

# Amalgam or composite fillings – which material lasts longer?

## Abstracted from

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Direct composite resin fillings versus amalgam fillings for permanent or adult posterior teeth. *Cochrane Database Syst Rev* 2014; **3**: CD005620.

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## Question: What is the failure rate of direct composite resin fillings versus amalgam fillings for permanent posterior teeth?

**Data sources** Cochrane Oral Health Group’s Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), Medline, Embase and LILACS. Hand searched relevant journals and attempted contact with authors of unpublished studies and manufacturers.

**Study selection** Randomised controlled trials comparing dental resin composites with dental amalgams in permanent posterior teeth with a minimum follow up of three years were eligible.

**Data extraction and synthesis** Data were extracted independently by a minimum of two review authors using specially designed data extraction forms. Risk of bias was assessed using the Cochrane risk of bias tool. Relative risks and 95% CIs were extracted for dichotomous data and mean difference (MD) or standardised mean difference (SMD) for continuous data. Relative risk was combined in a meta-analysis.

**Results** Seven studies were included. Two were parallel and five split-mouth design. Data from 871 participants were available from the two parallel studies but several of the split-mouth studies did not report the number of participants. All studies were considered at high risk of bias. Only data from the two parallel studies were included in the primary meta-analysis. Failure rates in these studies were recorded for between five and seven years. The risk ratio of failure for composite versus amalgam was 1.89 with 95% CI of 1.52-2.35. The increased failure was primarily due to caries rather than fracture.

**Conclusions** There is low-quality evidence to suggest that resin composites lead to higher failure rates and risk of secondary caries than amalgam restorations.

## Commentary

As one would expect from the hard working members of the Oral Health Group at the Cochrane Collaboration, this review has been carried out to a high standard.

All the included studies, however, were assessed to be at high risk of bias. In five of the seven eligible studies the reporting of data made it impossible to include them in the primary meta-analysis. For this the authors included the two parallel group studies which were conducted in Portugal and the USA and were both reported in 2007.

These two studies were large, including initially 1006 children of which data from 871 were analysed. All of the participants were aged 6-12 and most restorations placed under rubber dam. Though the review authors intended to conduct subgroup analysis based on the size of the cavity (ie class I or II) they were unable to extract this level of data from the studies.

As an aside, given that both of these studies had a primary outcome that was not the longevity of the restorations but the effect of the respective materials on the systemic or psychological well being of participants, perhaps this is not surprising. It raises an important issue, though, for those conducting trials and that is to consider how else their data could contribute to the knowledge base and collect and report on other relevant variables. These studies lasted a good length of time and will have cost a substantial amount of money. Collecting, recording and reporting data such as the failure rate for the different cavity sizes would surely be a relatively small additional effort.

However, to continue with the review, the risk ratio for restoration failure calculated from the two parallel group studies was 1.89 (95% CI: 1.52-2.35) suggesting that the failure rate for composite is almost double that for amalgam. The results from the other five studies supported this summary outcome.

The failure rate for amalgam was 7.5% and for composite 14.2% over 5-7 years. In these studies this gives an absolute risk reduction of using amalgam rather than composite of 6.7%, which in turn allows us to calculate a number needed to treat (NNT) of 15. Thus, if we were confident that the difference reported in these trials is true and the failure rates of amalgam restorations were similar, we would need to treat 15 patients with amalgam instead of composite to prevent one additional restoration failure.

What was the primary reason for failure? In these studies 5.7% of amalgam restorations and 12.2% of composites failed because of caries, giving a risk ratio of failure of 2.14 (95% CI: 1.67 to 2.74).

This paper is based on a Cochrane Review published in the Cochrane Library 2014, issue 3 (see [www.thecochranelibrary.com](http://www.thecochranelibrary.com) for information). Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and the Cochrane Library should be consulted for the most recent version of the review.

**Table 1 Average number of restorations per child using each material and percentage more composites placed than amalgams**

	Composite restorations placed	Children	Average composites / child	Amalgam restorations placed	Children	Average amalgams / child	% more composites placed than amalgams / child
Casa Pia 2007	892	233	3.82	856	239	3.58	6.7%
NECAT 2007	753	534	1.41	509	441	1.13	24.8%
Total	1645	767	2.14	1365	680	2.00	7%

That is, composites failed due to caries twice as often as amalgams did. The figures for failure due to fracture were 1.4% and 1.2% respectively (RR = 0.87, 95% CI: 0.46 to 1.64). Thus there was no statistical difference regarding failure due to fracture and, indeed, the baseline failure of amalgams due to fracture was just ¼ of that for caries.

So, rather than composites failing because of a mechanical deficit, they are failing far more often because of caries. However, despite there being a higher overall failure rate for both restorations due to caries, we might be cautious about the size of the higher failure rate due to caries in the composite group.

Neither of the two trials reported on what the baseline experience of caries was in the two groups but it was clear from the Characteristics of Included Studies table there was an imbalance in the number of restorations placed in the composite and amalgam groups for the two parallel group studies, Casa Pia 2007<sup>1</sup> and NECAT 2007.<sup>2</sup>

If we assume that the restorations were placed because there were carious lesions then these numbers suggest that the caries experience was 7% higher in the composite than in the amalgam groups. As with most biases it is impossible to say whether, or how large, the effect is on the difference seen in the failure rates of amalgam and composite but as the main reason for failure was caries, a higher caries risk in one group than the other (if this were the case) would perhaps reduce the difference in failure rates.

So how can we use this data as clinicians?

Relative risk is thought to be fairly consistent regardless of the underlying risk. In the two studies combined the underlying risk of failure of the amalgam restorations was 7.5%, for example, for every 1000 restorations placed 75 fail. But the majority of failures by a long way – in both groups – was because of caries: 57 in every 1000 amalgam (5.7%) and 122 in every 1000 composite restorations (12.2%), hence the risk ratio of 2.14 for failure due to caries  $12.2 \div 5.7$ .

So in the population we treat, if we have an idea of how many of the amalgams we place fail because of caries, we can estimate the number of composites that would fail by multiplying the failure rate by two. If the number of amalgams failing due to caries were ten in every 100 (10%) then we would expect 20 in every 100 (20%) of composites to fail over 5-7 years. Similarly, if just one in every 100 (1%) of the amalgams failed in the population we treat due to caries

we would estimate the number of composites to fail to be just two in 100 (2%).

We might use this at the individual level too. If we manage patients who for many years have not had a new restoration placed because of caries (for example their baseline risk of failure due to caries is close to 0%) then when the time comes to replace a restoration for other reasons (for example cusp fracture or aesthetics) we can be confident that if we place a composite it is unlikely to fail due to caries. If it fails due to fracture then we can also conclude that the risk of this failure type would have been the same for an amalgam restoration.

On the other hand, in patients with a high caries experience if we place composite restorations we might expect to be replacing them twice as often as if we had placed amalgam restorations. If two out of a patient's 10 amalgam restorations were replaced due to caries over five years we would expect four of the same ten restorations to need replacing over the same period if they were composite.

This leaves us with the ongoing problem of what we will do with the phasing down of amalgam following on from the Minamata Convention in 2013.<sup>3</sup> Where populations have high caries rates this review would suggest that they will lose out should amalgam be replaced with composite, whereas those with low or absent caries experience will (apart from the possible increased cost) not be affected.

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1. Bernardo M, Luis H, Martin MD, Leroux BG, Rue T, Leitão J, *et al.* Survival and reasons for failure of amalgam versus composite posterior restorations placed in a randomized clinical trial. *JADA* 2007; **138**: 775-783.
2. Soncini JA, Maserejian NN, Trachtenberg F, Tavares M, Hayes C. The longevity of amalgam versus compomer/ composite restorations in posterior primary and permanent teeth: findings from the New England Children's Amalgam Trial. *JADA* 2007; **138**: 763-767.
3. Mackey TK, Contreras JT, Liang BA. The Minamata Convention on Mercury: attempting to address the global controversy of dental amalgam use and mercury waste disposal. *Sci Total Environ* 2014; **472**: 125-129.

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