Dental Analgam: Myth vs. reality

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Dental Analgam: Myth vs. reality

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Abstract

Dental amalgam is a mixture of metals such as silver, copper and tin, in addition to mercury, which chemically binds these components into a hard and stable substance. Amalgam has been widely used to restore billions of teeth for the past 150 years. Popularity of amalgam restoratives stems, in large part, from its durability, affordability, and ease of placement. Despite rumors that amalgam has been banned in some countries, it is currently available for use around the world and several new brands marketed frequently by reputable dental companies.

Mercury is undisputedly a neurotoxin material. The safety of mercury-containing amalgam has periodically been questioned as mercury vapor is released from the surfaces of amalgam restorations. A public concern has arisen after sensational media stories have been aired and broadcasted about amalgam safety. Such media programs, coupled with authorized reports, have attributed a range of medical conditions and symptoms related to the presence of amalgam restorations. Included are multiple sclerosis, Alzheimer’s disease, psychological stress, and allergic reaction.

In this review article, it was meant to cite and analyze a collection of myths and half-truths virtual folklore of anti-amalgamists. Facts that are based on sound recent literature were also discussed in a trial to correct those myths. The vast majority of the scientific evidences indicated that dental amalgam has a well-documented history of safety and efficacy in dentistry.

Introduction

Dental amalgam is a common material used to restore decayed or fractured teeth. Amalgam is a combination of metals including mercury that has been used in dentistry for more than 150 years and is still common today. Although it sometimes is called “silver amalgam,” amalgam actually consists of a combination of silver, tin, copper, and small amounts of zinc, indium or palladium.1-5 Amalgam has been popular as a material for dental fillings and restorations because it is less expensive than other materials and holds up better over time, especially in teeth that undergo a lot of pressure and wear from chewing. 2,4 With the development of tooth-colored materials to restore teeth, the use of amalgam has decreased, but the newer materials can’t be used for all situations. Millions of people have amalgam fillings. Although concern has been raised over the mercury in amalgam, and the issue has been studied extensively, research has found no evidence of significant health problems from the use of amalgam in fillings.6-10

Mercury is used in amalgam because when it is mixed with an alloy powder, it creates a compound that is soft enough to mix and press into the tooth, but which hardens quickly and can withstand the forces of biting and chewing.7,9 Mercury is a metal that occurs naturally in the environment. Mercury can exist as a liquid—as is seen in many thermometers—or, when heated, as a gas. It also can be combined with many other materials. Everyone is exposed to mercury through air, drinking water, soil and food. Concerns have been raised, for instance, about the amount of mercury accumulating in fish as a result of pollution. Mercury enters the air from industries that burn mercury-containing fuels.9

The controversy over mercury in amalgam centers on how much mercury is released (Fig.1) from fillings and absorbed into the body.7,8,11-16 In the past, it was thought that amalgam fillings were inert, meaning that no mercury was released once the filling was complete. In recent years, sophisticated tests have shown that very small amounts of mercury in the form of vapor can be released as the amalgam wears.14 Research on this issue is complex and has arrived at various estimates of the actual amount of mercury released. However, several reviews 16-19 of the research have concluded that any amount released from amalgam in the mouth is very low. In rare cases, people have allergic reactions to the mercury in amalgam. 17-19 The ADA says that fewer than 100 cases of this type of allergy have ever been reported. People allergic to amalgam can receive alternative filling materials.

Research over the years has not demonstrated any health effects from amalgam fillings in pregnant
women. However, mercury can cross the placenta. In general, dentists recommend that pregnant women avoid unnecessary dental care. Pregnant women who have to have a tooth restored can talk with their dentists about their concerns and about possible alternatives to amalgam. 19-21

Since any concern about mercury is related to the total amount of mercury absorbed from all sources, some people who have high exposure to mercury may want to consider alternatives to amalgam, for instance, dentists may consider alternatives for people who are exposed to mercury through their occupation, or who eat large amounts of seafood. 14

Because dentists work with mercury almost every day, they must take safety precautions. Without appropriate protection, dentists can inhale mercury vapors, which over time can produce symptoms of mercury toxicity. 21-24 Public concern has arisen after sensational media stories have been aired and broadcasted about amalgam safety. Such media programs, coupled with authorized reports, have attributed a range of medical conditions and symptoms related to the presence of amalgam restorations. Included are multiple sclerosis, Alzheimer’s disease, psychological stress, and allergic reaction. 25, 26 In this review article, it was meant to cite and analyze a collection of myths and half-truths virtual folklore of anti-amalgamists. Realities that are based on sound recent literature were also discussed in a trial to correct those myths.

Review

DENTAL MYTHS VS. REALTIES

Cuspal Fracture
Myth: Many dentists believe that dental amalgam commonly causes teeth to fracture, necessitating more extensive treatment “the cuspal fracture characteristic of amalgam is well-known and observed almost daily in every general dental practice.” 27
Reality: Close examination of some studies reveals that they do not support the assertion that amalgam restorations commonly cause cuspal fracture. One study has serious limitations, however, should be cautiously interpreted, especially since the number of resin-restored teeth was rather small( Figs.2,3). 28 It also asserted that the optimal restoration for endodontically treated posterior teeth is not the intracoronal restorations in this study, but rather restorations with cuspal coverage, because endodontic treatment can weaken teeth. Amalgam bonding has been shown to increase fracture resistance and decrease cuspal deflection. 29

Although the resins in this study were enamel bonded, the study was published before amalgam bonding was prevalent; the preparations were therefore probably larger than commonly used for bonded amalgam restorations, further weakening the teeth.

Outdating
Myth: Because of recent advances in materials and techniques, most studies of composites are outdated; most studies of amalgams are not.
Reality: Many anti-amalgamists assert that resin composite materials and techniques have improved in the last few years, rendering any past studies of composites irrelevant, but amalgam materials and techniques have also improved. High-copper amalgams have much better properties than do conventional amalgams, including better corrosion resistance, higher early strength, and better performance, were not widely available until after 1975.

Tooth preparation techniques for amalgam restorations have changed from sharp to rounded line angles. Caries-indicating dyes, fluoride-releasing cavity liners, adhesive bonding materials, and smaller preparations are some recent advances in the placement of amalgam restorations. 30, 31

Banning
Myth: Amalgam has been banned in Germany and Sweden and therefore should be banned in the other countries.
Reality: Many anti-amalgamists state that amalgam has been banned in foreign countries notably Sweden and Germany. 32 Even a respected research newsletter has stated that amalgam “is or will be banned in Germany and Sweden.” Actually, the use of amalgam fillings is not banned in Germany or Sweden or any other country in the European Union. In countries in the European Union, including both Sweden and Germany, dental amalgam filling material is governed by the Medical Devices Directive 93/42/EEC. An Ad Hoc Working Group of experts from the countries of the European Union issued a report on dental amalgam in 1998. After an extensive review of the available literature, the group concluded that there was no scientific evidence of systemic health problems (other than rare cases of allergy) or toxic effects from dental amalgam and it did not recommend any special reservations on its use. Sweden and Germany not only implemented these recommendations but also participated in their development. 33

SYSTEMIC MYTHS VS. REALITIES:

Mercury Leakage
Myth: Amalgam restorations leak large amounts of mercury.
Reality: Mercury is ubiquitous in the environment. It is
in the air we breathe, the food we eat, and the water we drink. Dental amalgams contain about 43 to 50.5% mercury by weight before mixing, although less after condensation. There is no doubt that amalgam restorations release mercury vapor -- the question is how much. Amalgam restorations release small amounts of mercury, well below threshold levels considered dangerous for occupational exposure. 34-35. According to the World Health Organization, the threshold at which subtle toxic effects may occur is 30µg Hg/g creatinine. The maximum exposure limit for occupational exposure is 25 µg Hg/m3 air for long term exposure and 500 µg Hg/m3 for short-term peak exposure. The maximum recommended individual urinary mercury level is 50µg/g creatinine. 36,37

Kidney Damage

Myth: Mercury from dental amalgam causes kidney damage

Reality: Although it can accumulate in many organs, the target organs for mercury in the body are the kidney and the brain. High levels of mercury are known to cause renal damage in occupationally exposed patients. A group at the University of Calgary showed high Hg levels in various body tissues 29 days after twelve amalgam fillings were placed in one sheep. A later experiment by the same group in one monkey showed similar results. 38-41 In addition to other organs, there were particularly high levels of mercury accumulated in the stomach and gastrointestinal systems of the animals studied, particularly the sheep. The mercury accumulation was therefore most likely more from swallowing large amounts of amalgam scrap during placement than of the restorations. 39 As a ruminant animal chewing 15 hours per day, the sheep probably swallowed particles of amalgam from the fillings as they chewed. These factors combined with the fact that each experiment was done only on a single animal with no controls make the studies' relevance to humans questionable.

Dentists typically have higher mercury concentrations than other people with amalgam fillings. A 1991 study of dentists screened in the United States in 1985 and 1986 with urinary mercury concentrations as high as 115 µg Hg/L showed no renal dysfunction as measured by serum and urine 82 microglobulin concentrations, serum creatinine and creatinine clearance 40. There was also no relationship between the level of urinary mercury and potential kidney dysfunction. Similar results were reported in a 1997 study of Swedish dentists screened in 1990. 41

Alzheimer's disease

Myth: Mercury from dental amalgam causes Alzheimer's disease, multiple sclerosis, and other diseases of the central nervous system.

Reality: Mercury from dental amalgam can accumulate in many body tissues, including the brain and was found that there was a correlation between the number of occlusal surfaces of amalgam and the amount of Hg in the brain tissue. In 1986, Nylander reported on three dentists at necropsy had high levels of mercury in the pituitary glands versus four non-dentist controls. In addition it was showed that high levels of mercury accumulation in the thyroid, pituitary, occipital lobe, and kidneys in dentists and dental staff. 42,43

It has been alleged that mercury from dental amalgam can play a role in the development of Alzheimer's disease. Wenstrup et al. reported that at autopsy, the brains of Alzheimer's patients had higher levels of Hg compared to control patients and cited amalgam fillings as a possible source. Other studies have failed to confirm a correlation. In a 1999 study, investigators studied the autopsied brains of a group of 68 subjects with Alzheimer's disease and 33 control subjects without Alzheimer's disease and found no differences in brain Hg levels between the groups. They also found no association of Alzheimer's disease with the number, surface area, or history of dental amalgam placement. 44,45

To test the hypothesis that dental amalgam fillings are a causal factor in tumors of the central nervous system, Rodvall et al. in 1997 matched 333 patients with glioma, meningioma, or acoustic neurinoma by age, gender, and location with 343 controls. There was no association between the number of amalgam fillings and tumors of the central nervous system and concluded that there was no evidence that amalgam fillings are a cause of central nervous system tumors. 46

Mental Disease

Myth: Mercury from dental amalgam fillings causes mental disease

Reality: Controlled, scientific studies have failed to show a correlation between amalgam fillings and mental illness. After conducting psychological evaluations of 11 patients with "amalgam illness," Lindberg et al determined that the symptoms of "amalgam illness" in these patients were psychosomatic and that past traumatic events (and not amalgam) were the triggering factor in these patients' amalgam illnesses. In a study of 587 Swedish twins whose mean age was 66 years, investigators were unable to find a relationship between adverse physical or mental health effects and the number of surfaces of dental amalgam, either between twins or in the group as a whole, even after controlling for age, gender, education, and number of remaining teeth. 47,48

Not For the Children

Myth: Dental amalgam should not be used for children.
Reality: Although dental amalgams are a source of mercury exposure and are associated with slightly higher urinary mercury excretion, there is no scientific evidence of any measurable clinical toxic effects other than rare hypersensitivity reactions. An expert panel for the National Institutes of Health has concluded that existing evidence indicates dental amalgams do not pose a health risk and should not be replaced merely to decrease mercury exposure.49

Autism
Myth: Dental amalgam can cause Autism.
Reality: There is no known single cause for autism, but it is generally accepted that it is caused by abnormalities in brain structure or function. Brain scans show differences in the shape and structure of the brain in autistic versus non-autistic children. Researchers are investigating a number of theories, including the link between heredity, genetics, inherited genetic coding, and medical problems.50

Not To Be Used During Pregnancy
Myth: Dental amalgam should not be used during pregnancy
Reality: It is known that mercury can cross the placenta from mother to fetus and can also be detected in breast milk but this does not mean that amalgam fillings should be avoided during pregnancy or breastfeeding. There is no evidence of any link between amalgam use and birth defects or still births. Generally, it is sensible to minimize health interventions during pregnancy and breastfeeding, where this is clinically feasible. Dentists would approach the placement or removal of amalgam fillings from the same precautionary standpoint.51

Conclusion(s)

1. Amalgam has served dentistry well, and continues to do so. Overall, amalgam restorations demonstrate an excellent life expectancy and are considered to be the least technique-sensitive direct restoration.
2. 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 Public Health Service (PHS) should be a leader in this effort.
3. 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 preventative measures such as fluoride and dental sealants to prevent caries and thus further reduce the need for dental restorations.
4. At the dental college, King Saud University, it is advisable to supply the patients and parents of children seeking teeth restorations; with simple brochures and pamphlets explaining the various risks and benefits of available restorative materials in the educational clinics.
5. It is also recommended to design a survey, with an adequate sample size, in order to provide an insight concerning the materials that patients and parents of children prefer for have as direct and indirect restorations. Such survey should target criteria for the placement of these the materials and their associated complications.

References


by whole-body image scan and tissue analysis. FASEB J 1989;3:2641-46.
Illustrations

Illustration 1

Fig.1: Hg vapor concentration as a function of time.

Illustration 2

Fig.2: Profile of amalgam users.

Profile of Amalgam Users

Civilian Practitioners

Do you use amalgam in your practice?

Do you place fewer amalgams than 5 years ago?
Illustration 3

Fig.3: Review of clinical studies.

Review of Clinical Studies
(Failure Rates in Posterior Permanent Teeth)

![Graph showing failure rates in posterior permanent teeth](image)
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