower than those found in Lithuania (5) and Belgium (6), with 7% and 6.6%, respectively. The values found in Spain (11) were slightly higher than the Portuguese ones (1), which may be partially explained by the use of periapical radiographs instead of panoramic ones.

In contrast to other epidemiological studies, such as the one conducted in Spain (11), this study found a statistically significant difference between sexes in the prevalence of teeth with apical periodontitis (2% of men and 1.3% of women). This discrepancy may also be explained by the aforementioned factors, including the sociological, such as women seeking more dental care.

The majority of the sample was composed of younger individuals (19-39 years old). This distribution was also found in other studies (4, 6, 11), and may be because younger patients seek treatment more often than older patients.

There was a statistically significant difference between RFT and unfilled teeth in accordance with previous studies (8, 11, 15).

The presence of apical periodontitis is associated with the location of the tooth, and it is more commonly found in posterior teeth (2.7%) than anterior teeth (0.4%). A similar pattern was reported in a Danish study (7), where the percentage of teeth with periapical lesions was 9.8% for posterior teeth and 1.5% for anterior teeth. In a Spanish study (11), the percentage of posterior teeth with periapical lesions was 10%, compared to 3.2% for anterior teeth.

The probability of having apical periodontitis was much higher for roots, as dental units, than for teeth.

In terms of distribution by age, we found that a PAI status of 1 (normal periapical structure) was associated with the lowest age range (19-29 years). The presence of bone alterations increased with age. A significant association was found between the presence

of a periapical lesion and age, a result that has been corroborated by other studies (21, 11).

The prevalence of RFT was 3.9%, slightly higher than the prevalence found in Spanish, with 2.1% (11) and Irish, 2.0% (12) studies and a Portuguese study (1), conducted in 1998 (1.5%). This predominance is similar to that of a Danish study, 3.4% (7) and lower than that of Belgian, 6.8% (6) and Turkish studies, 9.39% (16). According to the authors, this finding may be explained by differences in the age stratification of patients in the studies or by differences in the health care services available in different countries.

In accordance with another study (5), we found no association between restoration types or the lack of a restoration and the presence of apical periodontitis.

Several of the radiographic images that were documented as periodontitis can be cured; therefore, the real results or prognoses for endodontically treated teeth are not reflected in this study. Many others, however, reflect deficient technical quality in endodontic treatments within the general population.

Conclusion

The prevalence of apical periodontitis is similar to the one in other European countries. Similar to other countries, the prevalence is higher for root-filled teeth than for unfilled teeth. The predominance of root-filled teeth in Portugal differs from other countries, which may reflect differences in these countries respective healthcare systems.

This study's results allow for reflection on the teaching and practice of endodontics in Portugal. This field deficiency also occurs in other countries. Therefore, a more in-depth debate is warranted, concerning the possible causes of this endodontic treatment results and the best way to overcome it.

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