



## Tooth filling materials

### Dental amalgams & alternative materials

**Source document:**  
SCENIHR / SCHER (2008)  
**Summary & Details:**  
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**Context** - Amalgam is a combination of mercury with other metals and has been used as a tooth filling material since early in the 19<sup>th</sup> century.

Alternative tooth-coloured materials are increasingly used because they look better and require less intervention.

How safe are different tooth filling materials? Are they equally effective in ensuring dental health?

*An assessment by the European Commission Scientific Committees on Emerging and Newly Identified Health Risks (SCENIHR) and on Health and Environmental Risks (SCHER).*

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The answers to these questions are a faithful summary of two opinions produced in 2008 by scientific committees of the European Commission: "The safety of dental amalgam and alternative dental restoration materials for patients and users" by SCENIHR (Scientific Committee on Emerging and Newly Identified Health Risks) and "The environmental risks and indirect health effects of mercury in dental amalgam" by SCHER (Scientific Committee on Health and Environmental Risks).

The full publication is available at: <https://copublications.greenfacts.org/en/dental-amalgam/>  
and at: <http://ec.europa.eu/health/opinions/en/dental-amalgam/>



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## 1. Introduction

Dental amalgam is a combination of mercury with other metals and has been used for over 150 years for the treatment of tooth cavities because it is very strong and durable. Moreover, it is soft enough to adapt to the size and shape of the tooth cavity, yet hardens sufficiently fast to make it practical. However, concerns have been voiced about possible harmful effects of the mercury present in dental amalgams.



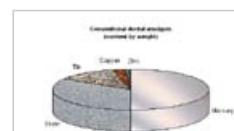
Amalgam fillings

Though it may still be considered a material of choice for some fillings in the back teeth, the use of amalgams has been decreasing in recent years, because it is not tooth-coloured and does not adhere to the surface of the tooth.

Alternative tooth-coloured filling materials have become increasingly popular. Not only do these materials look better, but they require the dentist to remove less tooth material. In addition they do not contain mercury. As a result, the teaching of the use of amalgams has either been reduced or discontinued in many dental schools in Europe in favour of alternative materials.

## 2. How are dental amalgams made?

Mercury is a heavy metal, sometimes known as quicksilver, that occurs naturally in the environment in different chemical forms. The pure form, elemental mercury, is liquid at room temperature and slowly forms a vapour in the air.



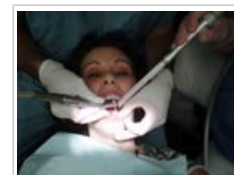
Conventional Dental Amalgam  
[see Annex 1, p. 7]

Dental amalgams are made by mixing one part of liquid mercury with one part of a mixture of other metals: mainly silver, but also tin, some copper and small amounts of zinc. The setting amalgam has the consistency of a paste and is pressed firmly into the prepared tooth cavity to make the filling as strong as possible. During this process, some excess mercury rises to the surface and is removed by the dentist. The amalgam becomes solid quickly and gradually hardens over a few hours to form a strong restoration that could last many years.

Set amalgam restorations release mercury vapour but much less so than liquid mercury. Amalgams corrode over time very slowly, which may contribute to overall exposure of the patient to mercury, but the exact level of this is not known.

## 3. How can dental patients and workers be exposed to mercury from amalgams?

The general public is for instance exposed to mercury when eating contaminated fish, using cosmetics, medicinal products and medical devices that contain mercury – including dental amalgams – or at certain workplaces where mercury is used (see question 8).



Patients are mainly exposed when fillings are placed or removed © Therese Chase

The main exposure of patients to mercury from dental amalgam happens when they are having fillings placed or removed.

To reduce exposure to mercury of dental patients, it is better to leave amalgam fillings in place unless there is a medical reason to remove them. However, it may be advisable to

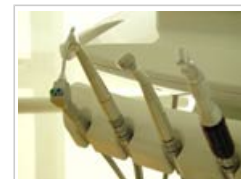
remove fillings in patients who are suspected to have allergic reactions to one of the metals in the amalgam.

While amalgam fillings are in place, patients are exposed to mercury that is released through normal wear, but the exposure is much lower than during placement and removal.

Dental workers are considerably more exposed to mercury than the general population. Their main sources of exposure are vapours released when placing or removing fillings and the exhaust air from dental vacuum systems. However, dental workers today are exposed to much less mercury than in the past because of improvements in technique and in hygiene measures, and because of the steady decline in the use of amalgams.

#### 4. What health effects could be linked to the form of mercury contained in dental amalgams?

4.1 People are mainly exposed to elemental mercury by breathing in its vapour, since contact with the skin or ingestion leads to very little absorption into the body. Mercury vapour is absorbed in the lungs, spreads to the entire body and is then slowly excreted.



Dental workers are more exposed than the general population  
© Marcelo Terraza

Breathing in extremely high concentrations of mercury may produce bronchitis and pneumonia and affect the central system, for instance leading to muscle tremors. Long-term exposure to high levels may affect the kidneys and the inside of the mouth and gums. Such effects have been observed in some workers employed in industries using mercury.

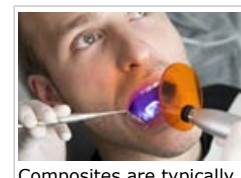
However, the amount released by dental amalgams is much lower than the limits allowed for exposure at work. There is no evidence that the other metallic elements in amalgams present a health risk, apart from allergic reactions.

4.2 Dental amalgam fillings occasionally cause local effects in the mouth, such as allergic reactions of the gums and of the skin inside the mouth, but this happens only rarely and is normally easy to manage. There have been claims that dental amalgam fillings might harm the kidneys or have effects on the nervous system or the mind. But studies on human populations have not found such link.

It is concluded that the current use of dental amalgams does not pose a health risk beyond occasional local effects.

#### 5. What are the possible health effects of alternative tooth filling materials?

5.1 In modern dentistry, restorations are increasingly made with alternative, tooth-coloured materials. They vary in composition and properties and include composites, cements, and sealants. Composites, for instance, contain many components, including a resin base and a ceramic filler. Composites are applied as a paste to the tooth cavity and typically hardened using visible blue light.



Composites are typically hardened using light  
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Some of the alternative materials are chemically very complex and not necessarily without any health effects. The substances within the material react inside the tooth and with the surrounding soft tissue. In the laboratory, it has been shown that certain resins that could remain present in the filling material can affect gum and pulp cells and cause mutations although this may not have any medical significance.

5.2 Certain resins used in alternative materials can, in rare cases, lead to allergic reactions in patients or dental workers. The light used to harden resins seems to be safe for most patients and users, when applied properly, but can occasionally cause adverse reactions.

Alternative materials have now been in medical use for more than thirty years with little evidence of adverse health effects. Over that time the materials themselves have been modified, improved and made less harmful. However, their full chemical composition is rarely disclosed and is hard to determine, and information on exposure is scarce and difficult to obtain. Therefore, it may not be possible to confirm on the basis of scientific evidence that all alternative tooth filling materials are safe.

## 6. Conclusion on health effects of dental amalgams and their alternatives on users

6.1 Both dental amalgams and various alternative materials are considered effective and safe to use. They are associated with a very small proportion of local effects in the mouth and there is no evidence that they can cause disease. The relative risks and benefits of using different tooth filling materials should be explained to patients and the public at large.

6.2 Dental amalgam fillings can, in rare cases, cause local allergic reactions and related conditions. However, current evidence does not support any link between dental amalgams and diseases – neither diseases of the urinary, neurological, reproductive and immune systems nor any psychological conditions.

Amalgam is a safe material to use for dental restorations. As with any other medical intervention, caution should be exercised when considering the placement of tooth fillings in pregnant women. Mercury exposure may be higher among dental personnel than in the general population, but there are very few reports of any adverse effects for that particular group.

6.3 Some components used in the preparation of alternative tooth filling materials can cause local allergic reactions, both in patients and in dental workers, although the number of cases is very low. There is no evidence of any link between the use of alternative tooth filling materials and any neurological or other health disorders. However, data are sparse and caution should be exercised before introducing new variations of these materials into the market.

## 7. What is the environmental risk of the use of dental amalgams and alternative materials?

7.1 Mercury occurs naturally in the environment in different chemical forms. Elemental mercury is the form used in dental amalgams. Forms more commonly found in nature are inorganic mercury and organic mercury. Natural events (e.g. weathering of rocks) and human activities (e.g. fuel and waste combustion and, to a lesser extent, use and disposal of dental amalgams) can cause releases of these different forms of mercury into the environment.



Wastewater released by dental clinics could increase the concentration of inorganic mercury in water bodies. The added risk for aquatic organisms of this source of inorganic mercury is considered low. Sludge from plants that treat such wastewater present a low risk for soil-dwelling organisms. In addition, the cremation of individuals with dental amalgam fillings also leads to releases into air and deposition on soil.

The main environmental concern relates to methylmercury, an organic form of mercury, because it can accumulate in organisms. The levels of methylmercury increase along the food chain and with age. Some of the mercury released by the use of dental amalgams will be converted into methylmercury. Though estimates are available of the amounts of mercury released by the use and disposal of dental amalgams in the European Union, it is not possible to say what proportion of the risk associated with organic mercury present in the environment is due to releases from amalgams.

7.2 For alternative tooth filling materials, potential effects on animals are known for certain components. However, available information is too limited to assess the environmental risk and compare it to dental amalgams.

## **8. How serious are the risks of indirect exposure to mercury from disposal dental amalgams?**

Mercury present in the environment – including that released by the use and disposal of dental amalgams – can be taken up by the humans through air, water and food. The general public is mainly exposed to methylmercury through the diet (particularly fish), and to elemental mercury vapours at certain workplaces and from tooth fillings. Methylmercury is particularly poisonous to the nervous system.

The indirect exposures of humans to methylmercury from dental amalgams are well below tolerable limits and the risk for serious health effects is low.

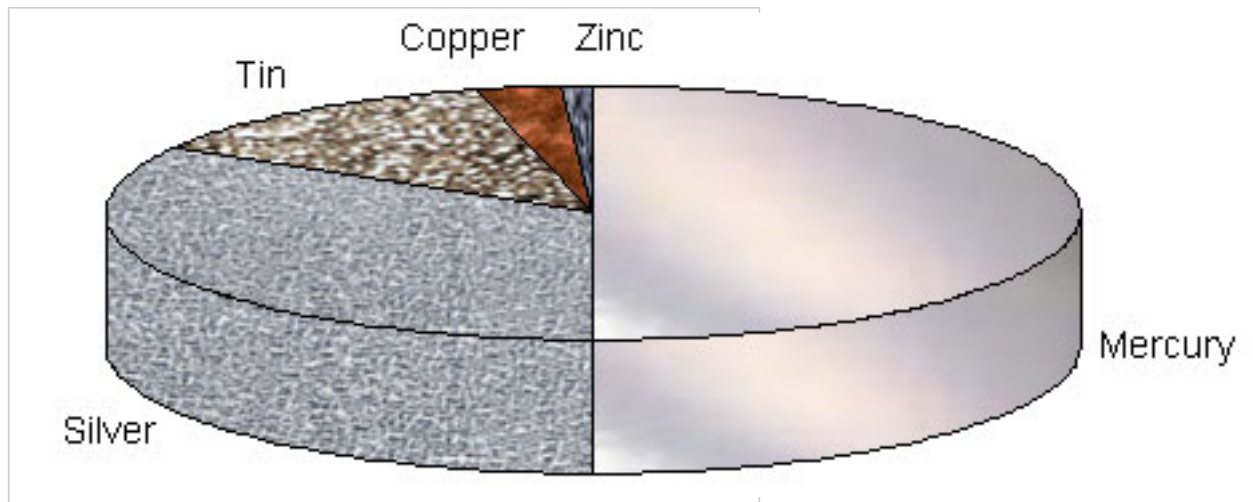
## **9. What further information is needed on environmental risks of dental amalgams?**

To enable a full assessment of environmental risks, more information is needed on regional variations across the EU in the use of dental amalgam as well as the related release and fate of mercury, including emissions from crematoria. It is also necessary to compile data on the effects of different forms of mercury on humans and on the environment as well as a review of the way methylmercury accumulates in organisms under different EU conditions. The relative contribution of dental mercury to the overall mercury pool in the environment needs to be determined.

## Annex

### Annex 1:

### Conventional Dental Amalgam (content by weight)



Source: GreenFacts

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