Clinical Research

Periradicular Status and Quality of Root Canal Fillings and Coronal Restorations in an Urban Colombian Population

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Abstract

Introduction: This cross-sectional study determined the prevalence of apical periodontitis in 1086 root canal–treated teeth from an urban Colombian population and evaluated the association of several factors with the periradicular status. **Methods:** Periapical radiographs were used for analyses, and teeth were classified as healthy or diseased according to the periradicular status. Other factors were also evaluated for their association with the periradicular conditions, including gender, quality of both endodontic treatment and coronal restoration, apical level of filling, and presence of post restoration. **Results:** Fifty-one percent of the treated teeth were classified as healthy. Only 33% of the teeth had endodontic treatment rated as adequate. The quality of both endodontic treatment and coronal restoration significantly influenced the periradicular conditions ($P < .001$). Combined data revealed that teeth with both adequate endodontic treatment and adequate restorations showed significantly better periradicular status than the other combinations ($P < .01$), except for teeth with adequate treatment and inadequate restoration ($P = .08$). Canals filled up to 0–2 mm short of the apex had a significantly higher number of teeth rated as healthy than overfilled or underfilled cases ($P = .02$). Regression analysis showed that the quality of endodontic treatment was the most significant factor influencing the periradicular status ($P < .001$). Gender and presence of post restoration had no association with the periradicular conditions. **Conclusions:** Data from this Colombian population showed a relatively high prevalence of apical periodontitis in root canal–treated teeth. This was largely due to an equally high prevalence of treatments performed under substandard technical quality. The quality of the endodontic treatment was the most determinant factor for healthy periradicular status. (*J Endod* 2013;39:600–604)

Longitudinal studies of endodontic treatment outcome performed in university-based or teaching hospital–based settings have shown a very high rate (about 90%–95%) of teeth free of apical periodontitis after 2–5 years of follow-up [1–5]. Nonetheless, cross-sectional studies performed in a large number of countries have revealed that the prevalence of apical periodontitis in root canal–treated teeth is relatively high, ranging from 30%–65% [6–11]. A systematic review and meta-analysis of cross-sectional studies about the prevalence of apical periodontitis in different countries with high or very high human development indices showed that 36% of 28,881 root canal–treated teeth exhibited periradicular radiolucencies [12]. If these teeth are categorized as treatment failures because of persistent or emergent disease, this picture becomes considerably alarming because it reflects the realistic outcome of the root canal treatment in the general population [13]. Inadequate treatment is, however, a very frequent observation in most cross-sectional studies and has been regarded as one of the most important factors associated with poor outcome [9, 12, 14–16].

The large majority of cross-sectional studies evaluating the periradicular status of root canal–treated teeth have been performed in Europe, North America, and Asia [6, 7, 14–27]. For countries located in the Southern Hemisphere, only limited information is available [9, 28]. To the best of our knowledge, there are no studies evaluating the prevalence of apical periodontitis in root canal–treated teeth in Colombia. Therefore, this study was undertaken to assess the prevalence of apical periodontitis in root canal–treated teeth from an urban adult Colombian population and evaluate the association of several factors with the periradicular status of these teeth.

Materials and Methods

Study Population

The sample for this cross-sectional study consisted of 688 adult patients who consecutively presented for the first time seeking routine dental care at the Dental School, Santo Tomas University, Bucaramanga and Floridablanca, Colombia between 2003 and 2010. To be enrolled in the study, the patients had to possess a current full-mouth series of periapical radiographs. Periapical digital radiographs were taken by a dental radiologist who used the radiovisiography system CDR-DICOM (Computerized Dental Radiograph-Digital Imaging and Communications in Medicine; Schick Technologies, Long Island, NY). All root canal–treated teeth from these patients

were included in the study, except for third molars whose radiographic images could not be conclusively analyzed.

Evaluation Criteria and Radiographic Analysis

The 1086 root canal–treated teeth included in this study were radiographically evaluated for the qualities of the root canal filling and the coronal restoration. The criteria used for evaluation were as described previously (14, 15).

Endodontic Treatment. For adequate treatment, all canals were obturated. No voids were present. Root canal fillings ended from 0–2 mm short of the radiographic apex.

For inadequate treatment, root canal filling ended more than 2 mm short of the radiographic apex or was grossly overfilled. Root canal filling with voids, inadequate density, unfilled canals, and/or poor condensation were also considered inadequate.

In multirooted teeth with similar periradicular status for all roots, the root with the worst treatment quality was used.

Coronal Restoration. Adequate restoration was regarded as any permanent restoration that appeared intact radiographically. Inadequate restoration was any permanent restoration with detectable radiographic signs of overhangs, open margins, or recurrent caries or presence of temporary coronal restoration. (Teeth with no coronal restorations, permanent or temporary, were also included in this group.)

Presence of posts was also recorded. Radiographs were analyzed on the computer screen in a darkened room, and the periradicular status was evaluated according to the criteria of Strindberg (1). Healthy periradicular condition was judged when both the contour and width of the periodontal ligament space were normal, or the periodontal ligament space contour was widened mainly around excess filling. Appearance of the surrounding bone was normal. Diseased teeth presented any discernible apical radiolucency (1, 29). Multirooted teeth were ranked according to the root with the worst evaluation.

Two observers were previously calibrated against a set of 100 reference teeth. Afterwards, they examined all the radiographs independently. Because agreement was moderate (Cohen kappa value = 0.45), a highly experienced endodontist served as the third observer for the cases where disagreement occurred.

TABLE 1. Distribution of Root Canal–treated Teeth According to the Tooth Group (n = 1086)

Covariate	N	%
Gender		
Female	457	66
Male	231	34
Quality of coronal restoration		
Adequate	433	40
Inadequate	480	44
Absent	173	16
Quality of endodontic treatment		
Adequate	360	33
Inadequate	726	67
Apical limit of filling		
0–2 mm short	568	52
>2 mm short	447	41
Overfilling	71	6.5
Post		
Yes	357	33
No	729	67
Periradicular status		
Healthy	555	51
Diseased	531	49

Statistical Analysis

Statistical analyses were performed by using the SPSS software (Statistical Package for the Social Sciences, version 17.0; IBM, Chicago, IL). Initially, a descriptive analysis was performed including the variable healthy treated tooth (dependent variable) and the covariates (independent variables) gender, quality of coronal restoration, quality of endodontic treatment, apical limit of obturation, and presence of post. Descriptive data were obtained as frequencies of the categories within each variable. The χ^2 test was applied to each covariate in relation to the periradicular status of treated teeth to look for significant associations ($P < .05$). A bivariate analysis was also performed to evaluate the combined effects of quality of coronal restoration and endodontic treatment. Next, unadjusted univariate logistic regression was applied between the dependent variable and the covariates to evaluate the association of each one with healthy periradicular conditions through calculation of odds ratio and 95% confidence interval. Finally, adjusted multivariate logistic regression was used to deduce the influence of each covariate on the periradicular conditions. This multiple analysis included only the variables that presented $P < .05$ in the previous analysis. The method used to insert the variables in the logistic model was the backward stepwise, which involved all variables chosen. Furthermore, these variables were gradually excluded until the final model was formed. A probability level of .05 was used as the criterion for statistical significance.

Results

Overall data are displayed in Table 1. Of the 1086 root canal–treated teeth included in this study, 457 (66%) were from female patients and 231 (34%) from male patients. Maxillary teeth corresponded to 77% of the teeth. Maxillary central incisors were the most frequently treated teeth, followed by maxillary premolars, maxillary lateral incisors, and mandibular molars (Table 2).

On the basis of the criteria of Strindberg (1), 555 teeth (51%) were classified as healthy and 531 (49%) as diseased. There was no significant difference in the periradicular status of root canal–treated teeth from male and female patients ($P = .23$). Only 33% of the teeth included in this study had endodontic treatment rated as adequate. Of these, 219 (61%) were ranked as healthy (Table 3). Of the 726 teeth (67%) rated as having inadequate endodontic treatment, only 336 (46%) were classified as healthy. A highly statistically significant difference was observed when comparing teeth with adequate and inadequate treatment ($P < .001$).

Of the 433 teeth (40%) that were found to have adequate coronal restorations, 249 (57.5%) were scored as healthy. The group with inadequate/absent restorations consisted of 653 teeth (60%), of which only 306 (47%) were healthy. Highly significant difference was observed when comparing treatment outcome for teeth with adequate and inadequate/absent restorations ($P < .001$).

Combined data of the quality of both endodontic treatment and coronal restoration were evaluated for periradicular status. The rate

TABLE 2. Distribution of Root Canal–treated Teeth According to the Tooth Group (n = 1086)

Tooth	Maxillary	Mandibular
Central incisor	293 (27%)	29 (3%)
Lateral incisor	152 (14%)	7 (0.6%)
Canine	78 (7%)	13 (1%)
Premolar	245 (23%)	79 (7%)
Molar	71 (6.5%)	119 (11%)
Total	839 (77%)	247 (23%)