

Amalgam: Are your teeth toxic?

By Eve Bessent

Amalgam has been used as a filling material since 1826 and is a mixture of mercury-50%, silver-20%, copper-15% and tin-15% [1]. Amalgam was originally viewed as a cheap and easy filling material, but we now know the detrimental effect it can have on both the body and the environment.

When placing dental amalgam, the dentist first drills the tooth to remove the decay, then they shape the tooth cavity for placement of the amalgam filling. Next, under appropriate safety conditions, the dentist mixes the encapsulated powdered alloy with the liquid mercury to form an amalgam putty, this softened amalgam putty is then placed and shaped in the prepared cavity, where it rapidly hardens into a solid filling. So why only now are we looking at amalgam fillings with our health and safety in mind? If the compound has not changed, then our understanding of it must have and the key element of Mercury (Hg) is the issue.



Mercury has a severely toxic effect on the nervous, digestive and immune systems as well as a potential impact on the thinking and learning abilities of patients. However, it cannot simply be removed from the filling process as it is required to bind the other alloy particles together into a strong, durable and solid filling. This makes it a vital component of dental amalgam as it makes the metal an easy moldable substance that can be pushed in the abstract space of a tooth where the decay has been drilled out. This type of filling, like any other dental fillings, produces a living tooth structure in teeth with small-to-medium cavities. Nevertheless, the popularity of amalgam as a restorative material is decreasing these days due to concerns about serious health effects, environmental pollution and aesthetics as the metallic colour of amalgam does not blend with the natural tooth colour.

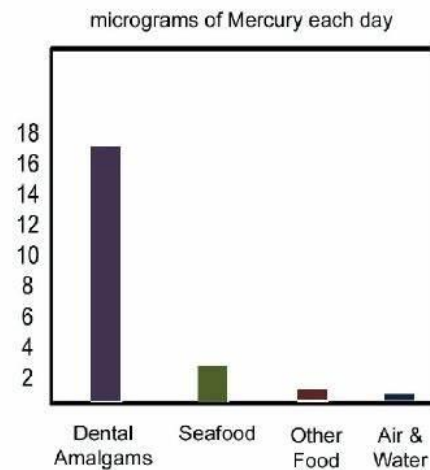
Ever since its introduction in the western world, amalgam has been the subject of recurrent controversies because of its mercury content, sparking what is known as the 'Amalgam war' between many dental professionals [2]. The toxic effect of mercury can cause damage to the lungs, kidneys, skin and eyes. Individuals with dental amalgam fillings/ restorations have a measurable amount of mercury in their blood and urine. Dental amalgam is by far the main source of mercury found within the human body. The World Health Organization says that inhaling or ingesting mercury, even in small amounts, could cause "serious health problems" [3]. This is proven by autopsy studies conducted by SCENIHR (Scientific Committee on Emerging and Newly Identified Health Risks) which found 2-12 times more mercury in body tissues of individuals with dental amalgam [4]. This is due to a small amount of mercury (2-20 mcg/day) being released from dental amalgam when it is manipulated, for example by chewing. This means something as harmless as the habit of gum chewing can release the mercury from dental amalgam greatly above the normal everyday levels putting a huge number of patients

with amalgam fillings at risk of respiratory and cardiovascular issues. In some extreme cases some patients have experienced fatigue, emotional instability and physical tremors, the side effects experienced are endless.

Amalgam can cause more adverse effects on a patient when there is a mix of metals in the mouth. For example, if a person is in possession of gold and amalgam in their teeth, a phenomenon known as the battery effect occurs. This is because electricity flows between the two different metals when placed in a conductive fluid, such as saliva due to its high mineral content [5]. Due to the extensive negative impact this can have on people's health there will continue to be no improvements in the number of people seen for these health-related problems, if anything they will only get worse as their immune system weakens.

How is the mercury produced from dental amalgam any different to the mercury we encounter naturally (e.g. fish mercury)? Well, dental amalgam contains elemental mercury which can be released as a vapor; But mercury that is found naturally, such as that found in fish, is methylmercury which is a type of organic mercury. This organic compound of mercury is readily absorbed by many organisms and accumulates as it passes into food chains, which is why we will also ingest mercury when we eat fish. How do we know that the mercury we absorb always leads to health problems? Research conducted on monkeys has shown that mercury released from amalgam restorations is absorbed into the blood and can accumulate in various organs such as the brain, lungs, kidneys and the gastro-intestinal tract [6]. The results also found that the mercury could cross the placental barrier in pregnant rats, explaining why dentists are advised not to place amalgam fillings in pregnant patients at risk of creating health complications for their child. If less people receive amalgam fillings, then this will show a positive correlation of less people experiencing health/ medical problems reducing the strain on the NHS.

World Health Organization



In light of the European Zero Pollution action plan under the green deal [7], which aims to reduce air, water and soil pollution to create a toxic-free environment, the European commission has decided to phase out amalgam with the ban starting on the 1ST of January 2025. This means the manufacture and export of dental amalgam will eventually be prohibited [8]. The phase out of amalgam originally started in 2018 where the NHS restricted the use of amalgam in

Waste Amalgam XL	Waste Amalgam L	Waste Amalgam S	Cap Guard	Toothbox
				
Product # B0US1904	Product# B0US1902	Product # B0US1901	Product # B0US1905	Product # B0US1900
6.5 Gallon Container Capacity	4.0 Gallon Container Capacity	1.5 Gallon Container Capacity	1.5 Gallon Container Capacity	0.35 Gallon Container Capacity
For amalgam waste from <ul style="list-style-type: none"> • chair-side traps • leftover or spent amalgam • removed teeth with amalgam fillings • empty amalgam capsules • vacuum traps located by the vacuum pump 			For empty, left-over & expired amalgam capsules	For removed teeth containing amalgam

deciduous teeth (baby teeth), pregnant and breastfeeding women, or children under 15 unless deemed clinically necessary. This is due to amalgams toxic and deadly properties and dentists not wanting to cause harm to some of the most vulnerable patients. Amalgam only fills a gap, it does not bond or arrest caries, it can crack teeth and needs to be disposed of very carefully, as seen in the image above.

Once mercury is released into the air, soil and/or water, it can pose a threat to wildlife for centuries as it is converted into toxic methylmercury. It does not degrade in the environment, and it becomes mobile because of the volatility of the element and several of its compounds. According to the National Resources Defense Council, dental amalgam is often a large source of mercury within wastewater and significantly contributes towards mercury poisoning within the soil and air, estimating it produces around 0.6 tons of pollution per year. [9]. The atmosphere containing mercury is one of the most important environmental problems in the modern world. To show a commitment to environmental sustainability steering away from mercury-containing materials allows for a push towards eco-friendly and sustainable dentistry.

Regarding patients' well-being, dentists can offer alternative materials that are not only safer but more technologically advanced. It is often the case that these heavily filled teeth with amalgam are the ones to fracture and can regularly be non-restorable for the patient, requiring extraction and if appropriate, an often-costly replacement (e.g. An implant).

How does the government plan to ban amalgam when it is so regularly used within practices? The timeline is as set: On the 1st of January 2025 the export of dental amalgam will be banned across the EU and by 30th of June 2026 there will be a ban on the manufacturing and import of amalgam completely. This will directly disrupt the UK's supply chain making dentistry more expensive. This will force many dental practices within the UK to use alternative materials. However, they will maintain provision to allow the import and manufacturing of dental amalgam for use with patients with specific medical needs. Finally, a review of the exemptions for the use of dental amalgam will be performed by the European Commission by 31st of December 2029 and will further consider the availability of mercury-free alternatives. To support this commitment, the UK along with over 240 other countries signed the Minamata Convention on Mercury which came into force on the 16th of August 2017 [10].

Will the ban of amalgam only lead to more issues arising to be faced by the NHS? There are now many concerns around how the NHS will continue to provide fillings now that the amalgam will be removed from UK practices, as it is the most commonly used filling material due to its cheap cost and longevity. One of the few positives of amalgam is its speed: Amalgam is so easily manipulated and pliable, inserting and shaping the filling is a relatively quick process. Other methods and materials are much slower (e.g.

Treatment	Time taken	Price
	(m)	
Permanent fillings - Amalgam - Single surface	20	£27.90
Permanent fillings - Composites - Single surface	27.5	£38.36
<i>Difference</i>	7.5	£10.46
<i>% difference</i>	37.5%	
Permanent fillings - Amalgam - More than a single surface	28	£39.06
Permanent fillings - Composites - More than a single surface	42.5	£59.28
<i>Difference</i>	14.5	£20.23
<i>% difference</i>	51.8%	

composite resins). This will increase the amount of time a patient is seen for, decreasing the number of patients that can be seen in a day. This will only add to the problems currently faced by NHS dentists of the high patient demands and long waiting times. The perception and response of the public will also be important to monitor as dental professionals will not want the change to spark unprecedented concern among patients demanding to have amalgam fillings replaced.

The ban of amalgam will also cause problems with finance within practices and the already stretched health boards. Amalgam is the least expensive medium for fillings, ranging from £30-£150 depending on the size, whereas composite fillings range between £40-£250. In more severe cases the use of crowns or veneers will range from £300-£1000+ depending on the location, material and additional tools used [11]. This shows that although other materials such as composite are considered safer as there is no concern about toxicity, they are much more expensive. This pricing difference will place further pressure on NHS funding within Dentistry as it means practices/ hospitals will have to order more expensive materials that they simply cannot afford due to the underfunding experienced. Amalgam fillings also last longer within the mouth, lasting the average patient 10-15 years. However composite fillings on average only last 5-10 years before they need to be replaced [12]. This will increase the number of patients that must return to the dentist over time to get their fillings replaced. However, due to the negative health effects of amalgam within the body being more widespread due to the ban, many people who currently have amalgam fillings may rush to get them removed. While this initially seems like the best idea for our overall health, it could potentially be the worst. Removing amalgam without proper skill and simply 'drilling it out' will mean the mercury from the filling is evaporated, meaning it is then inhaled and absorbed into the blood stream leading back to the negative health effects. This will cause many dentists to face difficult situations of explaining to patients the still apparent health risks and places a greater strain on the dentists that can skillfully remove amalgam fillings.

In conclusion, the ban of amalgam will generate many positive health benefits for all patients and future patients to come but only if it is managed well. It is predicted to have an inauspicious effect on many sectors of the NHS; it is likely to increase the financial crisis the NHS is facing within dentistry and patient waiting times.

It will be critical for all dentists to follow the same approach and for the health boards to work together to ensure the safe disposal of any waste products; mismanagement of the waste will lead to significant environmental impacts. The General Dental Council (GDC) has a role to ensure that the transition from amalgam to composite is delivered safely and considers both the financial and human resources required.



It will also be important to ensure that composite does not end up being the next amalgam, in that in years to come our understanding of composite changes and there is a need to act upon them as history repeats itself. It will be crucial for the dental industry to continuously review new and alternative materials that are appropriate and sustainable. For the successful transition from amalgam to composite/other methods there will need to be a clear and easy to understand message for patients. The GDC should consider whether a national awareness campaign is required or whether it would be more appropriate for it to be led by local practitioners.

While the movement from dental amalgam to other materials will hit the headlines in the immediate term following the ban, the focus must remain on educating people about oral health and preventing oral health complications from arising in the first place, ultimately reducing the need for any material to substitute the tooth. As the start of the ban approaches, we must ensure there is time to consider all the above issues carefully.

Bibliography

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