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Review article

Understanding the management and teaching of dental restoration repair: Systematic review and meta-analysis of surveys

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ABSTRACT

Objectives: Repair instead of complete replacement is recommended to manage partially defective restorations. It is unclear if and why such treatment is taught at dental schools or practiced by dentists. We aimed to identify barriers and facilitators for repairs using a systematic review and meta- and qualitative analysis.
Sources: Electronic databases (PubMed, CENTRAL, Embase, PsycINFO) were searched.
Study selection: Quantitative studies reporting on the proportion of (1) dentists stating to perform repairs, (2) dental schools teaching repairs, (3) failed restorations having been repaired were included. We also included qualitative studies on barriers/facilitators for repairs. Random-effects meta-analyses, meta-regression and a thematic analysis using the theoretical domains framework were conducted.
Data: 401 articles were assessed and 29, mainly quantitative, studies included. 7228 dentists and 276 dental schools had been surveyed, and treatment data of 30,172 restorations evaluated. The mean (95% CI) proportion of dentists stating to perform repairs was 71.5% (49.7–86.4%). 83.3% (73.6–90.0%) of dental schools taught repairs. 31.3% (26.3–36.7%) of failed restorations had been repaired. More recent studies reported significantly more dentists to repair restorations ($p = 0.004$). Employment in public health practices and being the dentist who placed the original restoration were facilitators for repairs. Amalgam restorations were repaired less often, and financial aspects and regulations came as barriers.
Conclusions: While most dentists state to perform repairs and the vast majority of dental schools teach repairs, the proportion of truly repaired restorations was low. A number of interventions to implement repair in dental practice can be deduced from our findings.
Clinical significance: Partially defective restorations are common in dental practice. While repairs are taught and dentists are aware of the recommendation towards repairs, the actually performed proportion of repairs seems low.

1. Introduction

Partially defective dental restorations have traditionally been managed via total replacement of the restoration. Alternatively, they can be repaired by only replacing the defective part. Recent studies have shown that repairs are able to significantly increase the lifetime of restorations [1], and come with reduced treatment time, possibly lower costs, and lower risks of complications than total replacements [2]. Repair of partially defective restorations prolongs tooth retention time and is cost-effective in certain situations [3]. Repair is highly accepted by patients as well [4,5].

A number of early survey studies, however, showed that a significant proportion of dentists rejects repairs, and does not practice them [6–8]. It is unclear if this gap between scientific evidence and clinical practice is generally present across countries, or whether it has narrowed in recent years. It is also unclear if repairs are widely taught at dental schools, and what further factors (beyond knowledge) are affecting dentists' decision towards repairs.

We aimed to systematically review survey studies and to analyze the proportion of dentists/dental schools in different countries performing/teaching repairs of partially defective restorations in permanent teeth. A further objective was to identify potential barriers and facilitators regarding dental restoration repair. On the basis of this information, future implementation interventions might be developed and applied to increase the utilization of repairs in dental practice.

2. Methods

This review was registered at PROSPERO (CRD42017063855) prior to initiation. The reporting of this study is in accordance with the

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PRISMA and the ENTREQ statements [9,10].

2.1. Eligibility criteria

Observational studies which report on the proportion of (1) dentists stating to perform repairs of partially defective restorations, (2) dental schools teaching repairs, and (3) defective restorations having actually been repaired (yielded via treatment data) were included. Additionally, (qualitative) studies which report on barriers or facilitators for performing repairs were assessed. These could have been interviews, focus-group discussion, or ethnographic studies. We also gathered qualitative data reported in surveys. There were no language, time, or quality restrictions. Grey literature was not searched, as we assumed the depth of reporting to be too limited to allow synthesis.

2.2. Outcomes

The primary outcome of this review was the proportion of (1) dentists stating to use repairs in practice, (2) dental schools teaching repairs, and (3) defective restorations which had actually been repaired. Secondary outcomes were knowledge, attitudes, and behaviours acting as barriers or facilitators of evidence-based decision-making regarding the management of partially defective restorations in permanent teeth.

2.3. Information sources

Four electronic databases (Embase, Medline via PubMed, Cochrane CENTRAL, and PsycINFO) were searched. In addition, further hand searches were conducted and the reference lists of identified full texts screened and cross-referenced.

2.4. Search strategy

For the database screening, the following strategy was used for PubMed and individualized for the other databases: Search ((((repair) OR refurbish) OR repolish) OR reseal) AND ((dental) OR dentists) AND ((((((filling) OR fillings) OR restoration) OR restorations) OR crown) OR crowns) AND ((((((((((survey) OR questionnaire) OR interview) OR discussion) OR attitudes) OR beliefs) OR knowledge) OR teaching) OR teach) OR education) OR curriculum).

2.5. Study records

Three reviewers independently screened the identified records and compared their findings. Duplicative studies, studies which were not original, and studies without any relevant information were excluded (Appendix Table S1). Data extraction was performed independently by all reviewers using a pilot-tested spreadsheet. There were no disagreements during screening or data extraction.

2.6. Data items

The following items were collected: Authors; year in which the study was published; study type (e.g. questionnaire survey, secondary data analysis using treatment or claims data, qualitative study); sampling method and sample size, characteristics of the dentists being investigated (country and demographics) or the dental schools evaluated (country); scenario in which repair or replacement was to be decided or actual treatment situation (including original restoration materials) in which the decision to repair or replace was made; the proportion of (1) dentists stating to perform repairs, (2) dental schools teaching repairs, and (3) defective restorations having been repaired; barriers and facilitators for teaching/performing repairs (see below for thematic analysis).

2.7. Data synthesis

Meta-analyses of the proportions were performed using Comprehensive Meta-Analysis 3.3.070 (Biostat, NJ, USA). Cochrane's Q and I^2-statistics were used to assess heterogeneity [11]. Since heterogeneity was found high, random-effect models were used. To assess potential changes of the proportions through the years, meta-regression using the maximum-likelihood method was performed [12,13]. Bonferroni correction was performed to adjust for alpha-inflation; as we performed three meta-regression analyses, $p < 0.05/3$, i.e. $p < 0.017$ was regarded as significant. Publication bias was evaluated using funnel plots as well as Egger's regression intercept test [14].

All included studies were quantitative in nature and did not employ truly qualitative methods. We nevertheless aimed to extract qualitative data, like remarks on barriers or facilitators made by the participants or the authors. These were synthesized using thematic analysis. Themes were abstracted by one reviewer (PK) and relationships between them identified [15]. Themes were then compared, grouped, and translated into the domains and constructs of the theoretical domains framework (TDF) [16,17]. Themes were classified as barriers, facilitators, or conflicting themes [16,18,19]. In order to improve the usability of the present study for further implementation of repairs, findings were subsequently aligned with domains of the Behavior Change Wheel [20]. To gauge the relative importance of the identified barriers and facilitators, frequency effect sizes (ES) were calculated by dividing the number of studies containing a particular theme by the total number of included studies reporting on dentists stating to perform repairs or treatment of failed restorations [21].

2.8. Quality assessment and confidence in data

Quality assessment of the included studies was based on the modified Newcastle-Ottawa Scale for cross-sectional studies, as described in the appendix (Appendix Table S2). Quality was assessed by one reviewer (PK) [22]. The assessment was validated by another reviewer (GG). The scale allowed for a maximum of 10 points ("stars"). Studies with high risk of bias were judged with 0–3, moderate risk resulted in 4–6 points, and low risk of bias in 7–10 points.

3. Results

3.1. Search and included studies

In total, 274 articles were identified via PubMed, 79 via Embase, 42 via PsycInfo, and 6 via Cochrane CENTRAL. Additionally, 5 articles were identified via cross-referencing and hand search. From all identified articles, 35 were screened in full-text and 29 included (Appendix Fig. S1). Details on excluded studies can be found in the appendix (Appendix Table S1).

Twenty-four of the included studies were surveys and five studies reported on collected treatment data. From the survey studies, 12 reported on the proportion of dentists stating to perform repairs (Table 1) and 12 on the proportion of dental schools teaching repairs (Table 2). A total of 7228 dentists and 276 dental schools had been surveyed. Studies were published between 2002 and 2017. Sample sizes ranged between 24 and 2026 dentists, or 6 and 52 dental schools. Response rates ranged between 28% and 100% (mean 76%). Among the survey studies reporting on the proportion of dentists stating to perform repairs, five studies used a scenario comprising description of cases or the teeth/restorations to be treated, including photographs, radiographs, and information on the patient's caries risk. The other 7 studies did not use a scenario (6 studies) or did not clearly describe the scenario (1 study). Additionally, the proportion of actually performed repairs was reported by five studies, which had collected treatment data on 30,172 failed restorations (Table 3).