

A 24-month evaluation of amalgam and resin-based composite restorations

Findings from The National Dental Practice-Based Research Network

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When placing a direct restoration, the clinician must consider a variety of factors that may affect the restoration's longevity. These factors range from those based on scientific evidence to those based on the personal preference of the patient or dentist. Such factors may include esthetic concerns,¹⁻³ cost,^{4,5} perceived health or environmental risks associated with mercury⁶⁻⁹ and technical expectations of the material.¹⁰⁻¹³ Of particular importance to many clinicians is the clinical longevity of the restoration and a predictable treatment outcome.

A wide variety of patient and operator variables influence the longevity of direct restorations.¹⁴⁻¹⁶ One example is a patient's caries risk. Patients with a high caries index are likely to experience decreased restoration longevity because of recurrent caries.¹⁷⁻²⁰ Larger restorations, which may be linked to high caries rates, also have shown greater failure rates.²¹⁻²⁴ Tooth position affects restoration longevity, with molars demonstrating long-term success rates lower than those of anterior teeth.²³

Operator variables also may influence restoration longevity. Investigators in one study found that restorations placed by operators who were more efficient had higher

ABSTRACT



Background. Knowing which factors influence restoration longevity can help clinicians make sound treatment decisions. The authors analyzed data from The National Dental Practice-Based Research Network to identify predictors of early failures of amalgam and resin-based composite (RBC) restorations.

Methods. In this prospective cohort study, the authors gathered information from clinicians and offices participating in the network. Clinicians completed a baseline data collection form at the time of restoration placement and annually thereafter. Data collected included patient factors, practice factors and dentist factors, and the authors analyzed them by using mixed-model logistic regression.

Results. A total of 226 practitioners followed up 6,218 direct restorations in 3,855 patients; 386 restorations failed (6.2 percent) during the mean (standard deviation) follow-up of 23.7 (8.8) months. The number of tooth surfaces restored at baseline helped predict subsequent restoration failure; restorations with four or more restored surfaces were more than four times more likely to fail. Restorative material was not associated significantly with longevity; neither was tooth type. Older patient age was associated highly with failure ($P < .001$). The failure rate for children was 4 percent, compared with 10 percent for people 65 years or older. Dentist's sex and practice workload were associated significantly with restoration longevity.

Conclusions. In this prospective cohort study, these factors were significantly predictive of failure for amalgam and RBC restorations: patient's age, a higher number of surfaces restored at baseline, the dentist's sex and the practice workload. Material choice was not significantly predictive in these early results.

Practical Implications. If clinicians can recognize and identify the risk factors associated with early restoration failure, more effective treatment plans may be offered to the patient.

Key Words. Direct restorations; decision making; evidence-based dentistry; operative dentistry; amalgam; resin-based composite; dental restorations.

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survival rates.²⁵ Clinicians' age and educational background may affect restoration longevity,²⁶ as may the type of restorative material selected. One study showed that female dentists were more likely to place amalgam restorations than were male dentists.²⁷ In that study, younger dentists tended to use amalgam more often than did older dentists, as did practitioners working in a large group practice setting.²⁷ Investigators in one study, which was based on insurance claims, suggested that patients who change dentists are far more likely to have restorations replaced, a factor that also would affect restoration longevity.²⁸

Published evidence regarding the effect of material type on the longevity of restorations is inconclusive; this may be related to a complex array of patient, tooth and operator variables.¹⁷ Investigators in three studies who compared resin-based composites (RBCs) and amalgam as restorative materials suggested that amalgam has greater longevity than do RBC materials. Researchers in one study reported the mean survival rate of amalgam restorations to be 14.6 years, compared with 7.8 years for RBC restorations.²⁹ In a randomized clinical trial involving pediatric patients, amalgam outperformed RBC, showing a 94.4 percent amalgam survival rate at seven years compared with 85.5 percent for RBC at seven years. The risk of experiencing secondary caries was 3.5 times greater with RBC.³⁰ Findings were similar in another randomized clinical study.³¹ However, results from at least one study show that RBC materials may have some long-term clinical advantages over other restorative materials, especially in cases in which the restoration is large and the patient's caries risk is low.¹⁷ Generally speaking, these clinical data are derived from a small number of clinicians rather than a broad network of operators; therefore, they may contain operator bias and have limited applicability to a larger population.

In this study, we report data obtained from participants in The Dental Practice-Based Research Network (DPBRN), a group of clinicians from a variety of backgrounds and regions. The DPBRN was one of three regional DPBRNs established in 2005 with a seven-year grant from the National Institute of Dental and Craniofacial Research, Bethesda, Md. It was a consortium of dental practices, established to answer questions that affect the daily practice of dentistry and the delivery of oral health care. (Authors' note: The data for this study were collected and the original manuscript was prepared under the auspices of The DPBRN. That

organization subsequently evolved into The National Dental Practice-Based Research Network, under the aegis of which we prepared the final version of this article.)

At the time this study was conducted, the network was composed primarily of clinicians from the United States and Scandinavia, principally from five regions: Alabama/Mississippi; Florida/Georgia; dentists in Minnesota, either employed by HealthPartners Dental Group (now HealthPartners Institute for Education and Research) (Bloomington, Minn.) or in private practice; Permanente Dental Associates, in cooperation with Kaiser Permanente's Center for Health Research in Portland, Ore.; and Scandinavia, encompassing Denmark, Norway and Sweden.

We conducted this prospective cohort study to identify factors associated with the clinical longevity of direct restorations, especially when comparing early failures of amalgam and RBC materials. The reasons that these restorations were placed in previously unrestored teeth are described elsewhere.³²

METHODS

We recruited dentists to participate in this study through direct mailings and other advertisements focused on the network regions described above. Participating dentists completed enrollment information and agreed to participate in a cross-sectional study investigating the reasons for placing restorations on previously unrestored permanent teeth. The specifics of recruitment of dentists participating in this study are presented elsewhere.²⁷ The participating dentists conducted annual follow-up to assess the condition of the restorations and record additional repair or replacement; if the patient visited the office at any time, for any reason, during the follow-up visit window, the clinician would note any change that occurred in the restoration before the annual visit. We report data from early follow-up visits (up to three years after restoration placement) in this article.

Patient, practice and clinical variables. At the baseline appointment, when they placed restorations, clinicians recorded a variety of data, such as patient characteristics, practice

ABBREVIATION KEY. **D1/D2:** Lesion within outer two-thirds of dentin. **D3:** Lesion within inner one-third of dentin. **DPBRN:** Dental Practice-Based Research Network. **E1:** Lesion within outer one-half of enamel. **E2:** Lesion within inner one-half of enamel. **GEE:** Generalized estimating equation. **RBC:** Resin-based composite.

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