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Risk factors for failure of class V restorations of carious cervical lesions in general dental practices

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ABSTRACT

Objectives: The aim of this retrospective, non-interventional, multi-center, practice-based study was to analyze factors influencing the survival of restorative treatments of one- and two-surface active cervical (root) caries lesions (CCLs).

Methods: Records from patients who visited five private practices regularly were searched for the presence of active one- and two-surface CCLs. Data from 1167 patients with 2070 CCLs being detected at least 6 months before the last recall visit were recorded. Kaplan-Meier-analyses were used to analyze time-to-failure. Cox proportional hazards models were used to evaluate the association between clinical factors and time until failure.

Results: Within 120 months [mean (SD) follow-up period:50 (40) months] 219 failures could be observed. Median survival time was 120 months. The AFR was 1.82% for one-surface restorations (CCL_1) and 3.25% for two-surface restorations (CCL_2). In multivariate Cox regression two-surface cervical restorations showed 1.75 times higher failure rates than one-surface cervical restoration. Furthermore, CCL being checked up more than twice a year showed significantly higher failure rates than restorations being checked up less than twice a year ($p < 0.001$).

Conclusion: Low failure rates could be found for restorative treatment strategies of one- as well as for two-surface CCLs.

Clinical significance: Restorative treatment of CCLs is a viable way to manage one-surface CCLs. However, the proximal extension of the CCL significantly shortens the longevity of the restoration.

The study was registered in the German Clinical Trials Register (DRKS-ID: DRKS00012510).

1. Introduction

Several improvements in dental health over the last decades have resulted in more retained teeth than past generation had [1–4]. Besides, prevalence of gingival recessions increases in an ageing population. Thus, cervical dentinal surfaces are more frequently exposed to the oral environment and consequently the risk for developing root caries lesions will be increased [4].

For primary [5], secondary [5] and tertiary prevention [6] of cervical root caries lesions several approaches could be revealed. However, due to the low numbers of clinical trials for the respective approaches, the high risk of bias within the studies and the limiting grade of evidence [5,6] there is need for more research in this area.

In restorative dentistry annual failure rates (AFR) at 5–10 years below 6% are considered as satisfying from a clinical perspective [7]. In recent systematic-analyses AFR for class V restorations due to non-carious cervical lesions (NCCLs) and for class II restorations varied between 1.9–5.8% [8] and 0–6% [9]. Contrastingly, in previous studies failure rates for class V restorations due to cervical (root) caries lesions (CCLs) were several times higher. In university setting [10–14], cumulative failure rates after two years varied between 27 and 96%. Large variations could not only be observed between the different restorative materials but also for the same material among various studies [6]. The large variation might be related to inhomogeneous methodologies and techniques, relatively short follow-up periods as well as the small study population of 'only' 269 patients with a total of 629 active cervical carious lesions [6]. Contrastingly, in private practice setting cumulative failure rates were lower; varying between 6% after a mean observation

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time of 3.5 years [15] and 40% after 5 years [16]. Thus, regarding CCLs only one study observed an annual failure rate (1.8%) below 6% [15]. However, this study analyzed patient records of only one (German) dental practice.

Regarding the access to proximal CCLs for restorative management the access is more limited and it requires extensive removal of sound dental hard tissues. Interestingly, there are no scientific data available with regard to the (annual) failure rates or risk factors for restorative management of active two- or three-surface cervical root caries lesions.

Thus, the aim of the present retrospective, non-interventional, multi-center, practice-based study was to investigate factors influencing the long-term survival of restorative treatments of active one- to two-surface cervical root caries lesions in five different private practices being recruited from a German dental practice based research network.

2. Materials and methods

2.1. Study design

This study was a retrospective, non-interventional, multi-center, clinical study without the need for local review board approval according to European guidelines for good clinical practice (CPMP/ICH/135/95) [17]. This study conforms to the STROBE guideline for cohort studies [18].

2.2. Patient selection

Five dentists in five general, preventively oriented practices were recruited from a German dental practice based research network (Arbeitskreis Zahnärztliche Therapie). Records from patients who visited the practices regularly between 1996 and 2014 were searched for the presence of active cervical (root) caries lesions (CCLs). Inclusion criteria for the CCLs were as followed:

1 detection of the CCL at least 6 months before the last recall visit,
2 restorative treatment of the CCL at least 6 months before the last recall visit,
3 location of the CCL on the vestibular
- cervical surface (one-surface cervical root caries restorations (CCL_1))
- mesio-cervical/disto-cervical surface (two-surface cervical root caries restorations (CCL_2))

Exclusion criteria for the CCLs were as followed:

1 scheduled restoration of the tooth by placing a crown, telescopic crown or bridge anchor at first detection of CCL,
2 scheduled extraction of the tooth at first detection of CCL,
3 detection of the cervical root caries lesions on a wisdom tooth,
4 extension of the caries to the occlusal surface.

2.3. Data extraction

The following data were collected anonymously (without reference to patient names) from the electronic patient files meeting the inclusion criteria:

- age and sex
- characteristics of the involved tooth and the dentition including the tooth-localization
- date of the detection of the CCL
- date of the first and second restorative intervention (on the cervical surfaces) – if present – including information such as the type of intervention/restoration (e.g. filling, crown, extraction)
- date of the first visit
- date of the last visit
- DMFT/S at the date of first CCL detection
- insurance status (private or statutory)
- number of teeth (per patient) being included in the study
- number of the regular check-ups during observation period
- number of the remaining teeth at the date of first CCL detection
- private practice/dentist
- restoration material
- restored tooth surfaces
- risk level of caries at the date of first CCL detection (only the DMFT at a respective age was taken into account [19,20])

2.4. Failure of treatment decision

Assessment of the status of the restorations was done by the dentist who placed the restoration when patients attended for routine care or recall.

The observation period started with the restoration inserted by the dentist.

When the restoration of the CCL was still in function at the last check-up visit and found to be clinically acceptable, the intervention was considered successful.

Whenever the cervical restoration was replaced, repaired, or scheduled for replacement at the last check-up for which an appointment was then made with the patient, the intervention was considered as failed.

In cases where a tooth was extracted or restored by placing a crown, telescopic crown or bridge anchor in the investigated period and the intervention was not related to the direct cervical root caries lesion, it was not considered as failed, but the observation period was then censored. The number of censored events can be seen in Table 1.

2.5. Statistical analyses

For descriptive purposes frequencies and percentages of measured baseline characteristics as well as frequencies and percentages of different failure types were tabulated (Table 2)

Statistical analyses were performed using SPSS (SPSS 25.0; SPSS, Munich, Germany). Time until any failure was the dependent variable. Kaplan-Meier statistics and log-rank tests were used to calculate significant differences between the groups ($p < 0.05$). For Kaplan-Meier statistic the independent method was used to generate survival curves up to 10 years [19]. The AFR were calculated from life tables. Crude associations between baseline characteristics and time until failure were calculated by fitting separate models for each baseline characteristic as the independent variable [30]. Factors associated with time until failure ($p < 0.25$ [15, 20]) in the separate models were entered in a multivariate Cox regression model.

Table 1
Frequency of successful, failed and censored restorations.

last assessment / treatment of the tooth	consideration as	Frequency [n (%)]
sufficient restoration	success	1621 (78%)
crown	censored[a]	67 (3%)
telescope crown	censored[a]	18 (1%)
bridge anchor	censored[a]	31 (1%)
extraction	censored[a]	114 (6%)
second restorative intervention	failure	219 (11%)
total		2070 (100%)

[a] In cases where a tooth was extracted or restored by placing a crown, telescopic crown or bridge anchor in the investigated period and the intervention was not related to the direct cervical root caries lesion, it was not considered as failed, but the observation period was then censored.