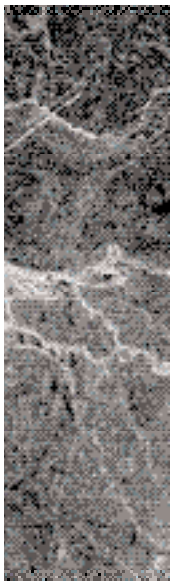
Ask the Experts



LONGEVITY OF POSTERIOR COMPOSITE RESTORATIONS

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QUESTION: What do we know about the longevity of posterior composite restorations and the reasons for failure?

ANSWER: The longevity or durability of a dental restorative material is an important factor in determining its efficacy as a treatment for dental caries and other defects in the teeth. Yet despite the large number of restorations placed annually by dental practitioners, the expected lifetime of a given restoration remains a matter of conjecture. Amalgam has long been the most extensively used material for the restoration of posterior teeth, because of the simple handling procedures, well-tested physical properties, and clinical success documented for over a century of use. During the last several years, however, resin-based composites (or simply "composites") have become an increasingly popular alternative for the restoration of the posterior dentition, owing to their excellent esthetics and other favorable characteristics.

The use of composites for posterior restorations often initiates comparisons with the proven track record of silver amalgam restorations. Collins and colleagues analyzed the 8-year clinical performance of three types of composites, using amalgam restorations as controls.[1] At the 8-year recall, 13.7% of the composite restorations had failed, as opposed to 5.8% of the amalgam restorations. The principal modes of restoration failure appeared to be bulk fracture and secondary caries at the margins.

Historically, posterior composite restorations failed because of excessive wear, tooth sensitivity, recurrent decay, pulpal death, open contacts, or restorative material fracture. Analysis of the performance characteristics of an early posterior composite in Class I and Class II restorations estimated a 10-year failure rate of 40 to 50%.[2] Another study reported a failure rate of 26% after a longitudinal assessment of 62 posterior restorations for 10 years.[3] Similarly, a 17-year longitudinal study of ultraviolet light (UV)-cured posterior composites demonstrated an excellent success rate of 76% of the restorations.[4]

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The impact of advances in composite research and technology on the longevity of posterior restorations is evident in the retrospective study conducted by Baratieri and Ritter on the clinical performance of Class I and Class II composite restorations after 4 years.[5] Although 2.5% of the restorations had clinically detectable marginal fracture, none required replacement. A meta-analysis on the longevity of restorations in posterior teeth reported an annual failure rate of less than 9% for direct composite restorations.[6] However, any practical application of longevity data is somewhat offset by the fact that composite products are being modified or superseded almost constantly, thereby mitigating the benefits of long-term studies.

Indirect resin-based composite restorations are often assumed to have better clinical performance because of the reported improvements in mechanical properties (decreased shrinkage, increased wear, and fracture resistance) with prepolymerized resin. However, the meta-analysis previously cited reported an annual failure rate of under 11% for posterior composite indirect restorations, which is comparable to the failure rate reported for direct restorations in the same study.[6] A longitudinal study of 96 composite inlays/onlays and 33 direct restorations found 27% of the direct restorations and 18% of the inlays/onlays to be unacceptable after 11 years.[7] The main reasons for failure of both types of restorations were fracture, occlusal wear in contact areas, and secondary caries. Both types of restorations exhibited a higher rate of fracture in molars compared with premolars. Another 11-year randomized clinical study compared direct and indirect composite resin restorations, and estimated a 1.5% annual failure rate for both types of restorations.[8] One disadvantage of indirect resin restorations is the challenge of obtaining adequate adhesion between resin-based cements and laboratory-processed composites.[9]

Composite restorations are technique-sensitive, and success may often be contingent on operator skill and attention to detail. Opdam and colleagues, in a longitudinal study of over 700 posterior composite restorations placed by dental students, reported a 5-year survival rate of 87%, with an annual failure rate of 2.8%.[10] The main reasons for failure were caries, restoration fracture, endodontic treatment, lack of proximal contact, and defective margins. It has been proposed that with average or superior clinical ability, posterior composite restorations can be expected to last 10 years or more.[11]

The choice of resin composite material is dependent on the clinical situation and is also a determinant of clinical performance. A review by Brunthaler and colleagues found that filler size had a significant effect on failure rate, specifically that failure rates were shown to be higher for conventional compared with hybrid composites.[12] On the other hand, as reported previously in this article, Wilder and colleagues reported a success rate of 76% for UV-cured posterior composites after 17 years of clinical performance, which is an outstanding figure given the unfavorable properties of this type of composite.[4]

Composites have certainly come a long way from their inception to their present-day use as the restorative material of choice in a multitude of clinical situations. Future research is poised to further improve the clinical applicability of resin-based composites, but at present, keeping in mind the limitations of bonding and polymerization, it is the practitioner's responsibility to make the prudent choice of material on a case-by-case basis.

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Editor's Note: If you have a question on any aspect of esthetic dentistry, please direct it to the Associate Editor, Dr. Edward J. Swift Jr. We will forward questions to appropriate experts and print the answers in this regular feature.

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