

CRITICAL SUMMARIES



Low-quality evidence suggests that amalgam has increased longevity compared with resin-based composite in posterior restorations

A critical summary of Moraschini V, Fai CK, Alto RM, Dos Santos GO. Amalgam and resin composite longevity of posterior restorations: a systematic review and meta-analysis. *J Dent*. 2015;43(9):1043-1050.

Ying J. Wong, MS, DDS, MAGD

Systematic review conclusion. Posterior resin-based composite restorations had decreased longevity and a greater incidence of secondary caries compared with amalgam restorations. With regard to fractures, there was no statistically significant difference between the 2 restorative materials in follow-up of 12 months or more.

Critical summary assessment. The results of this systematic review indicate that the life span of posterior resin-based composite restorations is shorter than that of amalgam restorations (risk ratio [RR], 0.46; 95% confidence interval [CI], 0.28-0.78; $P = .003$), whereas the incidence of secondary caries is higher (RR, 0.23; 95% CI, 0.18-0.30; $P < .00001$).

Evidence quality rating. Limited.

Clinical question. In patients with carious lesions in posterior teeth, what is the effect of using amalgam compared with resin-based composite on longevity, secondary caries incidence, and fracture rates?

Review methods. Reviewers conducted an electronic search of 3 databases (PubMed [MEDLINE], Cochrane Central Register of Controlled Trials, and Web of Science) from earliest studies available through March 2015, with no language restriction. They did not conduct a gray literature search. Two of the reviewers screened and selected the studies, with any disagreement being solved by discussion. They included randomized and nonrandomized controlled trials and cohort studies with at least 12-months of follow-up reporting on the failure rate between occlusal and occlusoproximal amalgam and resin-based composite restorations. They excluded animal studies, in vitro studies, complex restorations, case studies, case reports,

and reviews. They applied the Newcastle-Ottawa Scale to assess the methodological quality of included studies. Heterogeneity was expressed by the I^2 statistic. The reviewers used a random-effects model when there was significant heterogeneity, and a fixed-effects model for low heterogeneity. They explored publication bias using funnel plot.

Main results. The search resulted in 8 studies for inclusion: 2 randomized controlled trials, 5 prospective cohort studies, and 1 retrospective cohort study. The results for longevity and secondary caries (reported in RRs) were over a mean period of 55 months. The restoration and not the patient was the unit of observation for a total of 3,486 occlusal and occlusoproximal carious lesions restored (amalgam, $n = 1,844$; resin-based composite, $n = 1,642$).

One meta-analysis of the 8 studies suggested that receiving amalgam may reduce the risk of experiencing restoration failure by 54% compared

with resin-based composite (RR, 0.46; 95% CI, 0.28-0.78; $P = .003$), with substantial heterogeneity among included studies ($P < .0001$, $I^2 = 78\%$).

Another meta-analysis of 4 of the studies suggested that the use of amalgam to restore posterior teeth may reduce the risk of experiencing secondary caries by 77% compared with resin-based composite (RR, 0.23; 95% CI, 0.18-0.30; $P < .00001$), with only negligible heterogeneity detected ($P = .39$; $I^2 = 1\%$). Finally, a third meta-analysis including 5 studies suggested that the risk of experiencing restoration fracture may increase by 24% when using amalgam in the posterior region compared with resin-based composite; however, this difference was not statistically significant (RR, 1.24; 95% CI, 0.71-2.16; $P = 0.46$), and no heterogeneity was identified ($P = .77$; $I^2 = 0\%$). All studies were found to have moderate to high methodological quality (equal to or higher than 6 points in

the Newcastle-Ottawa Scale). The funnel plot did not suggest the presence of publication bias.

Conclusions. Posterior restorations using resin-based composite may

have a shorter life span and higher incidence of secondary caries than amalgam. It is, however, uncertain whether resin-based composite posterior restorations are at a higher risk

of experiencing fracture than amalgam restorations.

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COMMENTARY

Importance and context. Amalgam has been used to restore posterior teeth for more than 150 years. In the past few decades, because of increased demands for more esthetic and conservative restorations, as well as questions about possible mercury toxicity of amalgam, use of resin-based composite in posterior restorations has been on the rise. Due to limitations intrinsic to resin-based composite's physical properties, such as contraction on setting and sensitivity to the clinician's skill, longevity of these restorations compared with amalgam has been questioned. As the physical and mechanical properties of composites are being constantly improved, however, comparison studies between the 2 materials need to be revisited and updated regularly.

Strengths and weaknesses of the systematic review. This review had a number of strengths. The reviewers' clinical question was focused, and inclusion and exclusion criteria were clearly listed. They consulted 3 electronic databases with no language restriction, and conducted screening in duplicate. They used a validated scale to assess the methodological quality of cohort studies.

This review also had some limitations. The authors did not include gray literature resources, did not include specific tools to assess the methodological quality of randomized controlled trials, and used an instrument that was not intended for that purpose. It was unclear whether adjusted or unadjusted data from the observational studies were included for analysis, and the authors did not conduct subgroup analysis as an attempt to explain the identified substantial heterogeneity.

Strengths and weaknesses of the evidence. Risk of bias issues in relation to the use of an unadjusted analysis from observational studies reduced my confidence in the estimates of effect in this review. In addition, particularly for the outcome failure rate, substantial heterogeneity was identified and no subgroup analysis was planned or conducted as an attempt to explain it ($I^2 = 78\%$; $P < .00001$). The analysis included 8 studies and 3,486 observations, assessed at a restoration level. This may have introduced some artificial precision, as it is possible that participants in any of the studies could have contributed more than 1 restoration to the outcomes. The analysis ignores this issue and

assumes that all observations are independent. Finally, although the authors used a funnel plot to explore the possibility of publication bias, the number of included studies did not allow a reliable assessment of this bias. For these reasons, I found the quality of the evidence for these outcomes to be low to very low.

Implications for dental practice. Over the past few decades, the number of patients who have requested a "mercury-free" restorative material that is more esthetic than amalgam has increased. Although resin-based composite fulfills these criteria, its longevity as posterior restoration seems to be inferior compared with that of amalgam. This systematic review suggests that posterior resin-based composite may have a higher risk of experiencing failure and secondary caries compared with amalgam. The analysis by the reviewers did not provide information about restoration failure from a time-to-event outcome perspective (survival analysis). Such information would be of value for clinicians and patients, as it would facilitate decision making. Patients should be informed of this increased risk when given the options of different restorative materials, but at the same time, keeping in mind that the physical properties of composite materials are being constantly improved and when placed with great care are viable alternatives to amalgam. ■

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Dr. Wong is a clinical educator, Department of Cariology and Comprehensive Care, College of Dentistry, New York University, 345 E. 24th St., New York, NY 10010, e-mail yjw2@nyu.edu. Address correspondence to Dr. Wong.

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