

## Evaluation of the safety issue of mercury release from dental fillings

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THE 1993 U.S. DEPARTMENT of Health and Human Services (HHS) Report on Dental Amalgam was to address the continuing concerns about amalgam safety. These tooth restorations, commonly known as "silver" fillings, contain 50% mercury by weight. However, it is apparent that the first summary highlight of the HHS Report is merely a reiteration of the American Dental Association's (ADA) anecdotal position that the safety of mercury/silver fillings is based on popularity and long-term use (1). Even today, mercury/silver fillings remain the material of choice for most tooth restorations.

The impression conveyed by the second highlight is that mercury fillings emit only *minute* amounts of mercury vapor. To the contrary, clear experimental evidence exists that the daily total mercury released (all forms) from a single mercury filling is approximately 15  $\mu\text{g}$  (2). The average absorbed dose of mercury vapor for human subjects with 8 such fillings is estimated to be 10  $\mu\text{g}/\text{day}$ , with a range that may exceed 100  $\mu\text{g}/\text{day}$  for some individuals (3, 4), and these estimations do not account for the additional exposure from microparticles or ionic mercury in the gastrointestinal tract. Mercury fillings have been shown to contribute approximately two-thirds of the total human body burden of mercury (5). Moreover, experimental evidence in monkey demonstrates that the mercury absorbed from such fillings can be readily visualized by whole-body image scan in a variety of body tissues (6). In contrast to the opinion stated in the HHS Report regarding *minute* amounts of mercury, the World Health Organization Expert Committee on Inorganic Mercury (3) concluded correctly that mercury fillings constitute the *largest* single source of mercury exposure in the general population, greater than all other nonoccupational sources combined, including food, water, and air.

The second highlight goes on to suggest that *scant* evidence exists that mercury fillings pose a health risk to most people. The real reason for this scant evi-

dence (either for or against these fillings) is that the dental profession has historically failed to investigate this issue. Perhaps this is because dental materials experts have traditionally come from the ranks of materials engineering rather than from the biological sciences. Also, experts for the ADA have dismissed animal experimental studies as irrelevant to humans (7). On the other hand, medicine has been made aware only recently of this mercury tooth filling issue, and experimental evidence is now accumulating on several fronts (8). On the basis of present data, medical researchers (including ourselves) do not make any claims that amalgam mercury is the cause of a specific disease. But experimental pathophysiological evidence in sheep (9) and primate (10) models leads us to conclude that human health consequences might result from continuous exposure to mercury at levels released from mercury fillings. The possible role of dental mercury in Alzheimer's pathogenesis also should not be overlooked (8).

The third highlight recommends that a research program be directed at evaluating amalgam safety. This well-meaning statement was also the recommendation of the 1984 NIDR/ADA Workshop on the Biocompatibility of Metals in Dentistry (11). Review of the literature reveals that dentistry has accomplished very little on this topic over the past decade. The next highlight states that the Public Health Service should educate dental personnel about risks and benefits of mercury fillings. Considering that mercury fillings have already been in use for 150 years, one would expect that a modern dental education would cover the risks and benefits of this commonly prescribed tooth implant material, as does a medical education with pharmaceutical prescriptions.

The fifth highlight is vague, but the HHS Report recommends that mercury and silver alloy be classified and placed into the category of materials that are already considered safe, even though the U.S. Food and Drug Administration rules stipulate that where insufficient informa-

tion exists about the safety of a product, it should be relegated to a category that requires experimental evidence of safety. Surely a product containing 50% mercury, a well-known toxin, should qualify only for the latter category.

The sixth highlight states that there is insufficient evidence to assure the public that alternative dental filling materials are any safer than mercury fillings. If this is true, it is a telling commentary on the level of biological sophistication of a health care profession that each day implants dental materials and devices into millions of mouths.

It is interesting that a January 1993 press release from the HHS (12) states that "there is no solid evidence of any harm for millions of Americans who have these fillings." This assertion appears to contradict those sections of the HHS Report in which the HHS Research Work Group concludes that "the available research evidence is not specific enough or strong enough to make sound pronouncements about human health risks from dental amalgam," and where the HHS Risk Assessment Committee concludes that "the potential for effects at levels of [mercury] exposure produced by dental amalgam restorations, has not been adequately studied." It is not surprising, therefore, that the ADA has exploited the press release and these HHS Report highlights in order to support their opinion; nor is it surprising that the ADA continues to be ineffectual in defending its position on mercury fillings (13).

Given these obvious inconsistencies, it was prudent that the Preface to the Report contained the disclaimer, "this report is not intended to serve as the authoritative source on dental amalgam safety. . . ."

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## Dental Amalgam: A Scientific Review and Recommended Public Health Service Strategy for Research, Education and Regulation<sup>1</sup>

- Dental amalgam has been used as a dental restorative material for over 150 years. Amalgam remains popular because it is strong, durable and relatively inexpensive. Roughly half of the 200 million restorative procedures performed in 1990 utilized amalgam. Nonetheless, amalgam use is declining because the incidence of caries is decreasing and because improved substitute materials are now available for certain applications.

- Dental amalgam, an inter-metallic compound, contains elemental mercury that is emitted in minute amounts as vapor. Because vapor emitting from amalgam restorations can be absorbed by the patient through inhalation, ingestion, or other means, concerns have been raised about possible toxicity. At present, there is scant evidence that the health of the vast majority of people with amalgam is compromised, nor that removing amalgam fillings has a beneficial effect on health. It also is recognized that a total conversion from dental amalgam to alternative materials would cause a significant increase in U.S. health care costs. Nonetheless, the possibility that this material, as well as currently available alternatives, could pose health risks cannot be totally ruled out because of the paucity of definitive human studies.

- Given the limitations of existing scientific data, a research program should

be designed and implemented to fill as many gaps as possible in current knowledge about the potential long-term biological effects of dental amalgam and alternative restorative materials. The PHS should be a leader in this effort.

- The PHS should also educate dental personnel and consumers about the risks and benefits of dental amalgam. An educational program should include information on all restorative materials to help dentists and their patients make informed dental treatment decisions, and encourage dental care providers to report adverse reactions. Such a program should promote the use of preventive measures such as fluoride and dental sealants to prevent caries and thus further reduce the need for dental restorations.

- To exert greater control over dental amalgam use, the FDA should regulate elemental mercury and dental alloy as a single product. To help dentists identify patients who may exhibit allergic hypersensitivity to all restorative materials, including dental amalgam, FDA should require manufacturers to disclose the ingredients of these materials in product labeling.

- Sweden, Denmark and Germany have proposed restrictions on dental amalgam use. They have done so in an effort to

diminish both human exposure to and environmental release of mercury and not because of any documented health effects associated with exposure to dental amalgam.

The U.S. Public Health Service believes it is inappropriate at this time to recommend any restrictions on the use of dental amalgam, for several reasons. First, current scientific evidence does not show that exposure to mercury from amalgam restorations poses a serious health risk in humans, except for an exceedingly small number of allergic reactions. Second, there is insufficient evidence to assure the public that components of alternative restorative materials have fewer potential health effects than dental amalgam, including allergic-type reactions. Third, there are significant efforts underway in the U.S. to reduce the amount of mercury in the environment. And finally, as stated previously, amalgam use is declining due to a lessening of the incidence of dental caries and the increasing use of alternative materials.

<sup>1</sup>Highlights of the final report of the Subcommittee on Risk Management of the Committee to Coordinate Health and Related Programs, Public Health Service, January 1993.