



The Influence of Periodontal Status on Endodontically Treated Teeth: 9-year Survival Analysis

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Abstract

Introduction: The aim of this study was to investigate the effect of periodontal status at the time of nonsurgical root canal treatment (NSRCT) on the survival rate of endodontically treated teeth (ETT). **Methods:** In this retrospective investigation, molars that received NSRCT in an advanced specialty education program in endodontics from 2009 through 2017 were initially recruited. After the application of inclusion and exclusion criteria, 315 teeth were included in the study. Inclusion criteria were ETT with an acceptable quality of NSRCT; ETT that received an adequate crown within 3 months after NSRCT; and ETT with complete periodontal charting before NSRCT including pocket depths, clinical attachment loss, and bone loss. The periodontal status of all included teeth was assessed based on American Academy of Periodontology guidelines. All included ETT were divided into 3 groups as follows: healthy group, mild periodontitis, and moderate periodontitis. The survival rate of ETT was analyzed using univariate Kaplan-Meier and log-rank tests for differences between groups ($P < .05$). A Cox regression model was used to assess the effect of independent variables on the survival rate. **Results:** Teeth that were diagnosed with mild periodontitis were almost 2 times more likely to be extracted compared with ETT diagnosed with normal periodontium at the time of NSRCT (odds ratio [OR] = 1.9, $P < .05$). This increased risk of tooth loss was 3.1 (OR = 3.1, $P < .05$) for ETT diagnosed with moderate periodontitis. Smokers were twice as likely to have tooth loss compared with nonsmokers (OR = 2.2, $P < .05$). **Conclusions:** Patients' periodontal health, being 1 of the prognostic determinants of the outcome of NSRCT, requires attention before and subsequent to NSRCT. This may improve the survival of ETT and help patients maintain their natural dentition. (*J Endod* 2017;43:1781–1785)

Key Words

Endodontic, nonsurgical root canal treatment, outcome, periodontal disease, periodontitis, survival rate

The aim of endodontic and periodontal treatment therapies is to retain the natural dentition in a healthy and functional state (1). These treatments are both predictable and have high survival rates (2, 3). In order to enhance the effectiveness of these treatments, it may be prudent to recognize related factors that could influence the long-term survival of these teeth (4, 5).

Previous studies have detailed the influence of concurrent endodontic and periodontal treatments on the long-term survival of molars (3, 5, 6). Pretzl et al (1) reported that "root canal treatments contribute significantly to the loss of molars in patients under periodontal treatment." However, confounding variables such as the quality of nonsurgical root canal treatment (NSRCT) (7) and postendodontic restoration (2) that could have influenced the survival of endodontically treated teeth (ETT) were not considered in these studies. This might affect the reliability of these studies. Therefore, the current investigation was designed to investigate the concurrent effect of endodontic and periodontal treatment on the long-term survival of ETT while controlling for confounding variables.

Periodontal disease is known as 1 of the main reasons for tooth extraction after NSRCT (8–11). Only a few studies have assessed the effect of preoperative periodontal status of a tooth on the survival of ETT (10, 12). It was reported that probing depths deeper than 5 mm are associated with an increased risk of tooth loss after NSRCT (12). However, in this study, only pocket depth was used, and other periodontal prognostic factors such as clinical attachment loss and bone loss (6) were not included in the analysis. Furthermore, supportive periodontal treatments are significantly associated with higher long-term survival of molars (1, 3, 5). Despite this fact, no study has assessed the effect of supportive periodontal therapy (SPT) on the survival of ETT. According to the American Academy of Periodontology (13), periodontal disease severity can be categorized based on the amount of clinical attachment loss and bone loss. Therefore, the aim of the present study was to investigate the effect of periodontal

Significance

One of the prognostic determinants of NSRCT is patients' periodontal health. The results of this investigation reported that attention before and subsequent to NSRCT is required to optimize endodontic survival rate.

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status of a tooth at the time of NSRCT and the role of supportive periodontal treatment on the survival rate of ETT.

Materials and Methods

The protocol of the present retrospective study was approved by the Committee on Research Involving Human Subjects, Case Western Reserve University (CWRU), Cleveland, OH. Study data were collected and managed using General Systems Design Group (Cedar Rapids, IA) academic data capture tools hosted at CWRU.

Existing patients' electronic records based on the American Dental Association Code on Dental Procedure and Nomenclature identified all mature permanent molars that had received NSRCT at the endodontic department performed by postgraduate students using a dental operating microscope between January 1, 2008, and January 1, 2017. Records were restricted to active school patients. These patients were initially treated at the CWRU screening dental clinic and received a complete periodontal assessment before NSRCT. Also, screened patients were active school patients who regularly came to CWRU School of Dental Medicine for recall visits. These preliminary inclusion criteria resulted in 635 ETT from 754 patients.

Patients' records, radiographs, and computerized databases were retrospectively examined to identify samples that matched the final inclusion criteria in the present study. Inclusion data for ETT were as follows:

1. Patients between 18 and 75 years of age in good health (American Society of Anesthesiologists classification I or II).
2. ETT with an acceptable quality of NSRCT according to the criteria suggested by Tronstad et al (14) and Farzaneh et al (15).
3. ETT with a preoperative diagnosis of irreversible pulpitis. In order to standardize the results of the data and to minimize the risk of pulpal status as a confounding variable, the authors limited the investigation to only irreversible pulpitis (16).
4. ETT with complete periodontal charting before NSRCT including pocket depths and clinical attachment loss, degree of mobility, and radiographic bone loss.
5. Restorable teeth with at least a 2-mm coronal dentin height and at least a 1-mm dentinal thickness have been included to provide an adequate ferrule effect as described by Ferrari et al (17).
6. ETT that received an adequate crown within 3 months after NSRCT, which was confirmed by the absence of open/defective margins based on a clinical and radiographic examination.
7. Teeth with no detectable crack(s) under a dental operating microscope during the NSRCT.

Teeth with no preoperative radiographs before the initial NSRCT, teeth lost to follow-up, and cases with true combined endodontic-periodontal lesions that need advanced periodontal therapy were excluded (18). Also, ETT teeth with suspected vertical root fracture (19) and with any operative mishaps such as a perforation and/or a separated file were excluded.

After the application of the inclusion criteria, all included ETT were divided into 3 groups to assess the influence of various periodontal statuses on the survival of ETT:

1. ETT with no periodontal disease at the time of NSRCT (healthy/control group, $n = 125$)
2. ETT diagnosed with mild periodontitis (mild group, $n = 100$)
3. ETT diagnosed with moderate periodontitis (moderate group, $n = 90$)

The periodontal status of all ETT was assessed based on the criteria of the American Academy of Periodontology (13). According to this guideline, teeth with less than a 5-mm probing depth, 1- to 2-mm attachment

loss, and up to 15% radiographic bone loss were diagnosed with mild periodontitis. Also, teeth with probing depths between 5 and 7 mm, 3- to 4-mm attachment loss, and less than 30% bone loss were diagnosed with moderate periodontitis.

ETT diagnosed with severe periodontitis at the time of NSRCT were excluded from the study ($n = 13$). Finally, screening of the ETT that met the inclusion criteria yielded 315 ETT (1 tooth per patient) included in the final analysis.

The following characteristics were collected from the patients' records:

1. Patient's age, sex, and the dental arch of the ETT (maxilla v mandible)
2. Self-reported smoking status was assessed using 2 categories (ie, never smoked or former smoker who quit >5 years previously) or current smoker as described by Lang and Tonetti (20)
3. Date of NSRCT initiation and completion
4. Date and reason of an extraction if available
5. Status of periodontal health (normal periodontal status, mild periodontitis, or moderate periodontitis) at the time of NSRCT
6. Whether or not patients participated in the SPT at the periodontal department after NSRCT on a regular basis; SPT included clinical measurements, assessment of the plaque control record (21), and, if necessary, subgingival reinstrumentation of sites with a probing pocket depth of 4 mm that also had bleeding on probing or pocket depths of 5 mm and more (5)

In the present study, survival was defined as the presence of the ETT in the oral cavity by the end of the study (January 1, 2017). The time lapse between NSRCT and extraction was registered if the ETT were extracted during the study period. ETT with no extraction codes were considered to have survived, and the time lapse between NSRCT and the end of this study was calculated for these teeth. The date of the last recall visit of the patient was also recorded as the censoring date for ETT that were not extracted during the study period.

Statistical analysis was performed using SPSS 19 (SPSS Inc, Chicago, IL) and R version 2.8.0 (Foundation for Statistical Computing, Vienna, Austria). The survival rate of ETT was analyzed using univariate Kaplan-Meier and log-rank tests for differences between groups ($P < .05$). The annual failure rates were calculated from life tables. A multivariate Cox regression model was performed to analyze the imposed risk of independent variables such as periodontal status (normal/mild periodontitis/moderate periodontitis) and regular SPT (yes/no) on the outcome variable (survival/extraction), controlling for the confounding variables at a significance level of 0.05.

Results

In the present study, 315 teeth from 315 individuals with a mean age of 54 years were included for analysis. Of these patients, 125 teeth (39.6%) were diagnosed with a healthy periodontium, 100 teeth (31.7%) were diagnosed with mild periodontitis, and 95 teeth (30.1%) were diagnosed with moderate periodontitis at the time of NSRCT. Table 1 details the distribution and characteristics of the included teeth.

In this 9-year retrospective study, 20 ETT (6.3%) were extracted, and 295 (93.7%) survived to the end of the follow-up time or study (January 1, 2017). Prognostic variables for univariate survival analysis included periodontal diagnosis at the time of NSRCT (healthy/mild periodontitis/moderate periodontitis), receiving SPT (yes/no), dental arch, sex, and history of smoking. Three factors that were significantly ($P < .05$) correlated with the survival of the ETT were as follows: periodontal diagnosis, SPT provided, and smoking.

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