

The Environmental Impact of Mercury in Dental School Settings

Nitin Kanuri

ONE VCU Sustainability

Introduction

Mercury is an important element with notable applications in various industries. Mercury is commonly seen in many industries, especially the electronics industry, but also in common household appliances such as the thermometer. Although this element is so commonly used, it is important to understand that mercury can play a significant role on human and environmental health. This paper discusses the role of mercury in dentistry, and examines its benefits and potential drawbacks with a scientific lens in relation to the ONE VCU Sustainability Plan.

In dental schools, mercury is an important subject because it is an essential part of dental amalgam, which is a common filling material. Its benefits are undisputed: amalgam is a well-liked option for restorations because of its affordability. But because it depends on mercury, it must be handled carefully. Mercury vapor is released into the environment during the placement, removal, and disposal of amalgam. (Pant, Rathore, and Singh) In fact, mercury is released in any modification of dental amalgam, from titration (1-2 μg of mercury released) to dry polishing (44 μg of mercury released) (Jirau-Colón et al.). This could be dangerous for dental practitioners as well as patients because prolonged exposure to high concentrations of mercury vapor has been connected to a number of negative health outcomes, such as kidney damage, neurological impairments, and problems with reproduction.

The risk of mercury exposure is a major concern at the VCU School of Dentistry because dental amalgam is widely used there. Amalgam can release mercury vapor when it is handled improperly during dental filling procedures like placement and removal. Dental professionals may inhale these vapors while they are being released, exposing them to elemental mercury. The

risk of negative health effects, especially those affecting the central nervous system, is increased by this systemic distribution in the lungs. Long-term mercury exposure has been linked to neurological issues such as tremors, mood swings, and cognitive decline (Carocci et al.). Dentists, and patients at the VCU School of Dentistry should be cautious in enforcing safety protocols to reduce any chance of risk and prolonged exposure to mercury.

Mercury's role in the environmental setting must also be considered. Aquatic and other ecosystems can be harmed by sources that were contaminated by improper disposal of amalgam waste. This can be the result of contamination that came from either the VCU School of Dentistry, or dental clinics surrounding the Richmond area. Mercury is detrimental to the environment by the conversion of elemental mercury into methylmercury which is an extremely hazardous organic compound. Fish bioaccumulation, a common dietary staple, creates a direct route for mercury to enter the human food chain, raising concerns for public health in Richmond. However, biomagnification can also affect the food chain in Richmond and surrounding areas. Biomagnification is the increasingly progressive concentration of a contaminant such as mercury within organisms across. This concentration is amplified and can be a potential detriment for top predators within the food chain. For example, as seen on abc8, an eagle, which is an apex predator, died due to mercury and lead poisoning, which likely is a result of biomagnification (abc8).

There are several ways to mitigate mercury exposure. A strategy combining several different ideas is required to mitigate mercury exposure in dental settings in order to protect patients and dental professionals. Reducing the use of amalgam by switching to substitute

materials like porcelain or composite resin is one important step. Another is enforcing effective ventilation systems in dental offices in order to ensure adequate ventilation and dissipate any potential mercury vapor. Furthermore, wearing gloves and masks as part of a Personal Protective Equipment (PPE) helps protect dental professionals from direct exposure to mercury-containing materials while performing procedures. Patient education plays a crucial role in reducing the risks associated with mercury exposure. Dentists are extremely important in educating patients about the possible risks associated with amalgams that contain mercury as well as other available options. By enabling patients to make knowledgeable decisions about their dental care, this education promotes teamwork in the pursuit of oral health. Dental professionals can greatly reduce the risk of mercury exposure in their practices by combining these four strategies: using PPE, teaching patients, ensuring proper ventilation, and reducing amalgam use. This will promote a safer and more sustainable approach to dental care.

There are several safer options for dental restorations available to patients and dental professionals, in place of mercury found in dental amalgams. The International Academy of Oral Medicine and Toxicology (IAOMT) recommends composite resin, glass ionomer, porcelain, and gold as some of these substitute materials. A dental biocompatibility test can be used to select an appropriate substitute, guaranteeing that it will be in line with the patient's particular requirements and health concerns. A notable study from 2015 that has been referenced in dental literature highlights the performance of composite resins over a thirty-year duration, confirming their long-term sustainability as an alternative to conventional amalgams that contain mercury. According to Rejuvenation Health, these substitutes are not only safe but also biomimetic—that is, they approximate the hardness of natural teeth. These materials' biomimetic properties

prioritize the safety and health of patients while also making them effective for dental restorations. Raising awareness about amalgams free of mercury is essential, particularly in educational settings like the VCU School of Dentistry. Furthermore, choosing the right procedures for dental amalgam disposal is crucial for maintaining environmental accountability and reducing the risk of mercury waste-related accidents. The availability of reliable substitutes to mercury highlights can support the health of the environment, as well as patients.

This review is relevant to the initiatives of the environmental issues working group of the ONE VCU Sustainability Plan. One such initiative is “Reduce potable water consumption and protect the James River through stormwater control strategies.” This initiative is applicable because mercury contamination of the James River is an increasingly detrimental problem and should be address immediately. Another initiative this review is applicable to is the, “Reduce energy, waste, and hazardous waste from research labs and operating rooms.” This is relevant because the VCU SOD should more carefully control the usage of mercury or implement mercury alternatives in amalgam.

Citations

1. *Amalgam fillings: Risks, alternatives, & Mercury content*. Rejuvenation Health. (2023, November 8). <https://rejuv-health.com/amalgam-fillings/>
2. Brennan, F. (2023, August 28). *Alternatives to Mercury amalgam fillings*. IAOMT.
3. Carocci, A., Rovito, N., Sinicropi, M. S., & Genchi, G. (2013). Mercury toxicity and neurodegenerative effects. *Reviews of Environmental Contamination and Toxicology*, 1–18. https://doi.org/10.1007/978-3-319-03777-6_1
4. epa.gov
5. Jirau-Colón, H., González-Parrilla, L., Martínez-Jiménez, J., Adam, W., & Jiménez-Velez, B. (2019). Rethinking the dental amalgam dilemma: An integrated toxicological approach. *International Journal of Environmental Research and Public Health*, 16(6), 1036. <https://doi.org/10.3390/ijerph16061036>
6. Pant, V., Rathore, M., & Singh, A. (2012). The dental amalgam toxicity fear: A myth or actuality. *Toxicology International*, 19(2), 81. doi: 10.4103/0971-6580.97191