



## What Patients Should Know About Dental Materials

Dentistry uses more materials than almost any other industry. Dentists use metals, plastics, ceramics, and gypsum products. In fact, materials science is one of the key academic disciplines in schools of dental medicine, and many significant improvements in dental practice have come from the development of new materials.

Key requirements of materials for dentistry, especially those used in the mouth, include their being non-toxic, biocompatible, water resistant, and durable. In addition, many also need to be esthetic and wear-resistant. Materials delivered directly into the mouth (e.g., fillings, sealants, cements) need to set or harden within a reasonable period of time at mouth temperatures. For restorations and prostheses formed in dental laboratories or using computer-aided machines in the dental office, materials need to be either heat-processed (e.g., firing of ceramics) or machined to very high dimensional tolerances.

No material yet available for dentistry completely duplicates teeth or their natural components, enamel and dentin; however, all must be safe and effective based on animal and clinical studies. Most all materials used are approved by the U.S. Food and Drug Administration (FDA) and the American Dental Association's (ADA) Council on Scientific Affairs – often based on complying with international dental standards.

That said, there have been and will continue to be minor controversies regarding certain well-known materials. The first of these is dental amalgam or silver fillings. This material has been proven to be safe and effective in major clinical trials and is often the material of choice for certain procedures. While mercury is one initial component of this alloy, it reacts immediately with other metals such as silver and copper to form very stable inter-metallic compounds – leaving no free elemental mercury. One useful analogy is to consider both sodium and chlorine as quite toxic elements, but when combined into table salt are necessary for life. In fact, two large studies published in the April 2006 *Journal of the American Medical Association* found no difference in I.Q., behavior, or kidney function between a group of patients with amalgam fillings compared to another group with tooth-colored fillings.<sup>1,2</sup> A study published in the November 2011 *Journal of the American Dental Association* found no support for the hypothesis that prenatal mercury exposure arising from maternal dental amalgam restorations results in neurobehavioral consequences in the child.<sup>3</sup> In July 2009, the FDA decided not to place any restriction on the use of dental amalgam and categorized it as a class II medical device, placing it in the same class as gold and tooth-colored composite fillings. The ADA has supported a class II designation for dental amalgam since 2002 when first proposed by the FDA.



Other organizations concerned about public health, including the Alzheimer's Association,<sup>4</sup> the National Multiple Sclerosis Society,<sup>5</sup> and the American Academy of Pediatrics,<sup>6</sup> have publicly stated that there is no scientific evidence linking dental amalgam with any disease or syndrome.

Limitations placed on the use of amalgam by some northern European countries were due to environmental concerns, not health concerns. It is worth recognizing that these countries are relatively wealthy and can afford the higher per filling cost and replacement rates. In the U.S., the Environmental Protection Agency has calculated that less than one percent (0.4 %) of mercury released to the environment from man-made sources comes from dentistry.<sup>7</sup> Most state dental license regulations require dentists to use ADA Best Practices, including the capture of most waste amalgam. Prosthodontists, other specialists, and general dentists are members of the community; protecting the environment is just as important to them as it is to their neighbors.

Plastic-based, tooth-colored filling materials have also elicited controversy. Under some very limited conditions, certain products such as sealants have been found to release bis-phenol A (BPA). BPA can mimic the human sex hormone estrogen.<sup>8</sup> Such exposure is extremely limited: well below any exposure limits and lasting only minutes. Exposure can be eliminated by dentists removing the thin layer of unset material, which can be done by rubbing with cotton rolls or gauze. With dental caries remaining a significant public health problem, continued sealant use is beneficial and clinically proven as extremely effective.

Surprisingly, dental porcelain has also been in the news due to its containing small amounts of lead (app. 250 parts per million). Porcelain is quite insoluble in the mouth. In fact, under an accelerated solubility test designed by the International Organization for Standardization, a dental crown would not dissolve in 10 years. However if it did, the patient would experience an increase over dietary lead of about 0.00004 percent, based on average dietary levels from an extensive French study.<sup>9,10</sup> This lead is not well absorbed by the body.

## References

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