# The longevity of amalgam versus compomer/composite restorations in posterior primary and permanent teeth

## Findings From the New England Children's Amalgam Trial

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Two randomized controlled clinical trials conducted in the United States and Portugal recently demonstrated the safety of dental amalgam restorations in children.[1,2] Although these studies definitively addressed decades of controversy regarding the use of mercury-containing amalgam in children, dentists may continue to seek alternatives to amalgam that are thought to be more suitable for the restoration of posterior primary teeth or esthetically preferable for permanent teeth.

In the past three decades, resin-based composite restorative materials have become a common alternative to amalgam. The American Dental Association Council on Scientific Affairs concluded that both amalgam and resin-based compomer/composite materials are safe and effective for tooth restoration.[3] However, controversy continues regarding which material is more durable.[4-6]

Amalgam and resin-based compomer/composite have vastly different physical and functional properties. Amalgam, which has

## ABSTRACT

**Background.** Limited information is available from randomized clinical trials comparing the longevity of amalgam and resin-based compomer/composite restorations. The authors compared replacement rates of these types of restorations in posterior teeth during the five-year follow-up of the New England Children's Amalgam Trial.

**Methods.** The authors randomized children aged 6 to 10 years who had two or more posterior occlusal carious lesions into groups that received amalgam (n = 267) or compomer (primary teeth)/composite (permanent teeth) (n = 267) restorations and followed them up semiannually. They compared the longevity of restorations placed on all posterior surfaces using random effects survival analysis.

**Results.** The average ± standard deviation follow-up was 2.8 ± 1.4 years for primary tooth restorations and 3.4 ± 1.9 years for permanent tooth restorations. In primary teeth, the replacement rate was 5.8 percent of compomers versus 4.0 percent of amalgams ($P = .10$), with 3.0 percent versus 0.5 percent ($P = .002$), respectively, due to recurrent caries. In permanent teeth, the replacement rate was 14.9 percent of composites versus 10.8 percent of amalgams ($P = .45$), and the repair rate was 2.8 percent of composites versus 0.4 percent of amalgams ($P = .02$).

**Conclusion.** Although the overall difference in longevity was not statistically significant, compomer was replaced significantly more frequently owing to recurrent caries, and composite restorations required seven times as many repairs as did amalgam restorations.

**Clinical Implications.** Compomer/composite restorations on posterior tooth surfaces in children may require replacement or repair at higher rates than amalgam restorations, even within five years of placement.

**Key Words.** Dental amalgam; resin-based composites; compomers; dentition, primary; dentition, permanent; clinical trial; longevity.

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been used in dentistry for more than 150 years, is a mixture of mercury and silver alloy powder that solidifies at mouth temperature. It is tolerant to a wide range of clinical placement conditions and moderately tolerant to the presence of moisture during placement. The biocompatibility and durability of amalgam are good-to-excellent in large load-bearing restorations, but the silver-colored material has little esthetic value, and controversy regarding its safety lingers.[7-9]

Adequate retention of amalgam in posterior primary teeth may be difficult given the tooth structure (thin enamel and dentin, shallow pits and fissures, narrow occlusal tables and enamel rods that run in the occlusal direction) compared with that of permanent teeth; thus, primary teeth in particular are thought to benefit from restoration with resin-based compomer, which may allow greater conservation of sound tooth structure than does amalgam.[10-15] Compomers, which were introduced into dentistry in the mid-1990s, are polyacid-modified resin-based composites that contain 72 percent (by weight) strontium fluorosilicate glass, with an average particle size of 2.5 micrometers.[16] The presence of both acid functional monomer and basic ionomer-type glass attracts moisture into the material, which can trigger a reaction that releases fluoride and buffers acidic environments.[17,18] In addition to its ability to release fluoride, compomer has the esthetic value of being tooth-colored and the practical value of having simple handling properties that are particularly useful in pediatric dentistry.[16,19]

For permanent teeth, dentists commonly use resin-based composites, a heterogeneous blend of organic resin and inorganic filler.[20] For example, the hybrid composite consists of 60 to 65 percent volume filler of silica and glass and a particle size of 0.6 to 1.0 µm. The high percentage of filler particles provides strength, and the small size of the filler particles enhances polishability, which generally results in improved finishing qualities compared with compomer.[21] In a 1991 report, Newman[5] ranked composite as the superior restorative material in specific circumstances, such as those in enamel sites beyond the height of contour, in nonocclusal function, in cervical abrasion and in root caries. In 2002, Fuks[7] recommended composite for small occlusal restorations, because composite placement requires less removal of sound tooth structure than does amalgam (though refurbishing is recommended[22]). Some researchers have cited marginal leakage caused by polymerization shrinkage as a problem of resin-based composites.[23,24]

In determining the restorative material of choice, the dentist should consider the important factor of longevity, because replacement of failed restorations is a burden to patients, practitioners and health care systems. The survival time of restorations generally is shorter in primary and young permanent dentition, with recurrent caries often cited as the most common reason for replacement.[23,25-30] For primary dentition, differences in longevity between amalgam and resin-based compomer are difficult to determine from previous studies, mainly because studies using the split-mouth design have been limited by small sample sizes, and retrospective studies using chart reviews are subject to bias by confounding factors associated with receipt of treatment.[7] In their study of restorations in young dentition, Forss and Widstrom[26] concluded that tooth-colored restorative materials may be less durable than amalgam in pediatric patients. In particular, compomer's longevity may be more compromised in technically difficult situations (such as lack of patient cooperation, difficulty in isolating the tooth).[23,28] On the other hand, studies that limited variability by using split-mouth designs showed comparable retention rates for compomer and amalgam during 24- to 36-month periods and suggested that compomer restorations had better marginal adaptation or surface texture.[31-33]

Regarding posterior permanent teeth, researchers who conducted a systematic review found insufficient evidence from well-controlled studies to establish whether amalgam and resin-based composite have comparable longevity, but they cited several retrospective studies that reported a longer survival time for amalgam.[34] A 17-year longitudinal study published in 2003 found a significantly higher survival time for extensive amalgam restorations than for extensive composite restorations.[35] Because a variety of factors are associated with placement of amalgam or composite in children, results from studies in which investigators did not control for such factors may be biased in either direction, and the studies have not addressed the issue of longevity adequately.[36,37]

**ABBREVIATION KEY. NECAT:** New England Children's Amalgam Trial.