

## How toxic is composite?

Amalgam outlawed because of health concerns and the environment? Is the alternative, composite, as innocent as we think?

### *Introduction*

In more and more European countries the production and distribution of mercury, and thus also amalgam, is forbidden (1). In the European Union a proposal has even been adopted to introduce a complete ban by 2011 (2). Many articles have appeared that address whether the sequelae of amalgam are damaging or not, in which advocates and opponents argue vociferously. It is known that the current generation of dentists was taught in university to use composite instead of amalgam for fillings. The question is whether that material is truly as safe as the manufacturers want us to believe. Will we regard composite 10 years from now as we do amalgam at the moment? Can we in the trade demand from the manufacturers that they produce safe and completely biocompatible products that have no negative consequences for our health, the health of the patient and naturally for the environment, even after long-term exposure (30-40 years)?

This article considers these subjects on the basis of existing publications.

### *The end of the amalgam era?*

Amalgam has been used since 1800 as mouldable restoration material. Given this long history with this material, we can say that it has been very successful for about 200 years. No one need doubt the usefulness of this material.

This is due to a number of unique properties of this material that are not easy to match. The cost/quality ratio seems very favourable at first glance. A life expectancy for amalgam fillings of 40 years or more is not exceptional. The material is relatively easy to use and seals the



space between the edge of the crown and the tooth automatically through corrosion. It is not only potentially damaging for the environment but also for bacteria, which means it can prevent cavities to some extent. On the other hand, this corrosion also causes breaks in tooth tissue, which often leads to a crack in the element.

The “cost” becomes more unfavourable when we calculate how much of this material has ended up in our environment and has to be removed. Each year, for example through cremations and funerals, many tons of mercury are still being released into the environment (3). Despite a decrease in the percentage of amalgam fillings, the worldwide production of amalgam continues to increase as a result of growing dental care. This is due to the increased availability of dentistry for more people. In America, where a lot of composite is produced, no one is thinking of ending the amalgam era (4).

It has been estimated that health care in the USA will cost ca. \$18 billion per year more due to the higher cost of composite restorations, which also have a shorter lifespan. In Europe, in contrast, more and more countries are banning the use of amalgam.

Many articles have appeared that address the true danger posed by amalgam for the patient and especially for the dentist. Given the extensive exposure to this material, for example while drilling, dentists in particular form a potential risk group.

Despite the many articles about “revitalised” patients after the removal of amalgam, this is very difficult to demonstrate in controlled studies. Most dentists have a measurably elevated mercury concentration in their blood and urine (5). Happily, we do not collapse *en masse* under the strain, but we can develop some distressing disorders, such as auto-immune diseases, although in hindsight it is always difficult to find a direct link to amalgam (6). Toxicologists express the situation clearly: “Mercury (or vapour MeHg) is damaging at **any** concentration” (7). The recent commotion about mercury in energy-efficient lamps reveals that it is not a harmless material. Whether it is dangerous for dentists and/or their patients depends on many variables, including the individual's immune system, resistance and contact with other toxins. Advocates and opponents agree that if there is a good alternative, then the polluting and dangerous amalgam should no longer be used as a restoration material.

The choice of whether to use amalgam or not seems to be made nowadays not by the professionals, however, but by the patients who more and more often opt for “good-looking white fillings”, and possibly also by the environmental legislation.

### ***How safe is composite?***

Composite in its current form has been used for about 35 years in dentistry practice. Nevertheless, it took a relatively long time before composite began to serve as an alternative to amalgam. About 15 years ago, composite started to be applied to molars and premolars on a large scale. The manufacturers have done their best to develop the product to optimise the physical properties of the material. They have been only partially successful. Problems



remain especially in shrinkage and the adhesion to dentine, which clearly degenerates over time. The lifespan of composite restorations in molars and premolars is much shorter than that of amalgam (8). In addition, despite all of the improvements, there are more complaints of pain after the application of composite than after the application of amalgam (9). Dentists who have switched from amalgam to composite report more endodontic treatments than previously (10). Patients are primarily pleased with the aesthetic properties. Many patients have also had their fillings

replaced because of the potential toxic properties of amalgam. It is strange that relatively little is known about the safety of composite and that there are so few doubts, even though many articles have appeared on this topic (see pubmed online, enter: “toxicity dental composites of dental adhesives”).

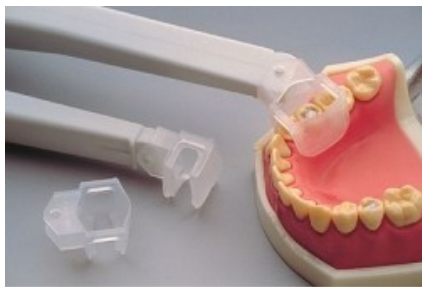
Could it be possible that the safety criteria for dental restoration material may need to be changed so that composite is no longer defined as a safe restoration material? The safety criteria are relatively easy to verify, and the studies manufacturers are required to conduct involve only short follow-up periods. Given the intensive commercial pressure, there is not enough clarity about this. Composite and dentine adhesives contain toxic components that can damage your health (11). Just as with amalgam, there are patients and dentists who react poorly to these products and have allergic reactions (12). But what about the dentist who is exposed to these products every day for a long period of time?

Dangerous compounds found in composites include, among others, TEGDMA, HEMA, UDMA, and Bis-GMA (13). Cured composite still contains considerable quantities of these monomers, primarily in the oxygen-inhibited layer. These substances are toxic to living cells such as odontoblasts and fibroblasts, and have a high penetrative capacity (14).

These toxins can end up in the gastrointestinal tract and then are stored in the liver and kidneys, where they have an accumulative effect. Possible diseases that can develop as a result primarily include skin irritations and eczematous symptoms as well as pulmonary diseases and immune system problems (15). In addition, they also have a mutagen effect and are converted into carcinogenic substance. It is clear that if these effects occur they usually lead to forced retirement from the profession and can also be damaging to the health of our patients (16).

A number of safety measures are therefore necessary:

- ✓ Avoid direct contact with composite and all related products, e.g. the bondings, resin modified GIC, protective layers, compomers, etc.
- ✓ These materials rapidly penetrate most types of gloves; replace them if you suspect contamination.
- ✓ Do not leave any bottles open, and prepare the bonding immediately before application. It is safer to use a blister strip with appropriate brush, giving the least opportunity for contamination.
- ✓ Do not leave unused products lying around but dispose of them immediately.
- ✓ When using composite, a rubber dam is not an unnecessary luxury for the patient.
- ✓ Use adequate suction, also when repairing occlusion or polishing.
- ✓ Ensure that the office is well ventilated, even in the winter.



Adequate suction decreases the risk of contamination

In addition, we should examine critically the indication for composite. There is currently no comparable (mouldable) alternative for composite in the aesthetic zone, but there are suitable ones for the posterior region.

Vitreous materials are a good alternative, if not better as restoration material against initial caries. New hardening techniques allow glass to be used for large restorations. Due to distribution and cell death direct pulp cappings should be avoided using composites and

dentin adhesives. In paediatric dentistry, composites are not a good choice because of their toxic and mutagenic nature. When old composite is being removed, it still releases dangerous products like free radicals and is thus a potential carcinogen (17). The number of directly related diseases is currently difficult to estimate, but will grow in the future due to the increased use of composite in the past 15 years. It is time for dentists and manufacturers to demand research not only into the physical properties of restoration materials but also their safety. It is striking that it is the newest restoration materials (especially composite and resin-reinforced glass products) that appear to be highly toxic due to their more complex chemistry.

### ***Alternatives***

In the front elements composites are unbeatable in aesthetic terms. The extensive use of composite in the posterior region can be replaced to a great extent by safer glasslike materials such as glass ionomers.

Other than a small quantity of bound aluminium, these do not contain a single substance that could potentially damage health, even when these restorations are replaced or repaired. This of course does not apply to the so-called light-cured glass ionomers, compomers and their protective layers, and bondings with plastics / resins that contain large quantities of dangerous substances. Certainly in the occlusal planes it is extremely evident that glass is not inferior to amalgam (18). Furthermore, these products have special, biological and remineralising properties, which will not be considered further in this article. Naturally, you can also choose restoration with porcelain or gold. In that case, pay attention to the correct choice of a non-toxic cement.

### ***Conclusions***

Composites and allied products contain substances that can be potentially dangerous to health of the patient and the dental staff.

Dental staff in particular must work as safely as possible with these products as they are subject to frequent exposure over a long period of time. Simply replacing amalgam by composite with the only reason being the potentially poisonous effect of amalgam no longer seems so sensible. If it still proves necessary to work with composite-like products, handle them as safely as possible. Manufacturers should examine the safety aspects of their products more closely and search for alternatives. It would be sensible to use alternative products that are more biocompatible, particularly vitreous materials such as glass ionomers or porcelain and gold.

**Glass Carbomer Products B.V.**

**28 February 2008**

**List of publications and references**

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