A Practice-based Study on the Survival of Restored Endodontically Treated Teeth

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Abstract

Introduction: This retrospective study evaluated the survival of endodontically treated teeth (ETTs) and investigated factors influencing restoration and tooth survival. **Methods:** Data from 795 ETTs were recorded, and success (restoration still intact) and survival (restoration intact or failed/repaired/replaced and tooth still *in situ*) were analyzed using Kaplan-Meier statistics. A multivariate Cox regression analysis was performed to assess the variables influencing success and survival. **Results:** At the end of the observation period (mean observation time = 4.48 years), 45 teeth had been extracted (annual failure rate for survival = 1.9% at 9.6 years) and 114 restorations had received a restorative follow-up treatment (annual failure rate for success = 4.9% at 9.6 years). **Conclusions:** ETTs showed acceptable survival and success in the long-term. Variables showing significant influence on survival were the number of teeth in the dentition and the presence of decay at the moment the patient entered the practice. *(J Endod 2013;39:1335–1340)*

Key Words

Clinical trial, dental restoration, endodontic treatment, longevity, retrospective study, survival

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A traditional restorative concept for endodontically treated teeth (ETTs) is to place a post in the root canal if required for retention of the restoration, especially when a large defect is present (1, 2). A coronal restoration is indicated if a significant portion of the tooth's clinical crown is missing. In contemporary practice, a bonded composite is often favored rather than a full crown or amalgam restoration because a composite resin restoration may prevent tooth fracture in combination with being minimally invasive (3). However, the traditional approach is still to make a post and core and, subsequently, a crown after endondontic treatment. The necessity to place a crown on an endodontically treated tooth has been investigated in clinical trials with limited observation time, but a recent Cochrane review on this subject was inconclusive because of a lack of suitable studies (4). The optimal design to compare the longevity of different types of restorations is a prospective randomized controlled trial (5). However, because differences between groups often appear only after long-term functioning, observation times of 5 to 10 years may be necessary (3). Prospective studies with longer observation times are scarce because they are difficult to perform because of high costs, changes in materials, and a low patient recall rate after longer periods of time. Clinical trials on the outcome of restored ETTs reported 0%–5% annual failure rates (AFRs), but these were based on follow-up times of only 3–5 years (6–9). Especially for ETTs with a large restoration that is often not easy replaceable, the long-term survival of restoration and survival of the tooth are important factors because complications like failing endodontic treatments and vertical root fractures may occur and result in tooth loss. ETTs are usually restored with complex and extensive restorations in which repair or replacement are not easily performed, thus making long-term follow-up even more essential. Moreover, because the failure of such extensive restorations is more likely to lead to tooth loss, this should be included as an important treatment outcome.

Practice-based studies differ in methodology and techniques (10), but all offer the advantage of reflecting what can be achieved in clinical practice. When sufficient data from patient files can be collected, an analysis of factors contributing to longevity is possible. For ETTs, several clinical studies are available on longevity (11–14). However, data generated in general practices reflecting routine dental care procedures are scarce. The present study aimed to evaluate the long-term longevity of ETTs in a general practice environment including several restorative concepts. Several tooth- and patient-related variables were related to restoration and tooth survival.

Materials and Methods

For this retrospective study, patient files from a private practice in Germany (RW) were used from 2000–2011. Data were collected without reference to patient names (anonymously). Because of the retrospective data collection, this study was a nonintervention clinical trial without the need for local review board approval according to European guidelines for good clinical practice (CPMP/ICH/135/95).

Records from patients who regularly visited the practice were searched for the presence of ETTs. Inclusion criteria for the ETTs were as follows:

1. A restoration was placed at least 6 months before the last recall visit.

2. A restoration was placed within 6 months after endodontic treatment.
3. Records contained information on the ETTs and the dentition (see later).

Screening of the patient files yielded 1,542 ETTs, and from these, 795 ETTs met the inclusion criteria. The following data were collected from the patient records:

1. Characteristics of the involved tooth and the dentition including the type of tooth, number of teeth, presence of caries at the time of entering the practice, decayed/missing/filled teeth at the moment of endodontic treatment, restorative status of ETTs before endodontic treatment, and date of the first visit
2. The date of endodontic treatment including relevant information (the number of sessions, number of canals, and number of filled canals)
3. The date of placement of the follow-up restoration including relevant information such as the type of restoration, number of surfaces, placement of a post, and core buildup
4. The type and date of all interventions on the ETTs in the period after endodontic treatment

The date of the last check-up visit of the patient was recorded because this was the censoring date for restorations still in place without intervention.

All endodontic treatments and restorations (inlays, crowns, telescopic crowns, and composite resin restorations) for the ETTs were placed by 1 operator (RW). In case an existing crown was left in place, with the access opening restored with a composite repair restoration, the restoration was defined as an "old crown." The decision regarding the indicated restoration was made by an informed consensus between the dentist and the patient.

From the files, the date and the type of all interventions were recorded for each included tooth in the period after the first restoration was placed. If no intervention was done, tooth and restoration were both considered to have successfully survived (defined as success). If the restoration was repaired or replaced, the restoration was considered to have failed, whereas the tooth was considered to have survived (defined as survival). If the tooth was extracted, both the tooth and restoration were considered to have failed.

Statistical analyses were performed using SPSS 19 (SPSS Inc, Chicago, IL) and R version 2.8.0 (Foundation for Statistical Computing, Vienna, Austria). The longevity of restorations and teeth was analyzed using Kaplan-Meier statistics and log-rank tests for differences between groups ($P < .05$). The annual failure rates were calculated from life tables. A multivariate backward stepwise Cox regression with clustering for patients was performed to analyze the influence of variables at a significance level of $P = .05$.

TABLE 1. Characteristics of Patients and the Involved Teeth

Patient characteristics		Mean (SD)
Years in practice		5.86 (3.36) years
Number of teeth in dentition at the first visit		26.10 (5.64) teeth
Decayed teeth at the first visit		1.31 (2.27) teeth
	Number (%)	
Characteristics of ETTs	Upper jaw	Lower jaw
Type of tooth		
Total	468 (58.9)	327 (41.1)
Anterior teeth	129 (27.6)	34 (10.4)
Premolars	158 (33.8)	97 (29.7)
Molars	181 (38.7)	196 (59.9)
Type of restoration after endodontic treatment		
Old crowns	42 (5.3)	
Composite restoration	376 (47.3)	
New crowns	238 (29.9)	
Inlays	69 (8.7)	
Telescope crowns	70 (8.8)	
Post	*n* (%)	
No	686 (86.3)	
Yes	109 (13.7)	
Number of sessions for endodontic treatment	*n* (%)	
1 session	332 (41.8)	
2 sessions	326 (41)	
3 sessions	84 (10.6)	
4 sessions	34 (4.3)	
≥5 sessions	19 (2.4)	
ETT = last tooth in the arch	*n* (%)	
No	557 (70.1)	
Yes	238 (29.9)	
Number of adjacent teeth	*n* (%)	
0 (none)	46 (5.8)	
1 tooth	213 (26.8)	
2 teeth	536 (67.4)	

ETT, endodontically treated tooth.