Commentary on two reviews of anterior composite restorations

Abstracted from

Demarco FF, Collares K, Coelho-de-Souza FH, Correa MB, Cenci MS, Moraes RR, Opdam NJ.

Anterior composite restorations: A systematic review on long-term survival and reasons for failure. *Dent Mater* 2015; **31**: 1214-1224. pii: S0109-5641(15)00214-6. doi: 10.1016/j.dental.2015.07.005. [Epub ahead of print] Review. PubMed PMID: 26303655

Heintze SD, Rousson V, Hickel R.

Clinical effectiveness of direct anterior restoration – a meta-analysis. *Dent Mater* 2015; **31**: 481-495. doi: 10.1016/j.dental.2015.05.015. Epub 2015 Mar 13. PubMed PMID: 257731887

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Question:

What is the longevity of anterior composite restorations?

What is the clinical effectiveness (durability and longevity) of anterior composite restorations?

Data sources

Medline/PubMed, SciVerse, Scopus and the Cochrane Central Register of Controlled Trials databases without restriction of date or language.

SCOPUS and Pubmed (1966-December 2012) without restriction to language.

Study selection

Longitudinal prospective or retrospective clinical trials evaluating clinical survival of direct restorations in anterior permanent teeth placed with visible light-cured composite resin were considered.

Prospective clinical trials evaluating clinical survival of class III/IV direct restorations in permanent teeth placed with composite resin, polyacid-modified resin composite (composer) or resin-modified glass-ionomer cements were considered.

Data extraction and synthesis

Two reviewers independently abstracted data and a narrative synthesis was presented.

Type of cavity, type of enamel/dentin conditioning, type of resin composite and operative procedure were abstracted and a meta-analysis of the longevity and durability (colour and texture, marginal integrity, anatomise form) was presented.

Two reviewers independently abstracted data and a narrative synthesis was presented.

Results

Seventeen studies were included with follow-up periods ranging from 3-17 years. Class III and IV restorations were considered by ten studies with five studies considering aesthetic restorations and two studies considering tooth wear restoration. Only seven studies were restricted to the evaluation of anterior direct restorations. A modified version of the United States Public Health Service (USPHS) criteria were the criteria most often used to evaluate restorations (12 studies). The total overall failure rate was 24.1% (439 restorations out of 1821), with individual study annual failure rates varying from 0 to 4.1% and survival rates from 53.4% to 100%.

Twenty-one studies were included with follow up-periods ranging from 2-12 years. Class III and IV restorations (2,300 at baseline and 1,722 at last recall) were considered in 14 and seven studies respectively. The estimated median longevity after ten years was 95% and 90% for Class III and IV respectively. The main reason for the replacement of Class IV restorations was bulk fractures, which occurred significantly more frequently with microfilled composite than with hybrid and macrofilled composite. Cavities adjacent to restorations were infrequent in most studies and accounted only for about 2.5% of all replacement restorations after ten years, irrespective of the cavity class.

Conclusions

Findings of the present review generally indicate a good clinical performance in the long-term (follow-up three+ years) for anterior composite resin restorations, with annual failure rates varying from 0 to 4.1%. It seems that failure behaviour in anterior restorations is different from posterior teeth, with less secondary caries present and more restorations being replaced for other reasons such as aesthetic appearance. However, there is still room for well designed clinical trials to evaluate the longevity of anterior composite restorations and investigate the specific factors associated with failure.

The meta-analysis found the long-term clinical performance (two+ years) of Class III/IV composite resin restorations is generally good with a ten years median success of 95% and 90% respectively. Adhesive systems which allow for enamel etching with 37% phosphoric acid reduces the occurrence of marginal discolouration. Hybrid composite performs better than microfilled composite, compositor and glass ionomer cements. Beveling of enamel is not necessary but adequate isolation is important for long lasting restorations.

Table 1 – Comparison of two recent reviews on the clinical effectiveness of anterior restorations

	Demarco <i>et al.</i> (2015)	Heintze <i>et al.</i> (2015)
Last Date of Review	Dec 2014	Dec 2012
Meets PRISMA Guidelines	Attempts	Does not attempt
Number of Included Studies	17	21
Types of Included Studies	Prospective and retrospective	Prospective
Inclusion <ul style="list-style-type: none"> Restorations Materials 	<ul style="list-style-type: none"> III, IV, Veneers and Core Build Light-Curing Composite Resins 	<ul style="list-style-type: none"> III, IV, Veneers and Core Build Light-Curing and Self-Curing Composite Resins, Compomers and Glass Ionomers
Duration of Study (Years)	3–17	2–13
Number of Restorations	1821 (Not clear if at baseline or at last follow-up)	2,300 at baseline 1,722 at last recall
Analysis of the Extracted Data	Qualitative Analysis	Meta-Analysis
AFR (%)	0–4.1	1.3–2.5 *

*Calculated using data from Figure 9 of Heintze *et al.*¹ and the formula described by Demarco *et al.*²

Commentary

Two articles published in the *Journal of Dental Materials* on the longevity of anterior restorations were recently reviewed.^{1,2} Although the authors of both articles come to a similar conclusion, they arrive at it from different perspectives (see Table 1).

Demarco *et al.*'s qualitative analysis is a more comprehensive systematic review that falls short of meeting the PRISMA guidelines by not doing a risk of bias analysis, an assessment of the quality of the included studies and an assessment of the risk to publication bias.³ On the other hand, the article by Heintze *et al.* does not even try to meet the PRISMA guidelines of a systematic review but is more a meta-analysis of some selected articles. Other differences are listed in Table 1.

Ideally, the clinical longevity of dental restorations is evaluated using a Kaplan-Meier survival analysis. This type of time-to-event data analysis follows a restoration through time and records, exactly when the failure occurred, and accounts for cases that were lost to follow-up (censored data). Intuitively, restorative failure rates are not linear but follow a geometric curve, where instantaneous rate of failure (referred to as the *hazard rate*) gets progressively greater over time. In other words, the annual rate of failure (AFR) is not constant but typically becomes progressively higher in the later years of the study.

Demarco *et al.*'s review circumvents this problem by using the AFR to assess the clinical durability of the restoration over time. The AFR is an engineering metric typically used to compare the longer-term durability of two or more objects.⁴ The problem with using the AFR as a stand-alone metric is that it is based on the incorrect assumption that the AFR is constant over time (linear). An AFR alone, without any comparison, offers limited value for clinical decision-making. For example, if Demarco *et al.* reported that Class IV restorations had an AFR of 4%, and Class III restorations had an AFR of 2%, then the ratio of these two AFRs implies that Class IV restorations are twice as likely to fail (hazard ratio) as Class III restorations are, without specifying any one-year failure rate of either restoration.

Another problem with Demarco *et al.*'s analysis is that there is no discussion about how censored data was accounted for. Not

considering censored data can bias the result, often in a more favourable direction. For example, from the van Dijken & Pallesen study (2010),⁵ Demarco *et al.* calculated the success rate and AFR to be 74.4% and 2%, respectively. This calculation was based on 43 restorations at the start of the study. However, the study reported that three restorations were lost to follow-up. Demarco *et al.*'s calculation assumes that those three lost restorations were all successful, without knowing this for sure. If we were to assume that the three restorations were actually failures, the success rate would drop to 67% and the AFR would rise to 2.8%.

Another limitation of Demarco *et al.*'s systematic review is that the risk of publication bias was not assessed. It is possible that publication bias may have played a role in this review, as many dental studies are supported by manufacturers with commercial interest. Industry-sponsored research is more likely to report favourable outcomes compared to research not directly funded by industry.⁶

Despite the limitations of both reviews, they generally conclude that anterior composite restorations typically perform comparably to posterior composite resins in the short-to-moderate time frame.

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