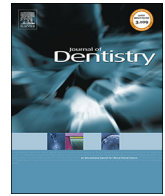




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Contemporary teaching of restoration repair at dental schools in Germany – Close to universality and consistency

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ABSTRACT

Objectives: To identify potential changes in various aspects of teaching and to ascertain whether previously found inconsistencies in the teaching of criteria, indications and operative techniques for the repair of defective composite restorations at German dental schools have been resolved.

Methods: A validated questionnaire was used to gain the information sought. It was sent to all dental schools in Germany (n = 30). Whenever possible, data were compared to previous studies conducted in 2000 and 2009. Statistical analysis was performed using Fisher's exact tests (p < 0.05).

Results: Twenty-nine schools responded to the survey – a response rate of 97%. All respondents indicated positive experiences with the repair of restorations. The teaching of repairs in 2018 (90%) was found to be comparable to the findings from the 2009 survey (88%, p = 1.000), but significantly increased since the 2000 survey (50%, p = 0.006). Main reasons reported for teaching repairs are tooth substance preservation (97%) and reduction of pulpal damage (79%). Main clinical indications are marginal defects and secondary caries. When performing repairs, almost all dental schools were found to teach both mechanical and adhesive substrate surface conditioning. Marked variation was observed in the method of mechanical surface treatment, with air abrasion having gained widespread popularity. The average expected longevity of repairs was 7.4 ± 3.0 years.

Conclusions: The teaching of the repair of resin composite restorations is widespread in dental schools in Germany. Aspects of this teaching were found to be more consistent between dental schools than in previous surveys, albeit variation in operative techniques still exists.

Clinical significance: Graduates from dental schools in Germany may be found to be well equipped with the knowledge and skills to perform repairs of defective resin based composite restorations in clinical practice.

1. Introduction

For many years the evidence-base and demand for the use of tooth-coloured restorations, particularly in stress-bearing areas, has been growing [1–3]. The paradigm shift from a 'mechanically-driven' to a 'biologically-focused' preventatively-orientated minimally interventive approach to the restoration of posterior teeth and the phase down in the use of mercury containing amalgam fillings, as a result of the Minamata Convention, have led to composite resins being taught across the developed world as the material of choice for the restoration of posterior teeth [4–7]. Notwithstanding technological advances in resin-based dental biomaterials science, composite restorations, in common with all dental restorations, suffer deterioration and degradation in clinical service [8–11].

National and international surveys over the past 15 years on the teaching of the repair of direct composite restorations (DCRs) have demonstrated a progressive increase in instruction – didactic and clinical, on restoration repair [12–21]. A recent meta-analysis on the teaching of restoration repair indicates that the concept of restoration repair has become embedded in dental school curricula in Germany and many other countries [22]. The advantages of composite repair, i.e. partial replacement of a DCR allowing preservation of that portion of the DCR which presents no clinical or radiograph evidence of failure, as an alternative to restoration replacement, are considerable [10,13]. Notwithstanding the widespread teaching of restoration repair, previous studies have shown marked variation in the criteria, indications and operative techniques taught for the repair of DCRs [13,16]. Given that the last survey on the teaching of the repair of DCRs in dental

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schools in Germany was undertaken in 2009, let alone recent advancements in adhesive technologies, which led to the development of restoration repair protocols [23–31], it was considered timely to re-examine the teaching on the repair of DCRs in Germany. Further purposes were to ascertain whether previous inconsistencies in teaching had been resolved in favour of a more consistent approach to the repair of DCRs in dental schools in Germany.

2. Materials and methods

2.1. Survey

The study protocol was approved by the local Ethics Committee of the University Medical Center Göttingen, Germany (application number 25/12/17).

A survey questionnaire, based on the questionnaire developed by Blum et al. [13], was translated into German language, and mailed together with a covering letter to the Heads of Department of Operative/Restorative Dentistry in all 30 dental schools in Germany with undergraduate dental degree programmes. All mailings included a pre-stamped, addressed return envelope. The questionnaire sought information on the respondents' experience of repairing defective composite restorations, the teaching of such repairs in their undergraduate curriculum, together with details of criteria, indications and operative techniques considered appropriate for such procedures. The survey questionnaire contained both open and closed questions.

To assist respondents in their task, and in an attempt to standardise the completion of the questionnaire, each respondent was sent a glossary, used in previous studies [13–18], to explain the terms used. The recipients were initially given eight weeks to complete and return the questionnaire, together with any additional information considered relevant to the survey. In March 2018, a reminder letter, including a copy of the questionnaire, was sent to the dental schools that had not responded. By April 2018, no further responses were received.

The returned questionnaires were scanned (EvaSys, version 7.1, www.evasys.de), computerised and analysed using Microsoft Excel (Excel for Mac 16.12, Microsoft, Redmond, Washington, USA). Data from handwritten information was entered manually into the spreadsheet. Statistical analysis was performed using the 'R Software for Statistical Computing' (R version 3.4.4; www.r-project.org). Whenever possible, findings were compared with results from previous, related surveys carried out in 2000 and 2009, using Fisher's exact tests with Bonferroni-Holm corrections. The overall level of significance was set at the 0.05 level.

3. Results

Completed questionnaires were returned by 29 of the dental schools included in the survey, giving a 97% response. One school refused to participate for reasons unknown.

The findings returned by the participating schools included responses to all, or most of the questions. All respondents reported that they have undertaken repairs of defective composite restorations as a definitive treatment, and that they considered this treatment option to be clinically viable and successful.

3.1. Teaching

Teaching of DCR repairs, as an alternative to restoration replacement, was found to be provided in 90% (n = 26) of the dental schools. This finding is comparable to the 2009 finding (88%) which was a significant increase compared to the 2000 finding (50.0%; p = 0.006).

All 26 schools reported that the teaching of the repair of DCRs was both theoretical and practical and took place mainly in the clinical phase of the programme. The three schools that did not teach this topic indicated an intention to include restoration repair in their

Table 1

Reasons for performing repairs.

Reason/indication for repairs	2000 (n = 24) [%]	2009 (n = 22) [*] [%]	2018 (n = 29) [%]
Tooth substance preservation	45.8 ^A	95.5 ^B	96.6 ^B
Reducing pulpal damage	45.8 ^A	77.3 ^A	79.3 ^A
Reduction in treatment time	45.8 ^A	31.8 ^A	41.4 ^A
Reduced treatment costs	8.3 ^A	45.5 ^A	34.5 ^A

Reasons for repairs as indicated by the German dental schools in 2000, 2009, and 2018. Multiple selections were possible. Different letters indicate significant differences between the surveys. Additionally, one respondent emphasized the advantages of repairs especially in older patients in 2018.

* In 2009, reasons for performing repairs were only assessed among dental schools teaching repairs (n = 22 among 25 participating dental schools).

undergraduate curriculum within the next three years. Therefore, all the following results are based on the total number of respondents in this survey (n = 29).

The vast majority of respondents (97%) reported that they taught the repair of DCRs largely on the grounds of personal clinical experience. Further reported justifications included evidence from the literature (79%) and case reports (21%). High patient-acceptance and the minimally interventive nature of performing repairs (i.e. tooth-substance preservation, avoidance of more invasive indirect restorations) were mentioned as positive advantages of repairs.

3.2. Reasons for repairs

An overview of the reasons reported for performing repairs of DCRs and how these compare to the survey findings of 2000 and 2009 are shown Table 1. Tooth substance preservation was significantly more commonly stated as a reason for repairs in 2018 compared to 2000 (p < 0.001) but was similar to 2009.

3.3. Indications for repairs

The reported indications for DCR repairs are presented and compared to previous survey findings in Table 2. Both secondary caries and marginal defects were significantly more often reported as indications

Table 2

Indications for performing repairs.

Reason/indication for repairs	2000 (n = 24) [%]	2009 (n = 22) [*] [%]	2018 (n = 29) [%]
Secondary caries	12.5 ^A	59.1 ^B	82.8 ^B
Marginal defects	12.5 ^A	90.9 ^B	96.6 ^B
Marginal discolouration	20.8 ^A	45.5 ^A	65.5 ^A
Superficial colour correction	29.2 ^A	50.0 ^A	69.0 ^A
Discolouration labial/buccal	12.5 ^A	36.4 ^A	44.8 ^A
Discolouration occlusal	0.0 ^A	18.2 ^A	10.3 ^A
Discolouration cervical	8.3 ^A	18.2 ^A	24.1 ^A
Discolouration proximal/lateral	0.0 ^A	13.6 ^A	13.8 ^A
Discolouration involving more than one surface	0.0 ^A	0.0 ^A	17.2 ^A
Abrasion/attrition	16.7 ^A	27.3 ^A	48.3 ^A
Partial loss of restoration	45.8 ^A	86.4 ^A	69.0 ^A
Fracture of restoration	12.5 – 37.5 ^{**}	18.2 – 77.3 ^{**}	51.7
Tooth fracture	–	–	58.6

Indications for repairs as indicated by German dental schools in 2000, 2009, and 2018. Multiple selections were possible. Different letters indicate significant differences between the surveys.

* In 2009, indications for performing repairs were only assessed among dental schools teaching repairs (n = 22 among 25 participating dental schools).

** Various different fractures and fracture locations were separately assessed in the surveys in 2009 and 2000, but are merged in this table. Therefore, no statistical comparisons were done.

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