Mercury Hygiene in Dental Offices, Clinics and Schools
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Brief Overview of Occupational Hazards and Dental Mercury

While amalgams are currently used for 45% of all direct dental restorations worldwide,1 articles published in the Journal of the American Dental Association have established that these mercury fillings are still being used on over 50% of Americans.2 What this means is that while some American dentists have stopped using amalgam, others are still using it on a routine basis.

The highly significant amount of mercury still being used by dentists in the U.S. has been established by other statistics. According to the United States Geological Survey, in 2010, dental amalgam was the leading end-use sector of mercury in the U.S.3 Other sources demonstrate that the use of mercury for dental amalgam in the U.S. has been estimated at 35.2 tons per year4 and that there are currently over 1,000 tons of mercury in the mouths5 of approximately 120 million Americans,6 which is more than half of all the mercury being used in the U.S. today.

In 2013, the United Nations Environment Programme (UNEP)’s Intercessional Negotiating Committee formalized a global, legally-binding mercury treaty, which has now been ratified by more than 70 countries, including the U.S. Part of UNEP’s “Minamata Convention on Mercury” text includes initiatives to phase-down the use of dental mercury.7 This treaty will enter into force on August 16, 2017. As part of this effort, a new EU mercury regulation plans to prohibit the use of dental mercury amalgam for vulnerable populations (pregnant or breastfeeding women, children under 15 years old), require amalgam separators in dental offices, and provide for discussion about ending dental mercury use in the European Union by 2030.8 Yet, even if dental mercury was no longer placed as a filling material, there would still be a need for American dentists to remove millions of the existing amalgam fillings due to device failure, tooth decay, consumer preference, and other circumstances.

Meanwhile, scientific research demonstrates that dental mercury amalgam exposes patients, dental professionals, dental staff, and fetuses to releases of mercury vapor, mercury-containing particulate, and/or other forms of mercury contamination.9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 Furthermore, mercury vapor is known to be released from dental mercury amalgam fillings at higher rates during brushing, cleaning, clenching of teeth, chewing, etc.,47 48 49 50 51 52 53 54 55 56 57 58 59 60 and mercury is also known to be released during the placement, replacement, and removal of dental mercury amalgam fillings.61 62 63 64 65 66 67 68 69

Because of daily exposures to dental mercury in their breathing zone during the placement, cleaning, polishing, removal, and other practices involving amalgam fillings, dentists, dental staff, and dental students are exposed to mercury at a greater rate than their patients. Severe exposures from past practices include hand-squeezing of fresh amalgam, where drops of liquid mercury could run over the dentist’s hands and contaminate the entire office.70 Dangerous levels of mercury are still generated in the dental workplace, and research has clearly identified that exposure to these mercury levels can cause ill-health to dental workers.71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 and dental students.103 104 105 Another area that has received much attention is the possibility of reproductive hazards to female dental personnel, including menstrual cycle disorders, fertility issues, and pregnancy risks.106 107 108 109 110 111
Clearly, dental workers require protection from mercury exposures when working with dental mercury amalgam, and a variety of studies have specifically called for protective measures to be taken in the dental office as a means of limiting mercury releases. There are levels of increasing protection for limiting exposure during mercury-related dental procedures. Depending on the level of protection, health risks will vary. The challenge is raising awareness of both the current OSHA standards and the EPA standards, as well as educating and training U.S. dentists to properly comply with them. In particular, dentists need easily accessible, hands-on information about adequately utilizing effective engineering controls, safe work practice controls, administrative controls, and personal protective equipment as they work with dental amalgam mercury.

In summary, chronic (low dose, long-term) exposure to mercury for dentists, dental staff, dental students, and dental patients exists for all those still placing dental amalgam mercury fillings. There is also a high risk of acute (high dose, short-term) mercury exposure to dentists, dental staff, dental students, and dental patients when previously existing dental mercury amalgam fillings are drilled out.

This acute exposure to mercury vapor and particulate for dentists, dental staff, dental students, and dental patients has been scientifically documented, and it can especially endanger pregnant women, lactating women, women of childbearing age, fetuses, children, and other sensitive populations. In fact, a series of studies have shown that the removal of amalgam fillings can generate mercury levels that exceed OSHA’s PEL.

Other than primary exposures during dental mercury amalgam removal, secondary exposures in less obvious areas of the dental office are emerging as additional sources of chronic mercury exposures. Some of these peripheral exposures include the following:

- mercury exposure to staff, patients, and visitors in other parts of the office not directly involved in the removal process
- environmental mercury exposure caused by the waste from removal and storage of amalgam, especially because the ADA’s “Best Management Practices for Amalgam Waste” is voluntary
- storage and disposal of workplace protective clothing and instruments used during procedures involving dental mercury amalgam
- mercury vapor exposure from sterilization of instruments used on dental mercury amalgam fillings
- mercury vapor and particulate on the clothing, and under/around the dentist, staff, dental students, and patients in the immediate removal area
- mercury particulate that is carried home in hair, on shoes, and other clothing from the dental office

To assist in mitigating the potential negative outcomes of both primary and secondary mercury exposure during amalgam removal, the IAOMT continually updates its rigorous safety recommendations for removal of existing dental mercury amalgam fillings to protect dental professionals, students, staff members, patients, and others from mercury exposure.

**U.S. Regulations—Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA):**

Amalgam separators can successfully reduce the amount of mercury discharge in wastewater from dental offices. In fact, a 2014 article about the issue written by mercury recyclers qualified: “Capture efficiency rates for mercury by amalgam separators range between 95-99%.”
For this reason, the U.S. EPA utilized measures in the Clean Water Act to develop standards for dental clinics to reduce mercury releases by requiring that dental offices install amalgam separators. This EPA requirement went into effect on July 14, 2017, and the EPA has estimated that it could reduce the discharge of mercury by 5.1 tons annually.\textsuperscript{141}

Enforced standards that require amalgam separators are essential in stopping mercury from entering the environment, especially because voluntary initiatives have often been successful.\textsuperscript{142} However, even when standards are required, it would be helpful to likewise enforce maintenance requirements for amalgam separators, as the Royal College of Dental Surgeons has done in Ontario, Canada.\textsuperscript{143} It should also be remembered that amalgam separators only contribute to solving the problem of dental mercury in wastewater and not the additional burdens placed by amalgam fillings on the environment and human health.

Employee exposure to mercury is regulated in the United States by the \textit{1970 Occupational Safety and Health Act}\textsuperscript{144} and \textit{Workers’ Rights Handbooks}\textsuperscript{145} from the United States Department of Labor’s Occupational Safety and Health Administration (OSHA), which establish that all employees have the right to know about the chemicals in their work environment. OSHA’s Hazard Communication Standard (HCS) states: “All employers with hazardous chemicals in their workplaces must have labels and safety data sheets [SDS] for their exposed workers, and train them to handle the chemicals appropriately. The training for employees must also include information on the hazards of the chemicals in their work area and the measures to be used to protect themselves.”\textsuperscript{146} Employers must also evaluate workplaces for allowable airborne concentrations,\textsuperscript{147} and they are supposed to keep a 30-year record of employee exposures and medical records.\textsuperscript{148} Employees have the right to access this information, and more on workers’ rights in regards to chemical exposures can be learned at \url{https://www.osha.gov/Publications/pub3110text.html}.\textsuperscript{149}

The purpose of the safety data sheets (SDS, formerly known as material safety data sheets, or MSDS) required by OSHA is to protect workers by supplying them with the most crucial facts about the hazardous materials at their jobsite, such as the physical properties of the material, proper storage and handling techniques, known health risks and essential emergency procedures.

Thus, manufacturers of amalgam fillings must create these information sheets, and excerpts from just a few of the SDSs for dental amalgam includes compelling evidence about the known dangers of using mercury in fillings:

- SDI; Permite; Lojic +; GS-80, GS-80 Spherical; F400; Ultracaps +; Ultracaps S; SDI Admix; SDI Spherical and New Ultrafine - Capsules; Australia, Brazil, Ireland, and the USA; 2015:\textsuperscript{150}
  - Hazard Identification/California Prop 65 Warning: “This product contains mercury, a chemical known to the State of California to cause birth defects or other reproductive harm.”
  - First Aid Measures: “May cause respiratory disorders including inflammation and fluid retention. Inhalation of mercury vapours at high concentration can cause dyspnea, coughing, fever, severe nausea, vomiting, excess salivation, kidney damage with renal shutdown.”
  - Toxicological Information/Chronic Health Effects: “Inhalation of mercury vapours, dusts or organic vapours, or skin absorption or mercury over long periods can cause mercurialism. Symptoms include tremors, inflammation of mouth and gums, excessive salivation, stomatitis, blue lines on gums, pain and numbness in extremities, weight loss, mental depression, and nervousness. Exposure may aggravate kidney disorders, chronic respiratory disease and nervous system disorders. May cause damage to blood, kidneys, liver, brain, peripheral nervous system, central nervous system.”
• **Kerr Corporation; Tytin FC™; USA; 2014.**\(^{151}\)
  - First Aid Measures/Inhalation: “Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations, salivation, metallic taste, eye irritation, respiratory tract irritation, coughing, pulmonary edema, wheezing and breathing difficulties, headache, fever, nausea or vomiting, diarrhea, abdominal cramps and pain, muscle weakness / pain, mental confusion or disorientation.”
  - First Aid Measures/Skin Contact: “Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations.”
  - First Aid Measures/Ingestion: “Adverse symptoms may include the following: reduced fetal weight, increase in fetal deaths, skeletal malformations.”

• **Henry Schein; SDS acc. to OSHA HCS; Stratosphere, Ionosphere, Troposphere; USA; 2014.**\(^{152}\)
  - Hazard Identification/Classification: “Very toxic, Very toxic by inhalation, Toxic, May cause harm to the unborn child, Toxic: danger of serious damage to health by prolonged exposure through inhalation.”
  - Disposal Consideration: “Must not be disposed of together with household garbage. Do not allow product to reach sewage system.”
  - Toxicological Information: “Avoid exposure of mercury to pregnant person.”

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135 For a list of studies with corresponding data of mercury levels during amalgam removal (that you can then apply to the OSHA PEL for comparison), see Richardson GM. Inhalation of mercury-contaminated particulate matter by dentists: an overlooked occupational risk. Human and Ecological Risk Assessment. 2003; 9(6): 1519-1531.
147 United States Department of Labor Occupational Safety and Health Administration. Safety and health topics: chemical hazards and toxic substances. United States Department of Labor Occupational Safety and Health Administration Web site.


